

# TIMOR-LESTE PUBLIC EXPENDITURE REVIEW: INFRASTRUCTURE

A JOINT MINISTRY OF FINANCE AND WORLD BANK REVIEW OF THE  
QUALITY OF INFRASTRUCTRE SPENDING IN TIMOR-LESTE, FOCUSING ON  
ROADS, IRRIGATION AND ELECTRICITY

*MARCH 2015*

# CONTENTS

LIST OF FIGURES .....	iii
LIST OF TABLES .....	v
ACKNOWLEDGEMENTS .....	vi
GLOSSARY .....	vii
EXECUTIVE SUMMARY .....	viii
CHAPTER 1 MACRO FISCAL ANALYSIS .....	1
1.1 Government Policy .....	1
1.2 Infrastructure: Initial Conditions .....	6
1.2.1 Initial Conditions: Roads .....	7
1.2.2 Initial Conditions Electricity .....	10
1.3 Past Spending, Future Spending and Budget Execution .....	12
1.3.1 Overall Trends in Infrastructure Spending .....	12
1.3.2 Infrastructure Spending by Program .....	14
1.3.3 Budget Execution .....	15
1.4 Outputs from Spending and Unit Costs .....	20
1.4.1 Outputs from Spending on Irrigation .....	20
1.4.2 Outputs from Spending on Electricity .....	22
1.4.3 Outputs from Spending on Roads .....	24
1.5 Operation and Maintenance .....	24
1.5.1 Operation and Maintenance and Other Recurrent Expenditure on Irrigation .....	24
1.5.2 Operation and Maintenance of Electricity Infrastructure .....	26
1.5.3 Operation and Maintenance: Roads .....	27
1.5.4 Operation and Maintenance: Conclusion .....	29
1.6 Infrastructure and Economic Growth .....	30
1.6.1 Theory and International Evidence .....	30
1.6.2 Empirical Evidence from Timor-Leste .....	35
1.6.3 Infrastructure Spending and Employment in Timor-Leste .....	42
1.7 Fiscal Sustainability .....	42
1.7.1 Background, Importance and Definition of Fiscal Sustainability .....	42
1.7.2 Fiscal Sustainability Policy .....	44
1.7.3 Scenario 1: High Infrastructure and Recurrent Spending .....	50
1.7.4 Scenario 2: A Sustainable Fiscal Policy .....	53
1.7.5 Fiscal Sustainability Conclusion .....	55
2 CHAPTER 2 PUBLIC INVESTMENT MANAGEMENT IN TIMOR-LESTE .....	58
2.1 The SDP Provides an Overarching Framework for Public Investment Driven Growth ..	58
2.2 Overview of Timor-Leste's institutions for managing the public investment cycle .....	59
2.3 Results of a Review of Timor-Leste Investment Institutions .....	61
2.4 Conclusion .....	65
2.5 Recommendations .....	67
3 CHAPTER 3 IRRIGATION .....	68
3.1 Summary .....	68
3.2 Historical Background .....	70
3.3 Past lessons .....	70
3.4 Future plans .....	73
3.5 Current Irrigation Strategy .....	77
3.5.1 Ex post economic appraisal of three Completed Irrigation Schemes .....	78
3.5.2 Ex ante appraisal of seven approved irrigation schemes .....	81
3.6 The difficulty of achieving imports substitution under the current strategy .....	84
3.7 Financial returns to farmers from growing rice .....	87

3.8	Irrigation Economics: Alternative Strategies.....	89
3.8.1	Irrigation Operations and Maintenance Budgets.....	97
3.9	Project Cycle Procedures and Compliance with Government Systems .....	100
3.9.1	Identification and Selection Process: Concept Stage .....	100
3.9.2	Design, Pre-construction Appraisal and Approval .....	101
3.9.3	Tendering and Procurement .....	101
3.9.4	Construction, Supervision and certification of works .....	101
3.9.5	Post-construction Evaluation .....	102
3.10	Impact of Current Government Policies on Rates of Return on Investment .....	102
3.11	Conclusions and Recommendations.....	103
4	CHAPTER 4 ROADS.....	105
4.1	Background .....	105
4.2	Summary .....	106
4.3	The Current and Projected Road Assets Base .....	108
4.3.1	Conclusion: Fix The Road Network, Allow the Economy to Grow .....	113
4.4	Appropriate road sector investment to create a Stable Maintainable Road Network	113
4.4.1	Conclusion: The first priority is to manage recurrent cost rather than build new roads	114
4.5	Past growth in plans for Road Sector Investment.....	115
4.6	Actual past spending on roads and bridges .....	118
4.7	Budget forecasts and the composition of spending .....	120
4.7.1	Conclusion: Ensure Budgets are Adequate, Deliverable and Maintainable.....	121
4.8	Implementation challenges that constrain execution .....	122
4.8.1	Financial Management.....	122
4.8.2	Measurement of outputs .....	125
4.8.3	Mandates and systems for Implementation and supervision.....	128
4.8.4	Conclusion: Ensure Efficiency in Project Delivery .....	132
4.9	Staffing capacity of the Directorate of Roads, Bridges and Flood Control .....	133
4.9.1	Conclusions: Maximize the Value of Human Resources .....	134
5	CHAPTER 5 ELECTRICITY .....	136
5.1	Summary .....	136
5.2	Strategy: Expanding access .....	139
5.3	Cost drivers .....	142
5.3.1	Aggregate efficiency analysis: the Hidden Cost framework.....	142
5.3.2	Specific analysis of efficiency .....	144
5.4	Diversifying the generation mix to reduce costs .....	164
5.5	Demand Management .....	168
5.6	Conclusion.....	169
6	ANNEX 1: SDP PILLARS AND TARGETS.....	174
7	ANNEX 2: FISCAL MODEL ASSUMPTIONS.....	177
8	ANNEX 3: CHAPTER 2 PIM INDICATOR ANALYSIS.....	180
9	ANNEX 4: SUMMARY OF CHAPTER 2 RECOMMENDATIONS.....	183
10	ANNEX 5: DE JURE AND DE FACTO ROLES OF NEW PIM AGENCIES, ILLUSTRATING OVERLAPS.....	186

