ECORYS

A sustainable future for Curacao

Strategic options for ISLA and the ISLA site

Final Report

Client: Refineria di Kòrsou

Rotterdam/Willemstad, March 2012

A sustainable future for Curacao

Strategic options for ISLA and the ISLA site
Final Report

Client: Refineria di Korsou

Leo Beumer
Nol Verster
Ilse van de Velde

Rotterdam/Willemstad, March 2012

ECORYS

About Ecorys

At Ecorys we aim to deliver real benefit to society through the work we do. We offer research, consultancy and project management, specialising in economic, social and spatial development. Focusing on complex market, policy and management issues we provide our clients in the public, private and not-for-profit sectors worldwide with a unique perspective and high-value solutions. Ecorys' remarkable history spans more than 80 years. Our expertise covers economy and competitiveness; regions, cities and real estate; energy and water; transport and mobility; social policy, education, health and governance. We value our independence, integrity and partnerships. Our staff are dedicated experts from academia and consultancy, who share best practices both within our company and with our partners internationally.

Ecorys Netherlands has an active CSR policy and is ISO14001 certified (the international standard for environmental management systems). Our sustainability goals translate into our company policy and practical measures for people, planet and profit, such as using a 100% green electricity tariff, purchasing carbon offsets for all our flights, incentivising staff to use public transport and printing on FSC or PEFC certified paper. Our actions have reduced our carbon footprint by an estimated 80% since 2007.

ECORYS Nederland BV
Watermanweg 44
3067 GG Rotterdam

P.O. Box 4175
3006 AD Rotterdam
The Netherlands

T +31 (0)10 453 88 00
F +31 (0)10 453 07 68
E netherlands@ecorys.com
Registration no. 24316726

W www.ecorys.nl

Ecorys Region, Strategy & Entrepreneurship
T +31 (0)10 453 87 99
F +31 (0)10 453 86 50

Table of contents

Preface

On behalf of Refineria di Korsou, in this final report Ecorys and its consortium partners (Purvin & Gertz International and Ecovision & Partners), present the final results of the project “A sustainable future for Curacao, strategic options for ISLA and the ISLA site”.

The report gives an overview of all efforts made and the results achieved by the consortium partners, finally resulting into an Economic Cost Benefit Analysis for the Land of Curacao. An important part of the results presented in this final report is laid down in separate reports published by the different partners during the study period.

Ecorys is grateful for the pleasant and productive cooperation and useful discussions with the consortium partners, with the core team of the principal, Refineria di Korsou, and their advisors, as well as with the project committee and all stakeholders directly or indirectly involved in the process of this assignment.

The Ecorys team:
Leo Beumer
Ilse van de Velde
Nol Verster
In cooperation with Rob van den Bergh (Curconsult)

Rotterdam/Curacao, March 2012

Summary

1. Questions answered through Ecorys research

1. Is it possible to retain refining operations for Curacao beyond 2019?

A. Upgrading the existing ISLA refinery: 3 alternatives
- Technical feasibility
- Commercial feasibility (considering market developments)
- Financial viability (given the potential of interested parties and commercial feasibility)

B. Grassroots refinery at Bullenbay: 4 alternatives
- Technical feasibility (given the Bullenbay location)
- Commercial feasibility (considering market developments)
- Financial viability (given the potential of interested parties and commercial feasibility)

2. What impact will a refinery have on national prosperity after 2019?

- Comparison of Curacao's future development with and without a refinery alternative
- Planning horizon: up to 2045
- Valuation of the annual differences between development with and development without a refinery for all national parties concerned
- Discounting and summary of the differences over the entire period
- Evaluation criteria: net present value (NPV) of net benefits
- Take other (non-priced) pros and cons into account

3. What are the costs of cleaning up the Schottegat area in a sustainable manner?

- Dismantling costs, as from 2020
- Cost of minimal clean-up, prior to 'no access' up to 2045 at the earliest (preventing soil pollution from spreading further)
- Cost of clean-up that ensures the site can be redeveloped without any health or safety hazards

4. Will the redevelopment of the Schottegat area as from 2020 contribute to the prosperity of Curacao between 2020 and 2045?

- Given the anticipated national economic development (excluding refinery): basic and optimistic scenario
- Given the existing pipeline of 'zoning' areas

A. Development alternative A (6 sub-alternatives), in first instance, provides for the establishment of new industries and services (excluding tourism) on ISLA; the remainder is intended for housing.
    - For two density alternatives for housing and services
    - With additional suggested alternatives in connection with the Eastpoint development

B. Development alternative B (2 sub-alternatives) primarily provides for green areas (ecology), and housing; the remainder is for industry and services (incl. tourism).

2. Summary, conclusions and recommendations

Assignment, question and approach

1. The Government of Curacao aims to pursue a policy that guarantees the island's sustainable economic and ecological development. This aim calls for well thought-out decisions concerning the ISLA refinery.
   The refinery is obsolete and the way in which its operations are managed seriously exceeds environmental standards on a regular basis. The contract with operator PDVSA expires in 2019. The Government (owner of the refinery via RdK - Refineria di Kòrsou) must therefore prepare itself for a new policy with respect to refining operations on the island and the designated use of the ISLA site.
   What policy options are there and what impact do they have on developing the island's sustainable prosperity in the future? The Government of Curacao has commissioned Ecorys to conduct a study aimed at providing an answer to these questions. The following is a summary of the research report.

2. The following strategic intervention options will present themselves during policy preparation:
   1. Measures aimed at continuing the refining operations on the island:
      a. Upgrading of the ISLA refinery at the current location
      b. Construction of a new (grassroots) refinery at Bullenbay
   2. Measures aimed at redeveloping the Schottegat area, if the production of the current refinery is shut down. These measures include the demolition of the existing installations and a thorough clean-up required for a healthy and safe reuse of the site.

3. To determine whether and to what extent these ISLA-related policy options contribute to national prosperity, they were compared in a cost-benefit analysis (CBA) with ISLA-related options that lack policy (the reference or 'do minimum' alternative M):
   M1. Abandon measures aimed at continuing refining operations in Curacao after 2019;
   M2. Abandon or postpone the long-term efforts to redevelop the Schottegat area.
   Abandoning/postponing the redevelopment of the Schottegat area – so letting it lie empty – does not mean that no policy measures are taken at all. The intention to pursue a sustainable policy implies that, even in the reference alternative, the refinery will be demolished and measures will be taken to ensure that the soil pollution does not spread and that the surrounding aquatic sediment (i.e. river or sea bed) will not suffer any further pollution ('no access' or 'containment policy'). Hence, a 'do minimum' policy' applies instead of a 'do-nothing' policy.

Business case: Grassroots refinery

4. Given the expected global market developments, a profitable operation of a new (grassroots) refinery in Curacao after 2019 (at Bullenbay) does not seem practicable. Four configurations were explored, including two oriented on the world market (investment costs approximately $5.8 billion) and two that focus mainly on the Caribbean market (investment costs approximately $3.6 billion). As this intervention option is not considered feasible, no cost-benefit analysis was conducted with regard to their impact on the national prosperity.

Business case: Upgrading the existing ISLA refinery

5. With regard to upgrading the existing refinery (on the ISLA site) after 2019 (investment costs of well over $3 billion) sufficient market opportunities are expected for realising profitable operations,

especially if a foreign investor finances a major portion (70%) with debt capital and PDVSA participates as a 'crude supplier'. Three configurations based on the 5000TC2 (themal cracker) were explored, all differing in the fuels to be used in particular for the refinery utility (pitch, LSFO and LNG). Two sub-alternatives were considered for each configuration (one fully financed with own funds and one in which 30% is financed with own funds).

6. Provided that the operations are managed efficiently, the refinery is expected to be sufficiently profitable. Based on 30% own funds, this results in a return on investment (IRR) of 18% to 20% (in other words higher than the threshold value of 15%), and a DSCR (Debt Service Coverage Ratio) of 1.9 to 2.1 (which exceeds the minimum target of 1.35 and the preferred target of 1.50). The LNG alternative is the most promising.
   Furthermore, the upgraded refinery can be funded sustainably during its expected life span (at least 15 years). Therefore, the impact that upgrading would have on the national prosperity was also worked out in a cost-benefit analysis (see below).

7. The Curacao Government could participate (risk-free) in this effort as a co-owner by making the existing 'assets' (land and existing installations) available. The value of the current installations (upon renovation) has been assessed.

8. Neither a Preferred Stock Dividend nor a Land Lease fee has as yet been included (as a cost) in the above calculation! However, upgrading is still profitable even if these items are included in the analysis. The additional revenue for the Government as compared with the current situation, however, depends on the negotiations with the new investor / operator. In addition, the Government plans to implement a new fiscal regime for the refinery, in which both the tax holiday (in number of years) as well as the tax rate will be negotiated with the new investor. Compared to the current situation, the Government is expected to generate additional revenue for Curacao in the long term.

9. An upgrade can only be successful if, firstly, full participation can be obtained from PDVSA in the short term to enable a new investor to finance the required upgrade. This is required to ensure a smooth change-over from the current operations prior to upgrading to the operational activities after upgrading. Secondly, in connection with the required investment programme of at least 5 or 6 years and taking into account the termination of the existing refinery's contract at the end of 2019, the decision on whether to upgrade the refinery should be finalised by the end of 2013. This means that a) the interested parties should be identified by the end of this year (2012) and b) that contracts should be signed with these new investors and operators within less than two years from now (end 2013).

10. The calculations regarding the technical, economic and financial feasibility of the upgraded refinery – in which the current energy supplier BOO (CUC) is integrated –explicitly take into account the fact that current international environmental requirements with respect to air emissions can be met. This will result in a significant reduction in the emission of sulphur oxides, nitrogen oxides and fine particulates; emissions of carbon dioxide and volatile carbon compounds will increase slightly. The emissions will barely exceed the Best Available Control Technology (BACT) World Bank Benchmark.

11. The above takes into account the fact that the energy supplier (BOO) will carry out required renovations on time, and be integrated into the upgraded refinery. The improved emissions relate to the integrated plant.

12. The upgraded refinery will employ approximately 100 FTEs more than the current number of employees. The number of jobs at the BOO will remain virtually unchanged. The number of

employed specialist contractors will increase by some 150 people (FTEs). The current workforce mainly consists of older workers (see annex 8). Efforts to maintain Curacao's refining sector will therefore need to be accompanied by considerable employment efforts, especially with regard to recruitment, proper education and specialisation.

13. Irrespective of what happens to the ISLA refinery (upgrading or closure), a separate contract will be signed with a third party for the Bullenbay Terminal (depending on what is decided with the refinery's new investor/operator or with the newly recruited operator for the Bullenbay Terminal). The contract will stipulate a lease amount for the use of the land and/or a Preferred Stock Dividend. The amount of the latter depends on whether the new operator will also co-own the Bullenbay Terminal or whether he will only be responsible for the 'operations'.

14. The financial implications for the Government's finances regarding the upgrade, on the one hand, depend on the results of the negotiations with the new investor on the amount of tax (on profits), and the duration of the tax holiday period (with a very low tax rate).
    On the other hand, they relate to the lease charged for the use of the ISLA site and a Preferred Stock Dividend to be paid by the new investor / operator for the existing 'assets' contributed by the RdK. These two matters must also be negotiated with the new investor / operator.
    The amount of a Land Lease fee and the Preferred Stock Dividend will, to some extent, influence the investor's return on the investment in the refinery. Demanding excessive amounts will put pressure on the investor's returns, and will therefore reduce the chances of success.

Dismantling, demolition and cleaning

15. If the Curacao Government can find investors who are willing to upgrade the refinery (on the ISLA site) on time so that it can remain operational beyond 2019, then the dismantling of the installations and the thorough clean-up of heavily contaminated soil will be delayed until the end of the life span of the upgraded refinery.
    However, mitigating measures can already be taken to minimise the pollution of the adjacent aquatic sediment (total investment cost approximately $50 million and annual operating costs approximately $1.5 million).

16. By the end of 2013 – despite the outlined possibility of a commercially viable and financially sustainable upgrade – Curacao should know whether or not it will be able to keep the ISLA refinery in operation between now and 2019.
    In the event of its closure, it must be decided what will be done with the vacant site. As part of this study, two options have been investigated for the period up to 2045. The available Schottegat area will not be used for other activities (minimal or 'no access' clean-up) or it will be reserved to accommodate new growth-related uses (maximum clean-up).

17. In both cases the existing structures and buildings will be demolished because the Government of Curacao aims to pursue a policy of environmental and economic sustainability. Demolition and disposal are estimated at a net cost of NAf 254 million, with a margin of around 40%. The activities will take two years and will provide employment to approximately 850 people (50% of whom are local workers).

18. For the same reason, and even if the site remains empty until 2045, sufficient measures must be taken to safeguard the health and safety of the island's citizens. This means that – if not in use – the site will be closed after 2019 and that sufficient investments will be required to prevent the existing soil pollution from shifting to the surrounding area, including the adjoining aquatic sediment.

The costs of this required clean-up are estimated at NAf 526 million (plus or minus 40%). These activities will also take two years after dismantling. During this period, this will provide employment to approximately 630 people (50% of whom are local workers).

19. On the other hand, if the site is developed for living or business activities in the services and industry sectors, a more intensive clean-up operation will be required for health and safety reasons. The total costs of this maximum alternative are estimated at NAf 1,467 million (plus or minus 40%). This is NAf 941 million more than the minimum alternative. It is assumed that these costs can be spread over a long period of time (up to 30 years) and that this will involve approximately 3,500 man-years of work (50% locally).

20. It is unlikely that a large part of these dismantling and clean-up costs (estimated at a total of NAf 1.7 billion) can be covered via subsidies or soft loans from foreign parties. The EU provides small grants through the European Development Fund (EDF) (in the order of <11 million euros) and the European Investment Bank (EIB) grants soft loans; however, the World Band (WB), Inter-American Development Bank (IADB) and the Commercial International Bank (CIB) do not grant soft loans. Local and international commercial loans can be taken out; however, the Curacao Government must issue a bank guarantee as a condition for a local loan.

Redevelopment of the Schottegat area

21. If the Government fails to find investors to upgrade the existing refinery, it may well consider redeveloping the Schottegat area before 2045 for new activities (instead of letting the site remain empty until 2045). In this case the site will replace other possible residential and business locations on the island. To determine whether this option would provide prosperity benefits for Curacao, the activities that qualify for the Schottegat area and the pace at which they can be realised must be specified. To this end, it must first be determined whether Curacao's expected economic growth will generate sufficient demand for such activities in the long term, and whether the demand for space is so much greater than the currently available zoning areas as to justify the redevelopment of the Schottegat location (close to 500 hectares).

22. Based on the Department of Economic Affairs' (DEZ) current sector-specific medium-term scenario exercise, two socio-economic scenarios were elaborated to get an impression of the demand for living space, business space and facilities space until 2045. The scenario exercise includes a 'base case' or low-growth scenario (average GDP growth of 1% per year) and an 'optimistic' or high-growth scenario (2% GDP growth up to 2028, followed by a GDP growth of 1.5% per year). The additional space required on behalf of homes, businesses and facilities resulting from each scenario are compared with the amount of space that, according to the Department of Urban and Regional Development Planning and Housing (DROV) and Land Registry (Kadaster) data, is currently being planned.

23. Two main alternatives were specified for the possible redevelopment of the Schottegat area, based on the afore-mentioned exercises:

    - Alternative A is aimed at establishing as many of the businesses anticipated in the scenarios as possible at Schottegat area. However, this alternative assumes that the location is not suitable for new tourist activities and also that as much of the remaining space as possible will be reserved for housing and residential services for people who will be working there, and their families.

As part of this alternative, six sub-alternatives can be distinguished. They differ with regard to the assumed higher and lower growth scenario, in terms in building density, and whether or not there is any competitive space on sites whose legal status as a zoning area was unknown to us at the time of the research (Wechi and Eastpoint).

The sub-alternatives for a low-growth scenario reserve approximately 90 hectares for businesses, and over 400 hectares for housing and residential services. Under this scenario there is no need for additional space for water/related activities before 2045. The sub-alternatives with a high-growth scenario earmark more than 140 hectares for water-related industry; this is at the expense of housing and residential services.

In the final situation (2045), the site will offer employment to between 8,000 and 9,000 workers based on the low scenario, and approximately 11,000 workers based on the high scenario. Under the low scenario, the site will be cleaned up at a slower rate, and construction work will be distributed over a longer period than under the high-growth scenario.

- Alternative B differs from Alternative A in that a large part of the site (185 ha) is reserved for green space. Furthermore, this alternative also has room for tourist activities. In this alternative 4,500 people will be employed in 2045, which is significantly fewer than in Alternative A.
  Alternative B has two sub-alternatives which take into account the high-growth and low-growth scenarios and the subsequent differences in pace as regards deploying the site upon redevelopment.

24. Estimates were subsequently made of the annual costs and revenues for alternatives and sub-alternatives A and B. The successive investment costs comprise land acquisition, site clean-up costs and site preparation, construction and design and/or management costs. The revenues comprise the sale or lease of dwellings and added value in connection with the investments and the operational phase of the new activities on the Schottegat site.
    The clean-up charge amounts to NAf 941 million. These are the additional costs that are required on top of the 'no access' clean-up order to make the site suitable for 'access' and use, i.e., for businesses and residences (see point 17).

Prosperity effect of retaining the (upgraded) refinery until 2045

25. The prosperity effect of the upgrading intervention is obtained by comparing the national socio-economic development of Curacao from year to year from now until 2045, plus the refinery (intervention 1.A in point 2) with the development without the refinery and without redevelopment (policy line M = M1 + M2, in point 3), subsequently determining the value of the annual differences and discounting and aggregating this value over the entire period.

26. The investment costs for upgrading and the operational costs of the renovated refinery up to the end of its economic life are pretty well entirely to the account of (foreign) investors and operators. The same is true for the operating profit to be made.

    The prosperity gain for Curacao's national economy consists mainly of the added value, which will be realised through the remuneration of the local employees if the refinery (and its associated specialised contractors) is retained. Besides this permanent source of revenue during the economic

life of the project, added value is also realised through the use of local labour during the investment phase.

As the economy of Curacao, like many island economies, is highly susceptible to market disruptions, a relatively large portion (50%) of the indirect effects of the project, as calculated with the Curalyse model, is interpreted as being a prosperity effect. However, this must be considered a maximum estimate.
In addition to this and depending on the investor's and operator's perceived yield capacity and the outcome of contract negotiations, Government revenues such as taxes and leases or Preferred Stock Dividends may be taken into account.

27. Total net revenue up to 2045 (NPV calculated at a social discount rate of 7%) varies at best – so with maximum Government revenue – between NAf 2.8 billion and NAf 3.2 billion (aggregated over the entire period). The Government's maximum share in this is an estimated NAf 725 million to NAf 825 million. This is excluding possible revenues for Bullenbay (Land Lease and/or Preferred Stock Dividend) which are not taken into account in the CBA. The higher the Government's revenue is, the lower the investor's and the operator's private operating results are.

    However, considering the estimated internal rate of return (IRR) for this project, there is sufficient reason to allow for the possibility of substantially lower revenues for the Government.

    Total Government's revenues from Bullenbay are estimated at annually NAf 53 million (not inflated) as a maximum, with a NPV of NAf 320 million, in case the new operator will not participate in the terminal. In case the new operator will also participate for 50% total Government's revenues are NAf 300 upfront and NAf 27 million annually (to be inflated) as a maximum, with a NPV of NAf 460 million.

28. The CBA takes non-priced or external prosperity effects into account in addition to priced prosperity effects. There was a lot of debate in recent years on the island about the pollution which hitherto was part and parcel of the refining industry. Consequently, the Government intends to gear its policy to environmental sustainability objectives. This demonstrates that the Curacao community sets great store by reducing soil pollution.

    If the refinery is upgraded the soil at the ISLA site will remain polluted or will possibly become even more polluted (as a result of spreading via the subsoil) during the refinery's economic life as the mitigation measures taken during upgrading will not be able to entirely prevent pollution from spreading further. So there is a negative environmental impact during this time. Moreover, upgrading will delay the benefits that the community will experience after a 'no access' clean-up by at least the economic life of the renovated refinery (say, 20 years).
    However, if the refinery is shut down and a 'no access' policy is pursued immediate action will be taken to effectively contain and clean up the pollution. The environmental benefits will be realised straight away.

    It is common practice to include environmental effects as provisional (or P.M.) items. The value of these provisional items can best be calculated by adopting the assumption as used in this study that when the refinery is shut down the site will inevitably be cleaned up in accordance with the 'no access' alternative. This assumption is based on the Government's sustainability intentions as well as on expanding international legislation. It follows from this assumption that the ongoing presence of soil pollution can be valued at the very least at the present value of the costs of a 'no access' clean-up, incurred as from 2022, minus these costs if they are incurred just after the closure of the ungraded refinery (expected in 2037). The estimated value of these negative provisional items

therefore boils down to a minimum amount of NAf 155 million (this amount will be significantly higher if the pollution spreads underground).

Keeping the refinery also has a positive external prosperity effect, namely the continuation of the current diversified national economy. After all, the refinery will need young technically qualified people. This will benefit the quality of the education on the island. A labour market characterised by a varied range of courses can also be a good starting point to further diversify the economy. The value of this positive provisional item cannot be determined (partly because adequate education and training involve investment costs).

Prosperity effect of redeveloping Schottegat area up to 2045

29. In order to determine the prosperity effect of this policy intervention, the national socio-economic development of Curacao between now and 2045 with an area redevelopment policy (intervention 2, alternatives A or B) was compared (in a similar manner as for the upgrading alternative) with the development without refinery and redevelopment (M). This comparison was done for all separate sub-alternatives of A and B.

30. Among the assumptions (deemed relevant) that were used in each of the sub-alternatives A, the Schottegat area redevelopment is an option that will generate more wealth than if other locations on the island were to be developed.
    The differences calculated for the lower and higher scenarios do not vary greatly. However, the preferred development density does make a big difference. When applying the current building standards for Curacao, the net benefits are between NAf 70 million and NAf 85 million. When applying a higher density for some of the homes and offices, the benefit increases to approximately NAf 220 million.
    Even if priority is given to the development of Wechi and Eastpoint the results remain positive although lower than if the priority is reversed (approximately NAf 70 million for both the lower and the higher growth).

    Sub-alternatives B show a lower result. This is due to the extensive green zones totalling 185 ha that generate less money than housing and businesses. Low growth generates a net result of approximately NAf 40 million; higher growth generates a small negative difference of NAf -16 million as compared with building elsewhere.

31. The direct and indirect effects of redevelopment have also been calculated. In this assumption up to 20% of the calculated indirect effects can be considered to contribute to national prosperity. (The remaining 80% of the calculated indirect benefits of redevelopment is assumed to be at the expense of other economic activities on the island; they are referred to as ‘crowding out’ effects, which on balance do not contribute to national prosperity.)

32. Extensive sensitivity analyses were done. The results show that several assumptions are crucial for the achieved positive results.
    Particularly the assumptions that the development of the centrally situated Schottegat site, especially in the case of high building density, can result in 5% to 10% more added value in the services sector than the development of other, more peripheral locations, and that houses can generate more money there than elsewhere, figure largely here.
    It is advisable to examine how much more these assumptions can be substantiated in the Strategic Vision Study, which commenced recently and which focuses explicitly on a careful analysis and selection of export-oriented activities.

In conclusion

33. The net social benefits (prosperity gain) that can be achieved by redeveloping the Schottegat area are significantly lower than the revenue, calculated for upgrading of the existing refinery. This is very easy to explain.
    Firstly, the very substantial upgrading costs are almost entirely for foreign investors and operators, while most of the expected added value (wages and salaries, income from Land Lease, Preferred Stock and taxes) will accrue to the island.
    Secondly, the reference alternative for upgrading is the total lack of a refinery in Curaçao, whilst the reference alternative for redevelopment is the development of other locations on the island and not 'no development at all'.

34. The uncertainty surrounding a successful policy for upgrading the existing refinery appears to be significant. Within a very limited period of time (before the end of 2013) foreign parties must be found prepared to commit to a major investment project – a project which most likely will not yield excessive profits.
    The oil refinery market is in a less favourable position, both globally and regionally. The Government should therefore explicitly allow for a 'no bid' outcome and closure of the existing refinery, in which case it will be faced with major policy issues due to the dismantling and clean-up of the ISLA site and due to decisions concerning possible redevelopment.

    It is therefore advisable to take a two-track approach when drawing up ISLA-related policy. If it is decided to undertake acquisition activities for keeping a refinery on Curacao, it is best to also develop a comprehensive policy plan for dismantlement, clean-up and redevelopment, so as not to lose any time if the first policy option does not achieve the desired results.

Agenda of action items

35. Continuation of refinery activities on Curacao
    - Find before the end of 2012 interested foreign parties who are able and prepared to invest in upgrading the present refinery, and to operate the upgraded refinery after 2019.
    - Enter before the end of 2013 into a final contract, in order to be able to pass on to the investment in 2014;
    - The upgrading investments will take 5 to 6 years. If contract negotiations take more time the investments will be made too late to warrant a smooth transition from the current to the upgraded refinery. Refinery activities will come to a stop for too long a period, and, worse, interested foreign parties (potential investors and operators) may pull out.
    - Formulate and negotiate immediately an MoU with PDVSA, which contains a description of its role till 2019 in the first place, and later on its role in the future with regard to the upgraded refinery aimed at by Curacao. Without such an MoU potential investors and operators will judge to have insufficient footing to enter negotiations and contracts about upgrading the present refinery.
    - The population of Curacao has mixed feelings about the present refinery and its operator. The MoU with PDVSA should pay due attention to guarantee that inconveniences by harmful emissions will be kept down to a minimum in the coming 8 years.
    - Ensure an optimal future utilization of Bullenbay terminal.
    - Formulate the minimum (financial) targets for the Government of Curacao to be achieved.
    - Ensure an independent and effective environmental department.
    - Make timely financial provisions annually for dismantling and remediation after 2037;

- Despite all efforts, be very seriously prepared for the ‘closure’ alternative (see below).

36. Refinery closure and possible redevelopment of Schottegat area
    - Prepare for (financing) dismantling the present installations and for remediation of the Schottegat area.
    - Secure national fuel supply including facilities needed in a future without refinery.
    - Decide if the Schottegat area should be considered officially as a competing zoning site to accommodate future national economic development during the period 2020 to 2045.
    - Don’t wait till 2014 with making planning preparations for dismantling, remediation and re-use of the Schottegat area in case of refinery closure in order to prevent delays. We recommend a parallel planning trajectory.
    - Ensure that, in case of closure, (long-lasting) zoning procedures will not hamper effective redevelopment.
    - Pay in the Strategic Vision Study attention to the suitability of Schottegat area for specific and viable export oriented economic activities.

Samenvatting

1. Vragen, beantwoord door het Ecorys-onderzoek

1. *Is het mogelijk om na 2019 raffinage-activiteiten te behouden voor Curaçao?*
   A. Upgrading the existing ISLA refinery: 3 varianten
      - Technische haalbaarheid
      - Commerciële haalbaarheid (gegeven marktontwikkelingen)
      - Financiele haalbaarheid en financierbaarheid (gegeven potentieel betrokken partijen en commerciële haalbaarheid)

   B. Grassroots refinery aan Bullenbaai: 4 varianten
      - Technische haalbaarheid (gegeven ligging Bullenbaai)
      - Commerciële haalbaarheid (gegeven marktontwikkelingen)
      - Financiele haalbaarheid en financierbaarheid (gegeven potentieel betrokken partijen en commerciële haalbaarheid)

2. *Wat betekent het hebben van een raffinaderij na 2019 voor de nationale welvaart?*
   - Vergelijking van toekomstige ontwikkeling van Curaçao met en zonder raffinaderij-variant
   - Tijdhorizon: tot 2045
   - Waardebepaling van de jaarlijkse verschillen voor alle betrokken nationale partijen tussen ontwikkeling met en zonder raffinaderij
   - Discontering en sommering van de verschillen over de gehele periode
   - Beoordelingscriteria: NPV van netto baten
   - Rekening houden met overige (niet geprijsde) voor- en nadelen

3. *Wat zijn de kosten van duurzame opruiming van het Schottegatgebied?*
   - Kosten van ontmanteling, vanaf 2017
   - Kosten van minimaal schoonmaken, voorafgaand aan 'no access' tot minstens 2045 (voorkomen van verdere verspreiding van bodemvervuiling)
   - Kosten van zodanig schoonmaken dat herinrichting kan plaatsvinden, zonder risico's voor veiligheid of gezondheid

4. *Draagt herinrichting van het Schottegatgebied vanaf 2020 bij aan de welvaart van Curaçao in de periode 2020-2045?*
   - Gegeven de voorziene nationaal-economische ontwikkeling (excl. raffinaderij): basis en optimistisch scenario
   - Gegeven de bestaande pijplijn van 'bestemmings'gebieden

   A. Inrichtingsvariant A (6 subvarianten) voorziet in eerste instantie in plaatsing van nieuwe industrie en diensten (excl. toerisme) op het Schottegatgebied; het resterend deel is voor woningbouw
      - Bij twee dichtheidsvarianten voor woningen en diensten
      - Met extra aanbodvarianten i.v.m. Oostpunt-ontwikkeling

   B. Inrichtingsvariant B (2 subvarianten) voorziet in de eerste plaats in groen (ecologie), en woningbouw; het resterend deelmis voor industrie en diensten (inc. toerisme)

2. Samenvatting, conclusies en advies

Opdracht, vraagstelling en aanpak

1. De Regering van Curaçao wil beleid voeren dat een economisch en ecologisch duurzame ontwikkeling van het eiland garandeert. In dat kader past zorgvuldige besluitvorming over de ISLA raffinaderij.
   De raffinaderij is verouderd en de bedrijfsvoering leidt tot veelvuldige en ernstige overschrijding van milieunormen. Het contract met operator PDVSA loopt af in 2019.
   De overheid (via RdK eigenaar van de raffinaderij) moet zich dus voorbereiden op nieuw beleid inzake raffinage-activiteiten op het eiland en de bestemming van het Schottegatgebied.
   Welke beleidsopties zijn beschikbaar en wat betekenen ze voor een duurzame toekomstige welvaartsontwikkeling van het eiland? In opdracht van de Regering heeft Ecorys een onderzoek uitgevoerd waarin geprobeerd is deze vragen te beantwoorden. Hier volgt een samenvatting van het onderzoeksrapport.

2. Bij de beleidsvoorbereiding dienen zich de volgende strategische interventie-opties aan:
   1. Maatregelen gericht op voortzetting van de raffinage-activiteiten op het eiland:
      a. Upgrading van de ISLA-raffinaderij op de huidige locatie;
      b. Bouw van een nieuwe (‘grassroots’) raffinaderij op Bullenbaai.
   2. Maatregelen gericht op hergebruik van het Schottegatgebied als de productie van de huidige raffinaderij wordt stilgelegd. Deze maatregelen omvatten uiteraard ook sloop van de bestaande installaties en adequate schoonmaakwerkzaamheden, nodig voor een gezond en veilig hergebruik.

   3. Om vast te stellen of en in welke mate deze ISLA-gerelateerde beleidsopties bijdragen tot de nationale welvaart zijn ze in een kosten-batenanalyse (KBA) afgezet tegenover ‘beleidsarme’ ISLA-gerelateerde keuzen (het referentie- of ‘do minimum’ alternatief M):
      M1. Zie af van maatregelen, gericht op voortzetting van raffinage op Curaçao na 2019;
      M2. Zie voor langere tijd af van inspanningen voor herinrichting van het Schottegatgebied.
      Afzien van herinrichting – dus het Schottegatgebied braak laten liggen – betekent niet dat er helemaal geen beleidsmaatregelen worden genomen. Het voornemen om een duurzaam beleid te voeren houdt in dat ook in het referentie-alternatief tot sloop wordt overgegaan, en maatregelen worden genomen die garanderen dat de bodemvervuiling zich niet uitbreidt en de verontreiniging van de omliggende waterbodems niet langer doet toenemen (‘no access’ of ‘containment policy’). Vandaar dat geen sprake is van een ‘do nothing’- maar van een ‘do minimum’-beleid.

Business case grassroots refinery

4. Een rendabele exploitatie van een nieuwe (grassroots) raffinaderij op Curaçao na 2019 (op Bullenbaai) lijkt – gezien de verwachte wereldwijde marktontwikkelingen – niet mogelijk. Er zijn 4 configuraties onderzocht, waaronder twee met oriëntatie op de wereldmarkt (investeringskosten ca. $5,8 miljard), en twee die vooral gericht zijn op de Caribische markt (investeringskosten ca. $3,6 miljard). Omdat deze interventie-optie niet haalbaar wordt geacht, is geen KBA uitgevoerd voor het effect op de nationale welvaart.

Business case upgrading bestaande ISLA raffinaderij

5. Voor upgrading van de bestaande raffinaderij (op het ISLA-terrein) na 2019 (investeringskosten ruim $ 3 miljard) worden wel voldoende marktmogelijkheden verwacht om tot rendabele exploitatie te komen; vooral als een buitenlandse investeerder een groot deel (70%) financiert met vreemd vermogen en PDVSA participeert als “crude supplier”. Er zijn 3 configuraties onderzocht, gebaseerd op de 5000 TC2 (thermal cracker), die verschillen naar de voor de elektriciteitscentrale van de raffinaderij in te zetten brandstof (pitch, LSFO en LNG). Bij iedere configuratie is gekeken naar 2 sub-varianten (één gefinancierd met 100% eigen vermogen, en één met 30% eigen vermogen).

6. De bedrijfseconomische rentabiliteit lijkt bij efficiënte bedrijfsvoering voldoende. Bij 30% eigen vermogen resulteert dat in een rendement op eigen vermogen (IRR) van 18% à 20% (ofwel groter dan de gestelde drempelwaarde van 15%), en in een DSCR (Debt Service Coverage Ratio) van 1,9 à 2,1 (die groter is dan de gestelde minimum target van 1,35 en de voorkeurs target van 1,50). De variant met LNG als brandstof is het meest veel belovend.

7. De Curaçaose overheid kan daarbij (risicoloos) als mede-eigenaar participeren door aanwezige "assets" (grond en bestaande installaties) ter beschikking te stellen. De waarde van de huidige installaties (bij renovatie) is getaxeerd.

8. Preferred Stock Dividend, respectievelijk een land lease fee, zijn nog niet meegenomen (als kostenpost) in bovenstaande berekening! Worden deze posten wel in de analyse opgenomen dan blijft upgrading nog steeds een rendabele zaak. De additionele inkomsten voor de overheid ten opzichte van de huidige situatie zijn echter wel afhankelijk van de onderhandelingen met de nieuwe investeerder/operator.
   Daarnaast is de overheid van plan een nieuw fiscaal regiem voor de raffinaderij in te voeren, waarbij met de nieuwe investeerder zowel over de "tax holiday" (in aantal jaren) als de belastingvoet zal worden onderhandeld. Ten opzichte van de huidige situatie wordt verwacht dat de overheid hiermee op termijn additionele inkomsten voor Curaçao genereert.

9. Upgrading kan alleen succesvol zijn als in de eerste plaats op korte termijn de volledige medewerking van PDVSA wordt verkregen om een nieuwe investeerder in staat te stellen de benodigde investeringen in upgrading te doen. Alleen dan kunnen de huidige operationele activiteiten vóór upgrading geruisloos overgaan in de operationele activiteiten na upgrading. In de tweede plaats dient, in verband met het benodigde investeringstraject van minimaal 5 á 6 jaar en rekening houdend met de contract-beëindiging van de huidige raffinaderij uiterlijk eind 2019, de besluitvorming over het al dan niet upgraden van de raffinaderij uiterlijk eind 2013 voltooid te zijn. Dat betekent dat a) geïnteresseerde partijen uiterlijk eind van dit jaar (2012) geïdentificeerd dienen te zijn en dat b) binnen minder dan twee jaar vanaf nu met deze nieuwe investeerders en operators contracten gesloten moeten zijn.

10. Bij de berekening van technische, economische en financiële haalbaarheid van de vernieuwde raffinaderij - waarbij de huidige energieleverancier BOO (CUC) is geïntegreerd - is er nadrukkelijk op toegezien dat voldaan kan worden aan internationaal geldende milieueisen betreffende luchtemissies. De uitstoot van zwaveloxiden, stikstofoxiden en fijne zwevende deeltjes zal aanzienlijk dalen; de uitstoot van koolstofdioxide en vluchtige koolstofverbindingen zal enigszins stijgen. De uitstoot zal nauwelijks hoger zijn dan de "Best Available Control Technology"(BACT) World Bank Benchmark.

11. Hierbij is aangenomen dat de energieleverancier (BOO) tijdig gerenoveerd wordt en geïntegreerd wordt in de upgraded raffinaderij. De emissieverbetering heeft betrekking op de geïntegreerde plant.

12. De vernieuwde raffinaderij zal ca. 100 fte's meer werknemers tellen dan nu. De werkgelegenheid bij de BOO blijft ongeveer gelijk aan de huidige. De werkgelegenheid van gespecialiseerde aannemers zal stijgen met ca. 150 personen (fte's).
    Hierbij moet men bedenken dat het huidige werknemersbestand vooral bestaat uit oudere werknemers (zie annex 8). Behoud van de raffinagesector voor Curaçao zal dus gepaard moeten gaan met aanzienlijke arbeidsmarktinspanningen, vooral op het gebied van werving, adequaat onderwijs en specialisatie.

13. Voor Bullenbaai Terminal zal, onafhankelijk van wat er gebeurt met de ISLA raffinaderij (upgrading of sluiting), een apart contract gesloten worden met een derde partij (afhankelijk van de beslissing met de nieuwe investeerder/operator van de raffinaderij of met de nieuw aan te trekken operator voor Bullenbaai Terminal). In het af te sluiten contract zal een lease bedrag voor gebruik van de grond worden opgenomen en/of een Preferred Stock Dividend worden overeengekomen. De hoogte van dit laatste is afhankelijk van het feit of de nieuwe operator ook mede-eigenaar wordt van de Bullenbaai Terminal of alleen de verantwoordelijkheid krijgt voor de "operations".

14. De financiële consequenties van upgrading voor de overheidsfinanciën hebben betrekking op enerzijds uitkomsten van de onderhandelingen met de nieuwe investeerder over de (winst)-belasting die geheven zal worden en de periode waarvoor een zogenoemde 'tax holiday' geldt (met een zeer lage belastingvoet). Anderzijds hebben zij betrekking op een te heffen lease bedrag voor het gebruik van de ISLA grond en een Preferred Stock Dividend die de nieuwe investeerder/operator moet gaan betalen voor de inbreng door RdK van de bestaande 'assets'. Bedacht dient te worden dat ook over deze twee zaken onderhandeld dienen te worden met de nieuw aan te trekken investeerder/operator.
    Daarbij beïnvloedt de hoogte van een Land Lease fee en het Preferred Stock Dividend in bepaalde mate het uiteindelijke rendement van de investeerder in de raffinaderij. Het vragen van te hoge bedragen heeft als consequentie dat het rendement voor de investeerder onder druk komt te staan en daarmee de kansen op succes afnemen.

Ontmanteling, sloop en schoonmaak

15. Indien de overheid van Curaçao er tijdig in slaagt investeerders te vinden die bereid zijn upgrading van de raffinaderij (op de ISLA site) te verwezenlijken, zodat deze ook na 2019 operationeel kan blijven, zal ontmanteling van de installaties en grondige schoonmaak van de sterk vervuilde bodem worden uitgesteld tot na afloop van de levensduur van de vernieuwde raffinaderij. Wel kunnen alvast mitigerende maatregelen genomen worden die vervuiling van aangrenzende waterbodems zoveel mogelijk beperken (totale investeringskosten zijn ca.$ 50 miljoen en de jaarlijks operationele kosten bedragen ca. $1,5 miljoen).

16. De kans bestaat dat eind 2013 duidelijk is, dat Curaçao er - ondanks de geschetste mogelijkheid van een commercieel haalbare en financieel duurzame upgrading - niet in slaagt tussen nu en 2019 de ISLA raffinaderij te behouden voor het eiland. Men moet dan beslissen wat er gebeurt met het vrijvallende terrein. Voor de periode tot 2045 zijn in deze studie twee mogelijkheden onderzocht. Het vrijvallend Schottegatgebied wordt niet gebruikt voor andere activiteiten (minimale of 'no access' schoonmaak) of het wordt bestemd om nieuwe groei-gerelateerde bestemmingen te accommoderen (maximale schoonmaak).

17. Omdat de Regering van Curaçao een beleid van ecologische en economische duurzaamheid wil voeren zal in beide gevallen worden overgegaan tot sloop van de huidige constructies en opstallen. De netto kosten van sloop en verwijdering zijn geschat op NAF 254 miljoen, met een marge van 40% (plus of min). De werkzaamheden duren 2 jaar en bieden per jaar werk aan ca. 850 personen (van wie 50% bestaan uit lokale arbeidskrachten).

18. Om dezelfde reden zullen, ook als men het terrein tot 2045 braak laat liggen, maatregelen worden genomen om de veiligheid en gezondheid van burgers te waarborgen. Dit betekent dat - bij niet-gebruik - het terrein na 2019 wordt afgesloten en dat de minimaal benodigde investeringen worden gedaan om te voorkomen dat de aanwezige bodemvervuiling zich verplaatst naar het omliggend gebied, inclusief de aangrenzende waterbodems. De kosten van deze minimaal benodigde schoonmaak zijn geraamd op NAF 526 miljoen (plus of min 40%). De werkzaamheden duren na ontmanteling eveneens 2 jaar en bieden per jaar werk aan ca. 630 personen (van wie 50% bestaan uit lokale arbeidskrachten).

19. Als het terrein daarentegen opnieuw wordt ingericht voor wonen of bedrijvigheid in dienstensectoren of industrie is om gezondheids- en veiligheidsredenen een intensievere schoonmaakoperatie nodig. De totale kosten van deze maximale variant zijn geschat op NAF 1.467 miljoen (plus of min 40%), dus NAF 941 miljoen meer dan die van de minimale variant. Verondersteld is dat deze kosten gespreid kunnen worden over een lange periode (tot 30 jaar) en voor ca. 3.500 manjaren werk biedt (50% lokaal).

20. De kans dat een flink deel van deze ontmantelings- en schoonmaakkosten (in totaliteit geraamd op NAF 1,7 miljard) kan worden gedekt door subsidies of zachte leningen van buitenlandse partijen moet klein worden geacht. De EU verstrekt via het EDF kleine subsidiebedragen (ordegrootte < € 11 miljoen) en de EIB zachte leningen. De WB, IADB en de CIB verstrekken echter geen zachte leningen. Commerciële leningen zijn zowel lokaal als internationaal mogelijk met als voorwaarde voor een lokale lening een bankgarantie van de Curaçaose overheid.

Herinrichting Schottegatgebied

21. Indien de Regering er niet in slaagt investeerders te vinden voor upgrading van de bestaande raffinaderij, kan ze overwegen het Schottegatgebied vóór 2045 opnieuw in te richten voor nieuwe activiteiten (in plaats van het terrein tot na 2045 braak te laten liggen). Het Schottegatgebied vervangt in dat geval andere mogelijke vestigingslocaties op het eiland. Om na te gaan of een dergelijke optie welvaartsvoordelen biedt voor Curaçao moet gespecificeerd worden welke activiteiten voor de Schottegatlocatie in aanmerking komen, en in welk tempo.
Daartoe moet eerst worden vastgesteld of de verwachte economische groei van Curaçao op lange termijn wel voldoende vraag naar deze activiteiten genereert, en of de daaruit af te leiden vraag naar ruimte zoveel groter is dan het bestaande aanbod aan beschikbare bestemmingsgebieden, zodat herinrichting van het Schottegatgebied (bijna 500 hectaren) een zinvolle optie is.

22. Om een beeld te krijgen van de vraag naar ruimte voor wonen, werken en voorzieningen tot 2045 zijn twee sociaaleconomische scenario's uitgewerkt, uitgaande van de bestaande sectorspecifieke middellange scenario-exercitie van DEZ. Deze kent een 'base case' of laag groeiscenario (gemiddelde GDP-groei van 1% per jaar) en een 'optimistisch' of hoger groeiscenario (tot 2028 2% GDP-groei, daarna 1,5% GDP-groei per jaar). De voor woningen, bedrijvigheid en voorzieningen benodigde extra ruimtebehoefte die uit elk scenario volgt is afgezet tegen het aanbod dat volgens gegevens van DROV en Kadaster nu in de planningspijplijn zit.

23. Op basis van de genoemde exercities zijn twee hoofdvarianten voor een mogelijke herinrichting van het Schottegatgebied gespecificeerd:

    - Variant A is erop gericht een zo groot mogelijk deel van de – in de scenario's voorziene – bedrijvigheid op het Schottegatterrein te vestigen. Daarbij is echter aangenomen dat de locatie niet in aanmerking komt voor nieuwe toeristische bedrijvigheid. Verder is ervan uitgegaan dat de resterend ruimte zoveel mogelijk zal bestemd wordt voor woningen en woonvoorzieningen voor degenen die er zullen werken en hun gezinnen.

      Voor deze variant zijn voorts 6 sub-varianten onderscheiden die verschillen naar het veronderstelde hogere en lagere groeiscenario, verschillen in bebouwingsdichtheid, alsmede wel/niet beschikbaar zijn van concurrerend ruimteaanbod op locaties waarvan ons, op het moment van onderzoek, de wettelijke status van bestemmingsgebied niet bekend was (Wechi en Oostpunt).

      In de subvarianten met een groeiscenario wordt circa 90 ha gereserveerd voor bedrijvigheid en ruim 400 ha voor woningbouw en woonvoorzieningen. Volgens dit scenario zal vóór 2045 geen behoefte bestaan aan extra ruimte voor watergebonden bedrijvigheid.

      Bij de subvarianten met hoge groeiscenario wordt ruim 140 ha bestemd voor watergebonden industrie wat ten koste gaat van woningbouw en woonvoorzieningen.
      In het lage scenario biedt het terrein in de eindsituatie (2045) werkgelegenheid voor ca. 8.000 à 9.000 werkenden; in het hoge scenario aan ruim 11.000 werkenden.
      Bij het lage scenario worden het terrein in langzamer tempo schoongemaakt en worden de constructiewerkzaamheden over een langere periode gespreid dan bij het hoge groeiscenario.

    - Variant B wijkt af van de vorige doordat een groot deel van het terrein (185 ha) gereserveerd wordt voor groenvoorzieningen. Verder wordt in deze variant ook enige ruimte geboden voor toeristische activiteiten.
      Het aantal werkenden in 2045 is volgens deze variant beduidend lager dan in variant A, namelijk 4.500.
      Varinat B kent twee subvarianten. Daardoor wordt rekening gehouden met het hoge en lage groeiscenario en met daaruit volgende tempo-verschillen voor ingebruiname van grond bij herinrichting.

24. Voor ieder van de (sub)varianten A en B zijn vervolgens ramingen gemaakt van jaarlijkse kosten en opbrengsten. De investeringskosten bestaan uit achtereenvolgens grondverwerving, schoonmaakkosten van de grond en kosten van "site preparation", constructie en ontwerp c.q. management. De opbrengsten bestaan uit de verkoop of verhuur van woningen en toegevoegde waarde verbonden met de investeringen en de operationele fase van de nieuwe bedrijvigheid op het Schottegatgebied.
    De schoonmaakkosten bedragen NAF 941 mln. Dat zijn de extra kosten die additioneel op de 'no access' schoonmaak moeten worden gemaakt, om het terrein geschikt te maken voor 'access' en gebruik, d.w.z. voor bedrijvigheid en bewoning (zie punt 17).

Welvaartseffect van behoud van de (upgraded) refinery tot 2045

25. Het welvaartseffect van de interventie ‘upgrading’ verkrijgt men door de nationale sociaal-economische ontwikkeling van Curaçao van jaar to jaar, vanaf nu tot 2045, met de raffinaderij (interventie 1.A onder punt 2) te vergelijken met de ontwikkeling zonder raffinaderij en zonder herinrichting (beleidslijn M = M1 + M2, onder punt 3), vervolgens de waarde van de jaarlijkse verschillen te bepalen, deze te disconteren en over de gehele periode te aggregeren.

26. De investeringskosten van upgrading en de operationele kosten van de gerenoveerde raffinaderij tot het einde van de economische levensduur komen nagenoeg volledig ten laste van (buitenlandse) investeerders en operators. Hetzelfde geldt voor de te behalen bedrijfswinsten.

    De welvaartsvoordelen voor de nationale economie van Curaçao bestaan vooral uit de toegevoegde waarde, die bij behoud van de raffinaderij (en de daarmee verbonden gespecialiseerde aannemers) via de beloning van lokale werknemers gerealiseerd wordt. Behalve deze permanente bron van opbrengsten gedurende de economische levensduur van het project, wordt ook gedurende de investeringsfase toegevoegde waarde gerealiseerd door inschakeling van lokale arbeidskrachten.

    Omdat de economie van Curaçao, zoals zoveel eiland-economieën, extra vatbaar is voor marktverstoringen, is een relatief omvangrijk deel (50%) van de met het Curalyse-model berekende indirecte effecten van het project opgevat als welvaartseffect. Dit moet echter wel beschouwd worden als een maximum schatting.

    Daarnaast mag men - afhankelijk van de door de investeerder en operator gepercipieerde opbrengstcapaciteit en de uitkomst van contractonderhandelingen - rekening houden met overheidsinkomsten, zoals belastingen en pacht of Preferred Stock Dividenden.

27. De totale netto opbrengst tot 2045 (NPV berekend tegen een maatschappelijke discontovoet van 7%) varieert in het gunstigste geval - dus met maximale overheidsinkomsten - tussen 2.8 en 3.2 miljard NAF (geaggregeerd over de hele periode). Het aandeel van de overheid hierbij is geschat op maximaal NAF 725 à NAF 825 miljoen. Dit is exclusief de mogelijke overheidsinkomsten voor Bullenbaai die niet in de CBA zijn meegenomen. Hoe hoger de overheidsopbrengsten, des te lager de private bedrijfsresultaten van investeerder en operator.

    Gegeven de voor dit project geschatte IRR is er echter reden om terdege rekening te houden met de mogelijkheid van substantieel lagere inkomsten voor de overheid.

    De totale inkomsten voor de overheid uit Land Lease en/of Preferred Stock Dividend worden geschat op jaarlijks maximaal NAf 53 miljoen, met een NPV van NAf 320 miljoen, in het geval de nieuwe operator niet in de terminal gaat participeren. In het geval de nieuwe operator voor 50% participeert, zijn de totale inkomsten voor de overheid geschat op eenmalig NAf 300 miljoen (bij sluiten contract) en jaarlijks NAf 27 miljoen (plus jaarlijkse inflatie) als maximaal haalbaar met een totale NPV van 460 miljoen.

28. Behalve in geprijsde welvaartseffecten is in de KBA ook rekening gehouden met ongeprijsde of externe welvaartseffecten. De afgelopen jaren bestond veel discussie op het eiland over de verontreiniging die tot nu toe met raffinage gepaard ging. De Regering heeft dan ook het voornemen haar beleid beter af te stemmen op doelstellingen van ecologische duurzaamheid. Dit betekent dat de Curaçaosche gemeenschap veel (positieve) waarde hecht aan vermindering van bodemverontreiniging, en veel (negatieve) waarde aan het laten voortbestaan ervan.

In het geval van upgrading zal de bodemvervuiling op het Schottegatterrein tenminste gedurende de economische levensduur blijven voortbestaan of zelfs verergen (door ondergrondse verspreiding). De mitigerende maatregelen die bij upgrading worden getroffen, zullen verdere verspreiding van bodemverontreiniging immers niet geheel kunnen voorkomen. Hier is dus sprake van een negatief milieueffect gedurende deze periode. Bovendien worden de baten die de gemeenschap ervaart na 'no access' schoonmaak bij upgrading ten minste gedurende de economische levensduur van de gerenoveerde raffinaderij uitgesteld (zeg met 20 jaar).
Bij sluiting en 'no access'-beleid daarentegen wordt direct overgegaan tot effectieve indamming en schoonmaak. De milieubaten worden onmiddellijk gerealiseerd.

Het is gebruikelijk zulke milieu-effecten op te nemen als Pro Memorie- of PM-posten. Men kan de waarde van deze PM-posten het best benaderen door gebruik te maken van de in deze studie gehanteerde veronderstelling dat bij sluiting van de raffinaderij schoonmaak conform de 'no access' variant onontkoombaar is, op grond van enerzijds de duurzaamheids-voornemens van de Regering, anderzijds de internationaal groeiende regelgeving. Uit deze veronderstelling volgt dat het laten voortbestaan van de bodemvervontreiniging te waarderen is op minimaal de contante waarde van de kosten van 'no access' schoonmaak, gemaakt vanaf 2022, verminderd met deze kosten, ingeval ze pas na sluiting van de ungraded raffinaderij worden gemaakt (naar verwachting in 2037). De geschatte waarde van deze negatieve PM-post komt aldus neer op een bedrag van tenminste NAf - 155 mln (bij ondergrondse verspreiding van de verontreiniging kan dit bedrag beduidend hoger uitvallen).

Behoud van de raffinaderij heeft ook een positief extern welvaartseffect, namelijk het behoud van de bestaande diversificatie van de nationale economie. De raffinaderij zal immers jonge technisch goed opgeleide mensen nodig hebben. Dat zal de kwaliteit van het onderwijs op het eiland ten goede komen. Een arbeidsmarkt die gekenmerkt wordt door gevarieerd opleidingsscala kan voorts een goed uitgangspunt zijn voor verdere diversificatie van de economie. De waarde van deze positieve PM-post is niet te bepalen (ook omdat adequate scholing en opleiding ook met investeringskosten gepaard gaan).

Welvaartseffect van herinrichting van het Schottegatgebied tot 2045

29. De nationale sociaal-economische ontwikkeling van Curaçao van nu tot 2045 met een een beleid van herinrichting van het Schottegatgebied (interventie 2, varianten A of B) is – op soortelijke manier als bij de upgradingsoptie - vergeleken met de ontwikkeling zonder raffinaderij en herinrichting (M), om het welvaartseffect van deze beleidsinterventie te bepalen. Dat is gedaan voor de alle onderscheiden sub-varianten van A en B.

30. Onder de (relevant geachte) veronderstellingen, gehanteerd bij ieder van de sub-varianten A zijn gehanteerd, is herinrichting van het Schottegatgebied een keuze die meer welvaart genereert dan wanneer andere locaties op het eiland ontwikkeld worden. De verschillen, berekend voor het lagere en hogere scenario lopen niet ver uiteen. De gekozen bebouwingsdichtheid maakt echter wel wat uit. Bij toepassing van de voor Curaçao geldende bouwnormen zijn de netto baten NAf 70 miljoen à NAf 85 miljoen. Bij toepassing van een hogere dichtheid voor een deel van de woningen en kantoren stijgt het voordeel tot circa NAf 220 miljoen.
Ook als men rekening houdt met prioriteit voor ontwikkeling van Wechi en Oostpunt, blijven de resultaten positief, hoewel lager dan wanneer de prioriteit wordt omgekeerd (zowel bij lagere als hogere groei NAf ca. 70 miljoen).

De sub-varianten B geven een lager resultaat. Dat is toe te schrijven aan de omvangrijke groenzones van tesamen 185 ha, die lagere monetaire opbrengsten genereren dan woningen en bedrijvigheid. Bij lage groei is het nettoresultaat ca. NAf 40 miljoen; bij hogere groei is er een klein negatief verschil met bouwen elders NAf -16 miljoen.

31. Ook in geval van herinrichting zijn directe en indirecte effecten berekend. Aangenomen is dat van de berekende indirecte effecten ditmaal maximaal 20% beschouwd mag worden als een bijdrage aan de nationale welvaart. (Van de overige 80% aan berekende indirecte voordelen van herinrichting wordt aangenomen dat ze ten koste gaan van andere economische activiteiten op het eiland; dat zijn dus zogenaamde verdringingseffecten, die per saldo niet bijdragen tot de natioonale welvaart.)

32. Er zijn uitgebreide gevoeligheidsanalyses verricht. Daaruit blijkt dat een aantal veronderstellingen cruciaal is voor de bereikte positieve resultaten. Vooral de veronderstellingen dat de ontwikkeling van het centraal gelegen Schottegatgebied, in het bijzonder bij hogere bebouwingsdichtheid, kan leiden tot 5% à 10% meer toegevoegde waarde in de dienstensector dan bij ontwikkeling van andere, meer perifeer gelegen locaties, en dat woningen er meer geld kunnen opbrengen dan elders, spelen daarbij een belangrijke rol.
    Het verdient aanbeveling na te gaan in hoever deze veronderstellingen nader kunnen worden onderbouwd in de Strategische Visie Studie, die onlangs is gestart en waarin expliciet aandacht wordt besteed aan een zorgvuldige analyse en selectie van export gerichte activiteiten.

Tenslotte

33. De netto maatschappelijke opbrengst (welvaartswinst) die met herontwikkeling van het Schottegatgebied kan worden behaald is beduidend geringer dan opbrengst, berekend voor upgrading van de bestaande raffinaderij. Dat is ook heel verklaarbaar.
    In de eerste plaats komen de zeer omvangrijke kosten van upgrading bijna geheel voor rekening van buitenlandse investeerders en operators, terwijl het grootste deel van de verwachte toegevoegde waarde (lonen en salarissen, inkomsten uit Land Lease, preferred stock en belastingen) zal toevallen aan het eiland.
    In de tweede plaats is het referentiealternatief voor upgrading het geheel ontbreken van een raffinaderij op Curaçao, terwijl het referentiealternatief voor herontwikkeling niet helemaal geen ontwikkeling is, maar ontwikkeling van andere locaties op het eiland.

34. De onzekerheid waarmee een succesvol beleid inzake upgrading van de huidige raffinaderij omgeven is, lijkt aanzienlijk. Binnen een zeer beperkte tijd (voor eind 2013) moeten buitenlandse partijen bereid gevonden worden zich te verbinden aan een groot investeringsproject, dat hen waarschijnlijk geen excessieve winsten zal opleveren. De markt voor olieraffinage bevindt zich voorts zowel wereldwijd als regionaal in een minder gunstige situatie. De Regering moet daarom uitdrukkelijk rekening houden met een 'no bid' uitkomst en sluiting van de bestaande raffinaderij. Ze wordt in dat geval geconfronteerd met omvangrijke beleidsproblemen wegens ontmanteling en schoonmaken van het Schottegatgebied, en wegens keuzen inzake eventuele herinrichting.

    Het verdient daarom aanbeveling om bij de voorbereiding van ISLA-gerelateerd beleid twee sporen tegelijk te volgen. Als besloten wordt om acquisitie-inspanningen te doen voor het behoud van een raffinaderij op Curaçao, kan men het best tegelijkertijd ook aan een gedegen beleidsplan voor ontmanteling, schoonmaken en herinrichting gaan werken, om tijdverlies te voortkomen voor het geval de eerste beleidsoptie niet tot het gewenste resultaat leidt.

Agenda van actiepunten

35. Voortzetting van raffinage-activiteiten op Curaçao
    - Vind vóór het einde van dit jaar (2012) een of meer buitenlandse partijen die in staat zijn en bereidheid vertonen om te investeren in de upgrading die noodzakelijk is om de huidige raffinaderij op Curaçao na 2019 te laten voortbestaan, en om de bedrijfsvoering van deze raffinaderij op zich te nemen.
    - Zorg dat deze bereidheid voor het einde van 2013 leidt tot een definitief contract, zodat meteen daarna, in 2014, wordt begonnen met de investeringen.
    - De upgradingsinvestering zal 5 à 6 jaar vergen. Als de contractonderhandelingen meer tijd in beslag nemen komen de investeringen te laat gereed om een soepele overgang van de huidige naar een gerenoveerde raffinaderij te garanderen. De raffinagewerkzaamheden komen dan voor langere tijd stil te liggen, en erger, potentieel geïnteresseerde investeerders en operators kunnen op grond van dit perspectief afhaken.
    - Sluit op korte termijn (binnen een half jaar) een 'Memorandum of Understanding' met PDVSA, waarin duidelijk vastligt wat de toekomstige rol van dit bedrijf zal zijn tot enerzijds 2019 en anderzijds daarna zal zijn tegen de achtergrond van een door Curaçao gewenste upgrading. Zonder concrete afspraken met de huidige operator, met het doel potentieel geïnteresseerde investeerders en operators duidelijke garanties te verschaffen over effectief en coöperatief verloop van de overgangsperiode, zullen de eerder genoemde actiepunten niet (tijdig) succesvol worden afgerond.
    - Schenk bij de MoU aandacht aan de publieke opinie; steun van de bevolking voor onderhandelingen over upgrading is mede afhankelijk van de garanties dat overlast de komende 8 jaar beperkt blijft.
    - Verzeker bij al deze contractonderhandelingen een voor Curaçao optimale benutting en bedrijfsvoering van Bullenbaai.
    - Zorg, in het belang van veiligheid, volksgezondheid en ter verwerving van publieke steun voor een mogelijke upgrading van de huidige raffinaderij voor een adequaat uitgeruste, onafhankelijke en effectief werkende milieudienst. Garandeer dat deze dienst alle nodige controlerende en uitvoerende bevoegdheden heeft om de regelgeving te handhaven die voldoet aan in 2020 geldende internationale normen.
    - Pleeg, ingeval voorvermelde acties succesvol zijn en tot upgrading leiden, tijdig de financiële voorzieningen, nodig om na de economische levensduur van de installaties (rond 2037) voorbereid te zijn op de kosten van sloop en schoonmaak van het terrein.
    - Blijf terdege voorbereid op de reële kans dat sluiting van de raffinaderij - ondanks alle te plegen inspanningen - onvermijdelijk blijkt en op in dat geval te volgen beleidsopties (zie hierna).

36. Sluiting raffinaderij en mogelijke herinrichting Schottegatgebied
    - Onderzoek de financiële implicaties van de sloop- en adequate schoonmaak-operaties van installaties en het Schottegatterrein.
    - Zorg dat het aanbod van brandstof in de toekomst op aanvaardbare voorwaarden verzekerd blijft en tref daartoe de nodige voorzieningen.
    - Bereid besluitvorming voor over de vraag of het vrijkomende terrein in het Schottegatgebied officieel in aanmerking dient te komen als bestemmingsgebied voor de nieuwe economische activiteiten die tot 2045 verwacht mogen worden, en ga daarbij na wat de voor- en nadelen van dit gebied zijn ten opzichte van andere (bestaande en mogelijk te ontwikkelen) bestemmingsgebieden op Curaçao.
    - Wacht niet het treffen van voorbereidingen voor sloop, schoonmaak en eventuele herinrichting van het Schottegatgebied tot duidelijk is dat sluiting van de raffinaderij onvermijdelijk is. Voorkom dat dit bij sluiting tot jaren vertraging leidt. Kies daarom voor een parallel traject van beleidsvoorbereiding.

- Zorg, in geval herinrichting wordt overwogen, dat (langdurige) bestemingsplanprocedures tijdig starten, zodat een onnodig lange voorbereidstijd effectieve herinrichting en het daarvoor benodigde elan ondermijnen.
- Laat in de Strategische Visie Studie nagaan welke export gerichte activiteiten specifiek voor de Schottegatlocatie geschikt zijn en wat hoe de economische haalbaarheid ervan kan worden beoordeeld.

1 Introduction

Background and Assignment

On January 1st 2019 the present lease contract of Refineria di Kòrsou (RdK), a state enterprise owning the ISLA-refinery in Willemstad, with its operator Petroleos de Venezuela S.A (PDVSA) will expire. The refinery was established in 1915 by 'Curaçaosche Petroleum Industrie Maatschappij' (CPIM), a Shell daughter, and sold to the Government of Curacao in 1986. Despite several renovations in the past is has become out of date.

Given the present state of the refinery, its somewhat dated product mix and its repeatedly exceeding of international environmental emission standards, oil refining activities can only be maintained in Curacao if a completely new (grassroot) plant will be set up, or if the present refinery will be very drastically upgraded. In order to warrant a smooth continuation of refining activities on the island, preparation and implementation of the investments needed should start at least five years before the expiration of the current contract with PDVSA. A go/no go decision must therefore be taken on very short notice (viz. in 2012).

In case neither of the replacement alternatives is technically, commercially and/or financially feasible, the Government of Curacao will be confronted with another dilemma, viz. what to do with the premises of the present ISLA refinery? The plant is located on a large site (490 hectares) at Schottegat Bay, in the very middle of Willemstad. This central location provides it in principle with a high development potential, which can contribute not only to economic growth and welfare increase of the island, but can also improve the spatial structure of the capital town and the island.

However, nearly a century of polluting oil refining activities has caused very substantial environmental damage on the site itself and its surrounding water bottom. Moreover, the processes of dispersion of and contamination with harmful pollutants have not yet stopped. Preparing the site for new types of use requires therefore not only dismantling the refinery structures, but also adequate cleaning of the site. What type of activities would be appropriate, what cleaning costs should be reckoned with, and what benefits can be expected from such an operation? Answers to these questions imply that a second series of decisions must be taken in the near future.

Ecorys B.V. concluded therefore in phase I of the present assignment that the Government of Curaçao is confronted with three main strategic policy options regarding the ISLA issue:
Make for a *radical upgrading* of the refinery at its present location; or:
Aim at the establishment of a *grassroots refinery at another location* on the island (i.c. Bullenbay), with a simultaneous shut down of the ISLA plant, dismantling existing structures and cleaning up the area; (this alternative might be combined with a redevelopment strategy for the Schottegat area; see next alternative); or:
Abandon the idea of retaining refining activities on Curacao, and switch over to a strategy of restructuring the Schottegat area, and redevelop the area by *stimulating other promising economic activities*, after dismantling the refinery structures and adequate cleaning.

In order to facilitate the decision process the consultant was requested to carry out a commercial and financial (or business case) analysis (BCA) for both refinery alternatives as well as a socio-economic cost-benefit analysis (CBA) for all three strategic options, and to formulate concrete recommendations that may assist the parties involved to take a right decision.

The BCA should answer questions regarding the demand for refinery products in the region (Caribbean and neighboring South America), technically and commercially viable product mix variants, the financial feasibility of such variants, and costs and business results RdK could derive from such renewed refinery investments on its territory.

The CBA should provide information about the contribution of feasible refinery variants to national welfare, in terms of net monetary benefits accruing to island parties as well as other (non-monetary) welfare effects, like external and welfare distribution effects. The CBA must moreover provide useful information about the consequences of the third mentioned strategic option: preparing the Schottegat area for other promising economic activities.

To assess such CBA effects the development taking place with the Government interventions, needed to realize the strategic options, must be compared with the development to be expected if the Government will not implement such ISLA related policy measures. This implies that performing the CBA requires the definition of an additional *reference alternative* (also called 'do minimum' option): how will the national welfare develop if ISLA site will not only be no longer used for refinery activities, but remains lying fallow for an indefinite period (at least till 2045)? So, for the CBA we add a (non-strategic, non-intervention) *reference option*:
Abandon the idea of retaining refining activities on Curacao, but do - after dismantling the refinery structures and implementing minimally necessary site cleaning - not restructure it (during the next 30 to 40 years), nor try to redevelop the area by *stimulating other economic activities.*

Overview of the Studies Carried Out to Answer the Research Questions

To execute this BCA and CBA in a proper way and to avail of all the information needed to formulate a well-balanced policy advice, a series of analyses have been carried out:

- Market analysis of refinery products;
- Feasibility studies of a new (grassroots) refinery or upgraded refinery;
- Assessment of dismantling and soil remediation costs;
- Formulation of social and economic scenarios for long term economic development;
- Economic impact assessment;
- Cost benefit analysis.

Structure of this Report

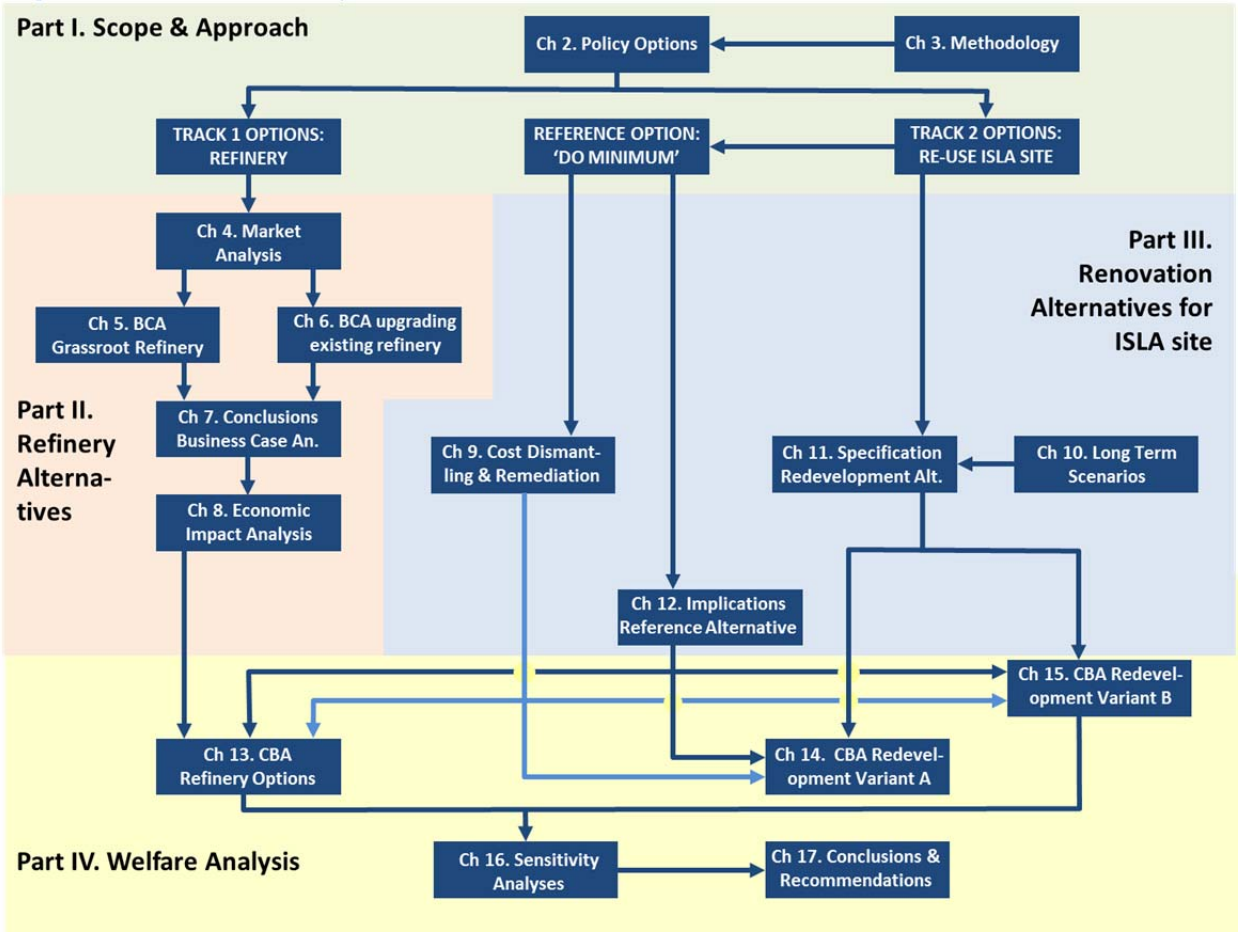
This report describes the methodology, the main research steps and the results of the study (the Business Case Analysis and the Cost Benefit Analysis). It consists of 4 main parts and 17 Chapters. The structure and the relationship between the parts and chapters are summarized in Diagram 1.1.

In part I the policy options, including the reference option (chapter 2), and the methodology (chapter 3) are explained. Then, in part II the policy options regarding the refinery (hereafter called track1 policy options) are discussed. Based on a market analysis for refinery products (chapter 4), the feasibility of establishing a new ('grassroot') refinery and of upgrading the present refinery are critically inspected in chapters 5 and 6 respectively. It is concluded in chapter 7 that only an upgrading option appears to be viable, under certain conditions. Therefore only this last alternative is, in chapter 8, subjected to a further Economic Impact Analysis (EIA).
In Part III attention is paid to policy options regarding redevelopment of the Schottegat area (called track 2 policy options). The first step is an assessment of the costs of dismantling the present refinery structures and several possible degrees of soil remediation (chapter 9). Then follows in chapter 10 a short description of two long term social and economic scenarios which function as a possible exogenous and consistent national economic background against which two main redevelopment options can be further analyzed. These two track 2 options and some sub-variants

are then specified in chapter 11. Finally in chapter 12 attention is paid to the consequences for the specification of proper reference or 'do minimum' policy options with which the ISLA redevelopment alternatives should be confronted in the subsequent national welfare assessment or Cost Benefit Analysis.

The results of the CBA or welfare analysis are discussed in part IV. Chapter 13 presents the CBA results of the track 1 option, viz. the refinery upgrading variant. Chapters 14 and 15 review the outcome of both track 2 redevelopment options. On the basis of the results obtained, some further analysis was done by analyzing the sensitivity of the main outcomes for a number of variables whose uncertain values may affect the national welfare consequences considerably. This is described in chapter 15. The final chapter 16 presents the main conclusions and policy recommendations. Some detailed information is provided in the annexes. At the beginning of the report an English and a Dutch summary have been presented.

Diagram 1.1 Structure of this Report



Part I. Scope and Approach

2 Review of Policy Options

2.1 Sustainable development: key policy issue of the Government

The national Government of Curacao aims at a sustainable development of the island. Sustainable development means that resources will be used in such ways that human needs are met while preserving the environment, and that these needs can be met not only in the present, but also in the future.
For the use of available space to accommodate the national economic development this means that areas, used for industrial purposes like the ISLA site, should – after ending such use – be restored in such a way that they don't impede possible new uses by future generations.

To carry out a welfare analysis for sustainable strategic policy interventions with respect to
1. a continuation of refining activities on Curacao or
2. a possible re-use of the ISLA site,
we must start from a careful description of the interventions to be taken into consideration.
During Phase I of the study a two 'tracks' approach was proposed, hereafter indicated as track 1 and 2.

- Track 1: development of a clear, well underpinned and socio-economic motivated view on continuation, or closure of refinery activities on the island after 2019 (or earlier).
- Track 2: development of an equally well founded view on recovering the ISLA area, and re-using it before 2045 for new value generating economic activities (after an appropriate cleaning up).

For each track a variety of policy interventions can be discerned.

If (the Government of) Curacao decides to carry out strategic policy interventions along track 1 or track 2 (the 'project' options) it has to devote a substantial amount of scarce resources (time and money) to realise the project objectives, even if the majority of the investments will be made by private and/or foreign parties. To evaluate the socio-economic effects of the interventions in an appropriate way an economic cost benefit analysis must be carried out. However, a CBA requires that the future island development which will occur by spending national resources on the project, be compared with the development to be expected if the same resources will not be spent on the project in question, but in another way ('business as usual').
To put it otherwise: the CBA-*effect* of a strategic intervention is the value, attached by the community to the *difference* between the expected development *with* and *without* carrying out the project.

