ACIL ALLEN CONSULTING

REPORT TO
TIMOR GAP E.P.
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TASI MANE PROJECT

POTENTIAL IMPLICATIONS FOR THE ECONOMY OF TIMOR-LESTE

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GLOSSARY OF TERMS

bpd	Barrels per day
billion	Billion measured by $1x10^9$ (or 1,000 million) as per the US convention
Capex	Capital expenditure
CGE	Computable General Equilibrium (model)
E&P	Exploration for and Production of Petroleum (may also apply, in other contexts, to mineral exploration and production)
EITI	Extractive Industries Transparency Initiative
FEED	Front End Engineering and Design
FID	Final Investment Decision
FLNG	Floating Liquefied Natural Gas
FTE	Full time equivalent
GDP	Gross Domestic Product. A measure of the size of an economy representing the total dollar value of all goods and services produced over a specific time period.
GNI	Gross National Income. Equal to GDP less net taxes on production and imports, less compensation of employees and property income payable to the rest of the world plus the corresponding items receivable from the rest of the world.
GTAP	Global Trade Analysis Project
IMF	International Monetary Fund
IRR	Internal Rate of Return
LNG	Liquefied Natural Gas
m3	Cubic metres
mtpa	Million tonnes per annum
NPAT	Net Profit after Tax
NPV	Net Present Value. The value of a future stream of income (or expenses) converted into current terms by an assumed annual discount rate. The

	underlying premise is that receiving, say, $100 in 10 years is not 'worth' the same (i.e. is less desirable) than receiving $100 today.
Real income	A measure of the welfare of residents in an economy through their ability to purchase goods and services and to accumulate wealth. In levels, it is equal to real GDP plus net foreign income transfers.
Real and nominal dollars	Nominal dollars are dollars that are expressed in the actual dollars that are spent or earned in each year, including inflation effects. Real dollars have been adjusted to exclude any inflationary effects and therefore allow better comparison of economic impacts in different years. Over time, price inflation erodes the purchasing power of a dollar thereby making the comparison of a dollar of income in 2040 with a dollar of income in 2015 invalid. Adjusting nominal dollars into real dollars overcomes this problem.
Tcf	Trillion cubic feet
US$/USD	United States Dollars

KEY FINDINGS AND EXECUTIVE SUMMARY

Summary of Key Findings

The Tasi Mane Project (comprising the Suai Supply Base, Betano Refinery, Beaço LNG Plant and supporting town developments, highway and airport upgrades) represents a major investment by the government of Timor-Leste aimed at establishing a national petroleum industry and associated supporting infrastructure, skills development and service capability in order to facilitate petroleum development in Timor-Leste. The project has the potential to catalyse a range of local support services providing business and employment opportunities.

Modelling these "emergent" economic growth gains is highly challenging, because experience shows that the specific businesses that develop vary greatly from village to village. For this reason the core modelling of the Tasi Mane Project has not assumed any "unlocking" or enhancement of labour or capital productivity beyond the movement of people from low skilled occupations to higher skilled occupations in response to the opportunities presented by the other project elements.

Consequently, the estimated economy-wide benefits of the Tasi Mane Project are likely to underestimate the true potential of the Project.

The analysis presented in this report shows that, on a consolidated basis and under the Base Case assumptions, the project has a post-tax internal rate of return (IRR) of about 10.7 per cent, with a net present value (NPV) of $436 million assuming a real discount rate of 10 per cent. Using Low Case oil price assumptions, the post-tax IRR falls to 9.6 per cent, with NPV of –$229 million. Using High Case oil price assumptions, the post-tax IRR increases to 12.3 per cent, with NPV of $1,860 million.

Government capital expenditure will be $2.2 billion, comprising the Suai Supply Base, highway and Suai and Viqueque airports. Capital expenditure by TIMOR GAP, project partners and investors will be about $11 billion, mostly for the LNG Plant and the Refinery. The majority of the capital expenditure will occur over the period 2016 to 2029. By far the largest portion of the capital expenditure (67 per cent under Base Case assumptions) is associated with the proposed Beaço LNG facilities.

Operating expenditure for the consolidated project reaches a maximum level of about $222 million per year in 2039 with the commissioning of the Betano Stage 3 project. Around 79 per cent of operating expenditure is expected to be non-labour.

The total value of product sales (net of feedstock purchase costs) over the life of the project is estimated at about $81.8 billion with about 85 per cent derived from the LNG project.

Construction workforce peaks at 12,000 workers in 2022 to 2023, with second peak of around 11,500 workers in 2028. Following completion of construction activities, the project provides ongoing employment for around 2,000 workers, the majority of whom are expected to be East Timorese.

Government revenue from taxes and duties is expected to total $6.7 billion over the period to 2050, peaking at around $340 million per year. The majority of government revenue will be derived from company income tax.

The consolidated project yields consistently positive returns to equity from 2029 on, rising to around $2.9 billion per year. Under the Base Case assumptions the project will generate about $41.7 billion net profit over the life of the project (to 2050). This does not include the cost of supporting infrastructure.

Assessment of the indirect economy-wide impacts shows that, under Base Case assumptions, the integrated Tasi Mane Project will increase the real Gross Domestic Product (GDP) of Timor-Leste by a cumulative total of US$98 billion (with a net present value of US$22.1 billion, using a 7 per cent real discount rate) over the period 2015 to 2050. To place this in perspective, the discounted present value is more than five times greater than Timor-Leste's 2015 estimated total GDP and nearly 15 times the estimated non-oil sector GDP. The corresponding cumulative increase in national real income is US$134.3 billion (with a net present value of US$28.9 billion).

The Tasi Mane Project Cluster

The Tasi Mane Project has the potential to become a major contributor to the economy of Timor-Leste and the communities along the South Coast, where the project is located.

The project is being progressed in a very difficult market environment, with depressed commodity prices sapping investment appetite and suppressing levels of exploration and mining activity in the international economy. Nevertheless, given appropriate support from government and other investors, the Tasi Mane Project could become a major transformational development in Timor-Leste.

This study provides an assessment of the direct and indirect economic benefits that could flow from the Tasi Mane Project. The study considers a scenario under which:

- Supporting Infrastructure construction commenced in 2015
- Suai Supply Base construction commences in 2016
- Betano Refinery and Petrochemical complex construction commences in 2017 (with first production in 2020)
- Beaço LNG Plant construction commences in 2020 (with first production in 2025)

For the Betano Refinery and Petrochemical complex and the Beaço LNG Plant components of the Tasi Mane Project three sensitivity cases are considered in order to illustrate the effects of different assumptions regarding the future price of oil:

- The **Base Case** under which oil prices are assumed to rise year-on-year from current levels, averaging approximately US$77 per barrel over the next 35 years. Petroleum product and LNG prices are benchmarked to oil.
- A **Low Price Case** under which long-run oil prices are assumed to rise year-on-year from current levels, averaging US$51 per barrel over the next 35 years. Petroleum product and LNG prices are benchmarked to oil on a similar basis as for the Base Case.
- A **High Price Case** under which long-run oil prices are assumed to are assumed to rise year-on-year from current levels, averaging US$103.50 per barrel over the next 35 years. Petroleum product and LNG prices are benchmarked to oil on a similar basis as for the Base Case.

Economic benefits from the Tasi Mane Project Cluster

The Tasi Mane project can be expected to have a range of economic impacts at national, regional and local levels. The project would increase national gross domestic product (GDP) and export earnings, and would provide a long-term boost to government revenues while creating employment opportunities during construction and operation. It should also provide a catalyst for further development in the South Coast region. The benefits from the project would be felt throughout the economy if the national government applies the earnings from its share of project revenues to fund major physical and social infrastructure investments. Such programs have the potential to improve the

quality of life of Timor-Leste citizens by providing essential services and enhancing the country's productivity. Benefits would also flow through the economy as the wages and salaries of project staff are spent on goods and services and as suppliers provide a range of inputs to the project. Landowners stand to benefit from potential business opportunities and improved social and economic infrastructure.

Direct benefits

The first part of the study addresses the direct impacts and associated benefits of the Tasi Mane Project in terms of capital investment, ongoing operational expenditure, employment, production value and expected revenue flows to the Government of Timor-Leste (in the form of equity returns, taxation and other payments).

The assumptions used in this report reflect the project design basis as at December 2015.

Development of the Tasi-Mane Project would directly benefit the Timor-Leste economy in a number of ways, including:

- direct capital investment in the Suai Supply Base, Betano Refinery and Petrochemical Complex, Beaço LNG Plant and associated infrastructure developments (airport upgrades, highway, new towns and administrative facilities)
- ongoing expenditure associated with the operation and maintenance of the Supply Base, Refinery and Petrochemical Complex, LNG Plant and support facilities
- training, skills development and employment opportunities for Timor-Leste nationals and expatriate workers
- direct cash flows to project participants (including the government of Timor-Leste, TIMOR GAP, private investors and landowners) in the form of taxes, royalties and profits
- increased exploration and production (E&P) activity in Timor-Leste.

We have assumed that fiscal terms consistent with current legislation will apply throughout the life of the project.

Direct benefits arising from the Suai Supply Base

Direct benefits for the Suai Supply Base have been estimated for Stage 1 only.

The Suai Supply Base will result in capital expenditure of $754 million over the life of the project.

Operating expenditure is expected to average about $18 million per year, totalling $566 million over the life of the project.

Total revenues under Base Case assumptions average around $60 million per year, with total income of $1.9 billion over the life of the project.

The overall economic performance of the Suai Supply Base under the Base Case assumptions is relatively modest: we find the project in this configuration yields a pre-tax internal rate of return of 3.9 per cent real (3.1 per cent post-tax). The NPV of post-tax cash flows is found to be –$333 million.

The construction workforce is expected to peak at around 2,000 workers including local and expatriate employees, contractors and administrative and support personnel, with a total of some 1,800 person-years of labour required over the construction period. East Timorese nationals are expected to account for 20 per cent of the construction workforce initially, rising to 80% by the end of the construction period. Once construction is completed, the project is expected to provide around 210 full-time positions per year initially, rising to 500 jobs by 2033.

Based on the anticipated levels of service business conducted through the Suai Supply Base, indirect employment in service businesses is expected to peak above 5,000 employees.

In terms of government income, the Suai Supply Base is expected to generate tax and duty payments totalling $169 million over the life of the project, with company income tax comprising around 56 per cent of the total. As a result of depreciation allowances and accumulated tax losses, no company income tax will be payable until 2029. The support businesses using the Suai Supply Base are

expected to contribute around $1.4 billion in tax and duty payments over the period to 2050: much more than the revenue contribution from the supply base itself.

Assuming the project is built without debt financing (100% equity) returns to equity would total $477 million over the projection period, with positive returns generated from 2020.

Direct benefits arising from the Betano Refinery and Petrochemical Complex

The total capital cost of the Betano Refinery and Petrochemical Complex under the Base Case oil price assumptions is $1,895 million (real 2015) comprising $522 million for Stage 1, $474 million for Stage 2 and $899 million for Stage 3.

Operating costs (excluding feedstock purchases) are assumed to average 3.5 per cent of cumulative capital expenditure, totalling $1.3 billion over the life of the project at an average $43 million per year over the operating life of the plant. These operating costs do not include crude oil feedstock purchases which total around $59.8 billion over the life of the project (Base Case).

Net revenue from refinery output under the Base Case would average around $65 million per year during Stage 1 operations, rising to $279 million per year in Stage 2 and $556 million per year in Stage 3.

The construction workforce is expected to average around 2,000 workers including local and expatriate employees, contractors and administrative and support personnel, over the initial stage of construction in 2018–19. For the Stage 2 construction period in 2028–29, the construction workforce is expected to average around 3,000 workers. For the Stage 3 construction period in 2038–39, the construction workforce is expected to average around 2,000 workers. Post-construction, at the commencement of the Stage 1 operational phase in 2021, the project will provide around 220 full-time positions per year, rising to around 600 after commissioning of Stage 3.

Tax and duty payments are estimated to total $819 million over the life of the project (Base Case), with company income tax comprising 82 per cent of that amount. Because of the accelerated depreciation arrangements that apply under current taxation law in Timor-Leste and the low margins for Stage 1 of the project, very little company income tax is payable until 2031.

Returns to equity amount to $4.7 billion for the Base Case, $2.7 billion for the Low Case and $6.6 billion for the High Case. Under the Base Case assumptions, returns for the Stage 1 project average minus $2 million per year after the initial investment period in 2018–19. Following completion of the Stage 2 expansion, returns to equity (NPAT) increase to an average $150 million per year, rising to an average $343 million per year after completion of the Stage 3 expansion.

Direct benefits arising from the Beaço LNG Plant

Over the project life, capital expenditure (under the Base Case oil price assumption) totals $8.8 billion, with $5.3 billion incurred over a five-year period between 2020 and 2024. The balance is incurred with construction of the second LNG train and associated pipeline expansion between 2026 and 2029.

Operating costs (Base Case, excluding feedstock purchases) are assumed to average 3 per cent of cumulative capital expenditure for the pipeline, 1.5% for the marine facilities, and 0.67 per cent of cumulative capital expenditure for the LNG plant, totalling $2.6 billion over the life of the project at an average $102 million per year.

Gross revenue from production under the Base Case would average around $3.5 billion per year for Train 1 ($3.0 billion per year from LNG and $0.46 billion per year from LPG). This would increase to $7 billion per year following start-up of Train 2 ($6.1 billion per year from LNG and $0.9 billion per year from LPG). Purchase of LNG feedstock is expected to cost $2 billion per year for Train 1, rising to $4 billion per year after commissioning of Train 2.

The construction workforce for Train 1 is expected to average around 6,000 workers over the five-year construction period including local and expatriate employees, contractors and administrative and support personnel, with a peak construction workforce of 10,000 in 2022 and 2023. For Train 2, a peak construction workforce of 8,000 is expected in 2028.

Post-construction, at the commencement of the Train 1 operational phase in 2025, the project will provide around 300 full-time operating positions per year, rising to 500 operational positions in 2030 when Train 2 comes on line.

Under the Base Case assumptions, tax and duty payments are estimated to total $6.6 billion over the period to 2050, with company income tax comprising around 91 per cent of that amount.

Returns to equity available to TIMOR GAP as 70% owner of the Beaço LNG Project total $26.7 billion over the projection period (under Base Case assumptions). Following commissioning of the second LNG train, TIMOR GAP's share of net profit rises from around $1.2 billion per year to $1.8 billion per year as the loans used to finance construction (70 per cent gearing assumed) are paid out.

Direct benefits arising from the Supporting Infrastructure

The main components of the supporting infrastructure for the Suai, Betano and Beaço developments include:

- The Highway linking the Suai cluster, the Betano Cluster and the Beaço/Viqueque cluster
- The Nova Suai Town, industrial park, airport redevelopment and crocodile reserves
- The Nova Betano Town Development
- The Nova Beaço, Nova Viqueque Town Developments and Viqueque airport upgrade

Over the project life, capital expenditure on supporting infrastructure totals $1.77 billion, most of which ($1.3 billion) relates to the construction of the four lane highway linking the three industrial clusters.

Operating expenditure varies as a function of cumulative capital investment reaching a plateau level about $30 million per year following the completion of construction activities in 2030. Total operating expenditure over the projection period to 2050 totals $908 million.

The supporting infrastructure is assumed to earn modest amounts of revenue from rental of housing and commercial facilities. Rental income reaches about $35 million per year with the largest contributors being commercial operations of the upgraded Suai and Viqueque airports. Total rental income from supporting infrastructure over the project life is estimated to be $1.1 billion.

The workforce involved in construction of supporting infrastructure is expected to peak at around 2,500 workers in 2018 and 2019, with the main construction activities spread over the period 2016 to 2023. This period will see an average construction workforce of almost 2,000 workers, most of whom are expected to be recruited locally. The shape and duration of this period of high construction activity will depend on the final timing of the supply base, refinery and LNG projects. The workforce required for ongoing operation and maintenance of the supporting infrastructure is relatively modest, at about 400 workers. All of these are assumed to be East Timorese.

The only significant government revenues contributed directly by supporting infrastructure are associated with withholding tax, import duty, and wages income tax during the construction phase. Under the revenue assumptions employed in this analysis, the operation of supporting infrastructure does not generate profits and therefore no company tax is paid. Direct tax revenues from supporting infrastructure during the operational phase are not expected to be significant.

The investment in supporting infrastructure is not expected to generate significant direct profits. Rather, the provision of road, town and airport infrastructure represents an investment by the government to make possible the successful development of the revenue-generating supply base, petroleum refinery and petrochemical facility and the LNG facility. Over the period to 2023, the provision of supporting infrastructure will have a net cost (total revenue minus capital contributions, debt repayment, operating costs and tax payments) of about $1.6 billion, the expenditure of which will facilitate the core elements of the Tasi Mane project.

Indirect benefits

While the direct benefits summarised above are important in their own right, the true significance of the Tasi Mane Project lies in its potential to generate *indirect* benefits, influencing broader economic performance as a result of flow-on to other industry sectors. Spending by project participants,

employees, government and private beneficiaries will lead to "multiplier effects" as the economic activities associated with the project impact on the economy generally. Investment in productive physical assets (such as power generation facilities, roads and airports) and in social assets (for example improved education and health services) can also benefit the economy by enhancing the productivity of economic factors.

One of the significant impacts of the project will be the opportunities it will create for local businesses. These opportunities include outsourcing of services such as catering, engineering, security, fuel supply, managerial, professional and technical services.

The indirect macroeconomic impacts of the Tasi Mane Project have been estimated over the period to 2050 using ACIL Allen's *Tasman Global* computable general equilibrium (CGE) model with a purpose-built specification of the Timor-Leste economy. Although the time frame for the macroeconomic modelling has been limited to the current planned life of the project, it is expected that the project will continue to have a positive influence on the macro-economy even after the nominal project end date. This is because of the investment in productive physical and human capital and general economic development in the regions that occurs during the productive life of the project.

The results of the macroeconomic modelling point to a range of very significant impacts:

— Under the Base Case, real Gross Domestic Product (GDP) for the country as a whole increases by a cumulative total of US$98.0 billion with a net present value of US$22.1 billion using a 7 per cent real discount rate. This is more than five times greater, in net present value terms, than Timor-Leste's current total GDP, and more than 15 times greater than its current non-oil GDP.

— The corresponding impact on Timor-Leste's real income under the Base Case is estimated to total US$134.3 billion over the period 2015 to 2050, with a net present value of $US28.9 billion using a 7 per cent real discount rate.

As shown in **Table ES 1**, the modelling indicates that the majority of the macroeconomic benefits are a result of the Beaço LNG element along with the Betano Refinery and Petrochemical Complex.

TABLE ES 1 PROJECTED CUMULATIVE CHANGE IN REAL GDP AND REAL INCOME BY PROJECT ELEMENT (BASE CASE), RELATIVE TO THE REFERENCE CASE (IN 2015 TERMS)

	Real GDP		Real income	
	Total (2015 to 2050)	NPV 7%	Total (2015 to 2050)	NPV 7%
	US$m	US$m	US$m	US$m
Supporting infrastructure	478	310	-172	159
Suai Supply Base	2,746	794	5,331	1,549
Betano Refinery	11,615	2,390	15,830	3,169
Beaço LNG	83,191	18,580	113,326	24,044
Total	**98,029**	**22,074**	**134,316**	**28,920**

Note: Net present values are calculated using real discount rates. NPV calculations begin from 2015.

SOURCE: ACIL ALLEN CONSULTING TASMAN GLOBAL MODELLING

Sensitivity analysis to demonstrate the effect on economic outcomes of differences in long-run average oil prices (and corresponding prices for other petroleum products) was also conducted. This analysis showed that there is proportionately more upside benefit with higher average realised product prices than with lower. In particular, it is projected that:

— a –34 per cent change in the long-run oil price results in changes of approximately –28 per cent for both real GDP and real income over the forecast period. In net present value terms, the sensitivity of real GDP and real income to this change are estimated to be –$27.1 billion and –$37.5 billion respectively.

— a +34 per cent change in the long-run oil price results in changes of approximately +34 per cent for both real GDP and real income over the forecast period. In net present value terms, the sensitivity of real GDP and real income to this change are estimated to be +$60.2 billion and +$83.2 billion respectively.

1 INTRODUCTION

1.1 The Tasi Mane Project

The Tasi Mane (South Coast) Project is a major strategic initiative of the Government of Timor-Leste aimed at establishing a national petroleum industry and associated supporting infrastructure, skills and service capability. Tasi Mane is a multi-phase integrated project comprising three industrial clusters located along a 155 km stretch of the southern coast of Timor-Leste, between the towns of Suai in west and Beaço in the east. Planned developments include a marine supply base, petroleum refinery, LNG plant, all-weather highway, airport upgrades and new town precincts.

The proposed development forms part of the strategic vision for Timor-Leste (Strategic Development Plan 2011 – 2030) and is central to securing the new commercial and industrial activities that can contribute to sustainable social and economic growth for the nation (Government of Timor-Leste, 2011). The Strategic Development Plan identifies the careful management of the petroleum sector as a key source of the nation's future development:

"This [the petroleum] sector is critical not only to our economic growth and strength, but also to our future progress as a successful, stable nation. While developing the sector, we must ensure that Timor-Leste's natural resource wealth is used to build our nation and support our people.

Currently, Timor-Leste lacks the core infrastructure, support industries and human resources to fully operate and manage our petroleum sector. This results in the loss of great opportunities for our people and nation.

Securing these opportunities will provide a strong foundation for the development of a successful petroleum industry, export and service industries and a mature and expanding private sector."

(Government of Timor-Leste, 2011, p. 136)

Project administration, planning and execution is being managed by TIMOR GAP E.P., the state-owned petroleum company of Timor-Leste.

1.2 The Economic Impacts Study

TIMOR GAP E.P. ("TIMOR GAP") engaged ACIL Allen Consulting Pty Ltd ("ACIL Allen") to prepare an economic impact study assessing the benefits that will arise from the various elements of the Tasi Mane Project.

The issues to be considered in assessing the economic impacts arising from the Tasi Mane project are broadly similar to those addressed in studies previously conducted by ACIL Allen (and its predecessor company, ACIL Tasman) of the potential impacts of petroleum and mining developments in Papua New Guinea (PNG LNG Project [2008-09]; Golpu copper-gold mine development project [2015]; Frieda River copper-gold mine [2015]). However, the current study involves an added degree

of complexity because the overall project comprises several discrete but interrelated components. Each of these investment elements, considered in isolation, could be expected to have significant impacts on the economy of Timor-Leste. Because of the inter-related nature of the investments, the aggregate economic impact is likely to be different from (and potentially greater than) the sum of the impacts of each project element assessed on a stand-alone basis.

In this assessment of the economic impacts arising from the integrated Tasi Mane project we first set out introductory material including a high level description of the project and each of its major components. We have sought to reflect the current planning basis for the overall project configuration and the individual project elements, recognising that detailed design and scheduling activities are on-going and subject to change. In this regard we have relied on information provided by TIMOR GAP and other agencies in relation to current plans and costings. Some elements of the overall project are already well advanced, and there is good information available to allow us to characterise these components. Other elements of the overall Timor-Leste Project are less well defined at this stage; for these we have accessed the best current information on the expected capital costs, operating costs, product streams (where relevant), facility utilisation rates, labour force and demographics, and other relevant characteristics of the project in order to be able to measure the economic effects of each element.

The assumptions used in this report reflect the project design basis as at December 2015.

1.2.1 Direct economic impacts

The first part of the study addresses the direct impacts and associated benefits of the Tasi Mane Project in terms of capital investment, ongoing operational expenditure, employment, production value and expected revenue flows to the Government of Timor-Leste (in the form of equity returns, taxation and other payments).

We have as far as possible undertaken detailed reviews of the direct impacts of each of the project elements on a stand-alone basis. For each project element we have compiled, in spreadsheet form, information on capital expenditure, recurrent operating expenditure, employment, products (petroleum products, LNG and so forth), revenue profiles and consequent taxation and other benefit streams flowing to the government of Timor-Leste.

In addition to the quantitative analysis, we have included discussion of the interdependencies and interactions between the various project elements in order to provide a qualitative account of the "economic leverage" that can be expected by bringing the various project elements together as a package, with each element supporting the others.

1.2.2 Indirect economic impacts

The second part of the study addresses the indirect economic impacts and associated benefits of the Tasi Mane Project. These indirect economic impacts are the flow-on effects into the broader economy of Timor-Leste. They include potential cross-sectoral effects. As with any large resource development project, it can be expected that some sectors of the economy will benefit from opportunities to provide goods and services to the Tasi Mane Project, while other sectors may face challenges such as increased competition for labour and resources resulting in higher input costs and reduced export competitiveness. This analysis has been undertaken using a computable general equilibrium (CGE) model of the Timor-Leste economy developed by ACIL Allen.

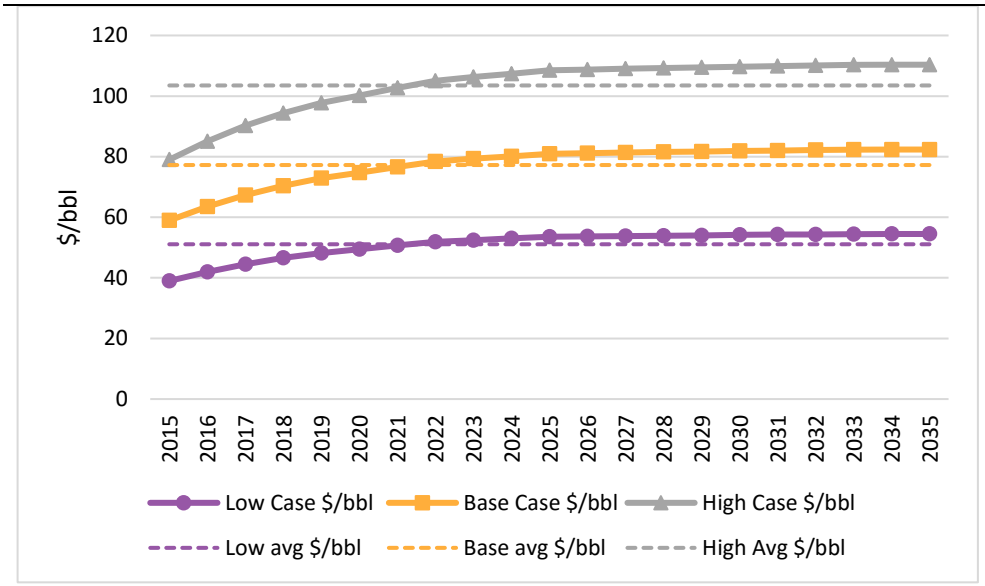
Three cases have been analysed to test the sensitivity of results to different assumptions about oil and petroleum product prices. TIMOR GAP has provided its current assumptions for Low, Base and High oil price projections, based on World Bank and RPS data (**Figure 1.1**). We have used these year-on-year price series for the calculation of all product revenues and feedstock costs, and for the calculation of tax payments and equity returns. For the purposes of determining capital cost profiles for the Betano and Beaço facilities we have reduced each price series to a single average price rather than using the year-on-year prices. This has been done to ensure that capital costs are fixed at the time of commencement of construction, rather than changing year-on-year through the construction period as oil prices vary. It also provides an appropriate basis for calculation of depreciation and operating costs.

The long run average oil prices used for capital cost sensitivities are as follows:

- **Base Case:** US$77 per barrel
- **Low Price Case:** US$51 per barrel
- **High Price Case:** US$103.50 per barrel.

All monetary values quoted in this report are expressed in US dollars and in real (2015) terms.

FIGURE 1.1 OIL PRICE SCENARIOS



SOURCE: TIMOR GAP

1.3 Purpose and use of the study

This study has been commissioned by TIMOR GAP on behalf of the Government of Timor-Leste. It is intended to be used to inform government decision making in relation to investment in the Tasi Mane Project and its various component sub-projects. It is also likely to be used by TIMOR GAP and the Government of Timor-Leste in discussions with potential development partners, funding agencies and other interested parties.

ACIL Allen acknowledges that the study will be disclosed to agencies, representatives and advisers of the Government of Timor-Leste and consents thereto subject to the reliance and disclaimer provisions set out in the report.

1.4 Reliance and Disclaimer

Unless otherwise explicitly stated, this report is issued subject to the general reliance and disclaimer provisions set out on the contacts page immediately following the front cover of the report.

The scenarios considered in this study are consistent with information on current development plans for the Tasi Mane Project provided to ACIL Allen by TIMOR GAP. However, for several of the project elements no final development scenarios have yet been defined, approved or permitted and therefore the configuration and timing of the project may change in the future. ACIL Allen has made assumptions about future circumstances (such as the fiscal regime under which the projects will operate and commodity prices) which are subject to change. As a result, the quantitative assessments of economic benefits reported in this study may change in the future. The study should therefore be regarded as an assessment of the benefits that could potentially arise if the project was to be constructed and operated in accordance with the current development concepts and the assumptions set out in the report regarding future circumstances, rather than a definitive quantification of the economic benefits that will ultimately accrue from development of the Tasi Mane Project.

2 TASI MANE PROJECT

The Tasi Mane (South Coast) Project is a major strategic initiative of the Government of Timor-Leste. The project is aimed at establishing a national petroleum industry and associated supporting infrastructure, skills development and service capability in order to facilitate petroleum development in Timor-Leste. The Project will also provide the country with a direct economic dividend from petroleum industry investment.

The Government of Timor-Leste in its *Strategic Development Plan 2011-2030* identifies the establishment of a national petroleum industry as a key strategy for the nation's sustainable development.

The Tasi Mane Project is a visionary concept involving the completion of a series of inter-related project elements. Together these will result in the establishment of a national petroleum industry capable of generating a range of direct economic benefits from Timor-Leste's natural resources, including job creation in the oil and gas sectors as well as in secondary industries providing related services and supporting businesses. The Government of Timor-Leste expects the Tasi Mane project to generate a range of indirect multiplier effects in the economy, thus raising of living standards of the East Timorese people. Tasi Mane will, in many respects, be a flagship project for Timor-Leste due to its importance to the economic development of the country. It will also be the first example for both government and community of the benefits and costs associated with large-scale industrial development.

TIMOR GAP has been mandated by the Government of Timor-Leste to manage and administer the Tasi Mane project.

2.1 Elements of the Tasi Mane Project

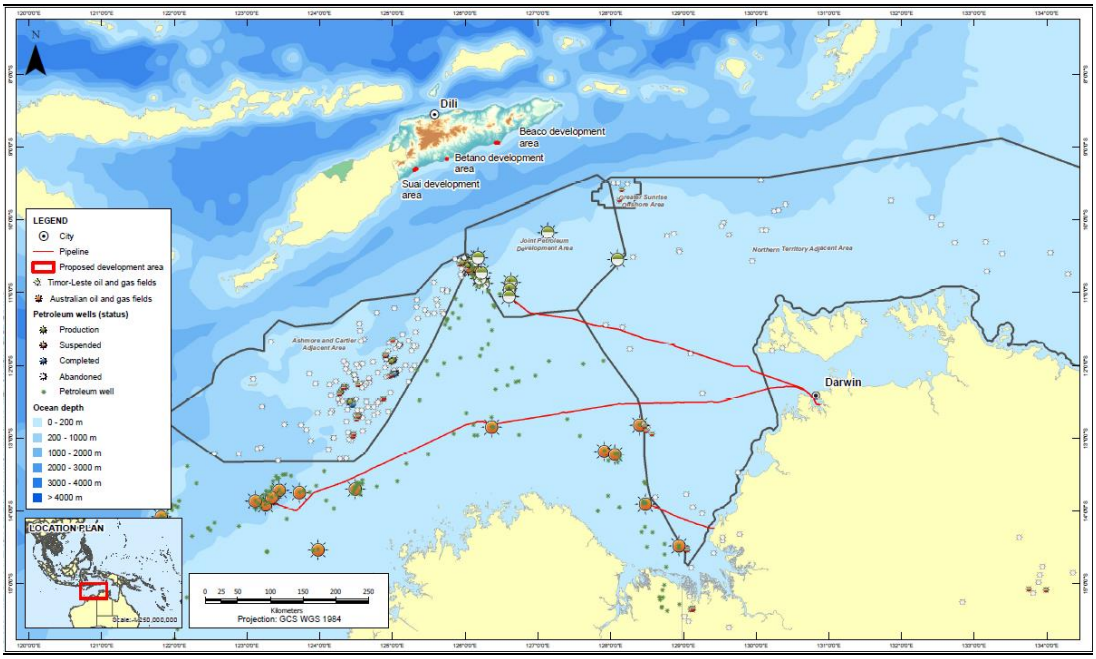
The Tasi Mane Project will involve development of a coastal zone extending over a distance of some 155 km from Suai in the district of Covalima to the west, to Beaço in the district of Viqueque to the east. The project includes the Suai Supply Base cluster, the Betano Refinery and Petrochemical Industry cluster, and the Beaço Liquefied Natural Gas (LNG) Plant cluster. The location of the Tasi Mane Project is shown in **Figure 2.1**.

The key elements of the plan, as described in the Program of the V Constitutional Government, include:

1. **International airport:** major redevelopment of the Suai airport.
2. **Supply base:** A logistics base for the petroleum sector in the Timor Sea, with the centrepiece being the construction of a new marine port at Suai. This facility is intended to open up the south coast to investment and growth and to provide an international access point to Timor-Leste. The Suai Supply Base will provide an entry point for materials and equipment that will be needed to build, operate and maintain petroleum industry infrastructure and plants in the Timor Sea region. It will be a multi-

purpose seaport including a container park, warehouse logistics area and fuel storage facilities. The port may also include shipbuilding and repair facilities to cater for oil and gas business, navy and cruise ships. Other possible supply base activities include fishing industry and fish processing, agribusiness and forestry exports.

FIGURE 2.1 REGIONAL LOCATION OF THE TASI MANE PROJECT



SOURCE: TIMORGAP E.P.

3. **Industrial park:** The Betano Cluster will consist of an industrial park where refinery and petrochemical industries will be located, along with a petroleum industry administration city (Nova Betano). The city will provide housing and social services, and form a new base of employment on the south coast.
4. **Oil refinery and petrochemical complex:** Development of a 30,000 barrel per day refinery at Betano. The initial phase will establish a refinery producing fuel for domestic use such as diesel, gasoline, jet-fuel and asphalts. Products from the refinery not required to meet local needs will be exported to increase trade in oil and gas products. Staged expansion to 100,000 barrels per day capacity would expand product range to include petrochemicals.
5. **LNG plant:** The Beaço LNG Plant cluster will be the area where a natural gas pipelines from Timor Sea gas fields reach Timor-Leste land and where the LNG plant to process the gas will be located. The first phase of the LNG Plant development will establish a production capacity of (nominally) 5 million tonnes per annum (Mtpa) or one train. This may be expanded in the future to a capacity of up to 20 Mtpa (or four trains). This cluster will incorporate the LNG Plant complex, including associated marine facilities, as well as the Nova Beaço and Nova Viqueque urban developments.
6. **Three major new towns:** The urban centres for the three development clusters, namely Nova Suai, Nova Betano, and Nova Beaço/Nova Viqueque.
7. **Highway:** 160 km of all-weather multi-lane road connecting Suai to Beaço, the highway will link the three urban and industrial clusters. The road will be built in stages, with each stage developed according to economic need and to support industrial growth. The project is scheduled to commence in 2015 and to be completed by around 2020.