## LIST OF FIGURES

Figure 1: Condition of the National Road Network.....	8
Figure 2: Paved Road Density by GDP per Capita (total length in kilometers of paved roads divided by a country coefficient).....	9
Figure 3: Access to Electricity (% of Households).....	11
Figure 4: Timor-Leste Power Grid Supply-Demand Balance .....	11
Figure 5: Spending on Infrastructure Assets 2004 to 2014 (\$ millions) .....	13
Figure 6: Past and Future Infrastructure Spending in US\$ million (nominal) and as a % of non-oil GDP.....	13
Figure 7: Government Investment as a % of non-oil GDP in 2011.....	14
Figure 8: Infrastructure Budget Spending, Actual Spending and Execution .....	16
Figure 9: Constraints on Project Execution (\$ million) in 2012.....	19
Figure 10: Government and Donor Irrigation Schemes Cost Per HA .....	21
Figure 11: Per capita electricity generation, and per capita GDP .....	23
Figure 12: Operations and Maintenance of Irrigation Schemes .....	26
Figure 13: Infrastructure and Operation and Maintenance of Electricity (\$ Million) .....	27
Figure 14: Roads Sector Required Maintenance.....	29
Figure 15: The Petroleum Fund Finances Increased Expenditure.....	38
Figure 16: Increased Government Consumption and Investment.....	38
Figure 17: And Growth in Sectors Heavily Dependent on the Government.....	38
Figure 18: Contributing to Low Competitiveness.....	40
Figure 19: Inflation Increases to Very High Rates for a Dollarized Economy.....	40
Figure 20: Despite Benign External Conditions Since 2011 (index) .....	40
FIGURE 21: CONTRIBUTING TO LOW GROWTH IN THE TRADED SECTORS (\$ MILLION REAL) .....	40
Figure 22: ESI Per Capita (with withdraws equal to the ESI) in Constant 2014 Prices .....	45
Figure 23: Measure of Sustainable Income from in Petroleum in 2014 (\$ Million).....	49
Figure 24: Accumulation of Irrigation Assets .....	72
Figure 25: Trends in Rice Paddy and Maize production, after losses and allowances for seed (Mt) (reduced paddy production in 2011) .....	72
Figure 26: Capital Investment on Irrigation: Past and Planned .....	74
Figure 27: Cumulative Investment in Irrigation Rehabilitation (US\$ million, 2013 prices) and Area of Paddy Planted (ha) .....	80
Figure 28: Cumulative Investment (includes O&M) in Irrigation Rehabilitation (US\$ million, 2013 prices) and Annual Rice Balance .....	81
Figure 29: Cost of Growing Irrigated Rice using Cross-River Diversion Weirs – Current System in Timor-Leste .....	87
Figure 30: Cost of Growing Irrigated Rice using Tube-Wells and Small Pumps to Supplement Weir-Based Irrigation Systems, plus Provision of Software Packages .....	93
Figure 31: Bar Chart of Marginal Costs and Benefits for Different Irrigation Systems (1000 ha irrigation schemes).....	97
Figure 32: MAFF's Total and Irrigation Budgets, Irrigation Budget Requirements, and Irrigation Budget Deficits .....	99
Figure 33: Timor-Leste National Road Network.....	105
Figure 34: Road Assets to GDP Ratio - Indonesian Provinces and Timor-Leste (truncated x-axis) .....	109

Figure 35: Paved Road Density by GDP per Capita .....	110
Figure 36: Total annual road budget required to achieve SDP targets (US\$ million; growth at 11.3%).....	111
Figure 37: Benefit Cost ratio, with Increasing Cost of Reconstruction (US\$ '000).....	118
Figure 38: Road Sector Budgeted Spending (US\$ '000) from All Sources 2008-2019 (As in GoTL State Budget).....	120
Figure 39: Road Maintenance: Share of Total Road Expenditure on roads (2010) .....	121
Figure 40: DRBFC and IF Budget Commitment and Expenditure .....	124
Figure 41: Project Development, Procurement and Monitoring Process .....	129
Figure 42: Multi-Criteria Analysis for Road Projects in Timor-Leste .....	131
Figure 43: Electricity access vs. GDP per capita (top) and Electricity use per capita vs. GDP per capita (bottom) .....	140
Figure 44: Fuel cost to rise with rising demand .....	142
Figure 45 Hidden Cost of the Electricity Sector in Timor-Leste, Eastern Europe and Central Asia and Africa Regions (total hidden costs share of GDP at the top and each category of hidden cost share of the total hidden costs at the bottom) .....	143
Figure 46: Timor-Leste Power Grid Supply-Demand Balance .....	146
Figure 47 MOPS: fixed in October 2012 vs. actual and possible savings by using actual monthly average MOPS.....	149
Figure 48 Flow of taxes and duties in-built in fuel cost .....	151
Figure 49 Comparison of wholesale costs of imported diesel on 4 October 2012 (excluding taxes & duties) .....	152
Figure 50 EDTL's fuel generation efficiency has improved (Liters of diesel consumed for generating each kilowatt-hour)* .....	153
Figure 51 Generation & use of EDTL's electricity 2007-2012 .....	155
Figure 52 Cost vs. tariff 2012 and what the subsidy funded in 2012.....	158
Figure 53 Distribution of 14,623 sample EDTL customers by consumption category (top) and Customer distribution by consumption category (bottom) in June 2013.....	161
Figure 54: Pacific Islands Countries Average Tariff in 2011 .....	163
Figure 55: Illustrative Screening Curves and Comparison of delivered energy costs (levelized costs) for Power Generation Technology Options for Timor-Leste 2015 and 2020 (\$2010 prices) .....	165
Figure 56: Indicative costs (\$2010 prices) of various options of generation mix for Timor-Leste 2015 (top) 2020 (bottom) .....	168

## LIST OF TABLES

Table 1: Roads and Bridges projects outlined in the SDP .....	2
Table 2: SDP electricity generation, transmission and distribution activities.....	3
Table 3: Agriculture key targets, projects and activities.....	4
Table 4: Total expenditure by program (2008-2018).....	15
Table 5: Contracts to a value in excess of US\$1 million (US\$ million) .....	64
Table 6: Contracts to a value of less than US\$1 million (US\$ million) .....	64
Table 7: Summary of ex ante Estimated EIRRs for Three ARP Irrigation Designs .....	71
Table 8: MAFF’s Irrigation Development Plans and Required Maintenance and Operations Budgets (2013 – 2020) .....	75
Table 9: Plans for Irrigation Development – Areas to be Irrigated (ha).....	76
Table 10: Summary of Appraisal of Three Rehabilitated Irrigation Schemes .....	79
Table 11: Summary of Results from Appraisal of Seven Priority Irrigation Schemes .....	83
Table 12: Cost of Growing Irrigated Rice using Cross-River Diversion Weirs – Current System in Timor-Leste .....	85
Table 13: Financial Returns to Farmers from Growing Irrigated Rice.....	88
Table 14: Cost of Growing Irrigated Rice using Tube-Wells and Small Pumps to Supplement Weir-Based Irrigation Systems, plus Provision of “Software Packages” .....	91
Table 15: Returns from Investing in “Hardware” and “Software, Supplemented with Tube-Wells and Small Pumps .....	95
Table 16: Summary of Economic Cost of Growing Rice (Two Systems) Compared with Rice Importation .....	96
Table 17: MAFF’s Total and Irrigation Budgets, Irrigation Budget Requirements, and Irrigation Budget Deficits .....	98
Table 18: MAFF’s Annual Budget for Directorate of Irrigation and water management .....	100
Table 19: Length of Roads by Administrative Category (Km).....	106
Table 20: Total annual road budget required to achieve SDP targets (US\$ million; growth at 11.3%).....	112
Table 21: Spending for Sustainable Road Network (World Bank Ronet 2013; US\$ million).....	113
Table 22: Range of Road improvement Cost (US\$).....	115
Table 23: Five Year Roads Investment Plan .....	117
Table 24: Road Budgets and Execution (US\$ ‘000) .....	119
Table 25: DRBFC and IF Budget Commitment and Expenditure 2009-2013, .....	123
Table 26: Works Completed by Category/Contract 2009-2012.....	126
Table 27 Road Network Condition .....	127
Table 28: Components of Nov 2012-April 2013 diesel supply contract (Litres to be supplied under six-month contract period: 47 million).....	149
Table 29: Timor-Leste’s tariff structure for residential households (left) and Ampere based monthly payment (USD) for electricity service (right) .....	160
Table 30: Tariff structure-Illustrative options A and B (US\$) .....	162