This poses the question of what will be the future development of Curacao if the Government takes no serious measures to keep refinery activities on the island after expiration of the lease contract in 2019, nor measures to renovate and re-use the abandoned ISLA site before the year 2045. Such a 'laissez fair' policy with *respect to the upcoming refinery and ISLA site problems* is hereafter called the base case, reference alternative, or the *'do minimum' policy* (M).
The 'do minimum' alternative should therefore also be properly specified.

Hereafter we first pay attention to strategic intervention variants for options 1 and 2. Then we discuss the do minimum alternative M, as used in this analysis.

2.2 Refinery options (track 1)

Track 1 consists of two main variants for a refinery plant:

1.A A radical upgrading of the present refinery on the ISLA site;

1.B A new (grassroots) refinery on Bullenbay.

For both main refinery variants a number of sub variants have been defined and analysed.
The product mix and production capacity of both refinery variants have been specified on the basis of a market study. This market study rendered information about the global and regional demand for refinery products, available 'room' in the refinery market and suitability of the island to provide new or renewed refining capacity.
Subsequently a business case study (BCA) has been carried out for every (sub) variant, in order to see if each case would be feasible, technically as well as commercially and financially.
For those (sub) variants which were expected to satisfy sound BCA criteria, a cost benefit analysis was performed, in order to gain insight in the possible contribution of the investment to the welfare of the island (GDP and external effects like health, safety and environmental risks resulting from changes in emissions to air, water and bottom, and other sustainability criteria). (Sub) variants which did not meet the BCA criteria, were considered not feasible and discarded from further (CBA) analysis.

2.2.1 Variant 1.A: Upgrading the ISLA-refinery

For Variant 1A, upgrading the ISLA refinery 5000TC2 (= 5000 tpd thermal cracker rate) from the 2009 study of Purvin & Gertz (PGI) is updated and evaluated. The following sub-variants have been elaborated:

- 5000 TC2 without integration of the BOO (CUC: utility plant) with and without PDVSA;
- 5000 TC2 including integration of the BOO, with and without PDVSA (with 3 fuel options for BOO).

For the 5000 TC2 and its sub-variants the following issues have been dealt with, assuming an unchanged exclusive use of the ISLA site by the refinery:

- Starting year of the investments and determination of the investment period;
- Starting year of operations;
- Expected economic lifetime of the investments;
- Estimate of the investment costs (excluding and including financing costs) as well as the annual operating costs;
- Estimate of the revenues and costs and its share to be attributed to Curacao (RdK, contractors, suppliers, etc.);
- Financing mode;
- Tax holiday and (profit) taxes to be paid;
- Etc.

Apart from that (as input for the Costs Benefits Analysis):

- Demolition and cleaning costs for the ISLA site to be implemented after finishing the economic lifetime of the upgraded refinery;
- Cost of adequate monitoring of the environmental standards/norms by an independent authority;
- Possible environmental activities to be started soon related to a sustainable development of Curacao;
- Etc.

2.2.2 Variant 1.B: Grassroots refinery at Bullenbay

For Variant 1B, the Grassroots refinery to be located at Bullenbay the following four cases were evaluated:

1. HCU/Coker configuration export refinery
2. FCC/Coker configuration export refinery
3. HCU/Coker configuration local refinery
4. FCC/Coker configuration local refinery

For the four cases mentioned above the following issues have been dealt with:

- Starting year of the investments and determination of the investment period;
- Starting year of operations;
- Expected economic lifetime of the investments;
- Estimate of the investment costs (excluding and including financing costs) as well as the annual operating costs;
- Estimate of the revenues and costs and (if applicable) its share to be attributed to Curacao (RdK, contractors, suppliers, etc);
- Financing mode;
- Tax holiday and (profit) taxes to be paid;
- Etc.

Apart from that (as input for the Costs Benefits Analysis):

- Demolition and cleaning costs for the ISLA site, in case of grassroots refinery will be realized and the existing ISLA refinery will be closed down in 2019 or earlier;
- Cost of adequate monitoring of the environmental standards/norms by an independent authority;
- Possible environmental activities to be started soon related to a sustainable development of Curacao;
- Etc.

2.3 Re-development of Schottegat area before 2045 (track 2)

We come now to track 2 which was split up into two re-development variants of the Schottegat area:

2.A Preparing and design the area for manufacturing, offices and warehousing activities, in combination with adequate housing accommodation for employees;

2.B Preparing and reserving the area for a broader mix of activities (to a certain extent comparable with recent ideas, brought forward by the 'Greentown' advocates, but with less activity densities and without the activities foreseen for areas neighbouring the Schottegat area), including private and public services, light industries, some hotels, residential buildings and facilities, as well as extensive 'green' open spaces, boulevards and beaches.

The scope of this study did not allow for performing market and business case analyses of each single industry or economic activity, eligible for location in the Schottegat area. For all economic activities (other than oil refining) therefore another approach had to be followed, in order to be able to carry out a cost benefit analysis in which the development *with* site renovation could be compared to the development *without* this strategic policy intervention.
We solved the problem by taking the recent midterm economic scenario exercise of the Government (DEZ) as our basis, i.e. as an exogenously given performance by industry of all activities on the island during a the 10 years period (2011 to 2021). In consultation with DEZ we decided to consider two different scenarios: I. the DEZ 'base case' or lower scenario, and II. the DEZ 'optimistic' or higher scenario. By using the scenarios - and extending the assumed growth

figures till 2045, we implicitly assumed that industries to be located at former ISLA premises can be assured to sell their production with a profit. This implies that – contrary to the procedure followed for the refinery options (1.A and 1.B) - no market studies are needed.
It also implies that differences between business performance of track 2 activities in case of location on ISLA and its reference alternative (location elsewhere on Curacao; see below) can only be ascribed to differences in site specific production costs (unless explicitly otherwise assumed) and site preparation costs.

Variant 2.A: Non-tourist industries and housing

Diagram 1a and 1b offer an impression of the layout of redevelopment option 2.A.
The left map refers to the layout at 'normal' densities (i.e. activity densities/hectare not exceeding existing zoning rules on Curacao), and the right map to higher densities. As the Schottegat area is centrally located and therefore most conveniently situated for a higher-rise urban style development, and because the present refinery structure was always characterized by high stacks, redevelopment of the location by condensing houses and offices appears to be a realistic option.

Diagram 2.1 Strategic option 2.A, Redevelopment of Schottegat area before 2045 Manufacturing, offices, warehousing, and residential accommodation Low (or 'base case') growth scenario

Diagram 2.1.a Normal density sub-variant

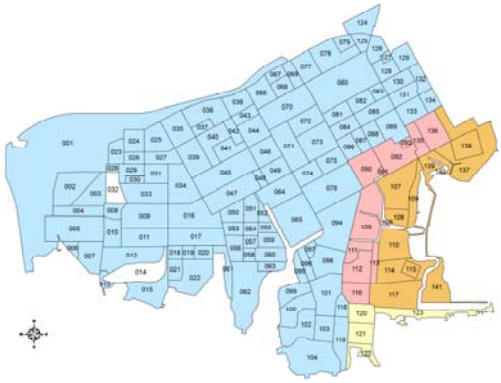
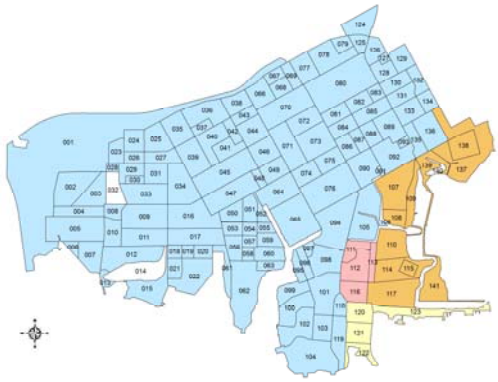


Diagram 2.1.b High density sub-variant

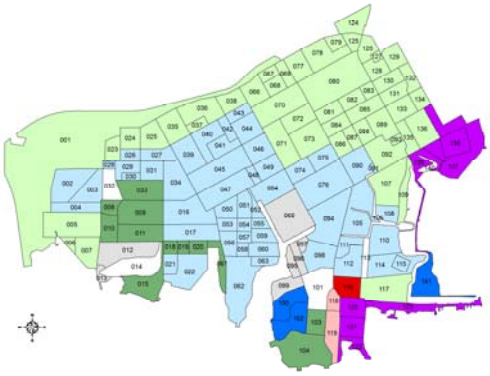


Pale blue = residential area
Pink = offices
Yellow = land related industry
Orange = warehousing

Variant 2.B: Mixed economic activities and extensive green area

The second redevelopment variant (B) is characterized by a large green area (185 ha of the total 493 ha will be designed as parks, pleasure grounds, nature, etc.). This implies that there is less space left for economic activities in general than in the former variant (less houses and less employment). Another difference is that this variant offers also explicitly reserved space for the tourist sector.

Diagram 2.2 Strategic option 2.B, Redevelopment of Schottegat area before 2045. Mixed economic activities and extensive green area



Pale blue = residential area
Pink = offices
Yellow = land related industry
Orange = warehousing
Grey = retail
Deep blue = water related industry
Pale green = green area
Red = tourism
Purple = other tourism
Deep green = public area

For an extensive discussion of both redevelopment variants (and sub variants) see Chapter 11.

2.4 Reference or 'Do Minimum' alternative

Finally we have to answer the question what will happen with Curacao if the Government does not see a possibility to retain any refinery activities for the island, and decides to not re-use the abandoned ISLA site before the year 2045. This development we call the reference alternative, the base case or the 'do minimum' policy (M). It will be assumed hereafter that the Government under such circumstances will hold on to its sustainability intentions.

In Table 2.1 the main differences between the policy options and the reference alternative are summarized for both tracks. The table shows three column headings: the presence of a *refinery* after 2019, the course of action regarding the *Schottegat area*, and the use of *other sites* on the island where expected economic development till 2045 must take place, if the Schottegat area will not be re-used.

If policy option 1A will be followed the economic development of Curacao *with* an upgraded refinery on the ISLA site will be compared with the development *without* upgrading and *without* re-using the ISLA site for any new activity.
The reference situation will be characterized by non-use of the fallow land, but it is also assumed a. that all present refinery structures will be removed, b. that the dispersion on and from the site of harmful liquid chemicals (Light Non Aqueous Phase Liquids or LNAPL) will be stopped by vertical isolation, and c. that the site will be fenced off for the public till at least 2045. Hereafter this is called the 'no access' policy with respect to the ISLA site (for further explanation, see chapters 9 and 12). The assumed vertical isolation to prevent further dispersion of LNAPL reflects the sustainability intention of the Government, and is in keeping with international conventions and environmental legislation.
The 'do minimum' or reference alternative for policy option 1A also means that all new national activities till 2045 must be accommodated elsewhere on the island. As new activities should also be located outside ISLA, they are not of any importance for the comparison of the 1A project and

reference case. They play no role in the CBA and therefore they are mentioned within brackets in Table 2.1.

Table 2.1 Outline of policy or project options, and reference or 'do minimum' options

Option		Refinery	Schottegat area	Elswhere on Curacao
1A	Project	Upgrading refinery	Upgraded refinery	(All new activities)
	Reference alternative	*No refinery*	*'No access'*	*(All new activities)*
1B. i:	Project	Grassroot refinery	('No access')	(All new activities)
	Reference alternative	*No refinery*	*('No access')*	*(All new activities)*
or ii:	Project	Grassroot refinery	Redevelopment with new activities	Remaining new activities
	Reference alternative	*No refinery*	*'No access'*	*All new activities*
2A or B	Project	No upgraded refinery[)]	Redevelopment with new activities	Remaining new activities
	Reference alternative	*No upgraded refinery*[a)]	*'No access'*	*All new activities*

This situation can in principle be combined with a new grassroot refinery at Bullenbay. In that case this option boils down to policy option 1B, variant ii.

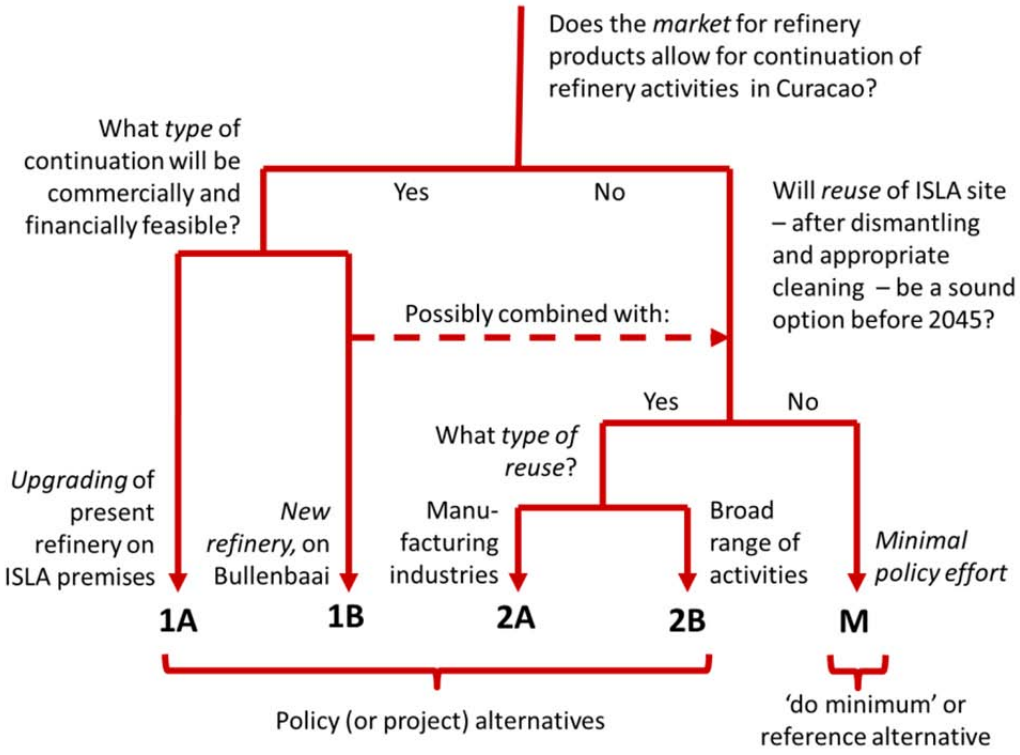
Let's now first concentrate on policy option 2 (A or B). This redevelopment option refers to the situation in which there will be *no upgraded refinery* on the ISLA site after 2010, but the Government decides to prepare the site for new economic developments. New activities (housing, industries, services, etc.) to be expected on Curacao till 2045 will be distributed among the Schottegat area and other locations on the island.
The reference or 'do minimum' option, chosen for option 2, is that a) no new development will take place in the Schottegat area till at least 2045 and all new activities will be located elsewhere on the island, and b) the sustainability aim of the Government implies implementation of the same 'no access' measures as mentioned above.
The reference situation in this case is the same as for option 1A, but in options 2 the share of non-ISLA sites in new activities (column 3 in Table 2.1) is no longer identical for the project and reference alternatives, and cannot be neglected. (Therefore, here the development elsewhere is not put within brackets.)

Finally we look at policy option 1B regarding a complete new grassroots refinery at Bullenbay. Two variants can be distinguished here, 1B.i and 1B.ii.
The first refers to the case in which the ISLA site remains fallow land until at least 2045 (or 'no access') in both the project and the reference alternative, and in which as a consequence all new (non-refinery) activities will be located outside ISLA, in the project as well as in the reference alternative. This means that what will happen on other sites than Bullenbay should be neglected in the CBA (that's why those items are put between brackets).
The CBA case of policy option 1B.ii will be quite different. This option resembles policy option 2, because the reference alternative differs from the policy alternative with respect to developments taking place on the ISLA site as well as on other planning sites.

2.5 Summary

The alternatives discussed are arranged in Diagram 2.3, which reflects the analytical procedure followed here. First, the market analysis should answer the question whether or not there will exist a large enough market in the future to allow a continuation of refining activities on Curacao after 2019 (or earlier). Then a business case analysis must show if such a refinery will be technically and financially feasible. A positive answer on this question means that a cost benefit analysis should be carried out for alternatives 1.A and/or 1.B. If the answer is negative and continuation is not feasible for A and/or B, no cost benefit analysis needs to be made for these non-viable refinery alternatives.

Diagram 2.3 Research logic followed in this analysis



Independent of a yes or no answer on the business case question regarding a refinery variant, a cost benefit analysis will be carried out to answer the question whether – in case the ISLA site will no longer be used for oil refining purposes (i.e. no upgrading) – re-developing the site in the near or not too distant future, and after dismantling and adequate cleaning might be a sound policy option from a national welfare point of view. The CBA should also answer the question what type of redevelopment would yield the largest socio-economic benefit – e.g. a manufacturing and services (cum residential) alternative (2.A), or a development with a broader range of activities, including a generously spaced green area (2.B).

3 Methodology and Research Steps

3.1 Relation to the Long Term Strategies Project

The Government has recently put out to tender the Strategies for Sustainable Long Term Economic Development Study Project. The present study is about the contribution to the national welfare of Curacao of a new or upgraded refinery in Curacao and/or redevelopment of the ISLA premises. It follows a rather comprehensive approach, and is indisputably related to the strategic study project, as the refinery is a central policy issue and the site covers a large area, situated at the heart of the island.

At the start of our assignment we expected to become able to adopt some interim results from the Strategy Project, e.g. long term scenarios regarding the national economic and demographic development, and ideas about specific new economic activities with growth potential for the island. As the project has not yet commenced, we were obliged to anticipate such outcomes in some respects, by making provisional assumptions about these issues. If the strategic project would come up with very different assumptions about the future it is of course possible to adjust the calculations, presented here.

3.2 Integral or comprehensive approach

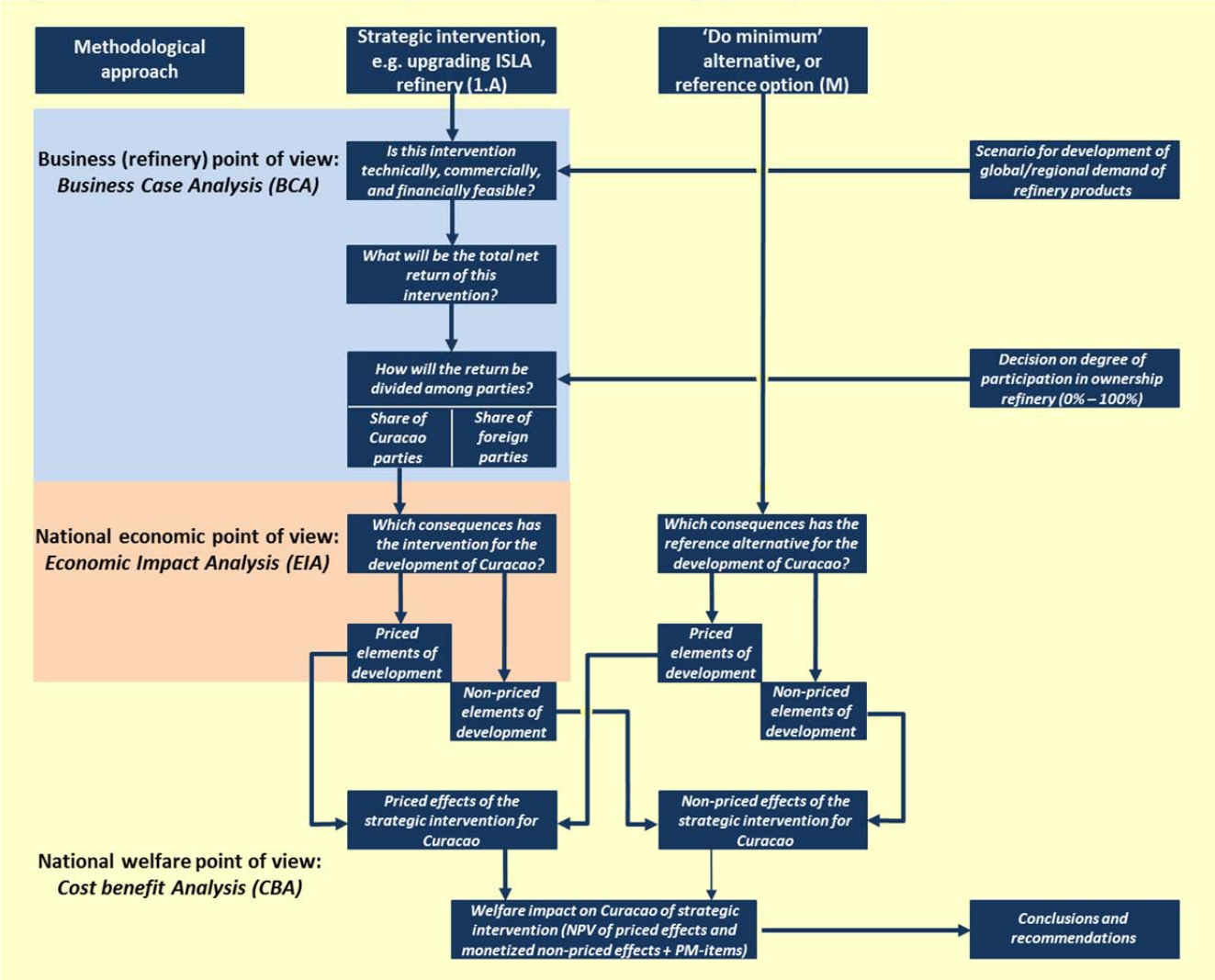
To describe the socio-economic effects of strategies regarding refinery activities and the redevelopment of the Schottegat area we follow an approach to be characterized as integral or comprehensive for the following reasons:

- The *scope* of the analysis is comprehensive. The economic cost benefit analysis focuses on welfare of the country as a whole, not only on priced effects of specific parties (like the owner, operator or employees of the investment to be evaluated).
- Changes on the *supply* side, arising from the project's investment during its lifetime, are confronted as good as possible, with the expected increase in *demand* (supply and demand for refinery products, for labor, houses, hotel rooms, and for building sites in hectares). However, one has to realize that it was not possible to take all relevant demand and supply issues into consideration, because that would take things to considerable lengths (e.g. possible capacity constraint of HATO airport to receive future tourist flows, or training and education constraint have not been taken into consideration) and would exceed the intended scope of the analysis.
- The effects of the investment cover a *long time horizon*. It should be stressed that the development related to each strategic option spans a long period of time, viz. from 2011 till 2045. (This is longer than the time span to be studied in the Strategy Project.) This means that, although the development during the first 10 years of this long period will probably not too much deviate from the real course of socio-economic events, the expected development for later years becomes less and less certain. The CBA results should therefore be considered more as a panoramic prospect in possible future development directions, than a blueprint of what exactly will happen in the long run.
- In order to stress the uncertain character of the assumed long term developments in market demand for sectors relevant to the project, the CBA results are inferred and calculated for *two economic demand scenarios*, a realistic or 'basic' scenario and an 'optimistic' scenario.

3.3 Structure of the assessment procedure: track 1 strategy options

The main elements of the welfare economic evaluation approach followed here are discussed in Diagrams 3.1 and 3.2.
Diagram 3.1 refers to strategies related to *refinery activities* (track 1 strategic options), e.g. interventions to upgrade the present refinery on the ISLA site (alternative 1.A). The top row shows the strategic intervention to be evaluated and the 'do minimum' alternative to which it must be compared.

Diagram 3.1 Structure of the assessment procedure for strategic refinery options (track 1 options)



- The first research step is a *Business Case Analysis (BCA)* of the strategic alternative (the blocks in the blue field). A market analysis, based on scenarios regarding global and regional (South America) market development for refinery products sets the scene and gives a picture of the commercial feasibility of a refinery on Curacao. Then a number of technical variants (a range of possible process inputs and outputs) with their corresponding amounts of investment funds are specified and reviewed. Next attention will be paid to parties which may become involved in investment and operation (PDVSA, RdK, a third party), and the way in which they may be involved (degree of ownership, lease variants, etc.), and expected annual returns. This leads to information about the financial viability and sustainability of the project. The outcome of this first analytical part gives insight in the overall feasibility of the intervention, and in the national share in its expected returns.

If the BCA of a particular intervention variant indicates that the project must be considered far less than feasible, the following research steps can be dropped.

- The second research step shown in Diagram 3.1 (the blocks in the red field) refers to an *Economic Impact Analysis (EIA)*. An EIA reveals how an investment and its operation fits within the national economy, how it relates directly and indirectly (by the impact of forward and backward inter-industry deliveries) to national GDP and Value Added. Moreover, attention is often paid to so-called induced effects, i.e. amounts of money locally spent by parties whose earnings are directly or indirectly related to the investment. (The combined indirect and induced macro-economic 'effect'[1] of the investment is calculated by respectively an indirect and induced multiplier.) An EIA can be characterized as a macro-economic, and therefore in a sense also an integral approach, for it takes the relationship of the investment with all other industries explicitly into consideration.
  However, it should be emphasized that the EIA approach remains restricted to prized implications of the investment, and even more important, that it does not pay attention to the fact that national funds invested in the project, can only be invested once and therefore will no longer be invested in other ways. National earnings which otherwise could have been realized in other (competing) applications must in fact be considered as benefits forgone and deducted from the impact ascribed the by an EIA to the project. This 'displacement' effect of projects is often not taken sufficiently into account. (It appears to be especially relevant in the assessment of a redevelopment of the Schottegat area; see next paragraph and Diagram 3.2.)
  Despite the drawbacks mentioned of the EIA approach we nevertheless included the EIA calculations to allow a comparison of the strategic intervention with other large investment initiatives on the island.[2]

- The last step of the assessment approach is to use the results of both previous steps to make a complete economic cost benefit analysis of the refinery project (the blocks in the yellow field of Diagram 3.1). The diagram shows that therefore some additional calculations should be made. First of all one should consider that the business case analysis and the EIA are carried out without bothering about the 'do minimum' alternative, the reference development which takes place if the refinery will not be upgraded and the national share in the investment funds (however low in comparison with the contributions of foreign parties) will be used differently. Therefore one has to assess the benefits foregone, which would be reaped in the reference case, i.e. if the project will not be carried out. The benefits forgone must be deducted from the project benefits. (Remember that we defined the effects of the project as the difference between both the developments *with* and *without* the project.)
  Secondly, one has to make sure that, if the project generates important *external* or other non-priced effects[3], such effects are properly taken into account. Negative welfare effects like stench, air, water and bottom pollution, noise and visual intrusion, climate changing emissions, etc. are in general not (adequately) priced and do therefore not appear in national accounts (GDP, Value Added) or in EIAs. The same applies for some positive welfare effects, like the possible attractive forces of a well-diversified economy to acquire more welfare generating activities than a poorly diversified economy. It may be difficult or impossible to value external effects properly. Sometimes it is even not possible to describe them in physical quantities, but

1 The term 'effect' is put between parentheses, because the economic impact calculated in an EIA doesn't comply with the meaning of an effect in CBA (i.e. the difference between a development *with* and *without* a project or an intervention).

2 See e.g. The Economic Impact Study Eastpoint Curacao (May 2011) by KPMG

3 External effects are defined as those consequences of the project for other parties than the originator or users (e.g. owners, operator or customers) of the project, which the originator or user don't need to consider, either because originators and users cannot be coerced to pay for the damage they cause for the other parties, or because they cannot claim payment for the benefit of such a consequence.

they should at least be mentioned and qualitatively discussed as pro memory (P.M.) items, so that will remain within the scope of the decision makers.

This description of the economic evaluation approach makes clear how the business case analysis and the economic impact analysis fit as necessary elements into the comprehensive approach of cost benefit analysis. The CBA should finally present all welfare effects (priced and non-priced) in a convenient statement, from which policy conclusions can be drawn.

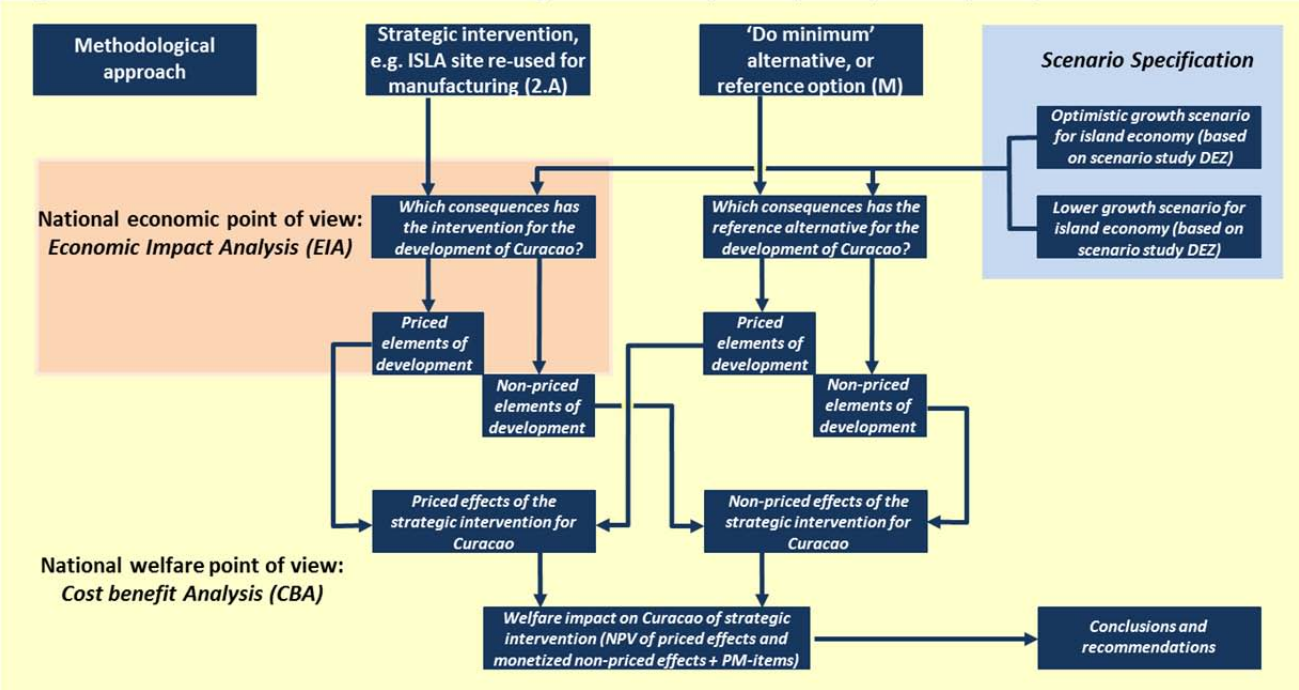
3.4 Structure of the assessment procedure: track 2 strategy options

For strategic options regarding *redevelopment of the Schottegat area* a somewhat different approach must be adopted. The reason is that, while the *refinery* interventions of track 1 can be well specified and studied in particular business case analyses, this procedure is not possible for track 2 strategy options. One can think of a whole range of economic activities that might be eligible for establishment in the Schottegat area, once it would be adequately cleaned: water or land related manufacturing, hotels and other touristic amenities, public and private services, including large scale art and entertainment services, houses and residential facilities, pleasure grounds and parks, etc.

The scope of the present study does not allow performing a specific BCA for every candidate activity. Another reason to refrain this research step here is that many of the activities qualified for establishment in the Schottegat area are much less export oriented than a refinery. Most of them serve only or mainly local island markets. And even if they are exporting goods or services (like the hotel and other tourist related industries), their feasibility is in most cases not dependent on their location on the island.

We therefore decided to follow a reduced approach, depicted in Diagram 3.2

Diagram 3.2 Structure of the assessment for strategic site redevelopment options (track 2 options)



- The first research step now consists of a specification of two *scenarios* (see blocks in the blue field), each postulating a trend in national economic development till 2045 (i.e. total GDP growth), and GDP growth of a number of broad defined industrial sectors: oil refinery (supposedly shutting down completely in 2019), other manufacturing (water and land related),

hotels and other touristic activities, and other services. The economic development affects other economic variables, like labor market demand, net migration of workers, and housing need. Based on the trends an increase in national demand for building area can be estimated to accommodate the growing economic activities (for an extensive description of the scenario analysis see Chapter 10). The need for space (hectares), thus calculated for each scenario, is confronted with available or planned space, according to existing zoning schemes (supply in pipeline). If the trend leads to excess demand, the area presently reserved for in current zoning plans will not suffice. So – after dismantling refinery structures and appropriate cleaning - the Schottegat area can compete with other free and not yet designated areas for new economic occupation.
For some free sites feasibility studies and EIAs regarding long term development of housing and residential amenities have recently been carried out (e.g. for the Eastpoint site). Part of the activities planned at Eastpoint is comparable with activities suitable for ISLA. Therefore scenario sub variants have been studied in which the possible area supply at Eastpoint was considered to be part of the existing pipeline.

For a better understanding of the assessment methodology used here the difference between the approaches of track 2 and track 1 projects can be further explained. Track 1 relates to well-defined refinery variants. Their business case studies answer the question whether they should be judged (technically, commercially and financially) feasible or not feasible. If a variant would not be feasible, the next research steps (EIA and CBA) need not to be carried out. However, if it is judged feasible, the second and third step should also be taken, and the national economic development with and without the project must be compared. It could be very well possible that the welfare effect (the value of the differences between both developments) is of considerable magnitude.
Track 2 refers to certain amounts of economic activities, belonging to broadly defined industries to be allocated *either* in the Schottegat area *or* on another part of the island. The GDP growth of all such industries on Curacao is given by the scenario in question. Under this circumstance there is *no need* for a business case analysis, because the growth, given by the scenario, is by definition thought feasible.
There will of course be differences between the intervention alternative (location in an adequately prepared Schottegat area) and the reference alternative (location elsewhere). They can be caused by different costs of site preparation and different cost for workers and clients (e.g. commuting costs). Or they can be ascribed to economies of scale to be realized by differences in permitted building height, or by efficiency gains attributable to differences in setting or density of activities, and other factors determining the quality and quantity of products and services. Take as an example the very high costs to be incurred if new water related industries could not be located in the Schottegat area but must be located on new deep water sites, to be constructed elsewhere on Curacao.

- The second and third research steps for track 2 interventions are identical to those described above for track 1 (see the blocks in the red and yellow fields respectively). An EIA can be carried out for each project alternative, giving insight into the interrelationship of the project with the rest of the national economy and its priced ‘effects’, based on a multiplier study. The cost benefit analysis widens this insight by taking a more comprehensive viewpoint. It also considers the consequences of economic development occurring if the ISLA site will not be reused before 2045 (according to the ‘do minimum‘ alternative), and moreover pays due attention to non-priced (external) welfare effects.

From the description of the methodology followed for each strategic intervention track it becomes clear that, despite the necessary shortcut for track 2, the results must be fully consistent and mutually comparable.

Part II. Refinery alternatives

4 Market Analysis of Refinery Activities & Opportunities for Curacao

4.1 Introduction

As already mentioned in the introduction chapter, Refineria di Korsou (hereafter RdK) retained Purvin & Gertz Inc (hereafter PGI) to develop a configuration and feasibility study for a new grassroots refinery on the island of Curacao as well as to update the previous studies conducted by PGI on the proposed upgrade project for the ISLA Curacao refinery. In the next chapters (in Part II of this report) the main results will be briefly discussed, as part of the overall study.

First for both the grassroots refinery and the upgrade of the ISLA refinery, a regional market analysis and overview for the proximate product markets around the island of Curacao was carried out, followed by an analysis of feedstock and product pricing for the island of Curacao (see hereafter). Second, the configuration and economics of building a new grassroots refinery on Curacao was analysed (see chapter 5). Third, an update of the refinery project economics for ISLA was carried out, including an update of the refinery valuation analysis work performed in 2009 (see chapter 6). Finally, an updated estimate was developed of the current fair market value of the Bullenbay marine terminal (or Curacao Oil Terminal, hereafter COT) that RdK owns and leases to PDVSA (see chapter 7).

In the next sections, a summary is presented of the regional market study dealing with the regional product specifications and trends and the Gulf Coast refining margin outlook[4]. For more detailed information on supply/demand balances for the major refined products for the numerous countries or sub-regions adjoining the Caribbean, including North America (PADD I and III), Central America, northern South America and the larger markets among the Caribbean islands, the reader is referred to the Final Report “Curacao Grassroots Refinery Configuration Study”, dated September 2011, PGI. The same is valid for more details on the analysis of margins for different types of Gulf Coast refineries and crude and finished product prices for the Gulf Coast, also related to various Caribbean, South/Central American and U.S. East Coast prices.

4.2 Regional product specifications and trends

Regional product specifications have tightened in key regional markets over the past few years impacting product demand for moderate and lower quality fuels. This trend is expected to continue although the pace varies by country and economic development. The refining industry including the ISLA refinery in Curacao will need to invest to meet the tightening products specifications both regionally and internationally. Refineries that forego investments in hydro treating and other product upgrading technologies will face an ever increasingly limited market for their products and weakening product pricing.

Major gasoline importers in the region served by ISLA are Mexico, Puerto Rico and the U.S. Mexico implemented 30 parts per million (ppm) sulfur gasoline in Mexico City in 2006 and has since transitioned the country to the same level. Puerto Rico follows the U.S. specifications as a U.S. province. The U.S. shifted to a 30 ppm average sulfur specification (80 ppm per gallon maximum) in

[4] The text in the following sections is extracted from the report “Curacao Grassroots Refinery Configuration Study”, Purvin & Gertz Inc, November 2011

2004 and a further reduction to10 ppm is expected in the next 5 to 8 years. Benzene and vapor pressure specifications are also becoming more stringent. Brazil's gasoline sulfur specifications are 50 ppm maximum and Columbia's is 300 ppm. Europe is a major exporter of gasoline and is requiring 10 ppm sulfur gasoline since 2009. Most of the smaller Central American and Caribbean import markets have less stringent specifications that will gradually become stricter over time, likely following the lead of other regional markets.

Table 4.1 Major regional gasoline importer sulfur specifications

Major regional gasoline importer sulfur specifications* **Parts per milion**		
	2011	**2018 est.**
Mexico **	30	30
Puerto Rico	30	10
United states	30	10

* The listed sulfur specification represents an annual average maximum limit. Any single produced or imported batch is limited to 80 ppm maximum.

** Mexico typically lags the U.S. by a few years before implementing similar product specifications

Source: PGI

The major consistent diesel importers are Mexico, Guatemala and the Dominican Republic. Brazil and Columbia have imported large volumes diesel in recent years, but refinery expansions in both countries are forecast to reduce these import requirements in the next few years. Brazil has a city diesel sulfur specification of 50 ppm that is scheduled to reduce to 10 ppm over the next few years. In 2010, Columbia introduced 50 ppm sulfur diesel in Bogota and 500 ppm in the remaining part of the country. Both Brazil and Columbia have mandated biodiesel blending of 5%. From 2006 through 2010, Mexico introduced 15 ppm sulfur diesel to different regions of the country and metropolitan areas and the specification now applies country-wide to on-road diesel with off-road diesel limited to 500 ppm sulfur. Europe is a major diesel importer with an on-road diesel sulfur specification of 10 ppm and other relatively stringent quality limits including density (0.845 kg/l) and distillation end-point (340 C T- 95% max). There is also a sizable but declining gasoil or higher sulfur distillate market in Europe, which requires 0.1% sulfur product. The U.S. is a net exporter of diesel and is currently at a 15 ppm sulfur specification.

Table 4.2 Major regional diesel importer sulfur specifications

Major regional diesel importer sulfur specifications* **Parts per milion**				
	2011		**2018 est.**	
	On-road	**Off-road**	**On-road**	**Off-road**
Dominican Republic *	7,500	7,500	500	500
Guattemala */**	5,000	5,000	500	500
Mexico **	15	500	15	500
Europe ***	10	1,000	10	10

* Limited information is available on future changes in sulfur specifications. All regional importers were assumed to require 500 ppmS by 2018.

** Guatemala is targeting reduction of 500 ppm sulfur diesl (delayed from original timeframe of 2010).

*** All diesel export to Europe from Curacao is assumed to be 10 ppm by 2018.

Source: PGI

4.3 Gulf Coast refining margin outlook

Global petroleum demand growth is forecast at about 2.0% per year as the global economy accelerates over the next few years. The vast majority of growth will be in emerging economies, notably in the Far East. Following this recovery period, growth is forecast to slow to about 1.5% by 2020 before gradually declining to less than 1.0% annually towards 2025. Demand responses to higher prices, the trend towards economic development in less energy-intensive sectors, and a renewed focus on energy efficiency will all act to reduce petroleum growth even as economic growth remains moderately strong.

U.S. Gulf Coast refining margins remain weak following the worldwide recession that started in mid-2008. Lingering overcapacity, the slow pace of rationalization, and continued refining expansions are expected to continue a multi-year margin down cycle for the refining industry as a whole and particular for cracking refinery configurations. The outlook is for 2011 and 2012 margins to remain near 2010 levels or decline slightly. The beginning of a margin recovery is forecast in 2013/14, with a return to sustained profitable levels by 2015/16. This outlook is predicated on our expectation that further refinery closures in the U.S. and Europe occur over the next couple of years. The number of refining assets being considered for sale remains high and indicates that more closures are likely.

U.S. Gulf Coast and global conversion (light/heavy) margins have recovered from the nadir of 2009, but remain well below reinvestment levels. Coking utilization rates have improved somewhat, but relatively weak coking returns are expected for a few more years due to new coking capacity additions and a relatively light near-term crude slate. Margins are projected to improve by 2015 as a result of three primary factors: 1) demand growth finally reducing excess capacity growth, 2) an increase in new heavy crude supplies, and 3) marine bunker fuel regulatory changes in the North European and North American markets. PGI's analysis supports the need for longer-term coking and hydrocracking capacity additions given the crude slate and product demand forecast.

4.4 Opportunities in refining activities for Curacao

Based on the results of the regional market analysis and overview as well as on the results of the feedstock and product price analysis and also based on the preliminary economic analyses using PGI FlexRefine LP models, the following selection was made:

- Four cases for consideration in the grassroots study including two refining configurations and two different refinery scales; and
- One case (out of several cases already studied in 2009) for upgrading the ISLA refinery

For the grassroots refinery, to be located at another location on the island of Curacao in an effort to remove refinery emissions from around the tourist areas in Willemstad, the following four cases were evaluated:

1. HCU/Coker configuration export refinery
2. FCC/Coker configuration export refinery
3. HCU/Coker configuration local refinery
4. FCC/Coker configuration local refinery

For upgrading the ISLA refinery the main expansion case analysis (Case 1-2a with a 5000 tpd thermal cracker rate, hereafter called 5000TC2) from the 2009 study is updated and evaluated.

The results of the grassroots refinery cases will be dealt with in the next chapter. The results of the Upgrade refinery case will be presented in chapter 6.

5 Business Case of Grassroots Refinery at Bullenbay

5.1 Introduction

PGI was asked by RdK to evaluate the feasibility of building a new refinery on another part of the island of Curacao to remove the refinery emissions from the ISLA refinery from around the tourist areas and make the existing site available for economic development. The new refinery would include state of the art process technology to produce high quality fuels while at the same time employing emissions controls to minimize emissions to the surrounding areas. Being grassroots, the refinery would be sized and configured to optimize its economics and minimize the capital investment. PGI was asked to provide the capital investment and economics of a grassroots refinery using several assumptions supplied by RdK.

In the next sections the main results of the above mentioned study will be presented (based on the final report “Curacao Grassroots Refinery configuration study”, PGI, September 2011). The majority of the text is extracted from this report. Where applicable the text is filled up with remarks from Standard International Group (SIG), the financial advisor of RdK, with results from discussions between RdK, PGI and Ecorys, and finally with own research/contributions from Ecorys.

5.2 Charge, yield results and the capital cost estimates for 4 selected cases

The first configuration considered for the grassroots refinery was the HCU/Coking configuration which includes a state of the art VGO hydrocracking unit, which process essentially the same feedstock as an FCC would and upgrades it to almost all jet/diesel with some naphtha and LPG production as well. This configuration also includes a delayed coker unit. This configuration has been seen often as the lead case for new refinery construction projects, since it favors diesel production and most often provides the most favorable economics.

The second configuration considered was the FCC/Coker configuration which includes a VGO Hydrotreater and state of the art FCC unit as well as a delayed coking unit, similar in configuration to the current refinery without the delayed coking unit. This configuration provides more gasoline production than the HCU/Coker configuration and also provides maximum upgrading of crude residuum. This configuration is most favorable in a region that must import gasoline to supplement local production, which is true of the Latin American region.

In addition to the two refinery configurations, two different refinery scales were evaluated.

- The first scale considered was a large refinery exporting product outside of the region with a crude capacity of 195,000 B/D. The crude capacity of the refinery was allowed to fluctuate but the conversion unit capacity was limited. For the HCU/Coker configuration the hydrocracker capacity was limited to 65,000 B/D, consistent with the maximum size possible for a single train unit. For the FCC/Coker configuration, the size of the FCC unit was also limited to 65,000 B/D. While larger FCC’s than 65,000 B/D are currently in operation, the 65,000 B/D limit provided for a refinery scale similar to that of the HCU/Coker configuration.
- The second scale considered was a smaller regional refinery only producing products for consumption in the local Caribbean and South American markets. In this case, the refinery crude capacity was limited to 100,000 B/D and the capacities of the conversion units were not

limited. The smaller scale provided for a lower capital investment and higher average product pricing, but was also expected to result in the loss of benefits from economies of scale.

Summarizing, the following four cases were evaluated in detail:

1. HCU/Coker configuration export refinery;
2. FCC/Coker configuration export refinery;
3. HCU/Coker configuration local refinery;
4. FCC/Coker configuration local refinery.

5.2.1 *Charge and yield results*

The LP modeling for both the HCU/Coker and FCC/Coker *export refineries* yielded a crude throughput of approximately 195,000 B/D based on the 65,000 B/D conversion unit capacity limit. It is assumed that the crudes being available to a new grassroots refinery include medium and heavy sour crudes out of Latin America and the Middle East as well as high TAN crude production out of West Africa. A maximum charge limit of 100,000 B/D was imposed on each individual crude grade so that no crude made up more than 50% of the total slate to insure refinery flexibility and to prevent locking the refinery into processing a single crude or crude type.

Table 5.3 Grassroots cases charge and yield results

GRASSROOTS CASES CHARGE AND YIELD RESULTS Barrels per Day				
	Export refinery cases		*Local refinery cases*	
	HCU/Coker	FCC Coker	HCU/Coker	FCC/Coker
Crude Oil				
Medium Sour (Basrah)	95.300	93.200	50.000	50.000
Local Heavy Sour	100.000	100.000	50.000	50.000
Total Crude Oil	195.300	193.200	100.000	100.000
Crude API	23,2	23,2	23,4	23,4
Crude Sulfur (wt%)	2,4	2,4	2,4	2,4
Other Feedstocks				
Isobutane	-	7.700	-	800
Total Other Feedstocks	-	7.700,0	-	800,0
Total Feedstocks	195.300	200.900	100.000	100.800
Products				
LPG	17.000	6.300	7.300	4.900
Naphtha/Unfinished Gasoline	-	-	4.300	4.300
Local Gasoline	43.600	43.600	28.200	41.500
Export Gasoline	20.900	51.700	-	-
Jet Fuel / Kerosene	16.300	13.600	7.500	800
Local Diesel	47.300	47.300	47.300	38.300
Export Diesel (Europe)	28.200	9.400	-	-
Marine Diesel (MDO)	5.000	5.000	-	-
Residual Fuel Oil	5.300	2.200	-	1.200
Total Liquid Products	183.600	179.100	94.600	91.000
Liquid Yield, LV%	94,0%	89,1%	94,6%	90,3%
Sulfur, LT/D	420	430	230	230
Coke, ST/D	4.100	4.300	2.200	2.200
Refinery Fuel Oil, % S	3,0	3,0	3,0	3,0

Source: PGI

The crude slate for the local grassroots refinery cases were based on projected crude availability during the life of the project excluding Venezuelan crude grades, and included the same crudes as assumed in the export cases. A maximum of 50% charge for any single crude was imposed to insure refinery flexibility. To limit the refinery scale for a local refinery, the crude unit capacity was limited to a maximum of 100,000 B/D with no capacity limits imposed on the HCU or FCC units.

The export refinery crude slates as well as the local refinery crude slates are shown in the table presented above.

From this table it can be concluded that the HCU/Coker export case configuration resulted in high diesel production and minimal fuel oil sales as opposed to the FCC/Coker configuration which maximized gasoline production. The HCU/Coker export case yields 96,800 B/D of jet/diesel product which represents about 53% of the total liquid product. The FCC/Coker export case yields 95,100 B/D of gasoline product which represents about 53% of the total liquid product.

5.2.2 Capital costs estimates and financing structure

PGI estimated the capital costs for the four grassroots cases, taking into account the financing structure discussed with the client. RdK requested the use of 70% debt financing at 7.85% nominal interest for the project per discussions with their financial consultant SIG. The loan duration is set at 15 years. The debt was calculated based on the capital expenditure schedule assuming all project equity (30%) was spent first, before use of the debt financing and resulting payment of interest incurred during the construction phase per PGI project experience. In addition, the interest during construction was assumed to be rolled into the project loan principal per RdK/SIG.

Total financing costs are roughly 15% of total project capital costs. The tax rate is 34.5%[5] and the tax holiday is assumed to be 10 years. The discount rate for the project (referring to the return on equity) is set at 20%, which according to PGI's project experience for grassroots refinery projects is the minimum discount rate for a grassroots project. According to SIG the minimum investment target is a discount rate of 17%, which might be on the conservative side given the latest development in the number of crude oil refinery closures. For the analysis of the grassroots cases the PGI discount rate of 20% has been used.

The capital costs for the grassroots export cases were USD 5.8 billion for the HCU/Coker configuration and USD 5.7 billion for the FCC/Coker configuration including construction costs (ISBL + OSBL), project direct costs and project financing costs. The capital costs for the local refinery cases were USD 3.6 billion and USD 3.5 billion respectively, also including the same cost categories as mentioned before. The investment period for all configurations starts in 2013 and is lasting for 5 years. The new grassroots refinery is planned to be operational in the beginning of 2018.

[5] During the course of the study a new tax rate was introduced (being 27.5% in stead of 34.5%). However, this will not significantly influence the presented results of the IRR and NPV calculations

Table 5.4 Grassroots capital cost summary for the four cases selected

Million Dollars	GRASSROOTS CASES CAPITAL COST SUMMARY			
	HCU/Coker	FCC Coker	HCU/Coker	FCC/Coker
Major Unit Capacities (MBPD)				
Crude	205.500	203.300	105.300	105.300
Delayed Coker	59.900	62.000	31.900	31.900
FCC		65.000		
Hydrocracker	65.000		33.500	-
CCR Reformer	59.400	34.200	27.200	17.800
Capital Costs				
Unit Construction Costs (ISBL)				
Crude/Vacuum Unit	370,9	368,0	219,3	219,3
Delayed Coker (1)	446,3	457,8	283,5	283,5
Hydrocracker	645,9	737,5	388,1	424,9
CCR Reformer/Splitter/Isom	424,1	307,3	274,8	219,7
Naphtha/Diesel Hydrotreating	239,6	252,1	151,6	166,0
Sulfur Plant	246,8	249,6	148,8	150,0
Hydrogen and Other	128,9	85,5	90,9	62,1
Total ISBL Costs	**2.502,5**	**2.457,8**	**1.557,0**	**1.525,6**
OSBL Costs	**1.251,2**	**1.228,9**	**778,5**	**762,8**
Total ISBL + OSBL	**3.753,7**	**3.686,8**	**2.335,6**	**2.288,3**
Additional Project Costs				
Project Direct Costs (2)	1.250,0	1.227,7	777,7	762,0
Project Financing Costs (3)	876,7	826,7	537,5	509,5
Subtotal Additional Project Costs	**2.126,6**	**2.054,3**	**1.315,2**	**1.271,5**
Total Project Capital Costs	**5.880,4**	**5.741,1**	**3.650,8**	**3.559,8**

(1) Includes coke storage and handling
(2) Project Direct Costs include Owner's costs, licensor costs, escalation and contingency
(3) Project Financing Costs include capital reserves (such as debt service), working capital, interest during construction and loan transaction costs.

Source: PGI

5.3 Grassroots economic results

The project economics were analyzed utilizing cash flow models to represent the refinery financial performance for the export cases as well as the local cases. The IRR and NPV results for both the HCU/Coker and FCC/Coker configurations are summarized in the next table.

First of all the performance of the investment is measured independently of the sources or methods of financing, following the EU guide for Cost Benefit Analysis (2008). This means that the commercial IRR and NPV have been calculated for the total capital costs without taking into account the financing costs as well as the taxes (if applicable, in this analysis the taxes have been set at zero).

Secondly, the sources of financing have been taken into account, to assess the investments financial viability and sustainability.

In both analyses a discount rate of 20% has been used as discussed earlier in section 5.2.2.

Table 5.5 Commercial and financial results of the grassroots investment cases.

GRASSROOTS REFINERY CASES NPV in Million Dollars	HCU/Coker Export		FCC/Coker Export		HCU/Coker Local		FCC/Coker Local	
	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV
Capital costs (excluding financing costs) in million USD	**5.061**		**4.942**		**3.143**		**3.064**	
Capital costs with financing costs in million USD	***5.880***		***5.741***		***3.651***		***3.560***	
Base Cash Flow Results without any financing and no taxes (NPV discounted at 20%)	**11,7%**	(1.261)	**8,5%**	(1.575)	**11,5%**	(798)	**6,8%**	(1.078)
Base Cash Flow Results based on 30%equity/70%debt (NPV discounted at 20%)	**11,2%**	(547)	**5,3%**	(797)	**10,9%**	(352)	**1,9%**	(571)

Source: PGI/Ecorys

The base cash flow results *without any financing and taxes* reveal that HCU/Coker export refinery provided a return on investment (IRR_{inv}) of 11,7%, which is far below the assumed minimum discount rate of 20% for a grassroots project. Therefore the NPV of the grassroots HCU/Coker export project at the 20% discount rate is ($1.261) million, indicating the project may not be commercially viable under the assumed discount rate. A comparable result 'is obtained for the HCU/Coker local refinery: IRR_{inv} is 11,5% and the corresponding NPV is ($798) million.

The results for the FCC/coker export refinery as well as the FCC/coker local refinery are even worse compared to the HCU/coker refineries. For the FCC/coker export refinery the IRR_{inv} is 8,5% and the corresponding NPV is ($1.575) million and for the FCC/coker local refinery the IRR_{inv} is 6,8% and the corresponding NPV is ($1.078) million. These results also mean that these projects are also not commercially viable.

Because in the oil refinery business equity investors will seek leverage for qualified capital intensive projects to spread the risk, the financing structure with 30% equity/70% debt (as discussed above) have also been taken into account. The results of this financial analysis are as follows:

- The HCU/Coker export refinery provided a return on equity IRR of 11.2%, which is below the assumed minimum discount rate of 20% for a grassroots project.
- The FCC/Coker export refinery provided a return on equity IRR of 5.3%, which is far below the assumed minimum discount rate of 20% for a grassroots project.
- The HCU/Coker local refinery provided an equity IRR of 10.9% compared to 1.9% for the FCC/Coker refinery case, which is (far) below the assumed minimum discount rate of 20% for a grassroots project.

The above results are indicating the four projects may not be attractive or financially feasible under the assumed economic conditions and discount rate.

Moreover, the Debt Service Coverage Ratio (DSCR) has been calculated: this is an important measure for the Lender (see for more information Chapter 6, section 6.4.1) to accommodate a loan to the equity sponsor. The minimum target in this sector is DSCR >1,35, but preferably DSCR >1,50 should be taken as a reference.

For the HCU/coker cases (export and local) the DSCR (on average for 15 years) is 1,41 and 1,39 respectively (with minimum values of 1,26 and 1,24 at the start year of operation). For the FCC/coker cases (export and local) the DSCR is 1,06 and 0,92 respectively (with minimum values of 0,96 and 0,81 at the start year of operation). These findings demonstrate that *it will not generate*

lender's confidence in the future financial performance of the project company coupled with its willingness and ability to meet its debt obligations in a timely manner.

Finally, a sensitivity analysis has been carried out for the 30% equity/70% debt financing structure, for which the results have been presented in the next table.

Table 5.6: Results of the sensitivity analyses for the refinery cases

GRASSROOTS REFINERY CASES SENSITIVITY RESULTS NPV in Million Dollars	HCU/Coker Export		FCC/Coker Export		HCU/Coker Local		FCC/Coker Local	
	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV
Base Cash Flow Results	11,2%	(547,3)	5,3%	(797,3)	10,9%	(351,8)	1,9%	(570,9)
Gross Margin								
+$2.00/bbl	15,6%	(297,1)	10,8%	(549,7)	14,5%	(223,6)	7,3%	(442,7)
-$1.00/bbl	8,8%	(672,5)	1,9%	(921,1)	8,8%	(415,8)	-1,4%	(635,0)
Operating Costs								
+$1.00/bbl	8,7%	(676,3)	1,8%	(924,8)	8,8%	(417,8)	-1,5%	(636,9)
-$1.00/bbl	13,5%	(418,4)	8,2%	(669,7)	12,8%	(285,7)	4,8%	(504,9)
Capital Costs								
+15% (1.15 multiplier)	9,8%	(669,5)	3,8%	(917,3)	9,4%	(427,8)	0,4%	(645,3)
-15% (0.85 multiplier)	12,9%	(425,2)	6,9%	(677,3)	12,5%	(275,7)	3,5%	(496,5)
LNG Fuel								
with LNG	12,9%	(443,0)	6,2%	(743,2)	12,2%	(298,3)	2,8%	(542,3)

Source: PGI

In summary: the above findings were also confirmed by the results of the sensitivity analyses for all four cases. Therefore, it can be concluded that all four projects are not attractive nor commercially and financially sound. Given these results it is not necessary to carry out a so-called "risk analysis" .

5.4 Manpower requirements and refinery air emissions

5.4.1 Grassroots manpower requirements

The manpower needed for the export refinery cases was estimated at 1,000-1,100 total employees with about 600 being full time refinery employees and the balance contract maintenance labor.

Table 5.7 Grassroots manpower requirements

GRASSROOTS REFINERY CASES MANPOWER REQUIREMENTS Number of Employees	Export Cases		Local Cases	
	HCU/Coker	FCC/Coker	HCU/Coker	FCC/Coker
Refinery Employees				
Operations	192	207	143	156
Maintenance	210	176	128	105
Administration	217	218	144	146
Total	619	601	415	407
Contract Maintenance Employees	489	412	300	245
Total Employee Requirement	1.108	1.013	715	653

Source: PGI

The manpower required for the local refinery cases was 650-715 total employees with about 400 full time refinery employees and the balance being contract maintenance. The results are summarized in the table above.

5.4.2 *Grassroots refinery air emissions*

PGI has estimated the annual air emissions associated with the current base operation at the ISLA refinery and the air emissions resulting from a new grassroots refinery using air emission factors published by the United States Environmental Protection Agency in their publication AP-42. PGI estimated the air emissions that would be associated with a new grassroots refinery processing approximately 100,000 barrels per day of crude oil through a hydrocracker oriented facility. It is anticipated that this facility would utilize low sulfur treated refinery fuel gas and LPG streams as its primary fuel source.

As shown in the table below, the estimated emissions from the grassroots refinery are significantly lower than those estimated for the existing facility due to modern and environmentally superior technology, smaller facility size, and the absence of the fluid catalytic cracking unit. Carbon Dioxide emissions would be reduced by almost half due to the replacement of fluid catalytic cracking technology with hydrocracking technology as well as the change in fuel type. Sulfur oxides currently released are estimated to be about 50.3 thousand tons per year and would be reduced to essentially 0 with newer technology and as high sulfur residual fuel oil is replaced with treated refinery fuel gas and LPG streams. Nitrogen oxides would also be reduced significantly as new low NOx burners would be installed with the new equipment to burn the low sulfur refinery fuel gas and LPG gas streams. Particulates would be reduced from the elimination of the existing fluid catalytic cracker at Isla. The coke piles from the new Coker would be in covered storage areas and kept damp to reduce coke fine dust associated with handling. These increments have been included in the overall estimates provided for the grassroots refinery.

Table 5.8: Summary of annual air emissions (in kT/Yr)

SUMMARY OF ANNUAL AIR EMISSIONS IN kT/Yr Basis USEPA - AP 42					
	Sulfur Oxides	Nitrogen Oxides	Carbon Dioxide	Particulates	VOC
Existing Isla Refinery - High Sulfur RFO	50,3	4,2	2.530,0	7,2	1,9
New Grassroots Refinery	0,0	0,4	1.300,0	0,2	0,4

Source: PGI

5.5 Bullenbay COT site and the possibility of establishing a grassroots refinery

5.5.1 *The current Bullenbay COT,its facilities and possibilities for extension*

The Bullenbay Oil Terminal (COT) is located on the west coast of the island of Curacao, approximately 7 kilometers from the ISLA refinery located at Willemstad. The facility is currently owned by RdK and leased to PDVSA for use in transshipping Venezuelan crude oil as well as supplying the PDVSA operated ISLA refinery at Willemstad. The terminal currently operates about 33 storage tanks having a total usable capacity of 15.9 million barrels. The total area of the COT is about 162 hectares (ha). According to the EOP (Island Development Plan or in Dutch: Eiland Ontwikkelings Plan) the entire Bullenbay industrial area is still not fully used. For instance the north western part directly adjacent to the COT is not developed, but unfortunately this area is very hilly and not directly suited for an extension of the facilities. However, possible extension (if in practice

feasible) is strongly hindered by constraints and regulations due to air traffic to and from HATO airport (see next section).

5.5.2 *Constraints and regulations due to the HATO airport and approach way*

From discussions with the Civil Aviation Department Curacao about establishing a new refinery at Bullenbay (partly making use of the possibility to extend the area of the COT in the north western direction), it appeared that the current area of the COT is already located within the extended runway centre line of HATO airport (see map in Annex 1). The following remarks were made by the Head of the Civil Aviation Department:

1. A large part of the EOP area of Bullenbay (and in particular a significant part of the existing COT site) already crosses the extended runway centre line of HATO airport. An oil refinery to be located within this area will significantly reduce the aviation safety. It is often prohibited to fly over the “approach area” and “take-off climb area” or in any case a minimal altitude of 3,000 feet has to be kept. ICAO did not prescribe minimal altitudes in case an oil refinery is located in the “approach area” or “take-off climb area”. However, it is beyond all doubt that this type of industry will strongly influence the external safety in a negative manner. This is neither supporting the aviation safety nor future development of sustainable tourism at Curacao. Finally, the altitude on which the so-called Visual Manoeuvring (circling) approach to airstrip11 and 29 at a straight circuit will be carried out, might be significantly influenced by the refinery located in that area.
2. Smoke emissions might reduce the accessibility of the runway, especially in a stable atmosphere and during winds coming from the west. The effect will reach a maximum during the morning hours – with a greater chance to face a stable atmosphere. Moreover, at the same time airplanes are flying towards the sun. In case the wind is coming from the west or from the south west, one is often facing irregular weather conditions, too.
3. The presence of a refinery might also influence the weather conditions in the “approach area”, and as a consequence also the accessibility of HATO airport, as well as having possible negative consequences for the aviation safety.

Before any decision might be taken about a possible establishment of a refinery at Bullenbay, a thorough evaluation on the aviation safety is certainly needed for sure. This evaluation has to include a description of all possible consequences of establishing a refinery near HATO on the environment on the one hand and the external safety of the aviation sector (among others, for instance through an Environmental Impact Assessment) on the other.

5.5.3 *Estimated grassroots refinery plot requirements*

PGI estimated the required plot size needed to provide sufficient land area for construction of the proposed grassroots refinery. The estimated size required for construction of the 100,000 B/D hydrocracking facility would be approximately 150 acres or 61 hectares. The majority of this space would be dedicated to the tank farm area storage tanks for refined products and feed stocks. Additional major requirements are needed for the process units and utilities, to provide a buffer zone around the facility, and provide space for future expansions or additions and onsite storage of maintenance and construction materials and equipment.

A quick review of the plot plan of the Bullenbay site indicates that (without extending the area) sufficient space is available between the current row of tanks and the shoreline and at the west end of the facility for storage tanks and at the east end of the facility for process units and utilities. It also appears from throughput records that sufficient capacity in the existing marine facilities is available to support the new refinery. Use of some of the existing storage at Bullenbay for crude oil or other refined products would reduce the required capital and insure adequate available land area for the

new refinery. However, in any case the evaluation of establishing a refinery on the existing COT site and its consequences on the aviation safety is a must.

5.6 Overall conclusion

So far, the study of PGI has focused on the financial aspects of a grassroots refinery project on the island of Curacao, estimating cash flows and determining returns on equity investment for a grassroots project. Based on this analysis it can be concluded that the grassroots project shows an IRR on investments as well as an IRR on equity (with a financing structure of 30% equity/70% debt) which is far below the required cut-off rate of 20%. In all four cases the IRR on investments was too low varying from 6,8% to 11,7% and the IRR on equity was also too low varying from 1.9% up to 11.2%. Both IRRs indicate that *the project is commercially and financially not viable and should not be built from a financial standpoint*. It has to be stressed here that in the above mentioned calculations not any concession fee to be paid to the Government of Curacao for the facility at the new site was included (see also later on).

An additional major point putting a complete hold on the establishment of a grassroots refinery at Curacao, was the statement made by SIG (financial advisor RdK):

- Debt Capital – Based on current and intermediate capital market conditions, the estimated US$4.64 billion (assumed minimum equity of 20%) would be extremely difficult to secure from global lenders and institutional investors on a project finance lending basis. As part of the overall plan of finance, Export Credit Agency lending/guarantee credit support could reduce the amount of limited recourse debt and potentially make the Project bankable.
- Equity Capital – In addition, the Lenders will require the Sponsor(s) to contribute a minimum equity contribution of 20% totaling up to US$1.16 billion. We believe that this amount of equity capital combined with an expected low rate of return will be a deterrent for equity investors to invest such an amount of capital in an aging and geographically shifting industry.

The above financial result is in line with the expectations of PGI, as refineries which must import their crude and export some or all of their products cannot compete with refineries of equity crude producers who have access to low cost crude or refineries in countries who realize a higher product value because they back out high cost imports. In this respect the Curacao refinery lacks the advantages enjoyed by Asian competitors who have built grassroots capacity in recent years, such as low cost equity crude production and significant domestic light product demand.

Apart from the expected emission reduction mentioned in the next paragraph, which is an advantage for Curacao, the establishment of a new grassroots refinery by a foreign investor/operator will not bring significant additional benefits to Curacao compared to the existing situation in which ISLA is still in operation. The possibility to negotiate a lease or concession fee with a new investor which is higher than the existing one is expected to be nil, and even worse, it is expected that a new lease or concession fee will be close to zero. The only positive issue for Curacao is the creation of new direct jobs at the grassroots refinery, but unfortunately more than 40% less compared to the current situation in case of an export oriented refinery and even 60% less in case of a local oriented refinery. Also the contractors for maintenance will face a slight reduction (up to 8%) in jobs in case of an export refinery and a significant reduction of 30% to 45% in case of a local oriented refinery.

One major advantage of a new grassroots refinery is the environmental emissions associated with it. The installation of new state-of-the-art equipment including emissions reduction technology provides for a much smaller environmental impact compared to that of an older existing facility such

as ISLA. While this sounds like a compelling argument to shut down ISLA in favor of a new grassroots facility, the economics of such a venture cannot be ignored. However, conversion of the ISLA refinery docks and tankage into a fuel import depot would provide a much lower cost option to provide fuel to the island with minimal environmental emissions impact.

Based on the above the following overall conclusion can be drawn**:**

“A grassroots refinery to be located at Curacao will definitely not be realized in the medium and long term”.

6 Business Case of Upgrading ISLA-refinery

6.1 Introduction

In this chapter the upgrading options for the ISLA refinery will be dealt with, based on the regional market analysis and the feedstock and product price analysis briefly discussed in Chapter 4 and also based on the preliminary economic analyses using PGI FlexRefine LP models.

First of all, in a nutshell, an overview will be presented of the different steps and activities that were undertaken for this part of the overall study, finally leading to a modification in the upgrading options due to advancing insights arisen during the first 6 to 9 months of the project.

Next, the final selected upgrading case will be presented and discussed. The charge, yield and capital costs estimates will be dealt with followed by the economics of the upgrading case, including sensitivity analysis and risk analysis. Furthermore, attention will be paid to the air emissions of the refinery before and after its upgrading as well as to the additional required manpower. Finally, attention will be paid to the valuation of the (assets of the) existing ISLA refinery.

A substantial part of the text is extracted from the following two reports: “Refinery Configuration and Valuation Study, October 2011”and “Refinery Utility Integration Study, February 2012”, both published by PGI. Other parts are based on contributions from the financial consultant from RdK Standard International Group (SIG), Solomon Associates and VPC (Viable Path Consulting) on the one hand, and on results from discussions between RdK, PGI, Solomon Associates, SIG, VPC and Ecorys, and finally on own research/contributions from Ecorys on the other.

6.2 Modification of upgrading options due to advancing insights

PGI was asked to update the 2009 analysis of the ISLA investment project which included the construction of a new delayed coking unit complex by Petroleos de Venezuela (PDVSA) at the Curacao refinery. The basis for the 2009 project evaluation was a study report provided to RdK by Axens outlining various coker configuration scenarios for the project. In addition, PGI was asked to evaluate the economics of ISLAa’s LVI (Low Viscosity Index) project, which would install new lubricant processing equipment to improve produced lubricant quality and increase overall lubricant production.

For this study, RdK requested that only the main expansion case analysis (Case 1-2a with a 5000 tpd thermal cracker rate) be updated and all other configuration cases analyzed in the 2009 study be ignored. The expansion case assumes that PDVSA builds the project and stays on as lessee of the facility beyond the end of the current lease in 2019.

PGI was also instructed to assume that the LVI project evaluated in the 2009 study would be installed by 2012 without performing any additional economic analysis or evaluation of the project. No new coker project data was provided for the study beyond that used in the 2009 analysis and a site visit by PGI personnel and meeting with PDVSA verified that no major changes to the project scope have been made.

In addition to updating the PDVSA expansion case analysis, RdK also requested that PGI evaluate the Curacao refinery investment project assuming a new JV partnership (hereafter JVC, which

stands for Joint Venture Company) without PDVSA. In this case it was assumed that the new JV partner would contribute the equity for the coker expansion project to the JV and RdK would provide the refinery. For this case, the unit configuration for the project was maintained, but alternative (non-Venezuelan) crudes were assumed as available to the refinery. The unit capacities of the expansion equipment were allowed to fluctuate for this case to allow optimization of the project with the alternative crude slate and maximize the JV partnership return.

The above resulted in 3 business cases (all dealing with the 5000 TC2 configuration) with the following ownership structure:

1. With PDVSA
   a. and a new lease agreement;
   b. and a JVC (with also a third party and including RdK also as shareholder);
2. Without PDVSA and a JVC (with a third party and including RdK also as shareholder).

The results for these three business cases are presented in PGI's final report "Refinery configuration and Validation study" from October 2011. Detailed analysis were made concerning charge, yield and capital costs estimates as well as operating costs, project economics, required manpower and refinery air emissions. For all business cases it was assumed that the BOO (from the Curacao Utility Company, CUC) would continue its operations as a separate entity/company supplying electricity and steam etc. to ISLA in the current situation as well as in case upgrading of ISLA would be realized, and including the necessary investments in BOO needed. Important to stress that the economics of the investment cases were all promising, as well as the estimated significant reduction in air emissions from the refinery all in line with the benchmarks from the World Bank.

During the course of the study on strategic options for ISLA and ISLA site, new insights were born and consequently, the scope of the upgrading options changed significantly. The main reasons are the following:

- Firstly, a take-over purchase of the BOO (from CUC) by RdK realized in October 2011, resulting in a significant change in the relationship with ISLA;
- A strong advice by Solomon Associates who were involved in the take-over business of BOO, resulting in the possibility to integrate the BOO into the ISLA refinery in the upgrading option, instead of a continuation as independent utility, which (see above) was still assumed in the proposed configurations by PGI (worked out during the first half year of the study).
- Thirdly, the future position of RdK (as owner of the existing ISLA refinery) in an upgraded refinery, which changed significantly, from a possible partner in a JVC with its own investments obligations and a participation risk component into a partner in a new company (NEWCO), in which RdK is preferring to bring in the existing assets (valued by PGI) and requiring a Preferred Stock Dividend and Land Lease from NEWCO without taking any risk participation;
- Finally, the role/position of PDVSA which is slightly changing from being the preferred partner in a new lease contract for the upgraded refinery or in a JVC into a partner looking for a third party and possibly not taking/continuing the existing role of an investor/operator in the upgraded refinery, but possibly willing to act as a crude supplier to NEWCO benefitting from a long term supply contract (with certain discounts on the price of crude to be compensated by an agreed dividend from the net earnings from NEWCO). As agreed with RdK, the latter is assumed to be more or less neutral at the end and is therefore not taking into account in the cash flow analysis.

Based on the above and on internal discussions with the client and its advisors **finally the following options for upgrading the ISLA refinery have been elaborated/investigated, all based on the 5000TC2 configuration, with PDVSA being the crude supplier**:

1. Case 1: Investment case with integration of BOO and pitch as input fuel for BOO;

2. Case 2: Investment case with integration of BOO and low sulfur fuel oil (LSFO) as input fuel for BOO;
3. Case 3: Investment case with integration of BOO and liquefied natural gas (LNG) as input fuel for BOO.

Whereby the ownership is taken over by NEWCO (to be established by a third party willing to invest in ISLA upgrading) and financing of the upgrading investment package is assumed through:

i. 100% equity; or
ii. 30% equity/70% debt.

The above defined final upgrading options differ slightly from the ones worked out by PGI in a second study, presented in the report "Refinery Utility Integration Study, February 2012", in which for each of the cases mentioned the ownership structure was still based on PDVSA as preferred partner through 1) a new lease agreement and 2) a JVC. Because the final options are dealing with the establishment of NEWCO (by a third party) with PDVSA as the crude supplier and RdK as preferred shareholder, only part of the data and results from the second PGI study have been used. It concerns the PDVSA case with a new lease agreement , hereafter renamed as NEWCO, because all ins and outs of both options are equal. As a consequence (also given the above mentioned advancing insights) the JVC case is no longer taken into account in this overall study.

Given the last modification in the final option and the request of the client also to take into account the 100% equity case, PGI provided additional cash flow sheets with 100% equity. Based on the new data Ecorys carried out a sensitivity analysis for both financing possibilities and VPC carried out a risk analysis for the 30% equity/70% debt case, which is likely the most realistic case as in the oil refinery sector the majority of the equity investors will seek leverage for qualified capital intensive projects to spread the risk. This is the more valid in the current historically low interest rate environment (UST 10YR – 2.00%). Finally, Ecorys calculated the IRR and NPV for all without any financing or any taxes involved to show the performance of the investment, independent of its financing.

6.3 Charge, yield results, capital cost estimates and operating costs for 5000TC case

6.3.1 Charge and yield results

The charge and yield results from the refinery investment case assuming **PDVSA remained as the refinery lessee**[6] did not change considerably from the 2009 study, although a small increase in liquid volume yield was realized due to changes in FCC and reformer operation. The largest changes between the 2009 and current expansion cases were the distribution of finished product, with a larger regional market available for the gasoline product and a shift in the economics of producing European export grade diesel. These charge and yield results are also identical for the investment case with the integrated utilities equipped with sulphur scrubbers as no changes were seen in the utility fuel balance. This is because the utility sulphur emissions were assumed to be controlled by the installation of sulphur scrubbers on the utility stacks, which would not impact the refinery charge and yield balance. The introduction of an alternative fuel in the utility generation system, however, does impact the refinery fuel balance as reflected in the PDVSA investment case with LSFO and PDVSA investment case with LNG. The alternative fuel results in the increased availability of residuum for asphalt production and coker unit feed from the displaced high sulfur fuel oil. The majority of additional material is routed as feed to the coker which results in an increase in total liquid products.