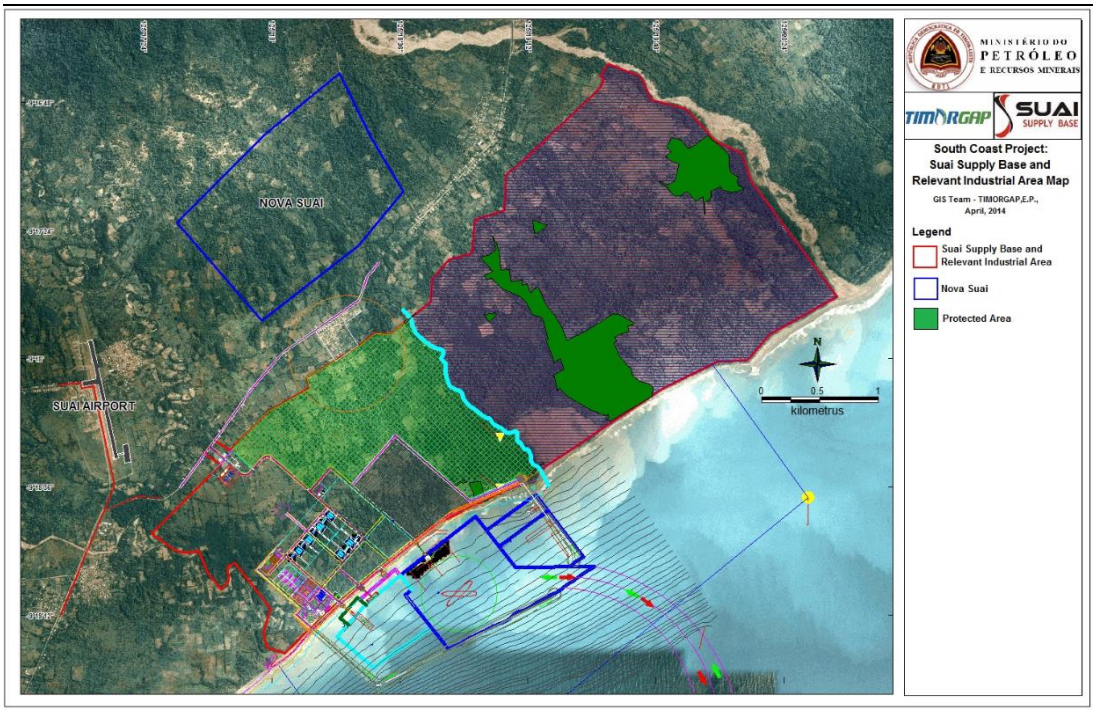
2.2 Main Project Components

The following sections provide further details on the various components of the Tasi Mane Project.

2.2.1 Suai Supply Base Cluster

The Government is planning to establish a logistics base for the petroleum sector in Suai. The base will provide capacity for the south coast to develop a domestic petroleum sector along with related and supporting industries and businesses. It will provide an entry point for the materials and equipment that will be needed to build and maintain petroleum industry infrastructure and plants. Suai will become a centre for the petroleum industry in Timor-Leste providing services, logistics, fabrication facilities and human resources of offshore and onshore oil and gas activities in the Timor-Leste Exclusive Area (TLEA), the Joint Petroleum Development Area (JPDA) and the Timor Sea region more generally. This will include the building of a sea port, a housing complex in Kamanasa, a rehabilitated and expanded Suai airport and a heavy metals workshop and ship building and repair facilities. The Suai Supply Base is intended to become a national industrial base and logistics platform to drive job creation and economic development on the south coast. It will also support the establishment of petroleum centres at Betano and Beaço.

FIGURE 2.2 SUAI SUPPLY BASE DEVELOPMENT AREA



SOURCE: (WORLEY PARSONS, 2012B)

Project description

The following summary is adapted from the description of the project contained in the Suai Supply Base Environmental Impact Assessment (Worley Parsons, 2012a).

The Government of Timor-Leste has determined Suai as the most appropriate location to develop a Supply Base and supporting infrastructure. The settlement of Suai is located approximately 135 km south-west of Dili, 22 km from the Indonesian border and 5 km inland from the Timor Sea (southern coastline). The main township of Suai is serviced by the national road network connecting to Uemassa (west), Zumalai (east), and Fatululic to the north.

Figure 2.2 shows the location of the Suai development area, which comprises the following:

— **Suai Supply Base:** The Supply Base facilities at Suai will be situated on the coast near the village of Samfuk (in the sub-district of Suai Vila). There will be a new breakwater and jetty with four multi-purpose berths capable of handling ships and barges up to 10,000 DWT with an overall capacity of approximately 2.0 mtpa of dry bulk cargo. The port will have a draught up to 9 meters with 6 meters draught at berth. There will be several mini-shore bases, and typical warehouses, yard and open area of up to 1,000 hectares to allow establishments of a range of services to the oil and gas industries

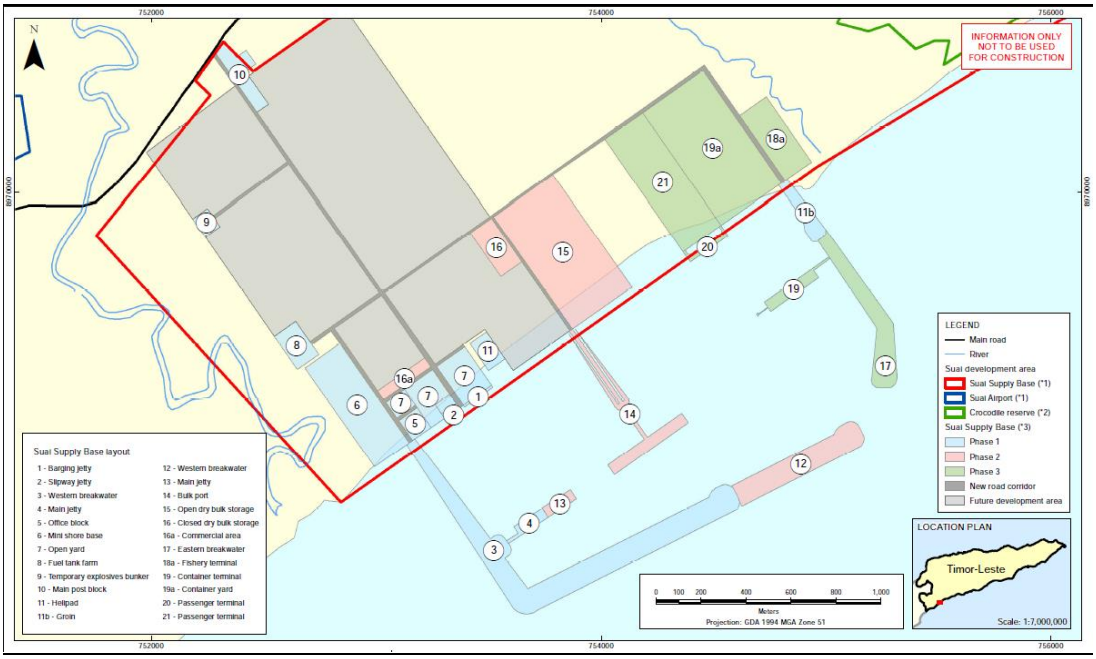
such as drilling, fuel bunkering, catering, waste management, pipe threading and repairing, storage and warehousing, wirelines, drilling mud services, seismic and drilling services, supply vessels, tug boats, compressors & pumps repairs, spare parts supplies, emergency & oil spill response services.

- **Industrial estate**: as part of future development at the Supply Base, an industrial estate will be developed adjacent (north-east) to the land-based facilities. The industrial state is intended to provide facilities for small and medium-sized local businesses to benefit from the infrastructure and transportation networks associated with the Suai Supply Base.
- **Nova Suai:** A new town, Nova Suai, will be located on land between the existing villages of Holbelis and Dais. The town is expected to house up to 6,500 staff, contractors and their families.
- **Suai Airport Upgrade:** The existing Suai Airport (non-operational), located in Holbelis, is classified as a district airport and will be upgraded to cater for expanded passenger and freight services. The main new features will be a 1.5 km long runway and, a new terminal building with facilities for customs and immigration, fire station and helipad with Medivac air ambulance facilities. Construction commenced May 2014, planned to finish Oct 2016. Total budgeted cost is $82.3 million.[1]
- **Crocodile reserves:** Two crocodile reserves are proposed within the existing habitat areas located at We Dare, near the centre of the Supply Base development area, and at We Matan Bua Oan, inside the north-east boundary of the Suai Supply Base development area adjacent to the Rio Raiketan.

The Supply Base will provide the logistics services required to serve the existing and future petroleum exploration in the Timor Sea and will facilitate development of hydrocarbons processing facilities ('downstream' activities) such as LNG (Beaço) and petroleum refining (Betano). It will serve multiple users, both off-shore and potentially onshore.

The indicative layout of the proposed facilities for the Suai Supply Base is shown in **Figure 2.3**.

FIGURE 2.3 SUAI SUPPLY BASE LAYOUT



SOURCE: (WORLEY PARSONS, 2012A)

It is expected that operational services at the Supply Base will be provided by a combination of government and private organisations that will be resolved through normal tendering processes as the project progresses. These services would potentially include marine engineering, stevedoring, security, catering, drilling, oil spill response and waste management and many more.

[1] Source: TIMOR GAP

Planning and status

The Suai Supply Base has been subject to extensive planning and design activity over the past five years.

In 2010, a feasibility study and front end engineering and design (FEED) for the Suai Supply Base was prepared (EastLog Holding Pte Ltd, 2010).

A detailed Environmental Impact Assessment was completed in May 2012 (Worley Parsons, 2012a), (Worley Parsons, 2012b). This report covered a broad range of issues including the regulatory context for the project, project description, stakeholder consultation, climate and meteorology, land use and visual amenity, topography, geology & soils, air quality, noise, hydrology and drainage, hydrogeology, terrestrial biodiversity, marine ecology, social and economic values, land transport, waste management, and environmental management plans.

In April 2013 the Government of Timor-Leste signed an agreement with community leaders for the use of land for the building of the Suai Supply Base. The agreement came after a long process of consultation with the local community over a period of several years. Under the terms of the agreement, the local people released 1,113 hectares of land for the development of the Suai Supply Base and Industrial Park, allowing the first phase of development to proceed. This will see construction of a breakwater, jetty, offices blocks, warehouse, liquid storage tank, open yard and mini shore base.

On 23 June 2015 Hyundai Engineering & Construction of Korea was awarded a US$719 million contract by Timor-Leste's Ministry of Petroleum and Minerals Resources for the design and construction of the Suai Supply Base Project[2].

2.2.2 Betano Refinery and Petrochemical Cluster

Summary

Located on the coast in the Manufahi District, approximately 70 km south of Dili and 5 km to the east of the Rio Caraulun, the proposed Betano Petroleum Refinery is expected to produce approximately 30,000 barrels per day of petroleum products from petroleum condensate piped to the site from fields in the Timor Sea. There is potential for expansion of the facility up to 100,000 barrels per day of petroleum and petrochemical products. The refinery and petrochemical complex will convert condensate to a range of fuels and other products. It is expected that the project will make Timor-Leste self-sufficient for unleaded petrol (ULP) and diesel, with room to meet demand growth.

Development of the refinery will be supported by construction of a new town – Nova Betano – which will house up to 14,500 staff, contractors and their families and cover an area of approximately 1,065 ha. The town area will include schools, hotels, commercial areas, recreation facilities and ancillaries such as water, waste, sewage and power plants. The existing Betano airstrip will be upgraded to the status of regional airport with a new runway and terminal facilities.

Description

The proposed project comprises of:

- A refinery and petrochemical complex in Betano
- Water Supply for refinery in Betano
- Pipelines along the new highway between Suai and Betano.
- Jetty facility and refinery facility in Suai
- A new city, Nova Betano

The refinery site has an area of approximately 230 hectares. The land is located between the new proposed highway and the Southern coastline. The refinery is adjacent to a power plant operated by Electricidade De Timor-Leste (EDTL).

[2] TIMOR GAP Newsletter No.9, September 2015

Water for the operation of the refinery will be delivered by pipeline from the source located approximately 10 km from the refinery.

The refinery in Betano will be connected by pipelines for transport of both condensate and petroleum products to the supply base at Suai, approximately 75 km to the southwest. The pipelines will run beside the proposed highway. The refinery and jetty facilities in Suai include shore tanks, pipeline, products and condensate jetty with loading arms for product loading.

The new petroleum city, Nova Betano, is located about 7 km northwest of the refinery and petrochemical complex. The refinery main complex consists of the process unit, and the process support units such as utilities units, waste treatment unit, tank farm, fire water and land fill for solid waste management. The refinery complex will have supporting facilities such as Warehouse, Operation Building, Administration Building, Laboratory Building, Fire and Safety Office and Canteen.

Figure 2.4 shows the location of the Betano development area.

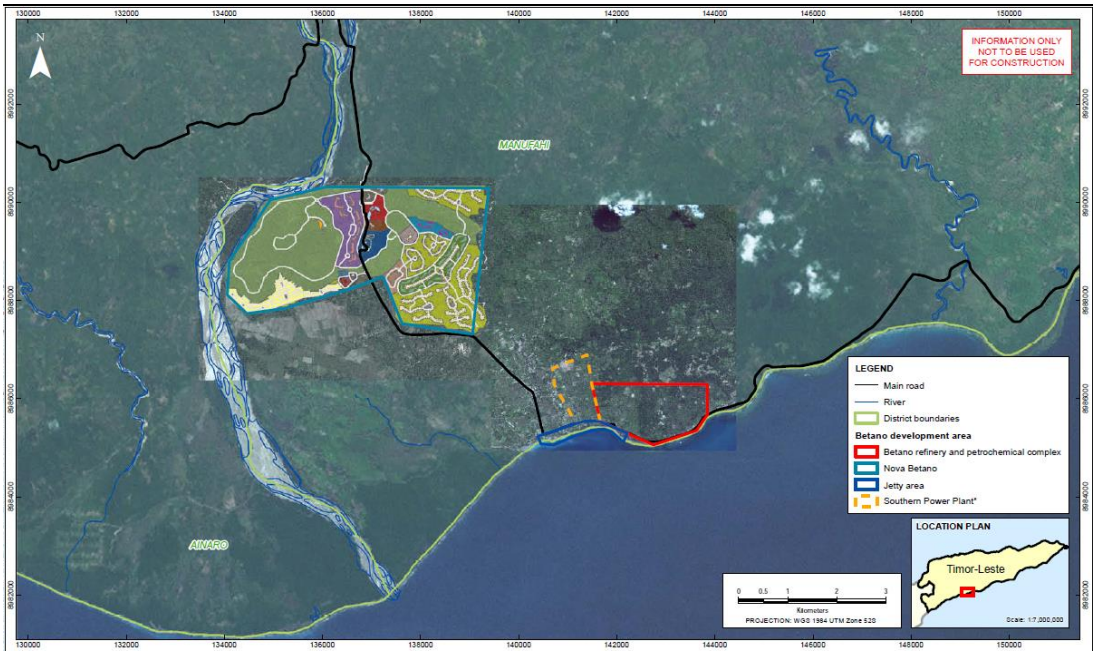
The initial phase of development will establish a refinery which will produce fuel for domestic use (diesel, gasoline, jet-fuel and asphalts). The products will be used both locally and for export.

Initially, Stage 1 refinery capacity is estimated at 30,000 barrels per day (bpd) with the following indicative product slate:

- LPG: 1,170 bpd
- Naphtha: about 19,000 bpd
- Gasoline: 900 bpd
- Jet-fuel: 0 bpd
- Diesel: 9,200 bpd
- Import reformer (gasoline blending): 640 bpd

Stage 2 would result in expanded capacity of 60,000 barrels per day with Stage 3 increasing total capacity to 100,000 barrels per day. The product mix would changes at each stage.

FIGURE 2.4 LOCATION OF THE BETANO REFINERY AND PETROCHEMICAL COMPLEX



SOURCE: TIMOR GAP, 2013

Planning and status

A pre-feasibility study for a refinery and petrochemical complex was undertaken by KBC ('Final Report' rev 2, 2011).

A Strategic Environmental Impact Statement on the Betano Refinery and Beaço LNG Plant, prepared by Worley Parsons, TIMOR GAP and the Secretaria de Estado dos Recursos Naturais (SERN) (Worley Parsons, 2012c) contains additional information on the refinery and petrochemical cluster which is summarised below.

The establishment of the complex is expected to be a commercial arrangement between the public and private sectors; TIMOR GAP will also play a crucial role in the development. The refinery will provide domestic fuel needs (such as diesel, gasoline, jet-fuel and asphalts), and it is intended that many products will be exported to increase Timor-Leste's trade in oil and gas products.

2.2.3 Beaço LNG Plant Cluster

Summary

The Government of Timor-Leste has determined a coastal location at Beaço, in the Viqueque district, as the most suitable location to develop an LNG plant and supporting infrastructure. This cluster will incorporate the LNG Plant complex and the Nova Beaço and Nova Viqueque developments. The existing airport at Viqueque will be refurbished with the capacity to operate as a fly-in-fly-out airport for LNG Plant operators, as well as serving as a regional airport. The Beaço LNG plant would draw on petroleum resource discoveries in the Timor Sea (for example, the Greater Sunrise field). The LNG plant would receive gas from off-shore fields via pipelines for processing into LNG, propane and butane for export.

It is proposed initially to construct a single train 5 million tonne per year (Mtpa) capacity LNG plant, with potential for expansion to up to 20 Mtpa (four trains) subject to access to adequate gas reserves. For the purposes of this study we model a two-train facility with a nominal capacity of10 Mtpa.

Planning and status

A conceptualisation (pre-feasibility) study undertaken by KBC with GS Engineering and Construction, (KBC, 2010) identifies the key built aspects that are likely to be required for the on-shore components of an LNG plant and associated jetty area at Beaço. An indicative layout of the proposed LNG plant is shown in **Figure 2.5**.

FIGURE 2.5 INDICATIVE LAYOUT OF BEAÇO LNG PLANT

SOURCE: (GOVERNMENT OF TIMOR-LESTE, 2013)

The Government identified the following key components likely to be required for an LNG plant at Beaço:

- Process and utilities area (gas reception, LNG train, utilities).
- Flare and hydrocarbon storage.

— Buildings.
— Marine facilities.

The processing facilities are expected to have a design life of 20 years, and the infrastructure facilities a design life of 40 years.

The establishment of the LNG facility will require the construction of wharf and jetty structures to enable the loading of the LNG vessels. A materials offloading facility (MOF) is also required to enable the transfer of materials and heavy equipment to the project site for construction and operation.

It is understood that LNG and LPG (propane and butane) will be exported by ship from the jetty (KBC, 2010). At the time of preparation of the Worley Parsons report requirements for dredging (capital and maintenance) to create shipping access and wave protection structures (breakwaters) were yet to be determined and studies relating to offshore components (pipeline, off-shore production facilities) had not been commissioned.

The conceptual design incorporates two 175,000m^3 LNG storage tanks, each equipped with loading pumps, level gauges, level transmitters, relief valves, vents, temperature elements and other basic instrumentation. The design would also incorporate refrigerant storage and handling facilities.

An electrical power generation source will be designed to meet the requirements of the processing facility, administration buildings, workshops, warehouses and operations camp. The LNG Plant will also require substantial quantities of water. Worley Parsons estimates that around 1.5 million tonnes of quarry materials; rock and sand, is likely to be required for construction as concrete aggregate, general fill, or for road construction.

2.2.4 Highway Development

To connect the three clusters and support growth of the petroleum industry, a road will be built from Suai to Beaço. This road will be built in stages. Each stage will be developed according to economic need and the growth of the industry. The project is scheduled to commence in 2016 and be completed by at latest 2020.

In addition to the highway construction, several existing roads will be upgraded and new roads constructed to connect project infrastructure sites.

The Scope of Works for the highway development project prepared by the Government of Timor-Leste (Government of Timor-Leste, 2013) provides information on the proposed design of the Suai – Beaço Highway.

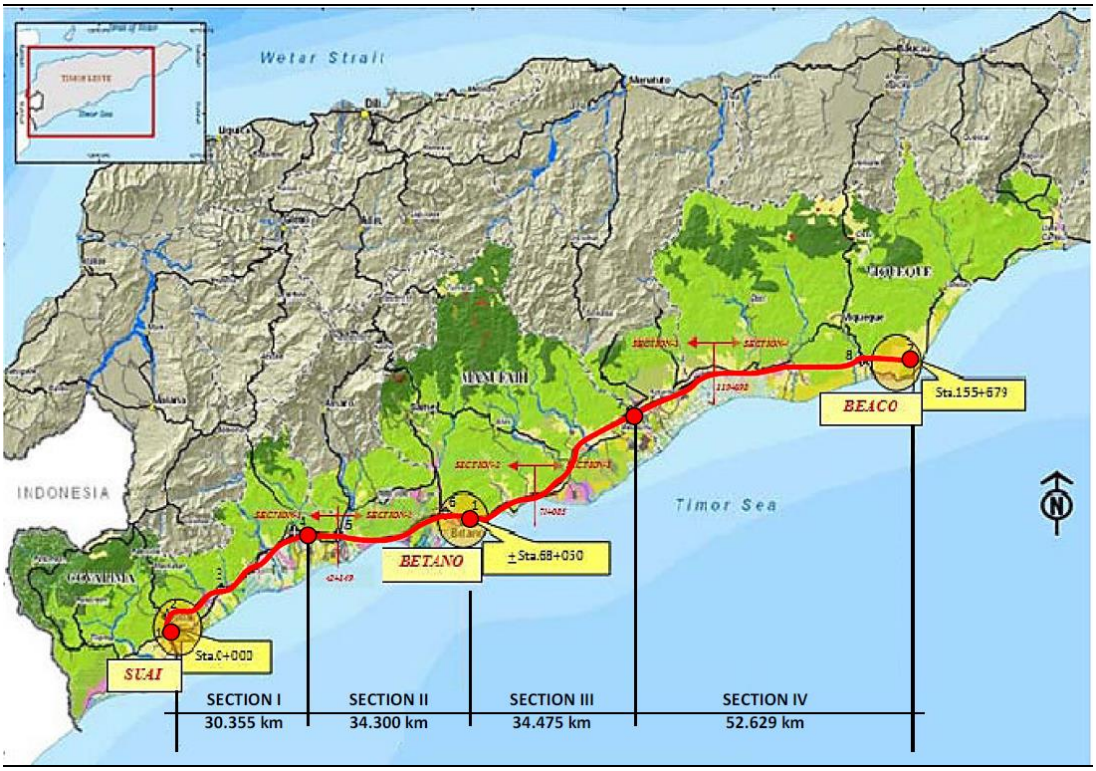
The highway will have four lanes (two in each direction), each 3.6m wide, with a total pavement width of about 26 m. Total length will be 155.7 km. There is a design speed of 100 km/hr in flat areas and 60km/hr in mountain areas. Estimated travel time of 2 hours from Suai to Beaço.

For construction purposes, the new highway is split into four sections:

— Suai to Fatukai – 30.4 km
— Fatukai to Betano – 34.3 km
— Betano – Clacuc – 34.5 km
— Clacuc to Beaço – 52.6km

The highway location map is shown in **Figure 2.6**.

FIGURE 2.6 SUAI TO BEAÇO HIGHWAY LOCATION



SOURCE: (GOVERNMENT OF TIMOR-LESTE, 2013)

The highway will include 28 major bridges with an aggregate length of about 5,661 metres, and a total of 240 culverts (199 reinforced concrete pipe type and 41 reinforced concrete box type).

The total capital cost for the project is estimated at $1 .3 billion.

In terms of timing, Stage I (Suai to Fatukai) is expected to be constructed over a period of 24 months commencing in 2016 at an estimated cost of $290 million. Indicative timings are then as follows:

- Stage 2 (Fatukai to Betano): two years after Stage 1—2017-2019 at an estimated cost of $285m
- Stage 3 (Betano to Clacuc): two years after Phase 2—2019-2021 at an estimated cost of $287m
- Stage 4 (Clacuc to Beaço): two years after Phase 3—2021-2023 at an estimated cost of $438m

2.2.5 Town Developments

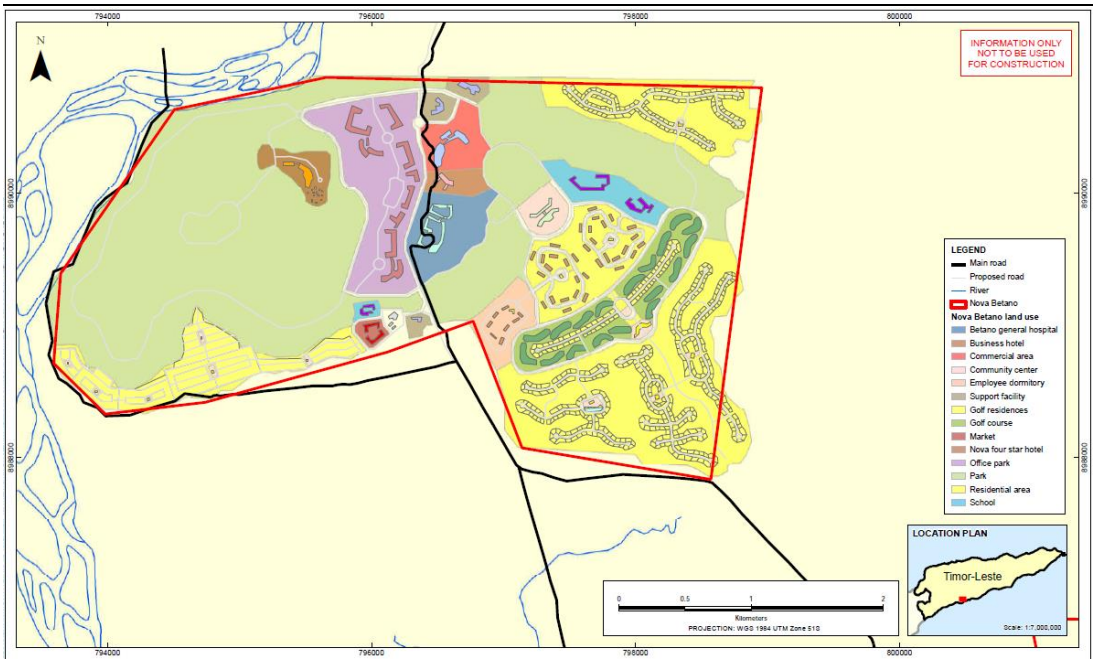
Nova Suai

It is estimated that around 6,000 residents will be accommodated in Nova Suai, with approximately 50 per cent being family members of employees. The plan is to build modern facilities e.g., hotels, schools and shopping centres to cater for the needs of the residents. A new road to access Nova Suai will be built from the existing Suai to Same Road as the main entry for residents and visitors (Worley Parsons, 2012b, pp. 15-247).

Nova Betano

Nova Betano will be the largest of the four new towns being developed under the wider Tasi Mane Project. It will provide for up to 14,500 residents, primarily intended for staff and their families involved in the oil and gas industry development including primary contractors, support companies and visitors. It will also provide a resettlement area for relocated communities as a result of the proposed refinery development. **Figure 2.7** shows the indicative layout for the new town.

FIGURE 2.7 INDICATIVE LAYOUT OF NOVA BETANO



SOURCE: (GOVERNMENT OF TIMOR-LESTE, 2011)

The Nova Betano development concept includes single family residential houses; multi-family residential apartments; an employee dormitory; schools; a business hotel; hospital; commercial area including shops and offices; community centre with assembly hall, sporting facilities, restaurant and library; park and recreation areas; public services such as security office and fire department; internal road infrastructure and support facilities (stormwater pond, water supply and facilities, sewerage and waste water treatment), power plant).

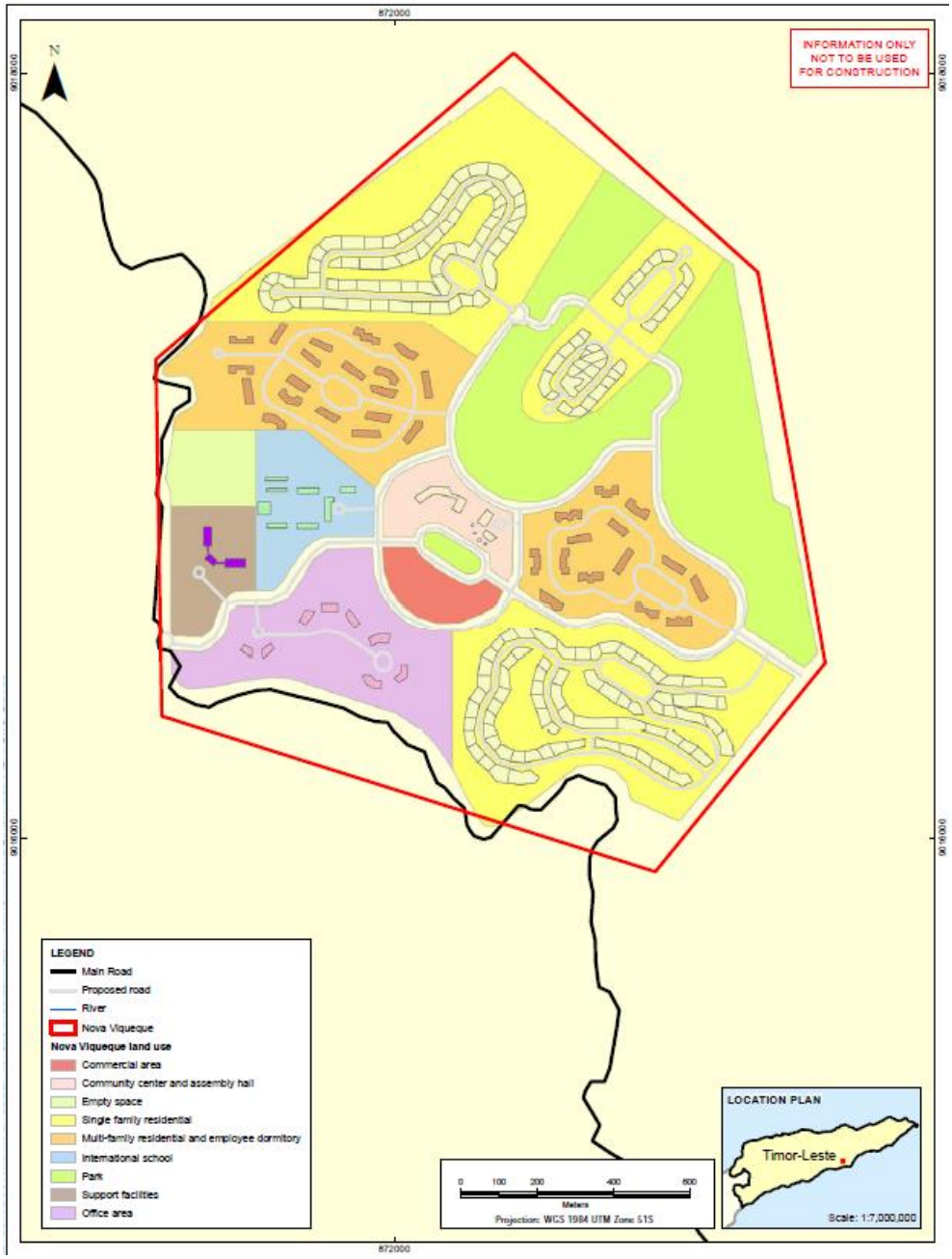
Nova Viqueque

Nova Viqueque will accommodate the workforce for the LNG Plant. The new town will provide for up to 6,400 residents, primarily intended for staff and their families involved in the oil and gas industry development, as well as guests associated with the company.

Figure 2.8 shows the indicative layout for the new town.

The Nova Viqueque development concept includes multi-family residential houses; apartment buildings; employee dormitory buildings; recreational facilities; single family residential houses; schools, commercial area with shops, petrol station and hotel, offices; community centre with assembly hall, recreation facilities and library; park and recreation areas, public services such as security office, fire department, maintenance and workshop; internal road infrastructure and support facilities (stormwater pond, water supply and facilities, sewerage and waste water treatment), power plant).

FIGURE 2.8 INDICATIVE LAYOUT OF NOVA VIQUEQUE



SOURCE: (GOVERNMENT OF TIMOR-LESTE, 2011)

The current plan involves development of Nova Viqueque in stages. Stage 1 would include building part of the multi-family residential and single family residential areas, the community centre, offices, commercial area and public facilities. Stage 2 would include the development of the school, completion of the multi-family residential area, and expansion of the office and single family residential area Stage 3 will include the development of the remaining areas of the single family residential area.

Construction of Nova Viqueque is currently scheduled to occur between 2017 and 2023.

Viqueque Airstrip upgrade

It is proposed to upgrade the existing airport at Viqueque to a fully operational regional airport, capable of operating as a fly-in-fly-out (FIFO) airport for the operators of the proposed LNG plant.

The upgrade works will include a new sealed runway, and new facilities for customs and immigration, arrival and departure, fire-fighting, and site fencing.

Upgrade works are scheduled to occur between 2017 and 2023.

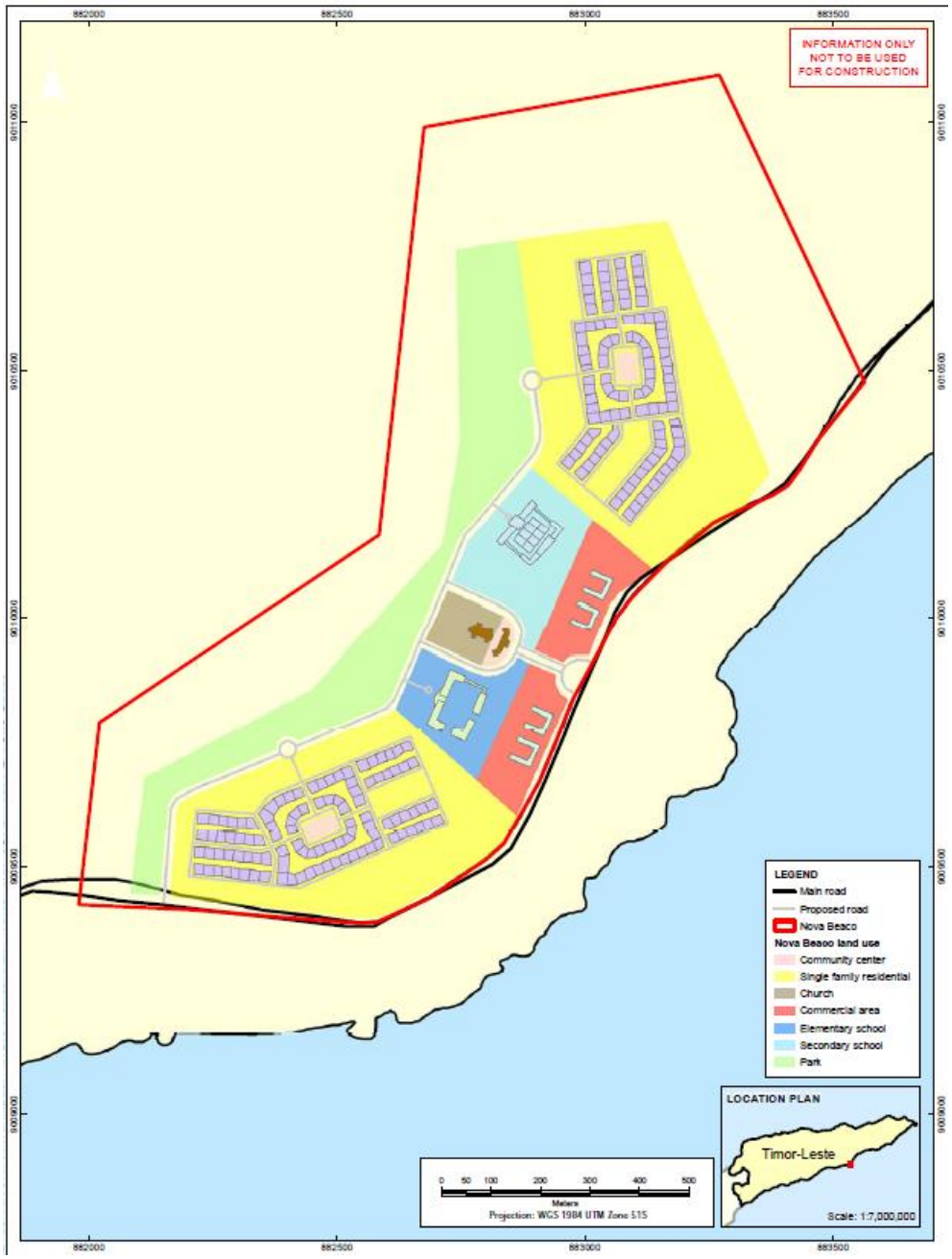
Nova Beaço

Nova Beaco is primarily intended to accommodate existing residents of nearby villages who will require relocation as a result of the development of the LNG plant.