## **ACKNOWLEDGEMENTS**

The report was prepared jointly by The World Bank and Timor-Leste's Ministry of Finance, by a team led by Hans Anand Beck (World Bank, Senior Economist and TTL), Daniel Wilde (Senior Economist, Ministry of Finance) and Epifanio Martins (Economics Cluster Leader, Ministry of Finance). The core team included Daniel Wilde, Jose Fatima and Francisco Soares de Jesus (Ministry of Finance); and Hans Beck, David Hook, Natsuko Toba, Philip Young (Agriculture), Greg Wood (Transport), Kazim Saeed (Energy) at the World Bank. Research Assistance and technical inputs were provided by Naysa Brasil Teodoro (World Bank), Ilce Maria A. Da Cunha Magno, Alex Stewart, Laura Alvarez and Nelio Francisco Baptista (Ministry of Finance) . Rideca Duarte (World Bank, Team Assistant) provided administrative support.

Overall guidance and advice were provided by Nikunj Soni (Ministry of Finance), and World Bank regional senior management, as well as peer reviewers.

Finally, the team is very thankful to all government officials from the Ministry of Finance, starting with the former and current Ministers, and Vice-Ministers of Finance, as well as senior officials at the National Development Agency, Major Projects Secretariat, National Procurement Commission, Ministry of Public Works, and Ministry of Agriculture and Fisheries, for their participation and guidance.

## GLOSSARY

ADB	Asian Development Bank
ADN	National Development Agency
ANS	Adjusted Net Savings
ARPs	Agriculture Rehabilitation Projects
BCR	benefit/cost ratios
BRC	Budget Review Committee
CAFI	Council for Management of the Infrastructure Fund
CFC	Consumption of Fixed Capital
CFTL	Consolidated Fund for Timor-Leste
DRBFC	National Directorate of Roads, Bridges and Flood Control
EAP	East Asia and Pacific region
ECA	Europe and Central Asia
EDTL	Electricidade de Timor-Leste
EIRR	Economic Internal Rate of Return
EITI	Extractive Industry Transparency Initiative
EPIA	Economic Policy and Investment Agency
ESI	Estimated Sustainable Income
EU	European Union
FSIRPP	Forecasted Sustainable Income with reference price and production
FSIIPR	Forecasted Sustainable Income Including Proven Reserves
GNI	Gross National Income
GNS	Gross National Savings
HSD	High-Speed Diesel
ICB	International Competitive Bidding
IFI	International Financial Institution
IRI	International Roughness Index
JICA	Japan International Cooperation Agency
MAFF	Ministry of Agriculture, Fisheries and Forestry
MoF	Ministry of Finance
MOPS	Mean of Platts Singapore
MPS	Major Projects Secretariat
MPW	Ministry of Public Works
NDEP	National Directorate of Economic Policy
NPC	National Procurement Commission
PBC	Performance-based maintenance contracts
PDID	District Integrated Development Plan
PIM	Public Investment Management
PLN	Indonesia's State Electricity Company (Perusahaan Listrik Negara)
RONET	Road Network Evaluations Tools
SANRAL	South African National Road Agency Limited
SDP	Strategic Development Plan
TWSP	Tube Wells and Small Pumps
WBRD	Weir Based River Diversion

## **EXECUTIVE SUMMARY**

The Timor-Leste Government's 2011-2013 Strategic Development Plan (SDP) outlines its plan for achieving upper-middle income country status, with a secure, well-educated and healthy population, by 2030. It argues that the four key national attributes of political will, economic potential, national integration and a dynamic population will underpin the achievement of this vision. Detailed policies and in some cases specific activities and projects are outlined by the SDP in the three core pillars of social capital, infrastructure development and economic development. The two cross-cutting themes of effective Government institutions and a sound macroeconomic environment support these pillars.

Timor-Leste's large stock of infrastructure assets was already deteriorating prior to Independence, with much of this stock being destroyed during the subsequent period of insecurity. The people of Timor-Leste voted for Independence in 1999. Due to declines in public expenditure prior to this point, the quality of the new state's infrastructure had already declined in the years immediately prior to the referendum. In the post-Independence upheavals, much of Timor-Leste's remaining infrastructure was destroyed. According to some estimates, as much as 70 percent of the country's previous stock of physical assets had been destroyed or was unusable by the year 2000.

In the six years following Independence, much key infrastructure was rehabilitated, often with financing provided by development partners. In particular, the airport, seaport, telecommunications network and electrical network were reconstructed and rehabilitated during this period. However, there is some evidence that access to roads continued to decline, with the walking time taken to access the nearest vehicle-passable road in the rainy season increasing from 8.8 to 16.3 hours in the period from 2003 to 2007. Access to electricity was also limited during this period, with less than one third of households having such access.

The Fourth Constitutional Government came to power in 2008. This Government prioritized the development of infrastructure, with increased oil revenue meaning that an increasing proportion of development projects could be financed through the state budget. The Fourth Constitutional Government drafted the SDP in 2011. In many ways, the SDP extends and makes explicit policies to develop infrastructure that had already been pursued prior to its publication. For example, the central electricity project, which commenced in 2008, is a key component of the SDP.

The SDP recognizes, through a range of proposed construction projects, that Timor-Leste currently lacks the core infrastructure required to support a modern and productive economy. According to the SDP, government spending on infrastructure will drive high, double-digit rates of economic growth in the short and medium term, and contribute to growth of 8 percent by 2020.