[6] As explained in the first sections of this chapter, PDVSA might also act as the crude supplier when a third party is establishing a New Company (NEWCO) for the upgraded refinery.

Table 6.1 Charge and yield results 5000TC2 with integration of BOO

PDVSA INVESTMENT CASES CHARGE AND YIELD WITH INTEGRATED UTILITIES Thousand Barrels per Day				
	Base Case	*Investment Case with PDVSA (crude supply)*		
	with PDVSA	*with Scrubbers*	*with LSFO*	*with LNG*
Crude Oil				
Venezuelan Crudes	204.200	204.200	204.200	204.200
Non-Venezuelan Crudes	10.400	10.400	10.400	10.400
Total Crude Oil	214.600	214.600	214.600	214.600
Other Feedstocks				
Isobutane	1.800	1.500	1.500	1.500
0.3% S Fuel Oil*	-	-	3.900	-
LNG (BFOED)*	-	-	-	3.900
Total Other Feedstocks	1.800	1.500	5.400	1.500
Total Feedstocks	**216.400**	**216.100**	**220.000**	**216.100**
Products				
LPG	1.600	1.300,0	1.500,0	1.500,0
Naphtha/Unfin. Gasoline	34.000	-	-	-
Local Gasoline	25.300	43.500	43.500	43.500
Export Gasoline	9.200	33.900	34.700	34.700
Jet Fuel / Kerosene	23.000	18.800	18.800	18.800
Local Diesel	42.400	47.300	47.300	47.300
Export Diesel (Europe)	-	19.400	20.900	20.900
Marine Diesel (MDO)	1.400	1.100	1.100	1.100
Residual Fuel Oil	41.700	8.000	11.900	11.900
Asphalt	11.000	11.000	11.000	11.000
Lubes/Byproducts	13.800	13.800	13.800	13.800
Total Liquid Products	**203.400**	**198.100**	**204.500**	**204.500**
Liquid Yield, LV%	94,0%	91,7%	93,0%	94,6%
Sulfur, LT/D	202,0	327,3	337,5	337,5
Coke, ST/D	0,0	1.608,5	1.885,5	1.885,5
Refinery Fuel Oil, % S	2,7	2,1	2,1	2,1
** LNG/LSFO fuels are not typically shown in charge/yield but are included here for reference.*				

For reasons of comparison, the base case, which is defined as the current (2012) situation of the refinery in terms of input and output, is presented in the second column.
Source PGI

Assessment of the regional gasoline market using updated annual reports from RdK and updated forecasts for gasoline demand in Latin America from our GPMO publication resulted in an increase in the assumption for regional gasoline sales out of Curacao. This allowed sales of gasoline to regional markets of 43,500 B/D compared to 24,700 B/D in the 2009 study. Regional sales yield a higher netback and are of lower quality (making them less costly to produce) compared to exports of high quality gasoline to the U.S. which yield lower netbacks to Curacao due to transportation costs.

The disposition of the diesel changed significantly from the 2009 study, with the expansion case maximizing regional diesel sales rather than maximize European diesel exports as it did in the 2009 study. The shift between export diesel and import diesel economics was due to a softening of the forecasted netback spread between European diesel exports and Latin American diesel sales.

The benefit of residuum upgrading to light products from the new coker was realized, with residual fuel sales being reduced from 41,700 B/D in the base case to 8,000 B/D in the expansion case with

pitch (with scrubbers) as fuel input for the BOO (for LSFO and LNG the figure is 11,900 B/D). This benefit, in conjunction with the other product upgrading units, resulted in gasoline sales increasing from 34,500 B/D to 77,400 B/D in the pitch/scrubber case (and to 78,200 B/D in both the LSFO and LNG case). Diesel sales increasing from 43,800 B/D to 67,800 B/D for the case with pitch (and 69,300 B/D for LSFO and LNG) compared to the base case[7]. As in the 2009 study, the 8,000 B/D residual fuel sales (in the pitch/scrubber case) represents sales of cracked material from the thermal cracker, as it was assumed that upgrading of this material was limited in the delayed coking unit. In the LSFO and LNG case the figure for residual fuel sales Is a bit higher 11.900 B/D.

6.3.2 *Financing structure*

As already mentioned in section 6.2 the following financing structures have been worked out:

1. financing by 100% equity capital;
2. financing by 30% equity and by a loan (debt-financing) for 70%.

The financial structure mentioned under 2 is based on the advice from SIG (financial advisor RdK). Apart from the reality that in the oil business in the majority of the cases equity investors are seeking for leverage to spread the risk, the current historically low interest environment (UST 10YR – 2.00%) is another reason equity investors will seek leverage for qualified capital intensive projects (like this upgrading project) to spread this risk. SIG is assuming that the Project company will maintain 30% equity and seek leverage for 70% thus creating a debt-to-equity ratio of 70/30. SIG believes that based on the credit risk of Curacao (which was recently assigned by Standard & Poor's an "A-" sovereign credit rating) combined with the Project credit risk, the 70/30 debt-to-equity ratio will be viewed as commercially acceptable by the lending community. Debt financing will be at an interest rate of 7.85% and loan duration of 15 years. The (profit) tax rate is 27.5% (as of 01-01-2012) and the tax holiday is assumed to be 10 years from the first year of operation (assumed to be 2018).

The financial structure at 100% equity capital is taken into account on request of the client.

6.3.3 *Capital costs estimates*

PGI estimated the capital costs for the three cases taking into account the financing structure as discussed in the previous section.

According to PGI the capital cost of refining facilities has decreased somewhat since the 2009 study after falling significantly from the run up in engineering, procurement and construction (EPC) costs experienced in 2008. Construction costs have been essentially flat in 2010 and 2011 with no expectations for increased construction costs in our forecasts outside of the usual inflationary pressures. The total project capital costs increased from $2.4 billion in the 2009 study to about $3.1 billion in the current study. The largest contributor to the capital cost increase was the addition of project financing costs including interest during construction to the total capital cost estimate which accounted for a $400 million increase on average. In addition, about $200 million are needed in each case for the integration of BOO into the refinery.

[7] The specs of these products are presented in the Annex 2 table A6.1

Table 6.2 Capital cost summary investment cases with integration of BOO

PDVSA INVESTMENT CASE - CAPITAL COST SUMMARY WITH INTEGRATED UTILITIES Million Dollars			
	Before Integration	Utility Emissions Compliance Option *with Scrubbers*	 *with LSFO/LNG Fuel*
Major New Unit Capacities (MBPD)			
Delayed Coker	31,1	31,1	36,5
Mild Hydrocracker	35,0	35,0	35,0
CCR Reformer	33,3	33,3	35,0
Capital Costs			
Existing Unit Revamps (ISBL)	77,1	77,1	77,1
Waste Water Treatment (WWT)[4]	-	15,3	15,3
Scrubber Costs	-	46,9	-
New Units (ISBL)			
Delayed Coking (1)	278,2	278,2	312,4
Hydrocracking/Hydrotreating	455,4	455,4	455,4
Reforming/Isom	304,5	304,5	311,0
Sulfur Plant and Environmental	143,2	143,2	143,2
Hydrogen and Other Process	113,2	113,2	113,2
CUC Utilities Infrastructure	-	63,6	63,6
New Unit Subtotal	1.294,6	1.358,2	1.398,9
Total ISBL Costs	**1.371,6**	**1.497,4**	**1.491,3**
OSBL Costs	**480,1**	**504,8**	**516,6**
Total ISBL + OSBL	**1.851,7**	**2.002,3**	**2.007,9**
Additional Project Costs			
Project Direct Costs (2)	616,6	666,8	668,6
Project Financing Costs (3)	376,9	396,3	428,3
Subotal Additional Project Costs	**993,5**	**1.063,1**	**1.097,0**
Total Project Capital Costs (5)	**2.845,2**	**3.065,3**	**3.104,8**

(1) Includes coke storage and handling
(2) Project Direct Costs include Owner's costs, licensor costs, escalation, and contingency
(3) Project Financing Costs include capital reserves (such as debt service), working capital, interest during construction and loan transaction costs.
(4) WWT modification consists of addition of biological treating to existing WWT. WWT mods for the expansion project are included in OSBL. WWT mods for existing refinery were not included in the October report.
(5) Total project capital costs option with LNG fuel is 10 million USD less, due to lower Project Financing Costs

For reasons of comparison incolumn 2, also the figures are presented referring to the configuration in which the CUC/BOO was still a separate entity (independent from the refinery), in other words:, that is the situation " before integration" of CUC/BOO into the refinery
Source: PGI

Between the three cases capital cost differ not significantly. The pitch/scrubber case is only 40 million USD cheaper than the LSFO case and the LNG case only 10 million USD.

Project financing costs are 13 to 14% of total capital costs (including interest during construction). Project financing costs also include the following costs based on assumptions provided by SIG/RdK:

- Debt Service Reserve Fund – a fund equivalent to 6 months of project loan payment to provide some protection to the lender in the event the refinery is unable to make the payment.
- Working Capital Reserve – equivalent to 2 months of the facility total operating costs providing for continued operation of the facility in the event of a short term shortage of cash.
- Costs of Refinery Inventory – it is assumed per RdK that 15% of the facility inventory costs (crude, product and chemicals/materials) would be included as part of the project, with the remaining 85% of inventory costs financed through a separate working capital loan at 5% interest.

- Loan Transaction Costs – transaction costs for obtaining the loan were assumed at 2% of the total loan amount as provided by RdK and SIG.

In the next table an overview is presented of the investment costs distributed over a 5 years period. This is done for the 100% equity cases as well as for the 30%/70% cases.

Table6.3:Distribution of investment costs for all cases (in current USD prices)

Upgrading Investment cases			Distribution of investment costs (in USD current prices)					
			total	2013	2014	2015	2016	2017
With pitch	*equity*	100%	**2.669**	123	134	806	1.174	432
With LSFO	*equity*	100%	**2.676**	123	134	808	1.178	433
With LNG	*equity*	100%	**2.676**	123	134	808	1.178	433
With pitch	*equity*	30%	**920**	131	143	646	-	-
	debt	70%	**2.146**	-	-	261	1.405	480
	total		***3.066***	*131*	*143*	*905*	*1.405*	*480*
With LSFO	*equity*	30%	**931**	133	144	654	-	-
	debt	70%	**2.173**	-	-	264	1.424	485
	total		***3.104***	*133*	*144*	*908*	*1.424*	*485*
With LNG	*equity*	30%	**928**	132	144	652	-	-
	debt	70%	**2.166**	-	-	263	1.419	484
	total		***3094***	*132*	*144*	*915*	*1.419*	*484*

Source: PGI/compiled by Ecorys

The project would take 5 years beginning in 2013, with 2 years of pre-construction work (engineering and pre-procurement activities) and 3 years of actual construction work. Project completion would occur in the 4th quarter of 2017. Project start-up would be on January 1, 2018

6.3.4 *Operating costs*

The project operating costs for the Base Case are based on actual recent historical expenditures through 2010 plus adjustments for inflation. Based on these costs and taking into account the upgrading of the 5000TC2 configuration, project fixed and variable operating costs have been estimated for the three cases, as well as the additional operating costs for the integration of BOO into the refinery. An overview for the year 2018 (which is assumed to be the first year of operation of the upgraded refinery) is presented in the following table. For reasons of comparison the base case is also showed separately.

Compared to the base case total operating costs have been increased with about 80 million USD (2018 prices) in the pitch/scrubber case (not taking into account the existing lease fee). The operating costs for the LSFO case are about 160 million USD higher than in the pitch/scrubber case due to the LSFO purchases and for the LNG case about 110 million USD.

The annual sustaining capital expenditures (not showed in the table) are taken at 1% of facility replacement cost.

Table 6.4 Operating costs for first year of operation after upgrading and integration of BOO

Operating Costs (in million USD) YEAR 2018	Investment cases Base Case	BOO PITCH	BOO LSFO	BOO LNG
Variable Costs				
Catalyst & Chemicals	28,6	28,6	28,6	28,6
Utilities-B.O.O. Net	35,8	0,0	0,0	0,0
BOO Water Purchases/Other Var.	0,2	2,8	2,8	2,8
Scrubber Variable Costs	0,0	2,1	0,0	0,0
BOO LSFO PURCHASES	0,0	0,0	164,3	0,0
BOO LNG PURCHASES	0,0	0,0	0,0	109,2
Project Incremental Variable Costs	0,0	20,1	19,9	19,9
Total Variable Costs	64,7	53,7	215,6	160,5
Fixed Costs				
Labor	82,6	90,3	90,3	90,3
Maintenance	52,6	62,0	62,0	62,0
Lease Fee *	20,0	0,0	0,0	0,0
Taxes & Insurance	9,6	10,7	10,7	10,7
Miscellaneous	9,9	11,6	11,6	11,6
Scrubber Fixed	1,3	1,6	0,0	0,0
Project Incremental Fixed Costs	0,0	73,2	75,7	75,7
Total Fixed Costs	176,0	249,3	250,2	250,2
Total Operating Costs **)	240,7	303,0	465,9	410,7
****) lease fee will be changed into land lease and preferred stock dividend in the***				
*****) Excluding sustaining capital***				

Source PGI/compiled by Ecorys

As already explained in the table above, the lease fee is only presented for the base case. This lease fee (according to contract with PDVSA) set at 20 million USD and being constant up to the expire date end of 2019, is covering both the current refinery facilities at ISLA as well as the oil terminal facilities at Bullenbay. This lease fee is no longer valid in a new contract to be concluded with NEWCO in case upgrading of the refinery will be realised. Independent from the decision whether the ISLA refinery will be upgraded or will be shut down, a separate contract for Bullenbay will come into force in 2018 (in case the upgraded refinery will become operational) or in 2020 (in case the ISLA refinery will be closed down end of 2019). In a new contract the lease fee will be changed into a Land Lease fee plus a Preferred Stock Dividend both to be paid to RdK. In the financial analysis so far, both components are not included, in order to calculate the maximum return on investment of the three upgrading cases, which is used as a starting point in the exercise to estimate the Land Lease and the Preferred Stock Dividend separately and to evaluate its consequences (see chapter 7).

6.4 Upgrading investment cases economic results

6.4.1 Base results

First of all the performance of the investment is measured independently of the sources or methods of financing, following the EU guide for Cost Benefit Analysis (2008). This means that the commercial IRR and NPV have been calculated for the total capital costs without taking into account the financing costs as well as the taxes (if applicable, in this analysis the taxes have been set at zero).

Secondly, the sources of financing have been taken into account, to assess the investments financial viability and sustainability. Moreover, the DSCR has been calculated for the cases in which part of the investment is financed by a loan.

For both analyses explained above, the discount rate was assumed to be 15% for the equity NPV calculation based on PGI project experience for similar projects in existing facilities (see also box 2).

Box 1: Debt Service Coverage Ratio ("DSCR") – Although there are many ratios that lenders use to both qualify and ensure credit compliance, the majority of lenders will rely on a debt service coverage ratio. The debt service coverage is the ratio, in any period, where the cash flow available for debt service is divided by the actual debt service. In the cash flow model, we projected the debt service in future years to ensure that an acceptable amount of cash flow will be available to meet the Project Company's annual debt service obligations. The Project's results of the greater than 1,35 or even better the 1,50x debt service coverage ratio demonstrates what we believe would generate lender confidence based on the future financial performance of Project Company coupled with its willingness and ability to meet its debt obligations in a timely manner.

As is explained in box 2, the opinion of SIG is to set the minimum discount rate at 17% instead of 15%. Generally speaking, there is no fixed minimum target set by the industry. For this analysis, the 15% from PGI will be taken as a minimum, knowing that higher rates are of course preferable.

Box 2: Rate of Return (IRR) – According to SIG, equity investors (sponsors) when deploying their treasury capital in the energy markets; and especially in those countries in the emerging markets, will seek a minimum IRR of 17%. Selectively, state-owned companies such as PDVSA when investing equity capital will accept a lower IRR that can range from 8% - 12%.

In general: in the upstream oil business the minimum requirement for the IRR is from 17% up to 25%+. In the downstream oil business, the minimum IRR rate might not be significantly deviate from the one in the upstream business. This is due to the fact that with crude oil refining downstream business units being a loss unit in major oil's operations, their willingness to commit equity capital at returns lower than the upstream business unit is not a debate internally under current market conditions. Therefore, although lower percentages will be accepted as are valid in the upstream business, the range is going from 10 up to 17% or even more, all depending on the particular position of the company involved.

The project economics were analyzed utilizing cash flow models to represent the refinery financial performance in the three upgrading cases. The IRR and NPV results are summarized in the next table, followed by the average DSCR. The detailed cash flow model results are shown in Annex 2 (Case 1A, 1B, 2A, 2B, 3A, 3B) in Tables 2 up to 7 respectively.

Table 6.5: Results commercial and financial analysis for the three upgrading cases

NPV in million $ Equity %	NEWCO CASES	BOO with Pitch	BOO with LSFO	BOO with LNG
Base without financing and no taxes	**IRR**	16,5%	15,0%	17,2%
	NPV (@15%)	213,7	1,9	309,8
100%	**IRR**	15,2%	13,8%	15,9%
	NPV (@15%)	23,5	(141,2)	114,0
30% (70% debt)	**IRR**	19,0%	18,0%	20,1%
	NPV (@15%)	294,4	220,9	376,7
	DSCR	2,02	1,93	2,10

Source: PGI/Ecorys

The NEWCO base cash flow results without financing and without taxes are all promising. In all three cases the IRR is equal or above the cut-off rate of 15%, meaning that independent of its

financing the three cases are commercially viable. This is also confirmed by the positive NPV (calculated at a discount rate of 15%).

In case the investments are fully financed by equity, and taking into account the (profit) taxes that are applicable, the results are slightly lower, than in the previous cases. Both the NEWCO case with pitch as well as the NEWCO case with LNG show an IRR of 15.2% and 15.9% respectively, which make those two projects financially viable. However, the NEWCO case with LSFO reveals an IRR of 13.8% just below the cut-off rate of 15%, and makes this case a bit doubtful.

But, as already discussed before, in the majority of the cases equity investors in the oil business are seeking for leverage to spread the risk. Moreover, the current historically low interest environment (UST 10YR – 2.00%) is another reason why equity investors will seek leverage for qualified capital intensive projects (like this upgrading project) to spread this risk.

Based on the advised 30% equity/70% debt financing, the IRR on equity of all three cases are significantly beyond the cut off rate of 15%. The NEWCO LNG case with 20,1% shows the highest return, followed by the NEWCO pitch case with 19%, but also the NEWCO LSFO case revealed a return on equity of 18%. Therefore, all three cases are in principle attractive or financially viable.

Also all cases are financially sustainable, because the Accumulated Cash Flow (ACCF) is positive in all years from the start of the operations. Moreover, the DSCR, an important measure for the Lender, is with 1,93 or more significantly above the minimum target of 1.35 (and also above the preferred target of 1,50): this is valid for all three upgrading cases.

6.4.2 Sensitivity analysis

Sensitivity analyses were performed on the investment cases economics to determine the impacts of changes in major input variables, like the gross margin, the operating costs and the investment costs. The sentivity analyses are carried out for the NEWCO investment cases with 30% equity/70% debt financing as well as for the 100% equity financing. The results are presented in the following two tables.

Table 6.6: Sensitivity analyses for NEWCO cases with 30% equity/70% debt financing

NPV in Million Dollars	NEWCO WITH 30% EQUITY AND 70% DEBT					
	BOO with Pitch		BOO with LSFO		BOO with LNG	
	IRR	NPV	IRR	NPV	IRR	NPV
Start Year	*2018*		*2018*		*2018*	
Base Cash Flow Results	**19,0%**	294,4	**18,0%**	220,9	**20,1%**	376,7
Gross Margin						
+$2.00/bbl	25,5%	845,0	24,6%	771,5	26,4%	927,4
-$1.00/bbl	15,3%	19,0	14,2%	(54,5)	16,5%	101,4
Operating Costs						
+$1.00/bbl	17,7%	191,2	17,7%	195,8	19,7%	345,5
-$1.00/bbl	20,3%	397,5	18,4%	245,9	20,5%	408,0
Capital Costs						
+15% (1.15 multiplier)	16,4%	109,9	15,4%	30,9	17,4%	186,7
-15% (0.85 multiplier)	22,4%	478,9	21,2%	410,9	23,5%	566,7

Source PGI/Ecorys

Decreasing the gross margin by $1,00/bbl resulted in a 3,5% drop in equity return IRR for all NEWCO cases and an average drop of the corresponding NPV of about $270 million. Positive changes in the gross margin are of course significantly increasing the equity return IRR with 6 to 6,5% points.

Changes in the capital costs (+ 15% and – 15%) were also evaluated. This range was used based on the historical construction cost index. From the table it can be concluded that increasing the construction costs with 15% resulted in a 2,5% drop in equity return IRR for all investment cases. A decrease of 15% in construction costs reveal about the same in opposite direction, leading to an equity return IRR of about 21% to 23%.

Table 6.7: Sensitivity analyses for NEWCO case with 100% equity financing

NPV in Million Dollars	NEWCO WITH 100% EQUITY					
	BOO with Pitch		BOO with LSFO		BOO with LNG	
	IRR	NPV	IRR	NPV	IRR	NPV
Start Year	*2018*		*2018*		*2018*	
Base Cash Flow Results	**15,2%**	23,5	**13,8%**	(141,2)	**15,9%**	114,0
Gross Margin						
+$2.00/bbl	19,2%	574,1	18,0%	375,9	19,9%	664,7
-$1.00/bbl	12,9%	(251,8)	11,4%	(401,2)	13,7%	(161,3)
Operating Costs						
+$1.00/bbl	14,4%	(79,7)	13,6%	(165,7)	15,7%	83,7
-$1.00/bbl	16,0%	126,7	14,0%	118,6	16,1%	145,3
Capital Costs						
+15% (1.15 multiplier)	13,4%	(220,1)	12,0%	(386,5)	14,1%	(130,3)
-15% (0.85 multiplier)	17,4%	267,1	16,0%	102,1	18,2%	358,3

Source PGI/Ecorys

Sensitivity analyses for the NEWCO 100% equity cases show a more or less comparable picture as presented in the 30/70% cases. However, the level of the equity return IRR is lower and therefore the results are less satisfying and less promising, given the fact that the results fall in some cases below the cut-off rate of 15%.

6.4.3 *Risk analysis*

Next to the sensitivity analyses a risk analysis has been performed, based on the Monte Carlo Simulation technique, in which selected uncertain inputs in the cash flow model are replaced by probability distributions instead of one value such as the most likely value. The simulated outcomes are then represented as probability distributions instead of just single values. This risk analysis is used to test the robustness of the results presented above and has been carried out by Viable Path Consulting (VPC). For all details about the inputs, method and assumptions is referred to the report "Risk Analysis Report for the Future Refinery Options", VPC from March 2012.

We summarize below the results of this risk analysis exercise for the 30% equity/70% debt financing cases (which are the most realistic cases given the preference of the majority of the equity investors to seek for leverage).

We are assuming that the project sponsors will look for a confidence level of 75% to achieve the minimum target for the above mentioned economic metrics as IRR, NPV and DSCR.

Table 6.8: Probability % to achieve the required criteria

Criteria	BOO LNG	BOO Scrubber	BOO LSFO	Minimum Requirement
IRR>12%	**99.8**	**99.7**	**96.8**	**75**
IRR>15%	**95.4**	**84.9**	**75.7**	**75**
IRR>17%	**83.2**	**62.7**	**53.8**	**75**
NPV@15%> 0	**95.4**	**84.9**	**75.7**	**75**

Source: VPC

The BOO LNG case clearly is the more robust case from NEWCO's perspective. This is the case if a cut-off rate of 15% is taking into account, but also if the higher cut-off rate of 17% is valid. The BOO Scrubber is a feasible proposition too, although the IRR>17% will not be met at the minimum required confidence level of 75%. And finally, although the BOO LSFO has its merits also, procuring a steady flow of LSFO (0.3% S fuel oil) to the refinery for the project's life cycle, is considered an extremely risky proposition.

The next table shows the probabilities for the new scenario's sub-cases of achieving 2 (two) targets 1.35 and 1.50.The probability of 75% has been assumed as a minimum requirement. The numbers in red are for the years when this target is not achieved.

Here again, the BOO LNG case is the more robust case as to the likelihood to meet the minimum target of 75%. However if the DSCR requirement is 1.50 instead of 1.35, all the cases have difficulty to reach the minimum confidence level of 75% during the first 6 years while for the BOO LSFO case this requirement is met is only in 2027, 2031 and 2032.

Table 6.9: Probability % Debt Service Coverage Ratio (DSCR) meeting the minimum requirement

	Probability Debt Service Coverage Ratio (DSCR) Meeting Minimum Requirement						
	BOO LNG DSCR> 1.35	*BOO LNG* DSCR>1.50	*BOO Scrubber* DSCR>1.35	*BOO Scrubber* DSCR>1.50	*BOO LSFO* DSCR>1.35	*BOO LSFO* DSCR>1.50	Minimum Req't
	%	**%**	**%**	**%**	**%**	**%**	**%**
2018	**70.0**	**62.1**	**65.8**	**56.0**	**57.9**	**49.6**	***75.0***
2019	**75.6**	**68.3**	**73.3**	**63.9**	**65.2**	**57.3**	**75.0**
2020	**75.8**	**68.2**	**73.7**	**65.2**	**66.0**	**57.7**	**75.0**
2021	**77.1**	**70.5**	**76.2**	**67.1**	**67.0**	**59.7**	**75.0**

	Probability Debt Service Coverage Ratio (DSCR) Meeting Minimum Requirement						
	BOO LNG DSCR> 1.35	*BOO LNG* DSCR>1.50	*BOO Scrubber* DSCR>1.35	*BOO Scrubber* DSCR>1.50	*BOO LSFO* DSCR>1.35	*BOO LSFO* DSCR>1.50	Minimum Req't
2022	**79.0**	**72.7**	**78.0**	**69.9**	**69.6**	**62.7**	**75.0**
2023	**80.6**	**74.4**	**80.2**	**73.2**	**72.4**	**65.1**	**75.0**
2024	**82.8**	**76.8**	**83.3**	**76.6**	**75.2**	**68.8**	**75.0**
2025	**84.0**	**79.1**	**85.3**	**79.6**	**77.8**	**72.0**	**75.0**
2026	**85.8**	**80.7**	**87.8**	**82.5**	**79.8**	**74.5**	**75.0**
2027	**87.2**	**82.9**	**89.8**	**84.7**	**82.3**	**77.2**	**75.0**
2028	**83.4**	**76.3**	**86.9**	**78.9**	**77.8**	**70.9**	**75.0**
2029	**84.2**	**77.2**	**87.2**	**80.6**	**79.9**	**72.5**	**75.0**
2030	**85.1**	**78.9**	**88.5**	**81.2**	**80.6**	**73.6**	**75.0**
2031	**85.7**	**80.0**	**89.5**	**83.1**	**81.8**	**75.2**	**75.0**
2032	**85.9**	**80.2**	**89.0**	**83.4**	**82.2**	**76.3**	**75.0**

Source: VPC

6.4.4 *Overall conclusion*

The NEWCO LNG case with a financing structure of 30% equity and 70% debt financing is clearly the most robust case from NEWCO's perspective, taking into account the sensitivity analysis as well as the risk analysis. The IRR > 17% is met with a probability of 83.2 % and the IRR > 15% in more than 95% of the cases.

However, the introduction of LNG to Curacao is quite uncertain. Therefore, these results are very preliminary and would need additional study to further define the scope and capital costs associated with this option. A feasibility study for LNG to investigate the establishment of an LNG terminal on Curacao and to supply the island in the (near) future has been started lately and will be finished end of April or May 2012. The results of this feasibility study are of significant influence on preliminary results of the NEWCO LNG case for upgrading the ISLA refinery and integration of BOO into this refinery.

The second best option is definitely the NEWCO pitch/scrubber case. While this option requires some capital investment, the economics are much more favorable for mitigating sulfur emissions than using higher cost low sulfur fuel oil as the fuel source. Sulfur scrubbing technology is utilized extensively in the industry to control sulfur emissions, and allows the facility operator flexibility in fuel sources that would not be available if the low sulfur fuel oil option was implemented.

But, remember that the results presented in this chapter do not take into account any Land Lease fee and/or Preferred Stock Dividend provided to RdK, as compensation for occupying/using the ISLA site for industrial purposes and/or operating the existing refinery facilities which are still be owned by RdK. Any proposal for generating income by RdK will influence the outcome of the business cases. This will be dealt with in the next chapter.

6.5 Manpower requirements and refinery air emissions

6.5.1 *Refinery upgrading manpower requirements*

PGI estimated the additional manpower requirement for the refinery investment cases using the PGI operating cost OPEXTarget models. The models provided the additional labor required for

operations, maintenance and administration of the project equipment based on PGI's industry experience. In addition, adjustments were made based on the location of the refinery.
The additional manpower needed for the expansion project at ISLA is estimated at approximately 100 full time employees at the refinery. An additional 150 to 160 contract workers are expected to be needed on average at the refinery to help conduct maintenance activities, including unit turnarounds.

Data about the existing manpower currently in operation at the BOO is provided by RdK. In case BOO will be integrated with the ISLA refinery about the same number of employees (92 persons) will be needed; after integration and upgrading there is a possibility to slightly increase this number of staff to100 employees in total.

The total manpower estimates are shown in the following table.

Table 6.10: Additional manpower requirement at ISLA and manpower from BOO after integration

	Number of Employees
Refinery employees	
Operations	26
Maintenance	65
Administration	4
Total	95
Contract employees	151
Total employee requirement refinery	246
Integration of BOO in refinery *)	92
* Might be increased up to 100 (as a maximum)	

Source PGI/Ecorys/RdK

6.5.2 *Refinery air emissions before and after upgrading and integration of BOO*

In addition to the financial and long-term refinery viability benefits associated with the proposed Isla refinery expansions project, the project will also result in significant improvement to air quality in and around the Isla refinery. The proposed project will substitute the burning of high sulfur residual fuel oil with refinery produced fuel gas streams containing virtually no sulfur including treated refinery fuel gas and recovered mixed liquid petroleum gas (LPG). In addition, air quality will be improved through the addition of additional fuel gas treating and flue gas clean-up on the fluid catalytic cracking unit. PGI has estimated the annual air emissions associated with the current base operation at the Isla refinery and the projected air emissions resulting from implementation of the new expansion project using air emission factors published by the United States Environmental Protection Agency in their publication AP-42. These factors are utilized throughout the industry to estimate air emissions from refinery related sources including fired heaters, boilers, as well as process units such as fluid catalytic crackers, cokers, and other sources. PGI did not undertake a comprehensive source by source inventory of air emissions but rather utilized the more general AP-42 methodology. The projections presented may differ from actual results at the refinery but the order of magnitude of emission reductions and air quality improvement should be representative of what can be achieved through the integration of control technologies as part of the expansion project.

As shown in the table below, it is estimated that the refinery expansion project will reduce the emissions of sulfur oxides, nitrous oxides and particulates associated with the Isla refinery. Carbon Dioxide emissions will be increased consistent with the addition of new process units on one hand. On the other hand (because of fuel replacement in the refinery) a 9% to 13% reduction of the base value of carbon dioxide emissions has to be taken into account. These two issues are summing up to an increase of 72kT/yr (or +2,9%) from a pestimistic perspective or to a reduction of 29 kT/yr

from an optimistic perspective. In the table the pessimistic view is presented. Sulfur oxides currently released are estimated to be about 50.3 thousand tons per year and will be reduced to about to 1 thousand tons per year as high sulfur fuel residual fuel oil is replaced with treated refinery fuel gas and LPG streams. It is also anticipated that nitrogen oxides will be reduced as new NOx burners are installed to burn the low sulfur refinery fuel gas, and LPG gas streams. Particulates will be reduced from the installation of flue gas cleanup technologies on the existing fluid catalytic cracker at the refinery. Because new process units are being added emissions of volatile, organic carbons (VOC) are expected to increase slightly. The proposed coker project will result in slight particulate and VOC emissions from the vent stack utilized when the coke drums are depressured prior to removal of the coke. The coke piles will be in covered storage areas and kept damp to reduce coke fine dust associated with handling. These increments have been included in the overall estimates provided for the expanded Isla refinery.

Moreover, the integration of BOO into the ISLA refinery will also have a significant improvement to air quality in and around the ISLA refinery. For that integration three options have been dealt with related to the fuel input for BOO, being pitch (with scrubbers to mitigate the emissions), LSFO and LNG. Solomon Associates have estimated the existing BOO emissions (sulfur oxides, nitrous oxides, particulates, carbon dioxide and volatile, organic carbons (VOC)) as well as the emissions after the refinery upgrade and integration of BOO into the refinery. These estimates have been done for the pitch/scrubber case, which shows the maximum levels after integration. The two other cases with LSFO and LNG as fuel input have not been worked out, but will result in even lower emissions. Sulfur oxides are estimated to be about 30.3 thousand tons per year and will be reduced to about to 1.5 thousand tons per year. VOC will be reduced to nil. Solomon Associates remarked that the estimate for the current VOC emission is based on the AP-42 methodology as is used by PGI. AP-42 only includes emission factors for Total Organic Compounds for fuel oil burned in power generation. Total organic compounds (TOCs) include VOCs, semi-volatile organic compounds and condensable organic compounds. The figure for BOO presented in table 2 is for TOC. VOC emissions will be lower. Finally, it can be remarked that nitrogen oxides as well as particulates also will decrease significantly, when BOO is integrated and scrubbers will be used.

Table 6.11 Annual air emissions in kT/Yr for ISLA and BOO before and after upgrading/integration

SUMMARY OF ANNUAL AIR EMISSIONS IN kT/Yr ISLA and BOO in existing 2012 situation and after upgrading and integration of BOO into ISLA refinery					
Emissions Ktons/Year	Sulfur Oxides	Nitrogen Oxides	Carbon Dioxide	Particulates	VOC
Existing Isla Refinery - High Sulfur RFO	50,3	4,2	2530,0	7,2	1,9
Expanded Isla Refinery w/ LPG & Ref Fuel Gas	0,9	1,4	2602,0	0,7	2,1
Existing BOO	30,3	3,3	1698,0	2,2	0,1
BOO after integration with Isla Refinery *	1,5	0,4	1697,0	0,7	nil
Total ISLA and BOO existing	80,6	7,5	4228,0	9,4	2,0
Total ISLA and BOO after upgrading and integration	2,4	1,8	4299,0	1,4	2,1
** based on BOO with pitch as fuel and scrubbers*					

Source PGI and Solomon Associates

There are no generally accepted International Standards in effect for air emissions from oil refineries since conditions and legislation differ throughout the world. The World Bank has provided guidelines regarding emission levels from refinery projects which may request World Bank assistance and these are generally viewed as the most representative International Standards available. Emissions levels for the design and operation of each project must be established through the environmental assessment (EA) process on the basis of country legislation and the World Bank guidelines as applied to local conditions. The emissions levels selected must be

justified in the EA and acceptable to the World Bank Group. The guidelines given below and compared with ISLA Refinery estimates present emissions levels normally acceptable to the World Bank Group in making decisions regarding provision of World Bank Group assistance and can be used as a benchmark against which ISLA Refinery emission estimates can be measured.

PGI has developed the table below to compare the World Bank Benchmarks for major air pollutants, to the estimated refinery air emissions from the ISLA refinery both under the existing refinery operation and configuration and under the refinery operation and configuration after the proposed upgrade project presented in this report is completed. In those figures also the emissions from BOO are included (both the current situation and after integration of BOO into ISLA in case the upgrading project will be realized. The table results presented for the post upgrade project assume that the refinery fuel system has been converted from high sulfur residual fuel oil to treated refinery fuel gas and LPG, and that other emission control devices such as low NOx burners have been installed. For BOO the option with pitch and scrubbers are included (see also for details the previous table).

Based on the pollutant emission benchmarks in terms of tons of pollutant emitted per ton of crude oil processed two figures per pollutant emission have been calculated when processing the target 214,600 B/D (12.4 million tons per year) of crude oil[8]. The one presented in the second column refers to refineries who have implemented emission control technologies in line with Best Available Control Technology (BACT) and the higher benchmarks in the third column are for refineries who have not incorporated BACT in regards to refinery emissions. Columns 4 and 5 then repeat the information presented in the table above using the US EPA AP 42 emission factors for the ISLA refinery operation before and after the completion of the proposed upgrade project and also included the BOO emission figures for both situations.

Table 6.12: Comparison air emissions ISLA and BOO with World Bank benchmark

Air emissions ISLA and BOO compared with benchmark	World Bank benchmark		Isla + BOO	
	with BACT	without BACT	before*	after**
Crude processed in million Tons/year	12,4	12,4		
Emissions Ktons/Year				
Sulfur Oxides	0,7	3,7	80,6	2,4
Nitrogen Oxides	1,1	5,6	7,5	1,8
Carbon Dioxide	3.098	4.958	4.228	4.299
Particulates	0,7	1,9	9,4	1,4
VOC	1,5	3,7	2	2,1

* *Existing situation*
** *After refinery upgrade and integration of BOO and after installation of a scrubber at BOO*

Source: PGI and Solomon Associates

After the refinery upgrade and installation of a scrubber at the CRU/BOO, the combined emissions are safely within the international benchmarks of refineries that have not implement BACT technologies. The estimates indicate the combined emissions would likely come within the more stringent benchmarks for refineries that have implemented BACT with some additional emission control hardware or full implementation of BACT.

In order to monitor and to control the environmental emissions and its compliance with the international environmental standards, an independent and effective environmental department is

[8] We refer to the PGI report "Refinery Configuration and Valuation Study, October 2011 for further details (page 93)

needed in Curacao. The existing environmental department does not have sufficient capacity to monitor and to control ISLA. Apart from a possible re-organizing of the entire environmental department (which is currently under discussion) the part that is responsible for ISLA has to be strengthened. In discussion with the department, a quick calculation was made by them resulting in an investment of NAf 0,66 million and an annual increase of operating costs from about NAf 0,73 million to NAf 1,319 million (both only dealing with employees responsible for monitoring and control). The figures mentioned have been taken into account in the CBA (see chapters 13 and 15).

6.6 Valuation of existing assets of the ISLA refinery

Next to the investment cases PGI was asked by RdK to update the refinery valuation analysis work performed in 2009 . PGI believes that the earnings approach is the method most often utilized by both buyers and sellers of petroleum refineries and best reflects the fair market value of a refining asset. The other approaches have limitations that require adjustments to be made to reflect the individual asset's economic characteristics.

The fair market value of the ISLA refinery assets to a new owner based on projected future earnings is calculated to be $331 million at a 12% discount rate and assuming approximately $381 million in working capital requirements. This value is estimated based on the refinery yields from the investment cases "base case". The refinery value was found to be very sensitive to the yield assumptions and a sensitivity case assuming 0.5 vol. % lower overall liquid yield dropped the refinery value to -$255 million.

To facilitate the use of the market comparables PGI calculates indexes for comparison of the subject refinery to the refineries present in the market data. In this evaluation, only the Toledo, OH refinery purchase by PBF Energy Partners was a comparable refinery sale between 2004 and 2011 based on size and complexity. Additional comparable sized refinery sales during this time period were the Delaware City refinery (April 2010) and the Paulsboro refinery (December 2010) purchases, which were also by PBF Energy Partners. While the complexity of these facilities made them unsuitable for direct estimation of the Curacao refinery value, these transactions were used to help validate the value of the Curacao refinery based on the sole comparable sale. The results would indicate that the Curacao refinery value is somewhere between $298 million and $404 million although the value could be somewhat lower due to the refinery's poor cracking economics and fuel (residual fuel oil) costs.

Construction costs have levelled out over the past 2 years, with the replacement cost estimate for the refinery falling to $4.5 billion. The depreciated asset value of the refinery after deductions for the age of the facilities is also shown, but does not have any relation to fair market value of the assets. The results of the different valuation methods are summarized in the table below. For more details and for a complete discussion of the methodologies, assumptions and limitations of this analysis is referred to the "Refinery Configuration and Valuation Study, October 2011, chapter V and its Annexes".

Table 6.13 ISLA refinery assets valuation; three approaches

SUMMARY OF CURACAO REFINERY VALUES (PRE-TAX) (2011 Basis - Millions of US Dollars)				
	Discount Rate	**Business Value**	**Working Capital**	**Asset Value**
Earnings Approach (1)				
Refinery	12%	713	381	331
Market Approach				
Refinery (using Toledo comparable only)				404
Refinery (using all comparables)				298
		Replacement Cost		**Depreciated Asset Value**
Cost Approach				
Refinery		4.478		1.377

7 Implications BC-analyses for GoC/RdK

7.1 Introduction

In the previous chapters the Business Case analyses have been carried out for Upgrading the ISLA Refinery (variant 1A in Chapter 6) as well as for the Grassroots Refinery (variant 1B in Chapter 5).

From these analyses it was concluded that the Grassroots Refinery, to be located at Curacao, will definitely not be realized in the medium and long term. The main reason is that the project is commercially and financially not viable and should not be built from a financial standpoint. Therefore, the Grassroots Refinery will not be taken into account in the Cost Benefit Analysis for Curacao.

The Upgrading ISLA refinery configuration is promising, in particular the cases with 30% equity and 70% debt financing. However, the results presented in Chapter 6 do not take into account any land lease fee and/or Preferred Stock Dividend provided to RdK. Any proposal for generating income by RdK will influence the outcome of the business cases.

Therefore, in this chapter some proposals will be presented for any land lease and-or Preferred Stock Dividend to be paid by the NEWCO to RdK. Also the consequences of the introduction of these two cost components for NEWCO in terms of financial viability will be dealt with.

Moreover, independent from the decision whether the ISLA refinery will be upgraded or closed down according to contract in 2019 or earlier, the Government of Curacao is intending to conclude a separate contract for the ISLA refinery as well as for Bullenbay Terminal. This separate contract for Bullenbay will be concluded with a) the new operator/investor in 2018 in case ISLA will be upgraded or with b) the new company which will operate the terminal in case the ISLA refinery will be closed end of 2019 or earlier. Therefore, for Bullenbay Terminal also some proposals for any land lease and/or Preferred Stock Dividend (to be paid to RdK) will be presented.

On the other hand as part of the Government Strategy to develop a Sustainable Long Term Economic Development Plan for Curacao, the Government intended to start soon with some environmental actions-measures independent from the decision to upgrade or to close down the ISLA refinery. However, in all likelihood these short term actions/measures will be financed by RdK and as a consequence will have a negative impact on their financial position.

Based on the above, we start with a summary of the results for Upgrading the ISLA refinery as presented in Chapter 6, followed by proposal for any land lease and/or Preferred Stock Dividend to be paid by NEWCO to RdK, and discuss the impact on the financial viability of this business case. Secondly, the intended short term environmental actions/measures will be briefly discussed in terms of investment costs (CAPEX) en operating costs (OPEX). Finally, the valuation of the Bullenbay Terminal will be presented, also followed by proposal for any land lease and/or Preferred Stock Dividend to be paid to RdK by the (existing or new) operator/investor of Bullenbay Terminal.

7.2 Feasibility of refinery upgrading activities on Curacao

7.2.1 Upgrading ISLA without Land Lease/Preferred Stock Dividend

As already mentioned in the introduction, the commercial and financial viability of Upgrading the ISLA refinery is promising, in particular the cases with 30% equity and 70% debt financing.

The NEWCO LNG case is the most robust case followed by the NEWCO pitch-scrubber case. The NEWCO LFSO case shows less promising results. However, the results presented in Chapter 6 do not take into account any land lease fee and/or Preferred Stock Dividend provided to RdK, as compensation for occupying/using the ISLA site for industrial purposes and/or operating the existing refinery facilities which are still be owned by RdK. Any proposal for generating income by RdK will in any case influence the outcome of the business cases.

In the next table a summary is presented of all major components describing the three business cases, including the financial results of the cash flow analysis and the results of the risk analysis. We have focused on the 30% equity/70% debt financing cases (which are the most realistic cases given the preference of the majority of the equity investors to seek for leverage).

In particular the financial results and outcome of the risk analysis should be kept in mind carefully in order to understand any impact of proposals for land lease and/or Preferred Stock Dividend, which will be discussed in the next section.

Table 7.1 : Summary table investment cases Upgrading ISLA refinery

SUMMARY TABLE	INVESTMENT CASES		
	BOO PITCH	BOO LSFO	BOO LNG
Thousand Barrels per Day			
Crude Oil			
Venezuelan Crudes	204.200	204.200	204.200
Non-Venezuelan Crudes	10.400	10.400	10.400
Total Crude Oil	**214.600**	**214.600**	**214.600**
Total Feedstocks	**216.100**	**220.000**	**216.100**
MAIN PRODUCTS			
Local Gasoline	43.500	43.500	43.500
Export Gasoline	33.900	34.700	34.700
Jet Fuel / Kerosene	18.800	18.800	18.800
Local Diesel	47.300	47.300	47.300
Export Diesel (Europe)	19.400	20.900	20.900
Marine Diesel (MDO)	1.100	1.100	1.100
TOTAL MAIN PRODUCTS	**164.000**	**166.300**	**166.300**
Total Liquid Products	198.100	204.500	204.500
Main products as % of total	***83%***	***81%***	***81%***
TOTAL CAPITAL COSTS (mio $)			
Total ISBL + OSBL	**2.002,3**	**2.007,9**	**2.007,9**
Additional Project Costs			
Project Direct Costs (2)	666,8	668,6	668,6
Project Financing Costs (3)	396,3	428,3	418,0
Subtotal Additional Project Costs	**1.063,1**	**1.097,0**	**1.086,6**
Total Project Capital Costs (5)	***3.065,3***	***3.104,8***	***3.094,5***
Investment/construction period	5 years	5 years	5 years
Financing mode	***30%equity/70% debt***	***30%equity/70% debt***	***30%equity/70% debt***
Duration Loan	15 years	15 years	15 years
Interest Rate	7,85%	7,85%	7,85%
Taxes Holiday 10 years at	2%	2%	2%
Taxes rate after taxes holiday	27,50%	27,50%	27,50%
Discount rate NPV	15%	15%	15%
Commercial IRR on investment	**16,50%**	**15,00%**	**17,20%**
NPV without financing and without any taxes (mio $)	**213,7**	**1,9**	**309,8**
Financial IRR on equity	**19,00%**	**18,00%**	**20,10%**
NPV with 30/70 financing (mio $)	**294,4**	**220,9**	**376,7**
Risk analysis	**Probability**	**Probability**	**Probability**
IRR > 12%	99,70%	96,80%	99,80%
IRR > 15%	84,90%	75,70%	95,40%
IRR > 17%	62,70%	53,80%	83,20%

Source: PGI/Ecorys/VPC

7.2.2 *Determination Land Lease fee and Preferred Stock Dividend for ISLA*

Since RdK is providing to NEWCO the existing refinery assets and infrastructure and a preferred share as a percentage of the overall refinery value after expansion/upgrading of the facilities, can be applied to calculate a reasonable “fixed income”. Next to this a Land Lease fee is also contemplated taking the ISLA site at Schottegat Bay into account.

According to Solomon Associates (and SIG) NEWCO would only agree with RdK on a certain fraction of the income payable to RdK based on its preferred share percentage. NEWCO is not interested is a breakdown of these costs, whatever it will be called: "a Land Lease plus Preferred Stock Dividend" or only "a Preferred Stock Dividend". At the end of the day only the total amount to be paid to RdK is decisive[9]. However, because this is in our opinion a negotiation issue, in our analysis we have opted for treating both income components for RdK separately.

Land Lease ISLA

A Land Lease fee can easily be calculated for the ISLA site, based on the lease fee CPA is already asking today for the land CPA is leasing in the Schottegat area to CDM and CPS. The rent is about 4 to 6 NAf per m2. And moreover, CPA is charging a concession fee which is related to the turnover of the activity of the party involved and are calculating on average a percentage from 3 to 7% (depending of the kind of business and depending on the investments CPA needs to do in buildings, quay's etc.).

In our calculation we have taken the minimum rent being USD 22,500 per ha (based on 4 NAf/m2 which is USD 2.25 per m2). This is based on the fact that the site is very extensive (440 ha) and therefore the minimum rate is used. The concession fee (see above) based on the turnover of a business we do not want to propose in this respect. A Preferred Stock Dividend, as will be discussed hereafter, will be a good substitution.

The above means that for the ISLA site which is about 440 ha, in total (440 * USD 22,500) about USD 10 million can be asked for. The price is in 2011 USD and should be inflated annually, with 2,0% to 2,5%!

Preferred Stock Dividend

Two ways of determining the Preferred Stock Dividend have been explored:

1. One method is based on the share of RdK in total equity of NEWCO. Total equity is defined as the new investments in NEWCO to upgrade the ISLA refinery increased by the existing assets of the refinery (owned by RdK). With this share, RdK will receive annually its share percentage of the net cash flow. However, in this approach NEWCO must absorb all the risk of volatile refining margins and as such has full ownership of the Free Cash Flow. In this case, NEWCO would only "guarantee" Curacao a fraction of the income due to RdK based on their equity share. Refinery margins are expected to remain extremely volatile. Therefore, according to Solomon Associates it might happen that NEWCO would only allow Curacao half its share based on equity in the form of fixed income. Also this is an issue for negotiation and will not be taken into account in the calculations.
2. A second method is based on paying the Preferred Stock Dividend through a so-called "loan", which is equal (as a proxy) to the value of the assets of the existing refinery (being USD 331 million). The contract period is set at15 years and there is NO repayment of the loan, but only interest has to be paid. The latter means that at the end of the contract period RdK is still the owner of the existing assets;

Ad 1:

The share of RdK in total assets has been calculated at 9,8% in the BOO Scrubber case, 9,6% in the BOO LSFO case and 9,7% in the BOO LNG case based on the definition as stated under

[9] While Curacao and RdK view the lease of land and the dividend as separate business transactions, we, Solomon Associates believe a potential NEWCO partner will view both payments as simply a single, fixed payment to a minority partner. As a result, the sum of the lease payment and dividend cannot exceed the share of NEWCO profit due to RdK based on percentage equity in NEWCO held by RdK.

method 2. After having determined the share of RdK one has to calculate the average net cash flow over a 15 years period. In this calculation one has to take into account the annual inflation, which is incorporated in these net cash flow figures. After having transformed the net cash flow during 15 years in constant prices of the base year, the average net earnings can be determined. This average net earnings can be used as starting point in the base year and should be inflated year by year. The results are presented in table 7.2.

Ad 2:
This method is very easy to implement, by only applying an interest rate of 7.85%[10] on the loan of USD 331 million. Because there is no need for repayment, every year the same amount will be paid to RdK, being 7.85% of USD 331 million, which is about USD 26 million (with NO discount) or less if a certain discount is negotiated. Be aware that the fixed amount is in current prices, this means that the fixed rate is not inflated, and as a consequence will devaluate year by year. The results are also presented in table 7.2.

We propose to apply both methods to the NEWCO cases to calculate the fixed income for RdK and to find out what the influence is on the return on equity by introducing this method together with the Land Lease fee. This analysis will be carried out for the 30% equity/70% debt financing cases)see section 7.2.3). The proposed Land Lease fee and the Preferred Stock Dividend are presented for each case in table 7.2. In this table NEWCO I is the case in which method 1 has been applied to estimate the Preferred Stock Dividend and NEWCO II is the case in which method 2 has been applied. All figures are in USD million and in 2011 prices!

Table 7.2: Proposed Land Lease fee and Preferred Stock Dividend for the investment cases

	All figures are in 2011 prices	**Investment Cases Amounts are in USD million**		
		BOO LNG	**BOO Scrubbers**	**BOO LSFO**
NEWCO I (30% Equity)	**Land Lease fee**	10 + annual inflation	10 + annual inflation	10 + annual inflation
	Preferred Stock Dividend	18,6 + annual inflation	17 + annual inflation	15,5 + annual inflation
NEWCO II (30% Equity)	**Land Lease fee**	10 + annual inflation	10 + annual inflation	10 + annual inflation
	Preferred Stock Dividend	26 (fixed)	26 (fixed)	26 (fixed)
	Share RdK in NEWCO I & II	9,7%	9,8%	9,6%

Source: Ecorys

From the table it can be concluded that the total amount that RdK will receive for land lease and Preferred Stock Dividend might be between USD 25 and 30 million (in 2011 prices) for the NEWCO I cases. For the NEWCO II cases the start value is higher (being USD 36 million), but because the Preferred Stock Dividend is fixed total income for RdK will go down to USD 25 million (still measured in 2011 prices) at the end of the contract period.

7.2.3 *Impact Land Lease and Preferred Stock Dividend on the financial results*

Based on the financial cash flow models of the three cases (with 30% equity/70% debt financing) and taking into account the Land Lease fee and the Preferred Stock Dividend as explained and estimated in section 7.2.2, the IRR on equity and the NPV (at a discount rate of 15%) have been calculated. As explained in section 7.2.2 NEWCO I stand for the first method of estimating the

[10] This is the same interest rate as has been applied to the refinery in case 70% of the total investment is financed by a loan.

preferred stock and NEWCO II for the second method. For reasons of comparison the IRR on equity and NPV (without any fee for RdK) are presented at the top of the table.

Table 7.3: Introduction of a Land Lease and Preferred Stock Dividend and its Implications on the IRR and NPV of the investment cases

		Investment Cases		
(NPV at 15% rate)		BOO LNG	BOO Scrubbers	BOO LSFO
Base results before any fee paid to RdK	**IRR**	20,1%	19,0%	18,0%
	NPV	376,7	294,4	220,9
NEWCO I (30% Equity)	**IRR**	18,7%	17,6%	16,7%
	NPV	264,0	187,5	120,0
NEWCO II (30% Equity)	**IRR**	18,6%	17,5%	16,4%
	NPV	259,1	176,8	103,3

Source: PGI/Ecorys

The results of introducing a Land Lease fee and a Preferred Stock Dividend in the financial cash flow models are clear. In nearly all cases (LNG, pitch/scrubber and LSFO) the IRR on equity decreased with about 1.3% point to 1.4% point in NEWCO I and about 1.5% point to 1.6% point in NEWCO II. In general the result of the IRR on equity is still above the cut-off rate of 15% applied by PGI (and also for the LNG and pitch Scrubber case above the 17% cut-off rate (as advised by SIG).

Subsequently, a risk analysis has been carried out by VPC, focusing on the BOO LNG case as well as the BOO Scrubber case. The BOO LSFO case which was already doubtful in the risk analysis without taking into account any fee for RdK, is no longer taking into account in this risk calculations.

The results of the risk analysis are presented in table 7.4. We again are assuming (see also section 6.4.3) that the project sponsors will look for a confidence level of 75% to achieve the minimum target for the economic metrics as IRR and NPV.

Table7.4: Results of the risk analysis with respect to Land Lease and Preferred Stock Dividend

Equity	30% *BOO LNG NEWCO I*	30% *BOO LNG NEWCO II*	30% *BOO SCUBBER NEWCO I*	30% *BOO SCUBBER NEWCO II*	*Minimum Requirement*
Criteria	%	%	%	%	%
IRR>12%	98,8	98,5	98,5	97,7	75,0
IRR>15%	87,6	86,8	81,4	78,8	75,0
IRR>17%	69,5	68,0	58,2	55,6	75,0
NPV> 15%	87,6	86,8	81,4	75,0	75,0

Source: VPC

It is no surprise that the BOO LNG case is still the most robust case from a NEWCO's perspective. This is again valid if the cut-off rate of 15% is taking into account, but not valid for the higher cut-off rate of 17%, because the confidence level of 75% is no longer met. The BOO Scrubber case shows satisfying results for the >15% IRR but relatively low results for the >17% IRR. However, Curacao Government/RdK should take care not to go too far and to be too optimistic in their expectations.

In order to support this message the following results from the risk analysis are presented in the next table.

Table 7.5: Preferred Share Value at Confidence Level of 75% LNG & Scrubber Cases @ 30% Equity (in current prices)

	Newco I	Newco II
	LNG 30% Eqty	*LNG 30% Eqty*
	Value @ 75% Min	Value @ 75% Min
	$	$
2018	12,7	14,5
2019	13,0	14,5
2020	13,2	14,5
2021	13,5	14,5
2022	13,8	14,5
2023	14,0	14,5
2024	14,3	14,5
2025	14,6	14,5
2026	14,9	14,5
2027	15,2	14,5
2028	15,5	14,5
2029	15,8	14,5
2030	16,1	14,5
2031	16,4	14,5
2032	16,8	14,5

	Newco I	Newco II
	Scrubber 30% Eqty	*Scrubber 30% Eqty*
	Value @ 75% Min	Value @ 75% Min
	$	$
2018	11,8	14,5
2019	12,0	14,5
2020	12,2	14,5
2021	12,5	14,5
2022	12,7	14,5
2023	13,0	14,5
2024	13,3	14,5
2025	13,5	14,5
2026	13,8	14,5
2027	14,1	14,5
2028	14,3	14,5
2029	14,6	14,5
2030	14,9	14,5
2031	15,2	14,5
2032	15,5	14,5

Source: VPC

When comparing the figures used for the Preferred Stock Dividend in the financial cash flow models with the figures from the risk analysis presented in this table (using the same period and both analysis based on current prices), it can be concluded that the calculated level of Preferred Stock Dividend for NEWCO I as well as for NEWCO II is about *42% to 44% lower* than the value used as input in the financial analysis. This is valid for the BOO LNG case as well as the BOO Scrubber case. This means that the proposed figure for the Preferred Stock Dividend might be too high for NEWCO I and NEWCO II.

Therefore, as already 'put forward by Solomon Associates, expectations from the Government of Curacao/RdK about the realizing a maximum level of the Preferred Stock Dividend should be not too high and therefore one should bear in mind that a certain discount in the order of 40 to 50% might be needed. Of course this is subject to negotiations! This will result in a total income for RdK (thus including the Land Lease fee) which will be in the range of USD 20 to 22 million (in 2011 prices) as a maximum.

7.3 Additional measures to reduce further pollution in soil, ground- and surface water

As part of the Government Strategy to develop a Sustainable Long Term Economic Development Plan for Curacao, the Government intended to start soon with some environmental actions-measures independent from the decision to upgrade or to close down the ISLA refinery. Because these actions/measures do have a direct relationship with the ISLA refinery, the proposed actions/measures will be taken into account in this overall study and incorporated in the Cost Benefit Analysis for Curacao.

Based on internal discussions between Solomon Associates, RdK and Ecorys, the following environmental actions/measures[11] have been suggested:

1. Cost to reduce seepage into the Schottegat Bay;
2. Cost to start remediation of the refinery site in a limited number of areas (with 10 up to 20 wells as a maximum);
3. Upgrade the Oil Catchers;
4. (Daily) Skimming of the Schottegat Bay;
5. Additional sustaining capital needed to improve the reliability of the ISLA refinery.

[11] An explanation of the content of these actions/measures will be provided by Solomon Associates, later on.

Apart from these 5 actions directly related to the refinery, also action 6 to remediate the asphalt ponds (or known as the Asphalt Lake) was discussed. Although there is not a direct relationship to the functioning of the refinery, this action and related costs will also included in this study.

The wastewater treatment plant (WWTP), which is currently not present, was also discussed with the client. However, this action is not taken into account in the above mentioned actions/measures, because the investments and operations of this WWTP are already included in the upgrading actions of the ISLA refinery prepared by PGI.

In the next table the CAPEX and OPEX as far as applicable are presented. Please be aware that the estimates provided by Solomon Associates a roughly figures.

Table 7.6: Environmental actions/measures, directly related (1 to 5) and indirectly related (6) to the ISLA refinery

Thousands of $	Year 2012	2013	2014	2015	2016	2017	2018	2019	2020
1 Cost to reduce seepage into the bay									
Capital Cost	$ 2.000	$ 8.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating Cost	$ 100	$ 500	→						
2 Cost to start remediation of refinery site									
Capital Cost	$ -	$ 2.000	$ 6.000	$ 2.000	$ -	$ -	$ -	$ -	$ -
Operating Cost	$ -	$ 100	$ 500	→					
3 Upgrade Oil Catchers									
Capital Cost	$ 2.000	$ 3.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating Cost	$ -	$ -	→						
4 Daily Skimming of Bay									
Capital Cost	$ 4.500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating Cost	$ 500	$ 500	→						
5 Added Susatining Capital to Improve Reliability of the Refinery									
Capital cost (over and above capital included in model by Purvin & Gertz)									
Capital Cost	$ 5.000	$ 10.000	$ 5.000	$ -	$ -	$ -	$ -	$ -	$ -
6 Cost to remediate asphalt ponds (net after recovery of oil)									
Capital Cost	$ 5.000	$ 5.000	$ 5.000	$ 5.000	$ -	$ -	$ -		$ -
Operating Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
→	**Indicates cost continues for remaining term of analysis and should be escalted for inflation at 2,5% per year.**								

Source: Solomon Associates

Most of the actions/measures are planned to be started soon, some in 2012 and some in 2013. In total (apart from the remediation of the Asphalt Lake) the investment costs for action 1 up to 5 are summing up to about USD 50 million. Some of the actions do have OPEX. In case upgrading of the ISLA refinery will be realized, the OPEX will be continued annually. In case the ISLA will be closed down, the actions will be stopped, because the demolition and remediation program for the entire refinery will start soon after closure.

It is not clear how the remediation of the Asphalt Lake (action 6) will be financed, directly by GoC or by a third party? However, for the CBA it is not important at this stage, because this action will be carried out in the base case as well as in the upgrading cases, and will result in a zero effect in the CBA which compares the actions in the base case with the upgrading cases.

7.4 Valuation of Bullenbay Oil Terminal and its future position

PGI was asked by RdK to valuate the facilities of the Curacao Oil Terminal at Bullenbay (hereafter Bullenbay Terminal) owned by RdK. PGI believes that the earnings approach is the method most

often utilized, by both buyers and sellers of petroleum marine terminals and best reflects the fair market value of a terminal asset. The other approaches, such as the market approach using comparable sales data, have limitations that require adjustments to be made to reflect the individual asset's economic characteristics. The current fair market value of the Bullenbay terminal as of August 2011and based on the projected earnings scenario is about $335 million (pre-tax) and $289 million (after tax) at a 12% nominal discount rate.

The continued strong market for petroleum terminal assets as reflected by the recent sale of the BORCO facility by First Reserve and VOPAK to Buckeye Partners, indicates higher values could possibly be realized based on recent comparable sales. These values for the Bullenbay terminal could be in the range of $350 to $400 million based on recent market activity. Two other large marine terminals have recently entered the sales market and could depress the market as the number of qualified buyers may be limited. The HFOTCO (Houston Fuel Oil Terminal) facility is located on the Houston ship channel currently has about 14 million barrels of storage capacity and is owned by the financial owner ArcLight Capital. The other facility is located in the New York Harbor area and is owned by Chevron with about 5 million barrels of storage. Both have ship and barge access. Although there has been significant interest, to date both facilities remain on the market.

The replacement cost of the Bullenbay terminal is estimated at $585 million slightly lower than the $630 million estimate in 2009 when construction costs were at a peak. The results of the different valuation methods are summarized in the table below

Table 7.7: Summary of Curacao Bullenbay Terminal Valuation

Summary of Curacao Bullenbay Terminal Values (2011 Basis – Million USD)			
	Nominal Discount		**Terminal Value**
Earnings Approach	12%		
Pre-tax			335
Post tax			289
Market Based Cost Approach	**Replacement Costs**	**% of Replacement**	**Terminal Value**
	585	60%	350
	585	70%	400

Source: PGI

7.4.1 *Bullenbay Oil Terminal's Future position*

As already mentioned in the introduction section the Government of Curacao is intending to conclude a separate contract for the ISLA refinery as well as for Bullenbay Terminal. For Bullenbay Terminal this means a separate contract to be concluded with a) the new operator/investor in case ISLA will be upgraded or with b) the new company which will operate the terminal in case the ISLA refinery will be closed end of 2019 or earlier.

In this contract among others a Land Lease fee will be included as well as a Preferred Stock Dividend.

Land Lease

Starting point for the determination of the Land Lease for the Bullenbay Terminal site is the proposed Land Lease for the ISLA site, estimated at USD 22,500 per ha (see section 7.2.2). Next, based on an internal discussion with the Client, it was in principle agreed to suggest a Land Lease fee for Bullenbay that is 4 times higher than the one for ISLA site. Main reasons for this significantly higher lease fee are:

- the strategic position of Bullenbay in the Caribbean;
- the possibility to accommodate very large ships (VLCC & ULCC), and
- the clean site at which the facilities are established.

For Bullenbay with an area of about 160 ha and based on the above mentioned assumptions the Land Lease fee can be calculated **at USD 14,4 million in total** (being 4* USD 22,500 per ha*160 ha). This is again in 2011 USD prices and should be inflated annually!

However, introducing a Land Lease in the cash flow model for Bullenbay, prepared by PGI, directly affects the net cash flow of the operator year by year (before and after tax) and is also influencing the Valuation of the Bullenbay Terminal based on the net earnings approach followed by PGI. Therefore, it has to be stressed here that the above suggestion for a total Land Lease of USD 14,4 million has to be evaluated together with the proposals for the Preferred Stock Dividend, discussed below**. Only, the final outcome of this evaluation (see later on) should be used in the next stage.**

Preferred Stock Dividend

Currently RdK is the owner of Bullenbay Terminal and at the end of the contract with PDVSA (end of 2019) all facilities (including the new facilities built by PDVSA in the mean time) will be part of the total assets and thus fully owned by RdK. This means that in case a new investor/operator is interested in operating Bullenbay Terminal, it has to be decided for which part the new partner will participate in a new to be established company. Is this for a share of 0% or for instance for 50%? Below these two particular cases will be dealt with (and of course in practice there are many other possibilities).

Like was done in the Upgrading ISLA case the same approach has been followed, taking into account the above:

1) The first method is referring to the case in which RdK will remain the full owner of the Bullenbay Terminal and the new partner has a zero share. The proposal is that the new partner has to pay a Preferred Stock Dividend to RdK through a so-called “loan”, which is equal (as a proxy) to the value of the assets of the existing Bullenbay Terminal (being USD 335 million, based on net earnings approach[12]) and being the pre-tax value. The contract period is set at 15 years and there is NO repayment of the loan, but only interest has to be paid. The latter means that at the end of the contract period RdK is still fully the owner of the Bullenbay Terminal.

The method is very easy to implement, by only applying an interest rate of 7.85%[13] on the loan of USD 335 million. Because there is no need for repayment, every year the same amount will be paid to RdK, being 7.85% of USD 335 million , which is about USD 26,3 million (with NO discount) or less if a certain discount is negotiated. Be aware that the fixed amount is in current prices, this means that the fixed rate is not inflated, and as a consequence will devaluate year by year.

[12] As a results of the discussions with the client is was decided to take the maximum market value of the Terminal (see table 7.7) in stead of the estimated earnings value. However, later on in a final discussion with PGI on the 22nd of March 2012 the net earnings approach preferred and is in practice the best estimation for negotiation of a partnership with a new investor.

[13] This is the same interest rate as has been applied to the refinery in case 70% of the total investment is financed by a loan.

2) A second method is based on the share of RdK in total assets of Bullenbay, assuming that the new investor/operator will participate for 50% in the terminal. This means that RdK will receive USD 167,50 million (= 50% of USD 335 million) up-front and a portion of the on-going annual terminal income. Since Curacao desires a fixed income, the partner must absorb all the risk of terminal margins. In this case, a partner would only "guarantee" Curacao a fraction of the income due to RdK based on 50% equity. Terminal margins are relatively stable and do not fluctuate like refinery margins. Therefore, according to Solomon Associates it might happen that NEWCO would only allow Curacao 80% of its share (=40% final share) based on equity in the form of fixed income. Also this is an issue for negotiation and will not be taken into account in the calculations.

Based on a 50% share of RdK one has to calculate the average net cash flow over a 15 years period taking into account the annual inflation, which is incorporated in the net cash flow figures. After having transformed the net cash flow during 15 years in constant prices of the base year, the average net earnings can be determined. This average net earnings can be used as starting point in the base year and should be inflated year by year.

Based on the financial cash flow model prepared by PGI, assuming a tax holiday of 10 years with a tax rate of 2% and thereafter a tax of 27,5%, the average net earnings over a 15 years period can be calculated at USD 30.4 million (in 2011 prices). However, be aware that this value does not include any Land Lease amount as suggested above. Therefore, the maximum fixed income based on RdK's share of 50%, is (50% of USD 30,4 million) estimated at USD 15,2 million (in 2011 prices) in the first year of operations. This amount should be inflated annually!

It has to be stressed here that the above two methods for estimating a Preferred Stock Dividend should be evaluated in combination with the proposals for a Land Lease fee. This evaluation will be done hereafter, and therefore the single figures presented for Preferred Stock Dividend might not be used as a sole entity. **Only the final outcome of the evaluation of Land Lease in combination with a Preferred Stock Dividend should be used in the next stage!**

Land Lease and Preferred Stock Dividend combined: an evaluation

As discussed above some suggestions for the level of Land Lease as well as Preferred Stock Dividend have been presented. However, both income flows for RdK have to be combined and the financial consequences for the new partner company have to be evaluated.

Starting point in our analysis is the current value of Bullenbay Terminal estimated by PGI in their Bullenbay Terminal Valuation at USD 335 million. This value is calculated based on the net earnings approach (pre-tax). Next step is the introduction of a Land Lease of USD 14,4 million as calculated above. Because the Land Lease is directly influencing the annual net earnings, and Preferred Stock Dividend is also related to the annual net earnings, we have set up table 7.8 in which the various suggestions have been combined and evaluated. For Preferred Stock Dividend two methods have been used, therefore we report on both methods separately.

Table 7.8: Bullenbay Terminal: suggestions for Land Lease and Preferred Stock Dividend

Bullenbay Terminal Land Lease and Preferred Stock Dividend suggestions	BASE land lease=zero	Land Lease factor 1	factor 2	factor 3	factor 4
		all figures in USD million			
Value Bullenbay Terminal (pre tax)	**335,3**	**335,3**	**335,3**	**335,3**	**335,3**
Method 1:					
Land Lease (in 2012)	**0**	**3,6**	**7,2**	**10,8**	**14,4**
Preferred stock div (as a loan) based on earnings value (pre tax)	26,3	**26,3**	**26,3**	**26,3**	**26,3**
Total land lease + preferred stock div	26,3	29,9	33,5	37,1	40,7
Total as % of net earnings	86,5%	109,7%	139,0%	177,1%	228,7%
Preferred stock as % of net earnings	86,5%	96,5%	109,1%	125,5%	147,8%
Total net earnings (average in 2011 prices)	**30,4**	**27,3**	**24,1**	**21,0**	**17,8**
Method 2:					
Land Lease (in 2012)	**0**	**3,6**	**7,2**	**10,8**	**14,4**
Preferred stock div based on 50% share (based on upfront payment of 50% of earnings value)	15,2	**13,6**	**12,1**	**10,5**	**8,9**
Total	15,2	17,2	19,3	21,3	23,3
Total as % of net earnings	50,0%	63%	80%	102%	131%
Up front payment 50% of earnings value	167,7	167,7	167,7	167,7	167,7
Total net earnings (average in 2011 prices)	**30,4**	**27,3**	**24,1**	**21,0**	**17,8**
Total net earnings NEWCO part (average in 2011 prices)	15,2	13,6	12,1	10,5	8,9
IRR on upfront investment NEWCO	9,7%	8,4%	6,9%	5,4%	3,9%

Source: Ecorys

Method 1

According to method 1, in which RdK will be the full owner of the Bullenbay Terminal and the new company will only operate this terminal, we found out that requiring a Land Lease of USD 14,4 million together with a Preferred Stock Dividend of USD 26,3 million) is not realistic and even not possible. The Preferred Stock of USD 26,3 million is nearly 150% of the average net earnings (in 2011 prices), resulting in a big loss for the operating company. Sensitivity analysis related to the level of the Land Lease reveal that only in case the Land Lease is set at USD 3,6 million (using the same Land Lease fee per hectare as is used for the ISLA site) or less (for example at zero), the Preferred Stock Dividend is less than 100% of the average net earnings, leaving some profits for the new operating company. What kind of profit level is acceptable for the new company is currently not known, but this is subject to negotiations.

Method 2

According to method 2, the new company will not only operate the Bullenbay Terminal but will also participate in the ownership of Bullenbay Terminal. In our calculations (based on internal discussions with the client) a share of 50% has been taken and an upfront payment of 50% of the value of the terminal, being USD 167,50 million.

From table 7.8 it can be concluded that starting with a Land Lease of USD 14,4 million, average annual net earnings are USD 17,8 million, of which 50% has to be paid to RdK (given the share of RdK in total assets). This means that also 50% of net earnings are left for the new operating company, which has invested USD 167,5 million in the Bullenbay Terminal. Calculations of the internal rate of return on investment (IRR) for the new investor/operator reveal that the result, being 3,9% is far below the cut-off rate of 12% or more. The cut-off rate used by PGI is 12%, but it might be that a new investor is opting for a higher value. Sensitivity analysis related to the level of Land Lease reveal that in all cases the IRR is below the cut-off rate of 12%. Even in the case in which the Land Lease is set at zero, the IRR is only 9,7%.

Here, again we repeat the discussion that with a no risk policy from the GoC/RdK, it is expected and argued by Solomon that a certain discount on the Preferred Stock Dividend might be needed. Moreover, the new investor will not consider Land Lease and Preferred Stock Dividend separately, but will consider the total amount he has to pay to GoC/RdK.

Taking a discount of 10% points on the share value of 50%, meaning a 40% share for RdK for its Preferred Stock Dividend, will result in an average annual Preferred Stock Dividend of 80% of USD 15,2 million, being USD 12,16 million. Based on this value, the IRR for the new investor will increase to 12,1%, just at the cut-off rate taken by PGI. So, at the end the Land Lease has to be set at zero and a 40% share on net earnings has to be applied, knowing that upfront 50% of total assets value of the Terminal will be paid to RdK being USD 167,50 million.

Conclusion

Depending on the willingness of the new company to invest or not in Bullenbay Terminal, respectively method 2 or method 1 might be used. However, in all cases the GoC/RdK should be careful not to require a too high Land Lease fee and/or Preferred Stock Dividend.

- In case the new company is not willing to invest the highest value for a total of Land Lease plus Preferred Stock Dividend ranges from about USD 26 million up to USD 30 million (values not inflated). But because it is not known what the minimum requirements are for the new company to conclude a contract, GoC/RdK should expect some lower values;
- In case the new company is participating in Bullenbay Terminal and is taking a 50% share, the GoC/RdK might expect an average annual total fee of about USD 15,2 million (inflated every year) as a maximum and an upfront payment of about USD 167,5 million. Because of investors minimum requirements on the internal rate of return on investment, a 40% annual payment (instead of 50%) being about USD 12,16 million is the more realistic and should be seriously taken into account.