The preliminary design allocates approximately 200 ha for the new town, and is intended to accommodate up to 1,900 people.

Figure 2.9 shows the indicative layout for the Nova Beaço development which will comprise single family residential houses; schools, commercial area with markets and shops, community centre and church; open space and recreation areas, public services such as security office; internal road infrastructure and support facilities (stormwater pond, water supply and facilities, sewerage and waste water treatment).

FIGURE 2.9 INDICATIVE LAYOUT OF NOVA BEAÇO



SOURCE: (GOVERNMENT OF TIMOR-LESTE, 2011)

Nova Beaço will be the last of the four new towns being developed as part of the wider Tasi Mane

The current plan for developing Nova Beaço is to build the main gate, southern single family residential area, southern market area, the elementary school, the church and community centre first. Stage 2 would include the development of the remaining single family residential area, northern market area, and the junior high school.

3 DIRECT ECONOMIC IMPACTS

This section of the report examines the potential direct economic impacts of the Tasi Mane Project in terms of its anticipated effects on capital and recurrent expenditure, production, employment and direct cash flow to project participants. The potential impact on levels of petroleum exploration and production activity are also discussed.

The following chapter examines the potential broader indirect economic benefits of the project resulting from flow-on effects to other sectors of the Timor-Leste economy.

Development of the Tasi-Mane Project would directly benefit the Timor-Leste economy in a number of ways, including:

- direct capital investment in the Suai Supply Base, Betano Refinery and Petrochemical Complex, Beaço LNG Plant and associated infrastructure developments (airport upgrades, highway, new towns and administrative facilities)
- ongoing expenditure associated with the operation and maintenance of the Supply Base, Refinery and Petrochemical Complex, LNG Plant and support facilities
- training, skills development and employment opportunities for Timor-Leste nationals and expatriate workers
- direct cash flows to project participants (including the government of Timor-Leste, TIMOR GAP, private investors and landowners) in the form of taxes, royalties and profits
- increased exploration and production (E&P) activity in Timor-Leste.

3.1 Assessment methodology

ACIL Allen has constructed spreadsheet benefits models to allow quantification of the direct benefits and cash flows arising from the Suai Supply Base, Betano Refinery and Petrochemical Complex, Beaço LNG Plant. Many of the key assumptions incorporated into the benefits model (for example, in relation to facilities configuration, capital and operating costs, and production profiles) necessarily rely on information provided by the project proponents.

The data used was approved for the purposes of this study as at October 2015 and is subject to ongoing studies. Detailed feasibility and front end engineering and design for some of the project elements has not yet been completed, and many assumptions regarding the detailed design and timing of the project remain subject to change. These include design and engineering aspects such as the sizing and configuration of facilities as well as commercial and fiscal terms. Accordingly, the detailed assumptions on which the economic impact analysis is based—which include but are not limited to costs, production profiles and labour requirements—reflect the current project design concepts but are likely to vary over time as the details of the project elements continue to evolve.

All assumptions relating to commodity prices (oil, petroleum products and LNG) have been independently developed by ACIL Allen and these forecasts may differ from those of the project proponents.

3.2 Scenario definition

For the Betano Refinery and Petrochemical complex and the Beaço LNG Plant components of the Tasi Mane Project three sensitivity cases are considered in order to illustrate the effects of different assumptions regarding the future price of oil:

- The **Base Case** under which long-run oil prices are assumed to follow an annual price series provided by TIMOR GAP (average approximately US$77 per barrel over the next 35 years). Petroleum product and LNG prices are benchmarked to oil. Petroleum product[3] is assumed to be priced at a premium to crude oil ranging from 7.5% of 18.5% depending on the product mix. The assumed LNG of $11.39/mmbtu equates to a pricing formula with a slope of 0.147 (LNG price in $/mmbtu = 0.147 x Oil Price in $/bbl).
- A **Low Price Case** under which long-run oil prices are assumed to follow an annual price series provided by TIMOR GAP (average about US$51 per barrel over the next 35 years). Petroleum product and LNG prices are benchmarked to oil on a similar basis as for the Base Case.
- A **High Price Case** under which long-run oil prices are assumed to follow an annual price series provided by TIMOR GAP (average US$103.50 per barrel over the next 35 years). Petroleum product and LNG prices are benchmarked to oil on a similar basis as for the Base Case.

The year-on-year oil price scenarios used in the three sensitivity cases are shown in **Figure 1.1**.

3.3 General assumptions regarding Taxes and Duties

3.3.1 Company Income Tax

Under the law of Timor-Leste, companies pay tax on assessable income (effectively net profits after taking into account any tax credits) at a rate of 10 per cent.[4] Companies that are "Contractors" under the *Taxes and Duties Act* (that is, companies having a contract, licence, permit, or other authorisation in relation to petroleum operations made or given pursuant to the Timor-Leste *Petroleum Act*) pay a higher rate of tax of 30 per cent.[5]

For the purposes of this analysis, we assume that all net profits of the component projects of the Tasi Mane Project pay Company Income Tax in accordance with the general provisions of Schedule IV rather than the rates applicable to Contractors under Schedule IX.

We assume that tax losses are able to be carried forward indefinitely[6], and that interest costs are not deductable for purposes of calculating taxable income[7].

3.3.2 Depreciation and amortisation

Depreciation and amortisation allowances for income tax payers other than contractors are set out in Sections 36 and 37, respectively, of the *Taxes and Duties Act.* The cost of acquisition or construction, and the cost of improvement, renewal, and reconstruction, of a business building are depreciated individually on a straight-line basis. The depreciation rate for the purposes of Section 36 and the amortisation rate for the purposes of Section 37 is 100%.[8] This means that such assets are in effect fully depreciated in the year in which the capital expenditure occurs.

[3] As discussed in section 2.2.2, the Betano Refinery and Petrochemical Complex is designed to produce a range of petroleum products including LPG, Naphtha, Gasoline, Jet-fuel and Diesel. The individual product streams have not been separately modelled. Instead a single "average petroleum product" premium to crude oil price has been assumed.
[4] *Taxes and Duties Act 2008*, Schedule VI.
[5] *Taxes and Duties Act 2008*, section 72.1.
[6] *Taxes and Duties Act 2008*, section 43.
[7] *Taxes and Duties Act 2008*, section 31(k).
[8] *Taxes and Duties Act 2008*, Schedule VII

3.3.3 Wages Income Tax

Under the law of Timor-Leste, wages paid to employees are taxed at the following rates[9]:

— For resident wage earners, 0 per cent on assessable earnings of up to $500/month, and 10 per cent on amounts over $500/month.

— For non-resident wage earners, 10 per cent on all assessable earnings.

For persons that are employed by "Contractors" under the *Taxes and Duties Act* (that is, companies involved in petroleum operations authorised under the Timor-Leste *Petroleum Act*) higher rates of tax are payable as prescribed in Schedule IX of the *Taxes and Duties Act*.

For the purposes of this analysis, we assume that all wages paid to local and foreign workers on component projects of the Tasi Mane Project pay tax in accordance with the general provisions of Schedule V rather than the rates applicable to employees of contractors under Schedule IX.

3.3.4 Withholding Tax

Withholding Tax is payable under the *Taxes and Duties Act 2008* (Schedule VIII) on income from prescribed services. Income from building and construction activities is subject to withholding tax at a rate of 2 per cent. Amounts paid as Withholding Tax are generally treated as tax credits (Taxes and Duties Act, section 60.3).

For the purposes of this analysis, we assume that all non-labour capital costs for component projects of the Tasi Mane Project are subject to Withholding Tax at a rate of 2 per cent, and that the amounts paid as withholding tax are treated as deductions from net income for the purposes of calculating Company Income Tax.

3.3.5 Import Duty

Under section 19 of the *Taxes and Duties Act 2008*, a person who imports goods into Timor-Leste (other than goods exempt from import duty) is liable to pay import duty on the imported goods at the rate set out in Schedule IV. The rate of import duty currently prescribed for purposes of section 19 is 2.5 per cent of the customs value of the goods.

For the purposes of this analysis, we assume that Import Duty is payable, at the prescribed rate of 2.5 per cent, on all imported capital costs, and on 50 per cent of the annual operating costs for component projects of the Tasi Mane Project. The amounts paid as Import Duty are treated as deductions from net income for the purposes of calculating Company Income Tax.

3.4 Exploration and production activity

Petroleum exploration and production (E&P) activity in the Timor-Leste Exclusive Area (TLEA) and the Joint Petroleum Development Area (JPDA) is heavily dependent on foreign companies. The construction of the Suai Supply Base, Betano Refinery and Beaço LNG Plant, as component parts of the broader Tasi Mane Project Initiative, would help to boost exploration and production activity in the TLEA and JPDA in a number of ways.

The projects would help to develop and maintain relevant skills and service capabilities within the region. The continued active engagement of major petroleum exploration companies in Timor-Leste, and the demonstration of petroleum project execution and operational capability would provide encouragement to other small and medium-sized explorers to invest in E&P activity in the region, either in partnership or independently.

It is reasonable to assume that the Tasi Mane Project as a whole will be a positive influence on levels of petroleum E&P activity in the Timor-Leste region and could encourage substantially higher levels of economic contribution from the petroleum sector in the long run as other projects are developed. The proposed marine supply base, refinery and LNG plant will act as catalysts for E&P activities in the region and provide outlets for local oil and gas production.

[9] *Taxes and Duties Act 2008*, Schedule V.

3.5 Broader sources of direct benefit

There are a number of other potential sources of direct benefit to Timor-Leste as a result of the investments made in the Tasi Mane Project. We have not attempted to quantify these other sources in the assessment of direct benefits but they are implicitly captured in the assessment of indirect benefits. The value and extent of these benefits may be part of fiscal and benefits sharing agreements between the project and affected landowners, between the project and government, and between the government and designated beneficiary groups. These are briefly discussed in this section.

3.5.1 Local Business Opportunities

Local Business Opportunities represent the dividends declared out of the net profits from local business development activities undertaken by landowner businesses supported by the wide Tasi Mane Project. These have not been quantified as part of the direct benefits. However the assessment of economy-wide benefits implicitly includes the flow-on effects into local business activities.

In the case of the Suai Supply Base, it is anticipated that there will be a range of fabrication and oil & gas service businesses that will locate at or near the supply base and will sell their services through the supply base to exploration and production (E&P) firms active in the Bayu-Undan, Greater Sunrise, Joint Petroleum Development Area (JPDA), Timor-Leste Exclusive Area (TLEA) Offshoreand Onshore and the Timor Sea area. TIMOR GAP has analysed the potential size of these market opportunities. Making reasonable assumptions about the level of E&P activity in these areas over time, the resultant demand for fabrication and field services, the percentage capture of these opportunities by Suai Supply Base firms, and the percentage of services value flowing to wages and profits, it is possible to estimate the amount of taxes and duties flowing to the Government of Timor-Leste from these service industries.

3.5.2 Linkages to the non-resources economy

Large-scale resource projects established in remote areas of developing countries have sometimes been referred to as “enclave developments” on the basis that they benefit a select, limited group but stimulate little growth in the remainder of the economy, creating ‘haves’ and ‘have nots,’ generating intense competition and aggravating perceptions of injustice amongst the groups who benefit directly, and those who don’t (World Bank 2012, p.79). Such a view fails to recognise that the petroleum industry in Timor-Leste potentially has many linkages to a wide range of service industries all over the country and much of the business and commerce in the main urban centre of Dili is driven by the petroleum sector. Such service industries include:

- Aviation
- Ground transport and logistics
- Drilling and drilling supplies
- Seismic contractors
- Analytical laboratories
- Earthmoving, sales and contractors
- Trucking, sales and contractors
- Local shipping and port services
- Supply of motor vehicles and tyres
- Wholesaling and retailing of fuel, general merchandise, white goods, equipment and tools
- Provision of food supplies and catering
- Maintenance and servicing contractors
- Accounting, legal, engineering, surveying and other professional services
- Accommodation services including hotels, office, and private rental accommodation
- Technical and vocational training
- Security
- Waste management services

— Emergency response capabilities
— Oil spill services
— Medevac services etc
— Oil storage and fuel bunkering services.

3.6 Suai Supply Base

This section sets out the study findings in relation to the direct economic impacts of the Suai Supply Base. A description of the project is provided in section 2.2.1.

3.6.1 Key assumptions

As discussed in section 2.2.1, the Suai Supply Base will provide support services, logistics, fabrication facilities and human resources for offshore and onshore oil and gas activities in the Timor-Leste Exclusive Area (TLEA), the Joint Petroleum Development Area (JPDA) and the Timor Sea region more generally.

Scope of study

The development of the Suai Supply Base is expected to occur in stages, with the range of facilities and service capabilities expanding over time in response to emerging market opportunities. For the purposes of this analysis, we have limited our assessment of the direct economic impacts to the first stage of development of the supply base (that is, the development which is the subject of the design and construction contract awarded to Hyundai Engineering & Construction of Korea in mid-2015). Clearly there will be opportunities to expand the Suai Supply Base and to extend the range of service offerings that it provides once the first stage of development is complete. Such expansion would increase the direct economic impacts of the project (more investment, more construction and operating jobs and more revenue earnings) and should improve the overall economic performance of the project because of greater utilisation of the base facilities provided in Stage 1 (in particular the large investment required to establish the breakwater).

We also provide some discussion and quantitative estimates regarding employment and payments to government arising from the service businesses that would locate in or near the Suai Supply Base, offering services to the petroleum exploration and production companies active in the region. While these are not, strictly speaking, direct impacts arising from the Suai Supply Base they are potentially important contributions to employment and revenue that will exist solely because of the supply base.

Study data

The assumptions regarding capital and operating costs, workforce requirements and demand for services provided by the Suai Supply Base are based on information provided by TIMOR GAP which has been updated from the feasibility study and front-end engineering and design (FEED) work that was undertaken in 2010 (EastLog Holding Pte Ltd, 2010).

Timor-Leste Government equity participation

For the purposes of this analysis, we have assumed that TIMOR GAP, the national oil company of Timor-Leste, will own 100 per cent of the project.

Economics of the project have been modelled assuming a debt/equity mix of 100 per cent equity, based on advice from TIMOR GAP.

3.6.2 Suai Supply Base – Capital and operating costs

The total capital cost assumed for the purposes of the assessment is $754 million (real 2015) including $734 million by the Timor-Leste Government for the Stage 1 supply base infrastructure. This covers development of about 40 hectares of onshore land including standalone integrated mini-shore bases, office buildings, covered warehouses, staging areas for offshore fabrication, open storage yards, pipe racks, fuel tank yards, trucking load outs and parking areas, salt water Reverse Osmosis system and associated infrastructure; construction of marine facilities including reinforced concrete

jetty structures and approximately 1800m of shore -connected rubble-mound breakwater; and associated mechanical and electrical works.

The remaining $20 million is the estimated investment by TIMOR GAP for operating assets including harbour tugs, cranes, trucks and forklifts, security equipment, oil spill response equipment, navigation aids, communications and information technology.

Equipment and bulk materials are assumed to account for 75 per cent of total capital cost, with the balance attributed to labour. It is assumed that 20 per cent of capital equipment and materials are locally sourced with 80 per cent imported.

For the labour component of construction capex it is assumed that 20 per cent of the cost of labour relates to local workers and 80 per cent to foreign workers.

For modelling purposes, full capital depreciation in the year of capital expenditure is assumed. This is consistent with current Timor-Leste tax law.

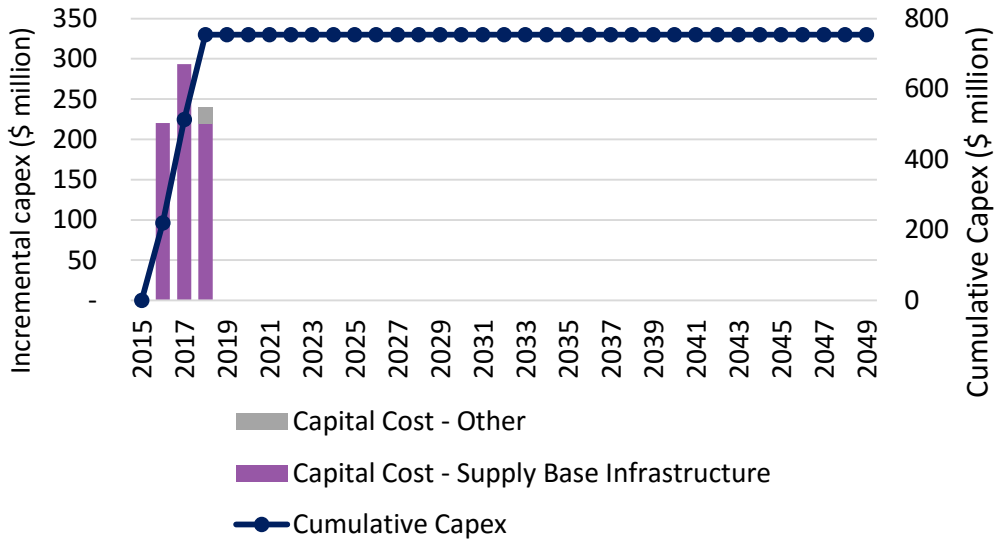
Operating costs are assumed to total $566 million (real 2015) over the life of the project at an average $18 million per year.

We have assumed that fiscal terms consistent with current legislation will apply throughout the life of the project.

Capital investment profile

The annual capital expenditure profile is shown in **Figure 3.1**. Over the project life, capital expenditure totals $754 million for the Stage 1 project, all costs being incurred over the period 2016 to 2018. As previously indicated we have not sought to quantify the direct costs or revenues associated with the Suai supply base beyond the first stage development.

FIGURE 3.1 SUAI SUPPLY BASE CAPITAL EXPENDITURE PROFILE (IN REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

Capital equipment and bulk materials comprise 75 per cent of the total capital spend ($566 million). 80 per cent of this amount is assumed to be sourced from outside Timor-Leste.

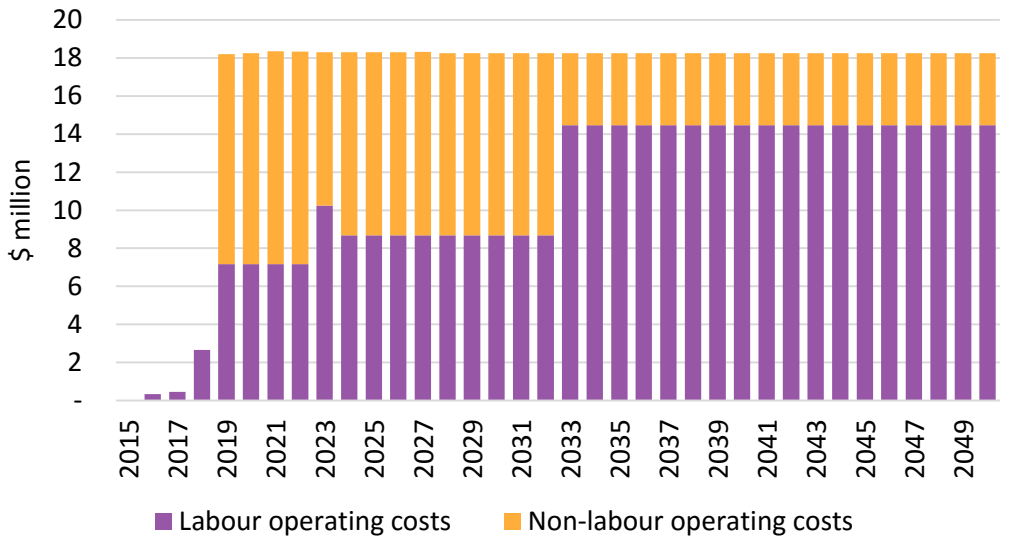
The labour component of capital expenditure accounts for the remaining 25 per cent of total capital ($189 million). Of this amount, 80 per cent is assumed to be the cost of expatriate labour and 20 per cent local labour during the construction phase.

Operating expenditure

The recurrent operating expenditure profile over the life of the project is shown in **Figure 3.2**. Operating expenditure averages about $18 million per year and over the life of project totals $566 million.

The operating expenditure comprises around 65 per cent labour costs and 35 per cent non-labour costs, with local (East Timorese) labour assumed to account for 30 per cent of full-time equivalent (FTE) positions initially, rising to 50 per cent over time.

FIGURE 3.2 SUAI SUPPLY BASE OPERATING EXPENDITURE PROFILE (IN REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

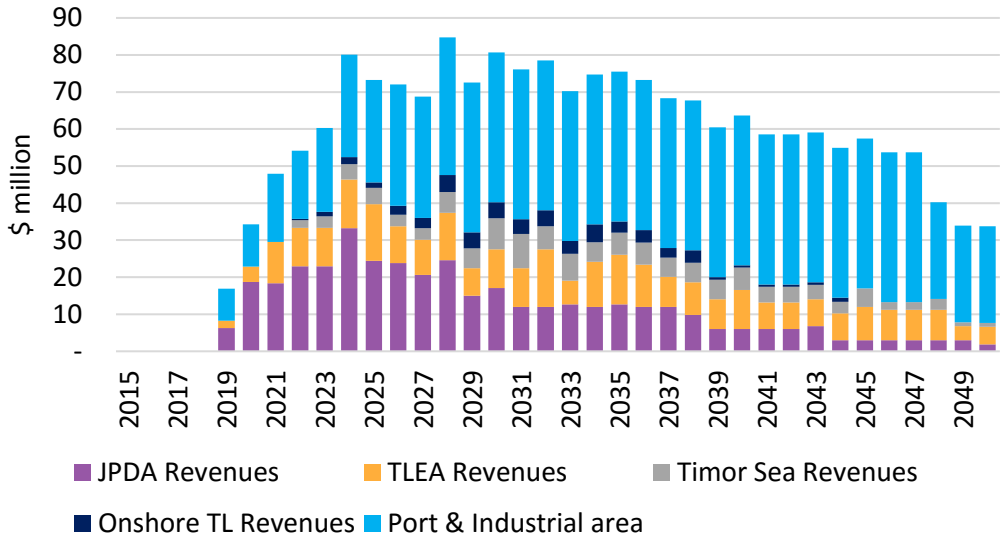
3.6.3 Suai Supply Base: Revenue Forecasts

The Suai Supply Base will provide a range of services, as described in section 2.2.1.

TIMOR GAP has provided forecasts of the value of field services based on projections of levels of petroleum exploration and production (E&P) activity in the region potentially served by the Suai Supply Base, and assumptions regarding the proportion of total expenditure on marine supply support for those E&P activities that will be captured by the Suai Supply Base. The forecasts include estimates of revenue sourced from the Joint Petroleum Development Area (JPDA), Timor-Leste Exclusive Area (TLEA), elsewhere in the Timor Sea area and Onshore Timor-Leste. The analysis takes into account the expected life of existing production fields (such as Kitan and Bayu-Undan) as well as assumptions about new field discoveries. TIMOR GAP has also forecast revenues arising from the provision of cargo storage, handling and other services provided at the Suai Supply Base itself.

The resulting revenue forecasts are summarised in **Figure 3.3**. As shown, total revenue builds up over a period of 10 years as the proportion of the offshore supply business captured by the Suai base increases with time. The contribution from offshore E&P supply services then declines over time, and total revenues fall, as activity levels drop off, particularly in the JPDA. Total forecast revenues under the Base Case would average around $60 million per year over the period to 2049, with total income over the period of $1.9 billion. A little over half the total revenue (54 per cent) is derived from the Port and Industrial Area, with revenues from E&P activities accounting for 46 per cent of revenues.

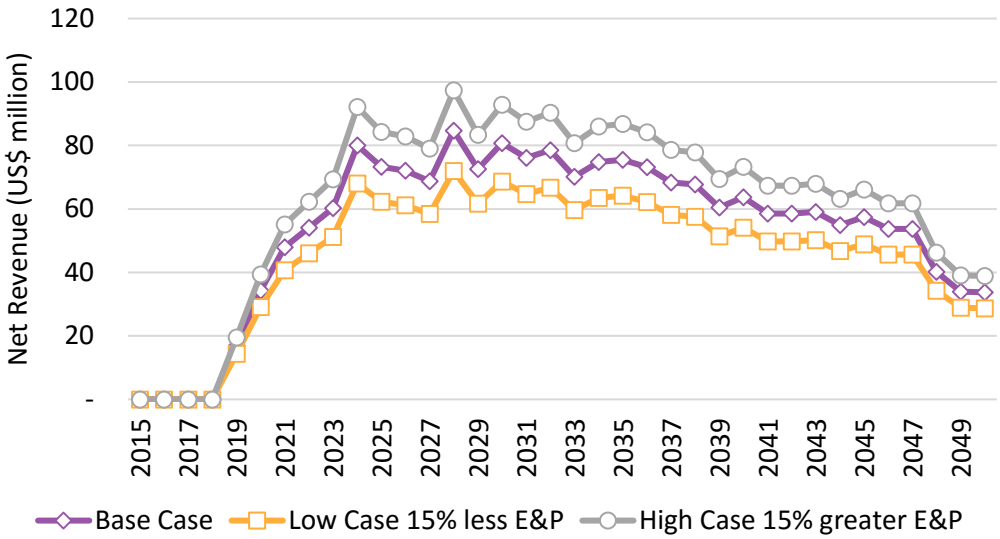
FIGURE 3.3 SUAI SUPPLY BASE: PRODUCT VALUE (BASE CASE, REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Clearly there is a significant degree of uncertainty in forecasting the levels of revenue that will be earned by the Suai Supply Base. Many factors could affect the outcome, including differences in levels of E&P activity (which in turn will be influenced by factors such as global oil prices and exploration success rates in the Timor Sea region) and the extent to which Suai is able to win business from existing supply bases such as the Port of Darwin. We have examined two sensitivity cases that assume different levels of E&P activity and different levels of business capture, resulting in total revenues that are 15 per cent higher and 15 per cent lower than the Base Case. The resulting revenue profiles are shown in **Figure 3.4**.

FIGURE 3.4 SUAI SUPPLY BASE: NET REVENUE SENSITIVITY TO LEVELS OF EXPLORATION AND PRODUCTION ACTIVITY (REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Implications for project economics

The overall economic performance of the Suai Supply Base under the Base Case assumptions is relatively modest: we find the project in this configuration yields a pre-tax internal rate of return of 3.9 per cent real (3.1 per cent post-tax). The NPV of post-tax cash flows is found to be –$333 million, reflecting the fact that the project rate of return is less than the discount rate[10]. The revenue sensitivity analysis shows that a 15 per cent increase in revenues over the life of the project would, all else being equal, result in an increase in pre-tax IRR to 5.3 per cent (4.5 per cent post-tax) while a 15 per cent reduction in revenues over the life of the project would reduce pre-tax IRR to 2.2 per cent (1.6 per cent post-tax).

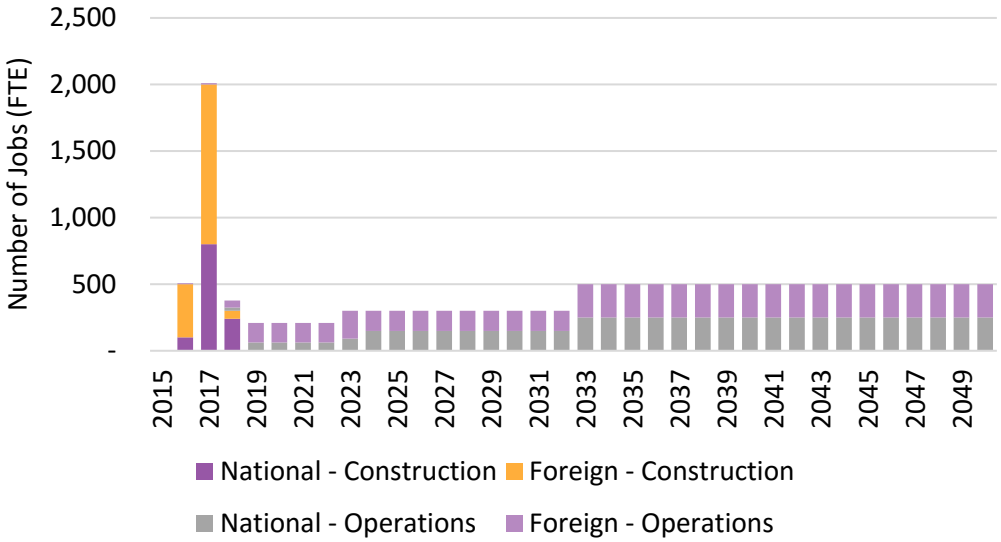
3.6.4 Suai Supply Base: Employment

The employment profile[11] for the construction and operation phases of the Suai Supply Base are summarised in **Figure 3.5**.

The construction workforce is expected to peak at over 2,000 workers including local and expatriate employees, contractors and administrative and support personnel, with a total of some 1,800 person-years of labour required over the construction period. East Timorese nationals are expected to account for 20 per cent of the construction workforce initially, rising to 80% by the end of the construction period.

[10] Net Present Value has been calculated at a discount rate of 10 per cent applied to the cash flows expressed in real 2015 dollar terms. This is equivalent to a 15.5 per cent nominal discount rate, assuming average inflation of 5 per cent.
[11] Employment numbers quoted in this section refer to full-time equivalent (FTE) positions, which may be filled by individual workers (typically for local employees) or by two or more individuals working on rotation (typically for expatriate workers).

FIGURE 3.5 CONSTRUCTION WORKFORCE DIRECT EMPLOYMENT AND CONTRACTORS (FTE)



NOTE: FTE = FULL-TIME EQUIVALENT

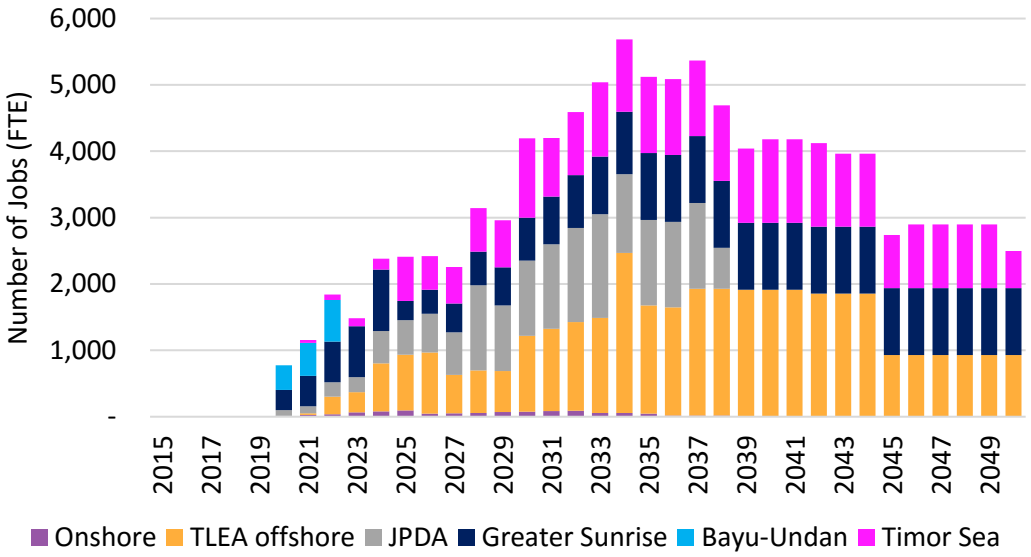
SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

Once construction is completed, the project is expected to provide around 210 full-time positions per year initially, rising to 500 jobs by 2033. It is assumed that East Timorese national employees will account for 30 per cent of the operational workforce initially, rising to 50% over time.

Indirect employment

There will be a number of companies providing services to the petroleum exploration and production sector through the Suai Supply Base and these companies will employ a significant number of people. In the absence of the supply base, these jobs would not exist in Timor-Leste. They can therefore be thought of as being indirectly employed by the Suai Supply Base, not as a result of general flow-on into the broader economy but as a result of the creation of a new industry in the economy—the petroleum services industry. TIMOR GAP has undertaken market analysis to assess the type and quantum of services that could be provided through the Suai Supply Base, and as part of that market assessment has estimated the number of employees that would be engaged in providing services to exploration and production companies in the various regions serviced by the supply base. The method used to calculate the number of employees engaged by these service businesses is to assume a fixed percentage (15 per cent) of gross revenue earned by these businesses is paid in salary, and to divide the total annual salary cost determined in this way by the assumed average salary per employee. The results are summarised in **Figure 3.6**.

FIGURE 3.6 INDIRECT EMPLOYMENT IN SERVICE BUSINESSES OPERATING FROM SUAI SUPPLY BASE



SOURCE: TIMOR GAP

Based on the anticipated levels of service business conducted through the Suai Supply Base, indirect employment in service businesses is expected to peak above 5,000 employees. The level of indirect employment associated with service businesses operating from the Suai Supply Base is therefore likely to be much greater than the employment by the supply base itself.

3.6.5 Suai Supply Base: Sources of Government Income and Direct Cash Flows

This section describes the sources of income to the Government of Timor-Leste expected to flow from the Suai Supply Base. Income to the Government of Timor-Leste comprises:

1. Direct Timor-Leste Government income
   a) Taxation
      i) Company Income Tax
      ii) Wages Tax payable by both construction and operations workers
      iii) Withholding Tax
   b) Import Duty
2. TIMOR GAP dividends

The national petroleum company of Timor-Leste, TIMOR GAP, will receive income in the form of returns to equity (net profit after tax). We assume that TIMOR GAP pays 100% of retained earnings as dividends to the Timor-Leste Government.

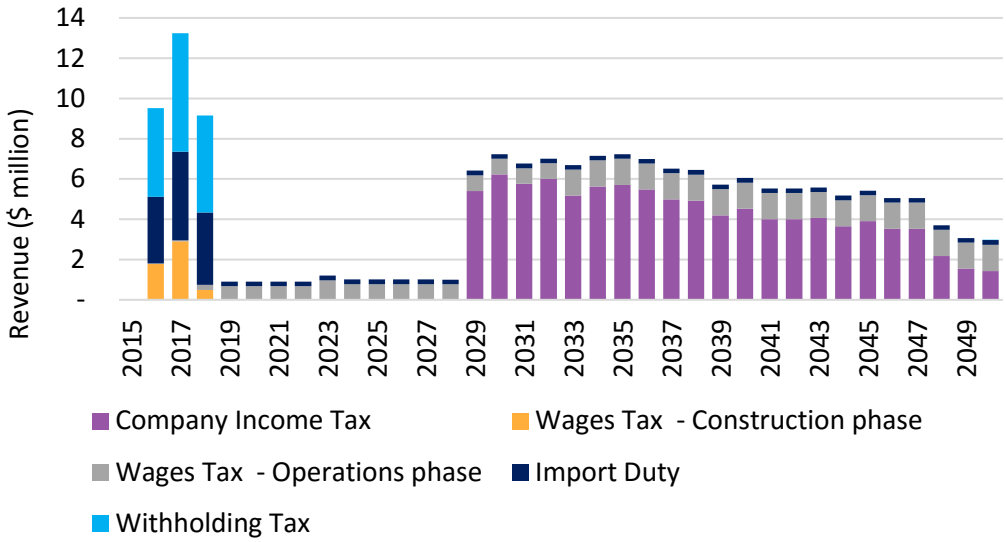
These two components — Direct Timor-Leste Government income and TIMOR GAP dividends — add up to total Timor-Leste Government income.