A macroeconomic supply side rationale is used to justify the development of infrastructure throughout the SDP. The argument is that construction of high quality infrastructure in a range of areas, particularly roads and electricity, will drive double-digit rates of economic growth in the short to medium term and contribute to high economic growth. In summary, the core argument of the SDP is that excess withdrawals are required to finance increased Government

expenditure on core infrastructure in the short and medium term. In the long term, the improved infrastructure will boost economic growth, generating increases in the value of domestic revenue. There is less emphasis on the concept that investments in infrastructure should be contingent on there being a sufficient level of demand for this infrastructure for it to generate a high rate of financial or economic return in the short term

The SDP is correct to argue that infrastructure needs to be improved, but fully implementing the SDP may result in Timor-Leste having more infrastructure assets than many other upper-middle income countries. Prior to the implementation of the SDP, less than 40 percent of the population had access to electricity and only 20 percent of the national road network could be used by two-wheel drive cars at reasonable speeds. The quality of infrastructure was also poor compared to that of the average middle and upper-middle income country. However, full implementation of all SDP projects would result in Timor-Leste having a stock of infrastructure assets to a value considerably higher than that of the average upper-middle income country. This suggests that the full implementation of all SDP projects may not be necessary to achieve upper-middle income status.

In line with the SDP, the Government has increased infrastructure spending. Infrastructure spending peaked in 2011 at US\$534 million, at a value equivalent to nearly half of total expenditure and non-oil GDP. This is one of the highest rates of infrastructure spending in the world. Constrained execution and a lower budget meant that infrastructure spending declined to under US\$300 million in 2013. Much infrastructure spending takes place through the Infrastructure Fund. This fund has elements of multi-year budgeting, which means there is no incentive to rush procurement, construction or payments to increase annual budget execution.

In the period from 2008 to 2013, the greatest proportion of total expenditure on infrastructure development was utilized to develop the electricity sector, with expenditure on this program amounting to 57 percent of total expenditure. The second largest sector, roads, accounted for a further 16 percent, while district development accounted for 11 percent. The Government plans to spend more than US\$3 billion on infrastructure development in the period from 2014 to 2018, with roads, South coast development and other transport being the three largest programs.

In 2011 Timor-Leste invested heavily in institutions to better manage large scale infrastructure. The checks and balances in the current investment management cycle may result in higher quality expenditure, but they also constrain expenditure. Delays in procurement in particular appear to be constraining execution, although this is mainly because this is the first time central institutions have become aware of poor quality project design undertaken by line ministries. This is also resulting in systems being bypassed. Delays in construction on tendered projects also delay execution, illustrating that there may be capacity constraints in the private sector which will be difficult for the Government to ameliorate in the short term.

Outputs from spending have been mixed. The central electric project massively increased generation capacity and connections, but it did not do so cheaply. Improved connections likely raised living standards. There is currently significant excess generation capacity, but companies in energy intensive industries, such as brewing and cement making, are now considering locating in Timor-Leste. Irrigation projects have benefited relatively few farmers and their

economic rates of returns have been low. As shown by data from road surveys, the condition of the national road network deteriorated from 2010 to 2012.

There is evidence of too much construction and too little maintenance. The central electric project has resulted in a sharp increase in operation and maintenance expenditure, which was not fully predicted or planned for. The current budget for maintaining the national grid (as a percentage of the value of the national) is low compared to international norms and maybe inadequate.

In addition, increased levels of consumption of electricity (which is heavily subsidized) will probably lead to increasingly high levels of expenditure into the future. The returns from the river diversion irrigation infrastructure have not been maximized. This is largely because the limited recurrent budget of the Ministry of Agriculture, Fisheries and Forestry has meant that extension services, seeds, fertilizer and marketing assistance have not been provided to farmers. The current operation and maintenance budget for roads is inadequate, given the asset value of the roads network. This is exacerbated by the fact that much of the funds allocated from operation and maintenance is in fact diverted to emergency rehabilitation works.

Expenditure on infrastructure has increased short term economic growth. Government expenditure on infrastructure assets increased from \$33m in 2008 to \$427m in nominal terms in 2012. This led to economic growth being concentrated in the Government administration and construction sectors, which grew by 128.4% and 97.4% in real terms, respectively, over the period. Household consumption has also grown strongly, indicating that living standards have likely increased. On the income side, companies' gross operating surplus and total remuneration of Government employees has increased.

In the long term, expenditure on infrastructure increases economic growth when it results in roads, electricity and other outputs which firms use to increase production. The evidence is that this has not yet occurred in Timor-Leste, with manufacturing and agriculture growing slowly between 2008 and 2012. This is, however, unsurprising as there are normally lags between spending, the completion of construction, and the availability of the new infrastructure. The central electric project has only recently been completed and much other infrastructure has not yet been constructed. In addition, there are already indications that some energy intensive industries, such as brewing and cement making, are considering moving to Timor-Leste. Meanwhile, high prices and company profits provide a motivation and source of financing for companies to expand production.

In the short and medium term the Government is in a strong financial position. The Government has wisely saved over \$16.5 billion in the petroleum fund, enough to pay for the 2014 budget more than ten times over. Few countries have accumulated liquid savings which are more than ten times their current budget and in this sense overall fiscal policy has been conservative. The fiscal sustainability analysis carried out in this report shows that even if there is high infrastructure spending from 2014 to 2018, recurrent expenditure grows by 9% a year and conservative estimates of oil revenue and investment returns are used the petroleum fund balance would not reach zero for over 15 years. The Government is therefore unlikely to face a cash constrained budget in the short or medium term.

The Government is committed to long term fiscal sustainability and has outlined a policy of frontloading infrastructure expenditure. According to this policy there will be excess withdrawals followed in the longer term by economic growth, increased domestic revenue and declining expenditure. The achievement of these goals should enable withdrawals to fall back to the level of the ESI. The fiscal sustainability analysis undertaken in this report demonstrates that frontloading is a viable strategy, but only if domestic revenue is increased as a percentage of non-oil GDP and there is constrained growth in nominal expenditure. More specifically, expenditure must average less than \$1.3 billion, \$1.34 and \$1.48 billion a year in the short, medium and long term respectively. This conclusion is broadly in line with and supports the Ministry of Finance’s recommendation in the 2014 Yellow Road workshop and the expenditure ceiling outlined in the SDP (see table below). A more sustainable spending path will mean lower expenditures than shown in the outer years (2015 to 2019) of the 2014 budget. It also means that expenditure will likely fall in real terms per-capita.