8 Economic impact of upgrading

8.1 Introduction

In the previous chapters 5, 6 and 7 the two strategic refinery options (track 1, see chapter 2) have been discussed in detail. As already mentioned in chapter 3 “Methodology and research steps” and more specifically in section 3.3 only options which are technically, commercially and financially feasible, will be considered in the next steps of the Cost Benefit Analysis for Curacao in order to assess the welfare effects of these options for Curacao. Therefore, only strategic option “Upgrading the ISLA refinery” will be dealt with in this chapter and in chapters 13 (CBA refinery activities) and 15 (Sensitivity analysis).

The focus in this chapter is to explain and to assess the economic impact of the Upgrading Refinery option, which distinguish the following three investment cases:

- Case 1: Investment case with integration of BOO and pitch as input fuel for BOO, hereafter called BOO Scrubber case;
- Case 2: Investment case with integration of BOO and LSFO as input fuel for BOO, hereafter called BOO LSFO case;
- Case 3: Investment case with integration of BOO and LNG as input fuel for BOO, hereafter called BOO LNG case.

First attention will be paid to the data to be used to asses the economic impact and to carry out the Cost Benefit Analysis for Curacao. Next, the direct and indirect impact of these options will be briefly discussed in terms of Value Added (VA) and in terms of employment. Finally, a short description will be given of the upgraded refinery versus the present situation of the ISLA refinery in terms of VA and employment.

8.2 Relevant data needed for the assessment of the economic impact and CBA

For each case the following information has been gathered:

- Data on operations, identifying financial flows from ISLA to the Curacao economy as well as to abroad (i.e. foreign economies);
- Data on total investments, investment period, and the share of local expenditures (assumed to be contracted to local contractors on the island)
- Data on costs for demolition and remediation of the ISLA site, which activities immediately will follow by any closure of the refinery and will cover a 5 to 7 years period;
- Data on costs for other activities the Government of Curacao is intending to carry out which are directly related to the operations of the ISLA refinery, independent from the decision whether the ISLA refinery will be upgraded or closed down according to contract in 2019 or earlier.

Most of these data mentioned are already discussed in the previous chapters as well as in chapter 9. In this chapter we only will pay attention to the question of how to deal with the data gathered in order to carry out the Economic Impact Analysis and the Cost Benefit Analysis. All the data are used as input in the Refinery Cost Benefit Analysis model, tailor made for the selected investment cases.
The starting point for the CBA and thus for gathering the data is the year 2012. All the data gathered have been converted at the end in constant 2011 prices.

Because the economic CBA, calculating the change in welfare of the island, only takes in consideration direct and indirect advantages and disadvantages of the local economy, special attention is paid to the share of local expenditures in total investments, in annual operations and shut downs/sustaining capital TA (turn around) and in demolition and remediation costs.

Permanent effects

Important for assessing the Economic Impact on Curacao are the *permanent effects* (which will happen year by year). These effects are born with the operations of the refinery. In the next table an overview is presented of the operating costs for the three investment cases for upgrading the ISLA refinery in the first year of operation, which is 2018. However, the analysis is carried out for a 20-years period of operation[14]. The figures are presented in current USD prices (taken from the financial cash flow models of PGI which are presented in the Annex 2) and based on data provided by ISLA and discussions with PGI translated into local and foreign expenditures. For the Economic Impact and Cost Benefit Analysis the costs will be converted in constant 2011 prices and in NAf prices.

Table 8.1: Operating Costs Investment cases for the year 2018 broken down into local and foreign expenditures

OPERATING COSTS (IN USD MILLION, CURRENT PRICES)	2018		
INVESTMENT CASES	BOO Scrubbers	BOO LSFO	BOO LNG
LOCAL			
NEW Gross Lease fee (Land Lease + Pref Stock Div)	32,2	30,4	34,1
Wages ISLA (workers+staff) local	123,0	123,0	123,0
BOO	0,00	0,00	0,00
contractors	53,1	53,4	53,4
purchases local	31,2	31,4	31,4
misc purchases	9,4	9,3	9,3
wastewater system (loc var part) purchases	0,4	0,4	0,4
TOTAL LOCAL EXPENDITURES	**250,0**	**248,0**	**288,8**
ABROAD			
purchases abroad (chem+catalyst etc)	47,5	47,3	47,3
interest on financed inventory	1,3	1,3	1,3
insurance	22,3	22,5	22,5
wages ISLA expats	1,0	1,0	1,0
scrubber cost (variable part)	1,4	0,00	0,00
wastewater system (var part)	0,8	0,8	0,8
BOO water/other purchases	2,8	2,8	2,8
BOO LSFO Purchase	0,0	164,3	0,0
BOO LNG Purchase	0,0	0,0	72,1
TOTAL EXPENDITURES ABROAD	**77,2**	**240,1**	**147,8**
TOTAL OPERATING COSTS EXCL SHUTDOWN+SUST CAP TA	**327,2**	**488,0**	**436,6**
Shutdowns (annually) average	42,8	43,3	43,3
Sustaining capital TA	40,9	41,3	41,3
Grand Total OPERATING COSTS	***411,0***	***572,6***	***521,2***

Source: PGI/ISLA/Ecorys

In this table a new lease fee is introduced which is explained and discussed in chapter 7. The BOO figures are not presented separately, because in the new investment cases the BOO is integrated in the upgraded refinery.

[14] The period of 20 years is deviating from the15 years period of analysis used by PGI. PGI used a shorter period for efficency reasons including a Terminal Value in their analysis.

The local expenditures are a substantial part of total operating costs (excluding the shutdown and sustaining capital expenditures). In discussion with RdK and with PGI the local component of these two cost components are estimated being 90% and 15% respectively.

Temporary effects

Apart from the annual operations, we have to take into account the investment costs for the new investment cases as well as the costs for demolition and remediation and those for the other activities intended to be implemented soon by the Government of Curacao. Those investment costs do have a temporary effect on the economy of Curacao as far as these investments will be done by local companies.

For the investment upgrading cases it is for sure that these cost will not by made by a party established in Curacao but by a foreign investor, however, only in case this investor is actually prepared to engage themselves on the short term (i.e. within two years) for an investment and operation of such a project. Therefore, in the CBA these costs will not appear on the accounts of the island. Only the local part of the investment expenditures will affect the economy. PGI has estimated the share of local expenditures in total expenditures at 6% to 10% (as a maximum). Because the investment costs are huge (more than USD 3 billion), we have used the 6% local share due to expected capacity constraints of local contractors. In the sensitivity analysis we will also use the 10% share.

For cost for demolition and for remediation it is assumed that 50% will be carried out by local companies and the other 50% by foreign companies. For the environmental actions/measures to be taken by the Government of Curacao (see also section 7.3), the local share is estimated by RdK/Ecorys varying from 20% and 25% up to 100% depending on the specific action. For investing in an oil depot, which is likely needed in case the refinery will be closed down in 2019 or in case upgrading is realised after a period of about 20 years, the local share is estimated at 40% (including importing equipment from abroad).

All the effects which are related to the investments mentioned are temporary effects, only realized during the construction period of the investments.

Based on the inputs mentioned above, the effects on the national economy of Curacao have been assessed using Curalyse, a macro- economic model for developed for the island of Curacao. We have used the latest version of this model which is adapted to the new status “Land of Curacao” and discussed the ins and outs regularly and in good cooperation with DEZ. The application of the Curalyse model will be explained in Annex 9.

8.3 Direct and indirect share of ISLA refinery in the national economy of Curacao

Permanent effects

With the Curalyse model the direct and indirect permanent effects for the operations of the upgraded refinery as well as the temporary effects related to a number of investments have been estimated. In the Economic Impact Analysis the direct effect is fully taken into account. These effects are related to the wages earned by the ISLA personnel as well as to the local contractors directly involved in maintaining and sustaining the ISLA facilities. The indirect effects are dealing with the suppliers of ISLA, which are partly specialized firms and partly firms which are supplying goods and services which are not typically asked for by the refinery in particular (like medical

services, port services, catering, etc.). The latter are only be taken into account for 50% in order to well assess the welfare effect for the island economy.

Induced effects, which are sometimes also included in the Economic Impact Analysis, are not taken into account at all. It was decided, in line with the prevailing CBA methodology, to not interpret them as welfare effects (see also section 14.2).

In table 8.2 the Value Added (VA) effects have been presented for the investment cases for two typical years, 2018 the first year of operation of the upgraded refinery and 2028 when the tax holiday of 10 years has expired and profit taxes (based on the new tax regime) have to be paid. Be aware that this is not the case in the current situation. Two year have been chosen in order to give insight in the changes over time. However, be aware that the VA effects are measured in constant 2011 prices.

Table 8.2 Value added effects of refinery operations after upgrading in 2018 and 2028 (annual)

VALUE ADDED (IN NAFS 2011 PRICES)	2018			2028		
INVESTMENT CASES	BOO Scrubbers	BOO LSFO	BOO LNG	BOO Scrubbers	BOO LSFO	BOO LNG
NEW NET lease fee (Land Lease + Preferred Stock Div) *)	35,3	32,6	38,1	35,3	32,6	38,1
Wages ISLA (workers+staff) local	184,4	184,3	184,3	185,2	185,2	185,2
CONTRACTORS LOCAL	36,3	36,6	36,6	36,5	36,8	36,8
SUPPLIERS LOCAL	48,0	47,3	89,9	48,3	47,6	102,3
	-	-	-	-	-	-
Shutdowns (annually) average Local	26,4	26,7	26,7	26,6	26,9	26,9
Sustaining capital TA LOCAL	4,2	4,2	4,2	4,2	4,2	4,2
TOTAL VALUE ADDED ISLA UPGRADING CASES	**334,5**	**331,7**	**379,8**	**336,1**	**333,2**	**393,5**
*) GROSS NEW LEASE FEE - OPEX RdK						
GDP CURACAO (IN 2011 PRICES) forecast CURALYSE	**5548**	**5548**	**5548**	**6561**	**6561**	**6561**
SHARE VALUE ADDED ISLA IN GDP CURACAO (IN %)	**6,0%**	**6,0%**	**6,8%**	**5,1%**	**5,1%**	**6,0%**
TAXES ON PROFIT (2% IN 2018 AND 27,5% IN 2028)	14,1	13,6	15,3	173,4	166,7	180,3
VALUE ADDED INCLUDING TAXES ON PROFIT	***348,6***	***345,3***	***395,1***	***509,5***	***500,0***	***573,8***
SHARE VA ISLA (INCL PROFIT TAXES) IN GDP CURACAO (IN %)	**6,3%**	**6,2%**	**7,1%**	**7,8%**	**7,6%**	**8,7%**

Source: Ecorys

From table 8.2 it can be concluded that the VA effect in total is about NAf 335 to 380 million per year (depending on the particular investment case). The effects in the BOO Scrubber case and the BOO LSFO case are more or less equal. The effects in the BOO LNG case are slightly higher based on the assumption that at Curacao a LNG terminal will be build and also distribution of LNG will occur by local firms. Based on figures from PGI and after discussions with them the local share in total expenditures is estimated at 30%.

The total VA effect of ISLA (after upgrading) expressed in terms of total GDP of Curacao has been estimated at about 6,0%in both the BOO LSFO and Scrubber cases and at about 6.8% in the BOO LNG case. In case also (profit) taxes will be taken into account (which are only set at 2% in the first 10 years of operation), the share of VA of ISLA is 0.3% point higher.

Looking at the figures for 2028, total VA of ISLA in total GDP of Curacao decreased in real terms to about 5% in both the BOO LSFO and Scrubber cases and to 6% in the BOO LNG case. Because (profit) taxes are significantly higher (after the expired tax holiday period), total VA of ISLA including taxes increased to 7.8% up to 8.7%. However, it should be stressed here that too optimistic expectations have to be damped. The reason is twofold:

- The net lease fee (Land Lease plus Preferred Stock Dividend minus OPEX of RdK) might be estimated too high taking into account the risk analysis as presented in section 7.2. A reduction of this figure, which is plausible, will negatively influence of course the total VA effect;
- The profit tax and tax regime assumed in this analysis has to be negotiated with NEWCO. So far ISLA is not paying any taxes. NEWCO will negotiate the whole package including the Land Lease and Preferred Stock Dividend and probably the tax and tax rates too, given the huge investment amount needed to upgrade the refinery. This might lead to a reduction of the assumed tax level in the short and medium term.

Table 8.3: Employment effect per year of the investment cases (in comparison with the current situation)

EMPLOYMENT (FTE)				
ISLA REFINERY	before upgrading	after upgrading and integration of BOO		
		Scrubber case	LSFO case	LNG case
ISLA	1010	1205	1205	1205
CONTRACTORS	450	600	600	600
SUPPLIERS	815	585	585	770

Source: Ecorys

Besides the Value Added effects also permanent employment effects have been estimated. After upgrading and integration of BOO into ISLA refinery, the direct employment within ISLA will be about 1,200 persons on average per year. This includes about 100 people from the BOO (see chapter 6). The contractors employment will increase with 150 people to about 600 persons and the suppliers employment will be reduced somewhat (partly because BOO is integrated in the refinery, which was not the case before) in both the BOO Scrubber and LSFO cases. Only in the BOO LNG case total employment will increase, due to among others the assumption that the establishment of a LNG terminal and distribution of LNG to ISLA will be realized.

Temporary effects

The temporary VA effects and employment effects from investments in the three investment cases are presented in table 8.4. Because both effects are not significantly different for all three cases, no distinction have been made between the cases.

Table 8.4: VA effects and Employment effects from investments in upgrading the refinery

Investment and VA amounts in millions		Distribution investments and effects					
BOO SCRUBBER/LSFO/LNG CASE		TOTAL	2013	2014	2015	2016	2017
TOTAL INVESTMENTS *)	USD cur pr	2669	123	133	806	1174	432
LOCAL PART OF TOTAL INVESTMENTS (6% IN TOTAL)	USD cur pr	160	8	8	48	48	48
VA EFFECT INVESTMENTS CONTRACTORS LOCAL	NAF 2011 pr	90	5	5	27	27	26
EMPLOYMENT EFFECT INVESTMENTS CONTRACTORS LOCAL	FTE	1493	79	77	454	446	437
*) Excluding all financing costs							

Source: Ecorys

Total investments for the three cases are summing up to about USD 2,7 billion, of which only 6% will probably be spend locally. Also in the cases in which the financing structure is 30% equity/70% debt, instead of 100% equity financing, total investments amounts will remain the same, but on top of that the financing costs will be added. The latter will be financed by a foreign bank and therefore will not affect the economy of Curacao.

The total VA effect will add up to NAf 90 million during an investment period of 5 years and will create a temporary employment of about 1.500 FTE (that is 300 FTE on average).

The temporary effects for dismantling and remediation for the DO-minimum scenario (see chapter 12) are summing up to a direct VA of about NAf 100 million (during 2 years) and NAf 158 million (during a 5 years period). The related direct employment is estimated at about 1.650 and 1.250 FTE (which is on average per year during demolition 825 FTE and during remediation 250 FTE.

Table 8.5 Value added and employment effects of dismantling and demolition in the Do-minimum scenario

	DO-minimum scenario	
	dismantling	remediation
Investments costs in NAF million	254	527
Value Added (direct) in NAF million	101	158
Employment (direct) in FTE (total man years)	1.658	1.258

Source: Ecorys/Ecovision

Finally, the short and medium term actions with respect to the environment on the one hand and the action proposed for the asphalt pond on the other, also will have a temporary effect in terms of VA and employment. Only for some measures also operations are needed during the lifetime of the investment, which will lead to permanent jobs.

Table 8.6: Value added and employment effects of environmental actions/measures in the short and medium term (in constant NAf prices x 1 million)

VA in 2011 Constant NAF prices								
CAPEX	Actions/Measures	2012	2013	2014	2015	2016	2017	etc.
VALUE ADDED (VA) LOCAL EXPENDITURES	POLLUTION MEASURES	10,7	18,4	8,9	1,6			
	ASFALT POND	3,1	3,1	3,2	3,2			
EMPLOYMENT	POLLUTION MEASURES	179	307	148	27			
	ASFALT POND	52	52	53	53			
OPEX								
VALUE ADDED (VA) LOCAL EXPENDITURES								
	SEEPAGE, SKIMMING BAY	0,1	0,9	1,2	1,2	1,2	1,2	1,2
EMPLOYMENT	& WELLS REMEDIATION	1	15	20	20	20	20	20

Source: Ecorys/Solomon/RdK

The VA effect of the pollution measures will sum up to about NAf 30 million, during a 4-years period and the related employment effect is about 650 FTE, meaning 160 FTE per year during the investment period. The actions on the asphalt pond have a temporary effect of NAf 12,5 million and 210 FTE's during a 4-years period.

The seepage, skimming bay and remediation actions will also continue after the investment phase, leading in total to an annual VA effect of NAf 1,2 million and to an annual employment effect of 20 FTE from the third year onwards.

8.4 Upgraded refinery versus present situation

In the present situation (which will be continued to the end of 2019 in case no upgrading will be realized) the ISLA refinery has a direct employment of about 1,000 people (see annex 8) and on the premises also contractors employment is estimated in total to about 450 people (see table 8.3). Next to that the suppliers of ISLA are also benefitting from the refinery and have jobs for about 800 people. In annex 8 an overview is presented of the work force at ISLA.

After upgrading, already discussed above, the total employment of ISLA (direct and indirect) will increase with about 130 jobs in the BOO Scrubber and LSFO case and with about 300 jobs in the BOO LNG case.

Table 8.7: VA of ISLA and share in total GDP of Curacao for the present situation (before upgrading) in NAF 2011 prices x 1 million

VALUE ADDED (IN NAFS 2011 PRICES)	**ISLA BEFORE UPGRADING**	
INVESTMENT CASES	**2011**	**2018**
CURRENT NET LEASE FEE *)	19,0	10,9
Wages ISLA (workers+staff) local	130,1	130,0
CONTRACTORS LOCAL	22,2	22,8
SUPPLIERS LOCAL	75,5	78,3
	-	-
Shutdowns (annually) average Local	14,7	15,1
TOTAL VALUE ADDED ISLA UPGRADING CASES	**261,5**	**257,2**
*) GROSS LEASE FEE - OPEX RdK		
GDP CURACAO (IN 2011 PRICES) forecast CURALYSE	**5019**	**5548**
SHARE VALUE ADDED ISLA IN GDP CURACAO (IN %)	**5,2%**	**4,6%**

Source: Ecorys

The total VA for ISLA in the present situation (2011) is summing up to about NAf 265 million. This is about 5.3% of total GDP. This share is decreasing due to a real development in total GDP for the island of 1,5% annually, and will therefore go down to about 4.7% in 2018 (also in the situation before upgrading the refinery). After upgrading, as discussed in section 8.3 the share of ISLA (including BOO) could be increased to even 7% to 8 % in the medium and long term. However, a significant part of this increase is due to the assumed tax regime and tax level and the higher lease fee consisting of a Land Lease and a Preferred Stock Dividend. Therefore, expectations that upgrading the ISLA refinery will lead to a substantial increase in VA has to be tempered and is fully dependant on the willingness of a foreign investor to invest in the refinery and furthermore to the willingness to accept partly or fully the terms and conditions of the Government of Curacao.

Part III. Renovation alternatives for Schottegat area

9 Costs of Dismantling and Cleaning Up

9.1 Introduction

In this chapter the cost of dismantling, demolition and soil and groundwater remediation is discussed. The Curacao based company EcoVision performed this part of the study, in co-operation with IGWR, Geotron and Eurofins Analytico (all from The Netherlands). This element of the study involves an assessment of the contamination on site, the related remediation possibilities and remediation costs and an estimation of dismantling costs. A summary of the results is presented in chapter 9.2 and 9.3. For a detailed description of the approach, the results of surveys and the calculation of the costs we refer to report “Cost estimations for soil and groundwater remediation Isla Refinery Curaçao”.

Since the total costs of dismantling, demolition and remediation is substantial an inventory is made of potential available sources which can be allocated for this purpose. A summary of potential sources is provided in Chapter 9.4.

9.2 Dismantling and demolition costs

Costs for dismantling and demolition of all refinery units have been calculated through estimation of costs for removal of:

- above ground objects (steel and concrete);
- asbestos pipelines (outside plant areas, off plot);
- roads
- foundations of plants and tanks;
- cleaning of plants, tanks and pipelines.

Aboveground objects like plants, tanks, warehouses etc. were assessed in all 141 subareas by means of estimations of volumes of insulation materials, steel and concrete and the respective costs for removal. For concrete removal, costs are 150 euro per m3 and no remaining value for concrete was calculated. For steel a remaining value of 250 euro/Mt was calculated.

A separate survey on off plot **asbestos pipelines** resulted in a total length of 37 kilometers of pipeline (all diameters) of which approximately 50% was present in upper level trenches and 50% in low level trenches. Costs for removal were derived from earlier projects at the ISLA refinery and amount to 100 euro per meter (high/low trenches, including labor, cranes, deco area etc.).

On the ISLA area 30 kilometers of **roads** are present outside plant areas and another 10 km inside plant areas. These roads have an average width of 7 meters. Costs of removal of the top layer are 10 euro per m2.

The total volume of **plant foundations** is estimated at 300,000 m3 (35 plants). For tanks, of which the majority has ring foundations, the total volume is estimated at 200,000 m3. Miscellaneous foundations are estimated at 60,000 m3. The local rate for removal of concrete in foundations is 116 euro per m3.

Cleaning of plants, tanks and pipelines is necessary before any dismantling can take place. The MEK Dewaxing plant was used as a reference plant (cleaning costs 160,000 USD or 100%). The

costs for cleaning of all other plants were derived from this plant; 20% labor costs and consumables were added to these costs. For the cleaning of 280 operational tanks a quote was received from a local cleaning company. The other 220 tanks are considered clean. Cleaning costs for pipelines were assumed identical as for cleaning of the plants.

Based on the above total costs of dismantling, demolition and cleaning have been calculated, which amount to 89 million euro /254 million NAf in total (see table 9.1).

Table 9.1 Costs for dismantling and demolition

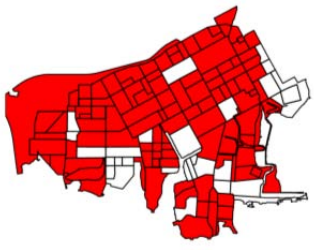
Objects	Net costs (million euro)	Net costs (million NAf)
Dismantling and demolition above ground structures (*)	7,4	21
Removal of asbestos pipes	3,7	11
Removal of roads	2,8	8
Removal of concrete foundations	65,0	186
Cleaning of tanks, plants and pipes	9,8	28
Total	*89*	*254*

* Total costs for above ground structures amount to 41.2 million euros;
total value of exported steel amounts to 33.8 million euros.
Accuracy is +/- 40% for all costs

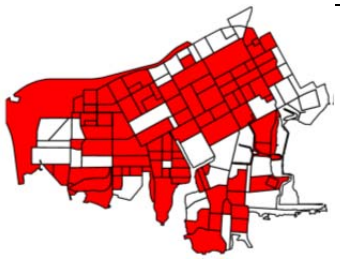
The total remediation process will take 2 to 30 years depending on the chosen scenario and the chosen remediation techniques. The duration of a dismantling and demolition operation will be at least 2 years. Total manpower required is 3,500 man years for soil and groundwater remediation (maximum scenario), and 1,700 man years for dismantling and demolition. Of this work approximately 60 percent can be carried out by local experts and workforce.

9.3 Soil and groundwater remediation

Based on a historical survey and current refinery activities, a first hypothesis was formulated on the type and degree of soil contamination of 141 subareas, assuming an even distribution of eventual contamination over a specific subarea. The historical survey was subsequently used to prioritize sampling points over these subareas.
The field work for the project included a total of 65 borings (55 groundwater monitoring wells, 10 soil borings without a monitoring well), development and sampling of 20 old monitoring wells (Foster Wheeler, 1995), 39 soil trenches, 3 shoreline borings (near Veld Salu) and 3 Schottegat Bay sediment samples.
Sample analysis and evaluation of the results revealed that –in accordance with earlier investigations- most subareas of the ISLA premises are contaminated in one way or the other. Of the 141 distinguished subareas 114 are contaminated with immobile contaminants in the top soil such as heavy metals, PAH's and asbestos; 99 subareas are contaminated with mobile contaminants (mineral oil) in groundwater; 26 subareas are contaminated with floating oil in soil (LNAPL); 23 subareas are contaminated with mineral oil in soil. Finally, in 6 subareas landfills for solid waste or oily wastes are present.



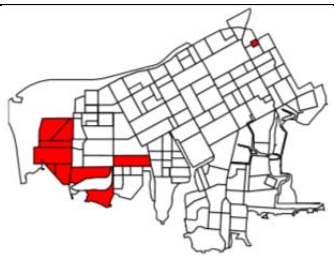
Immobile contaminants (114 subareas)



Mobile contaminants in ground water (99 subareas)

LNAPL's or floating oil in soil (26 subareas)

Mineral oil or "source" of oil in soil (23 subareas)



Landfills (6 main subareas)

In case of future use of the ISLA area –other than refinery operation- these contaminants may pose certain risks on the users of the areas or on ecosystems. Anticipated future functions are: residential use including recreation, industrial use including commercial use and no activity (no access).

For subareas contaminated with **immobile contaminants** in top soil the main risks related to future use are health problems because of dermal contact and ingestion of heavy metals and inhalation of asbestos and contaminated dust. These risks may be mitigated by applying isolation layers such as foundations of new buildings (future industrial use) or clean soil (future residential areas). If the area designation is "no activity" the proper response will be to prevent access to the area.

For subareas contaminated with **mobile contaminants in groundwater** future health risks are relatively low. On the other hand the costs of groundwater remediation are relatively low, which is the reason for including this measure as a proposed action for all future uses (including no activity/no access).

For subareas contaminated with **mineral oil in soil** or contaminated with **floating oil (LNAPL's)** the main risks related to future use are health problems because of dermal contact and ingestion of mineral oil. In case of future use of these subareas as residential or industrial areas, the risks can be mitigated by complete removal of the contaminated soil and/or product. If the subarea designation is "no activity" the proposed response is to apply vertical isolation with e.g. sheet piles to prevent further dispersion of the contamination. Additionally, health risks will be prevented by preventing access to the area.

The presence of **landfills** cannot be united with future use as residential or industrial areas for construction reasons. Therefore, the proposed action is complete removal of landfills in future residential and industrial areas to other subareas of the ISLA premises, including all necessary measures (floor isolation, top isolation, monitoring systems etc.). If the subarea designation is "no activity" the proposed response is to apply vertical isolation with e.g. sheet piles and horizontal isolation with e.g. liners and clean soil, to prevent further dispersion of the contamination. Additionally, health risks will be prevented by preventing access to the area. Exceptions to this rule are possible for extensive types of use (e.g. use as golf course, extensive recreation, parking space).

The costs incurred with actions related to soil remediation and risk remediation have been calculated for standard areas of 4 ha. Table 9.2 shows indicative costs per 4 hectares (accuracy of the estimations is +/- 40%). The table shows that removal of mineral oil from soil, removal of floating oil and the removal (and management) of landfills are the most expensive actions. By extrapolation to the real surface of the subareas, a matrix was created for all subareas combining contamination type and costs for remediation for the distinguished functions (residential, industrial no activity/no access).

Table 9.2 Indicative costs for risk remediation actions per area of 4 hectares

Risk remediation actions	Costs (€)	Costs (NAf)
General costs	357,000	1,020,875
Isolation sand-soil	349,376	999,073
Isolation by construction - general costs	80,000	228,768
Isolation by construction - activities (underground networks)	171,000	488,991
Removal of contaminated plume	400,000	1,143,838
Source + LNAPL removal	7,689,000	21,987,418
Removal LNAPL when no other source	2,678,000	7,657,993
Removal source when no LNAPL	6,609,000	18,899,056
Isolation LNAPL and source	612,000	1,750,071
Isolation-Check-Control (IBC) for landfills (residential, industrial)	16,502,000	47,189,019
IBC for landfills (no-access)	9,589,000	27,420,646

Three remediation scenarios were defined for calculation of costs for the total ISLA area. In the Maximum scenario all subareas can meet the most critical function, i.e. residential. In the Minimum scenario most contaminated areas are designated as no activity/no access. A third scenario is called ‘Green Town scenario’. This scenario was defined in order to join in a certain extent with recent ideas and discussions about the Green Town concept. In this concept and scenario, a mix of residential, recreational and industrial/commercial functions is proposed. Total costs for the scenario’s (in millions of euros) is presented in the table below. The accuracy of the estimations is +/- 40%.

Table 9.3 Total costs soil remediation per scenario

Scenario	Indicative costs (million €)	Indicative costs (million NAf)
Minimum	184	526
Maximum	513	1,467
Greentown	513	1,467

In the maximum and Green Town scenario, landfill relocation accounts for 29% of the total budget. In the minimum scenario, isolation of landfills accounts for 49% of total costs.

9.4 Financial options for dismantling and remediation

As discussed in the previous sections a substantial sum is needed to clean-up and eventually redevelop the ISLA area. The question arises where the capital will come from and under what conditions it will be granted?
The following grants, soft loan, commercial loans and other financial options have been examined and are passed in review in this section. As can be concluded from the table below, not many financial possibilities are available.

Table 9.4 Financial options for dismantling and remediation

Financial options		Suitable for financing dismantling and remediation?
Grants (public funds)	Government of Curacao The Netherlands – AgentschapNL EU	Yes No Yes, but limited
Grants (semi public and private financing)	Carbon credits	No
Soft loans	World Bank EIB IADB CIB	No Possibly No No
Commercial loans	Local financial sector International financial sector	Possibly Possibly

Grants

Government of the Country Curacao

As result of the debt relieve program between the Netherlands and Curacao a so called "rentelastennorm" (norm for a maximum of interest paid on public sector debt, this includes the fiscal debt but also the debt of other semi-government organizations like Social Security etc. but excludes the government pension funds) was introduced of 5%. This implies that the Country of Curacao is allowed to borrow on the capital market up to a level which is equivalent with 5% of its public sector budget. Based on an average interest percentage for borrowing of 5% this means that Curacao is allowed to borrow up to NAf. 2 billion. The "rentelastennorm" includes all public sector debts, for instance also the debt of SVB (medical care, old age pension (AOV), etc.) At present (Oct. 2011) this norm, in nominal terms, is calculated to be NAf. 108 million.
At present approx. 50% is used. The other 50% equivalent of approximate NAf. 1,0 billion can still be borrowed at the capital market. This can be used for instance to finance the clean-up of the Isla area. But there are other policy areas which require also public investments like for instance the development of Eastpoint and additional budget like health care.
All risks and liabilities for the government of having to pay additional bills and claims, including those which are not included in the fiscal budget, like for instance warrantees provided, will be an integral part in the calculation of the rentelastennorm.

The Netherlands

At present there are no subsidies or soft loans available for the Country of Curacao. All existing economic instruments are dealt with by the "Agentschap NL" which exclusively works for the Netherlands and not for the other states within the Kingdom.

European Union

European funds do not apply for the territories Curacao and Sint Maarten within the Kingdom because of the status as European Union/Overseas Countries and Territories (EU/OCT) associated member.
The EU/OCT status implies that the island can make use of the European Development Fund (EDF). For the 10th EDF an amount of 24 million euro is available for the years 2008-2013 for all the islands of the former Antilles. Part of this amount, 11,25 euro is allocated for Curacao. It is decided yet that the funds of the 10th EDF will be allocated along the lines of the former 9th EDF, so focused on urban infrastructure for socially deprived areas. The opportunity to allocate part of these funds geographically toward the ISLA area within the criteria of the program is limited. If there is an opportunity for using these funds (for instance upgrading areas under the fume of the refinery) it will account for a couple of millions guilders maximum and should be earmarked.

Carbon credits

The Netherlands Antilles, although its intention to join, never signed/ratified the Koyoto convention. This means that Curacao is not participating or benefiting of programs developed as result of Koyoto.

Soft loans

World Bank

Because Curacao is part of the Kingdom of the Netherland the Country of Curacao does not qualifiy itself for grants, soft loans and technical assistance of the Worldbank. Next to that Curacao will not be able to qualify due to their high per capita income.

European Investment Bank (EIB)

The EIB is financing public as well as private sector projects. Loans are provided for financial institutes like OBNA. In the past Curacao/Netherlands Antilles received loans from OBNA (1995) and Air Traffic Control (1996). Informally EIB would be willing to consider the financing of the expansion of the Economic Zone Koningsplein by Curinde.

Inter American Development Bank (IADB)

Curacao is no member of the Inter American Development Bank (IADB), therefore it cannot apply for any grant, subsidy, technical assistance or (soft) loan. Membership of IADB goes hand in hand with funding of the IADB by its member countries.

Caribbean Investment Bank

Curacao, public and private companies are not able to apply for a CIB-loan. Such a loan and other support by the CIB is only available for members of the Caricom.

Commercial loans

Local financial sector

Financial institutions on Curacao cope with over liquidity. Credit institutions and institutional investors (like pension funds) are very interested and willing to finance investment in the cleaning-up and redevelopment of the ISLA. Nevertheless it is foreseen that due to the commercial risk and the chance of none performing a guarantee of Country Curacao will be required.
Non commercial banks can only participate for a limited amount of money. The clean-up (and redevelopment) of the ISLA area requires long term loans while commercial banks can offer basically only short term financing. Institutional investors are able to provide the government of Curacao and/or private developers with long term loans up to 15-30 years.
In most cases it is foreseen that the financial institutes will require a government guarantee. For loans over 10-25 millions a consortium of financial institutions has to be formed.

International financial sector

Some international financial institutions might be interested to participate or lead an international consortium for the financing of the clean-up and development of the area. An international investment banker could organize an international bidding.

10 Two scenarios for long term economic development of Curacao

10.1 Introduction

To what degree will the National Government be able to realize the developments connected to the strategic options described in Chapter 2? One has to acknowledge that the role a government can play in this respect is mainly restricted to *facilitating* such developments, not to enforce them. At best it can create optimal preconditions, and stimulate private parties to assent to the options and to (entrepreneurially and financially) participate in the plans (in Dutch: 'flankerend beleid'). Whether the existing refinery will be upgraded (option 1.A) or a new refinery will be established on Curacao (1.B), or whether - after closure of the present refinery – the Schottegat area will before 2045 be actually used for other activities (e.g. option 2.A or 2.B) depends therefore of developments the Government has to a large extent not under control. It depends on market developments and on the preparedness of international market parties to make use of perceived opportunities for refining and other export oriented or import substituting activities, offered on the island.

Conclusion: there are many factors beyond the control of the Government (exogenous factors), determining the success or failure of the strategic policy options mentioned. Realization of the options (and of the demand for specifically designed plan areas on Curacao) depends on the increase of international demand. That demand is subject to major uncertainties, and all the more if the distant future (2020 – 2045) is under discussion.
To be able to establish a meaningful strategy, one should allow for a whole range of diverging development paths for the exogenous factors. To do so, one can formulate scenarios with different developing paths, and determine for each scenario the economic opportunities, under the assumption of a facilitating and stimulating Government policy. However, one has to keep in mind that if a scenario appears to warrant a high probability of success but is in itself not very likely, the actual chances to realize the outlined development will be limited.

10.2 Framing two long run economic scenarios

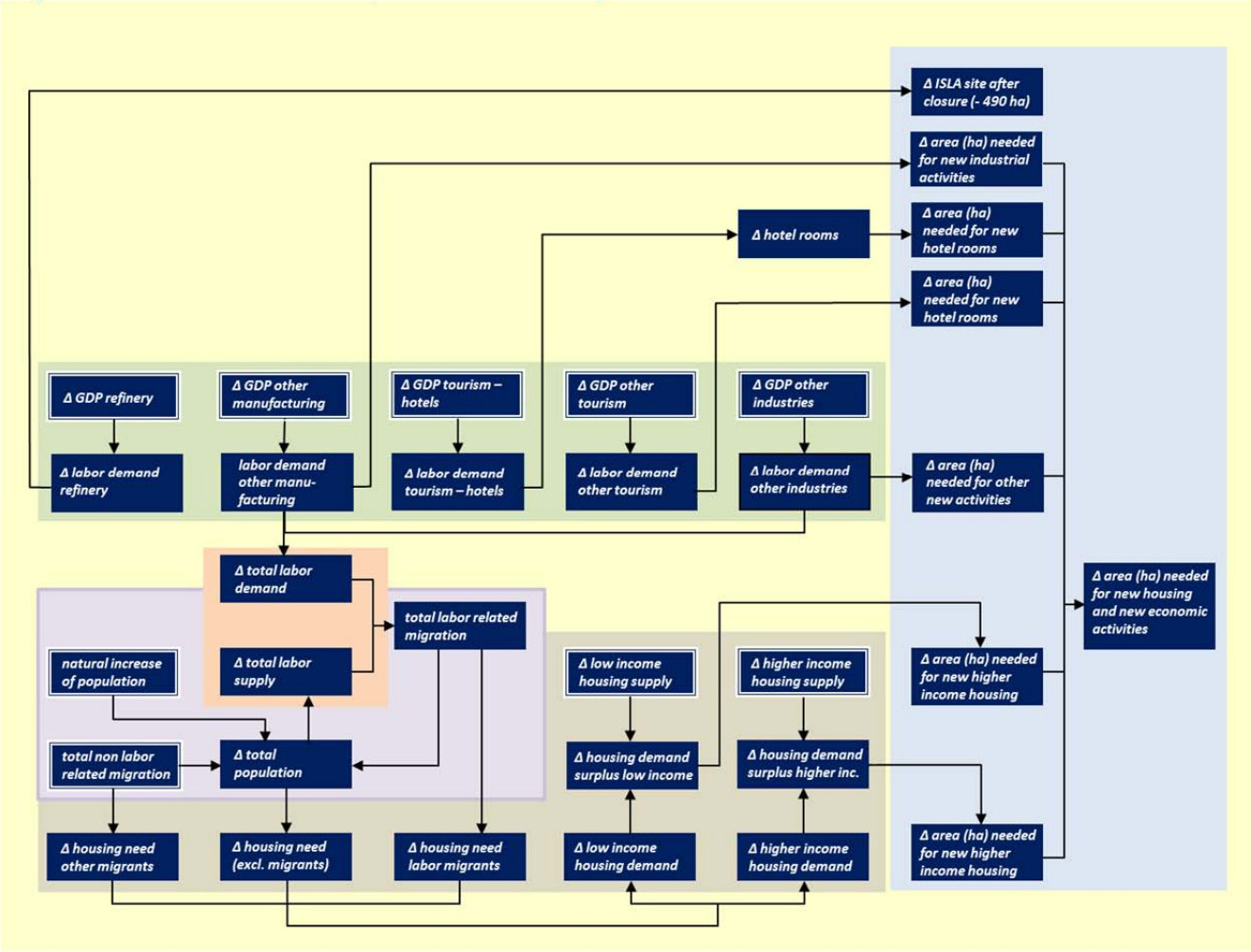
As was mentioned above, at the start of our assignment we expected that the Strategy Project the Government intended to engage upon would provide us in time with some (long term) scenarios for the national economic and demographic development, and with ideas about specific new economic activities with growth potential for the island. However, the Strategy Project has not yet taken off, so in advance of its outcomes we formulated provisional scenarios ourselves, since it is not possible to assess the track 2 options without such systematic and consistent footing for e.g. future national demand for labour, migrants, housing, and zoning area for various activities.

To this purpose we formulated long term scenario's, based on the recent midterm economic scenario study of the Ministry of Economic Development (DEZ[15]), providing pictures of the possible performance by industry during the 10 years period 2011 to 2021. In consultation with DEZ we decided to consider two different scenarios: a. the *'base case' or lower scenario*, and b. an *'optimistic' or higher scenario*. By using these scenarios - and extending and modifying the

[15] We like to thank Mr Luelo Girigorie, Mmes Natalie Petronella and Dainadira Martis of DEZ, as well as Mrs Candice Henriques of the Bank van de Nederlandse Antillen for their readiness to discuss our scenarios. However, we like to stress that the final version used for this assignment is under full responsibility of Ecorys.

assumed growth figures till 2045 - we implicitly assumed that the industries distinguished are able to sell their production with a profit.

Diagram 10.1 Schematic overview of per scenario reasoning



The procedure followed to estimate GDP growth, labor force increases, immigration and future demand for residential and industrial zoning area in both scenarios is schematically represented in Diagram 10.1. The double rimmed blocks in the diagram (GDP growth for five industries, natural population increase, non-labor related migration, and housing supply for two market segments refer to exogenously given characteristics. Variables mentioned in the remaining blocks are successively derived from these fixed data by using island specific statistical indicators.

The diagram shows how the annual growth of the GDP in five broadly defined industries - refining activities, water related and land related manufacturing, tourism (split up into hotels and other touristic facilities), and other industries (government and private services) – leads to changes in the demand for labor (see blocks in green field). This yearly labor demand change is confronted with the increase of labor supply (blocks in orange field), which in its turn depends on population dynamics (natural population increase and labor and non-labor related migration; see blocks in purple field). Such demographic changes affect the housing need of the existing population and both groups of migrants. The increase in housing need is translated into additional demand for housing for two market segments, a low income group and a middle and higher income category. The demand for housing is subsequently confronted with the existing and planned supply (blocks in grey field). The last part of the procedure is to calculate the need for additional space on the island for the expansion of industrial activity on the one and, and for new residential developments on the

other (blocks in the blue field). These calculations were made by multiplying the average number of workers by sector per hectare with the expected increase of the workforce by sector, and by multiplying the additional number of new houses by market segment (low income versus middle plus higher income houses) by the average number of houses in both segments respectively. For the hotel sector an intermediate step was taken by first translating the workforce increase into additional hotel rooms.

Then, scenario specific total demand for adequately equipped area (in hectares) and the actual and future supply according to existing zoning schemes (the 'pipeline'[16]) are deducted. The result is the net need by scenario for zoning space on the island till 2045.

10.3 Some important scenario characteristics

The following scenario aspects are worth mentioning here:

- Production growth figures by (broad) industrial sector are exogenously given (they are input for the calculations) and reflect on the one side expectations about the general dynamics of the world economy, and on the other side plans and intentions of island parties about specific activities (which should be closer studied and expressed in the Strategic Study).
- In both redevelopment scenarios the present refinery will be closed by 2019, having its effects on contractors on the island. Refinery activities (before closure, i.e. till 2019) are classified under 'refinery industry', contractors are categorized under 'other industries'. The effect of closure on annual GDP will be 4%, including 1,6% to be experienced by local contractors. If a new refinery will be constructed at Bullenbay, the activities of contractors will be continued. After closure of the refinery on the ISLA site a period of removal (of present constructions) and cleaning activities will commence, supplying local contractors with new jobs.
- The tourist sector on Curacao is defined as services of hotels, cafes and restaurants. As tourism is considered an important future policy spearhead, we decided to explicitly take account of other tourist related economic activity, like tourist transport, souvenirs industry, travel agencies, and employment related to touristic attractions on the island. We therefore distinguished these 'other touristic activities' from the sector of 'other industries'. Its GDP is assumed to be 2,25 times the GDP in the hotel sector.
- Labor demand by industry is calculated by relating sector GDP to sector labor productivity. The outcome is annually corrected by annual sector specific productivity increase figures.
- Effective labor supply is determined by natural population growth (births minus deaths), assumed changes in participation rates, and structural unemployment.
- The difference between calculated labor demand and supply determines incoming or outgoing labor migration. The propensity to immigrate in case of excess demand was assumed to be100%; the propensity to emigrate in case of excess supply was supposed to be only 50%.
- It was further assumed that labor migration will be coupled with a migration multiplier of 1,2: the average worker will bring 0,2 family members with him/her.
- Retirement migration (or non-labor related migration) was also allowed for (annual net immigration of 100 persons).
- Each year the total population is calculated by summing up natural growth and total net migration. The increase in each population component (existing population, labor related migrants, non-labor related migrants) has been translated in a component specific housing need (different household sizes). It was assumed that the household size of the existing population will decrease somewhat in the future (from the present 2,63 to 2,40 in 2045). We further

[16] It didn't become completely clear during our missions whether the large area, considered in the recent Eastpoint study, should be added to the pipeline stock. In some of sub variants described in Chapters 11 and 14 the net demand for zoning area has therefore also been calculated with the Eastpoint area included as additional supply available.

supposed that the (latent) housing need of this category can be determined by an occupation norm of 1,1 household per house. For labor related migrants and non-labor migrants we assumed an average occupation figure of 4 and 2 respectively. Based on these assumptions for 2010 a total housing need of nearly 47.000 has been calculated.

- The total housing need was subsequently split up into two major components: the need for houses of lower income households (less than NAf 1.000 per month in 2008/2009, or 40,24% of all households) and of middle or higher income households.
- The housing need thus calculated was confronted with the available housing stock (in 2010 some 43.000 houses). This results for 2010 in a latent housing shortage of 4.000. A further assumption is that this shortage comes completely to the account of low income households.
- According to information from DROV[17] a number of zoning sites has been officially destined for future housing development, mainly in the higher income segment. Only a limited amount of new social or public housing is foreseen, as public funds are difficult to become available. In both scenarios an annual increase of 202 low income houses and 189 middle/higher income houses was assumed for 2010-2015, and of 120 low and 334 middle/higher income houses for 2016-2020. If the recent Eastpoint development plan would not be considered as part of the official planning pipeline, no zoning plans are available for the period after 2020. If however the Eastpoint development plan would be considered as an officially ratified zoning plan there will be a large housing supply from 2020 onward, viz. an estimated yearly increase of some 230 low income houses, and 600 to 650 of middle/higher income houses from 2020 to 2040.
- The total increase of new houses was corrected for some removal (0,25%) of houses from the total stock, 75% of which are supposed to have been occupied by low income households.
- Based on these assumptions housing shortages or surpluses are calculated for both housing segments. By assuming average housing densities of 30 (low income housing) and 20 (high income housing) per hectare for both segments respectively, the future need for residential zoning area was calculated.
- The need for additional hotel rooms and the corresponding hotel area development demand (hectares) is estimated on the basis of an indicator (rooms per employee), applied to the increase in the annual number of workers demanded by this industry.
- The manufacturing industry is subdivided into water and land related manufacturing, and for both the additional area needed till 2045 is estimated by using the average surface area (m2) required per employee.
- For the service industries the same procedure is adopted.

10.4 Overview of scenario results

The result of the scenario calculations is the total annual increase in demand for space (hectares) for all future activities on the island from 2010 till 2045: housing, hotels, other touristic activities, manufacturing and services. This future demand for land must be confronted with the supply according existing zoning plans and the area which may become available in the Schottegat area, after closure, dismantling and remediation of the present refinery structures (493 ha).
The input data, used to construct the scenarios, are recorded in Annex 3 (Table A.10.1). Input data with different values for both scenarios, determining the different outcomes of both scenario calculations, are summarized given in Table 10.1.

[17] Dienst Ruimtelijke Ordening en Volkshuisvesting.

Table 10.1 Summary of differences in characteristics of high and low scenario

	optimistic (high(growth scenario					base case (low) growth scenario			
	start	pilot years				start	pilot years		
	2009	2009	2028	2045		2009	2009	2028	2045
real grow th rate GDP other manufacturing		2,0%	2,0%	1,5%	x		1,0%	1,0%	1,0%
real grow th rate GDP tourism - hotels & restaurants (hore)		7,0%			x		3,0%		
real grow th rate GDP tourism - other sectors		7,0%			x		3,0%		
real grow th rate GDP other industries		2,0%	2,0%	1,5%	x		1,0%	1,0%	1,0%
productivity grow th other manufacturing (Gi/FTEs in i)		0,5%	0,5%	0,5%	x		0,2%	0,2%	0,2%
productivity grow th other tourism (Gt2/FTEs in t2)		0,3%	0,3%	0,3%	x		0,1%	0,1%	0,1%
productivity grow th other industries (Go/FTEs in o)		0,3%	0,3%	0,3%	x		0,1%	0,1%	0,1%
percentage of low income households		33,0%	37,7%	37,0%	x		33,0%	34,6%	34,0%

Table 10.2 Summary of Calculation results high and low scenario

CALCULATION RESULTS HIGH GROWTH SCENARIO	2010	increase 2010-	2020	increase 2020-	2030	increase 2030-	2045	total increas
GDP other manufacturing (mln NAF; 2009 prices)	362	79	441	96	538	155	693	**331**
GDP tourism - hore (mln NAF; 2009 prices)	175	169	344	55	399	64	463	**288**
GDP other tourism (mln NAF; 2009 prices)	374	82	456	100	556	160	716	**342**
GDP other industries (mln NAF; 2009 prices)	4.201	945	5.145	1.462	6.608	1.908	8.516	**4.315**
total employed population (labour demand)	57.738	13.037	70.775	15.961	86.736	19.054	105.790	**48.052**
total employed population (labour supply)	60.593	8.999	69.592	15.907	85.499	19.580	105.080	**44.487**
total net labour related migration		10.270		20.731		17.344		**48.345**
total net migration		8.137		21.731		18.844		**48.712**
net natural grow th population		8.082		8.541		13.728		**30.351**
population	139.853	16.220	156.072	30.272	186.344	32.571	218.916	**79.063**
housing demand low income segment (based on occupation norm)	15.574	3.476	19.049	5.347	24.396	4.697	29.093	**13.520**
housing demand higher income segment (based on occupation norm)	31.267	2.996	34.263	6.177	40.440	9.202	49.641	**18.375**
total housing demand (based on occupation norm)	46.840	6.472	53.312	11.524	64.836	13.899	78.735	**31.894**
housing stock low income segment; actual stock (2010) and planned (in pipeline)	11.119	868	11.987	-735	11.252	-1.244	10.008	**-1.110**
housing stock higher income segment; actual stock (2010) and planned (in pipeline)	31.790	2.195	33.986	49	34.035	-415	33.620	**1.830**
total housing stock: actual stock (2010) and in planned pipeline	42.909	3.064	45.972	-686	45.287	-1.658	43.628	**720**
area (ha) needed for new low income residential building sites (not yet in pipeline)	209	62	270	270	540	218	758	**549**
area (ha) needed for new higher income residential building sites (not yet in pipeline)	-14	-24	-38	417	379	676	1.055	**1.068**
total area (ha) needed for new residential building sites (not yet in pipeline)	195	37	232	687	919	893	1.812	**1.617**
area (ha) presently reserved for new low income low income residential building (pipeline)	10	81	90	6	96	0	96	**86**
area (ha) presently reserved for new low income higher income residential building (pipeline)	14	176	190	24	214	0	214	**200**
area (ha) presently reserved for new residential building sites (pipeline)	23	257	280	30	310	0	310	**287**
tourism: hotel rooms	6.513	6.172	12.685	1.890	14.575	2.094	16.670	**10.156**
total area (ha) needed for hotel rooms		77		24		26		**127**
total area (ha) needed for other tourism (including restaurants)		3		4		4		**11**
total area (ha) needed for refinery		-493		0		0		**-493**
total area (ha) needed for new w ater related other manufacturing		89		103		147		**340**
total area (ha) needed for new land related other manufacturing		10		11		16		**38**
total area (ha) needed for new activities in other sectors		73		114		133		**320**
total area needed for all new activities (not corrected for area in pipelines)		**-202**		**942**		**1.220**		**1.960**
total area needed for all new activities (corrected for area in pipelines)		**-459**		**913**		**1.220**		**1.673**

CALCULATION RESULTS LOW GROWTH SCENARIO	2010	increase 2010-	2020	increase 2020-	2030	increase 2030-	2045	total increas
GDP other manufacturing (mln NAF; 2009 prices)	359	38	396	41	437	70	508	**149**
GDP tourism - hore (mln NAF; 2009 prices)	168	58	226	24	250	19	269	**101**
GDP other tourism (mln NAF; 2009 prices)	370	39	409	43	452	73	525	**154**
GDP other industries (mln NAF; 2009 prices)	4.160	449	4.609	754	5.363	863	6.226	**2.066**
total employed population (labour demand)	57.163	5.406	62.569	8.692	71.261	9.642	80.904	**23.740**
total employed population (labour supply)	60.416	2.336	62.752	8.082	70.834	9.635	80.469	**20.053**
total net labour related migration		-1.834		9.167		7.076		**14.409**
total net migration		-2.676		10.167		8.576		**16.067**
net natural grow th population		8.082		8.541		13.728		**30.351**
population	139.853	5.406	145.259	18.708	163.967	22.303	186.271	**46.418**
housing demand low income segment (based on occupation norm)	15.498	1.490	16.988	2.946	19.935	3.132	23.067	**7.568**
housing demand higher income segment (based on occupation norm)	31.348	1.749	33.097	4.724	37.821	6.999	44.820	**13.472**
total housing demand (based on occupation norm)	46.846	3.239	50.086	7.670	57.756	10.131	67.887	**21.041**
housing stock low income segment; actual stock (2010) and planned (in pipeline)	11.119	868	11.987	-735	11.252	-1.244	10.008	**-1.110**
housing stock higher income segment; actual stock (2010) and planned (in pipeline)	31.790	2.195	33.986	49	34.035	-415	33.620	**1.830**
total housing stock: actual stock (2010) and in planned pipeline	42.909	3.064	45.972	-686	45.287	-1.658	43.628	**720**
area (ha) needed for new low income residential building sites (not yet in pipeline)	209	-24	185	144	329	145	474	**266**
area (ha) needed for new higher income residential building sites (not yet in pipeline)	-14	-92	-106	321	215	501	717	**730**
total area (ha) needed for new residential building sites (not yet in pipeline)	195	-116	79	465	544	647	1.191	**996**
area (ha) presently reserved for new low income low income residential building (pipeline)	10	81	90	6	96	0	96	**86**
area (ha) presently reserved for new low income higher income residential building (pipeline)	14	176	190	24	214	0	214	**200**
area (ha) presently reserved for new residential building sites (pipeline)	23	257	280	30	310	0	310	**287**
tourism: hotel rooms	6.270	2.072	8.342	781	9.123	562	9.686	**3.416**
total area (ha) needed for hotel rooms		26		10		7		**43**
total area (ha) needed for other tourism (including restaurants)		2		2		2		**5**
total area (ha) needed for refinery		-493		0		0		**-493**
total area (ha) needed for new w ater related other manufacturing		46		50		83		**178**
total area (ha) needed for new land related other manufacturing		5		6		9		**20**
total area (ha) needed for new activities in other sectors		37		64		70		**171**
total area needed for all new activities (area already in planning pipelines not included)		**-493**		**596**		**817**		**920**
total area needed for all new activities (corrected for area in pipelines)		**-750**		**567**		**817**		**634**

Figure 10.2 Differences in development 2010 – 2045 for base case and optimistic scenario of some important economic and social variables

Figure 10.2a

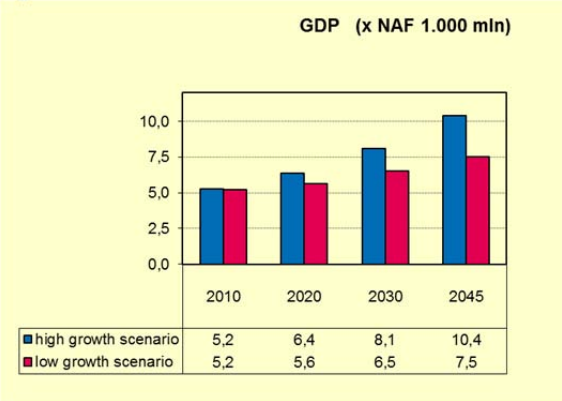


Figure 10.2b

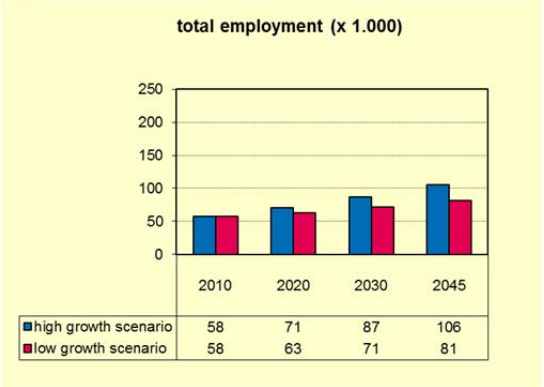


Figure 10.2c

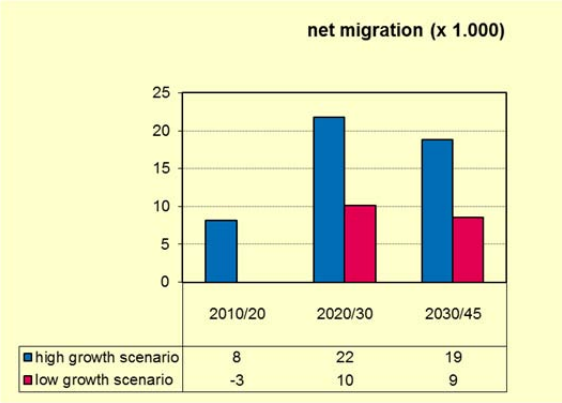


Figure 10.2d

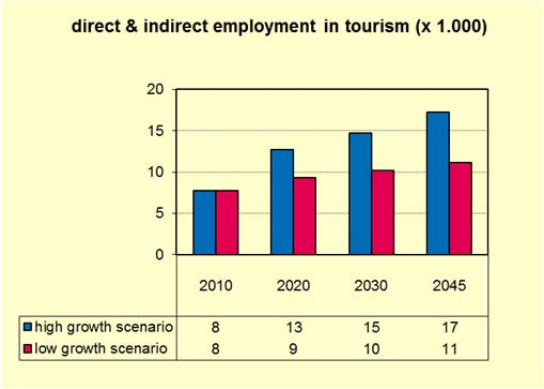


Figure 10.2e

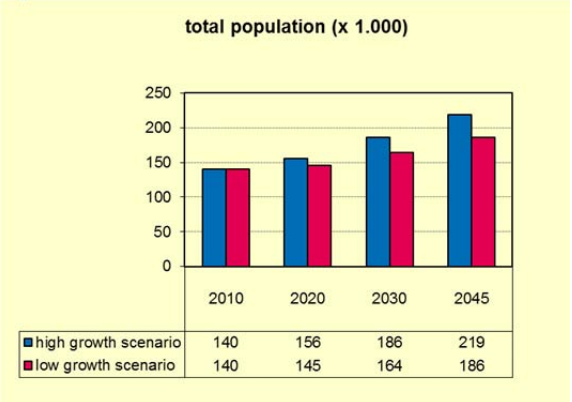
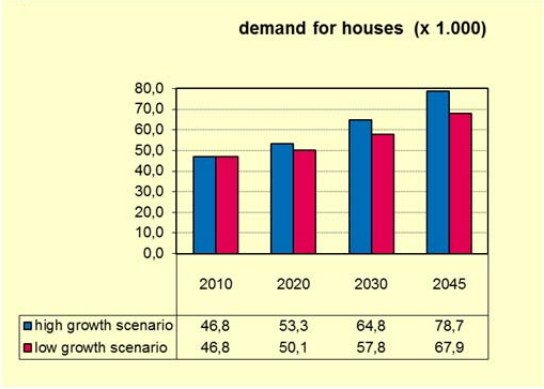


Figure 10.2f



11 Schottegat area renovation alternatives

11.1 Introduction

In paragraph 2.2 a short introduction of the two re-development alternatives for the Schottegat area (track 2, variants A and B) has been presented. Variant A refers to a combination of industries (except tourist industry) and housing; variant B to mixed economic activities, combined with an extensive green area. In this chapter both alternatives including sub-variants will be discussed in more detail.

11.2 Focus on non-tourist industry and housing (variant A)

In variant A the Schottegat area will be reserved for manufacturing, offices and warehousing activities, in combination with adequate housing accommodations for employees. Tourism activities are not included in this variant since it is expected that the current and expected investments in the near future is sufficient to fulfill the demand up to 2045. The area allocated to each activity depends on:

- The need for zoning space till 2045;
- The building density and height of houses/apartments and offices.

This section presents the main aspects of this variant.

Net need for zoning space on Curacao in 2045

The area needed for manufacturing, offices and warehousing activities and for housing in 2045 depends on the chosen scenario. As discussed in chapter 10 we considered two different scenarios: the 'base case' or lower scenario (LS) and the 'optimistic' or higher scenario (HS). The table below provides an overview of the demand for hectares, needed for the different activities in 2045.

Table 11.1 Net need for hectares for economic activities in 2045

Economic activities	# of Ha, needed in 'base case' or low growth scenario (LS)	# of ha needed in 'optimistic' or higher growth scenario (HS)
Water related manufacturing	0	142
Land related manufacturing	9	27
Low income housing	486	788
High income housing	761	1,180
Offices	70	134
Warehousing	98	187
Hotels	0	84
Other tourism	32	83
Total	*1,456*	*2,625*

Only 493 hectare is available. Therefore the available area is distributed over the above mentioned activities, starting with water and land related industry and accommodations for their employees. The remaining area was filled up with successively offices and warehouses including accommodation for their employees (depending on the availability of the area). The ISLA area

assigned for offices and warehouses is assumed to be maximum 50 percent of the total area needed for these activities on the entire island.

In the table above the Wechi and Eastpoint development plans have not been taken into account. If both development plan would be considered as an officially ratified zoning plan, there will be a large housing supply from 2020 onward (an estimated yearly increase of some 230 low income houses, and of 600 middle/higher income houses from 2020 to 2040). The need for hectares for housing is in this case lower as indicated in the table.

Building density sub variants

As the Schottegat area is centrally located and therefore most conveniently situated for a rather urban style development, and because the present refinery structure was already characterized by high rising refinery stacks, redevelopment of the location by condensing housing, hotels and offices appears to be a realistic and acceptable planning option.

We therefore distinguished two sub variants:

- sub variant LD: applying the current legally required building density and height.
- sub variant HD: applying for 10 per cent of the low and high income housing three-storeyed buildings instead of one-storeyed buildings in the present ('normal') situation. Applying for 50 per cent of the hectares assigned to offices an increase in building density from 25 per cent built area per hectare in the current situation to 40 per cent and an increased number of floors from 2 to 10 floors.

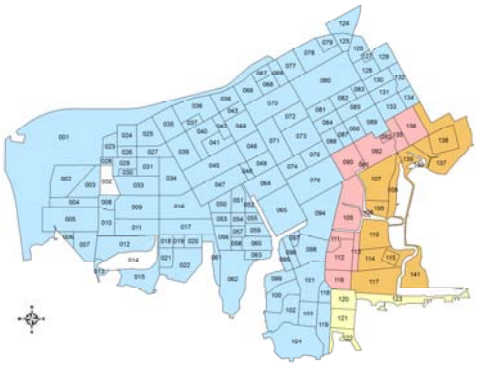
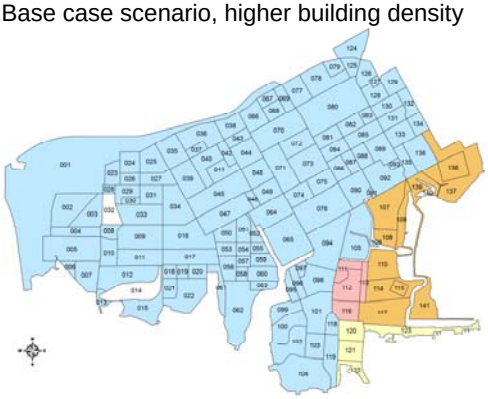
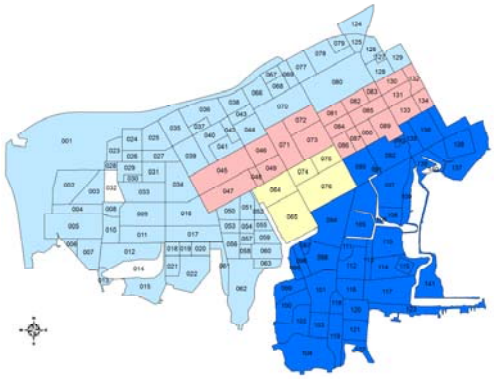
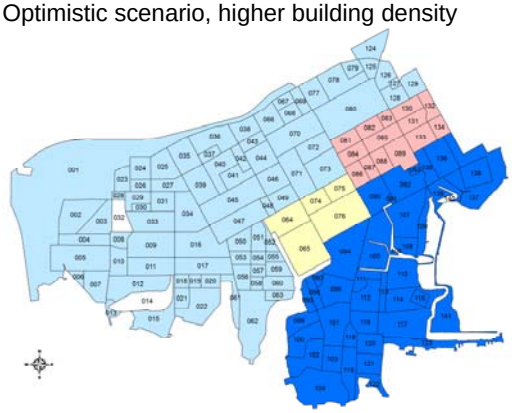
Variant A: Area reserved for (economic) activities on ISLA in 2045

The table below shows for Variant A and its sub variants the division of the total ISLA area amongst the economic activities in the base case scenario and optimistic scenario, respectively. The main difference between the base case and optimistic scenario is the starting point chosen, i.e. the area reserved for water related industry.

Table 11.2 Schottegat area used for new activities in 2045 (in # of hectares)

	Base case scenario (LS)			Optimistic scenario (HS)		
	Present building density (LD)	**Higher building density (HD)**	**Present building density incl. Wechi + Eastpoint devel. plans (LD+)**	**Present building density (LD)**	**Higher building density (HD)**	**Present building density incl. Wechi + Eastpoint devel. plans (LD+)**
Residences						
Houses/apartments	281	294	56	180	207	180
Neighbourhood amenities	120	126	24	77	89	77
Industry						
Water related industry	0	0	0	142	142	142
Land related industry	9	9	9	27	27	27
Offices	35	15	35	67	29	67
Warehousing	49	49	98	0	0	0
Total area	*493*	*493*	*222*	*493*	*493*	*493*

Taking into account the Wechi and Eastpoint development plans in the base case scenario, the area reserved for residences differs from the other sub variants. The total demand is 80 hectare for low income houses in the base case scenario, there is no demand for middle/high income houses. Part of the surplus of hectares will be reserved to fulfil the maximum demand of warehouses which is 98 hectares. In the optimistic scenario the sub variant including Wechi and Eastpoint development plans (A-HSLD+) equals the sub variant applying the present building density (A-HSLD). Although many additional residents will be built in Wechi and Eastpoint, the demand exceeds the supply of residents.

Base case scenario, present building density	Base case scenario, higher building density
	
Optimistic scenario, present building density	**Optimistic scenario, higher building density**
	
Pale blue = residential area Pink = offices Yellow = land related industry Orange = warehousing Deep blue = water related industry	

Variant A: characteristics

The table below summarizes the number of houses to be built in the Schottegat area and the number of residents living and employees working on the site in 2045 (according to the scenarios, and the building density and height sub variants chosen) .

Table 11.3 Characteristics of Variant A

	Base case scenario (LS)			Optimistic scenario (HS)		
	Present building density (LD)	Higher building density (HD)	Present building density incl. Wechi + Eastpoint devel. Plans (LD+)	Present building density (LD)	Higher building density (HD)	Present building density incl. Wechi + Eastpoint devel. Plans (HD+)
Residences						
Low income houses/apartments	310	498	1680	282	509	282
High income houses/apartments	5,393	9,631	0	3,410	6,584	0
Inhabitants	14,987	26,618	4,415	9,702	18,638	9,721
Industry						
Employees water related industry	0	0	0	710	710	710
Employees land related industry	135	135	135	405	405	405
Employees offices	5,880	5,880	5,880	11,256	11,256	11,256
Employees warehouses	1,960	1,960	3,920	0	0	0

Construction period

The estimated commencement of construction of the different activities depends on two factors: 1) the time needed for dismantling, soil remediation and site preparation and 2) the actual need for zoning space for each activity. The estimated time for dismantling, remediation and site preparation is 7 years. From 2027 the phased construction of houses, industry, offices and warehouses will therefore start. The pace of construction depends on the need for zoning space as indicated in the two scenarios for long term economic development of Curacao. The availability of employees on Curacao to realize the construction has been taken for granted.

Table 11.4 Construction periods per scenario

	Base case (LS)	Optimistic scenario (HS)
Dismantling	2020-2021	2020-2021
Soil remediation	2022-2041	2022-2031
Site preparation	2027-2045	2027-2045
Housing low income	2027-2031	2027-2031
Housing high/middle income	2027-2045	2027-2041
Water related manufacturing	Not applicable	2032-2045
Land related manufacturing	2030-2043	2027-2045
Offices	2027-2036	2027-2036
Warehouses	2027-2036	Not applicable

Investment Costs

The costs of dismantling, remediation, site preparation and construction of houses/apartments, industry, offices and warehouses are presented in the table below. Annex x presents the indicators behind these numbers.

Table 11.5 Investment costs (million NAf, 2011 prices)

	Base case scenario (LS)			Optimistic scenario (HS)		
	Present building density (LD)	Higher building density (HD)	Present building density incl. Wechi + Eastpoint devel. plans (LD+)	Present building density (LD)	Higher building density (HD)	Present building density incl. Wechi + Eastpoint devel. plans (HD+)
Dismantling						
ISLA site	254	254	254	254	254	254
Soil remediation						
ISLA site	1,466	1,466	948	1,462	1,462	1,462
Site preparation	345	345	345	345	345	345
Construction						
• Housing	3,902	6,962	196	2,477	4,779	2,477
• Water related industry				140	140	140
• Land related industry	45	45	45	135	135	135
• Offices	700	805	700	1,340	1,541	1,340
• Warehouses	274	274	549			
• Road, (waste) water, electricity	33	47	21	28	39	28
• Design, management	67	67	67	18	15	18

The remediation costs in the optimistic scenario are slightly lower than in the base case scenario due to less space for housing and more space for industry. The remediation costs for the use of housing are higher than the costs for the use of industry.

Developing the Schottegat area instead of a site elsewhere on Curacao, means that elsewhere planning area can be saved for other activities of some (yet unknown) economic use in the future. The economic value of this 'saved' area is called the 'opportunity cost' of this elsewhere site. Saving this site for other potential uses is a benefit (or a negative cost item) to be ascribed to the ISLA redevelopment project. The saved area (493 ha) was valued at NAf 1/m^2 and put in use gradually between 2027 and 2045.

Revenues of re-development variant A

The (positive and negative) benefits for the island – to be discussed later on; see Chapter 14 - stem on the one hand from effects with a market value (direct and indirect market effects), and on the other hand from external advantages and disadvantages for residents and other island parties which the originator has no right to be compensated for, or is not compelled to pay for (external effects, see next section). Effects are defined as the differences in socio-economic development between carrying out strategy A and following a 'do minimum' strategy (see Chapter 2).

Direct effects

Direct effects are related to the dismantling, soil remediation, construction and operation activities flowing from the project investments. These effects are calculated by estimating the value added

(VA) of the investments and operation of activities for Curacao. The direct annual value added consists of the value of the output of the activities minus the value of the inputs purchased. Essentially it is the sum of the factor incomes, the wages and profits.
The direct effects of dismantling, remediation and construction of new activities in the Schottegat area are calculated by multiplying the employment to be generated by redeveloping the site by the gross domestic product (GDP) per employee.
The table below shows the generated employment and GPD per employee.

Temporary employment is related to dismantling, remediation of the ISLA site and construction of the economic activities. The duration of this employment depends on the indicated time period for construction (Table 11.4). Permanent employment is employment generated by the economic activities that after construction will be established in the Schottegat area. We assumed that one year after the start of the construction the first permanent employment is created. The maximum employment figures, as indicated in the table below will be realized after the construction of all activities and new economic activities will be established on the site. It depends on the construction period for and expected development of each activity in the different scenarios (see table 11.4).

Table 11.6 Employment (fte)

	Base case scenario (LS)			**Optimistic scenario (HS)**		**GDP per employee (NAf/yr)**
	Present building density (LD)	**Higher building density (HD)**	**Present building density incl. Wechi + Eastpoint devel. plans (LD+)**	**Present building density (LD) + (LD+)**	**Higher building density (HD)**	
Total permanent employment	*7,975*	*7,975*	*9,935*	*12,371*	*12,371*	
Water related industry	0	0	0	710	710	89,779
Land related industry	135	135	135	405	405	104,394
Trade/warehouses	1,960	1,960	3,920	0	0	65,283
Services/offices	5,880	5,880	5,880	11,256	11,256	139,411
Total temporary employment (total of entire construction period)1)	*36,609*	*60,629*	*22,259*	*30,847*	*56,434*	
Dismantling	1,658	1,658	1,658	1,658	1,658	61,193
Remediation	3,500	3,500	3,500	3,489	3,489	125,687
Construction	31,451	50,315	11,016	25,701	41,417	60,658

1) These employment figures include both local and foreign employees.

Other direct effects are the additional value of residential accommodations in the Schottegat area. We assume that the value of houses in Schottegat area is 15 per cent higher than the value of the same residential accommodation elsewhere on the island. When applying a higher building density, the additional value is assumed to be somewhat lower, viz. 10 per cent.

Indirect effects

The project does not only affect the VA for the industry, service sector and construction companies, but can also have an impact on the rest of the economy. Indirect or higher order effects – also called 'ripple effects'; see section 12.1 hereafter - will, for example, also be perceived higher up or lower down in the production chain (backward or forward effects). The indirect effects are calculated by using direct-indirect added value multipliers. These multipliers are presented in the table below.

Table 11.7 Multiplier direct-indirect added value

Economic activities	Multiplier direct-indirect added value
Tourism	1,064
Other tourism	0,456
Water related industry	0,488
Land related industry	0,488
Offices	0,364
Warehousing	0,473
Dismantling	0,200
Remediation	0,200
Construction	0,725

Source: I/O table Ecorys

Opinions differ on the question whether an indirect effect implies only a redistribution of welfare among parties or leads to an increase in welfare. The answer depends on project-specific circumstances. We assumed that 20 per cent of the indirect effects results in a welfare increase.

External effects

Not all effects of variant A can be expressed in monetary values because of the non-existence of a market. These effects are called externalities or external effects. The following effects occur under variant A:

- Congestion costs and travelling costs;
- Synergy effect of clustering commercial activities;
- Exceptional export orientation;
- Benefits of dismantling the refinery and remediation.

These external welfare effects will be discussed in Chapter 12 (section 12.2) and Chapter 14 (section 14.5).

11.3 Mixed economic activities and extensive green area (variant B)

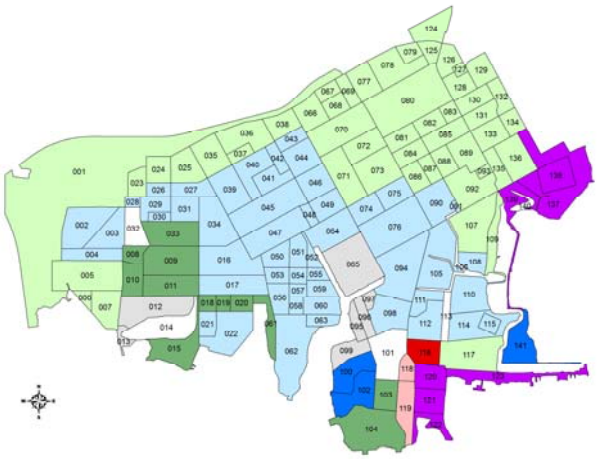
In this section re-development variant B will be discussed. In this variant the Schottegat area is designed for a mix of economic activities: services, industry, and housing. In order to join in to a certain extent with recent ideas and discussions about the Greentown concept - which among others is characterized by large amounts of greenery on a re-developed Schottegat area – the area, needed for the proposed mix of economic activities has been supplemented by a large amount of green area (such as parks, pleasure grounds, nature, etc.).