For the purposes of this analysis, we assume that the current fiscal arrangements in Timor-Leste, and in particular the provisions of the *Taxes and Duties Act 2008*, remain in force over the life of the Betano Refinery Project.

Modelled tax and duty payments

Figure 3.7 shows the modelled payments of taxes and duties to the Government of Timor-Leste as a result of the operation of the Suai Supply Base under the Base Case assumptions. Tax and duty payments are estimated to total $169 million over the life of the project, with Company Income Tax comprising around 56 per cent of that amount. The modelling indicates that, as a result of depreciation allowances and accumulated tax losses, no company income tax would be payable until 2029.

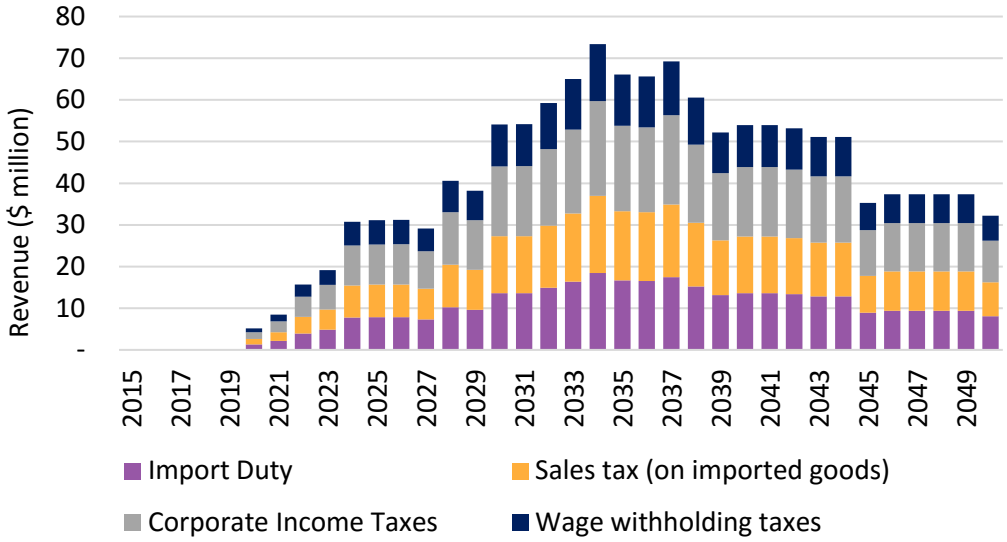
FIGURE 3.7 SUAI SUPPLY BASE: GOVERNMENT TAX REVENUE FORECAST (REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

As well as the tax and duty payments associated with the Suai Supply Base itself, the Government could expect to receive revenues from the companies providing services to the petroleum exploration and production sector through the Suai Supply Base. **Figure 3.8** summarises these sources of government revenue, based on market analysis undertaken by TIMOR GAP. This analysis indicates that the support businesses based out of the Suai Supply Base could contribute around $1.4 billion in tax and duty payments over the period to 2050: much more than the revenue contribution from the supply base itself.

FIGURE 3.8 INDIRECT REVENUE FROM SERVICE BUSINESSES OPERATING THROUGH SUAI SUPPLY BASE (REAL 2015 TERMS)

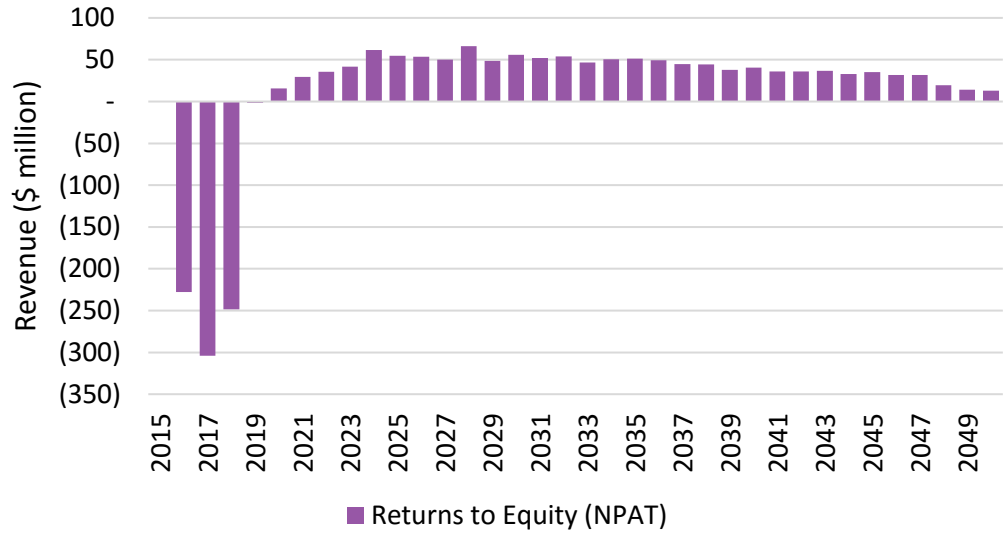


SOURCE: ACIL ALLEN CONSULTING BASED ON TIMOR GAP ANALYSIS

Modelled returns to equity

Figure 3.9 shows the modelled returns to equity[12] for TIMOR GAP as owner of the Suai Supply Base. In total, the Base Case assumptions result in total returns to equity of $477 million over the projection period. Net profit after tax is persistently positive from 2020 reflecting the assumption of zero debt (no loan costs).

FIGURE 3.9 SUAI SUPPLY BASE: MODELLED RETURNS TO EQUITY (NET PROFIT AFTER TAX)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

[12] "Returns to equity" are equivalent to net profit after tax, calculated as net revenue less capital contributions, debt repayment (principal and interest), operating costs, taxes and duties.

3.7 Betano Refinery and Petrochemical Complex

This section sets out the study findings in relation to the direct economic impacts of the Betano Refinery and Petrochemical Complex. A description of the project is provided in section 2.2.2.

3.7.1 Key assumptions

The key assumptions used to model the direct economic impacts of the Betano Refinery and Petrochemical Complex and the basis for those assumptions are discussed below.

Scope of the study

The Betano refinery and petrochemical complex is to be developed in a staged fashion. Stage 1 will provide production capacity of 30,000 barrels per day, with Stage 2 resulting in expanded capacity of 60,000 barrels per day with Stage 3 increasing total capacity to 100,000 barrels per day. The product mix changes at each stage, and the price premium over crude oil feedstock varies accordingly. This study addresses the direct economic impacts of the full development including all three project stages.

Production profile

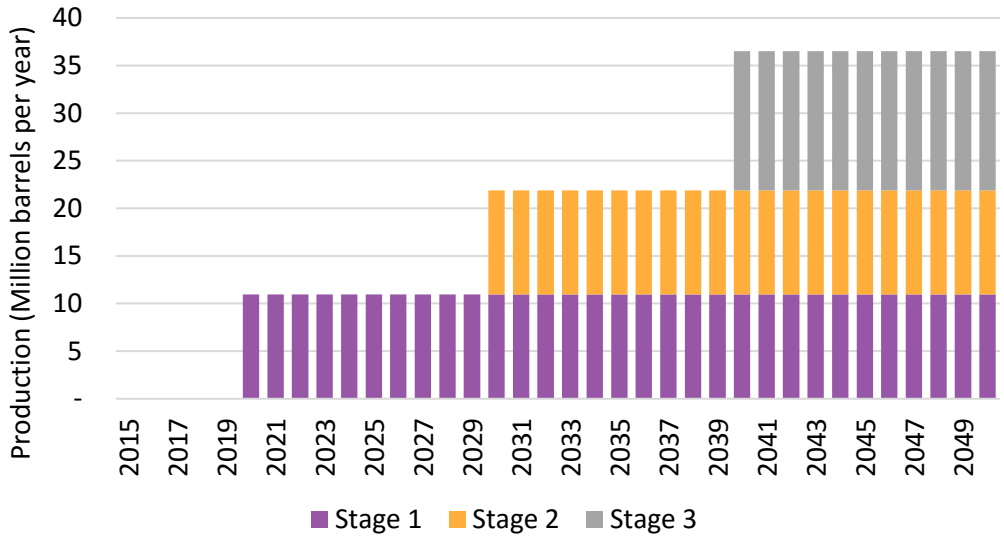
It is assumed that the refinery will purchase crude oil feedstock from one or more oil fields in the Timor Sea region, and will refine that crude oil to produce a range of petroleum products as discussed in section 2.2.2. The overall production profile is shown in **Figure 3.10**. The current project schedule sees Stage 1 of the refinery commencing production in 2020 at a rate of 30,000 barrels per day (10.95 million barrels per year). Stage 2 will increase production to 60,000 barrels per day (21.9 million barrels per year) commencing in 2030 while Stage 3 will take production up to 100,000 barrels per day (36.5 million barrels per year) commencing in 2040. We have assessed project economics over the period to 2050. No terminal value has been ascribed to the project at this point in time. In practice, we would expect the project to continue operating beyond this date (not least given the substantial investment in the Stage 3 expansion in 2038–39). Project metrics such as net present value (NPV) and internal rate of return (IRR) should therefore be expected to be greater in practice than the values calculated on the basis of a 2050 project cut-off.

Betano Refinery and Petrochemical Complex – Timor-Leste Government equity participation

For the purposes of this analysis, we have assumed that TIMOR GAP will own 100 per cent of the project.

The analysis assumes a debt/equity mix of 70:30. We have incorporated a highly simplified financing structure within the model to allow estimation of post-financing outcomes for the project owners. Projections of total government returns would normally be impacted by the financing terms and structure. However, given that the State investment will be through TIMOR GAP and also given that under the general taxation law of Timor-Leste interest costs are not tax deductible (see section 3.3.1) returns to government should be relatively insensitive to financing costs.

FIGURE 3.10 PRODUCTION PROFILE – BETANO REFINERY AND PETROCHEMICAL COMPLEX



SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

3.7.2 Betano Refinery and Petrochemical Complex – Capital and operating costs

The total capital cost assumed for the purposes of the assessment is $2,360 million (real 2015) comprising $650 million for Stage 1, $590 million for Stage 2 and $1,120 million for Stage 3. These capex assumptions are based on information provided by TIMOR GAP. Capital cost varies as a function of oil price: the above capital cost estimates are based on the high-range oil price assumption, which has an average long-run oil price of $103.50 per barrel. Capital costs are assumed to vary up or down by 0.75% for each $1 per barrel increase or decrease in oil price. Under the Base Case oil price assumptions with an average long-run oil price of $77.20 per barrel, the total capital cost reduces to $1,895 million. Equipment and bulk materials are assumed to account for 45 per cent of total capital cost, with the balance attributed to labour. This is broadly consistent with other comparable projects that ACIL Allen has analysed in the past.

For modelling purposes, straight-line capital depreciation at a rate of 100% (that is, full depreciation in the year that capital expenditure occurs) is assumed, in accordance with current tax law.[13]

Operating costs (excluding feedstock purchases) are assumed to average 3.5 per cent of cumulative capital expenditure, totalling $1.33 billion over the life of the project at an average $43 million per year over the operating life of the plant.

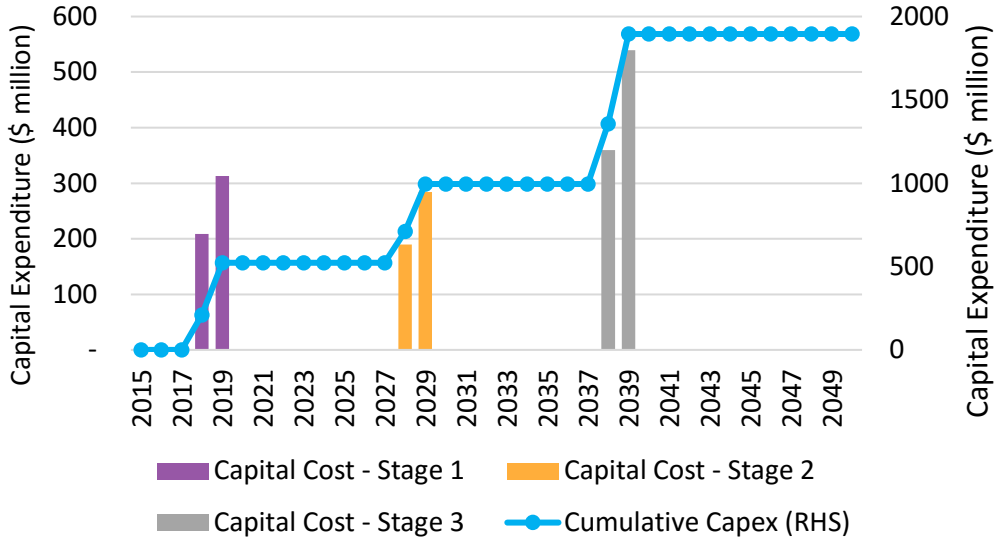
We have assumed that fiscal terms consistent with current legislation will apply throughout the life of the project.

Capital investment profile

The annual capital expenditure profile is shown in **Figure 3.11**. Over the project life, capital expenditure totals $1,895 million (mid-range oil price case) with the Stage 1 capital expenditure occurring over the period 2018 to 2019, Stage 2 over the period 2028 to 2029 and Stage 3 over the period 2038 to 2039. No allowance for plant decommissioning at the assumed end of project life (2050) has been included.

[13] *Taxes and Duties Act 2008*, section 36 and Schedule VII.

FIGURE 3.11 BETANO REFINERY AND PETROCHEMICAL COMPLEX CAPITAL EXPENDITURE PROFILE (IN REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

Capital equipment and bulk materials comprise 45 per cent of the total capital spend ($853 million). 80 per cent of this amount is assumed to be sourced from outside Timor-Leste.

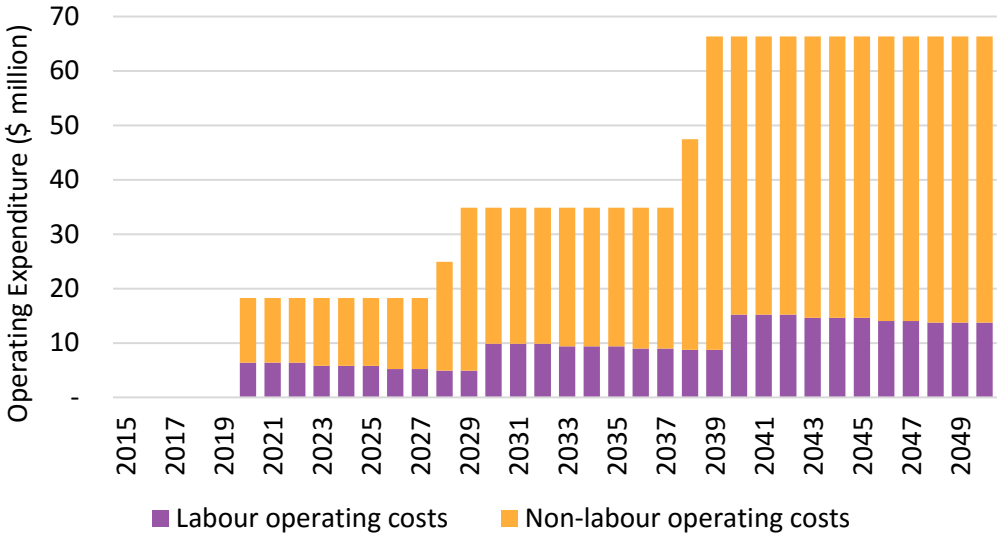
The labour component of capital expenditure accounts for the remaining 55 per cent of total capital ($1,042 million). Of this amount, 70 per cent is assumed to be expatriate labour and 30 per cent local labour during the construction phase for Stages 1 and 2, and 50 per cent each expatriate and local labour for State 3 construction.

Operating expenditure

The recurrent operating expenditure profile over the life of the project is shown in **Figure 3.12**. Note that these operating costs do not include crude oil feedstock purchases which total around $59.8 billion over the life of the project (mid-price case). Operating expenditure varies as a function of cumulative capital investment and averages about $18 million per year during Stage 1 operations, rising to almost $35 million per year following commissioning of Stage 2 and $66 million per year following commissioning of Stage 3. Total operating expenditure over the life of project totals $1.3 billion.

The operating expenditure comprises 77 per cent non-labour costs and 23 per cent labour costs, with the proportion of local (East Timorese) labour increasing over time from 50 per cent initially to 75 per cent by 2029.

FIGURE 3.12 BETANO REFINERY AND PETROCHEMICAL COMPLEX OPERATING EXPENDITURE PROFILE (IN REAL 2015 TERMS)

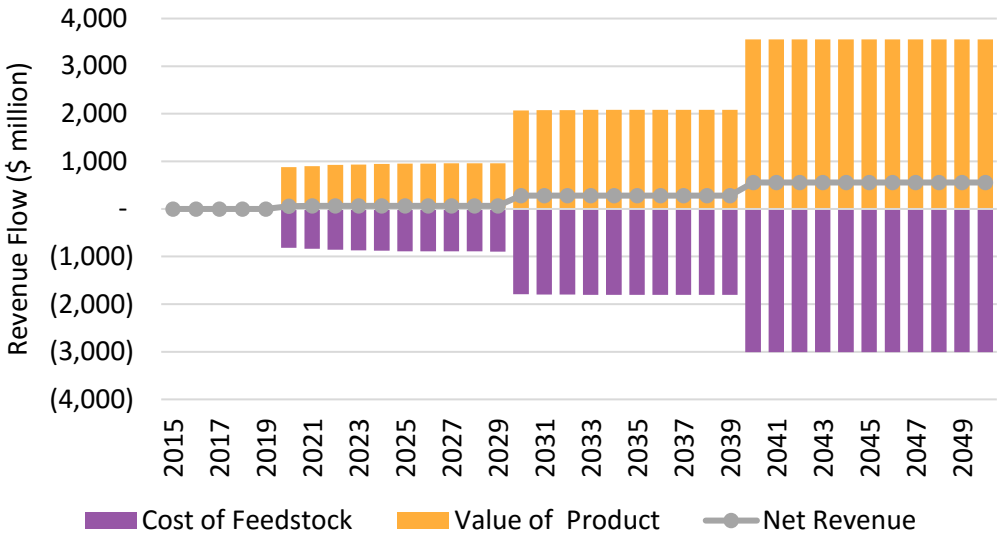


SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

3.7.3 Betano Refinery and Petrochemical Complex: Value of output

The Betano Refinery Project will produce a range of refined petroleum products, as described in section 2.2.2. Rather than attempt to model each component of the product slate separately, we have modelled production as a single product stream. It is assumed that this product, whether sold locally or exported, will be sold at a premium to the price of the crude oil feedstock used in its manufacture. Initially (Stage 1) the simple product slate will attract a modest premium of 7.5 per cent over the crude oil price. With higher value-added products, the price premium *for the entire output of the plant* is assumed to increase to 15.5 per cent for Stage 2 and 18.5 per cent for Stage 3.

FIGURE 3.13 BETANO REFINERY AND PETROCHEMICAL COMPLEX: PRODUCT VALUE (BASE CASE, REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

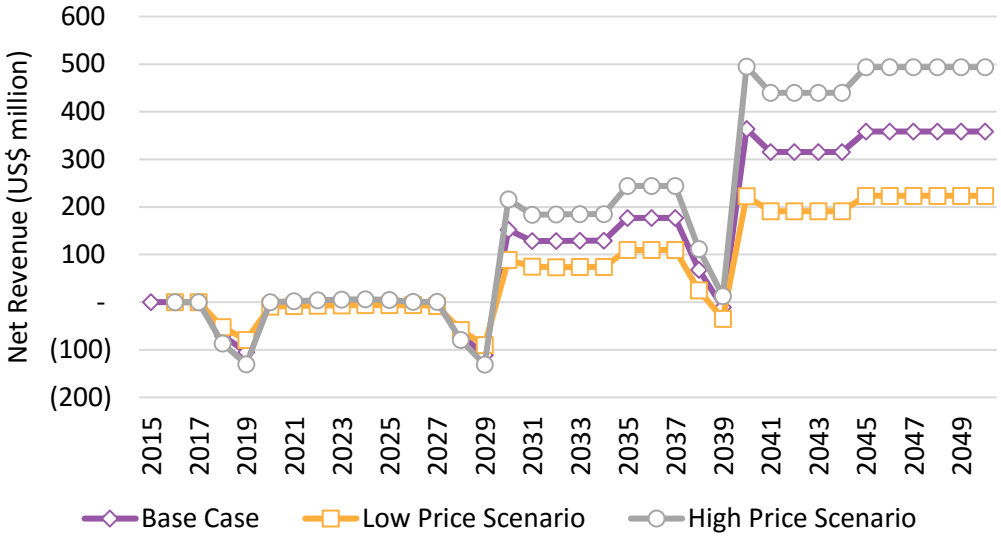
As shown in **Figure 3.13**, the net revenue of output under the Base Case would average around $65 million per year during Stage 1 operations, rising to $279 million per year in Stage 2 and $556 million per year in Stage 3. **Figure 3.13** also shows the costs of feedstock (which average about $871 million per year in Stage 1 rising to $1.8 billion per year in Stage 2 and $3 billion per year in Stage 3) and the gross value of refined petroleum products (which average about $937 million per year in Stage 1 rising to $2 billion per year in Stage 2 and $3.6 billion per year in Stage 3).

The after tax net cash flow (NCF) sensitivity analysis under the three long-run oil price cases is presented in **Figure 3.14**. Under the Base Case NCF averages about minus $2 million per year for Stage 1. This is because of the relatively low product premium over feedstock costs for this stage. With the Stage 2 expansion, the product premium over feedstock costs improves significantly and NCF increases to an average of $150 million per year. For Stage 3 there is a further increase in the product premium over feedstock costs and the average NCF increases to $343 million per year.

Under the Low Case (with long-run oil price averaging $51/bbl compared to $77/bbl under the Base Case) the average NCF falls to about minus $7 million per year for Stage 1 operations, rising to $89 million per year on average for Stage 2 operations and $212 million per year on average for Stage 3 operations.

Under the High Case the average NCF rises to about plus $3 million per year for Stage 1 operations, rising to $211 million per year on average for Stage 2 operations and $474 million per year on average for Stage 3 operations.

FIGURE 3.14 BETANO REFINERY AND PETROCHEMICAL COMPLEX: NET REVENUE SENSITIVITY TO OIL PRICE (REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

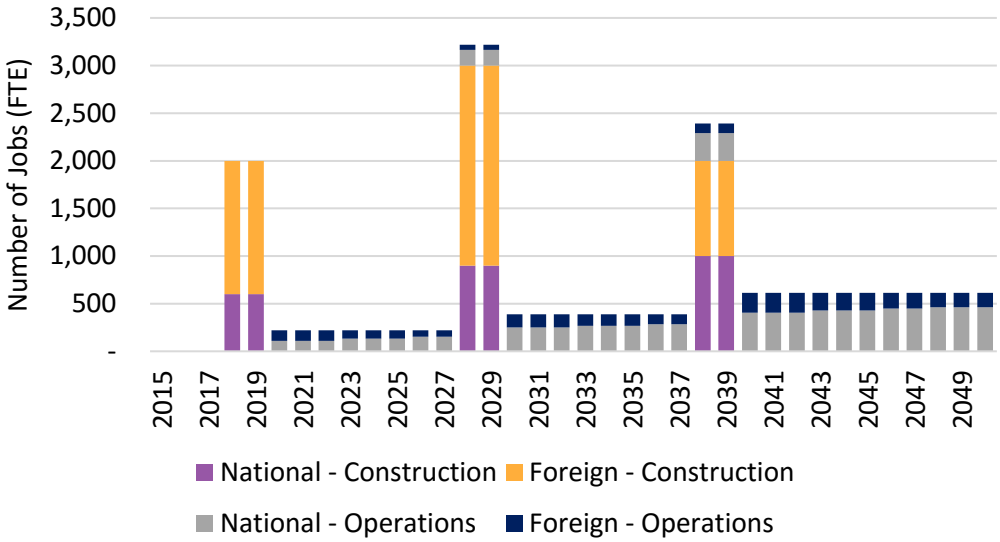
3.7.4 Betano Refinery and Petrochemical Complex: Employment

The development of the Betano Refinery and Petrochemical Complex would have significant employment benefits, both during construction and during the ongoing operations phase. The employment profiles[14] for the construction and operation phases are summarised in **Figure 3.15**.

The construction workforce is expected to average around 2,000 workers including local and expatriate employees, contractors and administrative and support personnel, over the initial stage of construction in 2018–19. For the Stage 2 construction period in 2028–29, the construction workforce is expected to average around 3,000 workers. For the Stage 3 construction period in 2038–39, the construction workforce is expected to average around 2,000 workers. East Timorese nationals are expected to account for around 30 per cent of the construction workforce for Stages 1 and 2, and about 50 per cent for Stage 3.

[14] Employment numbers quoted in this section refer to full-time equivalent (FTE) positions, which may be filled by individual workers (typically for local employees) or by two or more individuals working on rotation (typically for expatriate workers).

FIGURE 3.15 CONSTRUCTION WORKFORCE DIRECT EMPLOYMENT AND CONTRACTORS (FTE)



NOTE: FTE = FULL-TIME EQUIVALENT

SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

Post-construction, at the commencement of the Stage 1 operational phase in 2021, the project will provide around 220 full-time positions per year. At this stage, East Timorese national employees are expected to account for around 50 per cent of the operational workforce, rising to 75% per cent over time.

3.7.5 Betano Refinery and Petrochemical Complex: Sources of Government Income

This section describes the sources of income to the Government of Timor-Leste expected to flow from the Betano Refinery and Petrochemical Complex. Direct income to the Government of Timor-Leste comprises:

1. Direct Timor-Leste Government income
   a) Taxation
      i) Company Income Tax
      ii) Wages Tax payable by both construction and operations workers
      iii) Withholding Tax
   b) Import Duty
2. TIMOR GAP dividends

The national petroleum company of Timor-Leste, TIMOR GAP, will receive income in the form of returns to equity (net profit after tax). We assume that TIMOR GAP pays 100% of retained earnings as dividends to the Timor-Leste Government.

These two components — Direct Timor-Leste Government income and TIMOR GAP dividends — add up to total Timor-Leste Government income.

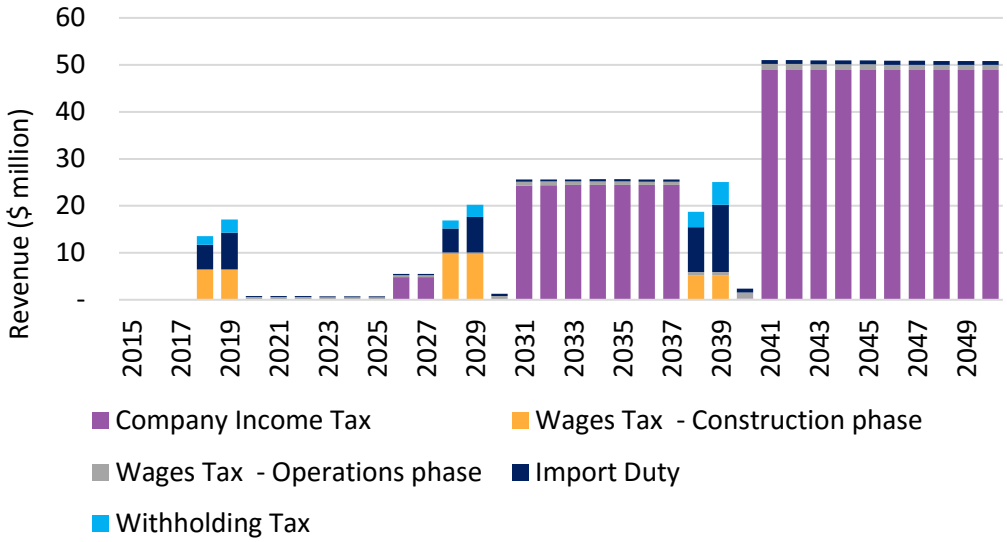
For the purposes of this analysis, we assume that the current fiscal arrangements in Timor-Leste, and in particular the provisions of the *Taxes and Duties Act 2008*, remain in force over the life of the Betano Refinery Project.

Modelled tax and duty payments

Figure 3.16 shows the modelled payments of taxes and duties to the Government of Timor-Leste as a result of the operation of the Betano Refinery under the Base Case assumptions. Tax and duty payments are estimated to total $819 million over the life of the project, with Company Income Tax comprising 82 per cent of that amount. Because of the accelerated depreciation arrangements that

apply under current taxation law in Timor-Leste and the low margins for Stage 1 of the project, very little company income tax is payable until 2031.

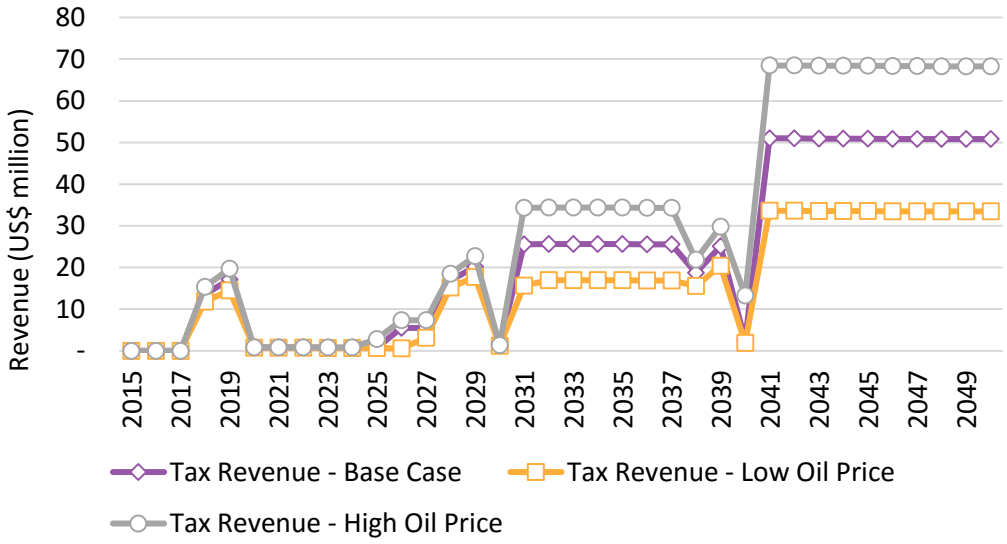
FIGURE 3.16 BETANO REFINERY AND PETROCHEMICAL COMPLEX: GOVERNMENT TAX REVENUE FORECAST (REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

The sensitivity of government tax receipts to changes in oil price is illustrated in **Figure 3.17**. Over the life of the project, total government tax receipts range from $559 million under the Low Case to $819 million under the Base Case and $1.1 billion under the High Case.

FIGURE 3.17 COMPARISON OF TOTAL GOVERNMENT TAX REVENUE – BASE, LOW AND HIGH CASE OIL PRICES (REAL 2015 TERMS)

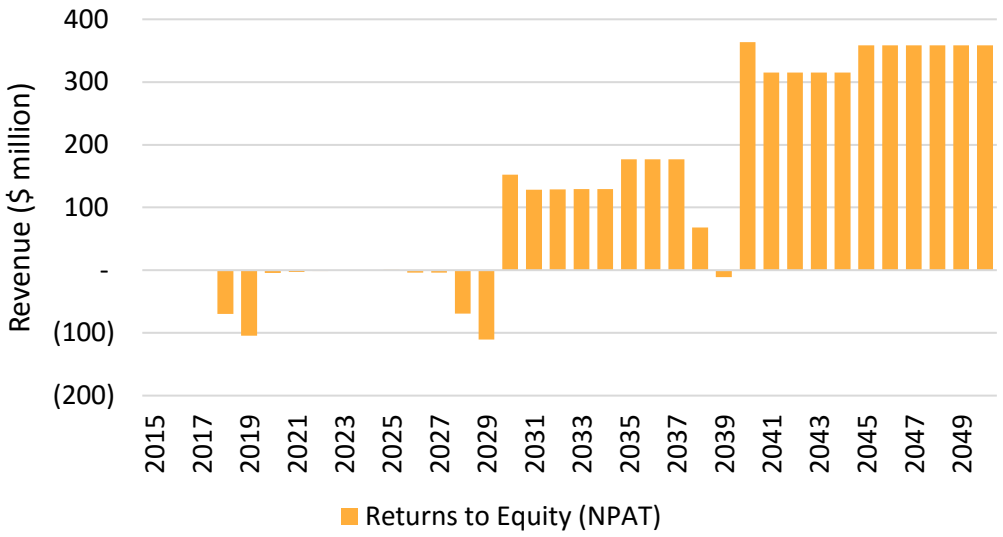


SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Modelled returns to equity

Figure 3.18 shows the modelled returns to equity[15] available to TIMOR GAP as the owner of the Betano Refinery and Petrochemical Project over the projection period, under the Base Case oil price assumptions.

FIGURE 3.18 BETANO REFINERY AND PETROCHEMICAL COMPLEX: MODELLED RETURNS TO EQUITY



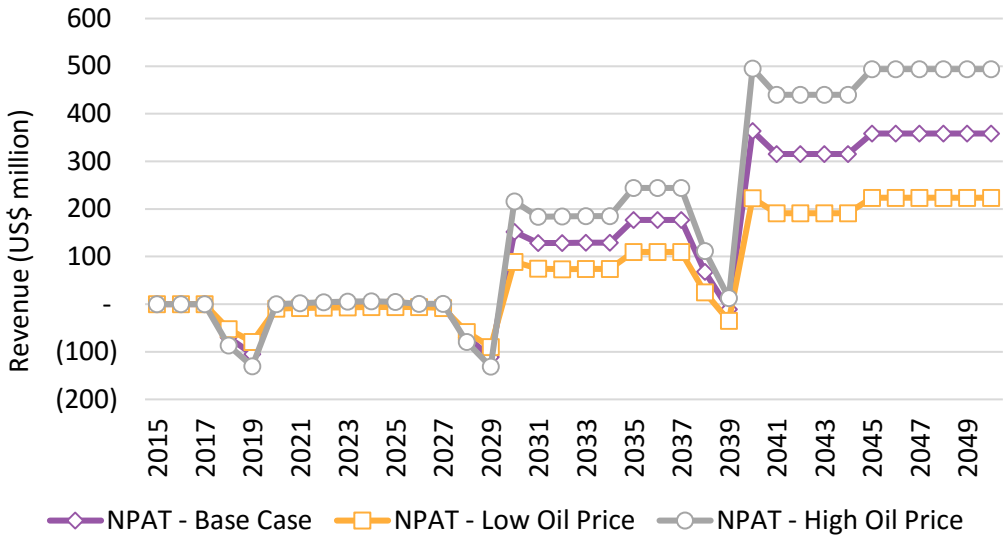
SOURCE: ACIL ALLEN CONSULTING ANALYSIS

In total, the Base Case assumptions result in returns to equity of $4.7 billion over the projection period. Equity returns for the Stage 1 project average minus $2 million per year after the initial investment period in 2018–19. Following completion of the Stage 2 expansion, returns to equity (NPAT) increase to an average $150 million per year, rising to an average $343 million per year after completion of the Stage 3 expansion.