	Average total expenditure per year in \$ billion		
	2015 Short Term	2016 to 2018 Medium Term	2019 to 2030 Long Term
IPER Fiscal Sustainability Model ESI, Sustainable Expenditure	1.3	1.3	1.5
IPER Fiscal Sustainability Model FSIRPP (reference oil price and production), Sustainable Expenditure	1.3	1.4	1.8
MoF Yellow Road Workshop and SDP	1.3	1.4	1.4
2014 State Budget	1.9	1.7	N/A

### Summary of Report Recommendations

1. Expenditure should be constrained to \$1.3 billion a year at most in the short and medium term. This recommendation is broadly in line with the Ministry of Finance’s recommendation at the 2014 Yellow Road workshop and the expenditure ceilings outlined on page 204 of the SDP.
2. The budget for operation and maintenance spending should be increased for roads and agriculture. The relative priority given to operation and maintenance expenditures compared to infrastructure construction should be increased.
3. For all new and existing large infrastructure projects, line ministries should submit a detailed plan and costing of likely long term operation and maintenance costs and

activities. The MPS, DNO, BRC and CAFI should consider these plans when deciding whether or not to approve projects. If a project is approved then the operation and maintenance costing should be included in the state budget.

4. Revise the current irrigation strategy to a hybrid strategy that maintains past investments in physical infrastructure, while at the same investing for high returns in tube-well irrigation and in farmer support services and market development programs.

5. The current road asset quality database should be updated and results fed into a performance management system to better plan routine and periodic maintenance, and to limit the use of emergency procedures for road maintenance and rehabilitation.

6. The government should urgently complete the installation of 70,000 additional pre-paid meters, as mandated by the Ministry of Public Works' Action Plan for 2014-2017, including in public buildings, where levels of electricity consumption are high. This will bring all consumers into EDTL's consumer database and allow every kilowatt-hour being generated to be accounted for. This would in turn allow for an accurate assessment of the level of benefit the electricity subsidy is providing, and to which consumers, also allowing the design of a more suitable tariff structure.

9. Establish a 'project bank', a portfolio of pre-qualified projects with detailed design studies, cost benefit analysis studies and high benefit to cost ratios from which the Infrastructure Fund Committee is able to select priority projects. All major infrastructure proposals should be sent to the MPS, for full appraisal, ranking and proposal to CAFI for decision.

10. Prepare Project Cycle Manuals for line ministries that provide technical guidance on project preparation: how to prepare project profiles, feasibility studies, design studies, and project implementation: defining supervision and accountability arrangements.

11. Urgently pass the new omnibus procurement law and prepare standard operating procedures. Require line ministries to submit procurement plans to the national procurement commission, and publish these. Clarify the limited circumstances in which direct awards can be considered. Monitor decentralized procurement by NPC using the Performance Framework included in the draft new law.

# CHAPTER 1

## MACRO FISCAL ANALYSIS

### 1.1 GOVERNMENT POLICY

The Timor-Leste Government's 2011-2013 Strategic Development Plan (SDP) outlines its plan for achieving upper-middle income country status, with a secure, well-educated and healthy population, by 2030. It argues that the four key national attributes of political will, economic potential, national integration and a dynamic population will underpin the achievement of this vision. Detailed policies and in some cases specific activities and projects are outlined by the SDP in the three core pillars of social capital, infrastructure development and economic development. The two cross-cutting themes of effective Government institutions and a sound macroeconomic environment support these pillars.

The development of infrastructure is a core pillar of the SDP. Thus, the SDP outlines specific plans for a number of large construction projects for the development of roads and bridges, water and sanitation facilities, electrical power generation facilities, telecommunications and ports. The SDP recognizes that Timor-Leste currently lacks the core infrastructure required to support a modern and productive economy. According to the SDP, Government spending on infrastructure will drive high, double-digit rates of economic growth in the short and medium term, contributing to a rate of growth of 8 percent by 2020.

The SDP commits the Government to making a substantial, long-term investment in the country's road network. The SDP prioritizes investment in six specific national and regional roads, while also committing the Government to rehabilitating all roads to meet specified minimum standards by 2015. In addition, the SDP commits the Government to constructing a four-lane national highway by 2030. Table 1 shows a full list of all the road and bridge projects specifically described in the SDP.

The SDP affirms that access to electricity is a basic right of all citizens and a fundamental requirement for Timor-Leste's economic development. On this basis, the SDP establishes a target of achieving universal access to reliable electricity 24 hours a day by 2015. The Government aims to achieve this goal through investment in new power plants and new transmission and distribution facilities. The SDP specifically outlines plans for the development of new power stations at Hera and Betano; of a 150 kilovolt transmission line that will form a 715 kilometer ring around Timor-Leste; and of nine sub-stations. Table 2 summarizes the main activities included in the SDP for the development of electricity generation, distribution and transmission facilities.

**TABLE 1: ROADS AND BRIDGES PROJECTS OUTLINED IN THE SDP**

Key Target	Specific Project / Activity	Date of Project	Project Cost in SDP
All national and regional roads will have been fully rehabilitated to international standards	The Dili – Manatuto – Baucau Road Link will have been fully upgraded and widened to international standards	2015	<b>\$100 million, with the final amount to be determined following the undertaking of the final design and costing assessment.</b>
All national and regional roads will have been fully rehabilitated to international standards	The Manatuto-Natarbora Road Link will have been fully upgraded and widened to international standards	2015	<b>In excess of US\$60 million, with the final amount to be determined following the undertaking of the final design and costing assessment</b>
All national and regional roads will have been fully rehabilitated to international standards	The Dili – Liquiça – Bobonaro Road links will be fully rehabilitated	2015	<b>Around US\$82 million.</b>
All national and regional roads will have been fully rehabilitated to international standards	The Pante Makassar – Oesilo   Pante Makassar – Citrana   Oesilo – Tumin Road links will be completed	2015	Not Stated
All national and regional roads will have been fully rehabilitated to international standards	All rural roads will have been rehabilitated by locally based contractors	2015	Not Stated
All national and regional roads will have been fully rehabilitated to international standards	Road condition monitoring surveys will have been carried out each year on all improved roads for determining maintenance needs	2015	Not Stated
All national and regional roads will have been fully rehabilitated to international standards	The Dili – Aileu – Maubisse – Aituto – Ainaro – Cassa rehabilitation project will have been completed	2020	Not Stated
All national and regional roads will have been fully rehabilitated to international standards	The Suai – Cassa – Hatu Udo – Betano – Natarbora – Viqueque – Beaço rehabilitation project will have been completed	2020	Not Stated
Bridge Construction program	New bridges will have been constructed to provide all-weather access on all national and district road routes	2030	Not Stated
National Ring Road	The plan for a National Ring Road will have been completed	2015	Not Stated
National Ring Road	The National Ring Road will have been completed	2030	Not Stated

**TABLE 2: SDP ELECTRICITY GENERATION, TRANSMISSION AND DISTRIBUTION ACTIVITIES**

<b>Key Target</b>	<b>Specific Project / Activity</b>	<b>Date of Project</b>	<b>Project Cost in SDP</b>
All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	Two new power stations will have been constructed in Hera and Betano providing 250 MW of electricity to support social and economic development across Timor-Leste	2015	Not Stated
All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	The Lariguto wind farm will be constructed	2015	Not Stated
All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	A Solar Centre will be established in Dili	2015	Not Stated
All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	Feasibility studies will have been conducted on the long-term prospects of attracting gas processing facilities to Timor-Leste; on potential mini-hydro sites throughout Timor-Leste; and on the viability of building a thermoelectric power plant to generate electricity from Dili's household and industrial rubbish	2015	Not Stated
All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	At least half of Timor-Leste's energy needs will be provided by renewable energy sources	2020	Not Stated
All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	Approximately 100,000 families will have access to solar powered electric light	2020	Not Stated

The SDP also emphasizes the construction of infrastructure as a means to achieve its stated goals in the pillars of economic development, notably agriculture, and the development of social capital. In terms of economic development, the SDP argues that an additional 70,000 hectares of irrigated rice fields is required to improve food security. The Government’s current policy is to improve irrigation through the Weir Based River Diversion (WBRD) system. Table 3 summarizes the main activities included in the SDP for the development of the agricultural sector.