The table below provides an overview of hectares allocated in variant B to the different activities in 2045. The relative large amount of green area (185 ha) implies that the remaining area demand for economic activities will arise at a speed which is no longer dependent on the scenario chosen (LS or HS). This re-development variant is therefore considered independent of the scenarios.

Table 11.8 Schottegat area used for new activities in 2045 (in # of hectares)

Economic activities	Ha needed in 2045
Water related industry	13
Land related industry	0
Low income housing	52
High income housing	95
Offices	4
Warehousing	0
Retail	20
Tourism	2
Other tourism	24
Other industry (oriented on local market)	29
Other industry (export oriented)	5
Green area	185
Roads	16
Area not to be sold	48
Total	*493*

Mixed economic activities and extensive green area



Pale blue = residential area
Pink = offices
Yellow = land related industry
Orange = warehousing
Grey = retail
Deep blue = water related industry
Pale green = green area
Red = tourism
Purple = other tourism
Deep green = public area

Variant B: characteristics

The table below summarizes the number of houses to be built in the Schottegat area and the number of residents living and employees working on the site in 2045.

Table 11.9 Characteristics of Variant B

	# residences /# fte
Residences	
• Low income houses/apartments	1,092
• High income houses/apartments	2,830
• Inhabitants	10,306
Industry	
• Employees water related industry	65
• Employees offices	672
• Employees retail	1,500
• Employees tourism	118
• Employees other tourism	1,008
• Employees other industry	1,100

Construction period

The estimated time for dismantling, remediation and site preparation is 7 years. From 2027 onwards the phased construction of houses, industry, offices and warehouses will start. The pace of construction depends on the need for zoning space as indicated in the two scenarios for long term economic development of Curacao. The availability of employees on Curacao to realize the construction has been taken for granted.

Table 11.10 Construction periods per scenario

	Base case (LS)	Optimistic scenario (HS)
Dismantling	2020-2021	2020-2021
Soil remediation	2022-2026	2022-2026
Site preparation	2027-2045	2027-2036
Housing low income	2027-2031	2027-2031
Housing high/middle income	2027-2045	2027-2041
Water related manufacturing	2040-2044	2031-2035
Land related manufacturing	Not applicable	Not applicable
Offices	2027-2036	2027-2036
Warehouses	Not applicable	Not applicable
Hotels	2040-2045	2037-2042
Other tourism	2027-2047	2027-2047
Retail	2027-2045	2027-2041
Public area	2027-2045	2027-2041
Green area	2027-2045	2027-2041

Costs

The costs of dismantling, remediation, site preparation and construction of houses/apartments, industry, offices and warehouses is presented in the table below. Annex 4 presents the indicators behind these numbers.

Table 11.11 Investment costs (million NAf, 2011 prices)

	Investment costs
Dismantling ISLA site	254
Soil remediation ISLA site	1,468
Site preparation	171
Construction	
• Housing	2,267
• Water related industry	13

	Investment costs
• Land related industry	Not applicable
• Offices	80
• Warehouses	Not applicable
• Tourism	29
• Other tourism	117
• Public area	334
• Green area	132
• Road, (waste)water, electricity	46
• Design, management	41

Also in this variant opportunity costs have been taken into account. In total 222 ha is saved for other potential use. This is valued at NAf 2.9 million in total and put in use gradually between 2027 and 2045.

Revenues of re-development variant B

Direct effects

Direct effects are related to the dismantling, soil remediation, construction and operation activities flowing from the project investments and are calculated by multiplying the employment to be generated by redeveloping the site by the gross domestic product (GDP) per employee.
The table below shows the generated permanent and temporary employment and GPD per employee.

Table 11.12 Employment (fte)

	Employment (fte)	GDP per employee (NAf/yr)
Total permanent employment	4,463	
Water related industry	65	89,779
Services/offices	672	139,411
Retail	1,500	65,283
Tourism	118	41,450
Other tourism	1,008	131,798
Other industry	1,100	139,411
Total temporary employment (total of entire construction period)	30,537	
Dismantling	1,658	61,193
Remediation	3,505	125,687
Construction	25,375	19,875

Other direct effects are the additional value of residential accommodations in the Schottegat area. We assume that the value of houses is 15 per cent higher compared to the same residential accommodation elsewhere on the island.

Indirect effects and external effects

For the indirect and external effects we refer to section 11.2 and section 14.5.

Part IV. Welfare Analysis

12 Reference Alternative ('Do Minimum')

12.1 Introduction

Cost-benefit analysis (CBA) is a conceptual framework for comparing the national or regional welfare development taking place in the situation *with* a project or intervention, with the welfare development occurring in the situation *without* the intervention. The annual differences between both developments are valued, aggregated, discounted and interpreted as the change in welfare brought about by the intervention.
De development taking place in the without-project situation is called the *reference alternative.* It refers to the option with the least possible policy effort. Sometime this means 'do nothing at all'. But doing nothing at all is for most burning questions socially or politically not acceptable. The reference alternative must therefore nearly always be specified as a 'do minimum' policy. That's also true in the present case.

It should be stressed that a CBA differs from an Economic Impact Analysis[18] (EIA). An EIA[19] describes the *ripple effect* of a policy intervention or project on the economy, and is usually carried out by making use of input-output or other multiplier analysis. The expression 'ripple effect' is used to describe a situation where - like the ever expanding ripples across water when an object is dropped into it - an effect from an initial state can be followed outwards incrementally. In our case the impact of the intervention is that purchases and sales are 'rippling' (indirectly and/or induced) from sector to sector through the national economy. Although, according to a correctly performed EIA, a large part of the economy can be affected by the intervention, this doesn't automatically imply that it also alters national welfare.
This means that an EIA is not necessarily the most appropriate instrument to calculate welfare effects of an intervention.[20] The ripple impact calculated in the EIA may not *a priori* be equated to a change in national welfare. For a proper welfare analysis a CBA must therefore be carried out. However, in a CBA use can be made of an EIA to describe both the *with* and *without* project development paths, on condition that the results are properly interpreted.

Two aspects of the reference alternative deserve some further attention. One is the motivation to choose the 'no access' measures as the alternative for using the ISLA site (in case of upgrading or redevelopment). The other is only relevant for track 2 alternatives and regards the consequences for other development areas on the island of not redeveloping the Schottegat area. They will be discussed in the next two sections.

12.2 No dismantling or no remediation is not an acceptable option

Part of the reference case for a new resp. upgraded refinery, or for redevelopment of the Schottegat area after 2019, is, as we have seen in Chapter 2 (Table 2.1 and Diagram 2.1), to leave the abandoned and polluted terrain unused for the next decennia, at least till 2045. In principle this could mean 'do nothing', i.e. leaving the present structures rust away and dilapidate, not stopping

[18] Grady, P. and Muller R.A., (1988), "On the Use and Misuse of Input-Output Based Impact Analysis in Evaluation", *The Canadian Journal of Program Evaluation*, Volume 3 Number 2.

[19] The acronym EIA refers in this report to Economic Impact Analysis; it is not used to refer to another frequently used assessment, viz. Environmental Impact Analysis.

[20] The recent 'Economic Impact Study Eastpoint Curaçao' 2011, KPMG is an example of an EIA. This study describes the indirect and induced multiplier (or ripple) effects of a possible real estate development of a large area on the island, i.e. a 'with project' situation. It should not be confused with a cost-benefit analysis.

the processes of soil and water contamination and the dispersion of LNAPL in the direction of Schottegat, and confining oneself to fencing off the whole area for an indeterminate period of time. It was stated earlier, however, that this (lack of) intervention would be seriously conflicting with the aim of Government to carry out a sustainable policy.

It was therefore agreed with the Government, that the inevitable starting point for this study should be a 'do minimum' reference policy option, characterized by – apart from properly fencing off the site - on the one hand dismantling the present refinery structures, and on the other hand minimum remediation of the polluted soil. The main features and costs of this 'no access' option were reported on in Chapter 9. There it became clear that both measures (dismantling and remediation) are costly. The net present value of dismantling are NAf 133 million, or around NAf 855 per inhabitant; the NPV of 'do minimum' remediation amounts to NAf 220 million.or some NAf 1,345 per inhabitant.
If some costs can be shifted onto parties outside Curacao, - e.g. former foreign owners and operators who share responsibility for the pollution of the area and maybe to some degree liable for the damage it causes, - this (foreign) part of the costs should not be included in the CBA, because a CBA remains limited to effects on *national* welfare.

One can of course ask oneself the question what welfare benefits are reaped from preferring 'no access' to 'do nothing'. In both cases effective fencing off the premises implies protection from direct health risks, while dispersion processes are nothing new; the presence of contaminants and the spread of chemical fluids is already lasting for many years. Why then choose the expensive 'no access' solution as reference option?

The decision to choose nevertheless the 'no access' reference option can be interpreted as the result of an *implicit* CBA exercise, with the 'do nothing' policy as reference case. In this CBA the known monetary costs are balanced against a number of important mainly non-monetary or *external* benefits. The benefits of dismantling and remediation, already discussed in Chapter 9, can be summarized as follows.

Benefits of dismantling:
- Prevent risks of illegal destruction and selling of (often polluted) refinery parts as scrap;
- Prevent dispersion of decomposition and degradation products by air and water, endangering the environment and national health;
- Prevent the long-lasting offensive visual intrusion of dilapidating refinery structures;
- Avoidance of a depressing national awareness that the country is not able to make this first-rate site presentable to inhabitants;
- Another dismantling benefit for the island may be that foreign visitors (including tourists and business people) will not be inclined to by-pass Curacao next time and spread their experience at home, once confronted with the dreary sight. This type of benefit must be considered an internal (or priced), not an external benefit.

Benefits of remediation:
- Prevent/reduce dispersion of oil contaminated groundwater to other (residential) areas. This is an external benefit, or – as far as it prevents property devaluation – an internal benefit.
- Prevention of oil (LNAPL) floating into Schottegat with risks of human dermal contact and ecological risks for the water system; health problems in residential areas (inhalation, odor of hydrocarbons);
- Prevention of dispersal of LNAPL (pure oil) to clean areas and Schottegat, threatening beaches and ships;

- Vertical isolation of LNAPL reduces high remediation costs after 2045 (when the need for space will probably still lead to redevelopment of the area);
- Avoidance of a psychologically depressing awareness that Curacao is not able to make this potential first-rate site suitable for useful development;
- Meeting environmental and ecological standards, applicable in developed countries (EU, USA), and thus acquiring – in line with the political desire to promote sustainability - a reputation of staying in the forefront with regard contending and controlling pollution;

Annex 6 presents an overview of health implications and other risks after implementation of proposed activites part of the 'do minimum' policy and 'do nothing' policy.

Preferring the 'no access' policy over the 'do nothing' option means that the Government (and the public it represents) implicitly judge the value of the accompanying advantages higher than the costs of such a policy.

12.3 Possible consequences of 'no access' for island development

Table 2.1 showed that for a correct comparison of what will happen with and without the policy options (upgrading the refinery and redeveloping the Schottegat area in case there will be no upgrading), not only the implications of 'no access' to the ISLA premises should be studied, but also the consequences for other locations on Curacao of not using this centrally located area. For in the reference situation all new economic activities, to be expected till 2045 according the long run scenarios, must be realized elsewhere.

The simplest hypothesis would be to assume that, if ISLA after appropriate remediation will not be redeveloped, existing and additional planning areas elsewhere can accommodate the same amount and the same quality of activities as ISLA would be able to do. If this hypothesis would be correct the economic evaluation could be reduced from a complex CBA to a rather straightforward Cost-Effectiveness Analysis (CEA). For both location alternatives would bring about the same amount of benefits, and the main task would therefore be to assess the cost differences between both policy options.

There are two reasons why a pure CEA approach is not really under discussion. In the first place the Schottegat area is characterized by deep water. Alternative development areas on the island lack this location advantage, or it would be very expensive to equip them with it. The low growth scenario shows an increase in water related demand of nearly 183 hectares till 2045 and the high growth scenario nearly 350 ha, while the additional supply outside the refinery site does not exceed 144 hectares.
In the second place one must realize that the ISLA site, when adequately cleaned up, provides the island with a centrally located open space with high potential for a unique urban development (for Curacao), very well visible for inhabitants, as well as for tourists and visiting business people. There are good reasons to contend that the present refinery design with its very noticeable high stacks could be replaced by rather high rise developments, where higher activity densities will be combined with more efficient land use than possible in other island areas, granting the site a striking superregional style. If the possibility of such a layout would be considered by the Government and in the course of the coming decennia could subsequently be realized, Curacao might be able to attract some economic activities from abroad which would otherwise probably not contemplate to establish a branch on this island. In short, higher densities, nowhere feasible but on the ISLA site given its location on the island, may lead to more productive and efficient activities.

Such competitive advantages of the area make a CBA a more appropriate evaluation tool than a CEA.

13 CBA Refinery Activities

13.1 Introduction

In this chapter the welfare implication of the three upgrading investment cases will be discussed:
Case 1: Investment case with integration of BOO and pitch as input fuel for BOO;
Case 2: Investment case with integration of BOO and LSFO as input fuel for BOO;
Case 3: Investment case with integration of BOO and LNG as input fuel for BOO.

For each case two sub variants are distinguished in which the ownership is taken over by NEWCO and financing of the upgrading investments package is assumed through:
A. 100% equity; or
B. 30% equity/70% debt.

The table below shows the name of the several investment cases as reflected in this chapter.

Table 13.1 Investment cases to be discussed in this chapter

Upgrading investment case	Designation in this chapter
Base case: closure of the refinery in 2019	BC
Investment case with integration of BOO and pitch as input fuel for BOO + 100% equity	Case 1A
Investment case with integration of BOO and pitch as input fuel for BOO + 30% equity/70% debt	Case 1B
Investment case with integration of BOO and LSFO as input fuel for BOO + 100% equity	Case 2A
Investment case with integration of BOO and LSFO as input fuel for BOO + 30% equity/70% debt	Case 2B
Investment case with integration of BOO and LNG as input fuel for BOO + 100% equity	Case 3A
Investment case with integration of BOO and LNG as input fuel for BOO + 30% equity/70% debt	Case 3B

In the following sections the CBA results will be presented in a number of steps. The next section concerns a detailed discussion of all costs and revenue of case 1 and in particular 1B. In section 13.3 the results of the other investments cases will be discussed. Finally follows an overview of the results of the CBA (net welfare effect of the 6 cases).

13.2 Case 1: Investment case with integration of BOO and pitch as input fuel

Table 13.2 presents the outcome of the CBA of the two sub variants of the first upgrading investment case. Both variants show a positive net welfare effect. Precondition of this positive effect is the willingness of a party to invest in the refinery. The difference between the two variants is caused by the amount of taxes received in Curacao from NEWCO. In the B variant, these taxes are slightly lower compared to variant A.

Table 13.2 Net welfare effect of case 1A and 1B

	Net welfare effect (NAf million; NPV 2011)
Case 1A: BOO pitch, NEWCO 100% equity	2,848
Case 1B: BOO pitch, NEWCO 30%	2,785

Since we expect that case 1B is more likely to take place than case 1A, we prefer to discuss case 1B instead of case 1A in more detail in this section.

All cost and benefit items are calculated, discounted at 7% and aggregated into 25 main net present value entries. The NPV results in 2011 prices for case 1B are presented in the following table. The time horizon used for discounting costs and benefits of upgrading the refinery is 2045. Benefits and costs beyond this horizon are considered to be zero.

The upper reddish part shows 6 types of investment costs, the middle (blue) part the 19 possible positive or negative socio-economic revenue items, and the last part (yellow) the gross cost and revenue totals and the net revenues of case 1B. The figures are arranged in three columns. The first column refers to costs and revenues of the project case (investment in upgrading and operating revenues of the old and renewed refinery till 2045), the next column to the base case, i.e. closure of the refinery in 2019. It includes operating revenues till 2019 of the existing out-of-date refinery and costs of dismantling and 'no access' remediation. The third column shows the costs and revenues differences of case 1B and the base case. The sum of the items in the last column is NAf 2,785 and represents the total net present value (in 2011 prices) of the revenues received by all Curacao parties in this investment case, including the Government of Curacao.
The net revenues of the Government of Curacao consist of the revenues from Land Lease, Preferred Stock Dividend and taxes. The total net revenues of the government is NAf 746 million.

Table 13.3 Summary of cost and benefits of investment case 1B (case 1B)

NPV 2011 (x NAF 1 mio)	Case 1B	BC	1B-BC
Investment costs			
1 Programme to avoid further polution	100	84	16
2 Dismanling costs	39	133	-94
3 Soil remediation costs	65	220	-155
4 Investment costs oil depot	7	22	-16
5 Investment costs asphalt lake	30	30	0
6 Other costs	249	246	2
Revenues			
Permanent			
7 ISLA (direct VA)	2.289	911	1.378
8 ISLA (indirect VA)	707	461	246
9 Regular yearly investments + shut down (direct)	302	98	204
10 Land lease ISLA	282	191	91
11 Preferred stock divided ISLA	239	0	239
12 Taxes received in Curacao from foreign company	416	0	416
Temporary			
13 Investments in refinery (direct + indirect VA)	65	0	65
14 Program to avoid further pollution (direct + indirect VA)	48	41	7
15 Demolition (direct + indirect VA)	9	31	-22
16 Soil remediation (direct + indirect VA)	13	43	-30
17 Investments oil depot (direct + indirect)	1	3	-2
18 Asphalt pond (direct + indirect)	11	11	0
19 Employment effects	28	81	-53
External effects			
20 Environmental benefits of no access	pm	pm	pm
21 Preservation economy diversification	pm	0	pm
NPV 2011 (x NAF 1 mio)	**Case 1B**	**BC**	**1B-BC**
Total investment costs	490	736	-246
Total revenues	4.409	1.870	2.539
Permanent	4.235	1.662	2.574
Temporary	174	208	-34
Net revenues	3.919	1.134	2.785

The amounts included in table 13.3 can be explained as follows.

Investment costs of the intervention

The investment costs taken into account in the cost-benefit analysis only include investment costs to be paid by Curacao. Since the investments in the refinery will be financed by a foreign company the investment costs to upgrade the refinery are not included in the cost-benefit analysis.

1. Programme to avoid further pollution

To prevent further soil, groundwater and surface water pollution from the refinery, investments will take place in the coming two years in a seepage program, wells remediation, bay skimmers and oil catchers. Operation costs of this program will take place until the refinery is closed. The net NPV of this program is NAf 16 million.

2. Dismantling costs

The cost of dismantling the refinery structures is estimated at NAf 254 million (plus or minus 40%; see chapter 9 and 11) and will take place in the years 2038 and 2039 in investment case 1B and in 2020 and 2021 in the base case. The NPV of the difference between case 1B and the base case is NAf (39-133) -94 million.

3. Remediation costs

The costs of remediating the ISLA site at a minimum level are NAf 527 million and will take place within 5 years from 2040 in case 1B and from 2022 in the base case. The net costs (Case 1B – BC) are NAf -155 million.

4. Investment costs oil depot

Before closure of the refinery in both the base case and case 1B, investments in an oil depot has to take place to guarantee the availability of oil in Curacao. The total costs are NAf 37 million and will take place in the two years before closure of the refinery. The NPV of the difference between case 1B and the base case is NAf (7-22) -16 million.

5. Investment costs asphalt lake

Investment costs in cleaning the asphalt lake will take place in 2012-2015. The present value of the cost are NAf 30 million. These costs will occur irrespective what investment case will be chosen. The net costs (case 1B – base case) are therefore NAf 0.

6. Other costs

The item other costs consists of costs for:

- an organisation for the enforcement of environmental regulations,
- the operation cost of RdK; and
- the cost for contractors of the refinery for compulsory redundancy after closure of the refinery.

The NPV (case 1B – base case) are NAf 2 million.

Permanent gross intervention revenues

7. ISLA direct added value

The added value indicated under this item consists of the direct added value of ISLA (which are the wages of ISLA personnel) and its contractors. In the base case the direct added value is NAf 130 million annually with a NPV of NAf 911 million. After upgrading of the refinery in case 1B, the direct value added related to ISLA workforce will be NAf 185 million with a corresponding NPV of NAf 2,289 million. This implies that the net benefit will be NAf 1,378 million.

8. Indirect value added ISLA

The indirect value added of ISLA includes the value added of the suppliers of ISLA. The NPV of the difference between case 1B and the base case is NAf (707 – 461 =) 246 million.

9. Direct value added of regular yearly investment costs and shut down

Apart from day-to-day operations, every year shut down activities are planned and regular investments will take place. The annual direct value added of these activities in the base case is NAf 18 million. After investments in the refinery (case 1B) the value added will be NAf 31 million annually.

10. Land Lease ISLA

In case 1B the expected Land Lease revenues are NAf 18 million annually. In the base case the Land Lease revenues will decrease from NAf 35 million in 2012 to NAf 29 million in 2019. The NPV of the difference between case 1B and the base case is NAf (282-191) 91 million.

11. Preferred Stock Dividend ISLA

In case 1B the Preferred Stock Dividend of ISLA reduces from NAf 39 to 27 million in the period 2018-2037. In the base case these revenues are zero. The net revenues are therefore NAf 239 million. The calculations are based on the NEWCO II case as discussed in section 7.2.2. Determination Land Lease fee and Preferred Stock Dividend for ISLA

12. Taxes received in Curacao from foreign company

It is assumed that NEWCO will pay taxes in case 1B from year 2018 onwards, the NVP of these taxes are NAf 416. No revenues from taxes will take place in the base case.

Temporary gross intervention revenues

13. Direct and indirect value added of investments in refinery

Investments in the refinery will take place from 2013 till 2017 and offer work on the island to about 1493 fte. This amount of work represents a total direct and indirect value added of NAf 65 million (NPV). In the base case this effect is zero.

14. Direct and indirect value added of program to avoid further pollution

Investments in the program to avoid further pollution will result in direct and indirect value added in the base case and case 1B. The NPV of the difference between case 1B and the base case is NAf (48-41) 7 million.

15. Direct and indirect value added demolition

16. Direct and indirect value added soil remediation

Dismantling and soil remediation activities take place from 2021 until 2026 in the base case and from 2038 to 2044 in case 1B. These activities offer work to about 2,900 local fte. This amount of work represents a total direct value added of NAf 149 million.

After discounting this welfare contribution at 7% its present value (2011) is NAf 74 million in the base case and NAf 22 million in case 1B. The NPV of the differences between case 1B and the base case is NAf -52 million.

17. Direct and indirect value added investments in oil depot

18. Direct and indirect value added investments asphalt lake

Just like the previous items (15-18) investments in oil depot and cleaning up asphalt lake will generate employment for local workers on the island. The direct value added of both investments is NAf 18 million. The NPV in the base case is NAf 14 and in case 1B NAf 12 million.

19. Employment effects

Employment effects are the personnel benefits after closure of the refinery. The employees will receive a severance payment by the the refinery operator. This payment amounts to NAf 172 million in case 1B and NAf 148 million in the base case. The NPV of the differences between the two cases is NAf -53 million.

External effects

In this CBA the known monetary costs are balanced against a number of important mainly non-monetary or *external* benefits.

20. Environmental benefits of ‘no access’ or ‘do minimum’ cleaning

Important external welfare effects are benefits of dismantling the refinery and remediation of the ISLA site. Section 12.2 list the benefits of dismantling and ‘do minimum’ cleaning. Preferring the ‘no access and minimum cleaning policy over the ‘do nothing’ option means that the Government (and the public it represents) implicitly judge the value of the accompanying advantages higher than the costs of such a policy.

21. Preservation economic diversification

Another non-monetary benefit is the preservation of economy diversification in case 1B. Without a refinery, the economy of Curacao less diversified and more sensitive to fluctuations in the remaining economic activities on the island.

To illustrate the welfare effect of case 1B graphically, see figures 13.1a and 13.1b (both based on amounts presented in the last (yellow) part of Table 13.3). The left columns in figure 13.1a show the *total* investment costs and revenues (in NPV) related to case 1B and the reference alternative (base case) respectively. The right column gives the NPV of the net welfare change. Figure 13.1b shows only two columns. The left column presents the difference in the investment costs and the difference in revenues of both alternatives, while the right column shows (again) the net welfare change. (NB: do notice the difference in scale of the vertical axis!). In the next sections other sub variants will be discussed, and figure 13.1b will be used as a reference to compare the results of these sub variants with.

Figure 13-4a Case 1B
Total cost and benefits of case 1B, of reference (M) alternative (BC), and net project benefits

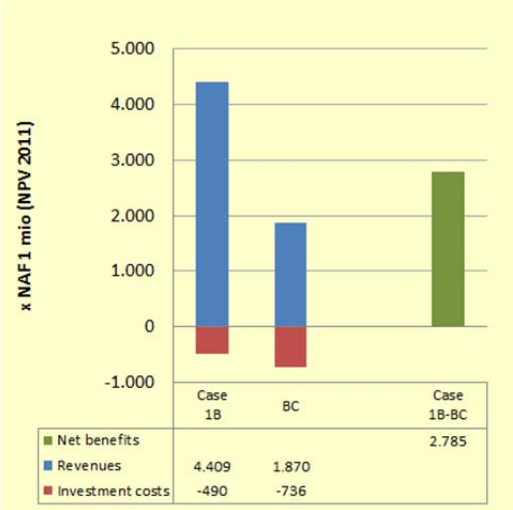
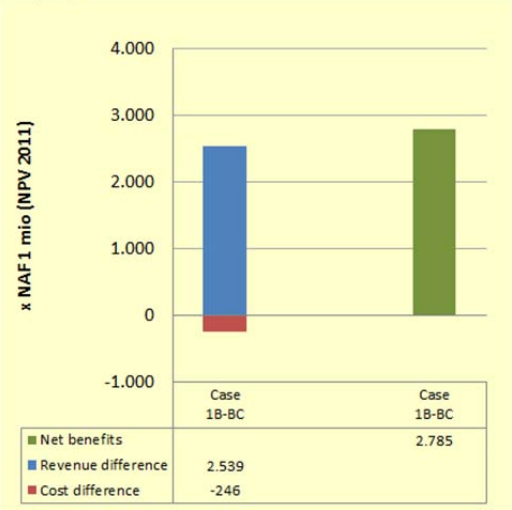


Figure 13-4b Case 1B
Cost and benefit differences between project and reference alternative (Case 1B- BC), and net project benefits



13.3 Other cases

Apart from case 1 (investment case with integration of BOO and pitch as input fuel for BOO) two other cases are analyzed:

- Case 2: Investment case with integration of BOO and LSFO as input fuel for BOO;
- Case 3: Investment case with integration of BOO and LNG as input fuel for BOO.

These sub variants are briefly discussed in this section.

13.3.1 Case 2: Investment case with integration of BOO and LSFO as input fuel

Table 13.5 presents the outcome of the cost-benefit analysis of the two variants of the second investment case. The positive net welfare effect of both sub variants (2A and 2B) are almost equal to the two variants in the first investment case. Again we have to stress that a crucial precondition of this positive effect is the willingness of an investor to invest in the refinery. The difference between the two sub variants is the amount of taxes received in Curacao from NEWCO. In the B variant, these taxes are slightly lower compared to variant A.

Table 13-5 Net welfare effect of case 2A and 2B

	Net welfare effect (NAf million; NPV 2011)
Case 2A: LSFO as input fuel, NEWCO 100% equity	2,829
Case 2B: LSFO as input fuel, NEWCO 30%	2,765

The results of case 2B are presented in table 13.6.

Table 13-6 Summary of cost and benefits of investment case 2B

NPV 2011 (x NAF 1 mio)	Case 2B	BC	2B-BC
Investment costs			
1 Programme to avoid further polution	100	84	16
2 Dismanling costs	39	133	-94
3 Soil remediation costs	65	220	-155
4 Investment costs oil depot	7	22	-16
5 Investment costs asphalt lake	30	30	0
6 Other costs	249	246	2
Revenues			
Permanent			
7 ISLA (direct VA)	2.290	911	1.380
8 ISLA (indirect VA)	702	461	241
9 Regular yearly investments + shut down (direct)	304	98	206
10 Land lease ISLA	282	191	91
12 Preferred stock divided ISLA	239	0	239
14 Taxes received in Curacao from foreign company	396	0	396
Temporary			
15 Investments in refinery (direct + indirect VA)	65	0	65
16 Program to avoid further pollution (direct + indirect VA)	48	41	7
17 Demolition (direct + indirect VA)	9	31	-22
18 Soil remediation (direct + indirect VA)	13	43	-30
19 Investments oil depot (direct + indirect)	1	3	-2
20 Asphalt pond (direct + indirect)	11	11	0
23 Employment effects	28	81	-53
External effects			
24 Environmental benefits of no access	pm	pm	pm
25 Preservation economy diversification	pm	0	pm
NPV 2011 (x NAF 1 mio)	**Case 2B**	**BC**	**2B-BC**
Total investment costs	490	736	-246
Total revenues	4.388	1.870	2.519
Permanent	4.214	1.662	2.553
Temporary	174	208	-34
Net revenues	3.899	1.134	2.765

Figure 13-7a Case 2B
Total cost and benefits of case 2B, of reference (M) alternative (BC), and net project benefits

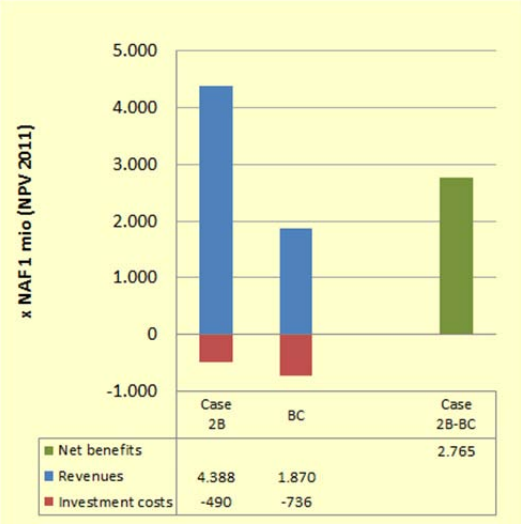
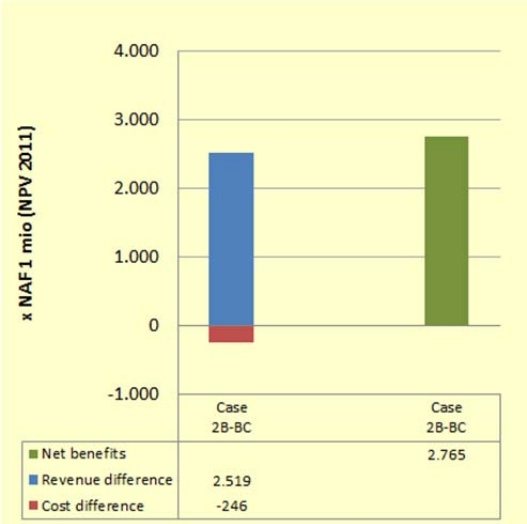


Figure 13-7b Case 2B
Cost and benefit differences between project and reference alternative (Case 2B- BC), and net project benefits



Comparison of figure 13.2b with figure 13.1b shows that the investment costs in case 1B and 2B are equal. In case 2B, the revenues are NAf 20 million less than case 1B. This is mainly caused by the lower income from taxes in case 2B.

13.3.2 Case 3: Investment case with integration of BOO and LNG as input fuel

The outcome of the cost-benefit analysis of the two sub variants of the third investment case is presented in table 13.8. Also in this case we have to underline that a precondition of this positive effect is the willingness of an investor to invest in the refinery. The difference between the two variants is the amount of taxes received in Curacao from NEWCO. In the B variant, these taxes are slightly lower compared to variant A.

Table 13.8 Net welfare effect of case 3A and 3B

	Net welfare effect (NAf million; NPV 2011)
Case 3A: LNG as input fuel, NEWCO 100% equity	3,221
Case 3B: LNG as input fues, NEWCO 30%	3,157

The results of case 3B are presented in Table 13.9.

Table 13-9 Summary of cost and benefits of investment case 3B

NPV 2011 (x NAF 1 mio)	Case 3B	BC	3B-BC
Investment costs			
1 Programme to avoid further polution	100	84	16
2 Dismanling costs	39	133	-94
3 Soil remediation costs	65	220	-155
4 Investment costs oil depot	7	22	-16
5 Investment costs asphalt lake	30	30	0
6 Other costs	250	246	3
Revenues			
Permanent			
7 ISLA (direct VA)	2.290	911	1.380
8 ISLA (indirect VA)	1.060	461	599
9 Regular yearly investments + shut down (direct)	304	98	206
10 Land lease ISLA	282	191	91
12 Preferred stock divided ISLA	239	0	239
14 Taxes received in Curacao from foreign company	431	0	431
Temporary			
15 Investments in refinery (direct + indirect VA)	65	0	65
16 Program to avoid further pollution (direct + indirect VA)	48	41	7
17 Demolition (direct + indirect VA)	9	31	-22
18 Soil remediation (direct + indirect VA)	13	43	-30
19 Investments oil depot (direct + indirect)	1	3	-2
20 Asphalt pond (direct + indirect)	11	11	0
23 Employment effects	29	81	-52
External effects			
24 Environmental benefits of no access	pm	pm	pm
25 Preservation economy diversification	pm	0	pm
NPV 2011 (x NAF 1 mio)	**Case 3B**	**BC**	**3B-BC**
Total investment costs	491	736	-245
Total revenues	4.782	1.870	2.912
Permanent	4.607	1.662	2.945
Temporary	175	208	-33
Net revenues	4.291	1.134	3.157

Figure 13-10a Case 3B
Total cost and benefits of case 3B, of reference (M) alternative (BC), and net project benefits

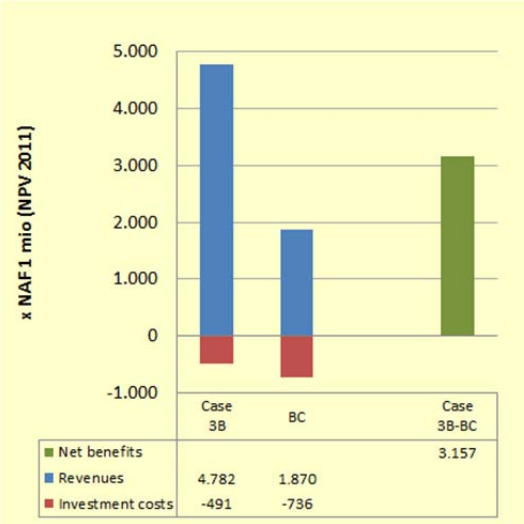
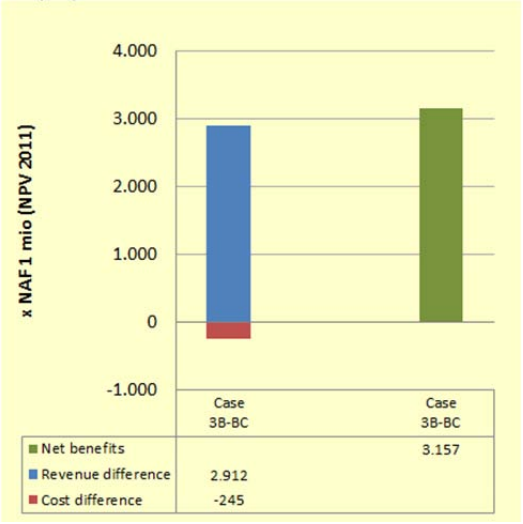


Figure 13-10b Case 3B
Cost and benefit differences between project and reference alternative (Case 3B- BC), and net project benefits



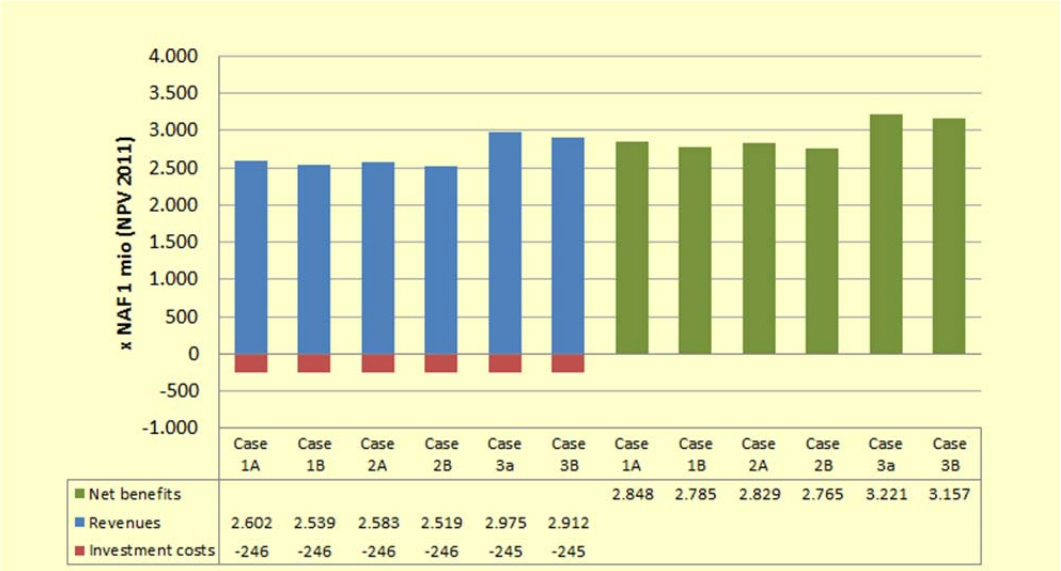
Comparison of Figure 13.3b with Figure 13.1b shows that the investment costs in case 1B and 3B are almost equal. In case 3B, the revenues (NPV) are NAf 372 million higher than case 1B. This is

mainly caused by the higher indirect value added of ISLA due to the LNG terminal. This investment case also results in more taxed receipts from foreign companies.

13.4 Summary of the base set of results

In this section a summary of the net welfare effect of the 6 investment cases is presented.
The main results discussed in the preceding sections are summarized in Figure 13.4. The figure shows the outcomes of all six sub variants of the refinery investment cases (differences of costs (red) and revenues (blue), and net welfare increases (green).

Figure 13.11 Overview of the outcomes of six refinery investment case variants



As can be concluded from the table, all investment cases show a positive net welfare effect ranging from NAf 2.8 to 3.2 billion. This means that all cases seem to be economically profitable. It has to be stressed however that the table gives a rosy picture of the investment cases. The following conditions have to be fulfilled before this welfare effect will take place:

- A company must be found that will be prepared to invest in the refinery;
- The investor must be prepared to pay the lease fee in line with the assumptions discussed in chapter 7;
- The Preferred Stock Dividend assumed in chapter 7 will actually be paid to Curacao;
- The taxes according to the assumptions discussed in chapter 7 will be paid.

Investment case 3 shows the highest positive net economic benefit for Curacao. However, as discussed in chapter 6, the introduction of LNG to Curacao is quite uncertain. The second best option are both investment cases 1 and 2 with almost the same net economic benefit.
Many of the assumptions underlying the cases discussed in this chapter are of course encompassed by risks and uncertainties. For this reason we tried to strengthen the quality of the cost benefit analysis, by carrying out a sensitivity analysis, in which a number of alternative assumptions are tested and the postulated values of a number of crucial values are changed (see Chapter 15).

14 CBA Schottegat area redevelopment options

14.1 Introduction

In this and the next chapter the welfare implications of the ISLA redevelopment options A and B (track 2 strategies) will be discussed. Option 2A focuses on a future development of the site with all types of industrial activities (manufacturing, offices and warehousing activities) except tourism, and of housing facilities for employees and their families. Option 2B includes an even broader mix of activities, such as private and public services, light industries, some hotels, residential buildings and facilities. It comprises moreover extensive 'green' open spaces, boulevards and beaches.

As described earlier the welfare effects of each strategic option are defined as the annual differences between the expected development with the strategic project (P) and the development expected to happen in the reference, i.e. 'do minimum' situation (M). The 'do minimum' alternative for redevelopment interventions A and B consists of two parts: a necessary 'no access' treatment of the ISLA site if no re-development will take place till 2045 (M-ISLA), and realization elsewhere on the island of the future growth of economic activities (M-non-ISLA); see Section 2.4 and Chapter 12.
The welfare effects can be split up into priced and non-priced or external effects. The way monetary values are attached to external effects is described in Chapter 11. The positive and negative values of all the annual effects (P - M) are weighted by a discount rate in order to derive the net present value (NPV) in 2011 of the strategy. This NPV represents the gross economic benefits of the intervention. After deduction of the investment costs (NPV of remediation and construction costs) one obtains the net economic benefits of the project.

For redevelopment variant A four sub variants are specified, dependent on assumptions about the rate of national economic growth (according to a low or basic and a higher growth scenario, described in Chapter 10), and assumptions about building height and density (lower and higher) to be realized on a redeveloped Schottegat area (Chapter 11; section 11.2). For redevelopment variant B only two sub variants were studied: one based on the low and the higher growth scenario. This means that we start our cost-benefit analysis (CBA) for a base set of six different redevelopment sub variants

The redevelopment picture of the ISLA from 2011-2045 and the results of the cost-benefit analysis depend on a large number of observations and assumptions carefully defined and quantified during the study (the parameters of the CBA calculation model). Examples of such assumptions are the zoning, growth and density parameters determining the results of and differences between the six basic sub variants. However, most parameters used are identical for all sub variants. As the values chosen for the parameters are often essentially uncertain, and sometimes must be expected to have a substantial impact on the CBA results, a sensitivity analysis has been carried out. By varying the values of a number of key parameters one gets an impression of the possible impact of such parameter values on the results. The outcome of this supplementary analysis will be described in the next chapter (Chapter 15). In this chapter the CBA for the base case set of six sub variants remains limited to what the consultants – generally after discussion with local experts - consider the most probable set of parameter values.

In the following sections the CBA results are presented stepwise. First sub variant A, characterized by low economic growth and relatively low building height and density (i.e. sub variant A-LSLD) will be discussed to some extent (section 14.2). Then follows an overview of the three remaining sub

variants A (section 14.3). The next step concerns both sub variants B (section 14.4). In section 14.5 follow the external effects (14.5). Then the relation of the CBA results to another often used assessment tool (i.c. economic impact analysis or EIA) will be explained (section 14.6). Finally follows a summary of the base set results for all six sub variants (section 14.7).

14.2 Option A: Housing and industries - low growth, normal density

Table 14.1 presents a summary of the results of the cost-benefit analysis of the housing and industries sub variant under the assumption of a national economic growth according to the basic (or low growth) scenario – i.e. average annual GDP increase of 1,2% till 2020, and 1% afterwards, from 2020 till 2045. As mentioned in Chapter 11, this sub variant (denoted as 2A-LSLD) is further characterized by 'normal' building height and densities of houses and offices (according the official standard regulations in Curacao).

Table 14.1 Summary of cost and benefits of strategic option 2A
Low growth scenario; normal density, (variant A-LSLD)

	NPV 2011 (x NAF 1 mio)	P	M (ISLA)	M (non-I)	M (total)	(P - M)
	Investment costs					
1	Land acquisition	-1	0	0	0	-1
2	Dismantling costs ISLA site	133	133	0	133	0
3	Soil remediation ISLA site	395	220	0	220	175
4	Site preparation	68	0	68	68	0
5	Construction costs	1.039	0	1.048	1.048	-9
6	Design, management	16	4	13	16	0
	Revenues					
7	Housing (sales, rentals)	1.022	0	889	889	133
8	Tourism (direct VA)	0	0	0	0	0
9	Other industries (direct VA)	2.107	0	2.107	2.107	0
10	Dismantling, remediation (direct VA)	86	60	0	60	26
11	Construction (direct VA)	319	0	321	321	-3
12	Tourism (indirect VA)	0	0	0	0	0
13	Other industries (indirect VA)	205	0	205	205	0
14	Dismantling, remediation (indirect VA)	12	9	0	9	4
15	Construction (indirect VA)	46	0	47	47	0
16	Tourism (induced effect)	0	0	0	0	0
17	Other industries (induced effect)	0	0	0	0	0
18	Dismantling, remediation(induced effect)	0	0	0	0	0
19	Construction (induced effect)	0	0	0	0	0
20	Other benefits	90	0	0	0	90
	NPV 2011 (x NAF 1 mio)	**P**	**M (ISLA)**	**M (non-I)**	**M (total)**	**(P - M)**
	Total investment costs	1.650	357	1.129	1.485	165
	Total revenues	3.887	68	3.568	3.636	251
	Net revenues	2.237	-289	2.440	2.151	86

Based on the features, described in Chapters 10 and section 11.2, more than 50 annual cost and benefit items are identified, calculated, discounted (at 7%) and aggregated into 20 main net present value entries. The NPV results (2011 prices) are presented in the table.
The upper (reddish) part shows six types of investment costs, the middle (light blue) part the fourteen possible positive or negative socio-economic revue items, and the last (yellow) part gross cost and revenue totals and the net revenues of intervention option 2A, according to this sub variant. The figures are arranged in five columns. The first column (P) refers to costs and revenues of the redevelopment of the Schottegat area and the next three columns to the reference alternative, i.e. the development which will take place if ISLA will not used till 2045. The figures for the reference case are split in two parts. The first part (column two: M (ISLA)) regards costs and revenues related to the 'no access' policy to be followed for ISLA in the 'do minimum' alternative; the second part (column three: M(non-ISLA)) refers to the costs and revenues to be made for the development of economic activities which must be located elsewhere on the island, if the ISLA site

will not be available. Column 4 shows the total costs and revenues of the reference alternative (M Total).
The last column is the most important one and presents the cost and revenue differences of the intervention (or project) alternative and the reference alternative (P – M).
The sum of the items in this last column is NAf 83 million, and represents the *total net present value* (in NPV 2011) of this sub variant 2A.LSLD.

The amounts, included in Table 14.1 can be explained as follows.

Investment costs of the intervention

1. *Land acquisition*
   Developing the Schottegat area instead of a site elsewhere on Curacao, means that elsewhere planning area can be saved for other activities of some (yet unknown) economic use in the future. The economic value of this 'saved' area is called the 'opportunity cost' of this elsewhere site. Saving this site for other potential uses is a benefit (or a negative cost item) to be ascribed to the ISLA redevelopment project. The saved area (493 ha) was valued at NAf 1/m^2 (or NAf 4.9 million in total) and put in use gradually between 2027 and 2045. The present value (PV at 7%) amounts to NAf - 972,000 (≈ NAf -1 million). The net economic benefit is then NAf +1 million.

2. *Dismantling costs ISLA site*
   The costs of dismantling the present refinery structures is estimated on NAf 254 million (plus or minus 40%; see Chapters 9 and 11) and will take place in the years 2020 and 2021. The PV in 2011 at 7% is NAf 133 million. Please note that this costs will occur, irrespective what option will be chosen (ISLA redevelopment or 'do minimum' alternative). The net costs (P – M) are therefore NAf 0!

3. *Remediation costs ISLA site*
   The costs of remediating the ISLA site to reuse it for development according to the A2.LSLD option are estimated on NAf 1,466 million (plus or minus 40%; see Chapters 9 and 11). As the costs will be distributed over a long period (2022-2041), the PV of this amount is NAf 395 million. If redevelopment will not take place, only containment costs must necessarily be made (NAf 527 million). But as these costs must be made immediately after closure of the refinery (i.e. in 2020 and 2021) their PV is relatively high, viz. NAf 220 million. The NPV (P – M) of remediation is therefore NAf (395 – 220) million = NAf 175 million.

4. *Site preparation costs*
   Site preparation for ISLA redevelopment (after dismantling and necessary remediation) is assumed to be equal to development elsewhere (in the reference case), and will take place during the same development period (gradually from 2027 till 2045). The costs at current prices are estimated to be NAf 345 million. The PV of this amount is 68 million. The NPV however is NAf 0, because these costs must be made irrespective the option chosen (project or reference alternative).

5. *Construction costs*
   The same goes for construction costs (consisting of a number of specified costs items); in case of redevelopment these costs come to NAf 4,954 million, with a PV of NAf 1,039 million. This time, however, the costs in the reference alternative are slightly higher (NAf 4,986 million, and a PV of NAf 1,048 million), because of differences in the costs of electricity, water and access

roads infrastructure. This leads to a limited advantage for the redevelopment alternative (PV: NAf 9 million).

6. *Design and management costs*
   There will be no real difference in plan, design and management costs between development on ISLA or elsewhere: NPV of NAf 0.

Gross intervention revenues

7. *Housing (revenues from sales and rentals)*
   According to redevelopment alternative 2A-LSLD the Schottegat area will till 2045 provide in the housing need of about 15,000 inhabitants. 281 ha will be developed for housing activities, on which 310 houses and apartments will be built for people in the lower income classes (to be built between 2027 and 2031), and more than 5,300 for people in higher income classes (between 2027 and 2045). In the reference situation these houses will be built on other locations on the island.
   The basis for the estimates revenues from sales, respectively the present value of the housing rents, are construction costs times an average factor of 1.3 for middle and high income class houses and 1.0 for lower income class houses. Given the pace in which these houses will be realized and moved into, total revenues till 2045 are estimated on NAf 4,680 million, and a PV of NAf 889 million. Based on discussions with local estate agents it was assumed that, if the same houses will be located on the cleaned, centrally located and highly presentable Schottegat area, the revenues per house will be higher with a PV of NAf 1,022. This implies that the net benefit or rent of building on ISLA instead of elsewhere will be NAf 133 (PV 2011).

8. *Tourism (direct Value Added revenue)*
   As mentioned before strategic option 2A implies that a redeveloped Schottegat area will not accommodate any touristic activity. Therefore no VA in this sector can be related to this intervention.

9. *Other industries (direct Value Added revenue)*
   For other industries on the other hand an area of 93 ha will be equipped for manufacturing, offices and warehousing activities. This will provide work opportunities to an increasing number of workers with a maximum of some 8,000 workers in 2045. The direct value added related to this workforce will be NAf 962 million annually. The PV in 2011 of the accumulated direct VA is NAf 2,107 million. But, as the same amount of VA will be realized elsewhere in the reference alternative, the net benefit will be zero.

10. *Dismantling of refinery structures and soil remediation (direct Value Added revenues)*
    Dismantling and soil remediation activities take place from 2021 until 2026, and offer some 5,150 man-years of work on the island, if remediation is not restricted to containment of further spread of soil pollution, but adequate for the subsequent redevelopment proposed. This amount of work represents a total direct value added of NAf 540 million. It should be assumed, however, that a substantial part of the workers involved will be foreigners. Therefore only 50 per cent of the value added is considered as a contribution to national welfare (i.e. NAf 270 million). The other 50% are assumed to be related to foreigners. Their wages should therefore not be considered as additional value added for Curacao and as a net welfare contribution. After discounting this welfare contribution at 7% its present value (2011) is NAf 86 million. If no redevelopment takes place – i.e. in the 'do minimum' reference case – remediation remains restricted to containment of pollution spread. This 'no access' alternative requires less man-years and produces less value added. The present value will then be limited to NAf 60 million,

with the implication that the NPV of dismantling and remediation for project alternative 2A.LSLD comes to NAf 26 million.

11. *Construction (direct Value Added revenues)*
Redeveloping ISLA or developing other zoning areas on Curacao further requires a lot of construction work during the period of 2027 to 2045. For this temporary activity 36,300 man-years of work are needed, leading to an estimated direct value added of NAf 1,906 million. It is assumed that 80 per cent of this VA will be earned by local workers (NAf 1,526 million) and only 20 per cent by foreigners. As the earnings are spread over a long period, the present value in 2011 – despite the large number of man-years involved – amounts to only NAf 319 million. However, more important is that the majority of the work involved is not specifically related to ISLA. For in the reference alternative a comparable development will take place elsewhere on the island, with even a slightly higher value added (because on other locations the costs of physical infrastructure facilities will be somewhat higher). The small net benefit is therefore negative and runs to NAf – 3 million.

12. *Tourism (indirect Value Added revenue)*
Indirect value added (or 'ripple') effects refer to backward and forward impacts in the production chain of industries, caused by direct effects in a sector. As there are no touristic activities in this redevelopment option, there will be no indirect effects.

13. *Other industries (indirect Value Added revenue)*
Based on the permanent direct VA effect by industrial activity (see sub 9) permanent indirect effects have been estimated by using sectorial indirect/direct VA multipliers. Total indirect VA effect realized during the operational period 2027 - 2045 in all other industries (than tourism) together sums up to NAf 6,276 million, with a present value of NAf 1,023 million. However, this 'ripple' impact must not be equated to a welfare effect. As mentioned in section 11.2 it was assumed that only 20% of the indirect effect can be considered as potentially contributing to national welfare (present value NAf 205 million). In fact the net welfare contribution is even lower. For, if the direct effects of new permanent economic activities will not be realized on the Schottegat area but elsewhere (reference alternative) and if they are of the same amount, indirect effects remain the same in the with (P) and without (M) intervention cases. This means that ISLA related permanent indirect effects (P – M) have no impact at all on national welfare.

14. *Dismantling and remediation (indirect Value Added revenue)*
The indirect VA effects related to the temporary dismantling and cleaning activities reflect a different situation. Now the present value of the total indirect effect is NAf 62 million in the project case (P) and NAf 43 million in the reference case (M). Assuming that 20% of these effects contribute to national welfare, the NPV of this revenue item is NAf (12 – 9) million = (approximately) NAf 4 million.

15. *Construction(indirect Value Added revenue)*
The same reasoning holds for the indirect effects of the temporary construction activities. (present value of NAf 231 million, if taking place on ISLA, and NAf 233 million if realized elsewhere (100%), or NAf 46 million and NAf 47 million (20%)). The resulting difference in NPV of this revenue item is estimated at less than NAf 1 million.

16. *Tourism (induced Value Added revenue)*
17. *Other industries (induced Value Added revenue)*
18. *Dismantling of refinery structures (induced Value Added revenues)*
19. *Remediation of ISLA site (induced Value Added revenues)*

    In Chapter 3 it was mentioned that in Economic Impact Analyses (EIAs) often attention is paid to so-called induced effects (amounts of money locally spent by parties whose wages and salaries are directly or indirectly related investment or to operational phases of a project). It was decided, in line with the prevailing CBA methodology, to not interpret them as welfare effects. Later on (in Chapter 14.7) we will review this type of effects, in order to allow a comparison of our type of results with those of other recent impact studies.[21]

20. *Other benefits*

    This heading refers to two types of assumed advantages of concentrating new high quality services on the Schottegat area.

    In the first place one may expect that concentration on this representative location will stimulate frequent face to face contacts and therefore leads to additional returns and profits, which will not be realized if the services will be distributed among other zoning areas in the pipeline. One may call this effect the ISLA related *synergy effect*. We hypothesize for this sub variant (2A-LSLD) that the value of this synergy effect can be related to the value added of the total service sector, which increases from NAf 82 million to NAf 820 million during the period 2027 till 2045, according to the low growth scenario (resulting in a present value of NAf 1.807 million). We further suppose that this present value can be put on at least 5%, or a present value of NAf 90 million.

    The second type of effect also relates to supposed locational advantages of a high quality (commercial) service sector, if established on ISLA. It is assumed that it will specifically appear in the high density sub variants (and therefore *not* in this sub variant 2A.LSLD). The effect is called an *exceptional export orientation*. It means that, to a certain extent, internationally oriented activities, serving the region, can be attracted to the ISLA location, if it offers an inspiring urban environment and radiates an international business atmosphere. A factor which seems indispensable for such a development will be a high density concentration of commercial and public activities. We assume that this can be realized in the high density sub variants, and that the economic effect in those sub variants can be estimated to be equal to the synergy effect (i.e. 5% of the service sector present value).

    Both 'bonus' effects are presumed to exist irrespective of the development stage of ISLA. One should realize that this may imply an overestimation of such bonuses in the early stages of development.

The previous discussion makes it clear that the CBA is essentially an incremental or 'marginal' approach. The welfare advantages of the policy intervention are always calculated as differences of costs and revenues of the intervention (P) and measures taken (if any) in the reference situation (M). This means that total (or absolute) costs and revenues of the intervention in itself or the reference alternative in itself are only relevant to calculate their balance (here: the NAf 86 million (NPV in 2011)).

Note that if redevelopment of ISLA will not be accompanied by synergy effects (or 0%, compared to development elsewhere on the island), net benefits become NAf 90 million lower, and total to NAf -4 million.

To illustrate this graphically, see Figures 14.1a and 14.1b (both based on amounts presented in the last (yellow) part of Table 14.1). The left columns in Figure 14.1a show the *total* investment costs

[21] E.g. the recent 'Economic Impact Study Eastpoint Curaçao', 2011, mentioned earlier.

and revenues (in NPV) related to the ISLA redevelopment alternative and the reference alternative respectively. The right column gives the NPV of the net welfare change. Figure 14.1b shows only two columns. The left column presents the difference in the investment costs and the difference in revenues of both alternatives, while the right column shows (again) the net welfare change. (NB: do notice the difference in scale of the vertical axis!). In the next sections other sub variants will be discussed, and Figure 14.1b will be used as a reference to compare the results of these sub variants with.

Figure 14.1a Low growth, normal density Variant A-LSLD
Total cost and benefits of project (P), of reference (M) alternative, and net project benefits

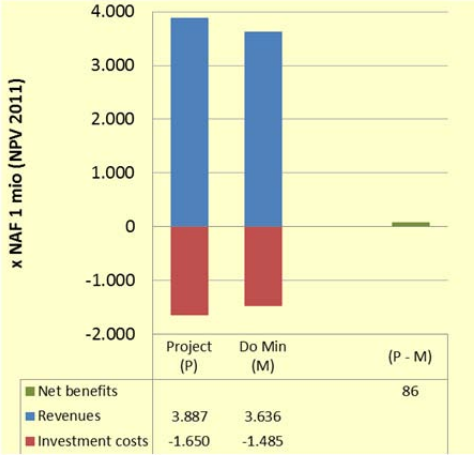
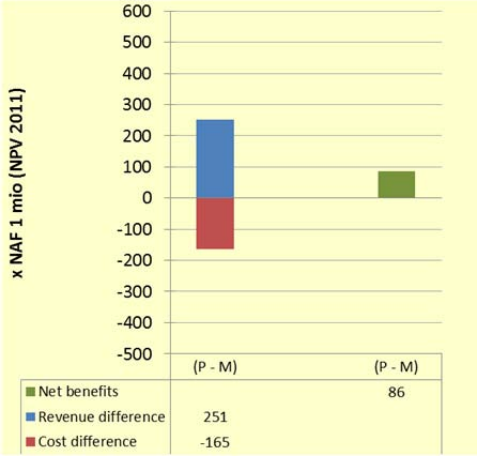


Figure 14.1b Low growth, normal density Variant A-LSLD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits



The time horizon and its impact on net redevelopment benefits

The time horizon used for discounting ISLA redevelopment costs and benefits is 2045. Benefits and costs beyond this horizon are considered to be zero. An important reason for this choice is that the same time horizon was used to evaluate the refinery options. The economic lifetime of a refinery was assumed to be 20 years, and the first possible year of operation a refinery option will be 2025.

There is no reason to assume that ISLA redevelopment investments, taking place from 2025 (and partly even from 2020) onward, will have an economic lifetime, comparable with that of a refinery. Limiting redevelopment revenues to the year 2045 is therefore a rather arbitrary choice. It can lead to a substantial underestimation of long-term benefits, relative to short-term costs.
There are, however, some arguments to defend this imperfect procedure. Firstly, excessive underestimation will be prevented because ISLA redevelopment benefits are treated in exactly the same way as development benefits foregone, to be realized on other island locations in the reference alternative. Only 'incremental' benefits are therefore subject to underestimation. Another argument is that, the longer the time horizon chosen, the higher uncertainties regarding developments, forecast by the scenarios. This means that it becomes nearly impossible and senseless to take a longer time horizon. Finally one should realize that the present value of future benefits and costs diminish because of the discounting procedure. At a 7% discount rate an amount of NAf 1,000, earned in 2045, has a present value of only NAf 100 in 2011. The further away the benefit and the higher the discount rate the lower the present value.

Despite the above arguments one should, however, keep in mind that the results of the time horizon chosen for the redevelopment sub variants imply an systematic underestimation of the net benefits calculated and presented in this chapter.

14.3 Option A: Housing and industries – other sub variants

Apart from the low economic growth scenario/normal building density sub variant, three other sub variants of redevelopment alternative A are analyzed:

- Low growth scenario/higher density A-LSHD;
- Higher growth scenario/normal density A-LHLD
- Higher growth scenario/higher density A-HSHD

These sub variants are briefly discussed in this section.

14.3.1 Low growth scenario and higher densities

The results of the low growth scenario/higher density sub variant are presented in Table 14.2. Differences with the first sub variant are caused by the higher number of houses (ca. 500 instead 300 for low income dwellers, and ca. 9,600 instead of 5,400 for higher income dwellers) on nearly the same zoning area for housing (an increases from 281 to only 294 ha), and by concentrating the same number of offices employees (6,000) on a much smaller zoning area for services (15 instead of 35 ha); see Tables 11.2 and 11.3.

The larger number of houses implies that this time ISLA redevelopment must be compared with a somewhat different reference alternative: if the new houses would be built elsewhere – with normal housing density – 312 additional ha would be needed, leading to additional costs of project related site preparation elsewhere. Site preparation costs in the reference alternative increase therefore from NAf 68 million to NAf 111 million, causing a net benefit of NAf 43 (NPV). The additional demand for building area in the reference alternative means that this intervention saves more space and land acquisition costs elsewhere than in the low density case (in this sub variant NAf – 2 million).

Construction costs of houses and offices increase more on the Schottegat area (characterized by not only more but also higher building) than on other locations (with normal density). Site preparation costs elsewhere, on the other hand, increase because of the higher demand for zoning space. The net costs of construction change therefore from NAf – 9 million in sub variant A-LSHD to NAf + 21 million in this sub variant A-LSHD. The NPV of all investment costs together decreases from NAf 165 million in the former sub variant to NAf 144 million in this sub variant.

Table 14.2 Summary of cost and benefits of strategic option 2A
Low growth scenario; high density, (variant A-LSHD)

NPV 2011 (x NAF 1 mio)		P	M (ISLA)	M (non-I)	M (total)	(P - M)
Investment costs						
1	Land acquisition	-2	0	0	0	-2
2	Dismantling costs ISLA site	133	133	0	133	0
3	Soil remediation ISLA site	395	220	0	220	175
4	Site preparation	68	0	111	111	-43
5	Construction costs	1.606	0	1.585	1.585	21
6	Design, management	16	4	21	24	-8
Revenues						
7	Housing (sales, rentals)	1.744	0	1.586	1.586	159
8	Tourism (direct VA)	0	0	0	0	0
9	Other industries (direct VA)	2.107	0	2.107	2.107	0
10	Dismantling, remediation (direct VA)	86	60	0	60	26
11	Construction (direct VA)	482	0	488	488	-6
12	Tourism (indirect VA)	0	0	0	0	0
13	Other industries (indirect VA)	205	0	205	205	0
14	Dismantling, remediation (indirect VA)	12	9	0	9	4
15	Construction (indirect VA)	70	0	71	71	-1
16	Tourism (induced effect)	0	0	0	0	0
17	Other industries (induced effect)	0	0	0	0	0
18	Dismantling, remediation(induced effect)	0	0	0	0	0
19	Construction (induced effect)	0	0	0	0	0
20	Other benefits	181	0	0	0	181
NPV 2011 (x NAF 1 mio)		**P**	**M (ISLA)**	**M (non-I)**	**M (total)**	**(P - M)**
Total investment costs		2.217	357	1.717	2.073	144
Total revenues		4.887	68	4.456	4.525	362
Net revenues		2.669	-289	2.740	2.451	218

Figure 14.2a Low growth, high density
Variant A-LSHD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits

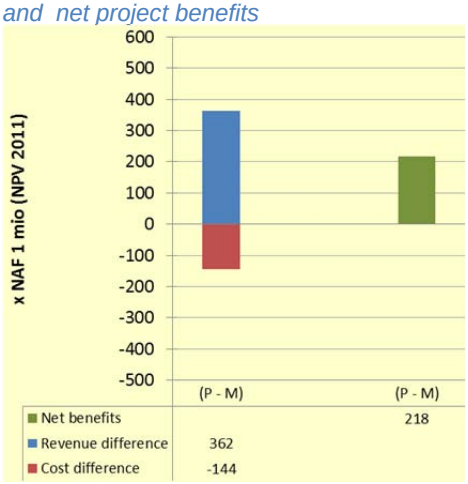
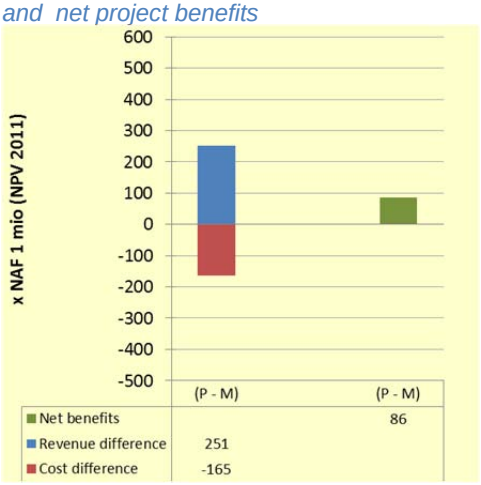


Figure 14.1b Low growth normal density
Variant A-LSLD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits



On the revenues side there are also some remarkable changes. The profit on housing sales leads to a PV of NAf 159 million instead of NAf 133 million (NAf + 26 million). Net direct value added effects of construction decrease with NAf 3 million, from NAf -3 million to NAf -6 million, and net indirect value added effects of construction with NAf 1 million. The largest revenue increase arises from the higher density related export orientation (5% of VA of the service sector). As a consequence other benefits increase with NAf 91 million, from NAf 90 million in sub variant A-LSLD to NAf 181 million in this sub variant A-LSHD.
The NPV of total estimated revenues becomes therefore NAf 362 million in this sub variant, and the NPV of net benefits NAf 218 million (see also Figure 14.2).

Comparison of Figure 14.2 with Figure 14.1b shows that, because the net investment costs are higher and revenues for the low growth/high density alternative are lower than the corresponding

values for the low growth/normal density alternative, the final result of the cost benefit analysis becomes substantially higher (the NPVs of net overall benefit are NAf 218 million and NAf 86 million, respectively).
Note again that, if synergy and export effect on ISLA, relative to the reference case, are completely missing, benefits would be NAf 181 million lower.

14.3.2 High growth scenario and normal densities

We come now to the optimistic or higher growth/normal densities alternative (A-HSLD; see Table 14.3). The higher economic growth rate leads to more economic activity and an earlier need for adequately prepared industrial space on the Schottegat area. Of the total available area (493 ha) 142 ha will be reserved for water related industry and 94 ha for other industries. This means that only 180 ha will be left for housing and 77 ha for neighborhood amenities (see Table 11.2).

Table 14.3 Summary of cost and benefits of strategic option 2A
Higher growth scenario; normal density, (variant A-HSLD)

NPV 2011 (x NAF 1 mio)		P	M (ISLA)	M (non-I)	M (total)	(P - M)
Investment costs						
1	Land acquisition	-1	0	0	0	-1
2	Dismantling costs ISLA site	133	133	0	133	0
3	Soil remediation ISLA site	522	220	0	220	302
4	Site preparation	68	0	48	48	20
5	Construction costs	946	0	933	933	13
6	Design, management	4	4	9	13	-8
Revenues						
7	Housing (sales, rentals)	743	0	646	646	97
8	Tourism (direct VA)	0	0	0	0	0
9	Other industries (direct VA)	3.574	0	3.519	3.519	56
10	Dismantling, remediation (direct VA)	105	60	0	60	45
11	Construction (direct VA)	292	0	283	283	9
12	Tourism (indirect VA)	0	0	0	0	0
13	Other industries (indirect VA)	349	0	343	343	5
14	Dismantling, remediation (indirect VA)	15	9	0	9	7
15	Construction (indirect VA)	42	0	41	41	1
16	Tourism (induced effect)	0	0	0	0	0
17	Other industries (induced effect)	0	0	0	0	0
18	Dismantling, remediation(induced effect)	0	0	0	0	0
19	Construction (induced effect)	0	0	0	0	0
20	Other benefits	173	0	0	0	173
NPV 2011 (x NAF 1 mio)		**P**	**M (ISLA)**	**M (non-I)**	**M (total)**	**(P - M)**
Total investment costs		1.673	357	990	1.347	326
Total revenues		5.294	68	4.832	4.900	394
Net revenues		3.621	-289	3.841	3.553	68

The present value of soil remediation costs (NAf 522 million) is higher than in the former alternatives (NAf 395 million), because the higher growth rate forces to move these costs forward in time. Site preparation costs are no longer equal for ISLA and locations elsewhere (as in sub variant A-LSLD), because the Schottegat area can accommodate water related industries and other locations cannot. The PV of the cost difference between ISLA and location elsewhere is NAf 20 million. There are also differences in construction costs between lower and higher growth alternatives: less houses, more offices, a different industry mix and a different spread of the costs over time leads to net cost of NAf +13 million, instead of NAf – 9 million for the first sub variant. The NPV of all investment costs differences (P-M) sums up to NAf 326.

The higher growth rate and location priority given to industrial activities instead of housing, combined with normal building density, result in a much lower number of new houses than in the low growth/normal density alternative (3,700 instead of 5,700 houses; see Table 11.3). This ends in lower gross and net sales revenues (NPV: NAf 97 million, instead of NAf 133 million in the low growth alternative A-LSLD). The value added revenues by contrast are higher. Industrial direct VA on ISLA increases to NAf 3,574 million (was NAf 2.107 million) and is no longer equal to the

revenues on other locations (because they lack water related activities), resulting in a net industrial VA of NAf 56 million. The net direct VA related to investment costs, and all net indirect value added items change correspondingly. The same holds for ISLA related synergy effects (other benefits) with an estimated value of NAf 173 million (density related additional export effect is not relevant here). The NPV of all revenue items sums up to NAf 394 million.
The implication of all this is that, despite the better growth performance of the national economy as a whole, the net CBA result for this ISLA redevelopment sub variant is NAf 68 million, i.e. lower than both low growth sub variants, discussed before. The result is summarized in Figure 14.3, which can be opposed to the outcome of the first sub variant (Figure 14.1b).

Figure 14.3 Higher growth, normal density Variant A-HSLD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits

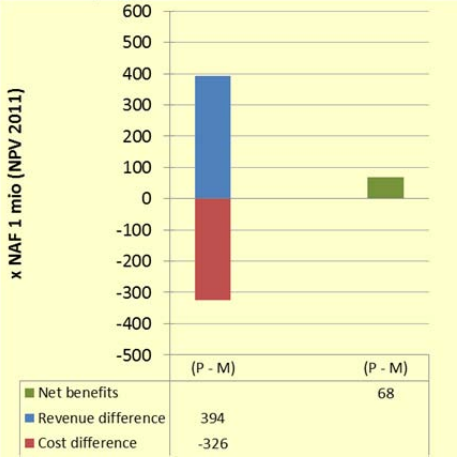
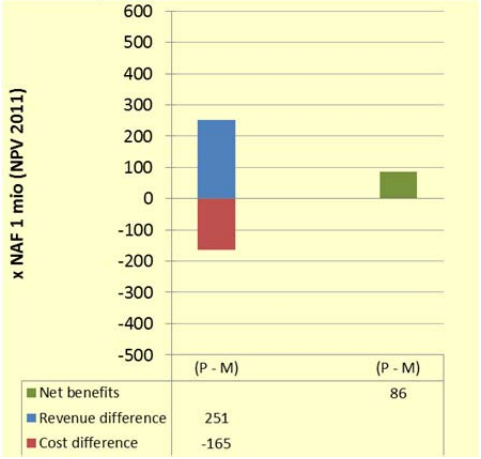


Figure 14.1b Low growth, normal density Variant A-LSLD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits



14.3.3 High growth scenario and higher densities

The result of the last A sub variant (optimistic growth/higher density) is given in Table 14.4. Here it is assumed that the employment in offices on ISLA (more than 11,000 employees in 2045, like in the high growth/normal density variant; see Table 11.3) are accommodated not on 67 ha but on an area of only 38 ha. The area thus saved will be used for housing purposes. The high density sub variant further implies that, instead of 3,700 new dwellings in sub variant A-HSLD, 7,100 houses will be built on the SLA area reserved for housing (207 ha).

This combination of high density and optimistic growth requires higher construction costs in the project alternative as well as in the reference alternative. The difference in construction costs (P-M) becomes larger in this sub variant (NAf 64 million) than in the A-LSHD (low growth, higher density) sub variant (NAf 21 million). This brings the sum of the NPV of total investment costs for this case on NAf 337 million (while this total amount was NAf 144 for the former sub variant).

The higher amount of investment costs is more than compensated by higher revenues. Although sales revenues of houses and the temporary direct and indirect value added of construction increase somewhat, the decisive factor here is ‘other benefits’ (NAf 309 million). They comprise now not only synergy effects but also an additional export effect (both 5% of the VA realized in the service sector).
This has as a consequence that the present value of the net CBA result for this sub variant is calculated at NAf 226 million. The result is shown in Figure 14.4.

Table 14.4 Summary of cost and benefits of strategic option 2A
Higher growth scenario; high density, (variant A-HSHD)

NPV 2011 (x NAF 1 mio)		P	M (ISLA)	M (non-I)	M (total)	(P - M)
Investment costs						
1	Land acquisition	-1	0	0	0	-1
2	Dismantling costs ISLA site	133	133	0	133	0
3	Soil remediation ISLA site	522	220	0	220	302
4	Site preparation	68	0	81	81	-13
5	Construction costs	1.483	0	1.419	1.419	64
6	Design, management	4	4	15	19	-15
Revenues						
7	Housing (sales, rentals)	1.371	0	1.246	1.246	125
8	Tourism (direct VA)	0	0	0	0	0
9	Other industries (direct VA)	3.201	0	3.145	3.145	56
10	Dismantling, remediation (direct VA)	105	60	0	60	45
11	Construction (direct VA)	447	0	432	432	15
12	Tourism (indirect VA)	0	0	0	0	0
13	Other industries (indirect VA)	312	0	307	307	5
14	Dismantling, remediation (indirect VA)	15	9	0	9	7
15	Construction (indirect VA)	65	0	63	63	2
16	Tourism (induced effect)	0	0	0	0	0
17	Other industries (induced effect)	0	0	0	0	0
18	Dismantling, remediation(induced effect)	0	0	0	0	0
19	Construction (induced effect)	0	0	0	0	0
20	Other benefits	309	0	0	0	309
NPV 2011 (x NAF 1 mio)		**P**	**M (ISLA)**	**M (non-I)**	**M (total)**	**(P - M)**
Total investment costs		2.209	357	1.515	1.872	337
Total revenues		5.825	68	5.193	5.262	563
Net revenues		3.616	-289	3.678	3.390	226

Figure 14.4 Higher growth, high density
Variant A-HSHD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits

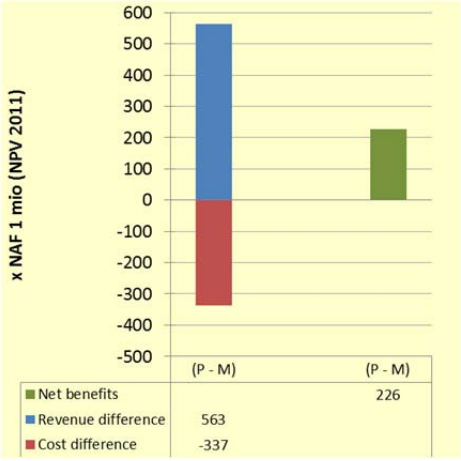
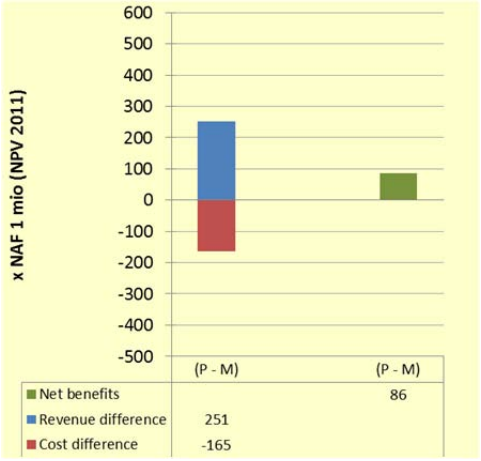


Figure 14.1b Low growth, normal density
Variant A-LSLD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits



14.4 Option B: Housing, mixed activities and greenery – two variants

Alternative B is characterized by a broader mix of economic activities, including tourism, housing accommodation and 185 ha of greenery. For this alternative only a low and an optimistic or high growth sub variant are distinguished (denoted as B-LS and B-HS). The distribution in the final year 2045 of activities over the available area is equal in both sub variants. The same applies to numbers of houses and employees by sector. Housing density and numbers of office employees per ha are therefore also equal for the Schottegat area and for other locations (i.e. 'normal' densities). Both sub variants differ only with regard to the assumed pace of investments made and

revenues earned. (Soil remediation, for example, starts in 2022, but takes 20 years in the low growth sub variant, and 10 years in the high growth sub variant. This has an important impact on the present value of this type of investment costs.)