The sensitivity of returns to equity to changes in oil and petroleum product prices has been assessed through the High and Low price cases. The results are summarised in **Figure 3.19**. Over the period from commencement of construction in 2018 to the end of the projection period in 2050, total returns to equity amount to $4.7 billion for the Base Case, $2.7 billion for the Low Case and $6.6 billion for the High Case.

[15] "Returns to equity" are equivalent to net profit after tax, calculated as net revenue less capital contributions, debt repayment (principal and interest), operating costs, taxes and duties.

FIGURE 3.19 COMPARISON OF RETURNS TO EQUITY (NET PROFIT AFTER TAX) – BASE, LOW AND HIGH CASE OIL PRICES (REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

3.8 Beaço LNG

This section sets out the study findings in relation to the direct economic impacts of the Beaço LNG Plant. A description of the project is provided in section 2.2.3.

3.8.1 Key assumptions

The key assumptions used to model the direct economic impacts of the Beaço LNG Plant and the basis for those assumptions are discussed below.

3.8.2 Feed gas supply

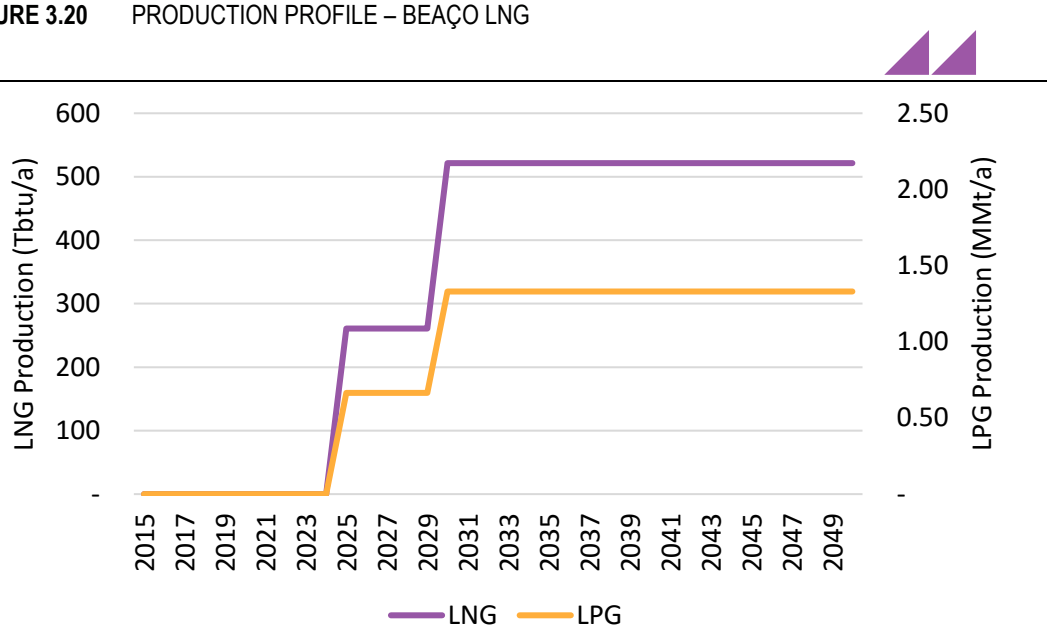
Feed gas supply for the Beaço LNG Project is assumed to come from the Greater Sunrise fields located in the Joint Petroleum Development Area (JPDA). The costs associated with the construction and operation of the upstream gas production facilities are assumed to be borne by the Greater Sunrise Joint Venture and are not included in the economic analysis of the Beaço LNG project. Feed gas is assumed to be purchased from the Greater Sunrise owners on an ex-field basis. For modelling purposes a raw gas purchase price equal to 56 per cent of the LNG selling price has been assumed. This is equivalent to $6.38/MMBtu for the mid-case oil price of $77.20/bbl. In practice, the raw gas purchase price will be a matter for commercial negotiation between the gas suppliers and the LNG facility owners.

The plant is assumed to have two LNG trains, each with a nominal capacity of 5 million tonnes per year (Mtpa) or 261 Tbtu/a. Based on advice from TIMOR GAP we have assumed that, after allowing for gas consumed through the transportation and liquefaction process including all on-site energy requirements, the total raw gas requirement will be about 308 Tbtu/a for Train 1 and 316 Tbtu/a for Train 2. This implies gas use in transport and processing of between 18 and 21.3 per cent. The raw gas feed requirement for the plant operating at full capacity is therefore approximately 624 Tbtu/a.

The overall production profile is shown in **Figure 3.20**. The current project schedule sees the first LNG train commencing production in 2025 at the design rate of 5 Mtpa and the second train commencing production in 2030, bringing total production to 10 Mtpa (about 521 Tbtu/a). LPG (propane and butane in approximately equal proportions by weight) is assumed to be produced as a second product stream at a rate of approximately 670,000 tonnes per year initially, rising to 1.33 million tonnes per year from

2030. Production of LNG and LPG is assumed to remain at these levels to the end of the projection period in 2050.

FIGURE 3.20 PRODUCTION PROFILE – BEAÇO LNG



SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

3.8.3 Beaço LNG – Timor-Leste Government equity participation

For the purposes of this analysis, we have assumed that TIMOR GAP will own 70 per cent of the project, with the remainder owned by international joint venture partners.

Net revenues (**Figure 3.24**) and returns to equity (**Figure 3.28**) have been calculated assuming a debt/equity mix of 70:30. We have incorporated a highly simplified financing structure within the model to allow estimation of post-financing outcomes for the project owners. Projections of total government returns (**Figure 3.27**) would normally be impacted by the financing terms and structure. However, given that the State investment will be through TIMOR GAP and also given that under the general taxation law of Timor-Leste interest costs are not deductible (see section 3.3.1) returns to government should be relatively insensitive to financing arrangements.

3.8.4 Beaço LNG – Capital and operating costs

The total capital cost for the Beaço project is assumed to be $11 billion (real 2015) comprising $2,065 million for two pipelines (one from Greater Sunrise and the other from a pipeline hub in the JPDA), $1,413 million for marine facilities and $7,510 million for the two LNG trains and associated facilities. These capex assumptions are based on information provided by TIMOR GAP which uses the high-range oil price assumption with an average long-run oil price of $103.50 per barrel. Capital cost varies as a function of oil price, with capital costs assumed to vary up or down by 0.75% for each $1 per barrel increase or decrease in oil price. Hence under Base Case oil price assumptions (average $77.20/bbl) the total capital cost for the LNG project reduces to $8.8 billion.

For modelling purposes, straight-line capital depreciation at a rate of 100% (that is, full depreciation in the year that capital expenditure occurs) is assumed, in accordance with current tax law.[16]

Operating costs (excluding feedstock purchases) are assumed to average 3 per cent of cumulative capital expenditure for the pipeline, 1.5% for the marine facilities, and 0.67 per cent of cumulative capital expenditure for the LNG plant, totalling $2.6 billion over the life of the project at an average $102 million per year.

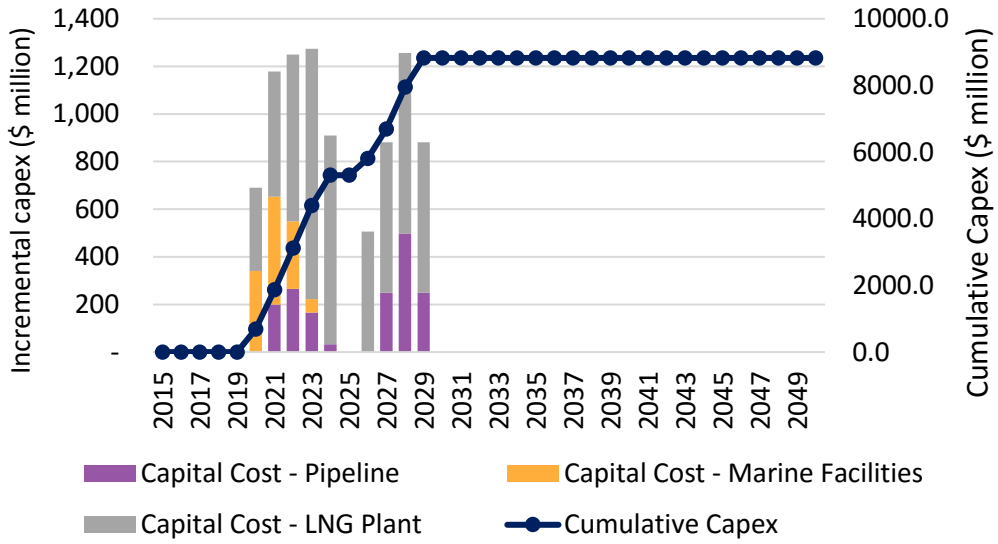
[16] *Taxes and Duties Act 2008*, section 36 and Schedule VII.

We have assumed that fiscal terms consistent with current legislation will apply throughout the life of the project.

Capital investment profile

The annual capital expenditure profile is shown in **Figure 3.21**. Over the project life, capital expenditure (under the Base Case average oil price assumption) totals $8.8 billion, with $5.3 billion incurred over a five-year period between 2020 and 2024 for the first LNG train and associated infrastructure (pipeline and marine facilities). The balance is incurred between 2026 and 2029 with the construction of the second LNG train and second raw gas delivery pipeline. No allowance for plant decommissioning at the assumed end of the modelling period (2050) has been included nor has any residual value been ascribed to the facility.

FIGURE 3.21 BEAÇO LNG CAPITAL EXPENDITURE PROFILE (IN REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

Based on assumptions provided by TIMOR GAP with regard to total capital cost, cost scheduling, expected employment numbers during construction, the expected split between local and expatriate workers and average wage rates for local workers, ACIL Allen estimates that capital equipment and bulk materials will account for about 85 per cent of total capital cost, with the balance attributed to labour. The equipment component of capital, which totals $7,515 million, accounts for 80 per cent of the pipeline cost, 67 per cent of the marine facilities and 90 per cent of the LNG plant. 97 per cent of equipment capital costs are assumed to be sourced from outside Timor-Leste.

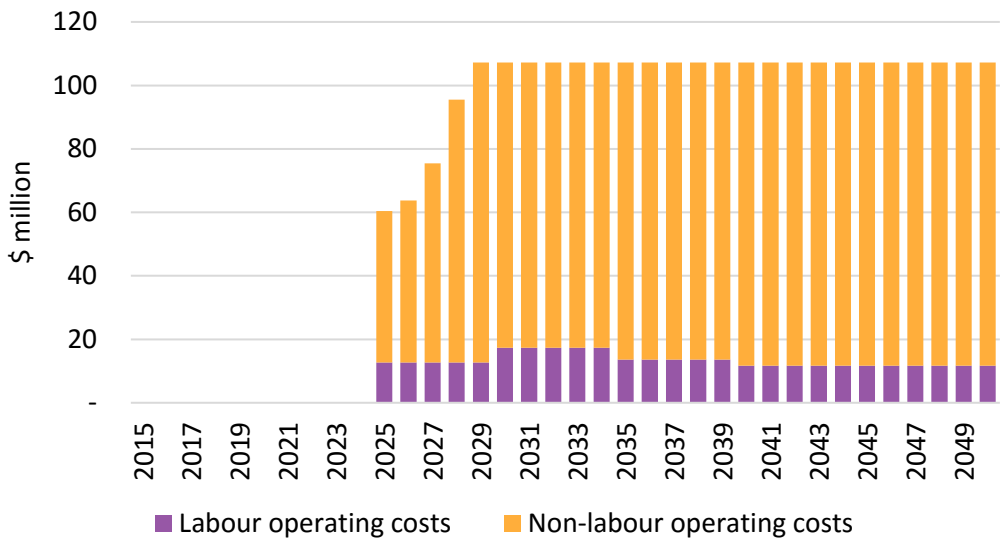
The labour component of capital expenditure accounts for the remaining 15 per cent of total capital ($1,309 million).

Operating expenditure

The recurrent operating expenditure profile over the life of the project is shown in **Figure 3.22**. Note that these operating costs do not include raw gas feedstock purchases which total around $95 billion over the life of the project (under Base Case oil price assumptions). Operating expenditure varies as a function of cumulative capital investment, and averages about $102 million per year. Total operating expenditure over the life of project totals $2.6 billion.

On average, operating costs comprise 87 per cent non-labour costs and 13 per cent labour costs, with the proportion of local (East Timorese) labour increasing over time from 30 per cent initially to 80 per cent by Year 16 of operations.

FIGURE 3.22 BEAÇO LNG PLANT OPERATING EXPENDITURE PROFILE (IN REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

3.8.5 Beaço LNG: Value of output

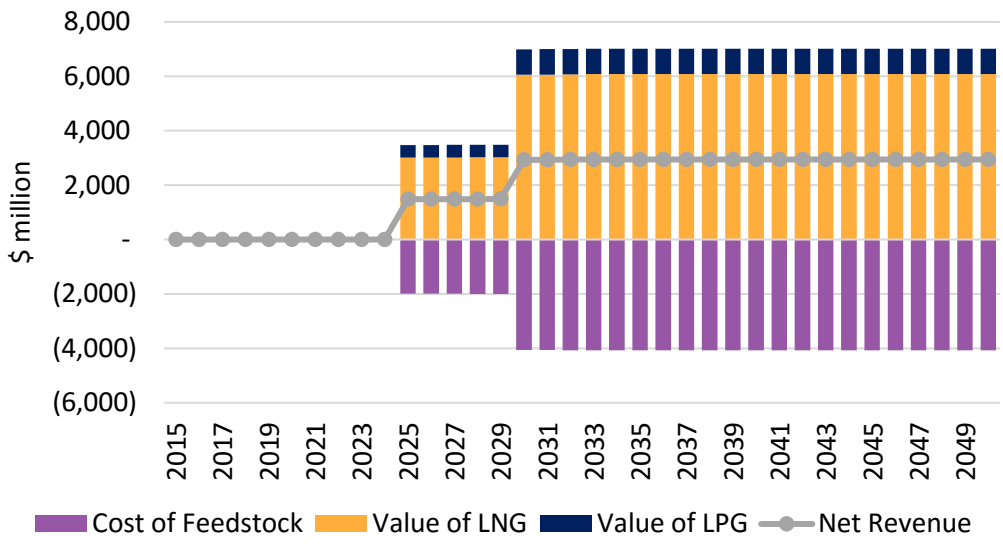
The Beaço LNG Project will produce both LNG and LPG product streams, as described in section 2.2.3. We have modelled the two product streams separately. The following product price assumptions have been adopted for the Base Case:

- LNG sells at a price (in $/mmbtu) averaging 14.2 per cent of the crude oil price (in $/bbl) over the period of operations, equivalent to $11.64/mmbtu.[17]
- LPG is priced at an average of about $700/tonne over the period of operations, or approximately 8.5 times the oil price in $/barrel.

As shown in **Figure 3.23**, the gross revenue of output under the Base Case would average around $3.0 billion per year of LNG and $460 million per year of LPG for Train 1, giving total gross revenue of about $3.5 billion per year. This would increase to $6.1 billion per year of LNG and $0.9 billion per year of LPG following start-up of Train 2. **Figure 3.23** also shows the costs of purchasing raw gas feedstock at an average of $2 billion per year (Train 1) rising to $4 billion per year (Trains 1 and 2 combined). Net revenue is therefore expected to be about $1 .5 billion per year rising to $3 billion following start-up of Train 2.

[17] ACIL Allen has adopted the oil price values for the forward oil price curves currently used by TIMOR GAP for planning purposes – see section 1.2.2.

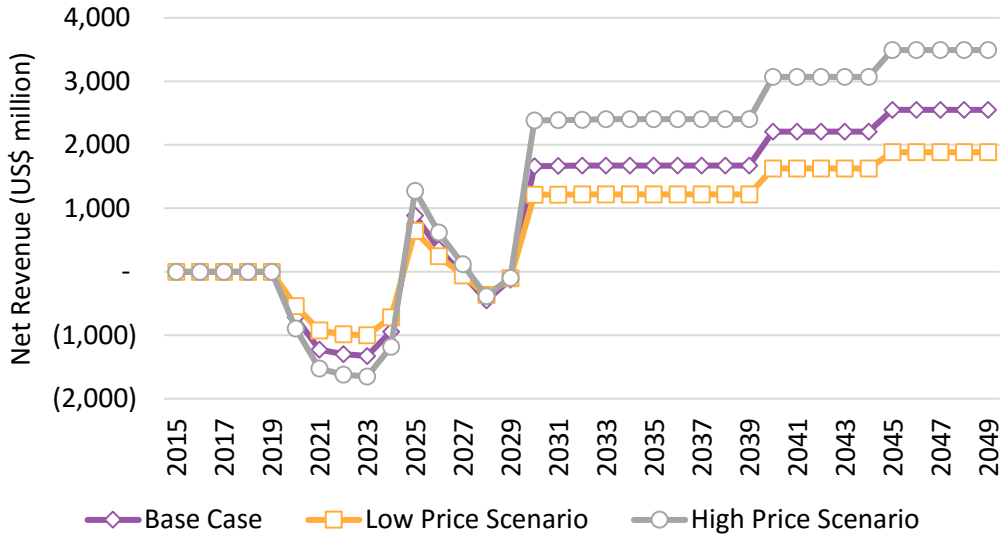
FIGURE 3.23 BEAÇO LNG: PRODUCT VALUE (BASE CASE, REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

The net revenue (after tax) sensitivity analysis under the three long-run oil price cases is presented in **Figure 3.24**. Under the Low Case net revenue reaches about $1.9 billion per year following commissioning of Train 2 and retirement of all project debt, compared to $2.55 billion for the Base Case. Under the High Case net revenue reaches about $3.5 billion per year, again following commissioning of Train 2 and retirement of all project debt.

FIGURE 3.24 BEAÇO LNG: NET REVENUE AFTER TAX, SENSITIVITY TO OIL PRICE (REAL 2015 TERMS)



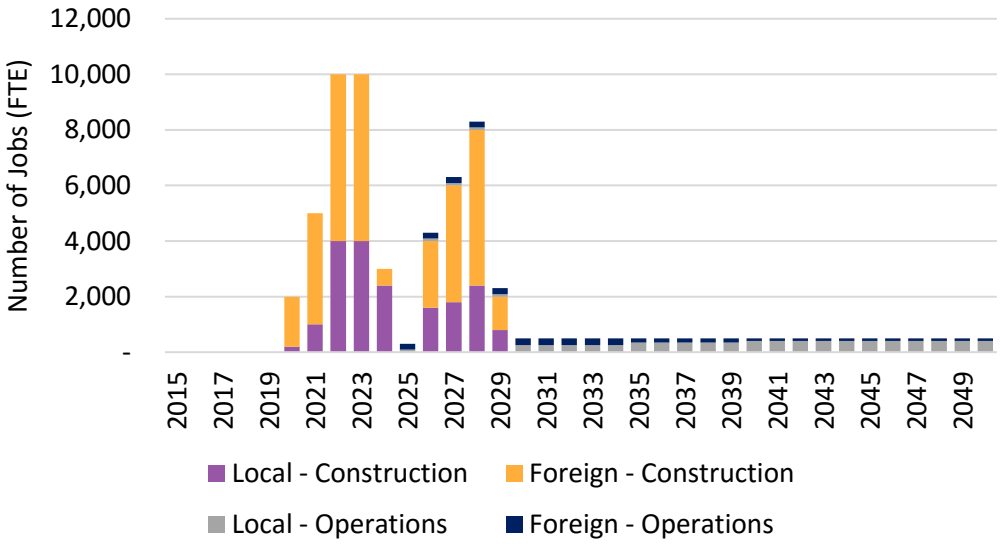
SOURCE: ACIL ALLEN CONSULTING ANALYSIS

3.8.6 Beaço LNG: Employment

The development of the Beaço LNG Plant would have significant employment benefits, both during construction and during the ongoing operations phase. The employment profile[18] for the construction phase is summarised in **Figure 3.25**.

The construction workforce for Train 1 is expected to average around 6,000 workers over the five-year construction period including local and expatriate employees, contractors and administrative and support personnel, with a peak construction workforce of 10,000 in 2022 and 2023. East Timorese nationals are expected to account for almost 40 per cent of the construction workforce, with the proportion of local workers increasing over time. For Train 2, a peak workforce of 8,000 is expected in 2028.

FIGURE 3.25 CONSTRUCTION AND OPERATIONS WORKFORCE DIRECT EMPLOYMENT



NOTE: FTE = FULL-TIME EQUIVALENT

SOURCE: ACIL ALLEN CONSULTING COMPILATION OF INFORMATION PROVIDED BY TIMOR GAP

Post-construction, at the commencement of the Train 1 operational phase in 2025, the project will provide around 300 full-time operating positions per year, rising to 500 operational positions in 2030 when Train 2 comes on line. East Timorese national employees are expected to account for around 30 per cent of the operational workforce initially, rising to 80 per cent by 2040 as more local staff take on operational roles.

3.8.7 Beaço LNG: Sources of Government Income and Direct Cash Flows

This section describes the sources of income to the Government of Timor-Leste expected to flow from the Beaço LNG plant. Direct income to the Government of Timor-Leste comprises:

1. Direct Timor-Leste Government income
   a) Taxation
      i) Company Income Tax
      ii) Wages Tax payable by both construction and operations workers
      iii) Withholding Tax
   b) Import Duty
2. TIMOR GAP dividends

[18] Employment numbers quoted in this section refer to full-time equivalent (FTE) positions, which may be filled by individual workers (typically for local employees) or by two or more individuals working on rotation (typically for expatriate workers).

The national petroleum company of Timor-Leste, TIMOR GAP, will receive income in the form of returns to equity (net profit after tax). We assume that TIMOR GAP pays 100% of retained earnings as dividends to the Timor-Leste Government.

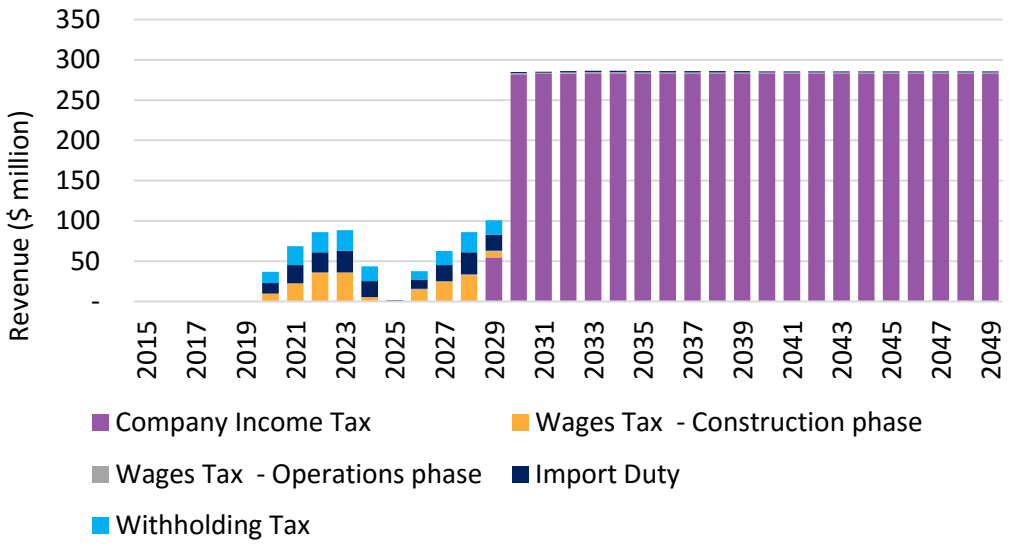
These two components — Direct Timor-Leste Government income and TIMOR GAP dividends — add up to total Timor-Leste Government income.

For the purposes of this analysis, we assume that the current fiscal arrangements in Timor-Leste, and in particular the provisions of the *Taxes and Duties Act 2008*, remain in force over the life of the Beaço LNG Project.

Modelled tax and duty payments

Figure 3.26 shows the modelled payments of taxes and duties to the Government of Timor-Leste as a result of the operation of the Beaço LNG under the Base Case assumptions. Tax and duty payments are estimated to total $6.6 billion over the period to 2050, with company income tax comprising around 91 per cent of that amount. The large step up in company income tax payments in 2030 reflects the contribution from Stage 2 production from this time.

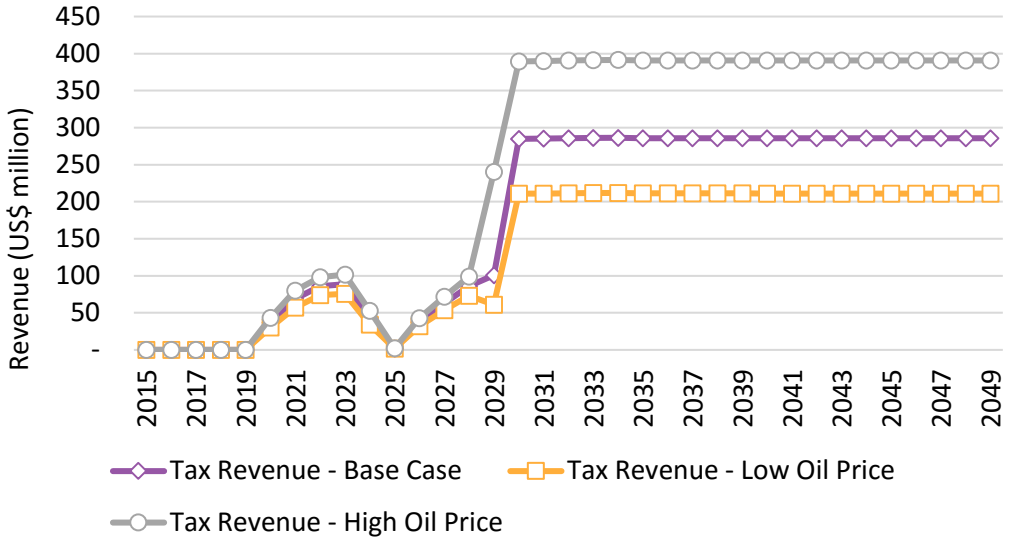
FIGURE 3.26 BEAÇO LNG: GOVERNMENT TAX REVENUE FORECAST (REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

The sensitivity of total government receipts (from taxation and duties) to changes in oil, LNG and LPG has been assessed through the High and Low price cases. The results are summarised in **Figure 3.27**. Over the period from the commencement of construction in 2020 to the end of the projection period in 2050, total government receipts average $213 million per year for the Base Case, $159 million per year for the Low Case and $292 million per year for the High Case.

FIGURE 3.27 BEAÇO LNG COMPARISON OF TOTAL GOVERNMENT REVENUE – BASE CASE, LOW CASE AND HIGH CASE (REAL 2015 TERMS)



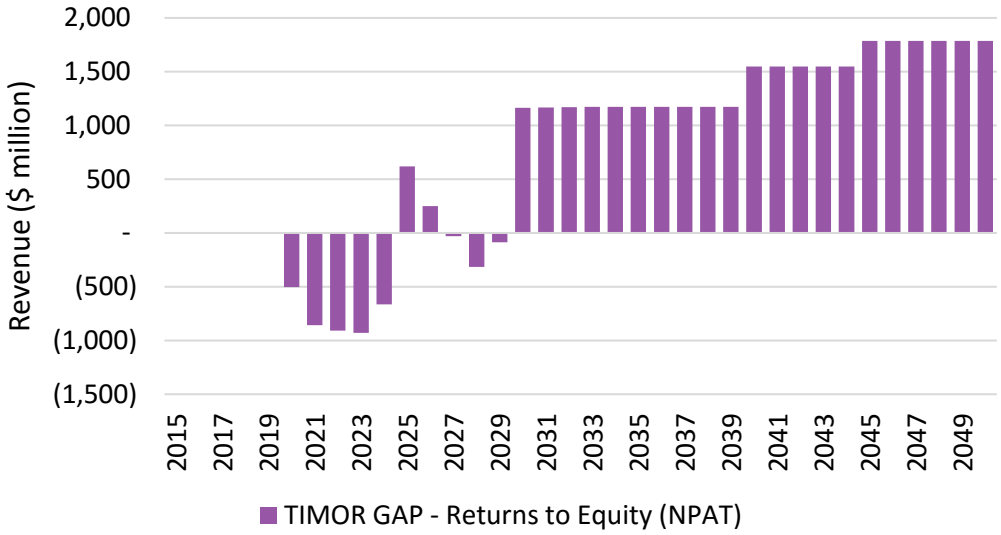
SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Modelled returns to equity

Figure 3.28 shows the modelled returns to equity[19] available to TIMOR GAP as 70% owner of the Beaço LNG Project over the projection period. In total, the Base Case assumptions result in returns to equity of $26.7 billion for TIMOR GAP over the projection period. Equity returns increase over time. Early on there are periods of negative net cash flow during the construction phases. However, after commissioning of the second LNG train, TIMOR GAP's share of net profit rises from around $1.2 billion per year to $1.8 billion per year as the loans used to finance construction (70 per cent gearing assumed) are paid out.

[19] "Returns to equity" are equivalent to net profit after tax, calculated as net revenue less capital contributions, debt repayment (principal and interest), operating costs, taxes and duties.

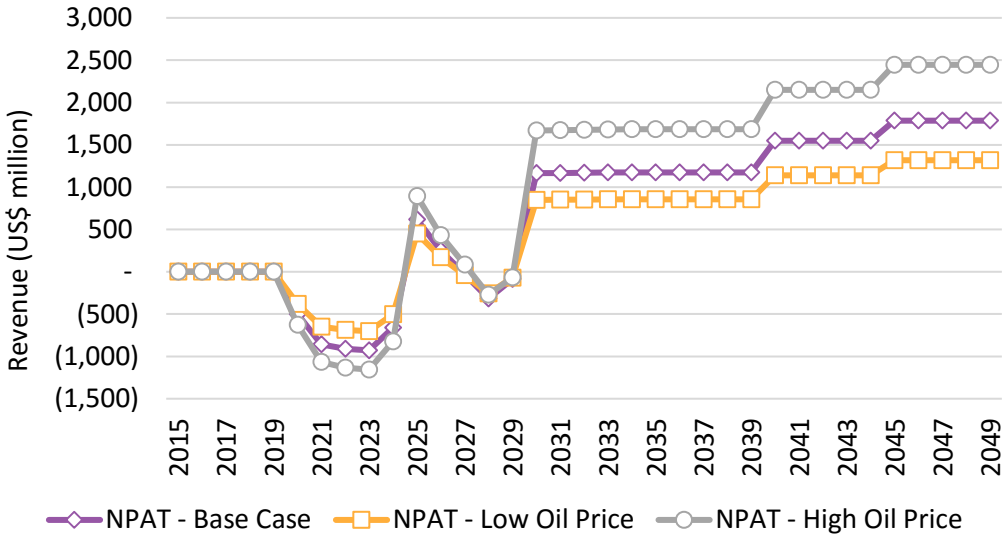
FIGURE 3.28 BEAÇO LNG: MODELLED RETURNS TO TIMOR GAP'S 70 PER CENT EQUITY STAKE



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

The sensitivity of equity returns to changes in oil, LNG and LPG prices has been assessed through the High and Low price cases. The results are summarised in **Figure 3.29**. Over the period from commencement of construction in 2020 to the end of the projection period in 2050, total returns to equity amount to $26.7 billion for the Base Case, $19.5 billion for the Low Case and $38.5 billion for the High Case.

FIGURE 3.29 BEAÇO LNG COMPARISON OF RETURNS TO TIMOR GAP'S SHARE OF EQUITY (NET PROFIT AFTER TAX) – BASE, LOW AND HIGH CASE OIL PRICES (REAL 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

3.9 Supporting infrastructure

In this section we review the main components of the supporting infrastructure for the Suai, Betano and Beaço developments. These include:

— The Highway linking the Suai cluster, the Betano Cluster and the Beaço/Viqueque cluster (see section 2.2.4)

— The Nova Suai Town, industrial park, airport redevelopment and crocodile reserves (see section 2.2.1 and section 2.2.5)
— The Nova Betano Town Development (see section 2.2.5)
— The Nova Beaço, Nova Viqueque Town Developments and Viqueque airport upgrade (see section 2.2.5)

3.9.1 South Coast Highway

The Highway development is described in section 2.2.4. Key assumptions in relation to the direct economic impacts of the highway project are discussed below.

Key assumptions

ACIL Allen has assumed a total construction cost of $313.6 million for first section, based on advice from TIMOR GAP regarding the contract price for this section, plus compensation payments and consultant fees, with a total of $1.32 billion for the entire highway. According to TIMOR GAP, this estimate was obtained through previous studies and reflects Timor-Leste topography and the need for a significant number of bridges. We assume that the cost of construction of the highway is 100 per cent government funded (zero debt).

— Stage I (Suai to Fatukai) is assumed to be constructed over a period of 24 months commencing in 2016 at an estimated cost of $313.6 million.

The costs for Stages 2, 3 and 4 have then been assumed to allocate the $1,010 balance of total capital cost on a distance pro rata basis, with schedule as follows:

— Stage 2 (Fatukai to Betano): two years after Stage 1—2017-2019 at an estimated cost of $285m
— Stage 3 (Betano to Clacuc): two years after Phase 2—2019-2021 at an estimated cost of $287m
— Stage 4 (Clacuc to Beaço): two years after Phase 3—2021-2023 at an estimated cost of $438m

In the absence of detailed information from the proponents, we have assumed that 85 per cent of the total capital cost will relate to equipment and materials. This is generally consistent with the highway construction and maintenance cost breakdown recorded by the World Bank in its 2002 Roads Cost Knowledge System (ROCKS). We assume that 25 per cent of construction capital will be spent locally. We further assume that 90 per cent of the road construction labour cost will be for employment of local workers, with the balance attributed to expatriate workers.

In order to estimate annual operating and maintenance costs for the highway we have examined the World Bank's Road Cost Knowledge System (ROCKS) database which is an extensive compilation on road projects from around the world (World Bank, 2015). We have considered, in particular, the records relating to 2-lane bitumen-sealed roads. The results are summarised in **Table 3.1**.

TABLE 3.1 GLOBAL CONSTRUCTION AND MAINTENANCE COSTS: 2-LANE BITUMEN ROADS

Activity	2002 Cost $/km			2015 Cost $/km		
	Average	High	Low	**Average**	High	Low
New Construction	**1,250,000**	1,880,000	640,000	**2,081,342**	3,130,338	1,065,647
Routine Maintenance	**2,200**	5,580	656	**3,663**	9,291	1,092
Periodic Maintenance	**8,946**	15,783	2,805	**14,896**	26,280	4,671
Ashpalt resurfacing	**68,700**	126,000	21,000	**114,391**	209,799	34,967
Rehabilitation/reconstruction	**226,668**	666,219	20,165	**377,419**	1,109,304	33,576

Note: Conversion to 2015 cost base assumes average annual inflation rate of 4%

SOURCE: ACIL ALLEN CONSULTING ANALYSIS OF WORLD BANK DATA PRESENTED IN (WORLD BANK, 2015)

The data in **Table 3.1** relates to two-lane bitumen roads. All costs in the database are expressed in 2002 US dollar terms. We have converted these to 2015 US dollar equivalents assuming 4% per year annual inflation. We also assume that:

— The cost per kilometre for a 4-lane grade-separated highway will be 2.5 times the cost for a standard 2-lane bitumen road.