In order to achieve its goal of developing social capital, in the area of health and education, the SDP also heavily emphasizes the construction of infrastructure. Thus, the SDP commits the Government to a significant school building program and to the expansion and rehabilitation of health facilities such as local clinics and hospitals.

**TABLE 3: AGRICULTURE KEY TARGETS, PROJECTS AND ACTIVITIES**

Key Target	Specific Project / Activity	Date of Project	Project Cost in SDP
The food supply will exceed demand	A comprehensive irrigation scheme inventory will have been assembled	2015	Not Stated
The food supply will exceed demand	Dam and groundwater pilot projects will have been developed and the results used to inform further development	2015	Not Stated
The food supply will exceed demand	The area of irrigated rice will have increased by 40% from 50,000 ha to 70,000 ha	2020	Not Stated

**A macroeconomic supply-side rationale is used to justify the development of Infrastructure throughout the SDP, but there must be more attention to analysis of the level of demand for this infrastructure.** The argument is that construction of high quality infrastructure in a range of areas, particularly roads and electricity, will drive double-digit rates of economic growth in the short to medium term and contribute to a high rate of economic growth of 8 percent from 2020. There is less emphasis on the concept that investments in infrastructure should be contingent on there being a sufficient level of demand for this infrastructure for it to generate a high rate of financial or economic return in the short term. For example, the SDP notes that the volume of road traffic in Timor-Leste is currently light. It argues that the rehabilitation of specific roads will promote development and economic growth, but not that it can be justified in terms of short-term financial returns from tolls or other sources of revenue. The SDP does not present or refer to cost-benefit analyses for any specific road rehabilitation project.

The rationale for the development of electricity is similar. The SDP assumes that access to electricity is a necessary condition for economic growth and for improved living standards and that the current electricity supply is inadequate. These assumptions are used in the SDP to justify plans for the construction of a national electricity generation, transmission and distribution system which has sufficient capacity to meet long-term demand. The SDP does not justify these plans on the basis of a cost-benefit analysis of the economic rate of return or *Electricidade de Timor-Leste* (EDTL)’s short term needs for a financial subsidy.

**The SDP explicitly argues that “a plan that is forced into a budget is not a plan at all, but an allocation process”.**<sup>1</sup> In light of this argument, the SDP does not contain comprehensive detailed costing of the amount of Government spending required to develop road, irrigation or agricultural infrastructure. However, it does provide aggregate expenditure and revenue targets. These targets are based on the Government following a frontloading scenario. According to this scenario, the Government will initially make withdrawals from the Petroleum Fund that exceed the value of the Estimated Sustainable Income (ESI), but then fall to zero as the level of domestic revenue increases.<sup>2</sup> According to this scenario, increases in domestic revenue will be driven by the strong economic growth which will result from the Government’s investment in infrastructure.

**In summary, the core argument of the SDP is that excess withdrawals are required to finance increased Government expenditure on core infrastructure in the short and medium term. In the long term, the improved infrastructure will boost economic growth, generating increases in the value of domestic revenue. With these increases, excess withdrawals will no longer be required. The validity of this argument is based on five interlinked assumptions, as follows:**

1. *The infrastructure in Timor-Leste is worse than that of the average middle income country, and the construction of the infrastructure outlined in the SDP will not lead to an oversupply of infrastructure (An examination of the validity of this assumption is contained in Section 1.2);*
2. *The Government has the financial resources and institutional capacity to increase expenditure on infrastructure and to construct core infrastructure at a reasonable cost. (An examination of the validity of this assumption is contained in Section 1.3, which focuses on budget execution and cost effectiveness, while Chapter 2 contains a detailed analysis of institutional effectiveness);*
3. *The constructed infrastructure will be properly maintained (Section 1.5);*
4. *Increased expenditure on infrastructure will lead to short and long term economic growth (Section 1.6);*
5. *The Government’s long term fiscal policy is sustainable, given the level of its financial resources and the likely links between expenditure on infrastructure and economic growth (Section 1.7);*

**For the SDP to achieve its stated objectives, all of these assumptions must be true. The next section examines these assumptions to determine their validity.** Institutional capacity is only briefly examined in this chapter, being discussed in greater detail in Chapter 2. The goal of this analysis is not to determine necessary revisions to the SDP, but to identify current constraints that may impact its implementation and to suggest how these can ameliorated.

---

<sup>1</sup> SDP page 12

<sup>2</sup> (See section 1.7 for a more detailed discussion on the Petroleum Fund, ESI and fiscal sustainability).

## 1.2 INFRASTRUCTURE: INITIAL CONDITIONS

**Timor-Leste's large stock of infrastructure assets was already deteriorating prior to Independence, with much of this stock being destroyed during the subsequent period of insecurity.** The people of Timor-Leste voted for Independence in 1999. Due to declines in public expenditure prior to this point, the quality of the new state's infrastructure had already declined in the years immediately prior to the referendum. In the post-Independence upheavals, much of Timor-Leste's remaining infrastructure was destroyed. According to some estimates, as much as 70 percent of the country's previous stock of physical assets had been destroyed or was unusable by 2000.<sup>3</sup>

**In the six years following Independence, much key infrastructure was rehabilitated, often with financing provided by development partners.** In particular, the airport, seaport, telecommunications network and electrical network were reconstructed and rehabilitated during this period. However, there is some evidence<sup>4</sup> that access to roads continued to decline, with the walking time taken to access the nearest vehicle-passable road in the rainy season increasing from 8.8 to 16.3 hours in the period from 2003 to 2007.<sup>5</sup> Access to electricity was also limited during this period, with probably less than one third of households having such access.<sup>6</sup>

The Fourth Constitutional Government came to power in 2008. This Government prioritized the development of infrastructure, with increased oil revenue meaning that an increasing proportion of development projects could be financed through the state budget. While the previous Government had also recognized the importance of the development of infrastructure, the lower level of revenues that it received meant it could not undertake the large-scale construction of infrastructure without financing provided by donors. The Fourth Constitutional Government drafted the SDP in 2011. In many ways, the SDP merely extends and makes explicit policies to develop infrastructure that had already been pursued prior to its publication. For example, the central electricity project, which commenced in 2008,<sup>7</sup> is presented as a key component of the SDP. For this reason, and because there are long gestation periods between the planning of larger infrastructure development projects and the operation of the resulting usable assets, this section discusses initial infrastructure conditions in 2008. The next section meanwhile examines the impact of expenditure on infrastructure since 2008.