14.4.1 Low growth scenario

The result for the low growth sub variant (B-LS) is shown in Table 14.5. The large green area involves less site preparation and construction costs than in sub variants of type A. The investment costs for ISLA redevelopment are NAf 1,215 million. However, the corresponding reference alternative goes therefore also with lower investment costs. The resulting NPV of investment costs is NAf 286 million (see Table 14.5).

On the revenue side the heavy accent on greenery implies that housing and housing sales becomes substantially lower than in the A sub variants. The same applies to economic activities.

Table 14.5 Summary of cost and benefits of strategic option 2B
Low growth scenario (variant B-LS)

NPV 2011 (x NAF 1 mio)		P	M (ISLA)	M (non-I)	M (total)	(P - M)
Investment costs						
1	Land acquisition	-1	0	0	0	-1
2	Dismantling costs ISLA site	133	133	0	133	0
3	Soil remediation ISLA site	395	220	0	220	176
4	Site preparation	34	0	32	32	2
5	Construction costs	643	0	535	535	108
6	Design, management	10	4	6	10	0
Revenues						
7	Housing (sales, rentals)	603	0	492	492	110
8	Tourism (direct VA)	176	0	176	176	0
9	Other industries (direct VA)	556	0	429	429	127
10	Dismantling, remediation (direct VA)	86	60	0	60	26
11	Construction (direct VA)	195	0	163	163	32
12	Tourism (indirect VA)	16	0	16	16	0
13	Other industries (indirect VA)	53	0	44	44	9
14	Dismantling, remediation (indirect VA)	12	9	0	9	4
15	Construction (indirect VA)	28	0	24	24	5
16	Tourism (induced effect)	0	0	0	0	0
17	Other industries (induced effect)	0	0	0	0	0
18	Dismantling, remediation(induced effect)	0	0	0	0	0
19	Construction (induced effect)	0	0	0	0	0
20	Other benefits	15	0	0	0	15
NPV 2011 (x NAF 1 mio)		P	M (ISLA)	M (non-I)	M (total)	(P - M)
Total investment costs		1.215	357	572	929	286
Total revenues		1.742	68	1.344	1.413	329
Net revenues		527	-289	772	484	43

Despite the fact that tourism will play a role in this sub variant, the summed value added of all other industries is only a quarter or even less of the VA in the A sub variants. Combined with lower indirect VA effects of the investment efforts, this leads to much lower revenues in the project case (P). However, the same holds for the reference case (M). Finally it should be remarked that the low level of economic activity in the Schottegat area in this sub variant goes hand in hand with a low contribution of synergy effects (5% of VA realized in the commercial services and office sector (NAf 10 million). The other part of 'other benefits' (NAf 5 million) consists of an assumed (maximum) willingness of the citizens of Curacao to pay for the nature and recreation facilities on the new green area (a WTP of NAf 25 per person per year). Despite these circumstances the end result will be of the same order of revenues (NPV) as was the case with the other alternatives (NAf 329 million).

Deducting gross investment costs from total benefits gives a net benefit of NAf 43 million for this sub variant (see also Figure 14.5).

Figure 14.5 Low growth
Variant B-LS
Cost and benefit differences between project and reference alternative (P-M), and net project benefits

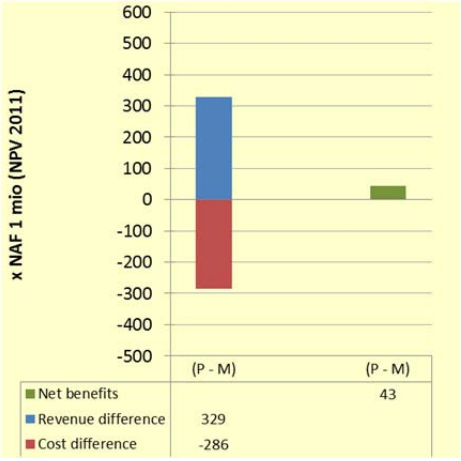
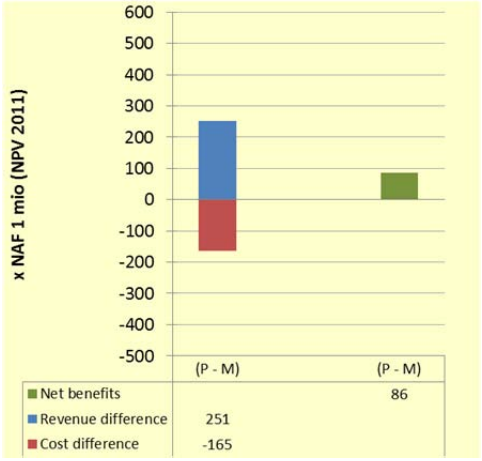


Figure 14.1b Low growth, normal density
Variant A-LSLD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits



14.4.2 High growth scenario

Table 14.6 Summary of cost and benefits of strategic option 2B
Higher growth scenario (variant B-HS)

NPV 2011 (x NAF 1 mio)		*P*	*M (ISLA)*	*M (non-I)*	*M (total)*	*(P - M)*
Investment costs						
1	Land acquisition	*-1*	*0*	*0*	*0*	*-1*
2	Dismantling costs ISLA site	*133*	*133*	*0*	*133*	*0*
3	Soil remediation ISLA site	*524*	*220*	*0*	*220*	*305*
4	Site preparation	*43*	*0*	*41*	*41*	*2*
5	Construction costs	*709*	*0*	*587*	*587*	*123*
6	Design, management	*13*	*5*	*7*	*12*	*0*
Revenues						
7	Housing (sales, rentals)	*686*	*0*	*560*	*560*	*126*
8	Tourism (direct VA)	*178*	*0*	*178*	*178*	*0*
9	Other industries (direct VA)	*647*	*0*	*482*	*482*	*166*
10	Dismantling, remediation (direct VA)	*105*	*60*	*0*	*60*	*46*
11	Construction (direct VA)	*217*	*0*	*181*	*181*	*36*
12	Tourism (indirect VA)	*17*	*0*	*17*	*17*	*0*
13	Other industries (indirect VA)	*62*	*0*	*49*	*49*	*12*
14	Dismantling, remediation (indirect VA)	*15*	*9*	*0*	*9*	*7*
15	Construction (indirect VA)	*31*	*0*	*26*	*26*	*5*
16	Tourism (induced effect)	*0*	*0*	*0*	*0*	*0*
17	Other industries (induced effect)	*0*	*0*	*0*	*0*	*0*
18	Dismantling, remediation(induced effect)	*0*	*0*	*0*	*0*	*0*
19	Construction (induced effect)	*0*	*0*	*0*	*0*	*0*
20	Other benefits	*15*	*0*	*0*	*0*	*15*
NPV 2011 (x NAF 1 mio)		*P*	*M (ISLA)*	*M (non-I)*	*M (total)*	*(P - M)*
Total investment costs		*1.422*	*358*	*635*	*993*	*429*
Total revenues		*1.974*	*68*	*1.493*	*1.561*	*413*
Net revenues		*552*	*-290*	*858*	*568*	*-16*

The second B alternative (sub variant B-HS) refers to the situation in which mixed activities, housing and greenery are combined with the optimistic growth scenario. The only difference between both sub variants is that the higher growth rate brings some investment costs and related revenues (house sales, permanent value added flows) forward in time (see Table 11.10). The consequences for the present values of costs and benefits are presented in Table 14.6.

The shift in time of site preparation and construction costs in this sub variant has, compared to the low growth scenario, a larger impact on the present value of total costs (here NAf 429 million) than

the impact on total benefits (here NAf 413 million, instead of respectively NAf 286 million and NAf 329), the result being a negative net benefit of NAf – 16 million.

Figure 14.6 Higher growth
Variant B-HS
Cost and benefit differences between project and reference alternative (P-M), and net project benefits

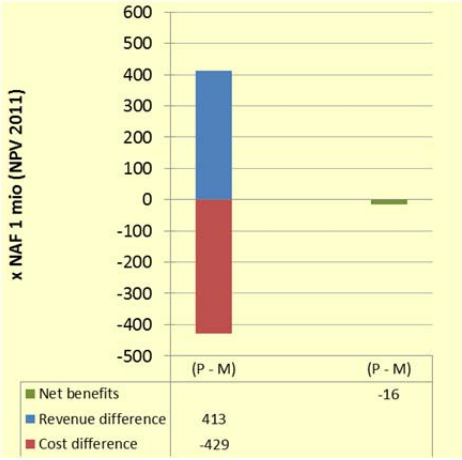
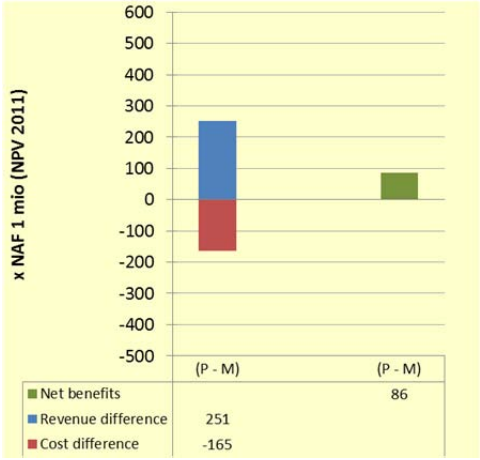


Figure 14.1b Low growth, normal density
Variant A-LSLD
Cost and benefit differences between project and reference alternative (P-M), and net project benefits



The final level of housing and economic activity in 2045 for both option B variants is much lower than for the A variants – because of the large amount of park area and recreational space. This means that the assumption of fast remediation and construction, underlying the high growth sub variant appears not to be necessary. By spreading out these investment costs over a longer period (than 10 years) the NPV of net benefits would become positive. (An investment period of 15 years leads to the same benefits as the low growth scenario, and a period of 20 years even to a doubling of the low growth benefits.)

14.5 External costs and benefits

Externalities or external effects arise because of the non-existence of markets. A good example are the effects of a project on clean air, water or soil, peace and quiet (noise), etc. Because there are no markets for these ‘goods’ they don’t have market prices. Under such circumstances of market failures it becomes very difficult or even impossible to attach values to externalities. In the preceding chapters several types of externalities were mentioned.

In Chapter 11 (section 11.2) we mentioned the increase or reduction of traffic congestion and travelling costs which can be realized by locating new economic activities and houses in the Schottegat area, instead of locating them on more peripheral planning areas. An estimation of the cost difference between the project (i.e. redevelopment of ISLA) and the reference alternative (development elsewhere) requires information about the value of travel time and the vehicle operation costs of all daily commuters. We were not able to reasonably estimate changes in numbers and distances of commuting trips, to be expected from ISLA redevelopment. So we limit ourselves to state this externality as a ‘pro memoria’ or P.M. item.

Another externality mentioned was the assumed synergy advantages to be derived from a concentration of commercial and public services on a representative area on a redeveloped Schottegat area, offering opportunities to more useful and profitable interactions and international exchanges than other island locations would provide. (This positive externality is recently strongly emphasized by proponents of the Greentown concept.) In order to do justice to this widely

supported idea, we decided to include this synergy item explicitly in our analysis, by attaching an a priori chosen value to it (5% of the value added realized in the service sectors). Moreover we postulated a possible export boost in redevelopment sub variants with a high service employment density (also a priori set on 5% of the value added in the service industry).
Both assumptions reflect the postulate that redeveloping ISLA will to some extent stimulate the competitiveness of island economy and results in a somewhat higher growth rate than the rate anticipated in the scenarios. Within the framework of our assignment it didn't belong to our tasks to identify specific service activities which can provide such efficiency and export advantages to Curacao. It is advisable to pay due attention to these aspects in the Strategic Project Study the Government has recently started.

Other important external welfare effects are benefits of dismantling the refinery and remediation of the ISLA site. These benefits have been discussed in Chapter 12 (section 12.2). As they are included in the project alternative as well as in the reference alternative, they play no role in a CBA of ISLA redevelopment. (They do play such a role, however, if a CBA would be carried out in which the 'do minimum' reference alternative is compared with a 'do nothing' reference alternative; see section 12.2. This point will be further discussed in the sensitivity analysis; see Chapter 15.)

14.6 EIA results: ripple effects versus welfare effects

In section 14.2 we stressed that cost benefit analysis is in essence a marginal or incremental approach. The costs and revenues of the project (P: ISLA redevelopment) are compared to the costs and revenues of the reference alternative (M: development of non ISLA sites, combined with dismantling and minimal remediation of ISLA). What counts are the costs and revenue *differences* of P and M, or (P – M). This welfare economic analysis differs from another widespread method, viz. the economic impact assessment (EIA).[22] The EIA looks only to costs and revenues of the project (P), and pays no attention to a reference alternative. To emphasize this difference in approach we explicitly presented cost and revenue figures for both, the project and reference alternatives, P and M, in the tables of this chapter.

Another difference between both approaches is that the EIA often shows the total of all 'ripple' effects, while CBA only presents the part of these effects which has an impact on national economic welfare. Ripple effects are defined as the indirect and induced impact of the direct value added (or sometimes employment) changes the project investment brings about in an economy. These impacts are calculated by using multipliers, usually obtained from an input-output analysis. The results are presented in Table 14.7; it contains both the CBA outcome (columns 1 and 2) and the EIA outcome (column 3) for ISLA redevelopment sub variant A-LSLD.

[22] As mentioned before, an EIA approach was followed for the impact assessment by KPMG of the Eastpoint Project.

Table 14.7 Summary of strategic option 2A
Low growth scenario, normal density (variant A-LSLD) CBA-results (left) versus EIA-results (right); 100% of indirect and induced effects

		CBA		EIA	
NPV 2011 (x NAF 1 mio)		**P**	**(P - M)**	**P**	**(P - M)**
Investment costs					
1	Land acquisition	-1	-1	-1	-1
2	Dismantling costs ISLA site	133	0	133	0
3	Soil remediation ISLA site	395	175	395	175
4	Site preparation	68	0	68	0
5	Construction costs	1.039	-9	1.039	-9
6	Design, management	16	0	16	0
Revenues					
7	Housing (sales, rentals)	1.022	133	1.022	133
8	Tourism (direct VA)	0	0	0	0
9	Other industries (direct VA)	2.107	0	2.107	0
10	Dismantling, remediation (direct VA)	86	26	86	26
11	Construction (direct VA)	319	-3	319	-3
12	Tourism (indirect VA)	0	0	0	0
13	Other industries (indirect VA)	205	0	1.023	0
14	Dismantling, remediation (indirect VA)	12	4	62	19
15	Construction (indirect VA)	46	0	231	-2
16	Tourism (induced effect)	0	0	0	0
17	Other industries (induced effect)	0	0	936	0
18	Dismantling, remediation(induced effect)	0	0	68	21
19	Construction (induced effect)	0	0	251	-2
20	Other benefits	90	90	90	90
NPV 2011 (x NAF 1 mio)		**P**	**(P - M)**	**P**	**(P - M)**
Total investment costs		1.650	165	1.650	165
Total revenues		3.887	251	6.195	283
Net revenues		2.237	86	4.545	118

The first thing to be noticed is that, while we assumed that for the CBA only 20% of the indirect ripple impact contributes to national welfare and the induced impact has even no welfare effect at all, both ripple impacts are for 100% included in the EIA. This has as a consequence that gross revenues of the project in the EIA total to NAf 6,195 million and net revenues to NAf 4,545 million, while the gross revenues according to the CBA are NAf 3.887 million, and the net revenues NAf 2,237 million or only half of the net EIA result.

The second result which catches the eye is that, according to the *incremental* approach of the CBA, i.e. after confrontation of the project impact with the impact of the reference investment, the *net welfare effect* will be only NAf 86 million. The EIA approach, however, doesn't compare the project impact with the reference impact and remains restricted to the result shown in the third column. In order to arrive at a welfare economic approach it would at least be necessary to apply the EIA to the reference investment as well. If we do so, we get the incremental result given in the last column (NAf 118 million, or NAf 32 million more than the welfare outcome of the CBA).

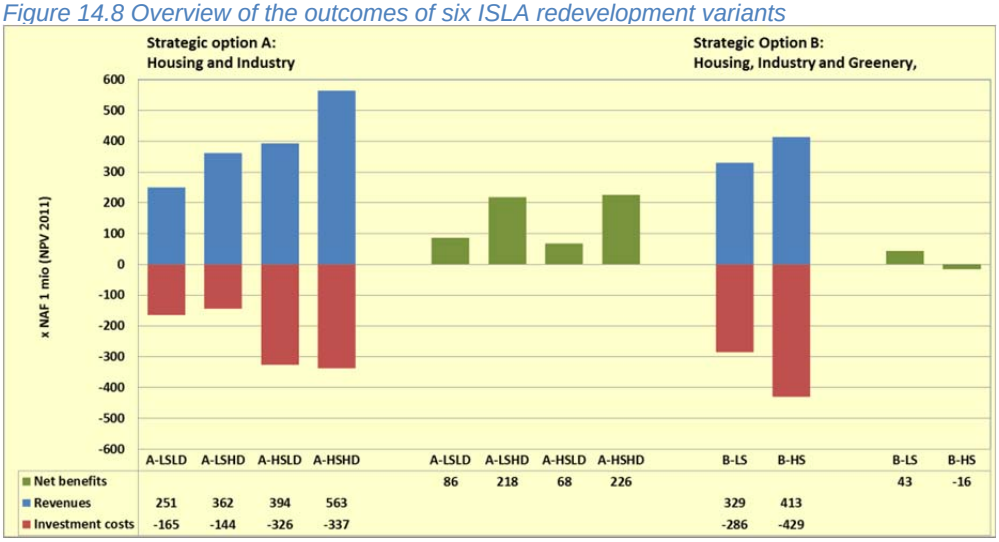
Two conclusions can be drawn from this exercise:

- An EIA provides an impression of changes in sales and purchases or 'ripples' an investment causes in an economy, but it gives no insight in *welfare* changes created, because it is not an *incremental* approach like a CBA. If the outcome of an EIA (its net revenue) is interpreted as a welfare contribution, this contribution exceeds by far the real welfare increase.
- Even if one expands the EIA analysis, by applying it to the reference alternative as well, the real welfare change will easily be overrated, because the *welfare* impact of indirect and induced effect is zero as long as the economy is not characterized by market failures. In order to allow for some degree of market failures in Curacao, we assumed that 20% (instead of the 100%, calculated in EIA) of the indirect impact and 0% (instead of 100%) of the induced impact can be considered as a contribution to real welfare. This explains the difference of NAf 32 million in CBA and (incremental) EIA results, presented here.

14.7 Summary CBA results of ISLA redevelopment

The main results discussed in the preceding sections are summarized in Figure 14.8. The figure shows the outcomes of all six sub variants of the ISLA redevelopment option, i.e. four A and two B sub variants (differences of costs (red) and revenues (blue), and net welfare increases (green)). The A sub variants are shown on the left, and the B sub variants on the right hand.

Figure 14.8 Overview of the outcomes of six ISLA redevelopment variants



The first thing to be noticed is that five of the sub variants show a positive net economic benefit, while only one is slightly negative (based on the assumption about a probably unnecessary fastness of the investment pace, as we have seen). This means that a redevelopment, if specified according to the assumptions discussed in Chapter 11, seems to be economically viable.

The figure shows further that A track low economic growth/low density variant (A-LSLD) goes with a somewhat higher welfare increase than the low density A variant based on the optimistic growth scenario (A-HSLD). The reason is that we assumed that while allocating new activities to the Schottegat area priority is given to businesses above housing. However, the revenues from selling new (mainly middle class) houses are higher than the value added revenues of the new economic activities. Higher economic growth causes a downward shift of the proportion new houses/new employment on ISLA, and therefore some decrease of project related net economic benefit.

High density A variants lead to considerably higher net benefits than the low density variants. The priority of businesses over housing is this time no longer to the advantage of the low growth variant.

Many of the assumptions underlying the basic redevelopment sub variants discussed in this chapter are of course encompassed by risks and uncertainties. Despite the predominantly positive outcomes it is advisable to reinforce the footing for implementation of the strategic re-development options discussed. For this reason we tried to strengthen the quality of the cost benefit analysis, by carrying out a sensitivity analysis, in which a number of alternative assumptions are tested and the postulated values of a number of crucial values are changed (see next Chapter).

15 Sensitivity analysis

15.1 Introduction

To be able to present sensible pictures of future economic developments of Curacao, with and without refinery upgrading investments or strategic redevelopment options for the Schottegat area, we had to make numerous assumptions regarding the options themselves, the socio-economic structure of the island and the way it may change on the medium and long term. Without formulating hypotheses and postulates it is impossible to make estimations about future costs and benefits. At the same time we know that all these assumptions are subject to uncertainty and risks.[23] The value attached to assumed characteristics (system parameters) is often unknown and knowledge about the continuation of valid assumptions is frequently not available. This makes it important to get some idea about the impact an assumption has on calculated outcomes. Although it is impossible to test all assumptions made on their impact, it makes sense to look at the sensitivity of the estimation results for some crucial hypotheses.

In section 15.2 and 15.3 the outcomes of the sensitivity analysis of respectively ISLA upgrading investment cases and ISLA redevelopment options will be presented.

15.2 Sensitivity analysis of ISLA upgrading investment options

In this section we will look how net benefits of the upgrading investment options change if we change assumptions. In table 15.1 the base values of the parameters are listed. We will discuss how the net benefit outcomes will change if we change these values.

Table 15. 1 Quantitative assumptions to be tested on their impact on net benefits

	Base values	Sens. analysis
Discount rate	7%	7%
Costs		
Soil remediation costs ISLA site	1	1
Dismantling costs ISLA site	1	1
Revenues		
Land lease ISLA option	1	1
Preferred stock dividend ISLA option	1	1
Taxes received in Curacao from foreign company	1	1
VA operations ISLA (direct)	1	1
VA operations ISLA (indirect)	1	1
VA refinery investments contractors (direct + indirect)		
- share indirect effect included in CBA	50%	50%
- local part sharing (max. 10%)	6%	6%
- increase VA due to an increase in investment costs	1,0	1,0
Curacao share induced effects	0,0	0,0

[23] Formally uncertainty differs from risk. A situation is called *uncertain* if the likelihood of an event occurring in that situation is not known at all. This means that *no probability distribution* can be attached to the outcomes. *Risks* refer to a context in which an event occurs with some probability or where the size of the event *does have a probability distribution*. As we know little or nothing about the probability of the assumptions made for this study, this sensitivity analysis remains restricted to uncertainties.

Social discount rate

The social discount rate measures the rate at which a society is willing to trade present for future consumption. As such it is one of the most critical inputs used in cost benefit analysis of public projects (and more generally public policies).[24] It should reflect the social view on how future benefits and costs are to be valued against present ones. It may differ from the financial rate of return because of market failures in financial markets.[25]

The appropriate selection of a social discount rate is crucial for cost-benefit analysis, and has important implications for resource allocation. However, there is wide diversity in social discount rates, with developed nations typically applying a lower rate (3–7%) than developing nations (up to 15%).

In our analysis we used 7% as a basis. The EU recommends a rate between 2.8 and 4.1% for some Western European member countries, and 5.3 to 8.1% for some Eastern European members. The rates recommended by supra-national agencies (like the World Bank) lie between 10 and 12%.[26]

To get an idea of impact a change in the social discount rate may have on the CBA outcome of the ISLA redevelopment strategy, two additional rates were applied: 10% and 4%.

Using 10% instead of 7% turns the average positive net benefit of NAf 2.9 billion (of the 6 cases discussed in Chapter 13) to a new average value of NAf 2 billion, i.e. a change in net benefit of NAf -0.9 billion. At a rate of 4% an average positive net benefit results of NAf 4.6 billion, or an increase of NAf 1.7 billion.

The results by sub variant are presented in table 15.3. The upper part of the table shows the indicator values used (pink colored cells), and the middle part shows for each upgrading investment case the net welfare effects. Part of these welfare effects are the net revenues of the government of Curacao (Land Lease, Preferred Stock, taxes). These revenues are summarized at the lowest part of the table. The column Basis gives the values discussed in Chapter 13. Column 1 and 2 relate to the 10% and 4% discount rate.

As a final remark we add here that consensus is growing that the social discount rate should be interpreted as a social time preference rate. According to this approach social discount rates should be calculated on the base of the long term growth rate of the economy, The approach considers the preference for benefits over time, taking into account the expectation of increased income, consumption, or public expenditure (see EU Guide p. 206). As the economic scenarios for Curacao used here are characterized by low to modest growth rates, this way of thinking makes a somewhat lower social discount rate than 7% defensible.

---

[24] Humberto Lopez (2008) The Social Discount Rate: Estimates for Nine Latin American Countries, World Bank

[25] European Commission (DGRP); (2008), Guide to cost-benefit analysis of investment projects; Structural Funds, Cohesion Fund and Instrument for Pre-Accession.

[26] Asian Development Bank (2007), Juzhong Zhuang, Zhihong Liang, Tun Lin, and Franklin De Guzman; ERD Working Paper No 94; Theory and Practice in the Choice of Social Discount Rate for Cost -benefit Analysis: A Survey

Table 15. 2 Summary of the calculation results of 16 sensitivity variants for the refinery upgrading investment cases during the period 2012-2045

	Sensitivity analysis variants														
	Basis	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Discount rate	7%	10%	4%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Costs															
Soil remediation costs ISLA site	1	1	1	1,4	0,6	1	1	1	1	1	1	1	1	1	1
Dismantling costs ISLA site	1	1	1	1,4	0,6	1	1	1	1	1	1	1	1	1	1
Revenues															
Land lease ISLA	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1
Preferred stock dividend ISLA	1	1	1	1	1	1	0	2	1	0	0	1	1	1	1
Taxes received in Curacao from foreign company	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1
VA operations ISLA (direct)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
VA operations ISLA (indirect) suppliers	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1
VA refinery investments contractors (direct + indirect)															
- share indirect effect included in CBA	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	0%	50%	50%
- local part sharing (max. 10%)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	10%	6%
- increase VA due to an increase in investment costs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1,4
Net welfare effect of sensitivity analysis (NAFL mln; NPV 2011)	Net Benefit														
	Reference alternative: Base														
	Basis	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1A: BOO pitch NEWCO 100% equity	2.848	1.890	4.428	2.927	2.769	2.757	2.609	3.098	2.369	2.039	1.793	2.123	2.830	2.891	2.874
1B: BOO pitch NEWCO 30%	2.785	1.851	4.326	2.864	2.707	2.694	2.546	2.761	2.369	2.039	1.793	2.123	2.768	2.829	2.812
2A: BOO LSFO NEWCO 100% equity	2.829	1.879	4.395	2.908	2.750	2.738	2.590	3.061	2.368	2.039	1.798	2.127	2.811	2.873	2.855
2B: BOO LSFO NEWCO 30%	2.765	1.839	4.290	2.844	2.686	2.674	2.526	2.721	2.368	2.039	1.798	2.127	2.747	2.808	2.791
3A: BOO LNG NEWCO 100% equity	3.221	2.139	5.008	3.300	3.142	3.130	2.982	3.496	2.726	2.396	1.798	2.127	3.203	3.264	3.247
3B: BOO LNG NEWCO 30%	3.157	2.099	4.903	3.236	3.078	3.066	2.918	3.153	2.726	2.396	1.798	2.127	3.139	3.201	3.183
Average net benefit (all variants)	2.934	1.950	4.558	3.013	2.855	2.843	2.695	3.048	2.488	2.158	1.796	2.126	2.916	2.978	2.960
Revenues of the government Curacao as part of the net welfare effect: land lease, preferred stock dividend, tax (NAFL mln; NPV 2011)	Basis	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1A: BOO pitch NEWCO 100% equity	808	503	1347	808	808	717	569	1.058	329	0	0	808	808	808	808
1B: BOO pitch NEWCO 30%	746	464	1245	746	746	655	507	722	330	0	0	746	746	746	746
2A: BOO LSFO NEWCO 100% equity	790	493	1315	790	790	699	551	1.022	330	0	0	790	790	790	790
2B: BOO LSFO NEWCO 30%	726	452	1210	726	726	635	487	682	330	0	0	726	726	726	726
3A: BOO LNG NEWCO 100% equity	824	513	1374	824	824	733	585	1.100	329	0	0	824	824	824	824
3B: BOO LNG NEWCO 30%	761	473	1269	761	761	670	522	756	330	0	0	761	761	761	761
Average sum revenues government(all variants)	776	483	1.293	776	776	685	537	890	330	0	0	776	776	776	776

Confidence band around dismantling and remediation costs (columns 3 and 4)

The results of the study about dismantling the present refinery and remediation of the ISLA site have been discussed in Chapter 9. The accuracy of the estimations was approximately 40% (plus or minus). Columns 3 and 4 of table 15.2 show the outcomes for both extremes.
If the costs are 40% higher, the average net benefit increase from NAf 2,934 million to NAf 3,013 million (or a cost increase of NAf 79 million), if they are 40% lower, net benefit decrease to NAf 2,855 million.

Decrease of the revenues received by the government of Curacao (columns 5-10)

The revenues of the government of Curacao heavily depend on:

- Land Lease fee for ISLA;
- Preferred Stock divided for ISLA;
- Taxes levied.

If these fees and taxes are not paid by NEWCO, the revenues for the government are NAf 0 instead of on average NAf 776 million. The average net welfare effect decreases from NAf 2,934 to NAf 2,158 million. The taxes have the largest impact on the net welfare effect followed by the assumed Preferred Stock Dividend to be paid by NEWCO.

Column 7 shows the effect of Preferred Stock Dividend for ISLA based on the NEWCO 1 case, see table 7.2 in section 7.2.2. This case results in on average a 30% increase of governmental revenues in 100% equity cases and a decrease of on average 3% of the governmental revenues in the 30% equity cases.

Indirect effects and welfare increase (column 11 and 12)

The refinery in operation has a direct and indirect added value. The direct value concerns the value added from employees of the refinery and from contractors for regular yearly investments and shutdown. Indirect value added is the value added from suppliers (like BOO and other supplier) to ISLA.
In general, indirect impacts in secondary markets should not be included in the economic appraisal, if appropriate shadow prices are given for costs and benefits. In other investment appraisal studies, recently carried out on behalf of the Curacao Government, indirect effects have been included for 100% (see section 14.6). In order to gain an idea of what difference it makes to consider 0% instead of 100% of the indirect impacts of operational outlays as potential welfare effects, sensitivity variant 11 was included.
The result is that, on the average, net benefits would reduce from NAf 2,934 to NAf 2,126 million.

We considered 50% of the indirect effect of investments in the refinery as welfare effects. The impact of considering 0% instead of 50% of the indirect impact as welfare effect is limited. The average net benefits would reduce with NAf 18 million.

Impact of an increase in investment costs refinery (column 13 and 14)

It is expected that a limited part (6 to 10%) of the investments in the refinery is spend in Curacao. We calculated the welfare effect of a local share in investments of 6%. The impact of considering 10% instead of 6% is limited, the average net benefit will increase with NAf 44 million.

The impact of an increase in investment costs with 40% is limited as well since only as small part of the investments is spend in Curacao. The average net benefit will increase from NAf 2,934 to NAf 2,960 million.

15.3 Sensitivity analysis of ISLA redevelopment options

In this section the outcome of the sensitivity analysis of the ISLA redevelopment options will be presented. In table 15.3 important hypotheses and postulates on which the cost-benefit analysis is based are listed. We will look how redevelopment outcomes will change if we change these values.

Table 15.3 Quantitative assumptions to be tested on their impact on net benefits

	base values
Discount rate	7%
Revenues: direct, indirect, induced effects	
sales revenues/construction costs houses outside ISLA	1,30
additional value if on ISLA (normal density)	1,15
additional value if on ISLA (higher density)	1,10
welfare share indirect VA all investments ISLA	0,20
welfare share indirect VA operational activities	0,20
welfare share induced effect investments	0,00
Synergy effect commercial activities (offices)	0,05
additional export effect (only in high scenario)	0,05
Density and height of buildings	
share normal houses in construction on ISLA, high income	0,90
share normal houses in construction on ISLA, low income	0,90
share normal offices in construction on ISLA	0,50
Construction density offices (%)	40
Height of offices (# of floors)	10
Height of low income houses (# of floors)	3
Height of middle/high income houses (# of floors)	5
Costs (range factor)	
Soil remediation costs ISLA site (M and P case)	1
Dismantling costs ISLA site (M and P case)	1

We start the sensitivity analysis by looking at the effect of an alternative assumption about the supply of zoning area in pipeline (section 15.3.1). Then the impact of a change in the social discount rate will be analyzed (from 7% to 10% and 4% respectively; section 15.3.2). Finally we look at the outcome effects of variations in the assumed values of twelve other assumptions, mentioned in Table 15.3 (15.3.3). The results are summarized in Table 15.5 and in the figures in Annex 7.

15.3.1 Additional area supply variants

As we attempted to get insight in the number of hectares assigned to future development of housing and economic activities, we learned that the Government of Curacao considers to (let) develop a 4,400 hectares private area at Eastpoint. Currently a zoning plan is being prepared, containing up to 19,000 residential units and 2,400 hotel rooms. Although the scope of the Eastpoint zoning plan differs from the Schottegat area redevelopment plan – the Eastpoint plan is particularly oriented on up-market tourism, housing and corresponding amenities – realization of (part of) the plan before 2045 would certainly have an impact on a demand for housing on the Schottegat area. Another additional – but smaller - development may take place on the Wechi location. To explore out the possible effect on the ISLA of the additional housing supply, two new sub variants A have been defined (A-LSLD+ and A-HSLD+; see also section 11.2).
The results of the low growth/normal density sub variant A-LSLD+ are presented in Table 15.4.

Table 15.4 Summary of cost and benefits of strategic option 2A
Low growth scenario; normal density, and additional supply of development area elsewhere (variant A-LSLD+)

NPV 2011 (x NAF 1 mio)		P	M (ISLA)	M (non-I)	M (total)	(P - M)
Investment costs						
1	Land acquisition	*0*	*0*	*0*	*0*	*0*
2	Dismantling costs ISLA site	*133*	*133*	*0*	*133*	*0*
3	Soil remediation ISLA site	*255*	*220*	*0*	*220*	*36*
4	Site preparation	*68*	*0*	*68*	*68*	*0*
5	Construction costs	*388*	*0*	*397*	*397*	*-9*
6	Design, management	*16*	*4*	*13*	*16*	
Revenues						
7	Housing (sales, rentals)	*54*	*0*	*47*	*47*	*7*
8	Tourism (direct VA)	*0*	*0*	*0*	*0*	*0*
9	Other industries (direct VA)	*2.389*	*0*	*2.389*	*2.389*	*0*
10	Dismantling, remediation (direct VA)	*65*	*60*	*0*	*60*	*5*
11	Construction (direct VA)	*131*	*0*	*134*	*134*	*-3*
12	Tourism (indirect VA)	*0*	*0*	*0*	*0*	*0*
13	Other industries (indirect VA)	*231*	*0*	*231*	*231*	*0*
14	Dismantling, remediation (indirect VA)	*9*	*9*	*0*	*9*	*1*
15	Construction (indirect VA)	*19*	*0*	*19*	*19*	*0*
16	Tourism (induced effect)	*0*	*0*	*0*	*0*	*0*
17	Other industries (induced effect)	*0*	*0*	*0*	*0*	*0*
18	Dismantling, remediation(induced effect)	*0*	*0*	*0*	*0*	*0*
19	Construction (induced effect)	*0*	*0*	*0*	*0*	*0*
20	Other benefits	*90*	*0*	*0*	*0*	*90*
NPV 2011 (x NAF 1 mio)		***P***	***M (ISLA)***	***M (non-I)***	***M (total)***	***(P - M)***
Total investment costs		*861*	*357*	*478*	*835*	*26*
Total revenues		*2.989*	*68*	*2.820*	*2.889*	*100*
Net revenues		*2.128*	*-289*	*2.342*	*2.054*	*75*

It is assumed that the large additional supply of middle and higher income housing elsewhere on Curacao reduces the demand on ISLA for this type of residences and accompanying amenities to 80 hectares. Although other activities – especially warehousing – will fill part of the gap nearly halve of the Schottegat area cannot be developed before 2045. This has as a consequence that the revenues from sales of houses will be much lower, and total revenues decrease to NAf 100 million. On the other hand remediation costs will be much lower, firstly because only part of ISLA will be developed before 2045 and secondly because remediation and construction costs will be spread over a longer investment period. Total revenues decrease from NAf 251 million and total investment costs from NAf 165 million to NAf 26 million in sub variant A-LSLD to NAf 100 million in A-LSLD+. The net benefit of becomes: NAf 75 million. This situation is also depicted in Figure 15.1.

Figure 15.1 Low growth, normal density and additional area supply
Variant A-LSLD+
Cost and benefit differences between project and reference alternative (P-M), and net project benefits

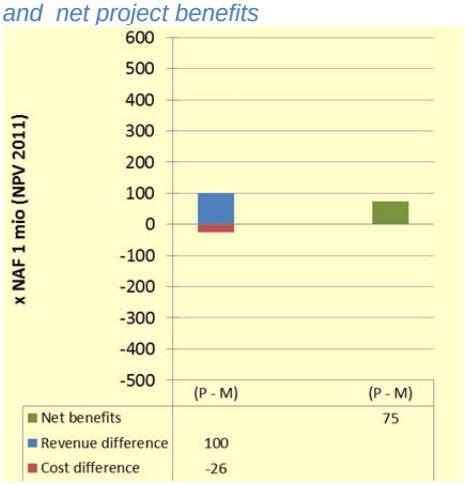
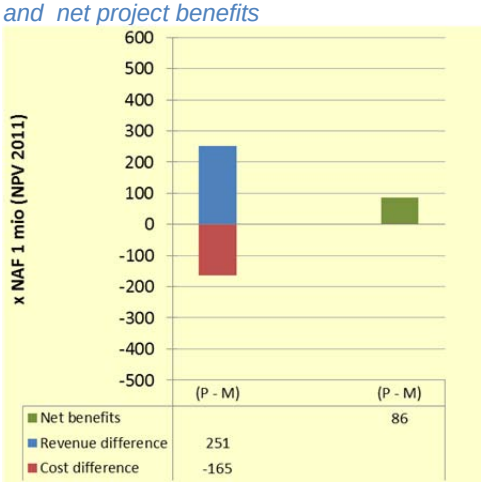


Figure 14.1b Low growth, normal density
Variant A-LSLD

Cost and benefit differences between project and reference alternative (P-M), and net project benefits



The optimistic growth/normal density sub variant A-HSLD+ is less troubling. Although this time the higher residential segment also stays somewhat away from the Schottegat area, the optimistic

growth scenario warrants a complete take-up of the available 493 hectares. In fact, as mentioned in section 11.2, this sub variant will result in a situation, nearly identical to sub variant A-HSLD, with an identical net benefit of NAf 68 million.
The additional area supply of Wechi and Eastpoint seems therefore not a threath for a successful redevelopment of ISLA.

15.3.2 Social discount rate

As discussed in section 15.2 is one of the most critical inputs used in cost-benefit analysis of public projects (and more generally public policies
To get an idea of impact a change in the social discount rate may have on the CBA outcome of the ISLA redevelopment strategy, two additional rates were applied: 10% and 4%.

Using 10% instead of 7% turns the average positive net benefit of NAf 104 million (of the 6 sub variants discussed in Chapter 14) to a new average value of NAf 61 million, i.e. a change in net benefit of NAf -43 million. At a rate of 4% an average positive net benefit results of NAf 383 million, or an increase of NAf 279 million.
The results by sub variant are presented in Table 15.3. The upper part of the table shows the indicator values used, and the lower part shows for each redevelopment sub variant the net benefit outcomes. The column Basis gives the values discussed in Chapter 14. Column 1 and 2 relate to the 10% and 4% discount rate. Figures A.15.1 and A.15.2 in Annex 7 present the outcomes in a graphical way.

Table 15.5 Summary of the calculation results of 15 sensitivity variants for redeveloping the Schottegat area during the period 2020-2045 [a])

	Sensitivity analysis variants															
	Reference alternative: 'do mimimum'														'do nothing'	
	Basis	1	2	3	4	5	6	7	8	9	10	11	12	13	14 (= Basis)	15
Discount rate	7%	10%	4%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Revenues: direct, indirect, induced effects																
Sales revenues/construction costs houses outside ISLA	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30
Additional value factor if on ISLA (normal density)	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,00	1,15	1,15	1,15	1,15	1,15	1,15	1,15
Additional value factor if on ISLA (higher density)	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,00	1,10	1,10	1,10	1,10	1,10	1,10	1,10
Welfare share indirect VA all investments ISLA	0,20	0,20	0,20	1,00	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Welfare share indirect VA operational activities	0,20	0,20	0,20	1,00	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Synergy effect commercial activities (offices)	0,05	0,05	0,05	0,05	0,00	0,10	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,15
Additional export effect (only in high scenario)	0,05	0,05	0,05	0,05	0,00	0,10	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,15
Density and height of buildings																
Share normal houses in construction on ISLA, high income	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,80	0,90	0,90	0,90	0,90	0,90	0,90
Share normal houses in construction on ISLA, low income	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,80	0,90	0,90	0,90	0,90	0,90	0,90
Share normal offices in construction on ISLA	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,25	0,50	0,50	0,50	0,50	0,50
Construction density offices (%)	40	40	40	40	40	40	40	40	40	40	40	60	40	40	40	40
Height of offices (# of floors)	10	10	10	10	10	10	10	10	10	10	10	10	12	10	10	10
Height of low income houses (# of floors)	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3
Height of middle/high income houses (# of floors)	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5	5
Costs (range factor)																
Soil remediation costs ISLA site (M and P case)	1,0	1,0	1,0	1,0	1,0	1,0	1,4	0,6	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Dismantling costs ISLA site (M and P case)	1,0	1,0	1,0	1,0	1,0	1,0	1,4	0,6	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Net welfare effect of sensitivity analysis by strategic ISLA redevelopment variant (NAFL mln; NPV 2011)	**Net Benefit**															
	Reference alternative: 'do mimimum'														'do nothing'	
	Basis	1	2	3	4	5	6	7	8	9	10	11	12	13	14 (= Basis)	15
Variant A. Focus on non-tourist industries and housing																
A-LSLD: Lower growth scenario, low density	86	47	173	100	-5	176	28	144	-47						-171	9
A-LSHD: Lower growth scenario, high density	218	113	450	230	38	399	160	276	60	316	214	219	219	238	-39	322
A-HSLD: Higher growth scenario, low density	68	0	261	122	-105	241	-32	168	-29						-189	157
A-HSHD: Higher growth scenario, high density	226	75	607	283	-82	535	126	326	102	298	220	227	227	241	-31	586
A-LSLD+: Lower scenario, low density; additional area supply	75	51	117	76	-16	165	147	2	68						-183	-2
A-HSLD+: Higher scenario, low density; additional area supply	68	0	261	122	-105	241	-32	168	-29						-189	157
Variant B. Focus on mixed industry and greenery																
B-LS: Lower growth scenario	43	20	108	114	33	54	-15	102	-35						-214	-193
B-HS: Higher growth scenario	-16	-46	99	80	-27	-6	-117	84	-106						-274	-253
Average net benefit (all variants, excl. additional area supply v.)	*104*	*35*	*283*	*155*	*-25*	*233*	*25*	*183*	*-9*	*307*	*217*	*223*	*223*	*240*	*-153*	*105*

[a]) Reference alternative in sensitivity variants 1-13 include the 'no access' or 'do minimum' investments of dismantling and remediation (but only soil pollution containment);
Reference alternative in sensitivity variants 14-15 includes only dismantling costs but no remediation investment costs at all.

15.3.3 Other sensitivity variants

Table 15.5 contains, apart from both discount rate variations, the results for 13 additional sensitivity variants.

Indirect effects and welfare increase (column 3)

As mentioned before, redevelopment has a direct impact on investors, workers, users, suppliers, etc. but also indirect impacts on third parties. When it comes to welfare effects, however, one should carefully consider the risks of double counting.
In general, indirect impacts in secondary markets should not be included in the economic appraisal, if appropriate shadow prices are given for costs and benefits. There is a general rule that states that market effects (i.e. quantity or price changes) in undistorted secondary markets should be ignored, if the shadow prices in the primary market are appropriate.
As long as there is no reason to assume that prices of goods and services on Curacao, used in the national input-output table and national accounts, are severely distorted and do not represent (international) opportunity costs indirect impacts should be considered no more than 'ripple' effects, without a net welfare effect.

On the other hand it is well known that small island economies in general have a good chance to become more prone to certain market distortions, than continental economies. It was not possible to make in-depth investigations into this subject during this study. We decided therefore to a priori accept arguments for the existence of some such distortions, and to consider 20% of the indirect multiplier impacts of investments and operational spending, related to ISLA redevelopment, as welfare effects.
In other investment appraisal studies, recently carried out on behalf of the Curacao Government, indirect effects have been included for 100% (see section 14.6). In order to gain an idea of what difference it makes to consider 20% instead of 100% of the indirect impacts of investments and operational outlays as potential welfare effects, sensitivity variant 3 was included (Table 15.3, column 3, and Figure A.15.3 in Annex 7). The result is that, on the average, net benefits would double, from NAf 104 million to NAf 155 million. The largest differences are found in sub variants based on the optimal growth scenario.

Synergy and export effects of ISLA redevelopment (columns 4 and 5)

In Chapter 14 it was assumed that redeveloping ISLA by locating there a large concentration of new service activities would create a special value added growth effect, called synergy effect. This effect was supposed to amount to an additional 5% of the value added in the offices industry, i.e. above the value added growth incorporated in the scenario in question.
For high density variants moreover an additional export effect was postulated, of likewise 5% of the value added, realized in new offices.
Column 4 of Table 15.3 shows the results of a sensitivity variant in which both effects do not exist (the synergy and export effects are both put on 0%). If this case occurs the net benefits of all redevelopment sub variants will be considerably reduced. The average net benefit for the six main sub variants becomes NAf -25 million (see Figure A.15.5).
Sensitivity variant 5 shows on the other hand that a doubling of both these effects from 5% to 10% increases net benefits substantially (from NAf 104 million to NAf 233 million on the average), and for all redevelopment sub variants A in fact more than doubles. The effect for B sub variants, on the other hand, is very modest (see also Figure A.15.6).

Confidence band around remediation (and dismantling) costs (columns 6 and 7)

The estimation results of the study about dismantling the present refinery and remediation of the ISLA site have been discussed in Chapter 9. The accuracy of the estimations was approximately 40% (plus or minus). Columns 6 and 7 of Table 5.3 show the outcomes for both extremes. If the

costs are 40% higher, the average net benefit decrease from NAf 104 million to NAf 25 million (or a cost increase of NAf 79 million), if they are 40% lower, net benefit increases to NAf 183 million (see also Figures A.15.5 and 7).
Mark that dismantling costs play actually no role, as they are identical for the redevelopment intervention and the reference alternative. The same is valid for the part of the remediation costs to be spent for containment purposes, which is also the same for 'do minimum' and the project alternative.

No differences in housing prices between ISLA and elsewhere (column 8)

Another possible variation regards the estimated value of the price/construction costs ratio for houses, if built on ISLA instead of elsewhere. Consultation of local experts learned that for the share of houses build with normal density a factor of 1.15 would be appropriate, and for houses build in higher densities a somewhat lower factor of 1.10. If both these factors are reduced to 1.00, as done in column 7 of Table 15.3, sales revenues would decrease with on the average NAf 115 million to an average of NAf – 9 million. Figure A.15.8 shows that now the net benefits of all sub variants become negative.

Increase of residential density in the Schottegat area (column 9)

The next five exercises (columns 9 to 13) were carried out only for both higher density sub variants (A-LSHD and A-HSHD). First attention was paid to the proportion of houses, built in normal density. Instead of 90% housing stock with normal density (and 10% with a higher density), this parameter was changed to 80%, i.e. more houses with higher density. This leads to a higher housing stock, built on the Schottegat area, and has as a consequence more sales (at higher prices) than in the reference alternative.
The average net benefit (for higher density sub variants A-LSHD and A-HSHD) becomes NAf 307 million, instead of NAf 222 million, or an average increase of NAf 85 million (column 9, and Figure A.15.9b).

Lower share of office activity (column 10)

Lowering the 50% share of the zoning area, reserved on ISLA for 'normal' density offices, to 25% means a larger share of office area with a higher offices density (40%/ha covered with offices). This leads to higher office construction costs on the Schottegat area and consequently more room for new houses. A decrease of normal office space from 50% to 25% increases the construction cost difference (between ISLA and locations elsewhere). This cost increase exceeds somewhat the sum of higher net housing revenues and the higher temporary VA revenues of (increased) construction. The average net benefit becomes NAf 217 million, or NAf 5 million less than the average amount (NAf 222 million) for high density cases in the base variant (see column 9, and Figure A.15.9c)

Higher office density and higher offices (columns 11 and 12)

Likewise, an increase of the office density parameter from 40% to even 60% in higher density sub variants (A-LSHD and A-HSHD) has a very small impact on net benefits. Average benefits increase from NAf 222 million to NAf 223. The same is true for increasing the height of offices in high office density areas. If the number of floors goes from 10 to 12, net benefits will hardly increase.

Higher building height of houses (column 13)

By raising the average number of floors of new houses, built in high density residential areas on ISLA (i.e. 10% of the ISLA area reserved for residential development) with one story total net benefits increase from NAf 222 million to NAf 240 million.

'Do nothing' instead of 'do minimum' reference alternative (column 14)

The last two sensitivity variants have a somewhat different character. Variant 13 shows what happens if one would give up the 'unacceptability' option regarding the immediate and minimally required soil remediation postulated in section 12.2 (NPV NAf 220 million, see Tabels 14.1 to 14.7) million). Stated differently, if the entire costs of remediation would come at the expense of ISLA redevelopment and only dismantling but no remediation costs would be made in the reference alternative. This approach would mean that the value, the people of Curacao attaches to continued soil pollution containment after closure of the refinery, is equal to zero ('do minimum' remediation would have no benefits; see section 12.2).

This case would imply that the revenues, needed to balance total remediation and construction costs, become much higher. Net revenues would become strongly negative, viz. NAf -153 million on the average (of all 6 main sub variants).

Idem, combined with higher synergy and export effects (column 15)

Following this line of thought, one could ask how much the synergy and export effects discussed before (the main components of 'other benefits' in Tables 14.1 to 14.7), must increase in order to compensate for these 'do minimum' remediation costs of NAf 220 million. Column 15 of Table 15.3 gives the answer. If both effects increase to 15% of the VA of total service sector, the average net benefit will increase to the NAf 105 million (nearly the average value of the Basis variant).

This means, however, that redevelopment of the Schottegat area requires the realization of an additional 30% value added in the service industries, i.e. on top of the value added foreseen in the national growth scenarios. It will be very difficult to achieve such a target.

16 Conclusions and recommendations

16.1 Refinery investments

Are refining activities feasible after 2019?

Based on the results of a regional market analysis, feedstock and price analysis and a preliminary economic analysis we conclude that there is a market for refining activities on Curacao.

The technical, commercial and financial feasibility of a grassroots refinery as well as for upgrading the existing ISLA refinery has been carried out. The various cases are presented in the next table. For the grassroots refinery configurations a financing structure has been assumed through 30% equity and 70% debt. For the upgrading cases a financing structure through 100% equity and through 30% equity/70% debt have been assumed.

Table 16.1 Refinery cases and the technical, commercial and financial feasibility scores

	Feasibility		
	Technical	Commercial	Financial
Grass roots refinery			
HCU/Coker configuration export refinery	√	X	X
FC/Coker configuration export refinery	√	X	X
HCU/Coker configuration local refinery	√	X	X
FCC/Coker configuration local refinery	√	X	X
Upgraded refinery: NEWCO cases:			
BOO pitch/scrubbers, 100% equity	√	√	√
BOO pitch/scrubbers, 30% equity, 70% debt	√	√	√
BOO LSFO, 100% equity	√	√	√
BOO LSFO, 30% equity, 70% debt	√	√	√
BOO LNG, 100% equity	√	√	√
BOO LNG, 30% equity, 70% debt	√	√	√

Grass roots refinery

The grass root refinery cases show an IRR on investments varying from 6,8% to 11,7% as well as an IRR on equity varying from 1,9% to 11,1%, which is far below the required cut-off rate of 20% used for new refineries (according to PGI). The cases are commercially and financially not viable and should not be built from a financial standpoint.

Upgraded refinery

All cases are technical, commercial and financial feasible. Especially in the 30% equity and 70% debt cases, the IRR on equity varies between 18% and 20% which is significantly beyond the cut off rate of 15% used for existing refineries (according to PGI). The accumulated cash flow is positive in all years from the start of operations. Moreover, the DSCR is with 1.93 significantly above the minimum target of 1.35.

The NEWCO LNG case with a financing structure of 30% equity and 70% debt financing is clearly the most robust case from NEWCO's perspective, taking into account the sensitivity analysis as well as the risk analysis. The IRR > 17% is met with a probability of 83.2 % and the IRR > 15% in more than 95% of the cases.

However, the introduction of LNG to Curacao is quite uncertain. Therefore, these results are very preliminary and would need additional study to further define the scope and capital costs associated with this option. The results of the on-going LNG feasibility study is are of significant influence on preliminary results of the NEWCO LNG case for upgrading the ISLA refinery and integration of BOO into this refinery.

The second best option is the NEWCO BOO pitch/scrubber case. While this option requires some capital investment, the economics are much more favorable for mitigating sulfur emissions than using higher cost low sulfur fuel oil (LSFO) as the fuel source.

But, in the above presented analysis the results do not take into account any Land Lease fee and/or Preferred Stock Dividend provided to RdK. Any proposal for generating income by RdK will of course influence the outcome of the business cases. Proposals varying from USD 25 to 30 million (in 2011 prices to be inflated annually) do show a negative impact on the IRR on equity of about 1.3% point to 1.5% point., still resulting in financially sustainable options. However, the risk analysis revealed that caution is needed with respect to a (probably too high level) of proposed Preferred Stock Dividend (given the proposal for Land Lease fee). Therefore, expectations related to total income for RdK should be adjusted accordingly. Of course this is subject to negotiations.

A very important condition for the feasible cases is the availability of a company that is willing to invest in the existing refinery.

What is the welfare economic impact of refinery activities?

The economic impact of the upgraded refinery cases for Curacao has been assessed and leads to the following findings:

- In the present situation the direct and indirect employment of the refinery is 2,250 (1,000 employees refinery, 450 employees contractors and 800 employees of suppliers). After upgrading the total employment of ISLA (direct and indirect) will increase with about 130 jobs in the BOO Scrubber and LSFO case and with about 300 jobs in the BOO LNG case.
- The total value added for ISLA in the present situation (2011) is summing up to about NAf 265 million. This is about 5.3% of total GDP. This share is decreasing due to a real development in total GDP for the island of 1,5% annually, and will therefore go down to about 4.7% in 2018. After upgrading the share of ISLA (including BOO) could be increased to even 7% to 8% in the medium and long term. However, a significant part of this increase is due to the assumed tax regime and tax level and the higher lease fee consisting of a Land Lease and a Preferred Stock Dividend. These benefits are fully dependent on the willingness of a foreign investor to accept these charges. Therefore, expectations that upgrading the ISLA refinery will lead to a substantial increase in value added has to be damped.
- All investment cases show a positive welfare effect ranging from NAf 2.8 to 3.2 billion. This means that all cases seem to be economically profitable. It has to be stressed however, that the following conditions have to be fulfilled before this welfare effect will take place:
    - A company must be found that will be prepared to invest in the refinery;
    - The investor must be prepared to pay a Land Lease fee of US$ 10 million (with inflation), a Preferred Stock Dividend of about US$ 15 to 20 million and taxes according to the existing tax regime.
- The LNG investment case shows the highest positive net economic benefit for Curacao (NPV in 2011 NAf 3,221 million at a social discount rate of 7%). However, as discussed earlier the introduction of LNG to Curacao is quite uncertain. The two other cases (BOO pitch/scrubber and BOO LFSO are the second best option with almost the same economic benefit (about NAf 2,8 billion).

- Important external welfare effects are benefits of dismantling the refinery and remediation of the Schottegat area. Preferring the 'no access and minimum cleaning policy over the 'do nothing' option means that the Government (and the public it represents) implicitly judge the value of the accompanying advantages higher than the costs of such a policy. Another non-monetary benefit is the preservation of economy diversification. Without a refinery, the economy of Curacao less diversified and more sensitive to fluctuations in the remaining economic activities on the island. Preservation of the refinery will lead to the need of young well educated people, which also will benefit the quality of education on the island. Both effects are non-monetary benefits (PM) and comes on top of the above mentioned net economic benefits.
- The revenues for the government amount to NAf 775 million (average of all 6 variants) and consist of Land Lease revenues, Preferred Stock Dividend and taxes on profit related to ISLA refinery only. If these fees and taxes are not paid (or partially paid) by the operator of the refinery, the revenues of the government are varying from NAf 0 to Naf 775 million (as a maximum) and as a consequence the net welfare effect reduces with that particular amount.
- However, independent whether the refinery will be upgraded or closed down, a separate contract will be concluded for Bullenbay Terminal, which in any case will generate income for the Government in the form of Land Lease and/or Preferred Stock Dividend to be paid be the new investor/operator. Total Government's revenues from Bullenbay are estimated at annually NAf 53 million (not inflated) as a maximum, with a NPV of NAf 320 million, in case the new operator will not participate in the terminal. In case the new operator will also participate for 50% total Government's revenues are NAf 300 upfront and NAf 27 million annually (to be inflated) as a maximum, with a NPV of NAf 460 million. These figures do not include any profit tax; this is dependent on the tax regime of the Government and final negotiations with the new investor/operator.

16.2 Dismantling and remediation

What are the costs of dismantling the refinery and remediation of soil and groundwater on the ISLA site?

In both the upgrading refinery variant and the redevelopment variant, dismantling and remediation will take place. Two remediation scenarios were defined for calculating the costs:

- Do minimum and no access: dismantling the present refinery structures, fencing of the area and minimum remediation of the polluted soil to prevent safety and health risks up to 2045;
- Thorough remediation (including dismantling) in order to meet the most critical function i.e. residential.

The first remediation scenario is applied to the refinery upgrading variants and to the reference case of the redevelopment variants. The second scenario is applied to the project cases under the redevelopment variant.

Dismantling (and demolition) costs of all refinery units have been calculated through estimation of costs for removal of:

- aboveground objects (steel and concrete);
- asbestos pipelines (outside plant areas, off plot);
- foundations of plants and tanks;
- roads.

To get a reliable estimation of the dismantling cost the following activities have been carried out:

- Based on historical survey and current refinery activities, a first hypothesis was formulated on the type and degree of soil contamination of 141 distinguished subareas.

- Field work (including a total of 65 borings, development and sampling of 20 old monitoring wells, 39 soil trenches, 3 shoreline borings and 3 sediment samples) and sample analysis resulted in an overview of the contamination in the distinguished subareas.
- Cost calculations for remediation and dismantling.

The total costs of dismantling and remediation are presented in the table below.

Table 16-1 Overview dismantling and remediation costs

	Dismantling Costs (NAFL million)	Remediation Costs (NAFL million)
Do minimum and no access	254	526
Thorough remediation to meet the proposed function of the redevelopment variant	254	1,467

It is assumed that the total dismantling and remediation process will take 7 years (2 years for dismantling and 5 years for remediation). The date of commencing is depends on the investment variant.

16.3 ISLA re-development investments

Introduction

Will redevelopment of the Schottegat area (instead of other possible zoning areas) to accommodate new economic activities during the period 2020-2045, contribute to the national welfare of Curacao, given the need for new planning areas foreseen in the 'base case' and 'optimistic' growth scenarios, and given the present supply of plan locations?

There are two reasons for the Government to pay attention to the national economic or welfare implications of redeveloping the Schottegat area between 2020 and 2045. The first reason is that, if upgrading the present refinery would appear technically, commercially or financially not economically sustainable, re-use of the vast ISLA premises (nearly 500 ha) might be an economically attractive alternative to zoning areas elsewhere on the island. A second reason is that, even if the business case analysis shows that upgrading of the refinery is viable and private parties are actually prepared to engage themselves on the short (i.e. within two years) for investment and operation of such a project, the question should be answered whether upgrading the refinery creates more national welfare than redevelopment.

In order to get a reliable impression of the economic viability of redeveloping the Schottegat area during the period 2020 to 2045, a number of research activities have been carried out:

- A picture has been drawn up of the expected upper and lower limit autonomous development of the national economy till 2045, with special attention to characteristics such as activities by industry, (working) population and migration development, and the expected supply and demand for houses by income category. This was done by drawing up two long-run socio-economic scenarios, based on the recent DEZ 'base case' and 'optimistic' scenario.
- Some feasible zoning designs for the Schottegat area have been formulated in sufficient detail, in order to specify its capacity to accommodate a substantial part of the growth related activities. Design variant A ('non tourist industries and housing') offers room for a variety of industries (except tourism); the remaining space is filled up with houses for lower and middle/higher income categories. For houses and offices are further two density sub variants distinguished; one for 'normal' building densities, and one for higher densities than at present allowed on Curacao. Design variant B ('housing, industries and greenery') comprises a large green area

(185 ha); it offers some room for tourism activities and industries, and the remaining area is used for new houses.

- According to the national spatial policy existing zoning schemes provide the island with an area supply for future development needs. This supply stock must be used up before the Schottegat area or alternative areas will come around. For this reason an inventory was made of the official zoning area stock. (In some sub variants also the availability of additional areas at Wechi and Eastpoint was taken into consideration).
- Based on these research steps the annual costs of remediation and construction, and the annual revenues (sales of new houses and value added of new economic activities) realized in the Schottegat area (or on alternative island locations) have been estimated and assessed for six sub variants A and two sub variants B. As mentioned before, dismantling and the 'no access' part of remediation costs (investment costs that must anyway be made, even if upgrading is not a viable option) must not be related to the redevelopment project in the cost-benefit analysis.
- Next the annual project costs and benefits have been discounted to their present values in 2011, and subsequently aggregated over the total time horizon (2020-2045). Finally the resulting net benefits for each redevelopment sub variant were presented in Chapters 14 and 15, together with an overview of external effects (welfare effects without market values).

Findings

The welfare economic evaluation leads to the following findings:

- Based on a variety of well-reasoned assumptions, presented in the previous chapters, all sub variants A as well as the low growth B sub variant appear to provide positive net benefits - in the average NAFL 104 million (net present value in 2011) after aggregation over the whole period 2020-2045, at a social discount rate of 7%. The average net benefits can be compared with the average cost difference between developing the Schottegat area and developing other island locations (NAFL 281 million; i.e. a net benefit/cost difference ratio of 37%).
- Variant A (making maximal use of the capacity of ISLA to construct houses, offices, warehouses and other industrial buildings) generates more measurable welfare than variant B (with 185 ha or 40% green area, reserved for parks and recreational purposes), even if every citizen are prepared to attach annually a (willingness to pay) value of NAFL 25 to such facilities. The resulting return is less than revenues to be gained instead by building houses and earning value added on this area. (The calculated average net benefit for sub variants A is NAFL 150 million, and for sub variants B NAFL – 13 million.)
- The fact that positive net benefits are estimated for nearly all variants (except for high economic growth sub variant of lay-out B) is mainly caused by a crucial assumption regarding synergy and/or centrality bonuses, attached to the assignment of new activities to the Schottegat area instead of to other island locations. The idea is that this location offers Curacao better opportunities to develop some metropolitan hallmarks and to stimulate competing services and office industries on a Caribbean scale. This is due to its setting on the island, adjacent to the existing capital, bordering on deep water in the Anna Bay and favorably situated with respect to island's main infrastructure amenities. The potential synergy bonus was specified as 5% of the value added realized in service industries to be situated on ISLA; the centrality bonus as another 5%, realized if the development will be realized in a high density lay-out.
- If this assumption is not correct and the Schottegat area would offer no competing advantages for housing and economic development net benefits would become lower, and in fact slightly negative (NAFL -25 million in the average). On the other hand if the advantages become double the assumed value (or 10% of the value added in the service industry) the net benefit will increase to NAFL 230 million.
- Higher GDP growth rates does not necessarily lead to higher net benefits on ISLA, because the impact of investment costs of remediation and construction, moved forward in time and squeezed into a shorter period of time, will not always be fully compensated by the earlier

revenues. (The average benefit of low growth sub variants is NAFL 116 million, and of higher growth sub variants NAFL 93).

- Building houses and offices in higher density (in variant A) on ISLA than elsewhere, on the other hand, provides higher net welfare revenues than building elsewhere. Construction costs per hectare become lower, house prices are higher than elsewhere (although less than in a normal density lay-out), and on top of this, the presumed centrality bonus will be cashed in. While normal density A sub variants generate an average benefit of NAFL 77 million, the higher density variants show an amount of NAFL 222 million.

These findings can be completed with the following results of the sensitivity analysis:

- Changing the social discount rate from 7% to 10% reduces the average net benefit from NAFL 104 to NAFL 35, while the investment costs difference decrease from NAFL 281 to NAFL 162 (net benefit/cost difference ratio: 22%). Decreasing the discount rate to 4% means a net benefit increase to NAFL 283, and a cost difference increase to NAFL 503 million (net benefit/cost difference ratio: 56%).
- New investments and the operation of new activities generate secondary impacts in the national economy (also called indirect forward and backward effects). However, such 'ripple' effects must not be considered welfare effects, unless they are a consequence of distortions of the national economy, caused by the project. There are no convincing reasons to assume that redeveloping ISLA instead of developing other locations on Curacao will cause considerable indirect welfare effects. Therefore, in the base calculations only 20% (at the very most) of the total indirect impact was interpreted as a possible welfare effect. If this percentage would nevertheless be raised to 100% net benefits would increase in the average from NAFL 104 million to NAFL 155 million.
- If the assumption is abandoned that houses of the same type build on ISLA can be sold at 10% to 15% higher prices than when build elsewhere on Curacao, net benefit would drop from NAFL 104 million to NAFL -9 million on average.
- The estimated amount of additional remediation costs, to be incurred if the ISLA site will be redeveloped (instead of left fallow till 2045 in the 'no access' reference option), has a uncertainty band width of plus and minus 40%. An overestimation with 40% end in higher net benefits (NAFL 183 million on average), and an underestimation with 40% to a reduction (to NAFL 25).
- Increasing the area on the ISLA reserved for high density residential construction (in the high density sub variants) from 10% to 20% increases net benefits in the average with 40%.
- Intensifying (in higher density areas) the construction density for houses or offices or increasing the number of floors has nearly no influence on net benefits.

16.4 Recommendations

ISLA refinery

The conclusion can be drawn that, under the given assumptions, upgrading of the ISLA refinery is technically, commercially and financially viable from a private point of view and economically profitable from a national (welfare) point of view.

An important recommendation is therefore, to immediately start with search for possible investors and operators and in parallel to execute a binding MoU with PDVSA with a goal to receive PDVSA's position on ISLA prior to lease termination scheduled for 2019. Both ways should be explored and if possible being combined (for instance to conclude a long term contract with PDVSA as crude supplier with parallel a contract for investing and operating the refinery).

It is advised that within a period of 2 years as a maximum (given the 5 to 6 years period needed from preparation stage, detailed design, etc. construction of the facilities to be upgraded up to first day of operation) but in practice before the date of 01-01-2014, a final contract has to be concluded. In this process of finding an investor the fiscal package (including taxes, depreciation, import duties and export rights, etc.) from the Government need to be clear and should be discussed /approved as soon as possible. Next to that ownership of the refinery and the role/partnership of the Government need to be clear and discussed (including proposals for Land Lease and Preferred Stock Dividend). Also it has to be clear to new investors that RdK and the Government agree to defend and indemnify Lenders and Sponsors for any costs, expenses or liability associated with the remediation, containment or any action or claim associated with pre-existing hazardous waste material etc. at the Refinery (site).

In case no bids are successful, and as a consequence the refinery has to be closed down according to contract with PDVSA, the Government has to identify in an early stage an alternative fuel supplier for local consumption on the island and to establish an additional oil depot, or to decide when the refinery will be closed to use one or more available tank facilities for that purpose. Furthermore, to identify a better use for the ISLA site prior to closing the refinery (see below Schottegat area).

In case of closing down the refinery, it is advised to explore as soon as possible a DO-minimum scenario for dismantling and remediation of the ISLA site. We are assuming that the DO-minimum scenario will be implemented, but given the fact that it is very doubtful that subsidies are available and/or any financial possibilities, the main question is: "where can we get the money from for dismantling and remediation actions described under this scenario"? It is advised to the Government to pay high attention to this important issue as soon as possible and to discuss in detail other possibilities for financing in order to be fully prepared in time in case the refinery will be closed down. However, also in case the refinery will be upgraded, ways of financing for future (after for instance 2035/2037) dismantling and remediation have to be explored and a significant part of the Land Lease and/or Preferred Stock Dividend from the refinery (and also from Bullenbay Terminal) should be put aside in a separate fund.

Apart from ISLA a separate contract for Bullenbay Terminal has to be concluded with:
a) the new operator/investor of ISLA in case ISLA will be upgraded or with
b) the new company which is interested to operate the terminal in case the ISLA refinery will be closed end of 2019 or earlier. Also in this case the fiscal regime, (partly) ownership of the facilities, proposals for Land Lease and Preferred Stock Dividend, etc; has to be explored.

Schottegat area

The general conclusion can be drawn that, under the given assumptions, redevelopment of the Schottegat area will be at least as economically profitable as development of alternative areas on the island, and will probably generate more welfare.
An important recommendation is therefore that – even if upgrading the existing refinery appears to be a viable economic option and search for possible investors and operators as soon as possible is advisable – there is enough good reason to pay simultaneously serious attention to the strategic option of redevelopment. A two track approach will offer the Government anyhow a useful and efficient fall back option.

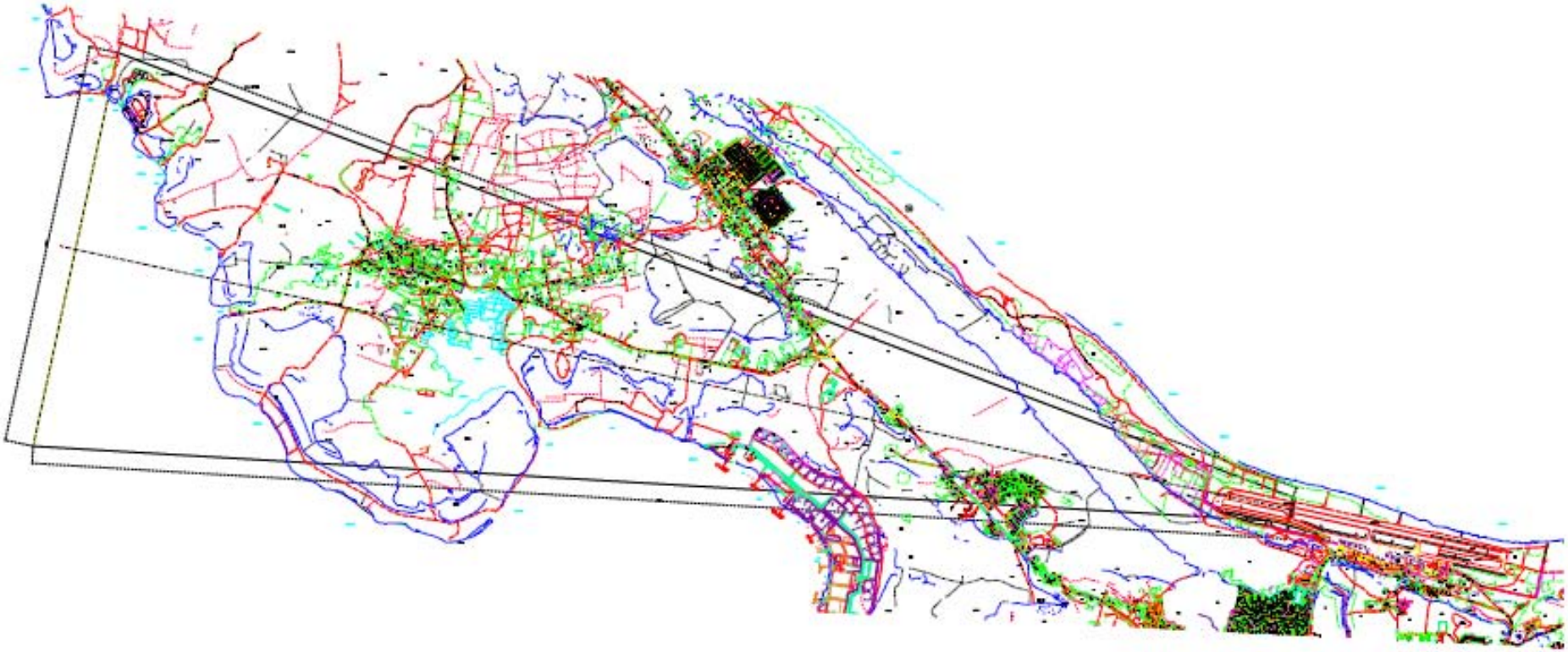
Crucial assumptions underlying this conclusion are the hypotheses of exploiting the centrality position of ISLA and a higher than 'normal' building density which may be realized on this unique location. They can be considered preconditions for the creation of fruitful synergetic effects and internationally competitive advantages.

On the other hand it must be stressed that the existence of these preconditions are no guarantee that such effects will actually be realized. It is therefore of the uttermost importance that the Strategic Vision Study, recently commissioned by the Government, pays thorough and detailed attention to the strategic role a redevelopment of ISLA can play to promote the national economy. Special attention must be given to the type of economic activities to be located there in order to effectively improve the international performance of the island economy.