— The cost of construction on the south coast of Timor-Leste will be higher than average global costs by a factor of 1.5.

Applying these assumptions to the data on average cost of new road construction presented in **Table 3.1**, the unit cost for building the Suai – Beaço Highway would be about $7.8 million per kilometre, giving a total capital cost for the 152 km highway of $1.2 billion. This is close to the capital cost estimate of about $1.32 billion provided by TIMOR GAP which has been used to model the economics of the highway development.

Table 3.1 also provides unit cost estimates ($/km) for different classes of road maintenance: routine, periodic, asphalt resurfacing and major rehabilitation/reconstruction. We have assumed that routine maintenance spending would be required every year; scheduled maintenance every five years; asphalt resurfacing every 15 years, and major rehabilitation every 50 years. Applying the same uplift factors for 4-lane carriageway and location considerations, this implies a total maintenance spend of about $600 million over 50 years, or an average of about $12 million per year which equates to 0.92 per cent of the total capital cost of the highway per year. For modelling purposes we assume annual road maintenance expenditure equal to 1 per cent of the total capital cost of the highway.

We assume that labour accounts for 25 per cent of road maintenance operations and that all labour for O&M is locally sourced.

On the revenue side, we do not assume any direct revenue from road use. This is a conservative assumption since we should expect that the presence of the highway will result in an increase in the number of vehicle registrations and hence an increase in vehicle registration payments. However we consider the increment is unlikely to be material in the context of the overall Tasi Mane project. The key economic benefits resulting from the highway project will relate to its role as an enabler of other economic activity rather than from revenues directly generated by the road.

3.9.2 New Town Developments

We assume that the cost of new town developments is 100 per cent privately funded, led by commercial developers.

Nova Suai

For the town of Nova Suai we assume a total capital cost of $73 million based on construction of 2,167 dwellings housing 6,500 residents. The 2011 Timor-Leste MDG Project under which a contract was awarded by the National Procurement Commission for the construction of 9,231 houses of four different designs, at a total cost of $99.944 million, resulted in an average of about $10,820 per house. Escalating this cost to 2015 terms would indicate an average cost per dwelling for the Nova Suai town development of around $13,500. However TIMOR GAP has advised that, based on experience with new housing associated with the Suai airport development, a more realistic current cost per dwelling would be $26,000.[20] We have made an allowance for shared common-user infrastructure in the new town equal to 30 per cent of the cost of house construction.

We assume that construction occurs over the period 2016 to 2018, consistent with the timeframe for development of the first stage of the Suai Supply Base.

We assume that the cost of operating and maintaining the new town development will be 5 per cent per year of the cumulative capital invested.

On the revenue side, we assume that all houses are rented out at an annual rate equivalent to 10 per cent of the capital cost of each house, resulting in an average rental rate of about $282/month per household or around 21 per cent of the gross wage of the average local worker.

Suai airport upgrade

Capital cost for the airport upgrade is assumed to be $82.3 million, expended over the period 2015 to 2018. Annual operating costs are assumed to be 1.5 per cent of the cumulative capital invested.

[20] Average cost for a 3-room 90-sqm house with 500-sqm total area.

On the revenue side, we assume that the facilities of the upgraded airport are rented out commercially at an annual rate equivalent to 5 per cent of the capital cost of the upgrade, resulting in an average rental income of about $4.1 million per year.

Suai industrial estate

For the first stage development of the Suai Industrial Estate we assume a capital cost of $20 million. This is based on recent comparable developments in Indonesia and Papua New Guinea[21]. Construction is assumed to occur over the period 2018 to 2019. Annual operating and maintenance costs are assumed to be 3 per cent of cumulative capital invested.

On the revenue side, we assume that the facilities of the industrial estate are rented out commercially at an annual rate equivalent to 5 per cent of the capital cost of construction, resulting in an average rental income of about $1 million per year.

Suai Crocodile reserves

The Suai Supply Base development includes the construction of crocodile reserves at an assumed capital cost of $10 million expended over the period 2018 to 2019. Annual operating cost for the reserves is assumed to be 3 per cent of capital cost of construction, or $300,000 per year.

We have not included any revenue generated by the crocodile reserves in the direct economic impact assessment. In practice, we would expect that there would be a modest amount of revenue earned from local visitors and, increasingly over time, from tourist visits as the Suai supply base becomes established as a cruise ship stopover point.

Nova Betano

The Nova Betano town development is assumed to occur in three phases. The first is to house the population of 5,200 displaced from the existing Betano village. Average household size for the population relocation is assumed to be 5.9 consistent with recent Timor-Leste census data, resulting in a requirement for 881 new houses. Timing for the Phase 1 town development is assumed to be prior to the first construction of the petroleum refinery, therefore over the period 2016 to 2017.

The second phase of town development is to accommodate a workforce and supporting population (total 2,790) for the operations of the first stage of the petroleum refinery. Assuming an average household size of three persons (local and expatriate), this stage sees the construction of 930 new dwellings. The second phase of town development is assumed to occur in 2018 to 2019, in the lead up to commissioning of the first phase of refinery operations.

The third and final phase of town development is to accommodate the workforce and supporting population of 6,510 for the second stage development of the petroleum refinery and petrochemical complex. Again assuming an average household size of three persons, this stage sees the construction of 2,170 new dwellings over the period 2027 to 2029.

The assumptions regarding the average cost per house are the same as for Nova Suai (that is, an average $26,000 per dwelling in real 2015 dollar terms) leading to a total cost for the Nova Betano town development of $104 million for a total of 3,981 dwellings. Again we make an allowance of 30 per cent for shared and common infrastructure, leading to a total cost of $135 million for the Nova Betano development.

We assume that the cost of operating and maintaining the new town development will be 5 per cent per year of the cumulative capital invested.

On the revenue side, we assume that all houses are rented out at an annual rate equivalent to 10 per cent of the capital cost of each house, resulting in an average rental rate of about $282/month per household or around 21 per cent of the gross wage of the average local worker.

[21] Upgrading & Expansion of Salambigar Industrial Park, Brunei Darussalam (Phase 1 and Phase 2) a cost of approximately US$12 .6 million. Development of an agricultural industrial park in East Sepik Province, PNG, at a cost of K40 million, equal to about US$14 million (see http://www.looppng.com/content/israelis-spend-k40m-sepik-industrial-park).

Viqueque municipality

Nova Beaço

The Nova Beaço development will accommodate about 1,900 people, primarily local residents who will be relocated as a result of the development of the LNG plant. We assume average household size of 5.9, hence a requirement for about 322 dwellings. At an average cost per dwelling of $26,000 (same as for the other new town developments) plus an allowance of 30 per cent for shared and common infrastructure, the total cost of the Nova Beaço development is estimated at $10.9 million.

Again we assume that the cost of operating and maintaining the new town development will be 5 per cent per year of the cumulative capital invested.

On the revenue side, we assume that all houses are rented out at an annual rate equivalent to 10 per cent of the capital cost of each house, resulting in an average rental rate of about $282/month per household or around 21 per cent of the gross wage of the average local worker.

Nova Viqueque

The Nova Viqueque development will house 6,400 residents, mainly the workforce of LNG plant and their families and contractors, plus supporting services population. We assume average household size of 3 persons per household (local and expatriate) hence a requirement for 2,133 dwellings. As for the other town developments we assume an average price per dwelling of $26,000 plus an allowance of 30 per cent for shared and common infrastructure, resulting in a total estimated capital cost of $72 million for the Nova Viqueque town development.

We again assume that the cost of operating and maintaining the new town development will be 5 per cent per year of the cumulative capital invested.

On the revenue side, we assume that all houses are rented out at an annual rate equivalent to 10 per cent of the capital cost of each house, resulting in an average rental rate of about $282/month per household or around 21 per cent of the gross wage of the average local worker.

Viqueque airport upgrade

We have been informed by TIMOR GAP that the upgrade of Viqueque airport will be less extensive than the ongoing Suai airport upgrade. In the absence of any specific cost estimates for the Viqueque airport upgrade, we have assumed capital costs equal to 50 per cent of the Suai upgrade or about $41 million.

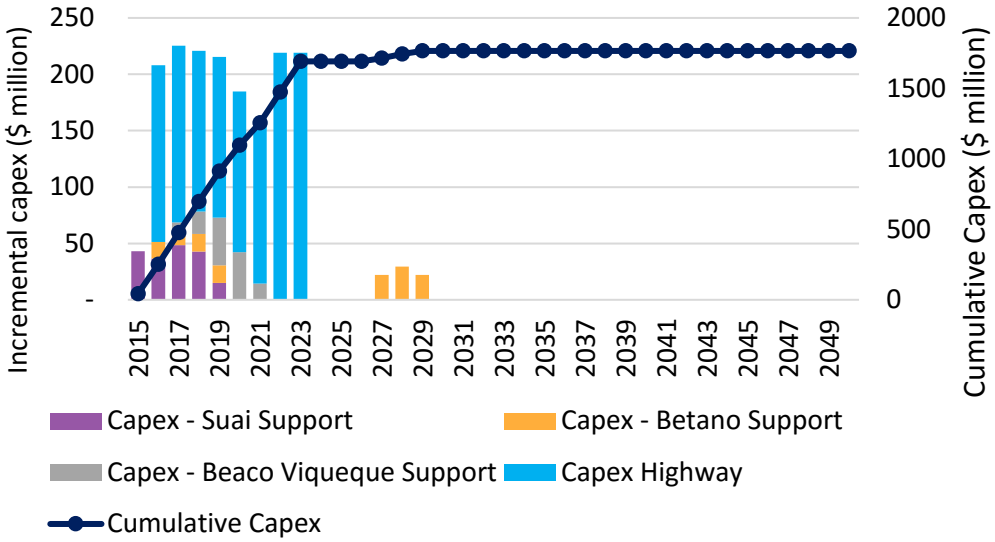
As with the Suai airport, we assume annual operating costs to be 1.5 per cent of the cumulative capital invested, or about $0.6 million per year.

On the revenue side, we assume that the facilities of the upgraded airport are rented out commercially at an annual rate equivalent to 5 per cent of the capital cost of the upgrade, resulting in an average rental income of about $2 million per year.

3.9.3 Direct economic impacts of the supporting infrastructure

The annual capital expenditure profile for provision of supporting infrastructure is shown in **Figure 3.30**. Over the project life, capital expenditure totals $1.77 billion, incurred mainly over the period between 2016 and 2023. Actual timing will depend upon the construction program for the Suai supply base, Betano refinery and Beaço LNG plants. As can be seen, the majority of capital expenditure ($1.3 billion) relates to the construction of the four lane highway linking the three industrial clusters.

FIGURE 3.30 CAPITAL EXPENDITURE FOR SUPPORTING INFRASTRUCTURE



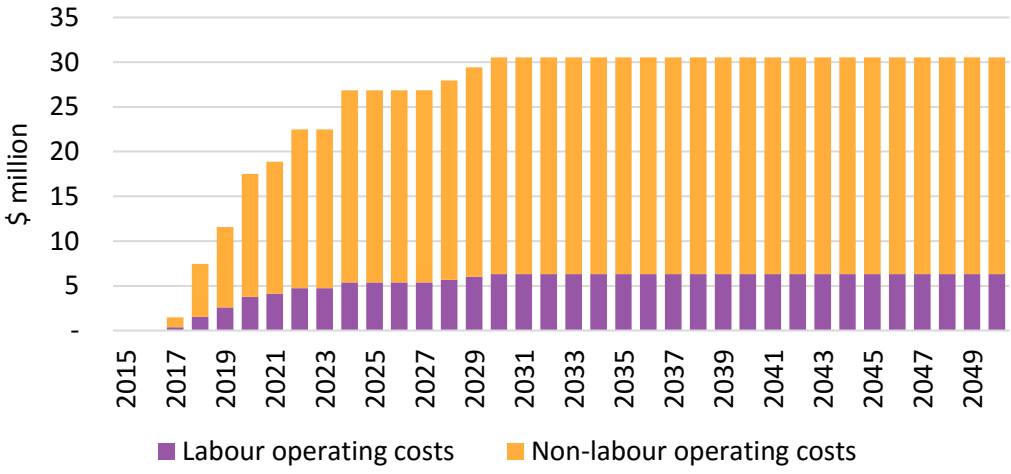
SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Capital equipment and bulk materials are assumed to account for about 82 per cent of total capital cost, with the balance attributed to labour. The equipment component of capital, which totals $1.46 billion, is assumed to be sourced 25 per cent locally and 75 per cent from imports. The labour component of capital expenditure on supporting infrastructure which totals $310 million is assumed to be sourced 90 per cent locally with 10 per cent being expatriate labour.

Operating expenditure

The recurrent operating expenditure profile for supporting infrastructure over the period to 2050 is shown in **Figure 3.31**. Operating expenditure varies as a function of cumulative capital investment. It reaches a plateau level about $30 million per year following the completion of construction activities in 2030. Total operating expenditure over the projection period to 2050 is $908 million. On average, operating costs comprise 79 per cent non-labour costs and 21 per cent labour costs.

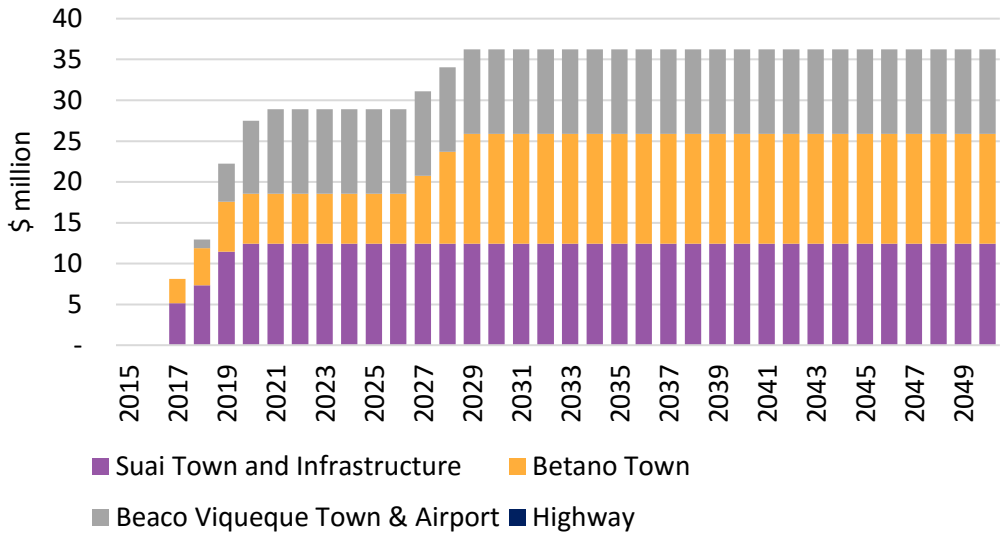
FIGURE 3.31 OPERATING EXPENDITURE FOR SUPPORTING INFRASTRUCTURE



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

The supporting infrastructure is assumed to earn modest amounts of revenue from rental of housing and commercial facilities. As shown in **Figure 3.32** rental income reaches about $35 million per year with the largest contributors being commercial operations of the upgraded Suai and Viqueque airports. Total rental income from supporting infrastructure over the project life is estimated to be $1.1 billion.

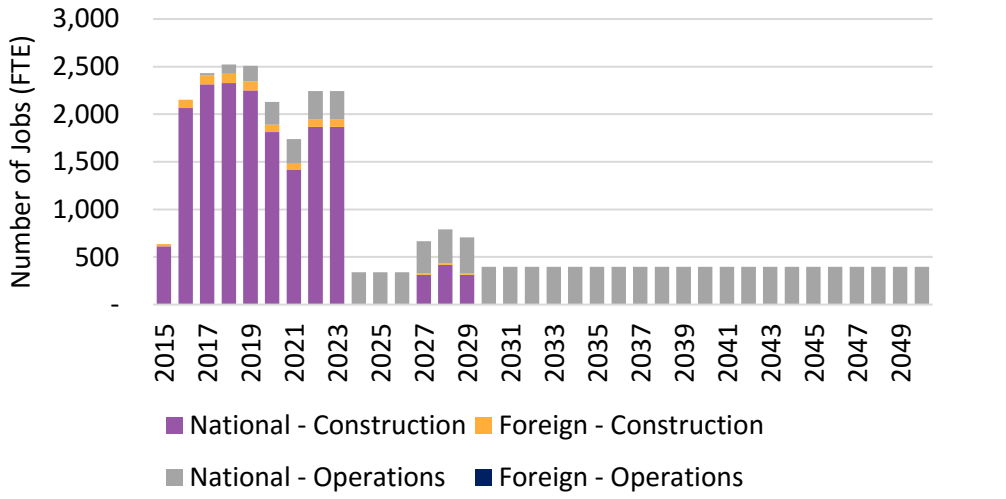
FIGURE 3.32 RENTAL INCOME FROM SUPPORTING INFRASTRUCTURE



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

The development of the supporting infrastructure will involve a significant workforce, particularly during the construction period. The employment profile for the construction and operational phases is summarised in **Figure 3.33**. The construction workforce is expected to peak at around 2,500 workers in 2018 and 2019, with the main construction activities spread over the period 2016 to 2023. This period will see an average construction workforce of more than 2,000 workers, most of whom are expected to be recruited locally. The shape and duration of this period of high construction activity will, of course, depend on the final timing of the supply base, refinery and LNG projects.

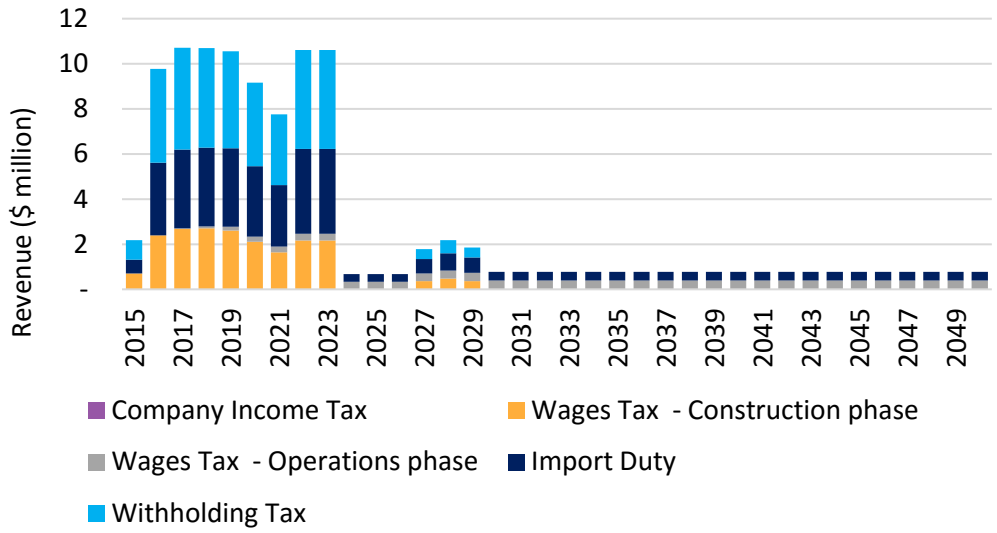
FIGURE 3.33 CONSTRUCTION AND OPERATING EMPLOYMENT FOR SUPPORTING INFRASTRUCTURE



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

The workforce required for ongoing operation and maintenance of the supporting infrastructure is relatively modest, at about 400 workers. All of these are assumed to be East Timorese. **Figure 3.34** summarises the returns to government through taxation and duty receipts as a result of the construction and operation of supporting infrastructure. As can be seen, the only significant government revenues contributed directly by supporting infrastructure are associated with withholding tax, import duty, and wages income tax during the construction phase. Under the revenue assumptions employed in this analysis, the operation of supporting infrastructure does not generate profits and therefore no company tax is paid. The contributions of import duty and withholding tax are effectively payments by the government to itself. Direct tax revenues from supporting infrastructure during the operational phase are not expected to be significant.

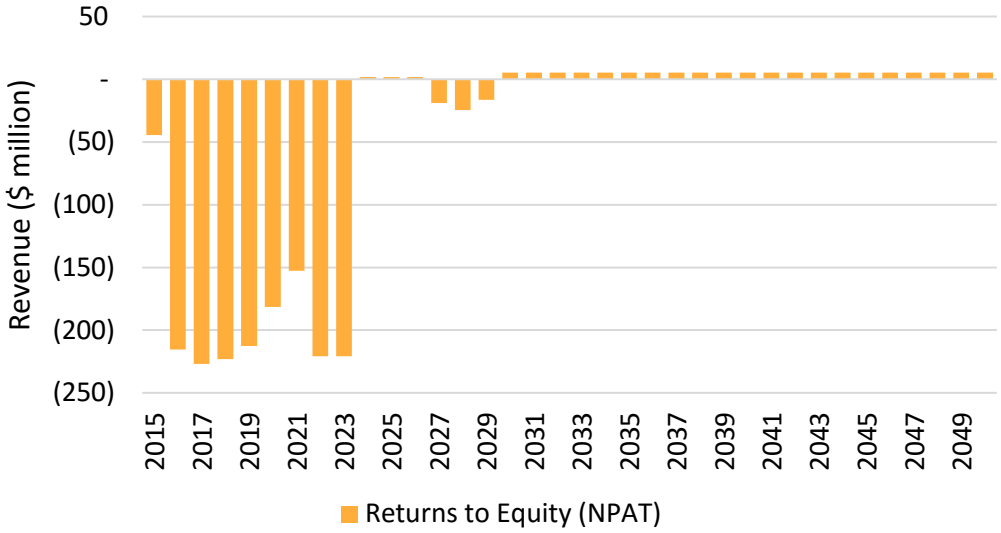
FIGURE 3.34 GOVERNMENT TAX AND DUTY RECEIPTS FOR SUPPORTING INFRASTRUCTURE



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Figure 3.35 shows equity contributions and returns to equity associated with the investment in supporting infrastructure. Clearly the investment in supporting infrastructure is not expected to generate significant direct profits. Rather, the provision of road, town and airport infrastructure represents an investment by the government to make possible the successful development of the revenue-generating supply base, petroleum refinery and petrochemical facility and the LNG facility. Over the period to 2023, the provision of supporting infrastructure will represent a net investment (total costs less revenues), principally by the government, of about $1.6 billion in order to facilitate the core elements of the Tasi Mane project.

FIGURE 3.35 GOVERNMENT EQUITY CONTRIBUTIONS AND RETURNS FOR SUPPORTING INFRASTRUCTURE



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

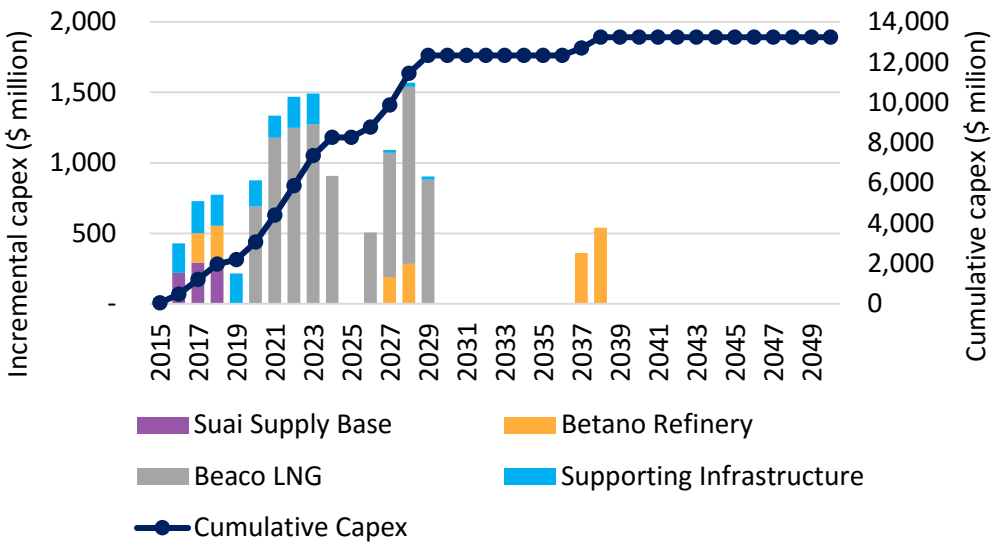
3.10 Consolidated Tasi Mane Project Direct Economic Impacts

In this section we summarise the direct economic impacts of the Tasi Mane Project as a whole by consolidating the results of analysis of the individual project components (Suai Supply Base, Betano Refinery, Beaço LNG Plant and supporting town developments, highway and airport upgrades).

We find that on a consolidated basis and under the Base Case assumptions, the consolidated project has a post-tax internal rate of return **(IRR) of 10.7 per cent,** with a net present value **(NPV) of $436 million** assuming a real discount rate of 10 per cent (in line with TIMOR GAP's standard practice). At a real discount rate of 5 per cent (higher than the Petroleum Fund average return) the NPV rises to $8.3 billion.

The consolidated capital expenditure profile for the Tasi Mane project is shown in **Figure 3.36**. Total capital expenditure is about $13.2 billion expended mainly over the period 2016 to 2029. Of this amount, the total Government financing is expected to be about US$ 2.2 billion, with the rest being financed by commercial arrangements between TIMOR GAP and its Joint Venture partners in the form of Project Financing schemes. By far the largest portion of the capital expenditure (67 per cent) is associated with the Beaço LNG facilities. The Betano refinery and petrochemical plant accounts for about 14 per cent of total capital cost, the Suai supply base for 6 per cent and the supporting infrastructure about 13 per cent of total capital cost.

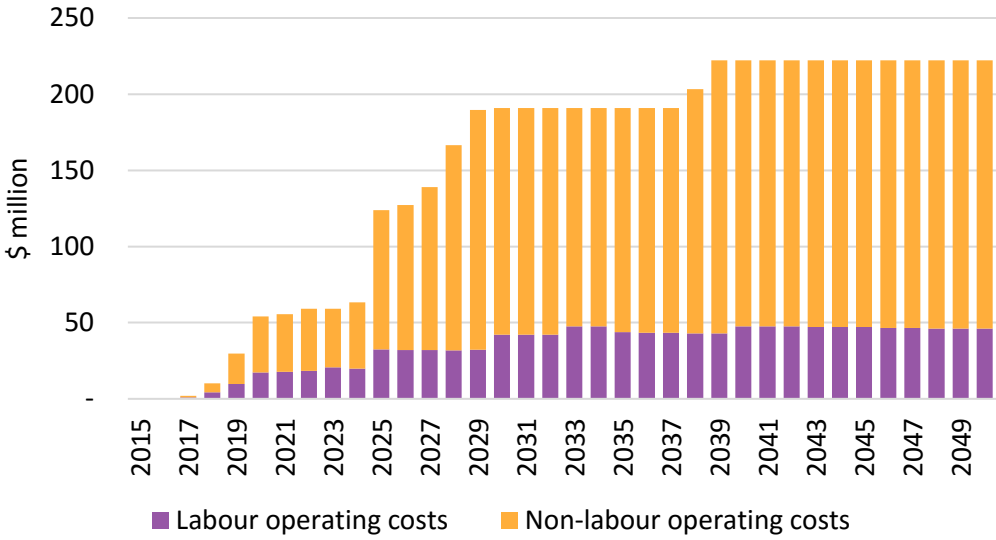
FIGURE 3.36 CAPITAL EXPENDITURE FOR CONSOLIDATED TASI MANE PROJECT



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Operating expenditure for the consolidated project reaches a maximum level of about $222 million per year in 2039 with the commissioning of the Betano Stage 3 project. Around 78 per cent of operating expenditure is expected to be non-labour.

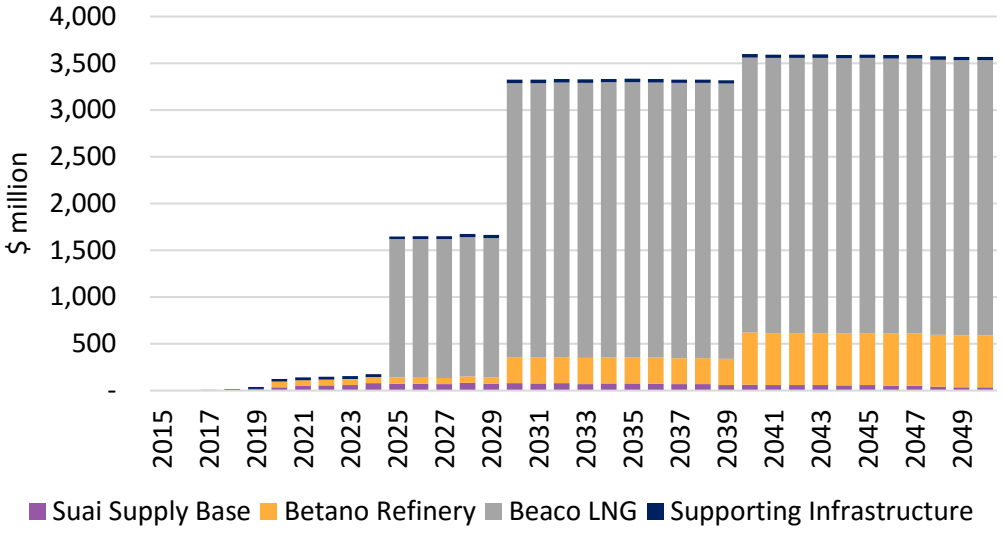
FIGURE 3.37 OPERATING EXPENDITURE FOR CONSOLIDATED TASI MANE PROJECT



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

The net revenue from production and services sold from the consolidated Tasi Mane project is shown in **Figure 3.38**. The total net value of output over the life of the project is estimated at about $78.3 billion. Of this amount, some 85 per cent is derived from the LNG project, with the refinery and petrochemical complex contributing 12 per cent of the total, and the supply base 2 per cent.

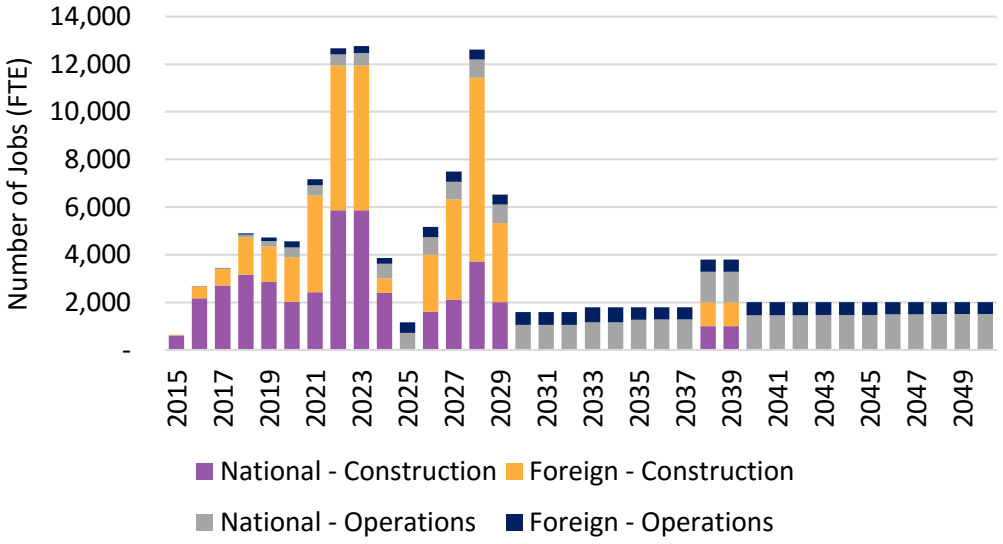
FIGURE 3.38 NET REVENUE FROM PRODUCTION AND SERVICES SOLD FOR THE CONSOLIDATED TASI MANE PROJECT



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Figure 3.39 shows the number of construction and operating jobs for the consolidated Tasi Mane project. Given the current assumptions about timing of construction of the various project elements, there is a large peak construction workforce over the period 2022 to 2023, with up to 12,700 workers engaged in construction at this time. A second peak of around 12,600 workers in 2028 corresponds to construction of the second LNG train and the second stage of the Betano complex. These workforce peaks clearly have implications for the recruitment and housing of a large number of transient workers. Following completion of construction activities, the consolidated project provides ongoing employment for around 2,000 workers, the majority of whom are expected to be East Timorese.

FIGURE 3.39 CONSTRUCTION AND OPERATING EMPLOYMENT FOR CONSOLIDATED TASI MANE PROJECT

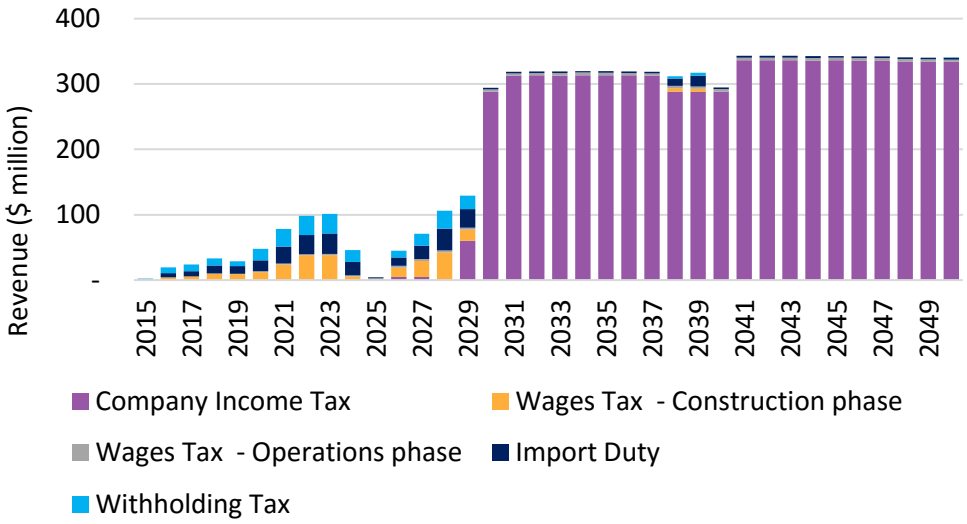


SOURCE: ACIL ALLEN CONSULTING ANALYSIS

Figure 3.40 shows the forecast government tax and duty receipts for the consolidated project. During the construction phase, most tax revenue comes from wages income tax, import duty and withholding

tax. Once the project is fully operational, most government tax revenue comes from company income tax. Altogether, tax and duty receipts over the life of the project are estimated at about $7.4 billion of which approximately 87 per cent is attributable to company income tax, 5 per cent to import duty, 5 per cent to wages income tax and 3 per cent to withholding tax during the construction period.