This review concentrates on the road, electricity and irrigation sectors. These sectors were chosen because, as with the irrigation sector, their development is emphasized under the SDP

---

<sup>3</sup> World Bank, "East Timor – Policy Challenges for a new Nation," Country Economic Memorandum (2002)

<sup>4</sup> ADB (2008). Technical Assistance to Timor -Leste: Preparing the Road Network Development Project.

<sup>5</sup> Timor-Leste Survey of Living Standards 2007, Final Statistical Abstract. The reported statistic is formally defined as "the percentage of those interviewed reporting that the nearest vehicle passable road is accessible during the rainy season".

<sup>6</sup> East-Timor National Development Plan (2002), page 83

<sup>7</sup> More specifically the Government of Timor-Leste entered into an agreement in October 2008 with China Nuclear Industry 22nd Construction Co. Ltd (CNI22) for the design, manufacture, testing, delivery, installation, pre-commissioning, commissioning and performance testing of a national electrical power grid, two power plants, and the related facilities.

and/or because, as with the electricity and roads sectors, Government expenditure has been concentrated on these areas since 2008 (see Table 4 and the Statistical Annex).

### **1.2.1 INITIAL CONDITIONS: ROADS**

**Timor-Leste has an extensive road network, with 1,427 kilometers of national roads; 869 kilometers of district roads; and 3,025 kilometers of rural roads.**<sup>8</sup> However, much of this road network is in a poor condition. The Road Survey of 2008 concluded that much of the road network had deteriorated, with many roads being impassable during the rainy season. On the basis of this survey, it can be concluded that approximately 65 percent of national roads were in a 'very poor' condition, while 96 percent of district roads were in a similar state.<sup>9</sup> In total, only 8 percent of the total road network could be described as being in a 'fair' condition.

**A 2011 study concurred that a significant proportion of the road network was in poor condition.**<sup>10</sup> Data from this study showed that two-wheel drive cars could only drive at reasonable speeds on 20 percent of the national road network. While two-wheel drive cars could pass at slow speeds on 74 percent of the network, on a significant proportion of these roads, conditions were so bad that they were likely to cause damage to these vehicles. More than 6 percent of the road network was in such a poor condition that it was only passable by four-wheel drive vehicles.

The quality of the road network for the 14 major national routes is summarized in Figure 1. Only on one major route (Aituto to Betano) can most of the road be passed by a two-wheel drive car at reasonable speeds. Every major route has sections where two-wheel drive cars can only pass at the risk of sustaining vehicular damage, while 11 of the routes have sections that can only be passed by four wheel drive cars. Thus, there is a significant body of evidence to show that the current road network in Timor-Leste is in a very poor condition.

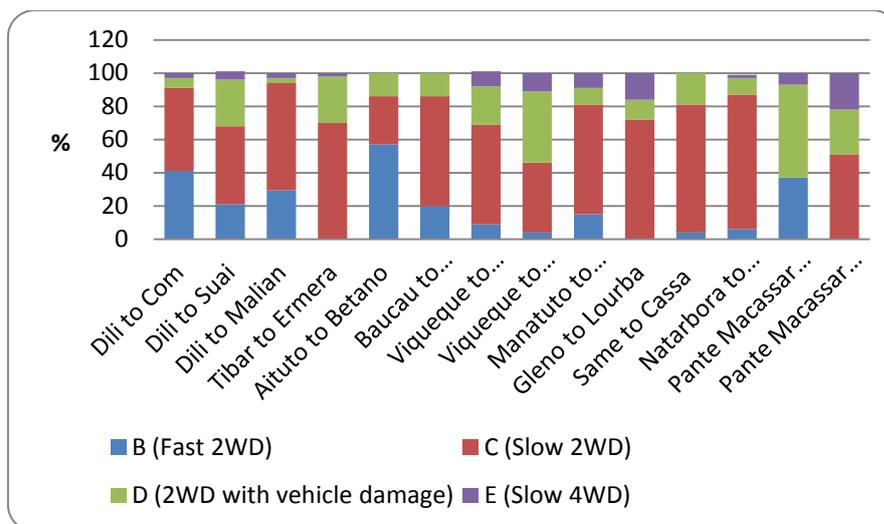
---

<sup>8</sup> Timor-Leste, Strategic Development Plan, page 75

<sup>9</sup> ADB (2008). Technical Assistance to Timor -Leste: Preparing the Road Network Development Project. Manila.

<sup>10</sup> Japan International Cooperation Agency. 2011. Maintenance/Repair Plan for Arterial (National) Roads in Timor-Leste.