Annexes

Annex 1 Map of runway centre line of HATO airport
Annex 2 Cash flow analyses part of chapter 6
Annex 3 Table part of chapter 10
Annex 4 Compilation of Input-Output table 2009 for Curacao
Annex 5 Indicators part of chapter 11
Annex 6 Risk table
Annex 7 Figures part of chapter 15
Annex 8 Work force at ISLA
Annex 9 Curalyse
Annex 10 List of interviewees

Annex 1 Map of runway centre line of HATO Airport



Annex 2 Cash flow analyses part of chapter 6

Table A.6.1 Product specification

ISLA EXPANSION PROJECT MODELING - PRODUCT SPECIFICATIONS				
Gasoline				
	Sulfur	Octane		RVP (avg.)
	ppm (max.)	RON (min.)	R+M/2 (min.)	psia (max.)
Latin/Caribbean Unleaded	500	91		10
Latin/Caribbean Premium	500	95		10
U.S. Export Unleaded	10		87	8
U.S. Export Premium	10		91	8
Diesel/Gasoil				
	Sulfur	Cetane		Smoke Point
	ppm (max.)	Index (min.)	Number (min.)	mm (min.)
Latin/Caribbean Jet/Kerosene	2000			19,5
Latin/Caribbean Gasoil	500		45	
Export ULSD (Euro V)	10	46	51	

Table A.6.2 Cash flow analysis Curacao refinery investment – NEWCO with integrated BOO with scrubbers (100% equity)

CURACAO REFINERY INVESTMENT - NEWCO WITH INTEGRATED BOO WITH SCRUBBERS (100% EQUITY)																								
(Millions of Dollars)																								
											START NEWCO OPERATIONS													
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Product Revenue		4.897,9	6.347,7	8.216,2	8.573,8	8.172,6	8.237,8	8.564,2	8.820,7	9.176,0	10.006,7	10.275,4	10.580,7	10.833,6	11.119,8	11.405,6	11.723,4	11.974,5	12.252,2	12.529,2	12.839,0	13.076,3	13.351,3	13.628,8	13.946,7
Feedstock Cost		(4.845,2)	(6.090,4)	(8.129,2)	(8.489,1)	(8.031,2)	(8.062,1)	(8.251,9)	(8.507,1)	(8.852,0)	(9.213,7)	(9.437,8)	(9.730,7)	(9.963,5)	(10.224,8)	(10.484,5)	(10.769,5)	(10.991,3)	(11.238,8)	(11.483,1)	(11.758,6)	(11.969,4)	(12.213,7)	(12.462,0)	(12.756,5)
Gross Margin Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Margin		**52,7**	**257,3**	**87,0**	**84,7**	**141,4**	**175,7**	**312,3**	**313,7**	**324,0**	**793,0**	**837,6**	**850,0**	**870,1**	**895,0**	**921,1**	**953,9**	**983,3**	**1.013,4**	**1.046,1**	**1.080,4**	**1.106,9**	**1.137,6**	**1.166,8**	**1.190,2**
Operating Costs																								
Variable																								
Catalyst & Chemicals	from history	(19,3)	(21,4)	(23,8)	(24,5)	(25,2)	(25,9)	(26,6)	(27,2)	(27,9)	(28,6)	(29,3)	(30,0)	(30,6)	(31,2)	(31,9)	(32,7)	(33,3)	(34,0)	(34,7)	(35,5)	(36,1)	(36,8)	(37,6)	(38,4)
Utilities-B.O.O. Net	from history	(28,8)	(29,2)	(30,0)	(30,9)	(32,0)	(33,0)	(33,8)	(34,5)	(35,1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOO Water Purchases/Other Var.											**(2,8)**	**(2,9)**	**(3,0)**	**(3,0)**	**(3,1)**	**(3,2)**	**(3,2)**	**(3,3)**	**(3,4)**	**(3,4)**	**(3,5)**	**(3,6)**	**(3,6)**	**(3,7)**	**(3,8)**
Scrubber Variable Costs											**(2,1)**	**(2,2)**	**(2,2)**	**(2,3)**	**(2,3)**	**(2,3)**	**(2,4)**	**(2,4)**	**(2,5)**	**(2,5)**	**(2,6)**	**(2,6)**	**(2,7)**	**(2,7)**	**(2,8)**
Project Incremental Variable Costs		(0,1)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(20,1)	(20,6)	(21,1)	(21,5)	(22,0)	(22,4)	(23,0)	(23,4)	(23,9)	(24,4)	(24,9)	(25,4)	(25,9)	(26,4)	(27,0)
LNG Fuel Cost Benefit ($ million)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Variable Costs		(48,3)	(50,7)	(54,0)	(55,6)	(57,3)	(59,1)	(60,5)	(61,9)	(63,2)	(53,7)	(54,9)	(56,2)	(57,3)	(58,6)	(59,8)	(61,3)	(62,4)	(63,7)	(65,0)	(66,5)	(67,7)	(69,1)	(70,5)	(72,1)
Fixed																								
Labor		(66,3)	(67,2)	(69,1)	(71,4)	(73,7)	(75,9)	(77,8)	(79,6)	(80,9)	**(90,3)**	**(92,1)**	**(94,1)**	**(95,8)**	**(97,7)**	**(99,7)**	**(101,9)**	**(103,7)**	**(105,8)**	**(107,9)**	**(110,3)**	**(112,2)**	**(114,5)**	**(116,8)**	**(119,4)**
Maintenance		(48,2)	(44,2)	(44,3)	(45,2)	(46,3)	(47,6)	(48,8)	(50,0)	(51,2)	**(62,0)**	**(63,3)**	**(64,9)**	**(66,1)**	**(67,6)**	**(69,1)**	**(70,7)**	**(72,0)**	**(73,5)**	**(75,0)**	**(76,8)**	**(78,1)**	**(79,7)**	**(81,3)**	**(83,2)**
Lease Fee	1	(18,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes & Insurance		(7,7)	(7,8)	(8,0)	(8,3)	(8,5)	(8,8)	(9,0)	(9,2)	(9,4)	**(10,7)**	**(10,9)**	**(11,2)**	**(11,4)**	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,1)**	**(13,3)**	**(13,6)**	**(13,8)**	**(14,2)**
Miscellaneous		(8,0)	(8,1)	(8,3)	(8,6)	(8,9)	(9,1)	(9,4)	(9,6)	(9,7)	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,0)**	**(13,3)**	**(13,5)**	**(13,8)**	**(14,1)**	**(14,4)**	**(14,7)**	**(15,0)**	**(15,3)**
Scrubber Fixed											**(1,6)**	**(1,6)**	**(1,7)**	**(1,7)**	**(1,7)**	**(1,8)**	**(1,8)**	**(1,8)**	**(1,9)**	**(1,9)**	**(2,0)**	**(2,0)**	**(2,0)**	**(2,1)**	**(2,1)**
Project Incremental Fixed Costs		(1,3)	(1,2)	(1,1)	(1,2)	(1,2)	(1,2)	(1,3)	(1,3)	(1,3)	(73,2)	(74,7)	(76,5)	(77,8)	(79,4)	(81,1)	(82,9)	(84,4)	(86,1)	(87,8)	(89,8)	(91,4)	(93,2)	(95,1)	(97,3)
Total Fixed		(149,5)	(148,5)	(150,9)	(154,6)	(158,6)	(162,7)	(166,3)	(169,7)	(172,6)	(249,3)	(254,5)	(260,4)	(265,1)	(270,6)	(276,1)	(282,5)	(287,5)	(293,3)	(299,3)	(306,1)	(311,4)	(317,7)	(324,1)	(331,4)
Operating Cost Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Operating Costs		**(197,8)**	**(199,2)**	**(204,9)**	**(210,1)**	**(216,0)**	**(221,7)**	**(226,8)**	**(231,6)**	**(235,8)**	**(303,0)**	**(309,4)**	**(316,6)**	**(322,4)**	**(329,1)**	**(336,0)**	**(343,7)**	**(349,9)**	**(357,0)**	**(364,3)**	**(372,6)**	**(379,1)**	**(386,8)**	**(394,5)**	**(403,4)**

Continuation of table

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
EBITDA		**(145,0)**	**58,0**	**(117,9)**	**(125,4)**	**(74,5)**	**(46,0)**	**85,5**	**82,1**	**88,2**	**489,9**	**528,3**	**533,4**	**547,6**	**565,9**	**585,1**	**610,2**	**633,4**	**656,3**	**681,8**	**707,9**	**727,7**	**750,9**	**772,3**	**786,8**
Depreciation (straight line)	Prior	**(2,1)**	**(2,2)**	**(2,2)**	**(2,3)**	**(4,7)**	**(7,2)**	**(9,7)**	**(12,2)**	**(14,9)**	**(18,6)**	**(22,4)**	**(26,2)**	**(30,2)**	**(34,2)**	**(38,3)**	**(42,5)**	**(46,8)**	**(51,1)**	**(55,6)**	**(193,6)**	**(198,2)**	**(202,9)**	**(207,7)**	**(212,6)**
Carryforward	-	**(2,1)**	-	**(2,2)**	**(4,5)**	**(9,2)**	**(16,4)**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Earnings Before Interest		**(145,0)**	**53,7**	**(117,9)**	**(125,4)**	**(74,5)**	**(46,0)**	**59,4**	**69,8**	**73,4**	**471,3**	**505,9**	**507,2**	**517,4**	**531,6**	**546,8**	**567,7**	**586,6**	**605,2**	**626,2**	**514,3**	**529,5**	**547,9**	**564,6**	**574,1**
Project Loan Interest Payment											(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
Other Before Tax Expense	0										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on Financed Inventory Cost		(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)
Taxable Earnings		**(145,0)**	**53,7**	**(117,9)**	**(125,4)**	**(74,5)**	**(46,0)**	**59,4**	**69,8**	**73,4**	**470,0**	**504,6**	**505,8**	**516,1**	**530,3**	**545,5**	**566,3**	**585,3**	**603,8**	**624,9**	**512,9**	**528,2**	**546,6**	**563,3**	**572,8**
Taxes		0,0	(14,8)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	(9,4)	(10,1)	(10,1)	(10,3)	(10,6)	(10,9)	(11,3)	(11,7)	(12,1)	(12,5)	(141,1)	(145,3)	(150,3)	(154,9)	(157,5)
Earnings		**(145,0)**	**38,9**	**(117,9)**	**(125,4)**	**(74,5)**	**(46,0)**	**59,4**	**69,8**	**73,4**	**460,6**	**494,5**	**495,7**	**505,8**	**519,7**	**534,6**	**555,0**	**573,5**	**591,8**	**612,4**	**371,9**	**382,9**	**396,3**	**408,4**	**415,3**
Other Non-Income Cash Flow Items																									
Sustaining Capital	1,00%	(43,0)	(43,6)	(44,8)	(46,1)	(47,7)	(49,2)	(50,4)	(51,4)	(52,4)	**(74,4)**	**(75,9)**	**(77,4)**	**(79,0)**	**(80,5)**	**(82,1)**	**(83,8)**	**(85,5)**	**(87,2)**	**(88,9)**	**(90,7)**	**(92,5)**	**(94,4)**	**(96,2)**	**(98,2)**
Capital Spending (excl. Interest)	(2.669,0)					(122,8)	(133,5)	(806,3)	(1.174,4)	(432,1)															
Project Equity Spending	(2.669,0)					(122,8)	(133,5)	(806,3)	(1.174,4)	(432,1)															
Project Loan Principal Payment	(0,0)										(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
Financial Assumptions																									
% Debt Financing	0%																								
Debt Interest Rate	7,85%																								
Loan Length (years)	15,0																								
Loan Start Date	31-12-2017																								
Interest on WC/Inventory	5,0%																								
Inventory Costs Financed (%)	85,0%																								
Tax Rate	27,5%																								
Discount Rate for Equity NPV	15%																								
Tax Holiday (years)	10,0			Tax Rate	2,0%																				
St. Line Depreciation Life (years)	20,0																								
Project Total Capital Cost	2.669,0																								
Loan Amount ($ million)	-																								
Final Payment to PDVSA	250,0																								
New PDVSA Lease, million $/yr	-																								
Terminal Value for Cash Flow																									**4.429,0**
Net After Tax Equity Cash Flow		**0,0**	**0,0**	**0,0**	**0,0**	**(122,8)**	**(133,5)**	**(806,3)**	**(1.174,4)**	**(432,1)**	**404,8**	**441,0**	**444,5**	**457,0**	**473,4**	**490,8**	**513,7**	**534,9**	**555,7**	**579,0**	**474,8**	**488,6**	**504,9**	**519,9**	**4.958,8**
IRR on Equity				**15,2%**																					
NPV at 15% ($ million)				**23,5**																					

Table A.6.3 Cash flow analysis Curacao refinery investment – NEWCO with integrated BOO with scrubbers (30% equity/70% debt)

CURACAO REFINERY INVESTMENT - NEWCO WITH INTEGRATED BOO WITH SCRUBBERS (30% EQUITY/70%DEBT)
(Millions of Dollars)

											START NEWCO OPERATIONS													
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Product Revenue		4.897,9	6.347,7	8.216,2	8.573,8	8.172,6	8.237,8	8.564,2	8.820,7	9.176,0	10.006,7	10.275,4	10.580,7	10.833,6	11.119,8	11.405,6	11.723,4	11.974,5	12.252,2	12.529,2	12.839,0	13.076,3	13.351,3	13.628,8	13.946,7
Feedstock Cost		(4.845,2)	(6.090,4)	(8.129,2)	(8.489,1)	(8.031,2)	(8.062,1)	(8.251,9)	(8.507,1)	(8.852,0)	(9.213,7)	(9.437,8)	(9.730,7)	(9.963,5)	(10.224,8)	(10.484,5)	(10.769,5)	(10.991,3)	(11.238,8)	(11.483,1)	(11.758,6)	(11.969,4)	(12.213,7)	(12.462,0)	(12.756,5)
Gross Margin Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Margin		**52,7**	**257,3**	**87,0**	**84,7**	**141,4**	**175,7**	**312,3**	**313,7**	**324,0**	**793,0**	**837,6**	**850,0**	**870,1**	**895,0**	**921,1**	**953,9**	**983,3**	**1.013,4**	**1.046,1**	**1.080,4**	**1.106,9**	**1.137,6**	**1.166,8**	**1.190,2**
Operating Costs																									
Variable																									
Catalyst & Chemicals	from histor	(19,3)	(21,4)	(23,8)	(24,5)	(25,2)	(25,9)	(26,6)	(27,2)	(27,9)	(28,6)	(29,3)	(30,0)	(30,6)	(31,2)	(31,9)	(32,7)	(33,3)	(34,0)	(34,7)	(35,5)	(36,1)	(36,8)	(37,6)	(38,4)
Utilities-B.O.O. Net	from histor	(28,8)	(29,2)	(30,0)	(30,9)	(32,0)	(33,0)	(33,8)	(34,5)	(35,1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOO Water Purchases/Other Var.											**(2,8)**	**(2,9)**	**(3,0)**	**(3,0)**	**(3,1)**	**(3,2)**	**(3,2)**	**(3,3)**	**(3,4)**	**(3,4)**	**(3,5)**	**(3,6)**	**(3,6)**	**(3,7)**	**(3,8)**
Scrubber Variable Costs											**(2,1)**	**(2,2)**	**(2,2)**	**(2,3)**	**(2,3)**	**(2,3)**	**(2,4)**	**(2,4)**	**(2,5)**	**(2,5)**	**(2,6)**	**(2,6)**	**(2,7)**	**(2,7)**	**(2,8)**
Project Incremental Variable Costs		(0,1)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(20,1)	(20,6)	(21,1)	(21,5)	(21,9)	(22,4)	(22,9)	(23,4)	(23,9)	(24,3)	(24,9)	(25,4)	(25,9)	(26,4)	(27,0)
LNG Fuel Cost Benefit ($ million)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Variable Costs		(48,3)	(50,7)	(54,0)	(55,6)	(57,3)	(59,1)	(60,5)	(61,9)	(63,2)	(53,7)	(54,9)	(56,2)	(57,3)	(58,6)	(59,8)	(61,2)	(62,4)	(63,7)	(65,0)	(66,5)	(67,7)	(69,0)	(70,4)	(72,0)
Fixed																									
Labor		(66,3)	(67,2)	(69,1)	(71,4)	(73,7)	(75,9)	(77,8)	(79,6)	(80,9)	**(90,3)**	**(92,1)**	**(94,1)**	**(95,8)**	**(97,7)**	**(99,7)**	**(101,9)**	**(103,7)**	**(105,8)**	**(107,9)**	**(110,3)**	**(112,2)**	**(114,5)**	**(116,8)**	**(119,4)**
Maintenance		(48,2)	(44,2)	(44,3)	(45,2)	(46,3)	(47,6)	(48,8)	(50,0)	(51,2)	**(62,0)**	**(63,3)**	**(64,9)**	**(66,1)**	**(67,6)**	**(69,1)**	**(70,7)**	**(72,0)**	**(73,5)**	**(75,0)**	**(76,8)**	**(78,1)**	**(79,7)**	**(81,3)**	**(83,2)**
Lease Fee	1	(18,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes & Insurance		(7,7)	(7,8)	(8,0)	(8,3)	(8,5)	(8,8)	(9,0)	(9,2)	(9,4)	**(10,7)**	**(10,9)**	**(11,2)**	**(11,4)**	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,1)**	**(13,3)**	**(13,6)**	**(13,8)**	**(14,2)**
Miscellaneous		(8,0)	(8,1)	(8,3)	(8,6)	(8,9)	(9,1)	(9,4)	(9,6)	(9,7)	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,0)**	**(13,3)**	**(13,5)**	**(13,8)**	**(14,1)**	**(14,4)**	**(14,7)**	**(15,0)**	**(15,3)**
Scrubber Fixed											**(1,6)**	**(1,6)**	**(1,7)**	**(1,7)**	**(1,7)**	**(1,8)**	**(1,8)**	**(1,8)**	**(1,9)**	**(1,9)**	**(2,0)**	**(2,0)**	**(2,0)**	**(2,1)**	**(2,1)**
Project Incremental Fixed Costs		(1,3)	(1,2)	(1,1)	(1,2)	(1,2)	(1,2)	(1,3)	(1,3)	(1,3)	(73,3)	(74,8)	(76,5)	(77,9)	(79,5)	(81,1)	(83,0)	(84,4)	(86,1)	(87,9)	(89,9)	(91,4)	(93,3)	(95,1)	(97,3)
Total Fixed		(149,5)	(148,5)	(150,9)	(154,6)	(158,6)	(162,7)	(166,3)	(169,7)	(172,6)	(249,3)	(254,5)	(260,4)	(265,1)	(270,6)	(276,1)	(282,5)	(287,5)	(293,4)	(299,3)	(306,1)	(311,5)	(317,7)	(324,1)	(331,4)
Operating Cost Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Operating Costs		**(197,8)**	**(199,2)**	**(204,9)**	**(210,1)**	**(216,0)**	**(221,7)**	**(226,8)**	**(231,6)**	**(235,8)**	**(303,0)**	**(309,4)**	**(316,6)**	**(322,4)**	**(329,1)**	**(336,0)**	**(343,7)**	**(349,9)**	**(357,0)**	**(364,3)**	**(372,6)**	**(379,1)**	**(386,8)**	**(394,5)**	**(403,4)**
EBITDA		**(145,0)**	**58,0**	**(117,9)**	**(125,4)**	**(74,5)**	**(46,0)**	**85,5**	**82,1**	**88,2**	**489,9**	**528,3**	**533,4**	**547,6**	**565,9**	**585,1**	**610,2**	**633,4**	**656,3**	**681,8**	**707,9**	**727,7**	**750,9**	**772,3**	**786,8**

Continuation of table

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Depreciation (straight line)	Prior	(2,1)	(2,2)	(2,2)	(2,3)	(4,7)	(7,2)	(9,7)	(12,2)	(14,9)	(18,6)	(22,4)	(26,2)	(30,2)	(34,2)	(38,3)	(42,5)	(46,8)	(51,1)	(55,6)	(213,4)	(218,0)	(222,7)	(227,6)	(232,5)
Carryforward	-	(2,1)	-	(2,2)	(4,5)	(9,2)	(16,4)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Earnings Before Interest		(145,0)	53,7	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	471,3	505,9	507,2	517,4	531,6	546,8	567,7	586,6	605,2	626,2	494,5	509,7	528,1	544,8	554,3
Project Loan Interest Payment											(168,4)	(162,2)	(155,4)	(148,1)	(140,2)	(131,7)	(122,6)	(112,7)	(102,0)	(90,6)	(78,2)	(64,8)	(50,4)	(34,8)	(18,1)
Other Before Tax Expense	0										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on Financed Inventory Cost		(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)
Taxable Earnings		(145,0)	53,7	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	301,6	342,4	350,4	368,0	390,1	413,7	443,8	472,6	501,8	534,3	415,0	443,6	476,4	508,6	534,9
Taxes		0,0	(14,8)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	(6,0)	(6,8)	(7,0)	(7,4)	(7,8)	(8,3)	(8,9)	(9,5)	(10,0)	(10,7)	(114,1)	(122,0)	(131,0)	(139,9)	(147,1)
Earnings		(145,0)	38,9	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	295,5	335,5	343,4	360,7	382,3	405,5	434,9	463,1	491,8	523,6	300,9	321,6	345,4	368,7	387,8
Other Non-Income Cash Flow Items																									
Sustaining Capital	1,00%	(43,0)	(43,6)	(44,8)	(46,1)	(47,7)	(49,2)	(50,4)	(51,4)	(52,4)	**(74,4)**	**(75,9)**	**(77,4)**	**(79,0)**	**(80,5)**	**(82,1)**	**(83,8)**	**(85,5)**	**(87,2)**	**(88,9)**	**(90,7)**	**(92,5)**	**(94,4)**	**(96,2)**	**(98,2)**
Capital Spending (excl. Interest)	(2.852,0)					(131,2)	(142,6)	(861,6)	(1.254,9)	(461,7)															
Project Equity Spending	(919,6)					(131,2)	(142,6)	(645,8)	0,0	0,0															
Project Loan Principal Payment	(2.145,7)										(80,0)	(86,2)	(93,0)	(100,3)	(108,2)	(116,7)	(125,8)	(135,7)	(146,4)	(157,8)	(170,2)	(183,6)	(198,0)	(213,6)	(230,3)
Tax Holiday (years)	10,0			Tax Rate	2,0%																				
St. Line Depreciation Life (years)	20,0																								
Project Total Capital Cost	3.065,3																								
Loan Amount ($ million)	2.145,7																								
Final Payment to PDVSA	250,0																								
New PDVSA Lease, million $/yr	-																								
Terminal Value for Cash Flow																									4.429,0
Net After Tax Equity Cash Flow		0,0	0,0	0,0	0,0	(131,2)	(142,6)	(645,8)	0,0	0,0	159,8	195,8	199,3	211,6	227,8	245,0	267,8	288,7	309,4	332,5	253,3	263,5	275,8	286,5	4.720,8
DSCR											1,64	1,79	1,80	1,85	1,92	1,99	2,08	2,16	2,25	2,34	2,02	2,06	2,11	2,15	2,17
IRR on Equity				19,0%																					
NPV at 15% ($ million)				294,4																					
ACC CASH FLOW FROM 2018 ONWARDS											159,8	355,6	554,8	766,4	994,2	1.239,2	1.507,0	1.795,8	2.105,1	2.437,6	2.690,9	2.954,5	3.230,2	3.516,7	3.808,5

Table A.6.4 Cash flow analysis Curacao refinery investment – NEWCO with integrated BOO with LSFO (100% equity)

CURACAO REFINERY INVESTMENT - NEWCO WITH INTEGRATED BOO WITH LSFO FUEL (100% EQUITY)
(Millions of Dollars)

											START NEWCO OPERATIONS													
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Product Revenue		4.897,9	6.347,7	8.216,2	8.573,8	8.172,6	8.237,8	8.564,2	8.820,7	9.176,0	10.145,8	10.418,1	10.727,6	10.984,0	11.274,1	11.563,9	11.886,1	12.140,6	12.422,1	12.702,8	13.016,8	13.257,2	13.535,9	13.817,3	14.139,6
Feedstock Cost		(4.845,2)	(6.090,4)	(8.129,2)	(8.489,1)	(8.031,2)	(8.062,1)	(8.251,9)	(8.507,1)	(8.852,0)	(9.205,0)	(9.428,9)	(9.721,5)	(9.954,1)	(10.215,1)	(10.474,6)	(10.759,3)	(10.980,8)	(11.228,1)	(11.472,2)	(11.747,4)	(11.958,0)	(12.202,1)	(12.450,1)	(12.744,3)
Gross Margin Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Margin		**52,7**	**257,3**	**87,0**	**84,7**	**141,4**	**175,7**	**312,3**	**313,7**	**324,0**	**940,8**	**989,2**	**1.006,1**	**1.029,9**	**1.059,0**	**1.089,4**	**1.126,8**	**1.159,8**	**1.193,9**	**1.230,6**	**1.269,4**	**1.299,2**	**1.333,9**	**1.367,2**	**1.395,3**
Operating Costs																									
Variable																									
Catalyst & Chemicals	from histor	(19,3)	(21,4)	(23,8)	(24,5)	(25,2)	(25,9)	(26,6)	(27,2)	(27,9)	(28,6)	(29,3)	(30,0)	(30,6)	(31,2)	(31,9)	(32,7)	(33,3)	(34,0)	(34,7)	(35,5)	(36,1)	(36,8)	(37,6)	(38,4)
Utilities-B.O.O. Net	from histor	(28,8)	(29,2)	(30,0)	(30,9)	(32,0)	(33,0)	(33,8)	(34,5)	(35,1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOO Water Purchases/Other Var.											**(2,8)**	**(2,9)**	**(3,0)**	**(3,0)**	**(3,1)**	**(3,2)**	**(3,2)**	**(3,3)**	**(3,4)**	**(3,4)**	**(3,5)**	**(3,6)**	**(3,6)**	**(3,7)**	**(3,8)**
BOO LSFO Purchase											**(164,3)**	**(168,5)**	**(173,5)**	**(177,6)**	**(182,3)**	**(186,9)**	**(192,0)**	**(196,0)**	**(200,4)**	**(204,8)**	**(209,7)**	**(213,5)**	**(217,9)**	**(222,4)**	**(227,5)**
Project Incremental Variable Costs		(0,1)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(19,9)	(20,3)	(20,8)	(21,2)	(21,7)	(22,2)	(22,7)	(23,1)	(23,6)	(24,1)	(24,6)	(25,1)	(25,6)	(26,1)	(26,7)
LNG Fuel Cost Benefit ($ million)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Variable Costs		(48,3)	(50,7)	(54,0)	(55,6)	(57,3)	(59,1)	(60,5)	(61,9)	(63,2)	(215,6)	(221,0)	(227,2)	(232,4)	(238,3)	(244,1)	(250,6)	(255,7)	(261,3)	(267,0)	(273,4)	(278,3)	(283,9)	(289,8)	(296,5)
Fixed																									
Labor		(66,3)	(67,2)	(69,1)	(71,4)	(73,7)	(75,9)	(77,8)	(79,6)	(80,9)	**(90,3)**	**(92,1)**	**(94,1)**	**(95,8)**	**(97,7)**	**(99,7)**	**(101,9)**	**(103,7)**	**(105,8)**	**(107,9)**	**(110,3)**	**(112,2)**	**(114,5)**	**(116,8)**	**(119,4)**
Maintenance		(48,2)	(44,2)	(44,3)	(45,2)	(46,3)	(47,6)	(48,8)	(50,0)	(51,2)	**(62,0)**	**(63,3)**	**(64,9)**	**(66,1)**	**(67,6)**	**(69,1)**	**(70,7)**	**(72,0)**	**(73,5)**	**(75,0)**	**(76,8)**	**(78,1)**	**(79,7)**	**(81,3)**	**(83,2)**
Lease Fee	1	(18,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes & Insurance		(7,7)	(7,8)	(8,0)	(8,3)	(8,5)	(8,8)	(9,0)	(9,2)	(9,4)	**(10,7)**	**(10,9)**	**(11,2)**	**(11,4)**	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,1)**	**(13,3)**	**(13,6)**	**(13,8)**	**(14,2)**
Miscellaneous		(8,0)	(8,1)	(8,3)	(8,6)	(8,9)	(9,1)	(9,4)	(9,6)	(9,7)	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,0)**	**(13,3)**	**(13,5)**	**(13,8)**	**(14,1)**	**(14,4)**	**(14,7)**	**(15,0)**	**(15,3)**
Scrubber Fixed					**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**
Project Incremental Fixed Costs		(1,3)	(1,2)	(1,1)	(1,2)	(1,2)	(1,2)	(1,3)	(1,3)	(1,3)	(75,7)	(77,3)	(79,1)	(80,5)	(82,1)	(83,8)	(85,7)	(87,2)	(89,0)	(90,8)	(92,9)	(94,5)	(96,4)	(98,3)	(100,6)
Total Fixed		(149,5)	(148,5)	(150,9)	(154,6)	(158,6)	(162,7)	(166,3)	(169,7)	(172,6)	(250,2)	(255,4)	(261,3)	(266,0)	(271,5)	(277,1)	(283,5)	(288,5)	(294,4)	(300,3)	(307,2)	(312,5)	(318,8)	(325,2)	(332,6)
Operating Cost Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Operating Costs		**(197,8)**	**(199,2)**	**(204,9)**	**(210,1)**	**(216,0)**	**(221,7)**	**(226,8)**	**(231,6)**	**(235,8)**	**(465,9)**	**(476,4)**	**(488,6)**	**(498,5)**	**(509,8)**	**(521,2)**	**(534,1)**	**(544,2)**	**(555,7)**	**(567,3)**	**(580,5)**	**(590,8)**	**(602,8)**	**(615,0)**	**(629,0)**

Continuation of table

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
EBITDA		(145,0)	58,0	(117,9)	(125,4)	(74,5)	(46,0)	85,5	82,1	88,2	474,9	512,9	517,5	531,4	549,2	568,1	592,7	615,6	638,2	663,3	688,9	708,4	731,1	752,2	766,2
Depreciation (straight line)	Prior	(2,1)	(2,2)	(2,2)	(2,3)	(4,7)	(7,2)	(9,7)	(12,2)	(14,9)	(18,6)	(22,4)	(26,3)	(30,3)	(34,4)	(38,5)	(42,8)	(47,1)	(51,5)	(55,9)	(194,3)	(199,0)	(203,8)	(208,6)	(213,6)
Carryforward	-	(2,1)	-	(2,2)	(4,5)	(9,2)	(16,4)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Earnings Before Interest		(145,0)	53,7	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	456,3	490,4	491,2	501,1	514,9	529,6	550,0	568,5	586,7	607,3	494,5	509,4	527,3	543,6	552,7
Project Loan Interest Payment											(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
Other Before Tax Expense	0										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on Financed Inventory Cost		(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)
Taxable Earnings		(145,0)	53,7	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	455,0	489,1	489,8	499,8	513,5	528,3	548,7	567,2	585,4	606,0	493,2	508,1	526,0	542,3	551,3
Taxes		0,0	(14,8)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	(9,1)	(9,8)	(9,8)	(10,0)	(10,3)	(10,6)	(11,0)	(11,3)	(11,7)	(12,1)	(135,6)	(139,7)	(144,7)	(149,1)	(151,6)
Earnings		(145,0)	38,9	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	445,9	479,3	480,0	489,8	503,3	517,7	537,7	555,9	573,7	593,9	357,6	368,3	381,4	393,2	399,7
Other Non-Income Cash Flow Items																									
Sustaining Capital	1,00%	(43,0)	(43,6)	(44,8)	(46,1)	(47,7)	(49,2)	(50,4)	(51,4)	(52,4)	(75,0)	(76,5)	(78,1)	(79,6)	(81,2)	(82,8)	(84,5)	(86,2)	(87,9)	(89,7)	(91,5)	(93,3)	(95,2)	(97,1)	(99,0)
Capital Spending (excl. Interest)	(2.676,5)					(123,1)	(133,8)	(808,6)	(1.177,7)	(433,3)															
Project Equity Spending	(2.676,5)					(123,1)	(133,8)	(808,6)	(1.177,7)	(433,3)															
Project Loan Principal Payment	(0,0)										(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
Financial Assumptions																									
% Debt Financing	0%																								
Debt Interest Rate	7,85%																								
Loan Length (years)	15,0																								
Loan Start Date	########																								
Interest on WC/Inventory	5,0%																								
Inventory Costs Financed (%)	85,0%																								
Tax Rate	27,5%																								
Discount Rate for Equity NPV	15%																								
Tax Holiday (years)	10,0			Tax Rate	2,0%																				
St. Line Depreciation Life (years)	20,0																								
Project Total Capital Cost	2.676,5																								
Loan Amount ($ million)	-																								
Final Payment to PDVSA	250,0																								
New PDVSA Lease, million $/yr	-																								
Terminal Value for Cash Flow																									2.574,8
Net After Tax Equity Cash Flow		0,0	0,0	0,0	0,0	(123,1)	(133,8)	(808,6)	(1.177,7)	(433,3)	389,5	425,2	428,3	440,5	456,4	473,4	495,9	516,7	537,2	560,1	460,4	474,0	490,0	504,7	3.089,1
IRR on Equity				13,8%																					
NPV at 15% ($ million)				(142,2)																					

Table A.6.5 Cash flow analysis Curacao refinery investment – NEWCO with integrated BOO with LSFO (30% equity, 70% debt)

CURACAO REFINERY INVESTMENT - NEWCO WITH INTEGRATED BOO WITH LSFO FUEL (30% EQUITY/70% DEBT)
(Millions of Dollars)

START NEWCO OPERATIONS

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Product Revenue		4.897,9	6.347,7	8.216,2	8.573,8	8.172,6	8.237,8	8.564,2	8.820,7	9.176,0	10.145,8	10.418,1	10.727,6	10.984,0	11.274,1	11.563,9	11.886,1	12.140,6	12.422,1	12.702,8	13.016,8	13.257,2	13.535,9	13.817,3	14.139,6
Feedstock Cost		(4.845,2)	(6.090,4)	(8.129,2)	(8.489,1)	(8.031,2)	(8.062,1)	(8.251,9)	(8.507,1)	(8.852,0)	(9.205,0)	(9.428,9)	(9.721,5)	(9.954,1)	(10.215,1)	(10.474,6)	(10.759,3)	(10.980,8)	(11.228,1)	(11.472,2)	(11.747,4)	(11.958,0)	(12.202,1)	(12.450,1)	(12.744,3)
Gross Margin Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Margin		**52,7**	**257,3**	**87,0**	**84,7**	**141,4**	**175,7**	**312,3**	**313,7**	**324,0**	**940,8**	**989,2**	**1.006,1**	**1.029,9**	**1.059,0**	**1.089,4**	**1.126,8**	**1.159,8**	**1.193,9**	**1.230,6**	**1.269,4**	**1.299,2**	**1.333,9**	**1.367,2**	**1.395,3**
Operating Costs																									
Variable																									
Catalyst & Chemicals	from histor	(19,3)	(21,4)	(23,8)	(24,5)	(25,2)	(25,9)	(26,6)	(27,2)	(27,9)	(28,6)	(29,3)	(30,0)	(30,6)	(31,2)	(31,9)	(32,7)	(33,3)	(34,0)	(34,7)	(35,5)	(36,1)	(36,8)	(37,6)	(38,4)
Utilities-B.O.O. Net	from histor	(28,8)	(29,2)	(30,0)	(30,9)	(32,0)	(33,0)	(33,8)	(34,5)	(35,1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOO Water Purchases/Other Var.											**(2,8)**	**(2,9)**	**(3,0)**	**(3,0)**	**(3,1)**	**(3,2)**	**(3,2)**	**(3,3)**	**(3,4)**	**(3,4)**	**(3,5)**	**(3,6)**	**(3,6)**	**(3,7)**	**(3,8)**
BOO LSFO Purchase											**(164,3)**	**(168,5)**	**(173,5)**	**(177,6)**	**(182,3)**	**(186,9)**	**(192,0)**	**(196,0)**	**(200,4)**	**(204,8)**	**(209,7)**	**(213,5)**	**(217,9)**	**(222,4)**	**(227,5)**
Project Incremental Variable Costs		(0,1)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(19,9)	(20,3)	(20,8)	(21,2)	(21,7)	(22,2)	(22,7)	(23,1)	(23,6)	(24,1)	(24,6)	(25,1)	(25,6)	(26,1)	(26,7)
LNG Fuel Cost Benefit ($ million)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Variable Costs		(48,3)	(50,7)	(54,0)	(55,6)	(57,3)	(59,1)	(60,5)	(61,9)	(63,2)	(215,6)	(221,0)	(227,2)	(232,4)	(238,3)	(244,1)	(250,6)	(255,7)	(261,3)	(267,0)	(273,4)	(278,3)	(283,9)	(289,8)	(296,5)
Fixed																									
Labor		(66,3)	(67,2)	(69,1)	(71,4)	(73,7)	(75,9)	(77,8)	(79,6)	(80,9)	**(90,3)**	**(92,1)**	**(94,1)**	**(95,8)**	**(97,7)**	**(99,7)**	**(101,9)**	**(103,7)**	**(105,8)**	**(107,9)**	**(110,3)**	**(112,2)**	**(114,5)**	**(116,8)**	**(119,4)**
Maintenance		(48,2)	(44,2)	(44,3)	(45,2)	(46,3)	(47,6)	(48,8)	(50,0)	(51,2)	**(62,0)**	**(63,3)**	**(64,9)**	**(66,1)**	**(67,6)**	**(69,1)**	**(70,7)**	**(72,0)**	**(73,5)**	**(75,0)**	**(76,8)**	**(78,1)**	**(79,7)**	**(81,3)**	**(83,2)**
Lease Fee	1	(18,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes & Insurance		(7,7)	(7,8)	(8,0)	(8,3)	(8,5)	(8,8)	(9,0)	(9,2)	(9,4)	**(10,7)**	**(10,9)**	**(11,2)**	**(11,4)**	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,1)**	**(13,3)**	**(13,6)**	**(13,8)**	**(14,2)**
Miscellaneous		(8,0)	(8,1)	(8,3)	(8,6)	(8,9)	(9,1)	(9,4)	(9,6)	(9,7)	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,0)**	**(13,3)**	**(13,5)**	**(13,8)**	**(14,1)**	**(14,4)**	**(14,7)**	**(15,0)**	**(15,3)**
Scrubber Fixed					**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**
Project Incremental Fixed Costs		(1,3)	(1,2)	(1,1)	(1,2)	(1,2)	(1,2)	(1,3)	(1,3)	(1,3)	(75,7)	(77,3)	(79,1)	(80,5)	(82,1)	(83,8)	(85,7)	(87,2)	(89,0)	(90,8)	(92,9)	(94,5)	(96,4)	(98,3)	(100,6)
Total Fixed		(149,5)	(148,5)	(150,9)	(154,6)	(158,6)	(162,7)	(166,3)	(169,7)	(172,6)	(250,2)	(255,4)	(261,3)	(266,0)	(271,5)	(277,1)	(283,5)	(288,5)	(294,4)	(300,3)	(307,2)	(312,5)	(318,8)	(325,2)	(332,6)
Operating Cost Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Operating Costs		**(197,8)**	**(199,2)**	**(204,9)**	**(210,1)**	**(216,0)**	**(221,7)**	**(226,8)**	**(231,6)**	**(235,8)**	**(465,9)**	**(476,4)**	**(488,6)**	**(498,5)**	**(509,8)**	**(521,2)**	**(534,1)**	**(544,2)**	**(555,7)**	**(567,3)**	**(580,5)**	**(590,8)**	**(602,8)**	**(615,0)**	**(629,0)**
EBITDA		**(145,0)**	**58,0**	**(117,9)**	**(125,4)**	**(74,5)**	**(46,0)**	**85,5**	**82,1**	**88,2**	**474,9**	**512,9**	**517,5**	**531,4**	**549,2**	**568,1**	**592,7**	**615,6**	**638,2**	**663,3**	**688,9**	**708,4**	**731,1**	**752,2**	**766,2**

Continuation of table

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Depreciation (straight line)	Prior	(2,1)	(2,2)	(2,2)	(2,3)	(4,7)	(7,2)	(9,7)	(12,2)	(14,9)	(18,6)	(22,4)	(26,3)	(30,3)	(34,4)	(38,5)	(42,8)	(47,1)	(51,5)	(55,9)	(215,8)	(220,4)	(225,2)	(230,0)	(235,0)
Carryforward	-	(2,1)	-	(2,2)	(4,5)	(9,2)	(16,4)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Earnings Before Interest		(145,0)	53,7	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	456,3	490,4	491,2	501,1	514,9	529,6	550,0	568,5	586,7	607,3	473,1	488,0	505,9	522,2	531,3
Project Loan Interest Payment											(170,6)	(164,3)	(157,4)	(150,0)	(142,0)	(133,4)	(124,2)	(114,1)	(103,4)	(91,7)	(79,2)	(65,6)	(51,0)	(35,3)	(18,3)
Other Before Tax Expense	0										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on Financed Inventory Cost		(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)
Taxable Earnings		(145,0)	53,7	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	284,4	324,8	332,4	349,8	371,5	394,9	424,5	453,1	482,1	514,3	392,6	421,0	453,5	485,6	511,6
Taxes		0,0	(14,8)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	(5,7)	(6,5)	(6,6)	(7,0)	(7,4)	(7,9)	(8,5)	(9,1)	(9,6)	(10,3)	(108,0)	(115,8)	(124,7)	(133,5)	(140,7)
Earnings		(145,0)	38,9	(117,9)	(125,4)	(74,5)	(46,0)	59,4	69,8	73,4	278,7	318,3	325,8	342,8	364,1	387,0	416,0	444,0	472,4	504,0	284,6	305,2	328,8	352,0	370,9
Other Non-Income Cash Flow Items																									
Sustaining Capital	1,00%	(43,0)	(43,6)	(44,8)	(46,1)	(47,7)	(49,2)	(50,4)	(51,4)	(52,4)	(75,0)	(76,5)	(78,1)	(79,6)	(81,2)	(82,8)	(84,5)	(86,2)	(87,9)	(89,7)	(91,5)	(93,3)	(95,2)	(97,1)	(99,0)
Capital Spending (excl. Interest)	(2.888,8)					(132,9)	(144,4)	(872,7)	(1.271,1)	(467,7)															
Project Equity Spending	(931,4)					(132,9)	(144,4)	(654,1)	0,0	0,0															
Project Loan Principal Payment	(2.173,4)										(81,0)	(87,3)	(94,2)	(101,6)	(109,6)	(118,2)	(127,4)	(137,4)	(148,2)	(159,9)	(172,4)	(186,0)	(200,6)	(216,3)	(233,3)
Financial Assumptions																									
% Debt Financing	70%																								
Debt Interest Rate	7,85%																								
Loan Length (years)	15,0																								
Loan Start Date	########																								
Interest on WC/Inventory	5,0%																								
Inventory Costs Financed (%)	85,0%																								
Tax Rate	27,5%																								
Discount Rate for Equity NPV	15%																								
Tax Holiday (years)	10,0			Tax Rate	2,0%																				
St. Line Depreciation Life (years)	20,0																								
Project Total Capital Cost	3.104,8																								
Loan Amount ($ million)	2.173,4																								
Final Payment to PDVSA	250,0																								
New PDVSA Lease, million $/yr	-																								
Terminal Value for Cash Flow																									4.291,4
Net After Tax Equity Cash Flow		0,0	0,0	0,0	0,0	(132,9)	(144,4)	(654,1)	0,0	0,0	141,3	176,9	179,9	191,9	207,7	224,5	246,8	267,4	287,7	310,4	236,5	246,4	258,3	268,7	4.565,0
DSCR											1,56	1,70	1,71	1,76	1,83	1,89	1,98	2,06	2,14	2,23	1,94	1,98	2,03	2,07	2,09
IRR on Equity				18,0%																					
NPV at 15% ($ million)				220,9																					
ACC CASH FLOW FROM 2018 ONWARDS											141,3	318,2	498,0	689,9	897,6	1.122,0	1.368,8	1.636,3	1.924,0	2.234,4	2.470,9	2.717,3	2.975,5	3.244,2	3.517,9

Table A.6.6 Cash flow analysis Curacao refinery investment – NEWCO with integrated BOO with LNG (100% equity)

CURACAO REFINERY INVESTMENT - NEWCO WITH INTEGRATED BOO WITH LNG FUEL (100% EQUITY)
(Millions of Dollars)

											START NEWCO OPERATIONS													
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Product Revenue		4.897,9	6.347,7	8.216,2	8.573,8	8.172,6	8.237,8	8.564,2	8.820,7	9.176,0	10.145,8	10.418,1	10.727,6	10.984,0	11.274,1	11.563,9	11.886,1	12.140,6	12.422,1	12.702,8	13.016,8	13.257,2	13.535,9	13.817,3	14.139,6
Feedstock Cost		(4.845,2)	(6.090,4)	(8.129,2)	(8.489,1)	(8.031,2)	(8.062,1)	(8.251,9)	(8.507,1)	(8.852,0)	(9.205,0)	(9.428,9)	(9.721,5)	(9.954,1)	(10.215,1)	(10.474,6)	(10.759,3)	(10.980,8)	(11.228,1)	(11.472,2)	(11.747,4)	(11.958,0)	(12.202,1)	(12.450,1)	(12.744,3)
Gross Margin Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Margin		**52,7**	**257,3**	**87,0**	**84,7**	**141,4**	**175,7**	**312,3**	**313,7**	**324,0**	**940,8**	**989,2**	**1.006,1**	**1.029,9**	**1.059,0**	**1.089,4**	**1.126,8**	**1.159,8**	**1.193,9**	**1.230,6**	**1.269,4**	**1.299,2**	**1.333,9**	**1.367,2**	**1.395,3**
Operating Costs																									
Variable																									
Catalyst & Chemicals	from histor	(19,3)	(21,4)	(23,8)	(24,5)	(25,2)	(25,9)	(26,6)	(27,2)	(27,9)	(28,6)	(29,3)	(30,0)	(30,6)	(31,2)	(31,9)	(32,7)	(33,3)	(34,0)	(34,7)	(35,5)	(36,1)	(36,8)	(37,6)	(38,4)
Utilities-B.O.O. Net	from histor	(28,8)	(29,2)	(30,0)	(30,9)	(32,0)	(33,0)	(33,8)	(34,5)	(35,1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOO Water Purchases/Other Var.											**(2,8)**	**(2,9)**	**(3,0)**	**(3,0)**	**(3,1)**	**(3,2)**	**(3,2)**	**(3,3)**	**(3,4)**	**(3,4)**	**(3,5)**	**(3,6)**	**(3,6)**	**(3,7)**	**(3,8)**
BOO LNG Purchase vs. HSFO											**(109,2)**	**(114,5)**	**(119,6)**	**(124,3)**	**(129,7)**	**(135,6)**	**(142,2)**	**(149,1)**	**(156,1)**	**(163,2)**	**(169,7)**	**(176,0)**	**(182,0)**	**(187,6)**	**(192,9)**
Project Incremental Variable Costs		(0,1)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(19,9)	(20,3)	(20,8)	(21,2)	(21,7)	(22,2)	(22,7)	(23,1)	(23,6)	(24,1)	(24,6)	(25,1)	(25,6)	(26,1)	(26,7)
LNG Fuel Cost Benefit ($ million)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Variable Costs		(48,3)	(50,7)	(54,0)	(55,6)	(57,3)	(59,1)	(60,5)	(61,9)	(63,2)	(160,5)	(167,0)	(173,4)	(179,1)	(185,7)	(192,9)	(200,8)	(208,8)	(217,1)	(225,4)	(233,3)	(240,7)	(248,1)	(255,0)	(261,8)
Fixed																									
Labor		(66,3)	(67,2)	(69,1)	(71,2)	(73,7)	(75,9)	(77,8)	(79,4)	(80,9)	**(90,3)**	**(92,1)**	**(94,1)**	**(95,8)**	**(97,7)**	**(99,7)**	**(101,9)**	**(103,7)**	**(105,8)**	**(107,9)**	**(110,3)**	**(112,2)**	**(114,5)**	**(116,8)**	**(119,4)**
Maintenance		(48,2)	(44,2)	(44,3)	(45,0)	(46,3)	(47,6)	(48,8)	(49,9)	(51,2)	**(62,0)**	**(63,3)**	**(64,9)**	**(66,1)**	**(67,6)**	**(69,1)**	**(70,7)**	**(72,0)**	**(73,5)**	**(75,0)**	**(76,8)**	**(78,1)**	**(79,7)**	**(81,3)**	**(83,2)**
Lease Fee	1	(18,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes & Insurance		(7,7)	(7,8)	(8,0)	(8,3)	(8,5)	(8,8)	(9,0)	(9,2)	(9,4)	**(10,7)**	**(10,9)**	**(11,2)**	**(11,4)**	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,1)**	**(13,3)**	**(13,6)**	**(13,8)**	**(14,2)**
Miscellaneous		(8,0)	(8,1)	(8,3)	(8,6)	(8,9)	(9,1)	(9,4)	(9,6)	(9,7)	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,0)**	**(13,3)**	**(13,5)**	**(13,8)**	**(14,1)**	**(14,4)**	**(14,7)**	**(15,0)**	**(15,3)**
Scrubber Fixed					**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**
Project Incremental Fixed Costs		(1,3)	(1,2)	(1,1)	(1,2)	(1,2)	(1,2)	(1,3)	(1,3)	(1,3)	(75,7)	(77,3)	(79,1)	(80,5)	(82,1)	(83,8)	(85,7)	(87,2)	(89,0)	(90,8)	(92,9)	(94,5)	(96,4)	(98,3)	(100,6)
Total Fixed		(149,5)	(148,5)	(150,9)	(154,3)	(158,6)	(162,7)	(166,3)	(169,3)	(172,6)	(250,2)	(255,4)	(261,3)	(266,0)	(271,5)	(277,1)	(283,5)	(288,5)	(294,4)	(300,3)	(307,2)	(312,5)	(318,8)	(325,2)	(332,6)
Operating Cost Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Operating Costs		**(197,8)**	**(199,2)**	**(204,9)**	**(209,8)**	**(216,0)**	**(221,7)**	**(226,8)**	**(231,2)**	**(235,8)**	**(410,7)**	**(422,4)**	**(434,7)**	**(445,2)**	**(457,2)**	**(470,0)**	**(484,3)**	**(497,4)**	**(511,4)**	**(525,7)**	**(540,5)**	**(553,3)**	**(566,9)**	**(580,2)**	**(594,4)**
EBITDA		**(145,0)**	**58,0**	**(117,9)**	**(125,1)**	**(74,5)**	**(46,0)**	**85,5**	**82,4**	**88,2**	**530,0**	**566,9**	**571,4**	**584,7**	**601,8**	**619,4**	**642,5**	**662,4**	**682,5**	**704,9**	**728,9**	**745,9**	**767,0**	**787,0**	**800,9**

Continuation of table

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Depreciation (straight line)	Prior	(2,1)	(2,2)	(2,2)	(2,3)	(4,7)	(7,2)	(9,7)	(12,2)	(14,9)	(18,6)	(22,4)	(26,3)	(30,3)	(34,4)	(38,5)	(42,8)	(47,1)	(51,5)	(55,9)	(194,3)	(199,0)	(203,8)	(208,6)	(213,6)
Carryforward	-	(2,1)	-	(2,2)	(4,5)	(9,2)	(16,4)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Earnings Before Interest		**(145,0)**	**53,7**	**(117,9)**	**(125,1)**	**(74,5)**	**(46,0)**	**59,4**	**70,2**	**73,4**	**511,4**	**544,4**	**545,0**	**554,4**	**567,4**	**580,9**	**599,8**	**615,4**	**631,0**	**648,9**	**534,6**	**546,9**	**563,2**	**578,4**	**587,3**
Project Loan Interest Payment											(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
Other Before Tax Expense	0										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on Financed Inventory Cost		(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)
Taxable Earnings		**(145,0)**	**53,7**	**(121,4)**	**(128,6)**	**(78,0)**	**(49,5)**	**55,9**	**66,7**	**69,9**	**510,1**	**543,1**	**543,7**	**553,0**	**566,1**	**579,5**	**598,4**	**614,0**	**629,7**	**647,6**	**533,2**	**545,6**	**561,9**	**577,1**	**586,0**
Taxes		0,0	(14,8)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	(10,2)	(10,9)	(10,9)	(11,1)	(11,3)	(11,6)	(12,0)	(12,3)	(12,6)	(13,0)	(146,6)	(150,0)	(154,5)	(158,7)	(161,1)
Earnings		**(145,0)**	**38,9**	**(121,4)**	**(128,6)**	**(78,0)**	**(49,5)**	**55,9**	**66,7**	**69,9**	**499,9**	**532,2**	**532,8**	**542,0**	**554,8**	**567,9**	**586,5**	**601,8**	**617,1**	**634,7**	**386,6**	**395,6**	**407,3**	**418,4**	**424,8**
Other Non-Income Cash Flow Items																									
Sustaining Capital	1,00%	(43,0)	(43,6)	(44,8)	(46,1)	(47,7)	(49,2)	(50,4)	(51,4)	(52,4)	**(75,0)**	**(76,5)**	**(78,1)**	**(79,6)**	**(81,2)**	**(82,8)**	**(84,5)**	**(86,2)**	**(87,9)**	**(89,7)**	**(91,5)**	**(93,3)**	**(95,2)**	**(97,1)**	**(99,0)**
Stay In Business Capital																									
Capital Spending (excl. Interest)	(2.676,5)					(123,1)	(133,8)	(808,6)	(1.177,7)	(433,3)															
Project Equity Spending	(2.676,5)					(123,1)	(133,8)	(808,6)	(1.177,7)	(433,3)															
Project Loan Principal Payment	(0,0)										(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)	(0,0)
Financial Assumptions																									
% Debt Financing	0%																								
Debt Interest Rate	7,85%																								
Loan Length (years)	15,0																								
Loan Start Date	########																								
Interest on WC/Inventory	5,0%																								
Inventory Costs Financed (%)	85,0%																								
Tax Rate	27,5%																								
Discount Rate for Equity NPV	15%																								
Tax Holiday (years)	10,0			Tax Rate	2,0%																				
St. Line Depreciation Life (years)	20,0																								
Project Total Capital Cost	2.676,5																								
Loan Amount ($ million)	-																								
Final Payment to PDVSA	250,0																								
New PDVSA Lease, million $/yr	-																								
Terminal Value for Cash Flow																									**4.514,5**
Net After Tax Equity Cash Flow		**0,0**	**0,0**	**0,0**	**0,0**	**(123,1)**	**(133,8)**	**(808,6)**	**(1.177,7)**	**(433,3)**	**443,5**	**478,1**	**481,1**	**492,7**	**508,0**	**523,6**	**544,7**	**562,6**	**580,6**	**600,9**	**489,5**	**501,3**	**515,9**	**529,9**	**5.053,9**

IRR on Equity	**15,9%**
NPV at 15% ($ million)	**114,0**

Table A.6.7 Cash flow analysis Curacao refinery investment – NEWCO with integrated BOO with LNG (300% equity, 70% debt)

CURACAO REFINERY INVESTMENT - NEWCO WITH INTEGRATED BOO WITH LNG FUEL (30% EQUITY/70% DEBT)
(Millions of Dollars)

START NEWCO OPERATIONS

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Product Revenue		4.897,9	6.347,7	8.216,2	8.573,8	8.172,6	8.237,8	8.564,2	8.820,7	9.176,0	10.145,8	10.418,1	10.727,6	10.984,0	11.274,1	11.563,9	11.886,1	12.140,6	12.422,1	12.702,8	13.016,8	13.257,2	13.535,9	13.817,3	14.139,6
Feedstock Cost		(4.845,2)	(6.090,4)	(8.129,2)	(8.489,1)	(8.031,2)	(8.062,1)	(8.251,9)	(8.507,1)	(8.852,0)	(9.205,0)	(9.428,9)	(9.721,5)	(9.954,1)	(10.215,1)	(10.474,6)	(10.759,3)	(10.980,8)	(11.228,1)	(11.472,2)	(11.747,4)	(11.958,0)	(12.202,1)	(12.450,1)	(12.744,3)
Gross Margin Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Margin		**52,7**	**257,3**	**87,0**	**84,7**	**141,4**	**175,7**	**312,3**	**313,7**	**324,0**	**940,8**	**989,2**	**1.006,1**	**1.029,9**	**1.059,0**	**1.089,4**	**1.126,8**	**1.159,8**	**1.193,9**	**1.230,6**	**1.269,4**	**1.299,2**	**1.333,9**	**1.367,2**	**1.395,3**
Operating Costs																									
Variable																									
Catalyst & Chemicals	from histor	(19,3)	(21,4)	(23,8)	(24,5)	(25,2)	(25,9)	(26,6)	(27,2)	(27,9)	(28,6)	(29,3)	(30,0)	(30,6)	(31,2)	(31,9)	(32,7)	(33,3)	(34,0)	(34,7)	(35,5)	(36,1)	(36,8)	(37,6)	(38,4)
Utilities-B.O.O. Net	from histor	(28,8)	(29,2)	(30,0)	(30,9)	(32,0)	(33,0)	(33,8)	(34,5)	(35,1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOO Water Purchases/Other Var.											**(2,8)**	**(2,9)**	**(3,0)**	**(3,0)**	**(3,1)**	**(3,2)**	**(3,2)**	**(3,3)**	**(3,4)**	**(3,4)**	**(3,5)**	**(3,6)**	**(3,6)**	**(3,7)**	**(3,8)**
BOO LNG Purchase vs. HSFO											**(109,2)**	**(114,5)**	**(119,6)**	**(124,3)**	**(129,7)**	**(135,6)**	**(142,2)**	**(149,1)**	**(156,1)**	**(163,2)**	**(169,7)**	**(176,0)**	**(182,0)**	**(187,6)**	**(192,9)**
Project Incremental Variable Costs		(0,1)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(0,2)	(19,9)	(20,3)	(20,8)	(21,2)	(21,7)	(22,2)	(22,7)	(23,1)	(23,6)	(24,1)	(24,6)	(25,1)	(25,6)	(26,1)	(26,7)
LNG Fuel Cost Benefit ($ million)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Variable Costs		(48,3)	(50,7)	(54,0)	(55,6)	(57,3)	(59,1)	(60,5)	(61,9)	(63,2)	(160,5)	(167,0)	(173,4)	(179,1)	(185,7)	(192,9)	(200,8)	(208,8)	(217,1)	(225,4)	(233,3)	(240,7)	(248,1)	(255,0)	(261,8)
Fixed																									
Labor		(66,3)	(67,2)	(69,1)	(71,2)	(73,7)	(75,9)	(77,8)	(79,4)	(80,9)	**(90,3)**	**(92,1)**	**(94,1)**	**(95,8)**	**(97,7)**	**(99,7)**	**(101,9)**	**(103,7)**	**(105,8)**	**(107,9)**	**(110,3)**	**(112,2)**	**(114,5)**	**(116,8)**	**(119,4)**
Maintenance		(48,2)	(44,2)	(44,3)	(45,0)	(46,3)	(47,6)	(48,8)	(49,9)	(51,2)	**(62,0)**	**(63,3)**	**(64,9)**	**(66,1)**	**(67,6)**	**(69,1)**	**(70,7)**	**(72,0)**	**(73,5)**	**(75,0)**	**(76,8)**	**(78,1)**	**(79,7)**	**(81,3)**	**(83,2)**
Lease Fee	1	(18,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	(20,0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes & Insurance		(7,7)	(7,8)	(8,0)	(8,3)	(8,5)	(8,8)	(9,0)	(9,2)	(9,4)	**(10,7)**	**(10,9)**	**(11,2)**	**(11,4)**	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,1)**	**(13,3)**	**(13,6)**	**(13,8)**	**(14,2)**
Miscellaneous		(8,0)	(8,1)	(8,3)	(8,6)	(8,9)	(9,1)	(9,4)	(9,6)	(9,7)	**(11,6)**	**(11,8)**	**(12,1)**	**(12,3)**	**(12,5)**	**(12,8)**	**(13,0)**	**(13,3)**	**(13,5)**	**(13,8)**	**(14,1)**	**(14,4)**	**(14,7)**	**(15,0)**	**(15,3)**
Scrubber Fixed					**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**
Project Incremental Fixed Costs		(1,3)	(1,2)	(1,1)	(1,2)	(1,2)	(1,2)	(1,3)	(1,3)	(1,3)	(75,7)	(77,3)	(79,1)	(80,5)	(82,1)	(83,8)	(85,7)	(87,2)	(89,0)	(90,8)	(92,9)	(94,5)	(96,4)	(98,3)	(100,6)
Total Fixed		(149,5)	(148,5)	(150,9)	(154,3)	(158,6)	(162,7)	(166,3)	(169,3)	(172,6)	(250,2)	(255,4)	(261,3)	(266,0)	(271,5)	(277,1)	(283,5)	(288,5)	(294,4)	(300,3)	(307,2)	(312,5)	(318,8)	(325,2)	(332,6)
Operating Cost Sensitivity		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Operating Costs		**(197,8)**	**(199,2)**	**(204,9)**	**(209,8)**	**(216,0)**	**(221,7)**	**(226,8)**	**(231,2)**	**(235,8)**	**(410,7)**	**(422,4)**	**(434,7)**	**(445,2)**	**(457,2)**	**(470,0)**	**(484,3)**	**(497,4)**	**(511,4)**	**(525,7)**	**(540,5)**	**(553,3)**	**(566,9)**	**(580,2)**	**(594,4)**

Continuation of table

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
EBITDA		(145,0)	58,0	(117,9)	(125,1)	(74,5)	(46,0)	85,5	82,4	88,2	530,0	566,9	571,4	584,7	601,8	619,4	642,5	662,4	682,5	704,9	728,9	745,9	767,0	787,0	800,9
Depreciation (straight line)	Prior	(2,1)	(2,2)	(2,2)	(2,3)	(4,7)	(7,2)	(9,7)	(12,2)	(14,9)	(18,6)	(22,4)	(26,3)	(30,3)	(34,4)	(38,5)	(42,8)	(47,1)	(51,5)	(55,9)	(215,2)	(219,9)	(224,7)	(229,5)	(234,5)
Carryforward	-	(2,1)	-	(2,2)	(4,5)	(9,2)	(16,4)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxable Earnings Before Interest		(145,0)	53,7	(117,9)	(125,1)	(74,5)	(46,0)	59,4	70,2	73,4	511,4	544,4	545,0	554,4	567,4	580,9	599,8	615,4	631,0	648,9	513,7	526,0	542,3	557,5	566,4
Project Loan Interest Payment											(170,0)	(163,7)	(156,9)	(149,5)	(141,5)	(133,0)	(123,7)	(113,8)	(103,0)	(91,4)	(78,9)	(65,4)	(50,9)	(35,2)	(18,3)
Other Before Tax Expense	0										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest on Financed Inventory Cost		(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(3,5)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)	(1,3)
Taxable Earnings		(145,0)	53,7	(121,4)	(128,6)	(78,0)	(49,5)	55,9	66,7	69,9	340,1	379,4	386,8	403,6	424,6	446,6	474,7	500,3	526,7	556,2	433,4	459,3	490,1	521,0	546,8
Taxes		0,0	(14,8)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	(6,8)	(7,6)	(7,7)	(8,1)	(8,5)	(8,9)	(9,5)	(10,0)	(10,5)	(11,1)	(119,2)	(126,3)	(134,8)	(143,3)	(150,4)
Earnings		(145,0)	38,9	(121,4)	(128,6)	(78,0)	(49,5)	55,9	66,7	69,9	333,3	371,8	379,1	395,5	416,1	437,6	465,2	490,3	516,1	545,1	314,2	333,0	355,3	377,7	396,4
Other Non-Income Cash Flow Items																									
Sustaining Capital	1,00%	(43,0)	(43,6)	(44,8)	(46,1)	(47,7)	(49,2)	(50,4)	(51,4)	(52,4)	(75,0)	(76,5)	(78,1)	(79,6)	(81,2)	(82,8)	(84,5)	(86,2)	(87,9)	(89,7)	(91,5)	(93,3)	(95,2)	(97,1)	(99,0)
Capital Spending (excl. Interest)	(2.879,0)					(132,4)	(144,0)	(869,8)	(1.266,8)	(466,1)															
Project Equity Spending	(928,3)					(132,4)	(144,0)	(651,9)	0,0	0,0															
Project Loan Principal Payment	(2.166,0)										(80,7)	(87,0)	(93,9)	(101,2)	(109,2)	(117,8)	(127,0)	(137,0)	(147,7)	(159,3)	(171,8)	(185,3)	(199,9)	(215,6)	(232,5)
Financial Assumptions																									
% Debt Financing	70%																								
Debt Interest Rate	7,85%																								
Loan Length (years)	15,0																								
Loan Start Date	########																								
Interest on WC/Inventory	5,0%																								
Inventory Costs Financed (%)	85,0%																								
Tax Rate	27,5%																								
Discount Rate for Equity NPV	15%																								
Tax Holiday (years)	10,0			Tax Rate	2,0%																				
St. Line Depreciation Life (years)	20,0																								
Project Total Capital Cost	3.094,3																								
Loan Amount ($ million)	2.166,0																								
Final Payment to PDVSA	250,0																								
New PDVSA Lease, million $/yr	-																								
Terminal Value for Cash Flow																									4.514,5
Net After Tax Equity Cash Flow		0,0	0,0	0,0	0,0	(132,4)	(144,0)	(651,9)	0,0	0,0	196,1	230,7	233,5	244,9	260,0	275,5	296,4	314,2	331,9	352,0	266,2	274,2	284,9	294,6	4.813,9
DSCR											1,78	1,92	1,93	1,98	2,04	2,10	2,18	2,25	2,32	2,40	2,06	2,09	2,14	2,17	2,19
IRR on Equity				20,1%																					
NPV at 15% ($ million)				376,7																					
ACC CASH FLOW FROM 2018 ONWARDS											196,1	426,8	660,3	905,2	1.165,2	1.440,8	1.737,2	2.051,4	2.383,3	2.735,3	3.001,5	3.275,7	3.560,7	3.855,3	4.154,7

Annex 3: Table part of chapter 10

Table A.10.1

	optimistic (high(growth scenario					base case (low) growth scenario				
	start	pilot years				start	pilot years			
	2009	*2009*	*2028*	*2045*		2009	*2009*	*2028*	*2045*	
real grow th rate GDP refinery		0%	0%	0%			0%	0%	0%	
real grow th rate GDP other manufacturing		2,0%	2,0%	1,5%	x		1,0%	1,0%	1,0%	
real grow th rate GDP tourism - hotels & restaurants (hore)		7,0%			x		3,0%			
real grow th rate GDP tourism - other sectors		7,0%			x		3,0%			
real grow th rate GDP other industries		2,0%	2,0%	1,5%	x		1,0%	1,0%	1,0%	
total effect on ***GDP*** of ISLA closure in 2019			-4,0%					-4,0%		
direct effect on ***GDPr*** of ISLA closure in 2019			-100,0%					-100,0%		
effect on ***GDPo via Go*** of removal & cleaning operation			6,0%					6,0%		
period (yrs) of removal & cleaning from 2019			7,0					7,0		
ratio w orkers/FTEs other manufacturing (>35 hrs/w eek)		1,03	1,0	1,0			1,03	1,0	1,0	
ratio w orkers/FTEs tourism - hore (>35 hrs/w eek)		1,03	1,0	1,0			1,03	1,0	1,0	
ratio w orkers/FTEs other tourism (>35 hrs/w eek)		1,08	1,1	1,1			1,08	1,1	1,1	
ratio w orkers/FTEs other industries (>35 hrs/w eek)		1,08	1,1	1,1			1,08	1,1	1,1	
ratio Gt2/Gt1 (GDP other tourism)			2,25					2,25		
productivity grow th other manufacturing (Gi/FTEs in i)		0,5%	0,5%	0,5%	x		0,2%	0,2%	0,2%	
productivity grow th tourism - hore (Gt1/FTEs in t1)		0,1%	0,1%	0,1%			0,1%	0,1%	0,1%	
productivity grow th other tourism (Gt2/FTEs in t2)		0,3%	0,3%	0,3%	x		0,1%	0,1%	0,1%	
productivity grow th other industries (Go/FTEs in o)		0,3%	0,3%	0,3%	x		0,1%	0,1%	0,1%	
participation rate		45,0%	47,5%	50,0%			45,0%	45,0%	45,0%	
structural unemployment rate		4,0%	4,0%	4,0%			4,0%	4,0%	4,0%	
natural grow th rate population		0,55%	0,50%	0,45%			0,55%	0,50%	0,45%	
household size		2,63	2,50	2,40			2,63	2,50	2,40	
propensity to emigrate (effect net labour surplus)		50%	50%	50%			50%	50%	50%	
propensity to immigrate (effect net labour shortage)		100%	100%	100%			100%	100%	100%	
percentage non-fixed labour of net inmigrants		45%	45%	45%			45%	45%	45%	
migration multiplier (employed population)		1,20	1,20	1,20			1,20	1,20	1,20	
dw elling occup. pop. excl. inmigrants (households/house)		1,25	1,25	1,25			1,25	1,25	1,25	
labour inmigrants dw elling occupation (dw ellers/house)		4,00	4,00	4,00			4,00	4,00	4,00	
other inmigrants dw elling occupation (dw ellers/house)		2,00	2,00	2,00			2,00	2,00	2,00	
removal rate of housing stock		0,25%	0,25%	0,25%			0,25%	0,25%	0,25%	
low income housing share in demolition		75%	75%	75%			75%	75,00%	75,00%	
percentage of low income households		33,0%	37,7%	37,0%	x		33,0%	34,6%	34,0%	
# of low income dw ellings/ha on new development sites		30	30	30			30	30	30	
# of higher income dw ellings/ha on new development sites		20	20	20			20	20	20	
GDP refinery (mln NAF; 2009 prices)	135					135				
GDP other manufacturing (mln NAF; 2009 prices)	355					355				
GDP tourism - hore (mln NAF; 2009 prices)	163					163				
GDP other industries (mln NAF; 2009 prices)	4.485					4.485				
employed population refinery (demand)	1.000					1.000				
employed pop. other manufacturing (demand)	3.677					3.677				
employed population tourism - hore (demand)	4.261					4.261				
employed population other industries (demand)	47.644					47.644				
population	141.765					141.765				
total net non labour related inmigration		100	100	100			100	100	100	
immigrated last 5 yrs w ithout steady job	1.495					1.495				
housing need net non labour related inmigrants	4.000					4.000				
(planned) housing supply/yr low income segment		specified for each year					specified for each year			
(planned) housing supply/yr higher income segment		specified for each year					specified for each year			
actual c.q.planned housing stock - supply	42.339					42.339				
w ater related other man. (employment share in other man.)		75,0%	75,0%	75,0%			75,0%	75,0%	75,0%	
tourism: rooms per employee		1,43	1,43	1,43			1,43	1,43	1,43	
tourism: rooms per ha		80	80	80			80	80	80	
other tourisme: # of ha per employee		0,01	0,01	0,01			0,01	0,01	0,01	
refinery: # of ha per employee		0,44	0,44	0,44			0,44	0,44	0,44	
w ater related oterh manufacturing: # of ha per employee		0,20	0,20	0,20			0,20	0,20	0,20	
land related other manufacturing: # of ha per employee		0,07	0,07	0,07			0,07	0,07	0,07	
other industries: # of ha per employee		0,0086	0,0086	0,0086			0,0086	0,0086	0,0086	

Annex 4 Compilation of Input-Output table 2009 for Curacao

Introduction

Input-Output (IO) tables are important data sources for various applications in applied economic research and policy analysis. They allow the description of sectoral interrelations in a national or regional economy. IO tables can furthermore be used for analysis of the economic impact of policy measures or public expenditure projects on employment and GDP. Through the use of input-output models, it is possible to capture industry linkages and estimate the economic impact of one set of activities on all other industries. Because all industries are to some degree linked to one another, a change in one sector of the economy will ripple through other parts of the economy. The estimation of these ripple effects, called multiplier effects, is the main objective of economic impact assessment.

This appendix describes the construction of Curacaos' Input-Output table for 2009. Furthermore, economic multipliers for 2009 that result from the IO table that can be used to calculate indirect and induced impacts are presented.

The IO table 2009 for Curacao has been developed in close collaboration with Department of Economic Affairs (DEZ) which has provided the necessary source data. A final version of the IO model was made available to DEZ for economic analysis.

Curacao Input-Output table 2009

The input-output model is based on the CBS 2004 Supply and Use tables (SUT) of Curaçao. These data sources show, at the national level, which industries produce specific goods and services (Supply Table) and the sets of inputs these industries use in their production process (Use Tables). These tables hence reflect the interdependencies of economic sectors in Curaçao (and with the rest of the world).

The methodology used for the compilation of the 2009 IO table is similar to the one used for the construction of the 1992 IO table for Curacao. This methodology involves the following three key steps:

- Transformation of use table at purchasers prices to basic prices
- Disaggregation of total use table in import use table en domestic use table
- Transformation of the asymmetric SUT to the symmetric input-output table

As a last step, the 2004 IO table was updated by applying the so-called RAS-method which is widely used for adjusting Input-Output tables for recent data. For the update the most recent 2009 GDP data was used.

Input-Output Multipliers for economic assessement

IO multipliers can be used to quantify the economic impacts (both direct and indirect) relating to policies and projects. In the tables below the 2009 sector multipliers for Curacao are presented. The Type I multipliers only account for one kind of indirect effect: induced sales from one sector to

another sector within the country. The Type II multipliers also account for induced household demands (through income), so they are larger.

The following multipliers are distinguished:

- **Output Multipliers**

The output multiplier for an industry is expressed as the ratio of direct and indirect (and induced if Type II multipliers are used) output changes to the direct output change due to a unit increase in final demand. So that multiplying a change in final demand (direct impact) for an individual industry's output by that industry's Type I output multiplier will generate an estimate of direct + indirect impacts upon output throughout the Curacao economy.

- **Employment Multipliers**

The employment multiplier is the ratio of direct plus indirect (plus induced if Type II multipliers are used) employment changes to the direct employment change.

- **GVA Multipliers**

The GVA multiplier is expressed as the ratio of the direct and indirect (and induced if Type II multipliers are used) GVA changes to the direct GVA change, due to a unit increase in final demand. In other words, if there is a change in GVA for a sector the GVA multiplier can be used to calculate the change in GVA for the economy as a whole.