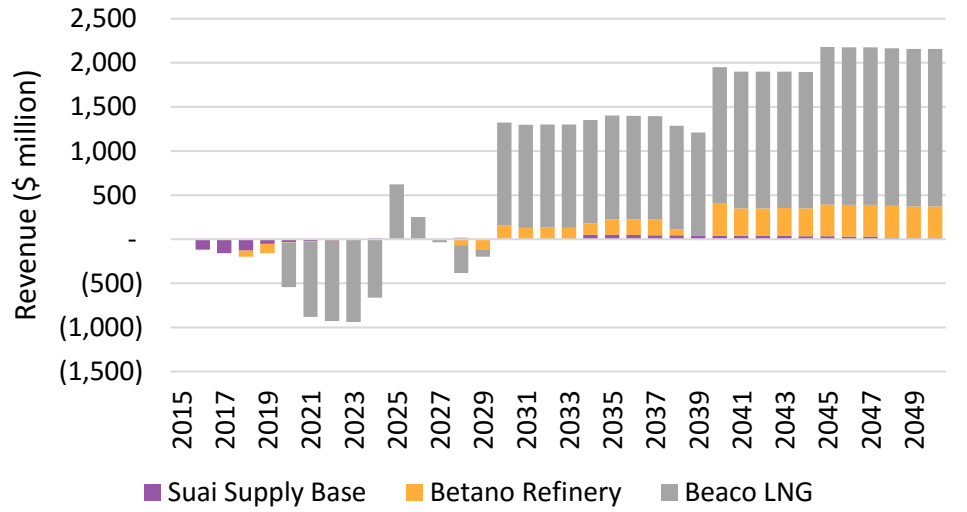
FIGURE 3.40 GOVERNMENT TAX AND DUTY RECEIPTS FOR CONSOLIDATED TASI MANE PROJECT



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

TIMOR GAP's investment in the Suai Supply Base, Betano refinery and petrochemical complex and Beaço LNG plant provide significant positive post-tax returns after the initial period of investment. As shown in **Figure 3.41** the consolidated project yields positive returns to equity from 2030 on, rising to around $2.2 billion per year from 2045 (when the last of the project debt is retired). The modelling shows that, under the Base Case assumptions for oil and petroleum product prices and capital costs, the project will generate about $31.5 billion net profit for TIMOR GAP over the life of the project.

FIGURE 3.41 EQUITY CONTRIBUTIONS AND RETURNS FOR CONSOLIDATED TASI MANE PROJECT



SOURCE: ACIL ALLEN CONSULTING ANALYSIS

4 INDIRECT ECONOMIC IMPACTS

4.1 Timor-Leste economic context

4.1.1 Key economic indicators

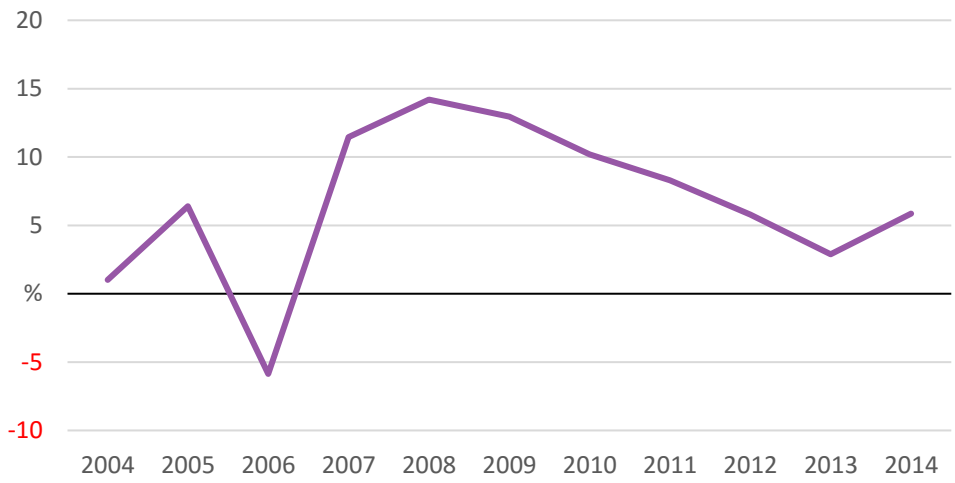
Gross Domestic Product and Gross National Income

The Gross Domestic Product (GDP) of Timor-Leste has grown substantially over the last ten years from $1.1 billion in 2004 to $4.2 billion in 2014 (nominal) (Ministry of Finance, 2015[22]). On a per capita basis, GDP grew from $1,158 in 2004 to $2,370 in 2014 (nominal) over the same period (Ministry of Finance, 2015).

Given the unique nature of the Timor Leste economy, when assessing the growth in the economy it is also useful to look at the non-oil sector GDP. Between 2002 and 2014 non-oil sector GDP grew $466 million to $1,400 million (nominal) (Ministry of Finance, 2015). The non-oil sector economy has also grown substantially in real terms. In 2012, 2013 and 2014, non-oil GDP grew in real terms by 5.8 per cent, 2.9 per cent, and 5.9 per cent, respectively. **Figure 4.1** below shows year-on-year real growth in GDP (non-oil) between 2004 and 2014 (Ministry of Finance, 2015). The recent decline in the rate of GDP growth is at least in part the result of a deliberate policy to moderate growth by reining in public sector expenditure (Ministry of Finance, personal communication).

[22] Ministry of Finance, 2015, *Timor Leste National Accounts 2000-2014*, General Directorate of Statistics, Dili, December.

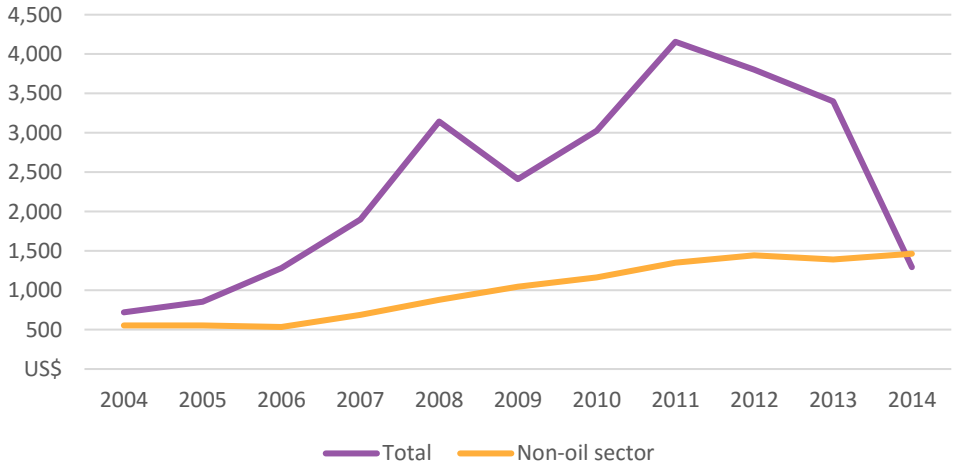
FIGURE 4.1 TIMOR-LESTE REAL YEAR-ON-YEAR GDP GROWTH 2004 TO 2014



SOURCE: MINISTRY OF FINANCE, 2015

While GDP is one measure of economic output, Gross National Income (GNI) and GNI per capita may provide greater insight into the economic status of Timor-Leste residents. Historically, the nominal GNI of Timor-Leste has also grown strongly increasing from $685 million in 2004 to $4.6 billion in 2011 before falling to $1.5 billion in 2014 as a result of falling oil prices (Ministry of Finance, 2015). Timor-Leste GNI per capita from the non-oil sectors of the economy has grown substantially in terms between 2004 and 2014, from $555 in 2002 to $1,464 in 2014 (nominal) (Ministry of Finance, 2015). However, as illustrated in **Figure 4.2** below, total GNI per capita has varied substantially over this period – principally due to fluctuations in oil prices.

FIGURE 4.2 TIMOR-LESTE GROSS NATIONAL INCOME PER CAPITA 2004-2014 (US$ PER PERSON)



SOURCE: MINISTRY OF FINANCE, 2015

Population

The population of Timor-Leste is increasing strongly, although its rate of growth is diminishing. The July 2015 Census recorded the population of Timor-Leste to be 1.167 million, an increase of 101,000 from the population of 1.066 million recorded in the 2010 Census. The population increased by 9.46 per cent in the period 2010 to 2015 compared to an increase of 15.51 per cent in the period 2004 to 2010 (Government of Timor-Leste, 2015b).

Personal remittances

Personal remittances are an important part of the Timor-Leste economy. Remittances increased from $3.6 million in 2006 to a high of $137.1 million in 2010 and $136.9 million in 2011 before decreasing to $33.6 million in 2013 (2015 US$) (World Bank, 2015e).

Forecasts

Under a business-as-usual scenario, the International Monetary Fund (IMF) forecasts that Timor-Leste will have real GDP (non-oil) growth of 4.3 per cent in 2015, 5.0 per cent in 2016 and 6.0 per cent in 2017 (IMF,2015). The Timor-Leste Government forecasts that GDP (non-oil) will be $1.681 billion (nominal) in 2015, growing to $2.691 billion (nominal) in 2019.

4.1.2 National budget

Context

The budget of the National Government of Timor-Leste is highly dependent on petroleum-related revenues. The approved 2015 State Budget includes expenditure of $1.570 billion funded by non-petroleum domestic revenues of $170.4 million, $1.328 billion from the Petroleum Fund, $70 million in public loans, and $2.1 million in cash (nominal) (Government of Timor-Leste, 2015a).

The overall levels and components of expenditure and revenue in the State Budget have changed over time. Expenditure (including loans) has increased from $1.105 billion (nominal) in 2011 varying between $1.081 billion in 2013 and $1.570 billion in 2015. Revenues from domestic taxation have increased from $105 million in 2011 to $170 million in 2015 (Government of Timor-Leste, 2015a).

Petroleum Fund for Timor-Leste

In 2005, the Parliament of Timor-Leste passed the *Petroleum Fund Law* (Law No. 9 /2005), which established the Petroleum Fund for Timor-Leste and provided that petroleum revenues are to be paid into the Fund. Monetary transfers from the Petroleum Fund to the State Budget can only be made through Parliamentary appropriation in respect of a particular fiscal year.

The Petroleum Fund had a balance of $16.6 billion at the end of the third quarter of 2014 and the Timor-Leste Government estimated that the balance would increase to $18.9 billion by the end of 2019 (Government of Timor-Leste, 2015a). Revenues from the Petroleum Fund have been used to assist with the funding of the State Budget.

Extractive Industries Transparency Initiative

The Timor-Leste Government has signed up to the Extractive Industries Transparency Initiative (EITI) and is an EITI Compliant Country, indicating that it has been confirmed as meeting all EITI requirements (Extractive Industries Transparency Initiative, 2015a). The EITI is "an international standard for openness around the management of revenues from natural resources" (Extractive Industries Transparency Initiative, 2015b). Under the EITI, the Timor-Leste Government is required to disclose the revenues it receives from extractive companies operating in the country. It must publish reports disclosing revenues from the extraction of Timor-Leste's natural resources and payments it receives from those companies. Companies extracting resources must also report payments they make to governments. These various reports are reconciled by an independent party and are then reported on in an EITI Report (Extractive Industries Transparency Initiative, 2015b). Timor-Leste is the first country in the Asia-Pacific region and third in the world to achieve full EITI compliance.

Forecasts

The Timor-Leste Government forecasts that total State Budget expenditure will increase between 2015 and 2019 while having material year-on-year variations. Expenditure is forecast to be $2.089 billion in 2016, reducing slightly to $2.033 billion in 2017, then reducing to $1.840 billion in 2018 and then $1.645 billion in 2019. Capital expenditure is the major contributor to this year-on-year variation in expenditure with $468 million in 2015, $933 million in 2016, $833 million in 2017 and then $350

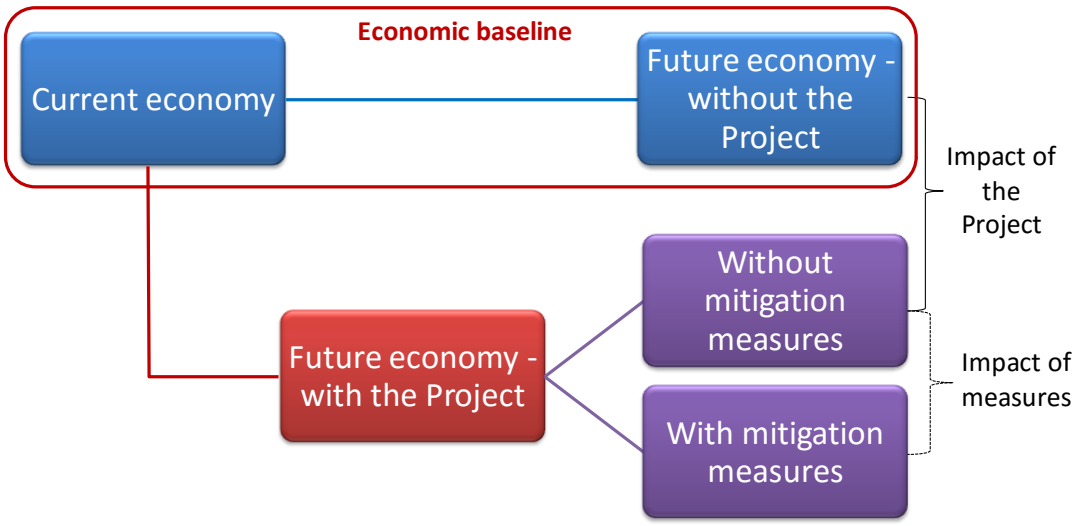
million in 2019. Other expenditure components are forecast to increase gradually to 2019 (Government of Timor-Leste, 2015a).

The Timor-Leste Government forecasts that domestic taxation revenue will continue growing from $179 million in 2015 to $209 million in 2019 (Government of Timor-Leste, 2015a). The State Budget is forecast to still be strongly dependent on funding from the Petroleum Fund in 2019.

4.2 Estimation of indirect economic impacts

Large, complex resource and infrastructure projects such as the integrated Tasi Mane project can be expected to have indirect economic impacts that are felt throughout the host economy. These economic impacts arise because the various sectors of the economy are interrelated: the output of one economic sector provides inputs to other economic sectors. These interrelationships can be represented in what are referred to as "input-output tables". The inputs of labour and capital required to undertake a major infrastructure project will tend to draw resources away from some sectors of the economy, while providing growth opportunities for other supporting sectors. Hence it is usual to find that some economic sectors benefit from the development while other economic sectors may experience adverse changes.

FIGURE 4.3 KEY ELEMENTS OF THE ECONOMIC IMPACT ANALYSIS



SOURCE: ACIL ALLEN CONSULTING

Figure 4.3 provides a summary of the key elements that are required for an economic impact analysis. The first part of the analysis establishes a so-called "economic baseline" by establishing the current size and configuration of the economy and projecting how the current economy would be likely to change in future *in the absence of the project*. The second part of the analysis involves a projection of the economy in the future *with the project included*. The difference between the future economy with the project and the baseline economy without the project provides a measure of the economic impacts of the project. The size of that economic impact may depend upon whether or not the government implements *mitigation measures* to reduce potential adverse impacts on some sectors of the economy. For example, carrying out the project may result in competition for labour resources that drives up cost in traditional areas of the economy such as agricultural production, thereby reducing competitiveness. Mitigation measure might look to limit this effect by investing some of the income form the project into productivity-enhancing infrastructure.

The exact scope for any particular study depends on the specific circumstances of the project and client needs. For example, the analysis can focus purely on the macroeconomic impacts (that is,

GDP/GNP, real income, aggregate employment and so forth) or it can also include the potential microeconomic impacts (that is, industry impacts, employment by industry, and so forth). Finally the analysis may or may not include the study of a range of socio-economic impacts such as changes to the local housing and rental market, impacts on social cohesion, cultural identity or the potential impacts on disadvantaged residents. For this project, we have focussed on the macro-economic and micro-economic impacts rather than the social impacts.

Economic baseline

The first task in the indirect economic impact analysis is to establish a picture of the current national economy of Timor-Leste and the outlook for the economy in the absence of the integrated Tasi Mane project. This is an important part of an economic impact assessment as it provides the basis for determining the potential impacts of the proposed project.

To create the economic baseline, we have analysed key economic variables including:

— population and demographic factors and trends
— the structure of the economy including major industries and their relative contributions to economic performance
— characteristics of the workforce, including employment and unemployment (total and by industry), skill levels and wage rates
— an understanding of local businesses – particularly those that may be affected by the integrated Tasi Mane project.

The analysis has sought to take into account both the current situation in Timor-Leste and a range of key developments that are likely to happen in the region in the coming years. This includes anticipated population growth, any other planned and potential major projects, anticipated government policy changes and other key drivers shaping the future economic growth of the nation. This analysis has relied primarily on publically data published by the Timor-Leste Government, key industry proponents, organisation such as the World Bank and the IMF and ACIL Allen's own internal databases and projections developed as part of our prior experience in studying the economy of Timor-Leste.

A key question regarding the future economy is: What would be likely to happen in the absence of the integrated Tasi Mane project? This is a critical question since it will determine the nature and magnitude of the economic benefits associated with the Project.

Economic impact analysis

Having determined the economic baseline, ACIL Allen has constructed economic forecasts of the region incorporating the construction and operation of the integrated Tasi Mane project. Comparing the forecasts against the baseline provides an assessment of the incremental economic contribution of the proposed developments (see **Figure 4.4**). This element of the assessment has necessarily used project data supplied by TIMOR GAP.

There are essentially two components to forecasting the likely economic impacts of the Project: 'economic modelling' and 'mitigation management'. These components are discussed in turn.

Economic modelling

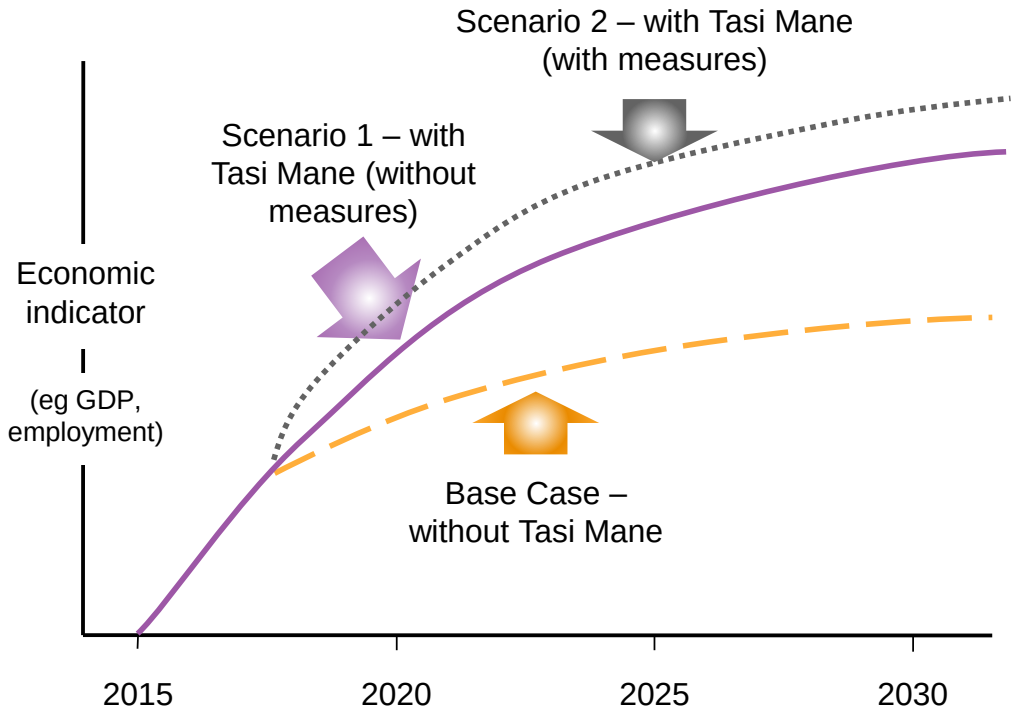
Economic modelling has been used to analyse the economic impact of the integrated Tasi Mane Project in terms of direct and indirect effects on employment, income and production.

Two approaches can be used to clarify the economy wide impacts of a major development such as this. One approach is to estimate input-output (I-O) multipliers directly from input-output databases for Timor-Leste. An alternative approach is to use an input-output database in conjunction with a computable general equilibrium (CGE) model of the economy. The selection of the right tool is critical to the accuracy of the projected impacts.

Fundamentally, although various aspects of a policy or project such as the number of jobs or the size of the investment expenditure are of relevance to certain stakeholders, the key aggregate measure of the impact of a project is the extent to which the total wealth of the economy changes as a result of the policy or project. Typically this is measured at the national level by real gross national disposable

income (RGNDI), although real gross domestic product (GDP) and consumer surplus (among others) can also be important aggregate measures depending on the nature of the policy or project being analysed.[23]

FIGURE 4.4 ILLUSTRATIVE SCENARIO DEVELOPMENT



Note: This is a stylised representation only. In reality impacts can be positive, negative or a mixture through time.

SOURCE: ACIL ALLEN CONSULTING

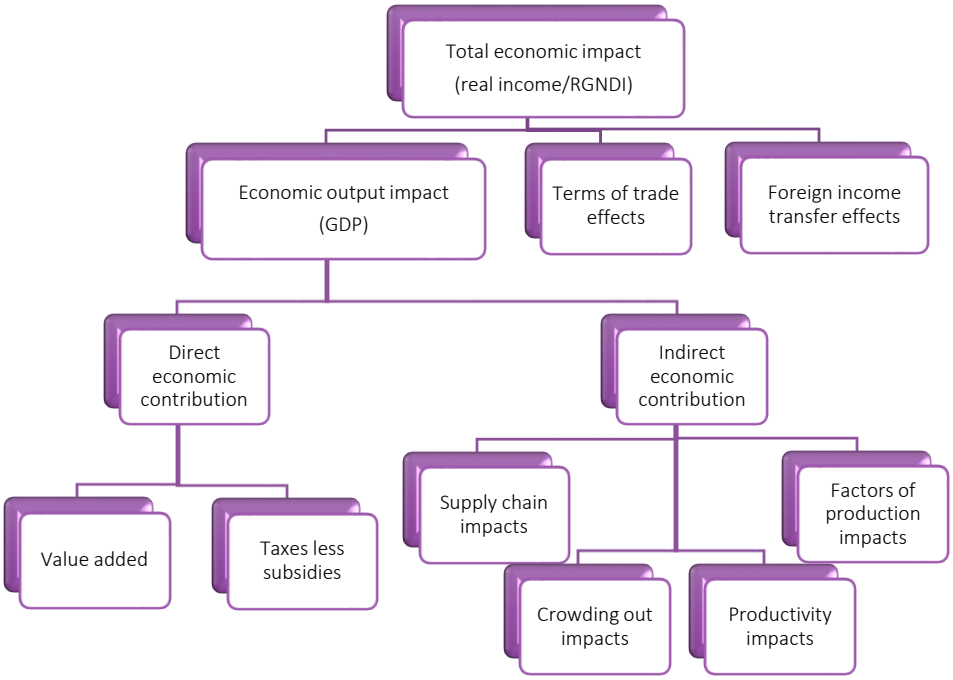
The main factors that need to be considered when analysing the economic impacts of a project or policy include:

- the direct and indirect contribution to the economy as a result of the activities associated with the project
- any 'crowding out' implications, which is where the use of scarce resources in one project means that resources are diverted from other productive activities, potentially 'crowding out' those activities by delaying or preventing them from occurring
- any productivity effects generated as a direct result of the policy or project activities – particularly any enduring productivity changes or productivity spillovers to other activities not directly associated with the project or policy
- any changes to the factors of production in the economy
- any welfare implications associated with changes in terms of trade or foreign income transfers
- whether there is a dynamic element to the size of any of the above effects (for example due to different phases of the project).

Figure 4 shows these components graphically. Some of these effects may have negligible impact while others may be very significant and an understanding of the relative size of these effects helps determine the most appropriate tool(s) for the analysis.

[23] Analysis of any non-market impacts (such as the loss of biodiversity, changes in air quality, social justice implications, and so forth) may also be relevant in assessing the full implications of a project or policy. However, these are outside the scope of this project.

FIGURE 4.5 ESTIMATING THE ECONOMIC IMPACT OF A PROJECT OR POLICY



SOURCE: ACIL ALLEN CONSULTING

For many projects, static estimates of the direct economic contribution and supply chain implications can be obtained through the use of I-O multipliers. Estimating the size of other components using multiplier techniques is either not possible or very complex, as is estimating the economic impacts through time. In contrast, most CGE models are able to estimate all of the components shown in **Figure 4.5**, with dynamic CGE models able to estimate the impacts through time. The greater complexity of CGE models enables a much broader range of economic impacts to be considered within a single framework provided the necessary data inputs are available.

For this project ACIL Allen has used a CGE model in which Timor-Leste has been disaggregated from the "Rest of Southeast Asia" region in the economic databases.

Management measures

The development of the integrated Tasi Mane Project has a number of potential implications that need to be managed in order to ensure that the economic benefit accruing to the people of Timor-Leste is maximised. The project will have strong benefits, but may also entail some risks. Maximising these benefits and mitigating risks will require implementation of a range of management measures.

Impacts that need to be managed by government and others include provision of social and economic infrastructure, property management, labour supply and local business facilitation. Many of these issues are likely to be analysed in other studies as part of the social impact assessment. However, in the context of the economic impact analysis attention will be needed to be given to factors such as the potential use of local employment and potential local business content in the project; opportunities for education and training given job opportunities and the skill set of local people; cost inflation and potential impacts on trade competitiveness with consequent crowding out of traditional economic activities.

4.3 Measures of macro-economic impacts

One of the most commonly quoted macroeconomic variables at a national level is real gross domestic product (real GDP), which is a measure of the aggregate output generated by an economy over a given period of time (typically a year). GDP may be calculated in different ways:

— On the expenditure side by adding together total private and government consumption, investment and net trade.
— On the income side as the sum of returns to the primary factors of production (labour, capital and natural resources) employed in the national economy plus indirect tax revenue.

Although the term 'economic output' is often used, the acronym GDP has been used in the discussion of the relevant results presented in this report.

Measuring the impact of a policy or project using just real GDP may disguise investments or policy changes that are not beneficial in the overall economic welfare sense. This is because it is possible for real GDP to increase while at the same time consumers may be worse off as measured in terms of real income. In such circumstances people and households would be worse off despite economic growth.

This leads to a preference for considering real income effects. Real income is a measure of the ability to purchase goods and services, adjusted for inflation. A rise in real income indicates a rise in the capacity for current consumption, but also an increased ability to accumulate wealth in the form of financial and other assets. The change in real income from a development is a measure of the change in welfare of the people in an economy. As shown in **Figure 4.5**, the change in real income at a national or regional level can be measured by the change in real GDP plus the change in external income transfers and the change in the nation's or region's terms of trade (which measures the purchasing power of the nation's or region's exports relative to its imports). As many residents in different countries around the world have experienced first-hand in recent years, changes in the terms of trade can have a substantial impact on residents' welfare independently of changes in real GDP and is important to include in economic welfare measures. In global CGE models such as *Tasman Global*, the change in real income is equivalent to the change in consumer welfare using the equivalent variation measure of welfare change resulting from exogenous shocks. Hence, it is valid to say that the projected change in real income (from *Tasman Global*) is also the projected change in consumer welfare.

4.4 Indirect Impacts

As discussed previously in Section 3.2, the Tasi Mane Project development has been assessed under three Cases. Section 4.5 focusses on the impacts as assessed under the **Base Case** which assumes long-run oil prices rise year-on-year from current levels, averaging approximately US$77 per barrel (in real 2015 terms).

The **Low Price Case** and **High Price Case** are presented as sensitivities in Section 4.6.

There are a number of complexities in modelling such a large and potentially nation-changing project such as Tasi Mane in the context of an emerging economy the size of Timor-Leste.

— Many of the local people are reported to be subsistence or near-subsistence farmers.
— Infrastructure connections (notably, road, air and sea) are poor and unreliable (although it is understood that access to telecommunications and electricity is relatively good).

These factors mean that markets in the South Coast region are underdeveloped and relatively unsophisticated. The lack of reliable transport routes makes it difficult, for example, to gain access to national and international supply chains. This lack of access to broader and deeper markets is a barrier for locals to move out of subsistence or near-subsistence lifestyles because they are physically unable to trade at certain times of the year or it is relatively very expensive (especially in terms of time and effort) to undertake trade. This limits the amount of division of labour and specialisation that is the hallmark of developed economies.

FIGURE 4.6 EXAMPLE OF POOR ROAD SECTIONS IN TIMOR-LESTE

Note: Example of a section of road between Dili and Ainaro before upgrades commenced in 2011.

SOURCE: WORLD BANK (http://www.worldbank.org/en/results/2016/05/12/timor-leste-connecting-people-through-climate-resilient-roads)

The challenge for locals across the South Coast is that current access routes are of poor quality and are often impossible to travel along, particularly during the rainy season as there are many river crossings and hilly areas experience landslides. This is not only caused by the effects of the weather, but also by a lack of maintenance and poor design, with many roads lacking drainage infrastructure and strong foundations. As a result of these road conditions, communities are effectively isolated with high vehicle operating and freight costs and journey times. Due to the lack of any natural harbour on the South Coast, and the expense of air travel being too great for most purposes, alternate options are generally not available. This is a physical barrier that hinders the ability for people to develop small-medium businesses and also impacts on people gaining access to key services such as health and education.

The planned highway with asphalt pavement as part of the Supporting Infrastructure will make a more climate resilient access route between villages and improve connectivity to Dili. In addition, the highway should reduce the number of emergency incidents, the cost of responding to them as well as reduce the overall cost of keeping roads in serviceable condition through the year. Combined with the new all-season harbour at Suai, the Tasi Mane Project will enable residents throughout the South Coast to obtain reliable access routes to domestic and international markets. How residents will take advantage of this access is difficult to predict. However, when combined with well-defined property rights with suitable enforcement, access to justice and a peaceful environment, the region should be well positioned to take advantage of whatever comparative advantages may exist throughout the region.

Modelling these “emergent” economic growth gains is highly challenging, because experience shows that the specific businesses that develop vary greatly from village to village. For this reason the core modelling of the Tasi Mane Project has not assumed any “unlocking” or enhancement of labour or capital productivity beyond the movement of people from low skilled occupations to higher skilled occupations in response to the opportunities presented by the other project elements.

Consequently, the estimated economy-wide benefits of the Tasi Mane Project are likely to underestimate the true potential of the Project.

4.5 Base Case

Real GDP and real income

A summary of the projected impacts for components of the aggregate change in real GDP and real income for each scenario are presented in **Table 4.1**. **Figure 4.7** shows the change in Timor-Leste real GDP and real income for each year of the projection period under the Base Case (with the Tasi Mane Project) compared to the Reference Case where there is no project.

TABLE 4.1 PROJECTED CUMULATIVE CHANGE IN REAL GDP AND REAL INCOME AS A RESULT OF THE TASI MANE PROJECT (BASE CASE), RELATIVE TO THE REFERENCE CASE (IN 2015 TERMS)

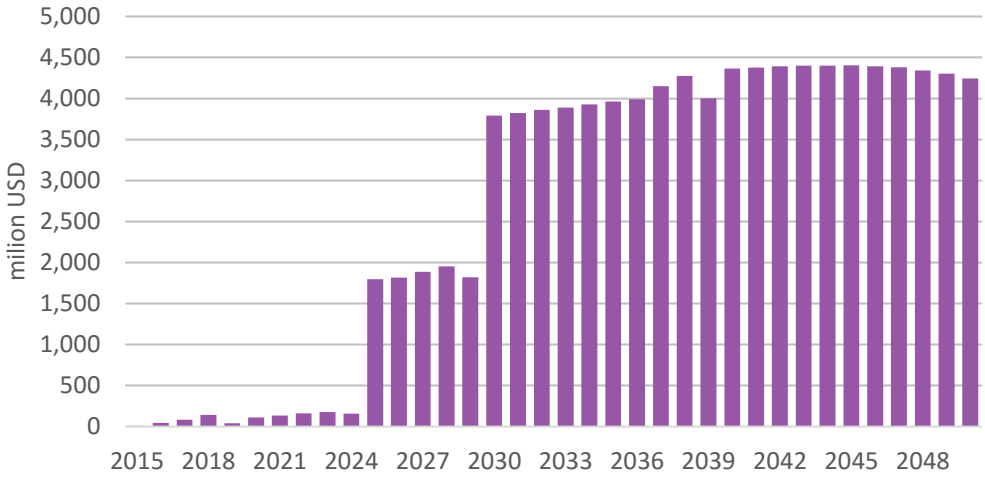
	Total (2015 to 2050)	Net present value		
		4%	7%	10%
	US$m	US$m	US$m	US$m
Private consumption	12,599	5,131	2,809	1,626
Government consumption	31,139	11,947	6,249	3,457
Investment	9,401	8,150	6,983	5,938
Net foreign trade	44,890	14,879	6,034	1,844
– *Real exports*	48,710	20,500	11,395	6,620
– *Contribution of imports*	–3,820	–5,621	–5,361	–4,776
Real GDP	**98,029**	**40,107**	**22,074**	**12,865**
Terms of trade	2,379	757	318	126
Net foreign income transfers	33,907	12,688	6,528	3,569
Real income	**134,316**	**53,552**	**28,920**	**16,560**

Note: Net present values are calculated using real discount rates. NPV calculations begin from 2015.

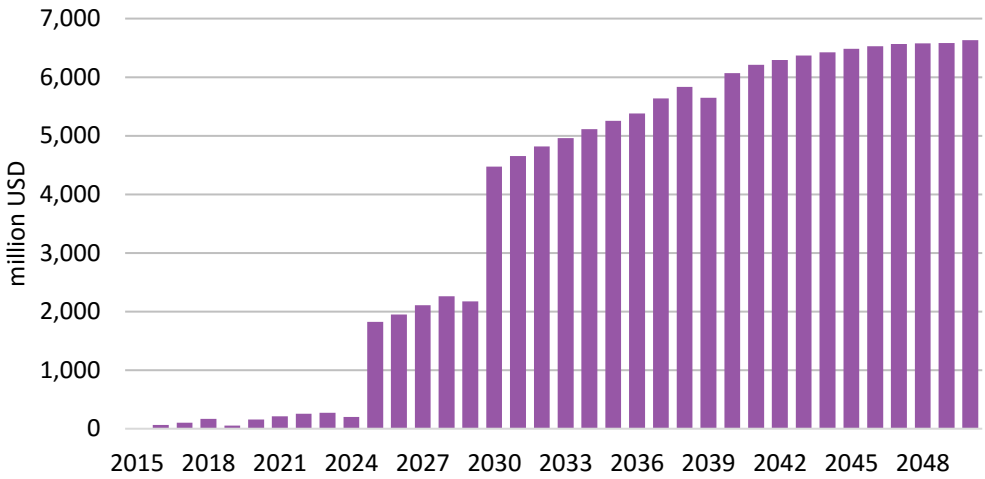
SOURCE: ACIL ALLEN CONSULTING TASMAN GLOBAL MODELLING

FIGURE 4.7 CHANGE IN TIMOR-LESTE REAL GDP AND REAL INCOME AS A RESULT OF THE TASI MANE PROJECT (BASE CASE), RELATIVE TO THE REFERENCE CASE (IN 2015 TERMS)

A. Real GDP



B. Real income



SOURCE: ACIL ALLEN CONSULTING TASMAN GLOBAL MODELLING

Real GDP

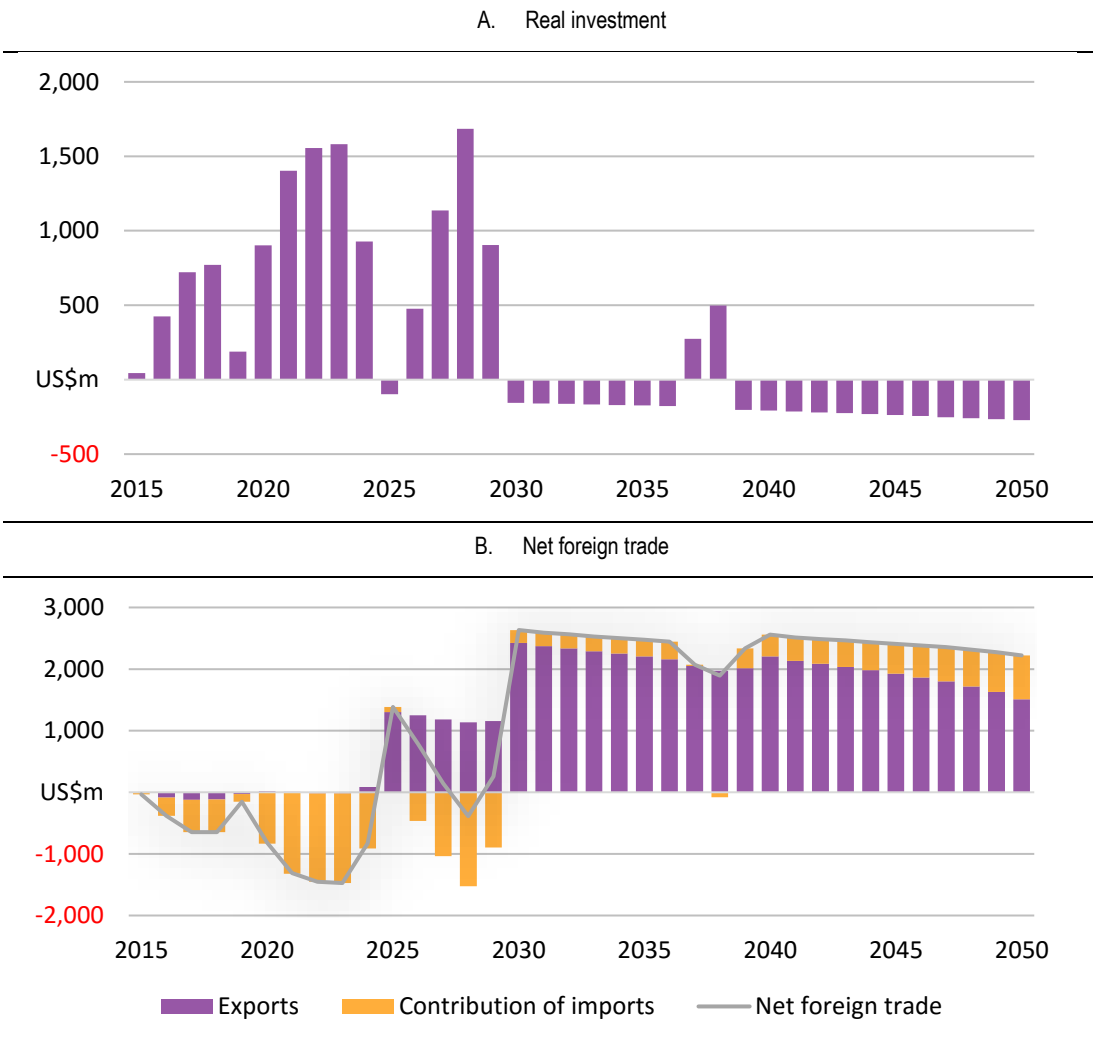
Over the period 2015 to 2050 the Tasi Mane Project is projected to increase the real GDP of Timor-Leste by a cumulative total of US$98 billion (with a net present value of US$22.1 billion, using a 7 per cent real discount rate). To place this in perspective, the discounted present value is more than five times greater than Timor-Leste's 2015 estimated total GDP and nearly 15 times the estimated non-oil sector GDP. This is a very significant change arising from a single project.