Table 2 Output multipliers (output total/ direct output)

Sector	Type I Indirect	Type II Indirect + induced
Agriculture, fishing, mining	1,78	2,19
Manufacturing	1,46	2,14
Electricity, gas, and water supply	1,41	1,73
Construction	1,49	1,99
Trade	1,48	2,10
Horeca	1,67	2,23
Transport and communication	1,48	1,91
Financial Intermediation	1,43	1,92
Other real estate activities	1,31	1,48
Public administration and defense	1,23	1,90
Education	1,21	2,65
Health	1,34	1,64
Other services	1,60	2,38

Table 3 Added value multipliers (added value total/ direct added value)

Sector	Type I Indirect	Type II Indirect + induced
Agriculture, fishing, mining	2,51	3,39
Manufacturing	1,49	2,26
Electricity, gas, and water supply	1,54	1,97
Construction	1,73	2,51
Trade	1,47	2,11
Horeca	2,06	3,02
Transport and communication	1,62	2,21
Financial Intermediation	1,39	1,84
Other real estate activities	1,24	1,38

Sector	Type I Indirect	Type II Indirect + induced
Public administration and defense	1,16	1,67
Education	1,15	2,20
Health	1,34	1,65
Other services	1,76	2,74

The indirect added value figures (type 1) are also indicated in annex 5 Indicators part of chapter 11. The figures in table 2 include on top of the indirect added value the direct added value which is not the case in annex 5. The direct added value is 1. For the horeca sector for instance, this means that the indirect value is 2,06 – 1 = 1,06. This figure corresponds with the figures in annex 5.

Table 4 Employment multipliers (jobs total/ direct jobs added)

Sector	Type I Indirect	Type II Indirect + induced
Agriculture, fishing, mining	1,71	2,15
Manufacturing	1,44	2,23
Electricity, gas, and water supply	2,60	4,22
Construction	1,42	1,92
Trade	1,22	1,63
Horeca	1,33	1,73
Transport and communication	1,69	2,52
Financial Intermediation	1,71	2,88
Other real estate activities	1,21	1,37
Public administration and defense	1,17	1,76
Education	1,11	2,22
Health	1,18	1,38
Other services	1,49	2,33

Annex 5 Indicators part of chapter 11

Rates	
exchange rate NAf - Euro	0,3497
exchange rate NAf - US$	0,558659218
discount rate	7%

Indicators	Costs (NAf)	Source
Dismantling and remediation costs		
Soil remediation costs ISLA site M case	526.880.848	Ecovision
Dismantling costs ISLA site (M and P case)	253.645.982	Ecovision
Soil remediation cost ISLA (average) P case - variant A; high scen.	1.466.344.297	Ecovision
Soil remediation cost ISLA (average) P case - variant A; low scen.	1.461.682.382	
Soil remediation cost ISLA (average) P case - variant B	1.468.251.684	
Dismantling costs alternative site	0	Ecorys
Soil remediation costs alt. site	0	
Opportunity costs (NAf/hectare)	10.000	Ecorys assumption
Benefits remediation		
Value residual oil	0	Ecovision
Site preparation		
Site preparation (NAf/m2)	70	DROV, Mr. Neuman, Mr. Dennert
Construction costs		
Housing		
Low income housing (NAf/resident)	100000	KPF
Middle/high income housing (NAf/m2)	4000	Rob v.d. Bergh
Average m2 per middle/high income resident	175	KPMG
High/middle income housing (NAf/resident)	700000	
Public facilities + retail (NAf/ m2)	2000	Thoonen/Dennert/Nandpersad, KPMG
m2 public facilities/retail in residential area per inhabitant	3,2	KPMG
Number of residents per dwelling	2,63	
Tourism		
# rooms per hectare	84	Ecorys expert
# of beds per hectare	168	Ecorys expert
construction cost per hotel room (NAf)	173400	KPMG (prices per m2), # m2 gross Ecorys
construction costs other tourism (Per HA)	4855200	Ecorys+ DEZ
Industry		

Indicators	Costs (NAf)	Source
Water related industry (NAf/ha) excluding offices or other infra	984.500	Ecorys
Land related industry (NAf/m2)	1.250	Curinde
offices (NAf/m2)	4.000	Rob v.d. Bergh
Warehouses (NAf/m2)	1.400	BVO
Public area (verzorgend/bovenregionaal)	4.000	Ecorys, based on offices figures
Additional cost offices bij hoger bouwen	1,3	Ecorys Vastgoed
Capacity utilization industry, offices, warehousing (current situation)		
m2/ ha Land related industry	4.000	Curinde
m2/ha offices	5.000	Ecorys
M2/ha Warehouses	4.000	Curinde
Bebouwingsdichtheid retail /amenities	0,5	Ecorys
Capacity utilization industry, offices, warehousing (future situation)		
m2/ ha Land related industry	4.000	
m2/h offices	40.000	Ecorys calculations
M2/ha Warehouses	4.000	
Road, water, electricity for development on ISLA site		
Access roads (external)	12.500.000	Ecorys based on KPMG + DOW
Electricity + water (external)	0	Aqualectra
Waste water collection, treatment (NAf/p.e.)	1.159	KPMG based on waterboard
Road, water, electicity for development elsewhere		
Access roads (external)	18.750.000	Ecorys based on KPMG + DOW
Electricity + water (external)	25.500.000	Aqualectra
Waste water collection, treatment (NAf/p.e.)	1.159	KPMG based on waterboard
Additional costs Greentown project alternative		
Road internal for development Greentown	20.000.000	Estimation Ecorys
Green area (NAf/ha)	714.898	Paul Jansen met correction Ecorys
Investment costs public area verzorgend	44.091.206,62	Ecorys calculations
Investment costs public area bovenregionaal	290.245.175,0 0	Ecorys calculations
# people equivalent per employee (waste water)		
- residents	1	
- tourism (i.e. per hotel bed)	1	
- other tourism	0,33	
- water related industry	0,25	
- land related industry	0,25	
- offices/other industry (verzorgend/bovenregionaal)	0,33	
- warehousing/retail	0,25	

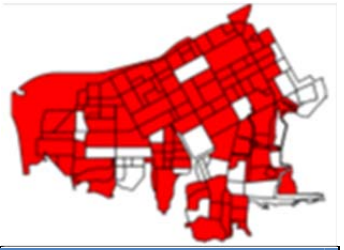
Indicators	Costs (NAf)	Source
Design, preparation, implementation supervision		
Plancosts dismantling (% of investment costs)	0,06	Ecorys vastgoed
Plancosts site preparation (% of investment costs)	0,15	Ecorys vastgoed
Revenues		
Housing		
Low income housing		
Revenues from sale low income residents (% of construction costs) outside ISLA site	1	
Revenues from sale high/middle income residents (% of construction costs) outside ISLA site	1,3	Rob v.d. Bergh obv projectontwikkelaars
Additional value of residents on ISLA compared to outside ISLA with current construction density	1,15	Estate agents Curacao
Additional value of residents on ISLA compared to outside ISLA with new construction density	1,1	Estimation Ecorys
WTP green area	3.500.000	Estimation Ecorys
Direct Added Value		
Index 2011-2009	1,0498	Curalyse 2011 May version: loonkostenindex 2011 tov 2009
Created GDP per employee (million NAf)		
GDP per employee tourism	41.450	GDP/fte (2011) D/S model Ecorys
GDP per employee other tourism	131.798	GDP/fte (2011) D/S model Ecorys
GDP per employee water ralated industry	89.779	GDP/fte (2011) D/S model Ecorys
GDP per employee land related industry	104.394	GDP/fte (2011) D/S model Ecorys
GDP per employee offices	139.411	GDP/fte (2011) D/S model Ecorys
GDP per employee warehousing	65.283	I/O table Ecorys (sector trade)
GDP per employee dismantling	61.193	Ecovision/Ecorys
GDP per employee remediation	125.687	Ecovision/Ecorys
GDP per employee construction	60.658	IO table Ecorys (sector construction)
GDP per employee ILSA/constructors	94.445	ISLA
GDP per emloyee shut down	94.445	ISLA
Percentage of direct added value of tourism, industry, offices, warehousing attributed to Curacao	1,00	Assumption Ecorys
Percentage of direct added value of dismantling and cleaning investment attributed to Curacao	0,50	Assumption Ecorys
Percentage of direct added value of redevelopment investments attributed to Curacao	0,80	Assumption Ecorys

Indicators	Costs (NAf)	Source
Synergy effect commercial activities (offices)	0,05	Assumption Ecorys
Bovenregionaal effect (alleen in high density varianten)	0,05	Assumption Ecorys
Multiplier public area (bovenregionaal)	1	Assumption Ecorys
Indirect Added Value		
multiplier direct-indirect added value		
- Tourism	1,063954191	I/O table Ecorys (sector tourism)
- Other tourism	0,456485	I/O table Ecorys (sector tourism)
- Water related industry	0,487760478	I/O table Ecorys (sector manufacturing)
- Land related industry	0,487760478	I/O table Ecorys (sector manufacturing)
- Offices	0,364045105	I/O table Ecorys (combination of various sectors)
- Warehousing	0,472701359	I/O table Ecorys (sector trade)
- Dismantling	0,725459165	Assumption Ecorys
- Remediation	0,725459165	Assumption Ecorys
- Construction	0,725459165	I/O table Ecorys (sector construction)
Percentage of indirect added value of operational activities	0,2	Assumption Ecorys
Percentage of indirect added value of investments attributed to the intervention	0,2	Assumption Ecorys
Induced effects		
multiplier direct-induced effect		
- Tourism	0,956824354	I/O table Ecorys (sector tourism)
- Other tourism	0,689255	I/O table Ecorys (sector tourism)
- Water related industry	0,773650958	I/O table Ecorys (sector manufacturing)
- Land related industry	0,773650958	I/O table Ecorys (sector manufacturing)
- Offices	0,411564201	I/O table Ecorys (combination of various sectors)
- Warehousing	0,633902913	I/O table Ecorys (sector trade)
- Dismantling	0,787593479	Assumption Ecorys
- Remediation	0,787593479	Assumption Ecorys
- Construction	0,787593479	I/O table Ecorys (sector construction)
Percentage of induced effects attributed to project intervention	0	Assumption Ecorys

Indicators	Costs (NAf)	Source
Employment		
Employment per hectare (fte/ha) current situation		
Water related industry	5	
Land related industry	15	
Offices	168	
Warehouses/retail	40	
Tourism	59	
Other tourism	42	
Employment per hectare (fte/ha) higher density		
Water related industry	5	
Land related industry	15	
Offices	1344	
Warehouses	40	
Tourism	472	
Other tourism	168	
Employment refinery (# fte)		
ISLA + contractors		
Shut down		
Turnover/fte		
Dismantling	152.983	I/O table Ecorys (sector construction
Remediation	418.956	I/O table Ecorys (sector construction
Construction	168.496	I/O table Ecorys (sector construction
Income and housing		
# woningen/werknemer low	0,5	Ecorys
# woningen/werknemer high	1	Ecorys
# woningen/ha low income	30	
# woningen/ha high income	20	
% high income water-land industry	75%	Ecorys
% low income water-land industry	25%	CPS
% high income offices	90%	Ecorys
% low income offices	10%	Ecorys
% high income warehouses	30%	Ecorys
% low income warehouses	70%	Ecorys
% high income tourism	10%	Ecorys
% low income tourism	90%	Ecorys
% high income other tourism	30%	Ecorys
% low income other tourism	70%	Ecorys
Gross-net ratio (ha residents)	0,7	

Annex 6 Risk table

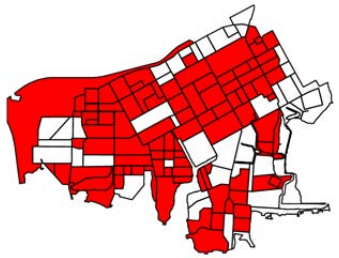
Immobile contaminants in top soil
(heavy metals, PAH's and asbestos, 114 sub-areas*)



Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
Proposed action: isolation by 1 meter of clean soil	**Proposed action: no action, building foundations and roads function as isolation layers, however: additional excavation and clean sand/soil for future underground utility networks**	**Proposed action: fencing** **= *'do minimum' policy*** **= *' do nothing' policy***	
Health implications: no problems	Health implications: During normal operation: low levels of dermal contact, ingestion, inhalation of asbestos and contaminated dust (outdoors, workers). During construction: elevated risks.	Health implications: no problems	
Other risks after proposed action: no risks; benefit: added value for both ISLA-subareas and adjacent properties	Other risks after proposed action: no risks; benefit: added value for both ISLA-subareas and adjacent properties	Other risks after proposed action: no risks	
No action: no isolation by 1 meter of clean soil	**No action: no additional excavation (utility network largely in contaminated soil)**	**No action: no fencing**	
Health implications: dermal contact, ingestion, inhalation of asbestos and contaminated dust, possible health problems	Health implications (outdoors, workers): low levels of dermal contact, ingestion, inhalation of asbestos and contaminated dust, especially during construction and maintenance of underground network.	Health implications: illegal visits lead to dermal contact, ingestion, inhalation of asbestos and contaminated dust, possible health problems, although much less than in "residential"	
Other risks: devaluation of property (both ISLA-subareas and adjacent properties), psychological impact, poor image (investors, tourists).	Other risks: devaluation of property (both ISLA-subareas and adjacent properties), psychological impact, poor image (investors, tourists).	Other risks: no value of property, devaluation of adjacent properties, bad publicity, poor image for investors when change of function	
Intermediate action: not applicable	**Intermediate action: not applicable**	**Intermediate action: not applicable**	

* indicated red

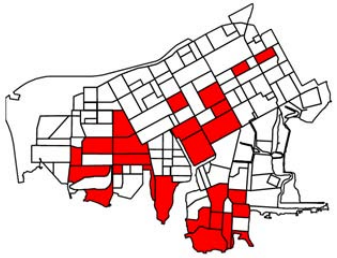
Mobile contaminants in groundwater (99 sub-areas)



Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
Proposed action: plume treatment	**Proposed action: plume treatment**	**Proposed action: plume treatment and fencing (and security)** ***= 'do minimum' policy***	**Possible action: fencing (and security) but no plume treatment** ***= ' do nothing' policy***
Health implications: no problems	Health implications: no problems	Health implications: no problems	Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system
Other risks after proposed action: no risks	Other risks after proposed action: no risks	Other risks after proposed action: no risks	Other risks: devaluation of property (both ISLA-subareas and adjacent properties), psychological impact, poor image (investors, tourists).
No action: no plume treatment	**No action: no plume treatment**	**No action: no plume treatment and no fencing (and security)**	**No action: no plume treatment and no fencing (and security)**
Health implications sub-area: potential health problems related to (limited) risk of ingestion through ground water (limited use of deepwell), ecological risks to consumable crop and greenery, permeation of potable-water pipes, inhalation during excavation works.	Health implications sub-area: possible health problems related to (negligible) risk of ingestion through ground water, ecological risks to consumable crop and greenery, permeation of potable -water pipes, inhalation during excavation works.	Health implications sub-area: no significant risk of contact for illegal visitors.	Health implications sub-area: no significant risk of contact for illegal visitors.
Health implications outside sub-area: dispersion of contamination to other areas ; possibility of human contact and ecological risks in water system	Health implications outside sub-area: dispersion of contamination to other areas ; possibility of human contact and ecological risks in water system	Health implications outside sub-area: dispersion of contamination to other areas ; possibility of human contact and ecological risks in water system	Health implications outside sub-area: dispersion of contamination to other areas ; possibility of human contact and ecological risks in water system
Other risks: devaluation of property (both	Other risks: devaluation of property (both	Other risks: devaluation of property (both	Other risks: devaluation of property (both

Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
ISLA-subareas and adjacent properties), psychological impact, poor image (investors, tourists).	ISLA-subareas and adjacent properties), psychological impact, poor image (investors, tourists).	ISLA-subareas and adjacent properties), psychological impact, poor image (investors, tourists).	ISLA-subareas and adjacent properties), psychological impact, poor image (investors, tourists).
Intermediate action: not recommended (low cost of ground water treatment)	**Intermediate action: not recommended (low cost of ground water treatment)**	**Intermediate action: not recommended (low cost of ground water treatment)**	**Intermediate action: not recommended (low cost of ground water treatment)**

LNAPL or floating oil in soil (26 sub-areas)

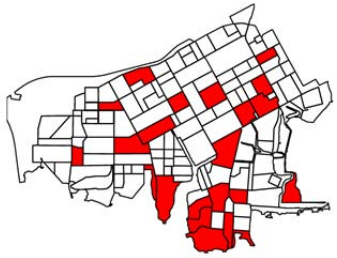


Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
Proposed action: removal of LNAPL	**Proposed action: removal of LNAPL**	**Proposed action: vertical isolation of LNAPL and fencing (and security)** ***= 'do minimum' policy***	**Possible action: fencing (and security) but no vertical isolation** ***= ' do nothing' policy***
Health implications: no problems	Health implications: no problems	Health implications: no problems	Health implications sub-area: no problems. Outside sub-area: floating oil in Schottegat with possibility of human dermal contact and ecological risks in water system; health problems in residential areas (inhalation, odor of hydrocarbons)
Other risks after proposed action: no risks; benefit: increase of value of both ISLA-area and adjacent property	Other risks after proposed action: no risks; benefit: increase of value of both ISLA-area and adjacent property	Other risks after proposed action: LNAPL remains in soil, poor image (investors, tourists)	Other risks after proposed action: LNAPL remains in soil, poor image for investors, citizens and tourists. Disper-sal of oil to clean areas and Schottegat, threatening beaches and ships.
No action: no removal of LNAPL	**No action: no removal of LNAPL**	**No action: no vertical isolation of LNAPL and no fencing (and security)**	**No action: no vertical isolation of LNAPL and no fencing (and security)**

Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
Health implications sub-area: high risk of contact and inhalation especially in low areas and ingestion through ground water (few people will use deepwell), risks to consumable crop and greenery, permeation of potable water pipes. Health implications outside sub-area: floating oil in Schottegat with possibility of human dermal contact and ecological risks in water system; health problems in residential areas (inhalation, odor of hydrocarbons)	Health implications sub-area: limited risk of contact and inhalation, ecological risks to greenery, vegetation and landscaping, permeation of potable water pipes. Health implications outside sub-area: floating oil in Schottegat with possibility of human dermal contact and ecological risks in water system; health problems in residential areas (inhalation, odor of hydrocarbons)	Health implications sub-area: for illegal visitors risk of contact and inhalation especially in lower areas of ISLA area. Health implications outside sub-area: floating oil in Schottegat with possibility of human dermal contact and ecological risks in water system; health problems in residential areas (inhalation, odor of hydrocarbons)	Health implications sub-area: for illegal visitors risk of contact and inhalation especially in lower areas of ISLA area. Health implications outside sub-area: floating oil in Schottegat with possibility of human dermal contact and ecological risks in water system; health problems in residential areas (inhalation, odor of hydrocarbons)
Other risks of “no action”: dispersion of LNAPL to other areas (*) and Schottegat, threatening beaches and ships, strong devaluation of property (ISLA site), strong psychological impact on users, poor image (investors, tourists) (*) leading to increased costs of future remediation	Other risks of “no action”: dispersion of LNAPL to other areas (*) and Schottegat, threatening beaches and ships, strong devaluation of property (ISLA site), psychological impact on users, poor image (investors, tourists). (*) leading to increased costs of future remediation	Other risks of “no action”: dispersion of LNAPL to other areas (*) and Schottegat, threatening beaches and ships, strong devaluation of property (ISLA site) and in surroundings, bad publicity, poor image (investors, tourists) when change of function (*) leading to increased costs of future remediation	Other risks of “no action”: dispersion of LNAPL to other areas (*) and Schottegat, threatening beaches and ships, strong devaluation of property (ISLA site) and in surroundings, bad publicity, poor image (investors, tourists) when change of function (*) leading to increased costs of future remediation
Intermediate action: horizontal isolation with durable liner	**Intermediate action: horizontal isolation with durable liner**	**Intermediate action: horizontal isolation with durable liner**	**Intermediate action:**
Health implications sub-area: no problems (however risk not permanently mitigated) Health implications outside sub-area: floating oil in Schottegat with possibility of human dermal contact and ecological risks in water system; health problems in residential areas (inhalation, odor of hydrocarbons)	Health implications sub-area: no problems (however risk not permanently mitigated) Health implications outside sub-area: floating oil in Schottegat with possibility of human dermal contact and ecological risks in water system; health problems in residential areas (inhalation, odor of hydrocarbons)	Health implications sub-area: no problems Health implications outside sub-area: floating oil in Schottegat with possibility of human dermal contact and ecological risks in water system; health problems in residential areas (inhalation, odor of hydrocarbons)	Not applicable
Other risks after intermediate action: dispersion of LNAPL to other areas (*) and	Other risks after intermediate action: dispersion of LNAPL to other areas (*) and	Other risks after intermediate action: dispersion of LNAPL to other areas (*) and	Not applicable

Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
Schottegat threatening beaches and ships, strong devaluation of property, strong psychological impact, poor image (investors, tourists). (*) leading to increased costs of future remediation	Schottegat threatening beaches and ships, strong devaluation of property, psychological impact, poor image (investors, tourists). (*) leading to increased costs of future remediation	Schottegat threatening beaches and ships, strong devaluation of property, poor image (investors, tourists). (*) leading to increased costs of future remediation	

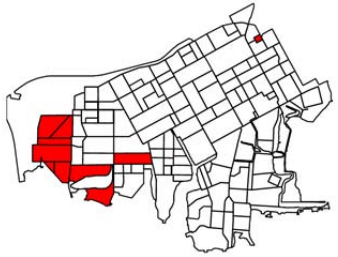
Mineral oil/source of oil in soil (23 sub-areas)



Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
Proposed action: source removal	**Proposed action: source removal**	**Proposed action: vertical isolation of source and fencing (and security)** ***= 'do minimum' policy***	**Possible action: fencing (and security) but no vertical isolation** ***= ' do nothing' policy***
Health implications: no problems	Health implications: no problems	Health implications: no problems	Health implications sub-area: no problems. Health implications outside sub-area: dispersion of contamination to other areas through groundwater with possibility of human contact and ecological risks in water system
Other risks after proposed action: no risks; benefit: increase of value of both ISLA-area and adjacent property	Other risks after proposed action: no risks; benefit: increase of value of both ISLA-area and adjacent property	Other risks after proposed action: source remains present, poor image (investors, tourists).	Other risks after proposed action: source remains present, dispersion of contamination to other areas, devaluation of property, poor image (investors, tourists).
No action: no removal of source	**No action: no removal of source**	**No action: no vertical isolation of source and**	**No action: no vertical isolation of source and**

Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
		no fencing (and security)	**no fencing (and security)**
Health implications sub-area: potential health problems related to (limited) risk of ingestion through groundwater (limited use of deepwell), limited risk of dermal contact and inhalation, ecologi-cal risks to consumable crop and green-ery, permeation of potable-water pipes, inhalation during excavation works. Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system	Health implications sub-area: potential health problems related to (limited) risk of ingestion through groundwater (limited use of deepwell), limited risk of dermal contact and inhalation, ecologi-cal risks to consumable crop and green-ery, permeation of potable-water pipes, inhalation during excavation works. Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system	Health implications sub-area: for illegal visitors limited risk of contact and inhalation. Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system	Health implications sub-area: for illegal visitors risk of contact and inhalation especially in lower areas of ISLA area. Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system
Other risks of “no action”: dispersion of contamination to other areas, devaluation of property, psychological impact, poor image (investors, tourists)	Other risks of “no action”: dispersion of contamination to other areas, devaluation of property, psychological impact, poor image (investors, tourists)	Other risks of “no action”: dispersion of contamination to other areas, devaluation of property, psychological impact, poor image (investors, tourists)	Other risks of “no action”: dispersion of contamination to other areas, devaluation of property, psychological impact, poor image (investors, tourists)
Intermediate action: horizontal isolation	**Intermediate action: horizontal isolation**	**Intermediate action: horizontal isolation**	**Intermediate action:**
Health implications sub-area: no problems Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system	Health implications sub-area: no problems Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system	Health implications sub-area: no problems Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system	Not applicable
Other risks of “no action”: dispersion of contamination to other areas, devaluation of property, psychological impact, poor image (investors, tourists)	Other risks of “no action”: dispersion of contamination to other areas, devaluation of property, psychological impact, poor image (investors, tourists)	Other risks of “no action”: dispersion of contamination to other areas, devaluation of property, psychological impact, poor image (investors, tourists)	Not applicable

Landfills (6 sub areas)



Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
Proposed action: remove landfill to other location using full isolation-check-control at new location	**Proposed action: remove landfill to other location using full isolation-check-control at new location**	**Proposed action: isolation-check-control at existing location and fencing (and security) = *'do minimum' policy***	**Possible action: fencing (and security) but no vertical isolation = ' *do nothing' policy***
Health implications: no problems	Health implications: no problems	Health implications: (in case of low intensity recreation) no problems	Health implications sub-area: landfill will continuously supply hazardous contaminants to surroundings (residential, industrial, other) Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system
Other risks after proposed action: no risks; benefit: increase of value of ISLA-area	Other risks after proposed action: no risks; benefit: increase of value of ISLA-area	Other risks after proposed action: source remains in soil, poor image (investors, tourists).	Other risks after proposed action: source remains in soil, dispersion of contamination to other areas, devaluation of property, poor image (investors, tourists).
No action: NA (landfills cannot be developed as residential areas)	**No action: NA (landfills cannot be developed as industrial areas)**	**No action: no vertical isolation of source and no fencing (and security)**	**No action: no vertical isolation of source and no fencing (and security)**
		Health implications: continuous supply of contaminants to ground water, continuous dispersion of contaminants by air. Health implications sub-area: for illegal visitor strong risk of contact and inhalation of contaminants. Health implications outside sub-area:	Health implications: continuous supply of contaminants to ground water, continuous dispersion of contaminants by air. Health implications sub-area: for illegal visitor strong risk of contact and inhalation of contaminants. Health implications outside sub-area:

Function Sub-area: Residential	Function Sub-area: Industrial	Function Sub-area: No Activity (No Access)	
		dispersion of contamination to other areas; possibility of human contact and ecological risks in water system	dispersion of contamination to other areas; possibility of human contact and ecological risks in water system
		Other risks: source remains in soil, dispersion of contamination to other areas, devaluation of property, poor image (investors, tourists).	Other risks: source remains in soil, dispersion of contamination to other areas, devaluation of property, poor image (investors, tourists).
Intermediate action: NA (landfills cannot be developed as residential areas)	**Intermediate action: NA (landfills cannot be developed as industrial areas)**	**Intermediate action: horizontal isolation**	**Intermediate action:**
		Health implications: continuous supply of contaminants to ground water, continuous dispersion of contaminants by air. Health implications outside sub-area: dispersion of contamination to other areas with possibility of human contact and ecological risks in water system	Not Applicable
		Other risks after intermediate action: dispersion of contamination to other areas, devaluation of property, psychological impact, poor image (investors, tourists).	Not Applicable

Annex 7 Tables and figures part of chapter 15

Table A.15.1

	Sensitivity analysis variants															
	Reference alternative: 'do mimimum'														'do nothing'	
	Basis	1	2	3	4	5	6	7	8	9	10	11	12	13	14 (= Basis)	15
Discount rate	7%	10%	4%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Revenues: direct, indirect, induced effects																
Sales revenues/construction costs houses outside ISLA	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30	1,30
Additional value factor if on ISLA (normal density)	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,00	1,15	1,15	1,15	1,15	1,15	1,15	1,15
Additional value factor if on ISLA (higher density)	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,00	1,10	1,10	1,10	1,10	1,10	1,10	1,10
Welfare share indirect VA all investments ISLA	0,20	0,20	0,20	1,00	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Welfare share indirect VA operational activities	0,20	0,20	0,20	1,00	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Synergy effect commercial activities (offices)	0,05	0,05	0,05	0,05	0,00	0,10	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,15
Additional export effect (only in high scenario)	0,05	0,05	0,05	0,05	0,00	0,10	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,15
Density and height of buildings																
Share normal houses in construction on ISLA, high income	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,80	0,90	0,90	0,90	0,90	0,90	0,90
Share normal houses in construction on ISLA, low income	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,80	0,90	0,90	0,90	0,90	0,90	0,90
Share normal offices in construction on ISLA	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,25	0,50	0,50	0,50	0,50	0,50
Construction density offices (%)	40	40	40	40	40	40	40	40	40	40	40	60	40	40	40	40
Height of offices (# of floors)	10	10	10	10	10	10	10	10	10	10	10	10	12	10	10	10
Height of low income houses (# of floors)	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3
Height of middle/high income houses (# of floors)	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5	5
Costs (range factor)																
Soil remediation costs ISLA site (M and P case)	1,0	1,0	1,0	1,0	1,0	1,0	1,4	0,6	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Dismantling costs ISLA site (M and P case)	1,0	1,0	1,0	1,0	1,0	1,0	1,4	0,6	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Net welfare effect of sensitivity analysis by strategic ISLA redevelopment variant (NAFL mln; NPV 2011)	**Net Benefit**															
	Reference alternative: 'do mimimum'														'do nothing'	
	Basis	1	2	3	4	5	6	7	8	9	10	11	12	13	14 (= Basis)	15
Variant A. Focus on non-tourist industries and housing																
A-LSLD: Lower growth scenario, low density	86	47	173	100	-5	176	28	144	-47						-171	9
A-LSHD: Lower growth scenario, high density	218	113	450	230	38	399	160	276	60	316	214	219	219	238	-39	322
A-HSLD: Higher growth scenario, low density	68	0	261	122	-105	241	-32	168	-29						-189	157
A-HSHD: Higher growth scenario, high density	226	75	607	283	-82	535	126	326	102	298	220	227	227	241	-31	586
A-LSLD+: Lower scenario, low density; additional area supply	75	51	117	76	-16	165	147	2	68						-183	-2
A-HSLD+: Higher scenario, low density; additional area supply	68	0	261	122	-105	241	-32	168	-29						-189	157
Variant B. Focus on mixed industry and greenery																
B-LS: Lower growth scenario	43	20	108	114	33	54	-15	102	-35						-214	-193
B-HS: Higher growth scenario	-16	-46	99	80	-27	-6	-117	84	-106						-274	-253
Average net benefit (all variants, excl. additional area supply v.)	*104*	*35*	*283*	*155*	*-25*	*233*	*25*	*183*	*-9*	*307*	*217*	*223*	*223*	*240*	*-153*	*105*

Figure A.15.Basis Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Basic sensitivity variant (see Table 15.3, column Basis)

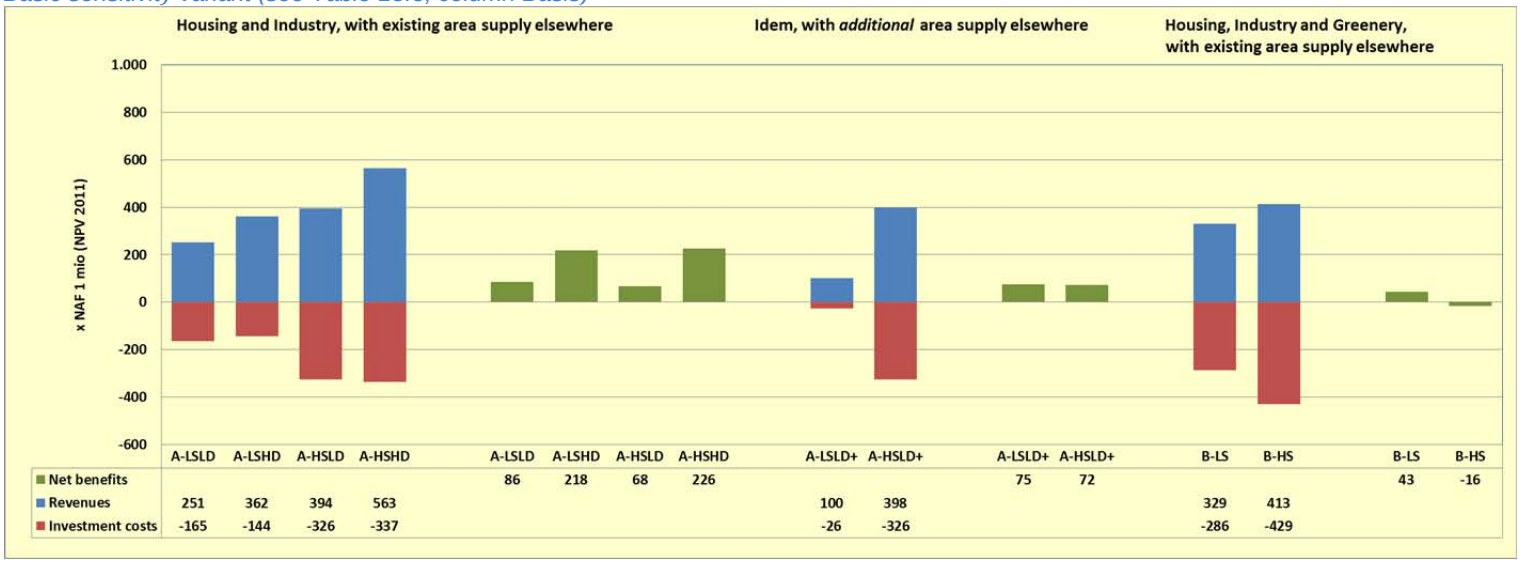


Figure A.15.1 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 1; 10% discount rate (see Table 15.3, column 1)

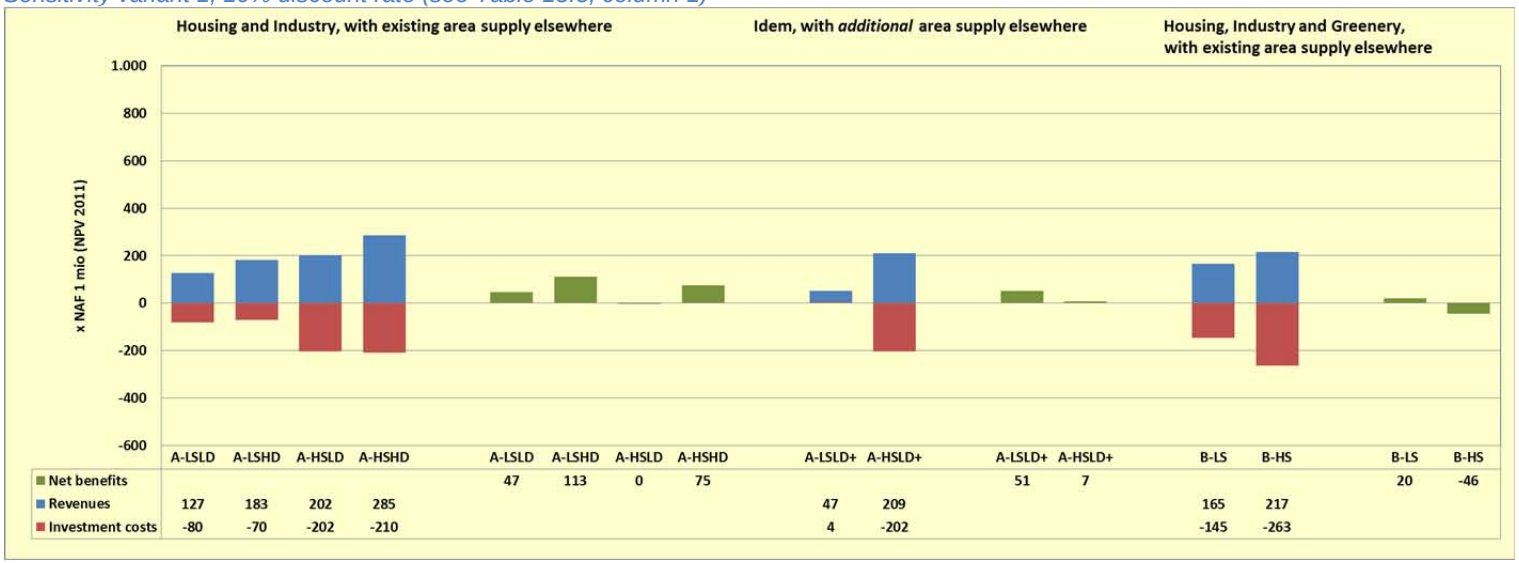


Figure A.15.2 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 2; 4% discount rate (see Table 15.3, column 2)

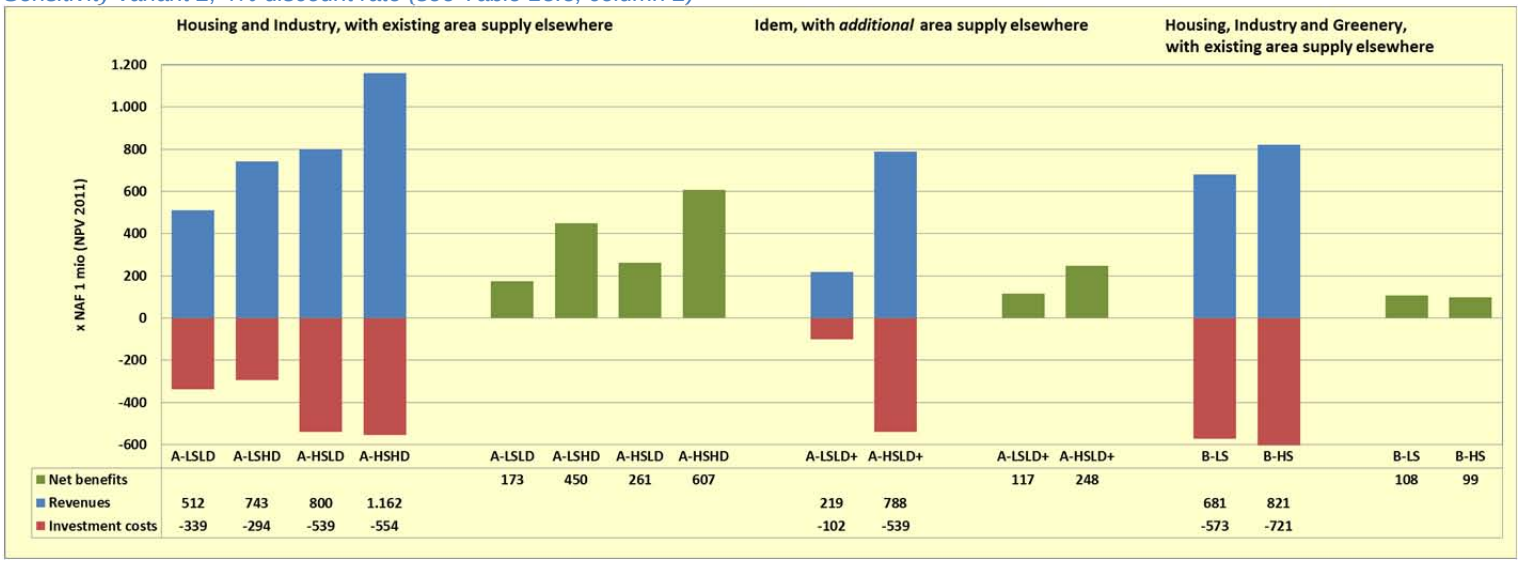


Figure A.15.3 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 3; 100% of calculated indirect effects taken into account (see Table 15.3, column 3)

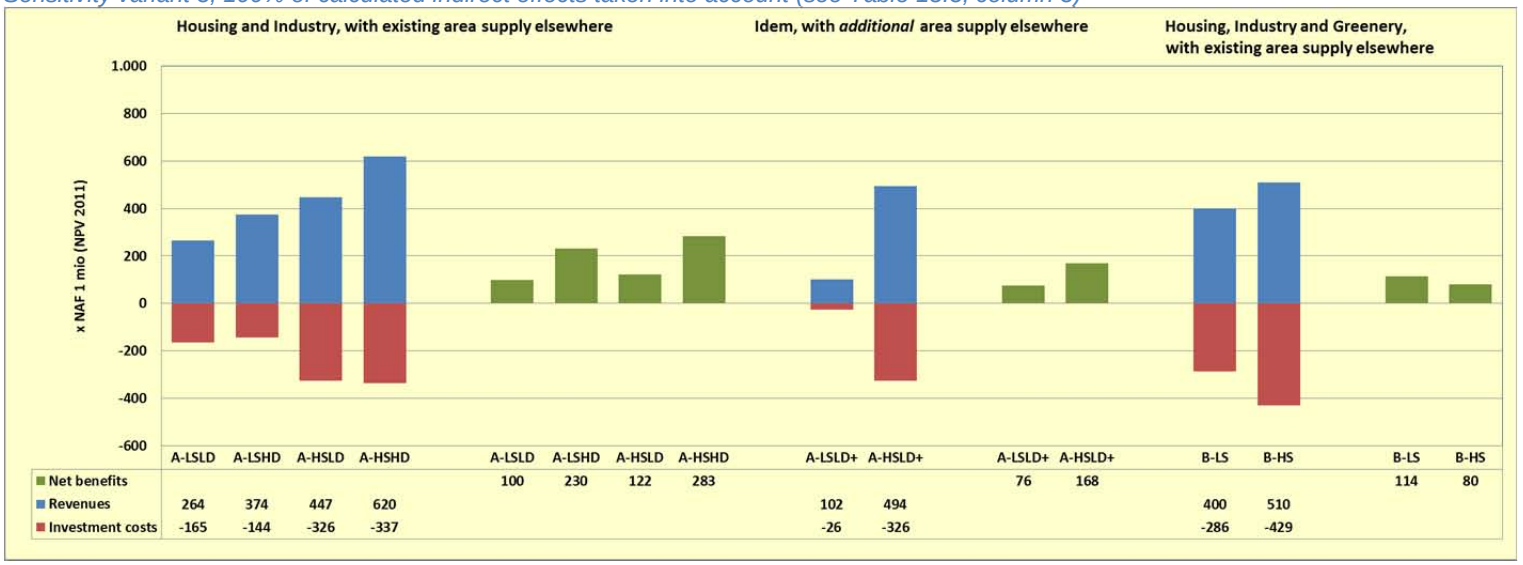


Figure A.15.4 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 4; no synergy and export effects (see Table 15.3, column 4)

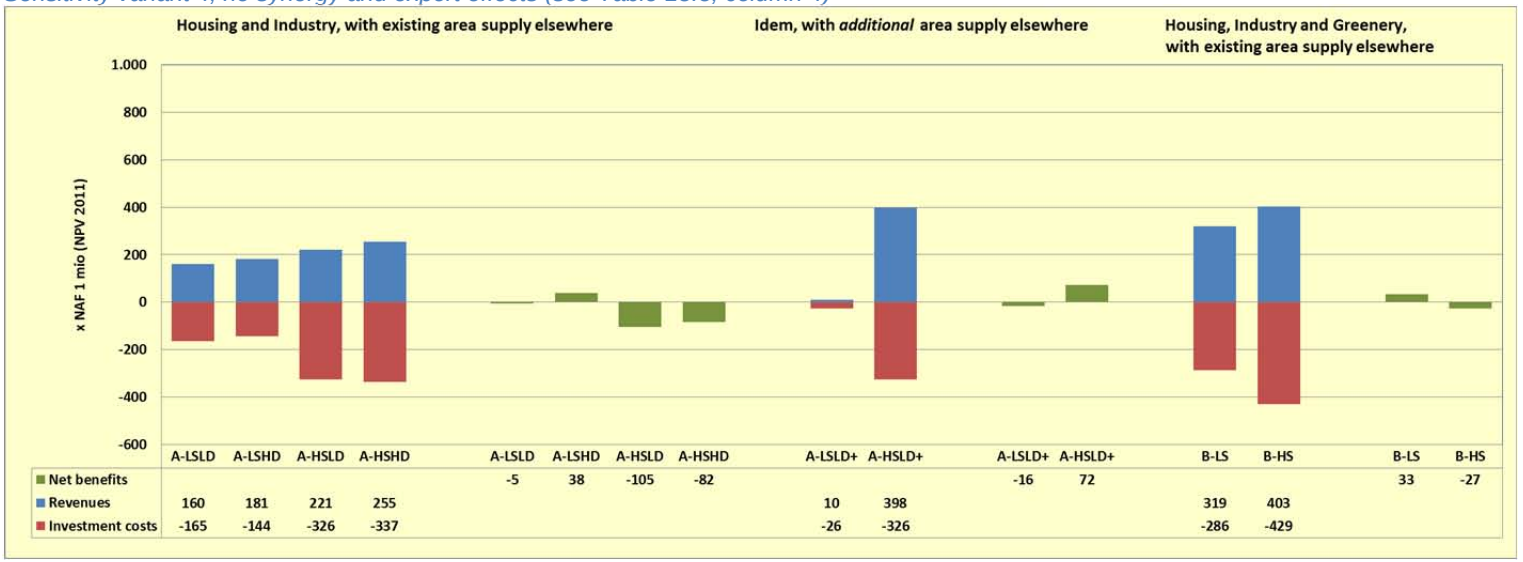


Figure A.15.5 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 5; doubling of synergy and export effects (see Table 15.3, column 5)

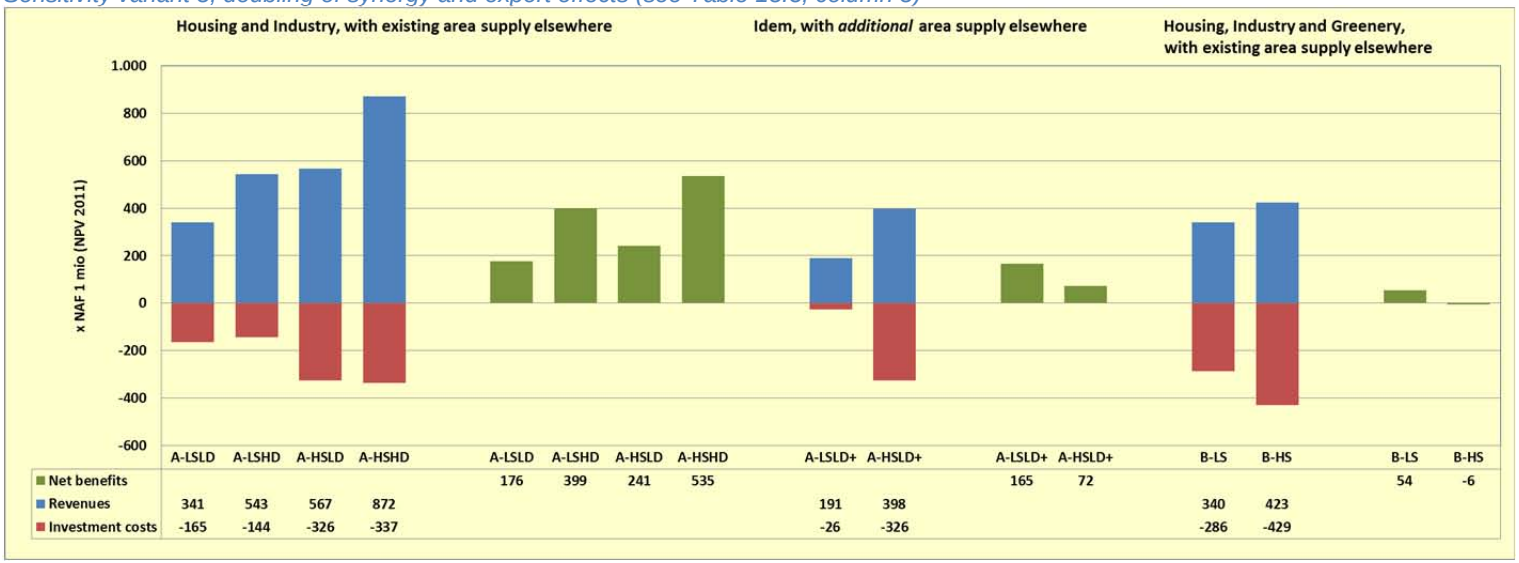


Figure A.15.6 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 6; dismantling and remediation costs 40% higher (see Table 15.3, column 6)

Figure A.15.7 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 7; dismantling and remediation costs 40% lower (see Table 15.3, column 7)

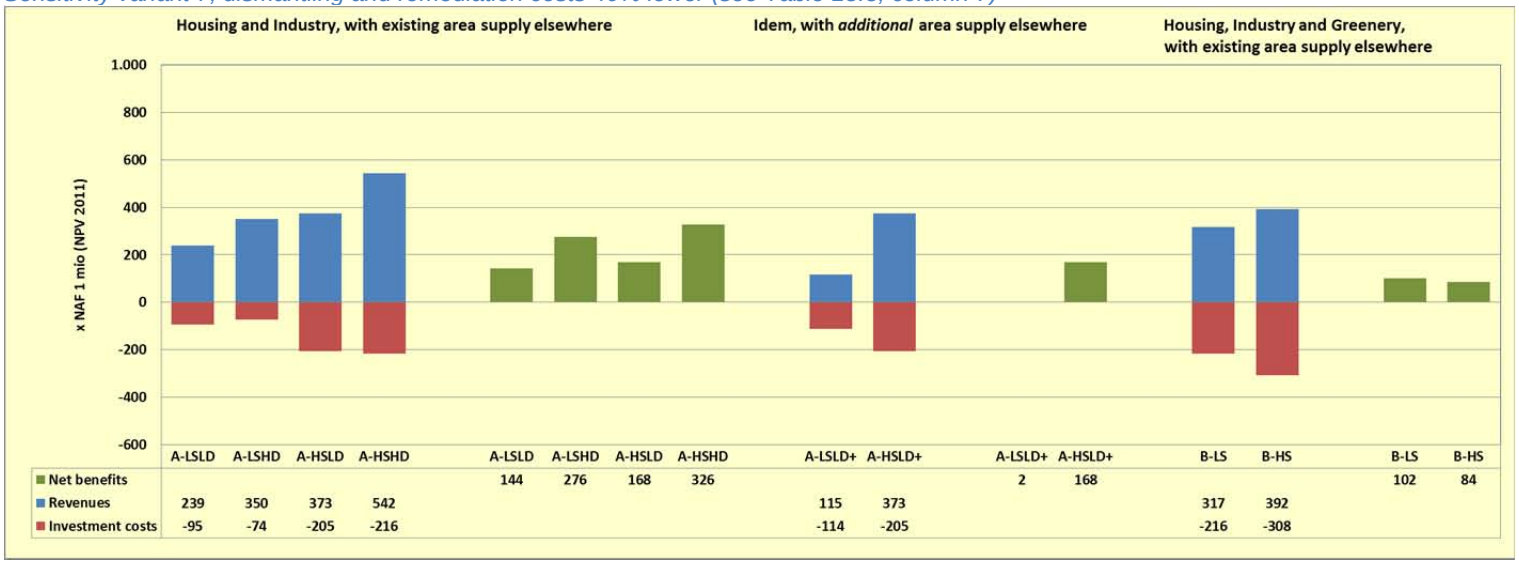


Figure A.15.8 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 8; no additional value of houses if built on ISLA (see Table 15.3, column 8)

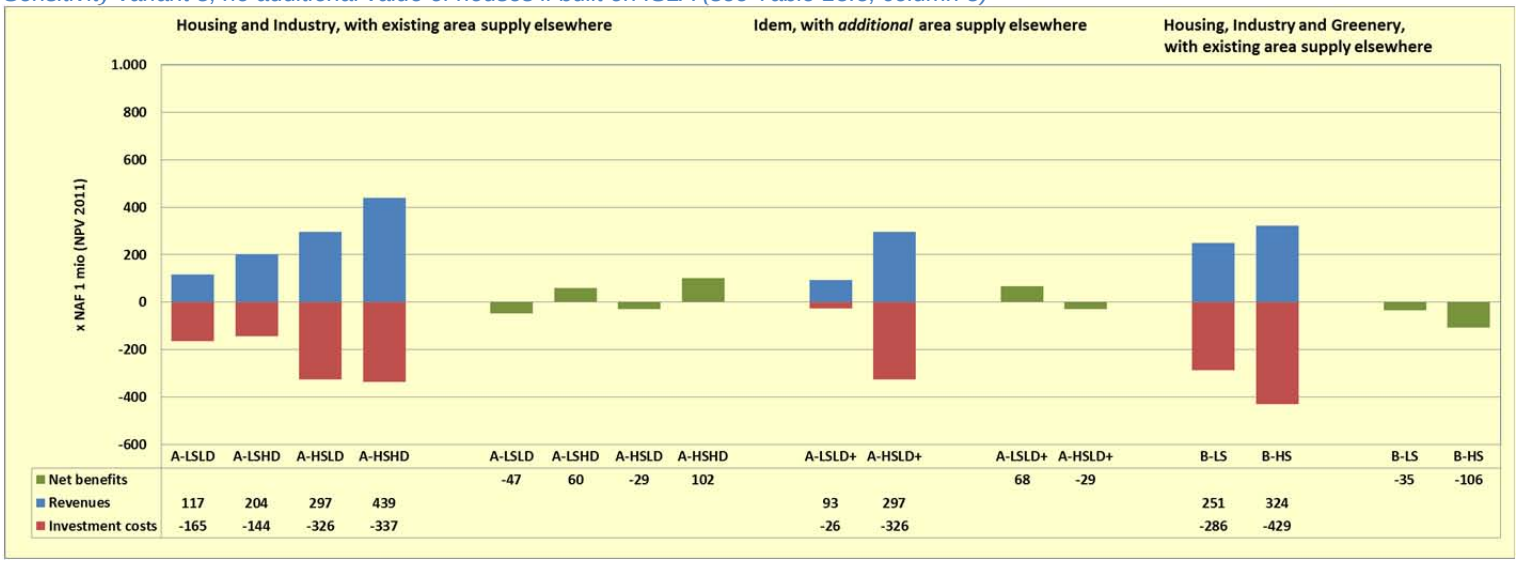


Figure A.15.9 Cost and benefit differences between high density project variants and their reference alternatives, and net project benefits: Sensitivity variant 9-13; building density and height on ISLA (see Table 15.3, column 9-13)

Fig. A.15.9a C and B differences between project and reference alternative (P-M), and net project benefits; basic sensitivity variant (see Table 15.3 column Basis)

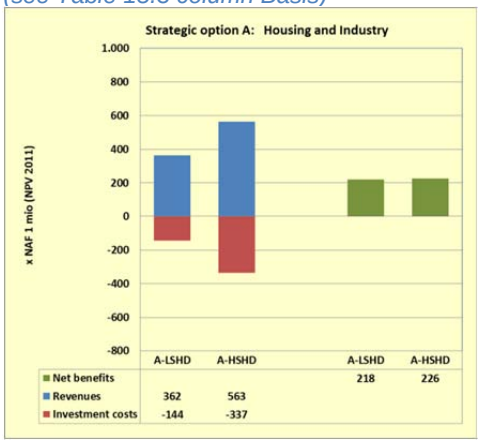


Fig. A.15.9b C and B differences between project and reference alternative (P-M), and net project benefits; increased share of high density housing (see Table 15.3 column 9)

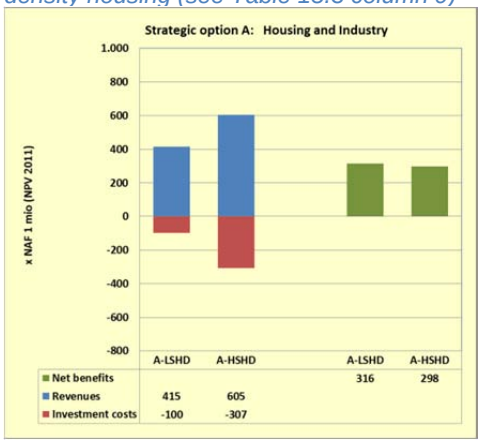


Fig. A.15.9c C and B differences between project and reference alternative (P-M), and net project benefits; increased share of high density offices (see Table 15.3 column 10)

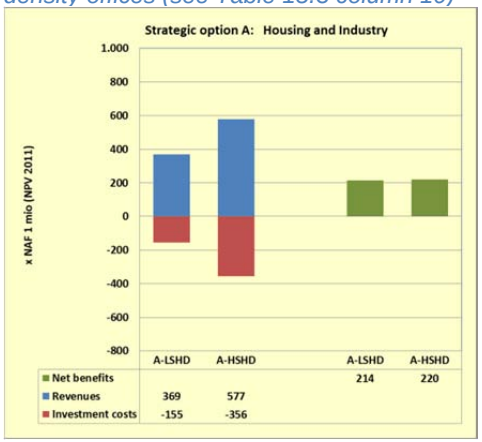


Fig. A.15.9d C and B differences between project and reference alternative (P-M), and net project benefits; increased construction density of offices (see Table 15.3 column 11)

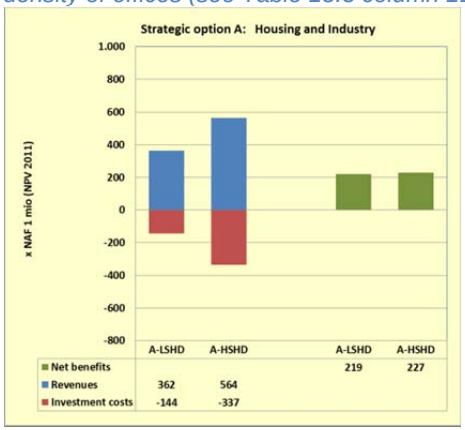


Fig. A.15.9e C and B differences between project and reference alternative (P-M), and net project benefits; increased height of offices (see Table 15.3 column 12)

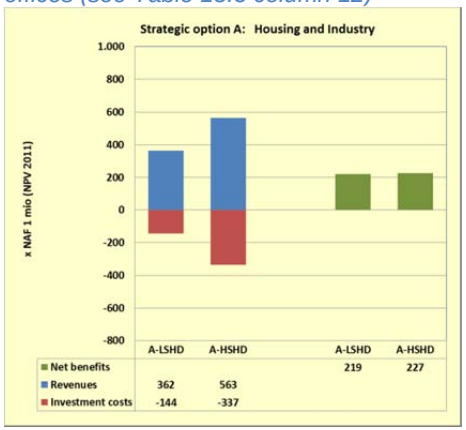


Fig. A.15.9e C and B differences between project and reference alternative (P-M), and net project benefits; increased height of houses (see Table 15.3 column 13)

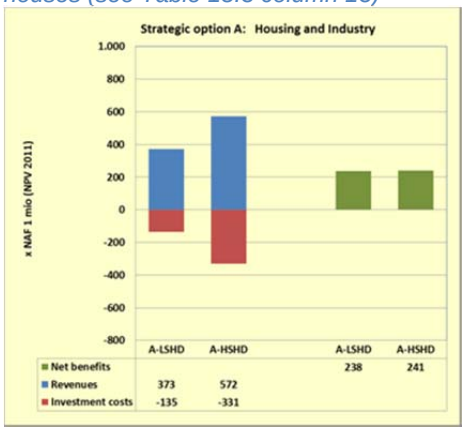


Figure A.15.10 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 14; No dismantling and remediation costs in reference alternative ('do nothing' instead of 'do minimum'; basis variant)

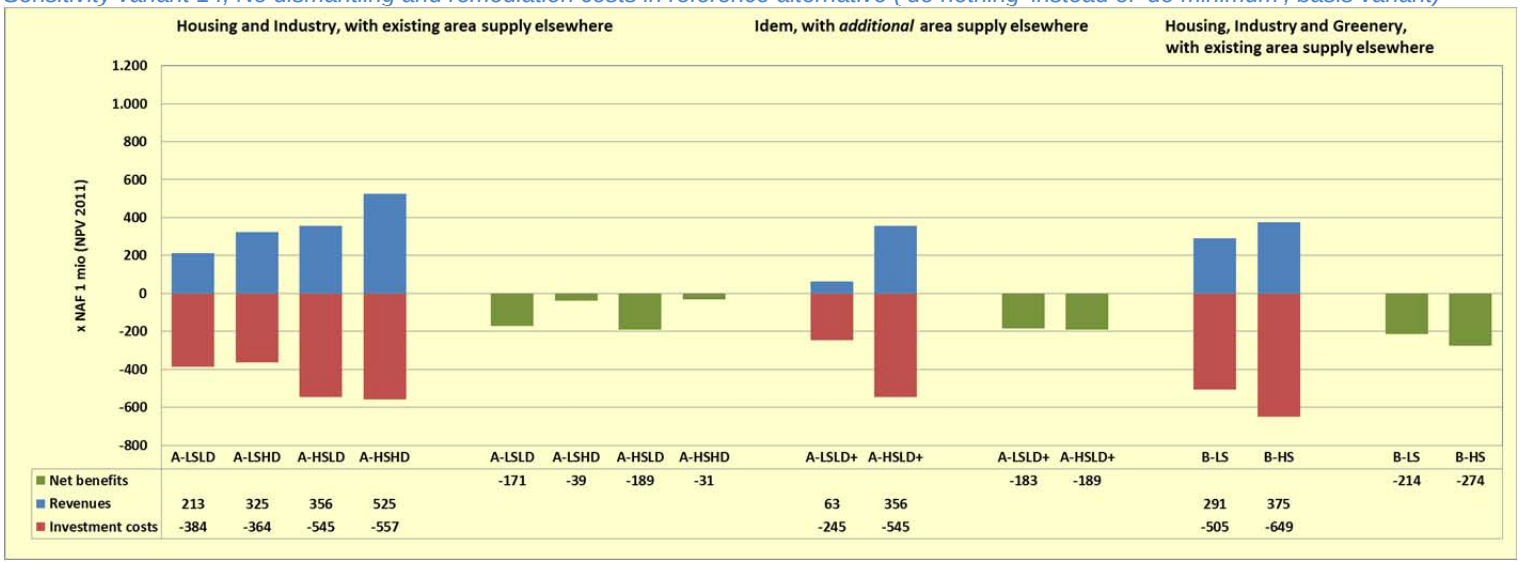
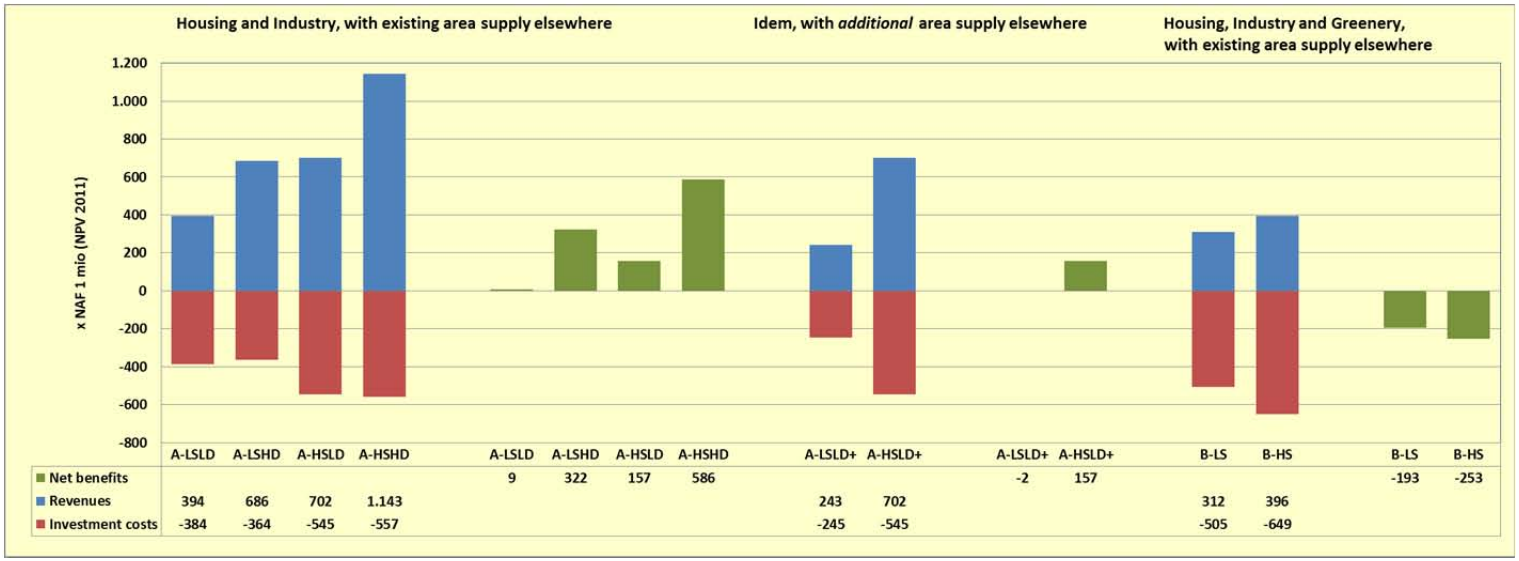
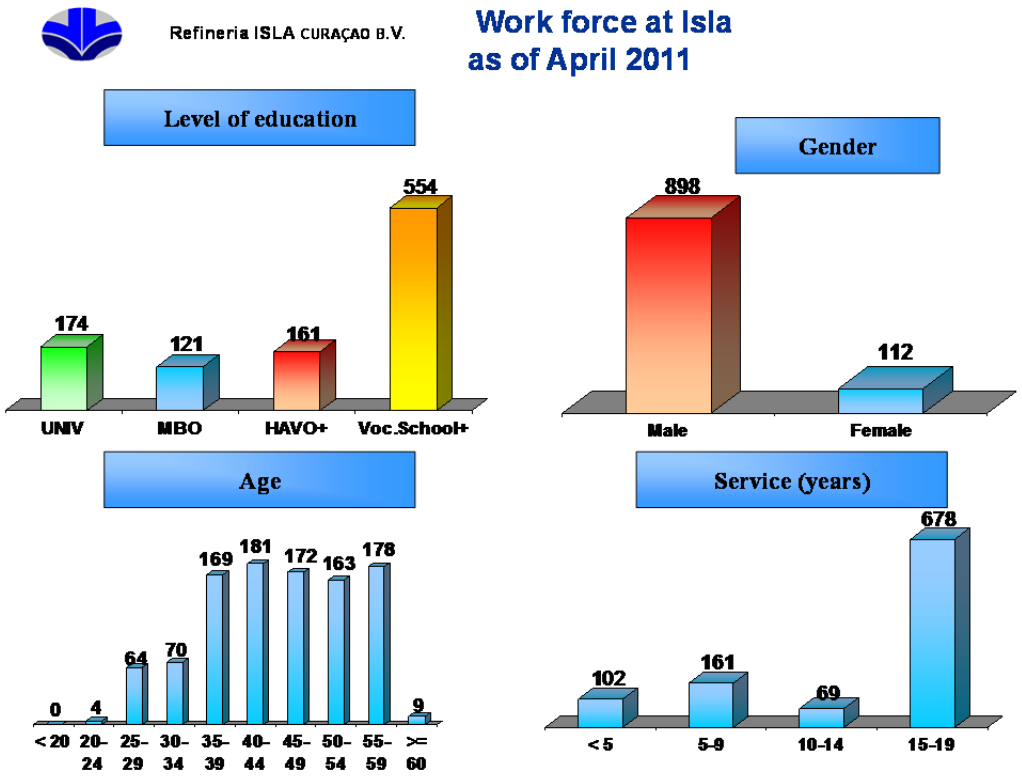


Figure A.15.2.11 Cost and benefit differences between project variants and their reference alternatives, and net project benefits: Sensitivity variant 15; see variant 14 ('do nothing' instead of 'do minimum'); synergy 15% and export effects 15% (instead of 5%)


Housing and Industry, with existing area supply elsewhere
Idem, with *additional* area supply elsewhere
Housing, Industry and Greenery, with existing area supply elsewhere
x NAF 1 mio (NPV 2011)
1.200
1.000
800
600
400
200
0
-200
-400
-600
-800
A-LSLD A-LSHD A-HSLD A-HSHD A-LSLD A-LSHD A-HSLD A-HSHD A-LSLD+ A-HSLD+ A-LSLD+ A-HSLD+ B-LS B-HS B-LS B-HS
Net benefits 9 322 157 586 -2 157 -193 -253
Revenues 394 686 702 1.143 243 702 312 396
Investment costs -384 -364 -545 -557 -245 -545 -505 -649

Annex 8 Work force at ISLA



Annex 9 Application of the Curalyse model

Model

Curalyse is a macro-economic model developed for the island economy of Curacao. This instrument consists of a database, inclusive of all economic data currently available (e.g. National accounts, Government Financial Statistics, Monetary Survey, Prices and Labour Market Survey), and a simulation and forecasting model. Curalyse was built during 1995 and 1996 by the Department of Economic Affairs (DEZ) in close co-operation with MicroMacro Consu1tants and bas been operational since 1996.

Curalyse has been used intensively to make several policy simulation runs, scenarios and forecasts, with a view to advising the Government on matters of major policy. This instrument is used e.g. to:

- Monitor the socio-economic development of the island economy of Curacao;
- Calculate the effects of structural measures proposed by the IMF and IDB;
- Show the impact of policy measures on the main export sectors of the Curacao economy (tourism, financial off-shore, and oil refinery);
- Make consistent forecasts for the annual Economic Outlook of the Department of Economic Affairs of Curacao;
- Provide a consistent quantitative framework for discussions in workshops held twice a year with, among others, economists of the Central Bureau of Statistics, Central Bank, Department of Finance, Trade Unions, and Chamber of Commerce.

Since its creation, Curalyse has been regularly updated and enhanced in order to better reflect the functioning of the island economy and to project more accurately the variations/changes introduced in the local economy. The Department of Economic Affairs, DEZ, has made this model publicly available and has promoted and stimulated its wide usage for business and academic purposes by holding periodic awareness/training workshops following the release of each new version throughout the year.

However, at 10-10-10 the political relations between Curacao, the Netherlands Antilles and the Netherlands changed significantly and as a consequence Curacao changed into the new status ”Land of Curacao”. Therefore, in the beginning of 2011 MicroMacro Consultants started to adjust the Curalyse model to the new political situation. Their contribution will last until the end of 2013. This adjustment process will be done step by step. The latest version of Curalyse available for Ecorys dated from 19th of May 2011. This version do not take into account, yet, the revenues and expenditures for the Government of Curacao. This information is still pending, but did not influence the results of our analysis with respect to the refinery options.

Curalyse and this study

In this study, Curalyse has been used to calculate the direct and indirect effects of the selected refinery alternatives (base case, case 1A/B, case 2A/B and case 3A/B) in terms of value added (VA), as one of the components in the CBA. The following data has been used as input for Curalyse (only as far as it concerns local expenditures):

- Investment costs, needed to realize cases 1A/B, 2A/B and 3A/B;
- Operating costs;
- Annual shutdowns and sustaining capital expenses;
- CAPEX and OPEX of additional environmental short term actions/measures by the GoC;
- Investment oil depot.

Direct and indirect effects of costs of removing the installations after closing the refinery, and cost of site cleaning were already estimated in strategic option 2, re-development of the ISLA site (Schottegat Area) after closure of the ISLA refinery at the end of 2019. Use has been made of I/O-analysis and the updated I/O-table for Curacao for the year 2009 made by Ecorys.

As the strategic options span an estimated production period running till 2038, after which a seven year removal and cleaning period is assumed to take place, all calculations run till the year 2045. However, Curalyse is a model for short run developments. For this study DEZ developed Curalyse to a medium run model with economic data for the period 2011-2021. The effects after 2021 are considered constant.

In close consultation and cooperation with DEZ the method used to calculate the various effects mentioned above has been discussed and agreed upon in the period March-end of August 2011. The following equations in the Curalyse model have been used for relevant inputs:

For investments (and also for shutdowns, sustaining capital and other short term investments)
- Row 79 (gross investments by companies) and;
- Row 155 (balance of payments);

For operations expenditures:
- Row 79 and155 (see investments) for payments to contractors on the island;
- Row 80 (export for payments to local suppliers on the island);
- Row 80 (export) for expenditures in BOO in existing (current) situation. In future situation in which BOO is integrated in ISLA refinery, all operating costs of BOO are transferred to the various costs items of ISLA.

The lease fee received by RdK (corrected for OPEX) and the wages of ISLA personnel are directly taken as an impulse to the economy of Curacao.

All direct and indirect effects have been calculated firstly in terms of Gross Value Added at current prices) and in the end translated into 2011-prices (used in the CBA model. Direct employment effects (for ISLA personnel and for the contractors) are based on ISLA data, and indirect employment effects are based on multipliers taken from the I/O-analysis.

Annex 10 List of interviewees

Government institutions

Mrs. M. Jonker	Ministry of Traffic, Transport and Spatial Planning
Mr. L.J. Janga	Ministry of Traffic, Transport and Spatial Planning
Mrs. E. Biesbrouck-Palm	Ministry of Health, Environment and Nature
Mr. U. Sillié	Ministry of Health, Environment and Nature
Mr. R.M.B. Bomberg	Department of Public Works
Mr. F. Mercilia	Department of Public Works
Mr. A.E. Con	FKP
Mrs. D.B. Philbert	Ministry of Social Affairs and Employment
Mr. J. Sierhuis	MAC
Mr. L. Girigorie	Ministry of Economic Affairs Curacao
Mrs. N. Petronella	Ministry of Economic Affairs Curacao
Mr. D. Martis	Ministry of Economic Affairs Curacao
Mrs. S. van Rijn	Government of Curacao
Mr. M van Nierop	Environmental department of Curacao
Mr. T. Ras	Environmental department of Curacao
Mr. J. Martis	Government of Curacao Domeinbeheer
Mr. K. Martis	Government of Curacao Domeinbeheer

Private organisations

Mr. W. Kelly	RdK/VPC
Mr. S. Maduro	RdK
Mrs. S. Isidora	RdK
Mr. A.C. Casperson	Aqualectra
Mr. K. Tujeehut	Aqualectra
Mr. E. Martina	CDM
Mr. M.R.J. de Lannoy	CPA
Mr. H. de Castro	CPA
Mr. G.R. Caldera	CPA
Mr. G.J. Capella	Curoil
Mr. E. Paulina	Curoil
Mr. G. Louisa	Curoil
Mr. E.R. Smeulders	Curinde
Mr. E.J. Yzer	Curinde
Mr. H. Clarinda	CTB
Mr F. Ayoubi	CTB
Mr. D. Daal	CTB
Mr. V.R. Pieter	Curacao civil aviation authority
Mr. M. Ilames	Curacao civil aviation authority
Mr. I.S. Martina	Buskabaai NV
Mr. N. George	Foundation Humanitarian Care
Mr. P. van Leeuwen	SMOC
Mr. M. Ruijter	SMOC
Mr. J. Hernandez	Former director PdVSA
Mr. R.H. Ignacio	CGTC/ABVO
Mr. K.E. Valpoort	CGTC/CTDF
Mr. M van Schaaijk	Micromacro Consultants BV

Mr. G.C. Bijlstra	Landmark real estate
Mr. A. Casimiri	GreenTown
Mr. S. Rusticus	GreenTown
Mr. R. Neuman	New Winds Realty
Mr. F.R. Suriel	Spanish Water Resort
Mr. E.M. Menig	Netherlands Antilles Air Traffic Control N.V.
Mr. Z.A. Lake	CBS
Mr. C.M. Jager	CBS
Mr. H. Rooijakkers	Studio acht
Mr. C.M. Henriquez	Bank van de Nederlandse Antillen
Mr. I. Colina	Refinery ISLA Curacao
Mrs. A. Inesia	Refinery ISLA Curacao
Mr. M. Lanjouw	Island design
Mr. J. van der Velde	Buro Vijn
Mr. E. Martina	Curacao Drydock Company
Mr. F.J. da Costa Gomez	CPS
Mr. J. de Freitas	Carmabi
Mrs. S. Fignal	APNA
Mr. M. Dennert	IMD design
Mr. M. Koch	IMD design
Mr. M. Thoonen	Boca Gentil
Mr. S. Nandpersad	Vida Nova
Mr. F. Piket	Plan'D2
Mr. D. Klaus	Klaus Architects
Mr. K. Raymann	Architectenatelier Lobo & Raymann

Principal

Mr. R. Garmes	RdK
Mr. O. van der Dijs	RdK

P.O. Box 4175
3006 AD Rotterdam
The Netherlands

Watermanweg 44
3067 GG Rotterdam
The Netherlands

T +31 (0)10 453 88 00
F +31 (0)10 453 07 68
E netherlands@ecorys.com

W www.ecorys.nl

Sound analysis, inspiring ideas