The projected impact of the project on real GDP largely follows the profile of the revenues generated by the project. The impact of the US$8.2 billion capital expenditure between 2015 and 2024, prior to first production of the LNG in 2025, is small compared to the operations phase. This occurs for two reasons. First, the majority (88 per cent) of the capital expenditure is on foreign equipment and foreign labour, hence the increase in investment is largely offset by a simultaneous increase in imports (see **Figure 4.8**). Second, it is the operations phase that generates the key benefits of the Project – namely, through the monetisation of otherwise unutilised resources. In contrast, the construction phase is largely increasing demand for scarce factors of production and so has a smaller effect on GDP compared to the size of the investment. Another way to view this is to note that investment is an alternative form of consumption. All else being equal, it does not add to the productive capacity of the

economy. Only when the operations phase begins is the productive potential of the economy increased (and consequently the real output, or GDP).

Although not modelled, real GDP is expected to continue to be higher relative to the Reference Case even after the Tasi Mane Project has finished. This is because a portion of the higher incomes obtained during the period to 2050 will have been invested into additional capital stock, thereby increasing the longer term productive potential of the economy relative to the Reference Case through capital deepening.

FIGURE 4.8 CHANGE IN TIMOR-LESTE REAL INVESTMENT AND NET FOREIGN TRADE AS A RESULT OF THE TASI MANE PROJECT (BASE CASE), RELATIVE TO THE BASE CASE (IN 2015 TERMS)



SOURCE: ACIL ALLEN CONSULTING TASMAN GLOBAL MODELLING

Real income

As discussed in Section 4.3, real income is a measure of the ability to purchase goods and services, adjusted for inflation. A rise in real income indicates a rise in the capacity for current consumption, but also an increased ability to accumulate wealth in the form of financial and other assets. The change in real income from a development is a measure of the change in the economic welfare of the residents in an economy.

The extent to which the Timor-Leste residents will benefit from the additional GDP depends on the level of ownership of the capital (including the natural resources) utilised in the business as well as any wealth transfers undertaken by the Timor-Leste government as a result of the taxation revenues generated by the Tasi Mane Project. A substantial portion of the welfare effect associated the Tasi

Mane project is projected to come from an improvement in Timor-Leste's terms of trade (adding US$2.4 billion, as shown in **Table 4.1**).

In total, over the period 2015 to 2050, under the Base Case, the Tasi Mane Project is projected to increase the real income of Timor-Leste residents by a cumulative total of US$134.3 billion, relative to the Reference Case (with a net present value of US$28.9 billion, using a 7 per cent real discount rate).

4.5.2 Impact by project element

Table 4.2 and **Figure 4.9** present the projected impacts of the Tasi Mane project by each of the four major project elements. As can be seen, it is projected that, of the US$98.0 billion increase in the real GDP of Timor-Leste over the period 2015-2050:

- US$478 million is nominally due to the construction and operation of the supporting infrastructure
- US$2.7 billion is due to the Suai Supply Base
- US$11.6 billion is due to the Betano Refinery and Petrochemical Complex
- US$83.2 billion is due to the Beaço LNG facility.

Similarly, of the US$134.3 billion increase in Timor-Leste real income:

- Negative US$172 million (–US$172 million) is nominally due to the construction and operation of the supporting infrastructure
- US$5.3 billion is due to the Suai Supply Base
- US$15.8 billion is due to the Betano Refinery and Petrochemical Complex
- US$113.3 billion is due to the Beaço LNG facility.

It should be noted that these splits are based on the individual financial models constructed for each of the major project elements (as discussed in Chapter 3); they are not necessarily an indication of the relative merit of each individual business case.

The small negative for the Supporting infrastructure element is due to the ongoing operating costs exceeding the estimated direct project revenues.

TABLE 4.2 PROJECTED CUMULATIVE CHANGE IN REAL GDP AND REAL INCOME BY PROJECT ELEMENT (BASE CASE), RELATIVE TO THE REFERENCE CASE (IN 2015 TERMS)

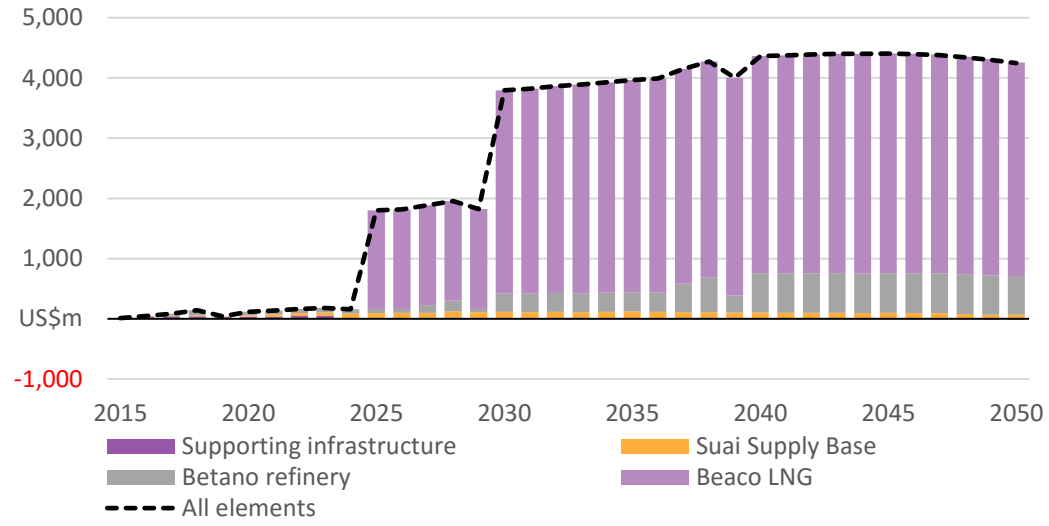
	Real GDP		Real income	
	Total (2015 to 2050)	NPV 7%	Total (2015 to 2050)	NPV 7%
	US$m	US$m	US$m	US$m
Supporting infrastructure	478	310	–172	159
Suai Supply Base	2,746	794	5,331	1,549
Betano Refinery	11,615	2,390	15,830	3,169
Beaço LNG	83,191	18,580	113,326	24,044
Total	**98,029**	**22,074**	**134,316**	**28,920**

Note: Net present values are calculated using real discount rates. NPV calculations begin from 2015.

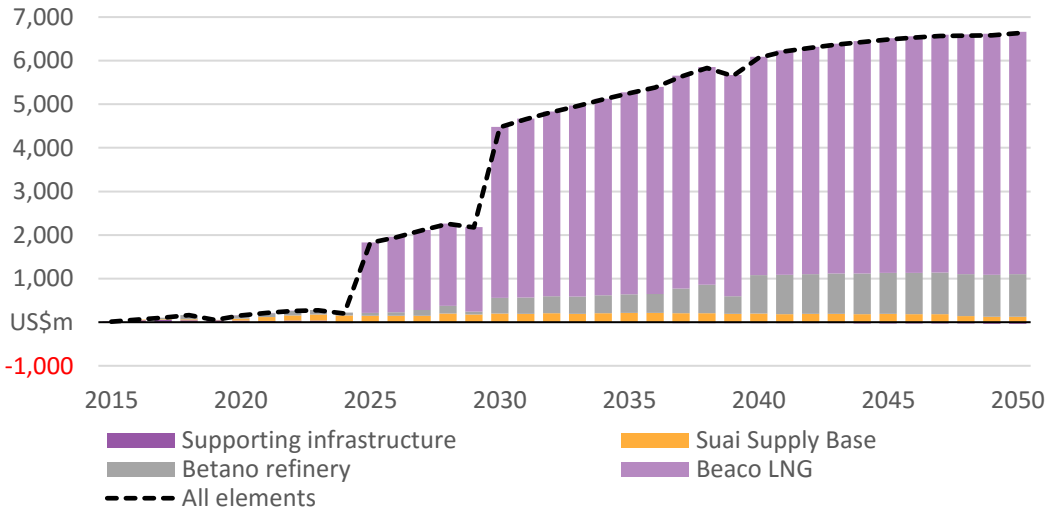
SOURCE: ACIL ALLEN CONSULTING TASMAN GLOBAL MODELLING

FIGURE 4.9 CHANGE IN TIMOR-LESTE REAL GDP AND REAL INCOME BY PROJECT ELEMENT (BASE CASE), RELATIVE TO THE REFERENCE CASE (IN 2015 TERMS)

A. Real GDP



B. Real income



SOURCE: ACIL ALLEN CONSULTING TASMAN GLOBAL MODELLING

4.6 Price sensitivity

This section examines the sensitivity of the projected impacts of the Tasi Mane Project under each scenario to lower and higher product prices (called the Low Price Case and High Price Case, respectively).

In particular, the **Base Case** assumes that long-run oil prices will average US$77.24 per barrel (in real 2015 terms). In addition to the **Base** Case, the direct economic impacts of the Tasi Mane project were assessed under a **Low Price Case** and a **High Price Case** (see Chapter 3) where long-run oil prices changed by approximately ±34 per cent. In particular:

— Under the **Low Price Case** long-run oil prices are assumed to average US$51.10 per barrel (–34 per cent). Petroleum product and LNG prices are benchmarked to oil on a similar basis as for the Base Case.

— Under the **High Price Case** long-run oil prices are assumed to average US$103.50 per barrel (+34 per cent). Petroleum product and LNG prices are benchmarked to oil on a similar basis as for the Base Case.

All other assumptions are assumed to remain the same. The results are presented in **Table 4.3**.

TABLE 4.3 SENSITIVITY OF PROJECTED REAL GDP AND REAL INCOME TO CHANGING COMMODITY PRICES

	Real GDP		Real income	
	Total (2015 to 2050)	Difference from Study Case	Total (2015 to 2050)	Difference from Study Case
	US$m	US$m	US$m	US$m
Base Case	98,030	–	134,316	–
Low Price Case	70,882	–27,148	96,820	–37,495
High Price Case	131,053	60,171	180,009	83,189

SOURCE: ACIL ALLEN CONSULTING TASMAN GLOBAL MODELLING

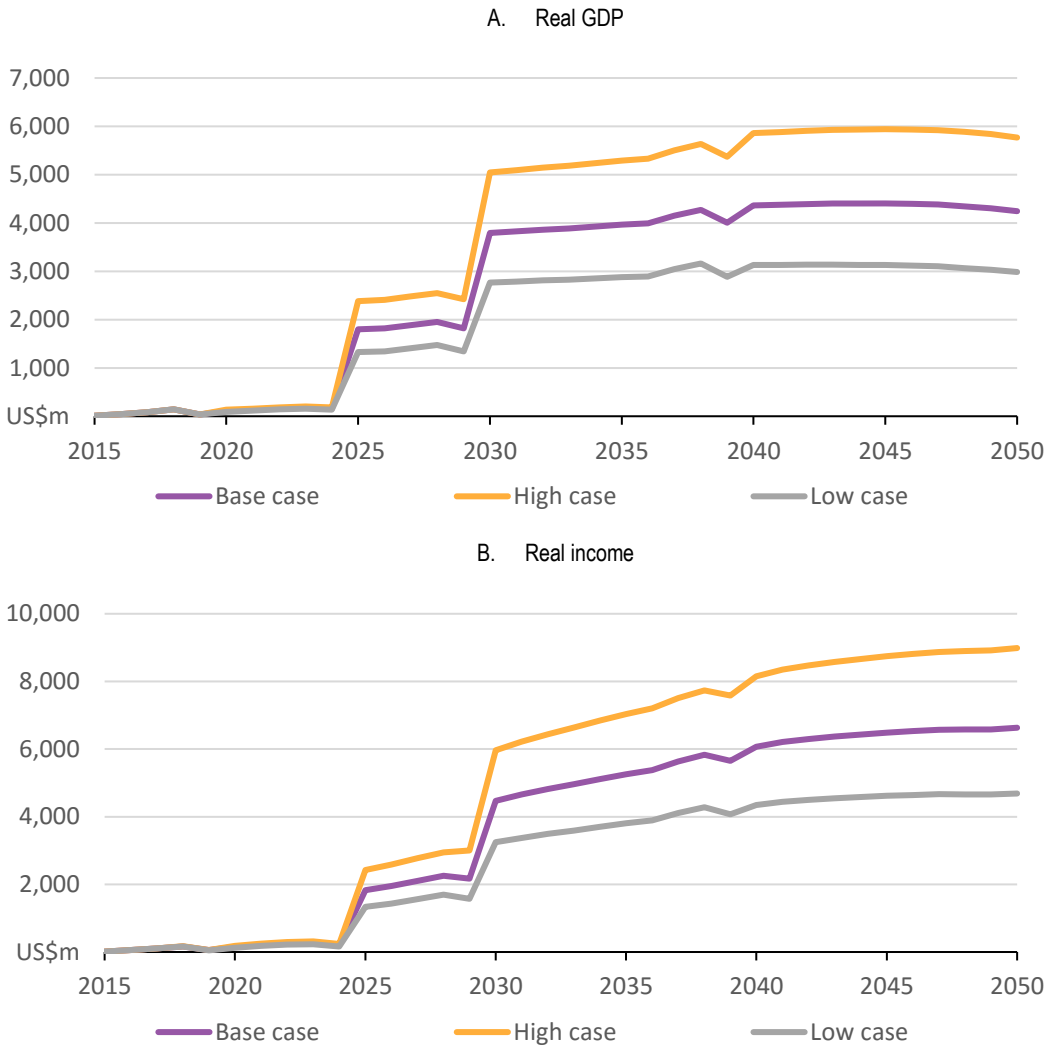
As can be seen from **Table 4.3**, a change in the average underlying prices assumed for the analysis of the Project will have a disproportionate upside benefit with:

— a –34 per cent change in the long-run oil price, changing the projected impact on Timor-Leste's real GDP and real income over the forecast period by approximately –28 per cent (or by –$27.1 billion and –$37.5 billion, respectively)

— a +34 per cent change in the long-run oil price, changing the projected impact on Timor-Leste's real GDP and real income over the forecast period by approximately +34 per cent (or by +$60.2 billion and +$83.2 billion, respectively).

The year on year impacts on real GDP and real income under the three cases are presented in **Figure 4.10**.

FIGURE 4.10 CHANGE IN SELECTED MACROECONOMIC VARIABLES UNDER THE BASE CASE, LOW PRICE CASE AND HIGH PRICE CASE, RELATIVE TO THE REFERENCE CASE



SOURCE: ACIL ALLEN CONSULTING TASMAN GLOBAL MODELLING

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A OVERVIEW OF *TASMAN GLOBAL*

A.1 Overview

Tasman Global is a dynamic, global computable general equilibrium (CGE) model that has been developed by ACIL Allen for the purpose of undertaking economic impact analysis at the regional, state, national and global level.

A CGE model captures the interlinkages between the markets of all commodities and factors, taking into account resource constraints, to find a simultaneous equilibrium in all markets. A global CGE model extends this interdependence of the markets across world regions and finds simultaneous equilibrium globally. A dynamic model adds onto this the interconnection of equilibrium economies across time periods. For example, investments made today are going to determine the capital stocks of tomorrow and hence future equilibrium outcomes depend on today's equilibrium outcome, and so on.

Thus a dynamic global CGE model, such as *Tasman Global*, has the capability of addressing total, sectoral, spatial and temporal efficiency of resource allocation as it connects markets globally and over time. Being a recursively dynamic model, however, its ability to address temporal issues is limited. In particular, *Tasman Global* cannot typically address issues requiring partial or perfect foresight, however, as documented in Jakeman et al (2001), it is possible to introduce partial or perfect foresight in certain markets using algorithmic approaches. Notwithstanding this, the model does have the capability to project the economic impacts over time of given changes in policies, tastes and technologies in any region of the world economy on all sectors and agents of all regions of the world economy.

Tasman Global was developed out of the 2001 version of the Global Trade and Environment Model (GTEM) developed by ABARE (Pant 2001), and has been evolving ever since. In turn, GTEM was developed out of the MEGABARE model (ABARE 1996), which contained significant advancements over the GTAP model of that time (Hertel 1997).

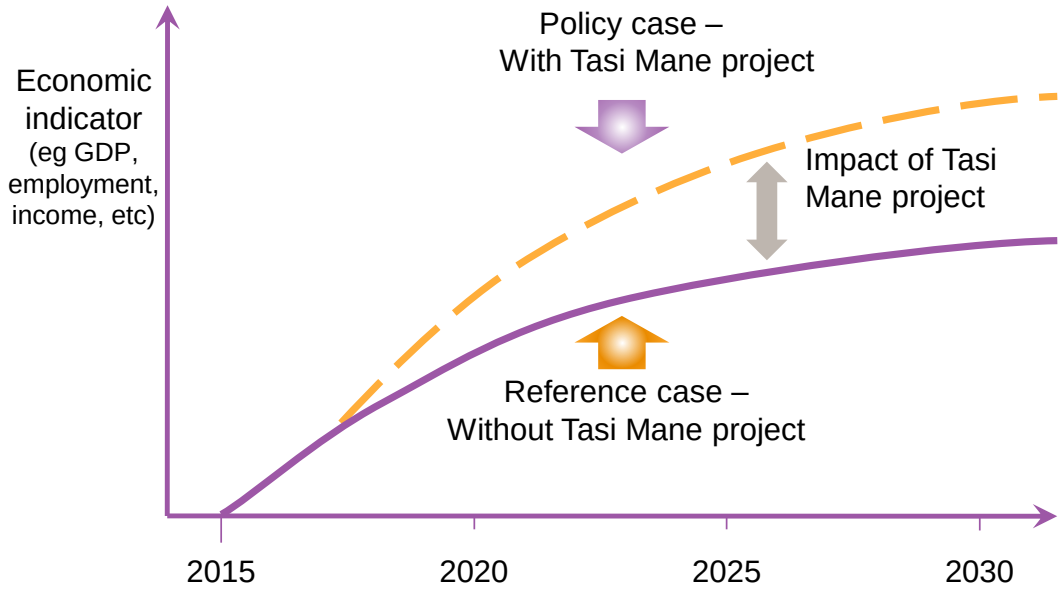
A.2 A dynamic model

Tasman Global is a model that estimates relationships between variables at different points in time. This is in contrast to comparative static models, which compare two equilibriums (one before a policy change and one following). A dynamic model such as *Tasman Global* is beneficial when analysing issues where both the timing of and the adjustment path that economies follow are relevant in the analysis.

In applications of the *Tasman Global* model, a Reference Case simulation forms a 'business-as-usual' basis with which to compare the results of various simulations. The Reference Case provides projections of growth in the absence of the changes to be examined. The impact of the change to be

examined is then simulated and the results interpreted as deviations from the Reference Case (see **Figure A.1**).

FIGURE A.1 ILLUSTRATIVE SCENARIO ANALYSIS USING *TASMAN GLOBAL*



SOURCE: ACIL ALLEN CONSULTING

A.3 The database

A key advantage of *Tasman Global* is the level of detail in the database underpinning the model. The database used for this analysis is derived from the Global Trade Analysis Project (GTAP) database (version 9). This database is a fully documented, publicly available global data base which contains complete bilateral trade information, transport and protection linkages among regions for all GTAP commodities. It is the most detailed database of its type in the world.

Tasman Global builds on the GTAP database by adding the following important features:

- a detailed population and labour market database
- detailed technology representation within key industries (such as electricity generation and iron and steel production)
- disaggregation of a range of major commodities including iron ore, bauxite, alumina, primary aluminium, brown coal, black coal and LNG
- the ability to repatriate labour and capital income
- explicit representation of the states and provinces of certain countries (including Australia, Papua New Guinea and Canada)
- the capacity to explicitly represent multiple regions within states and territories of disaggregated countries.

Nominally, version 9 of the *Tasman Global* database divides the world economy into 149 regions (GTAP's 139 international regions, plus Timor-Leste and Papua New Guinea, plus the 8 states and territories of Australia) although in reality the regions are frequently disaggregated further. ACIL Allen regularly models Australian projects or policies at the regional level.

The *Tasman Global* database also contains a wealth of sectoral detail currently identifying up to 70 industries (**Table A.1**). The foundation of this information is the input-output tables that underpin the database. The input-output tables account for the distribution of industry production to satisfy industry and final demands. Industry demands, so-called intermediate usage, are the demands from each industry for inputs.

For example, electricity is an input into the production of communications. In other words, the communications industry uses electricity as an intermediate input. Final demands are those made by households, governments, investors and foreigners (export demand). These final demands, as the name suggests, represent the demand for finished goods and services. To continue the example, electricity is used by households – their consumption of electricity is a final demand.

Each sector in the economy is typically assumed to produce one commodity, although in *Tasman Global*, the electricity, transport and iron and steel sectors are modelled using a 'technology bundle' approach. With this approach, different known production methods are used to generate a homogeneous output for the 'technology bundle' industry. For example, electricity can be generated using brown coal, black coal, petroleum, base load gas, peak load gas, nuclear, hydro, geothermal, biomass, wind, solar or other renewable based technologies – each of which have their own cost structure.

TABLE A.1 SECTORS IN THE *TASMAN GLOBAL* DATABASE

Sector		Sector	
1	Paddy rice	**36**	Paper products, publishing
2	Wheat	**37**	Diesel (incl. nonconventional diesel)
3	Cereal grains nec	**38**	Other petroleum, coal products
4	Vegetables, fruit, nuts	**39**	Chemical, rubber, plastic products
5	Oil seeds	**40**	Iron ore
6	Sugar cane, sugar beef	**41**	Bauxite
7	Plant- based fibres	**42**	Mineral products nec
8	Crops nec	**43**	Ferrous metals
9	Bovine cattle, sheep, goats, horses	**44**	Alumina
10	Animal products nec	**45**	Primary aluminium
11	Raw milk	**46**	Metals nec
12	Wool, silk worm cocoons	**47**	Metal products
13	Forestry	**48**	Motor vehicle and parts
14	Fishing	**49**	Transport equipment nec
15	Brown coal	**50**	Electronic equipment
16	Black coal	**51**	Machinery and equipment nec
17	Oil	**52**	Manufactures nec
18	Liquefied natural gas (LNG)	**53**	Electricity generation
19	Other natural gas	**54**	Electricity transmission and distribution
20	Minerals nec	**55**	Gas manufacture, distribution
21	Bovine meat products	**56**	Water
22	Meat products nec	**57**	Construction
23	Vegetables oils and fats	**58**	Trade
24	Dairy products	**59**	Road transport
25	Processed rice	**60**	Rail and pipeline transport
26	Sugar	**61**	Water transport
27	Food products nec	**62**	Air transport
28	Wine	**63**	Transport nec
29	Beer	**64**	Communication
30	Spirits and RTDs	**65**	Financial services nec
31	Other beverages and tobacco products	**66**	Insurance
32	Textiles	**67**	Business services nec
33	Wearing apparel	**68**	Recreational and other services
34	Leather products	**69**	Public Administration, Defence, Education, Health
35	Wood products	**70**	Dwellings

NOTE: NEC = NOT ELSEWHERE CLASSIFIED

The other key feature of the database is that the cost structure of each industry is also represented in detail. Each industry purchases intermediate inputs (from domestic and imported sources) primary factors (labour, capital, land and natural resources) as well as paying taxes or receiving subsidies.

A.4 Model structure

Given its heritage, the structure of the *Tasman Global* model closely follows that of the GTAP and GTEM models and interested readers are encouraged to refer to the documentation of these models for more detail (namely Hertel 1997 and Pant 2001, respectively). In summary:

- The model divides the world into a variety of regions and international waters.
  - Each region is fully represented with its own 'bottom-up' social accounting matrix and could be a local community, an LGA, state, country or a group of countries. The number of regions in a given simulation depends on the database aggregation. Each region consists of households, a government with a tax system, production sectors, investors, traders and finance brokers.
  - 'International waters' are a hypothetical region where global traders operate and use international shipping services to ship goods from one region to the other. It also houses an international finance 'clearing house' that pools global savings and allocates the fund to investors located in every region.
  - Each region has a 'regional household'[24] that collects all factor payments, taxes, net foreign borrowings, net repatriation of factor incomes due to foreign ownership and any net income from trading of emission permits.
- The income of the regional household is allocated across private consumption, government consumption and savings according to a Cobb-Douglas utility function, which, in practice, means that the share of income going to each component is assumed to remain constant in nominal terms.
- Private consumption of each commodity is determined by maximising utility subject to a Constant Difference of Elasticities (CDE) function which includes both price and income elasticities.
- Government consumption of each commodity is determined by maximising utility subject to a Cobb-Douglas utility function.
- Each region has *n* production sectors, each producing single products using various production functions where they aim to maximise profits (or minimise costs) and take all prices as given. The nature of the production functions chosen in the model means that producers exhibit constant returns to scale.
  - In general, each producer supplies consumption goods by combining an aggregate energy-primary factor bundle with other intermediate inputs and according to a Leontief production function (which in practice means that the quantity shares remain in fixed proportions). Within the aggregate energy-primary factor bundle, the individual energy commodities and primary factors are combined using a nested-CES (Constant Elasticity of Substitution) production function, in which energy and primary factor aggregates substitute according to a CES function with the individual energy commodities and individual primary factors substituting with their respective aggregates according to further CES production functions.
  - Exceptions to the above include the electricity generation, iron and steel and road transport sectors. These sectors employ the 'technology bundle' approach developed by ABARE (1996) in which non-homogenous technologies are employed to produce a homogenous output with the choice of technology governed by minimising costs according to a modified-CRESH production function. For example, electricity may be generated from a variety of technologies (including brown coal, black coal, gas, nuclear, hydro, solar etc.), iron and steel may be produced from blast furnace or electric arc technologies while road transport services may be supplied using a range of different vehicle technologies. The 'modified-CRESH' function differs from the traditional CRESH function by also imposing the condition that the quantity units are homogenous.
- There are four primary factors (land, labour, mobile capital and fixed capital). While labour and mobile capital are used by all production sectors, land is only used by agricultural sectors while the fixed

[24] The term "regional household" was devised for the GTAP model. In essence it is an agent that aggregates all incomes attributable to the residents of a given region before distributing the funds to the various types of regional consumption (including savings).

capital is typically employed in industries with natural resources (such as fishing, forestry and mining) or in selected industries built by ACIL Allen.

- Land supply in each region is typically assumed to remain fixed through time with the allocation of land between sectors occurring to maximise returns subject to a Constant Elasticity of Transformation (CET) utility function.
- Mobile capital accumulates as a result of net investment. It is implicitly assumed in *Tasman Global* that it takes one year for capital to be installed. Hence, supply of capital in the current period depends on the last year's capital stock and investments made during the previous year.
- Labour supply in each year is determined by endogenous changes in population, given participation rates and a given unemployment rate. In policy scenarios, the supply of labour is positively influenced by movements in the real wage rate governed by the elasticity of supply. For countries where sub-regions have been specified (such as Australia), migration between regions is induced by changes in relative real wages with the constraint that net interregional migration equals zero. For regions where the labour market has been disaggregated to include occupations, there is limited substitution allowed between occupations by individuals supplying labour (according to a CET utility function) and by firms demanding labour (according to a CES production function) based on movements in relative real wages.
- The supply of fixed capital is given for each sector in each region.
  - The model has the option for these assumptions to be changed at the time of model application if alternative factor supply behaviours are considered more relevant.

— It is assumed that labour (by occupation) and mobile capital are fully mobile across production sectors implying that, in equilibrium, wage rates (by occupation) and rental rates on capital are equalised across all sectors within each region. To a lesser extent, labour and capital are mobile between regions through international financial investment and migration, but this sort of mobility is sluggish and does not equalise rates of return across regions.

— For most international regions, consumption goods for each consumer (private, government, industries and the local investment sector), can be sourced either from domestic or imported sources. In any country which has disaggregated regions (such as Australian), consumption goods can also be sourced from other intrastate or interstate regions. In all cases, the source of non-domestically produced consumption goods is determined by minimising costs subject to a Constant Ratios of Elasticities of Substitution, Homothetic (CRESH) utility function. Like most other CGE models, a CES demand function is used to model the relative demand for domestically-produced commodities versus non-domestically produced commodities. The elasticities chosen for the CES and CRESH demand functions mean that consumers in each region have a higher preference for domestically produced commodities than non-domestic and a higher preference for intrastate or interstate produced commodities versus foreign.

— The capital account in *Tasman Global* is open. Domestic savers in each region purchase 'bonds' in the global financial market through local 'brokers' while investors in each region sell bonds to the global financial market to raise investible funds. A flexible global interest rate clears the global financial market.

— It is assumed that regions may differ in their risk characteristics and policy configurations. As a result, rates of return on money invested in physical capital may differ between regions and therefore may be different from the global cost of funds. Any difference between the local rates of return on capital and the global cost of borrowing is treated as the result of the existence of a risk premium and policy imperfections in the international capital market. It is maintained that the equilibrium allocation of investment requires the equalisation of changes in (as opposed to the absolute levels of) rates of return over the base year rates of return.

— Any excess of investment over domestic savings in a given region causes an increase in the net debt of that region. It is assumed that debtors service the debt at the interest rate that clears the global financial market. Similarly, regions that are net savers gives rise to interest receipts from the global financial market at the same interest rate.

— Investment in each region is used by the regional investor to purchase a suite of intermediate goods according to a Leontief production function to construct capital stock with the regional investor cost minimising by choosing between domestic, interstate and imported sources of each intermediate good

via the CRESH production function. The regional cost of creating new capital stock versus the local rates of return on mobile capital is what determines the regional rate of return on new investment.

— In equilibrium, exports of a good from one region to the rest of world are equal to the import demand for that good in the remaining regions. Together with the merchandise trade balance, the net payments on foreign debt add up to the current account balance. *Tasman Global* does not require that the current account be in balance every year. It allows the capital account to move in a compensatory direction to maintain the balance of payments. The exchange rate provides the flexibility to keep the balance of payments in balance.

— Emissions of six anthropogenic greenhouse gases (namely, carbon dioxide, methane, nitrous oxide, HFCs, PFCs and SF_6) associated with economic activity are tracked in the model. Almost all sources and sectors are represented; emissions from agricultural residues and land-use change and forestry activities are not explicitly modelled but can be accounted for externally. Prices can be applied to emissions which are converted to industry-specific production taxes or commodity-specific sales taxes that impact on demand. Abatement technologies similar to those adopted in Australian Government (2008) are available and emission quotas can be set globally or by region along with allocation schemes that enable emissions to be traded between regions.

More detail regarding specific elements of the model structure are discussed in the following sections.

A.5 Population growth and labour supply

Population growth is an important determinant of economic growth through the supply of labour and the demand for final goods and services. Population growth for each region represented in the *Tasman Global* database is projected using ACIL Allen's in-house demographic model. The demographic model projects how the population in each region grows and how age and gender composition changes over time and is an important tool for determining the changes in regional labour supply and total population over the projection period.

For each of region, the model projects the changes in age-specific birth, mortality and net migration rates by gender for 101 age cohorts (0-99 and 100+). The demographic model also projects changes in participation rates by gender by age for each region, and, when combined with the age and gender composition of the population, endogenously projects the future supply of labour in each region. Changes in life expectancy are a function of income per person as well as assumed technical progress on lowering mortality rates for a given income (for example, reducing malaria-related mortality through better medicines, education, governance etc.). Participation rates are a function of life expectancy as well as expected changes in higher education rates, fertility rates and changes in the work force as a share of the total population.

Labour supply is derived from the combination of the projected regional population by age by gender and the projected regional participation rates by age by gender. Over the projection period labour supply in most developed economies is projected to grow slower than total population as a result of ageing population effects.

For the Australian states and territories, the projected aggregate labour supply from ACIL Allen's demographics module is used as the base level potential workforce for the detailed Australian labour market module, but which has not been described in this report.

For non-Australian regions, *Tasman Global* recognises 5 different broad occupation categories as per the GTAP v9 database:

— Officials and Managers
— Technicians and associate professionals
— Clerks
— Service workers and shop and market sales workers
— Agricultural and low-skilled or unskilled (including craft and related trade workers and plant and machine operators and assemblers).

The firms who hire labour are provided with some limited scope to change between these 5 labour types as the relative real wage between them changes.

A.5.1 Elasticities

Factor-factor substitution elasticities in non-technology bundle industries are industry specific and are the same as those specified in the GTAP version 9 database[25], while the fuel-factor and technology bundle elasticities are the same as those specified in GTEM.[26] The unemployment rate function in the policy scenarios is a non-linear function of the change in the labour demand relative to the reference case with the elasticity being a function of the unemployment rate (that is, the lower the unemployment rate the lower the elasticity and the higher the unemployment rate the higher the elasticity).

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