**FIGURE 1: CONDITION OF THE NATIONAL ROAD NETWORK<sup>11</sup>**

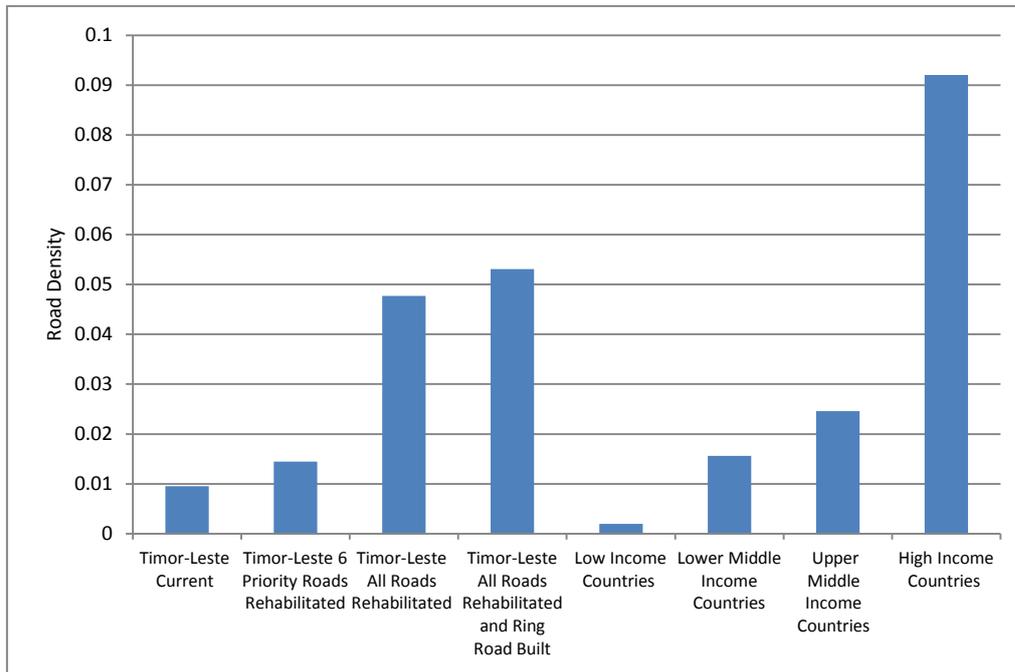


**On this basis, the SDP argues that Timor-Leste’s road network needs to undergo significant rehabilitation and expansion in order for Timor-Leste to achieve its goal of becoming a middle income country.** Figure 2 compares the density of paved roads in ‘good condition’ in Timor-Leste to that in low, middle, upper-middle and high income country groups. Our measure of road density is the total length in kilometers of paved roads divided by a country coefficient, which accounts for population and land area.<sup>12</sup> Figure 2 shows that currently, Timor-Leste has a much lower rate of density of good condition paved roads than does the average middle or low income country. This suggests that some road rehabilitation is required as Timor-Leste moves towards middle income country status. The rehabilitation of the six roads prioritized under the SDP would result in Timor-Leste having a rate of density of good condition paved roads similar to that of the average lower middle income country. However, the rehabilitation of *all* roads, as mandated by the SDP, would lead to Timor-Leste having a much higher rate of density of good condition paved roads than most upper-middle income countries.

<sup>11</sup>Data taken from Japan International Cooperation Agency. 2011. Maintenance/Repair Plan for Arterial (National) Roads in Timor-Leste and Jica.

<sup>12</sup> Formally the country coefficient is: the square root of the country’s land area multiplied by its population.

**FIGURE 2: PAVED ROAD DENSITY BY GDP PER CAPITA (TOTAL LENGTH IN KILOMETERS OF PAVED ROADS DIVIDED BY A COUNTRY COEFFICIENT)**



The evidence suggests that the rehabilitation of the six roads prioritized under the SDP is an important and required measure. However, the full rehabilitation of all existing roads to an international paved standard is unlikely to be a necessary condition for the achievement of lower- or upper-middle income country status. This suggests that if financial or capacity constraints make the entire road building program outlined under the SDP unfeasible, a further prioritization process could be conducted and the SDP’s overarching goal of achieving upper-middle income status for Timor-Leste could still be achieved.

In addition, if the existing road network is rehabilitated to a maintainable standard, Timor-Leste would have a larger road network than the current size of the economy either warrants or could support (see Chapter 4: Roads). In Timor-Leste, at 109 percent, the ratio between the road asset stock<sup>13</sup> and non-oil Gross Domestic Product (GDP) is larger than the economy can sustain without reducing expenditure on other important sectors, such as education and health. A sustainable ratio is considered to range from between 20 percent to 40 percent. A high ratio is not unusual for developing countries, but in order to sustain the asset base at these levels, expenditure on road maintenance would be far greater than could be justified solely in terms of economic return.

<sup>13</sup> The value of the roads when they are in good condition, measured by replacement cost.

## 1.2.2 INITIAL CONDITIONS ELECTRICITY

**The post-referendum upheavals caused considerable damage to Timor-Leste's electricity infrastructure.** Development partners and the Government made significant efforts to expand supply and improve the reliability of electricity in the first nine years following Independence. Despite these efforts, interruptions to electricity supplies were still common in 2007, with the rate of access to electricity in Timor-Leste standing at around only 22 per cent, one of the lowest rates in the world. By 2013, this rate had improved to 53 percent.

**In 2008 electricity was supplied via a non-integrated power generation and distribution network.** There was no national, integrated transmission infrastructure. Power was generated through the large Comoro power plant in Dili and through 10 district power plants and 50 sub-district power plants.<sup>14</sup>

**The SDP argues that electricity supply will need to be sharply increased for Timor-Leste to become a middle income country.** There is some evidence to support this argument. More specifically, the evidence suggests that the level of access to and the rate of production of electricity were much lower in Timor-Leste in 2008 than in most middle income countries (see Figure 3).

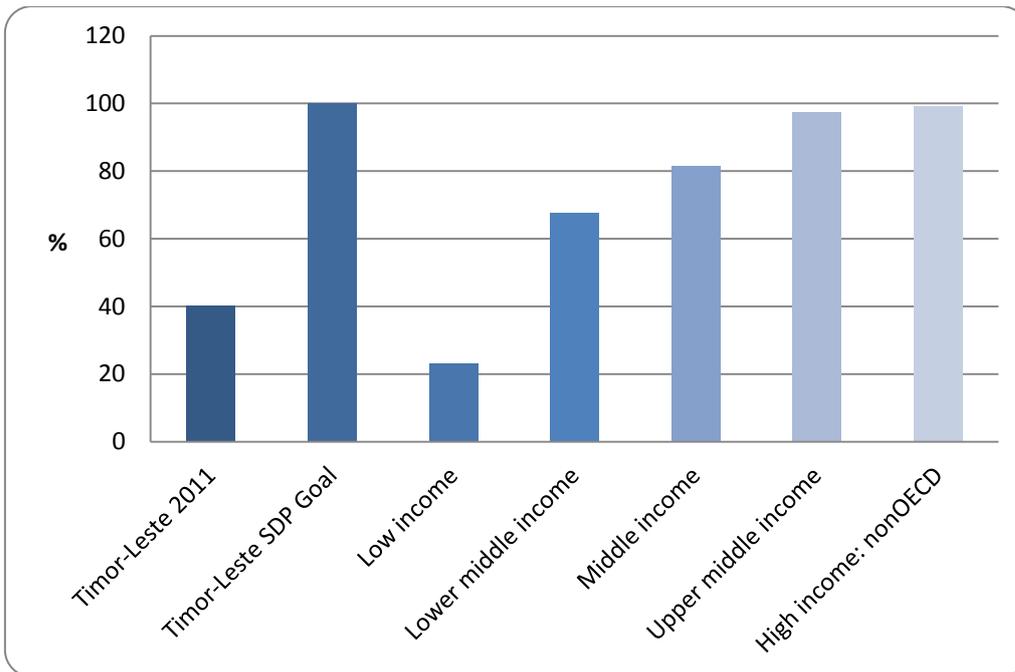
**The SDP also sets forth the Government's plan to develop electricity infrastructure to a level where supplies are significantly in excess of current demand. This is seen as a means of driving economic growth.** Figure 3 shows the higher income countries have higher electricity access rate than lower income countries. The achievement of the targets established under the SDP would lead to an increase in power generation capacity by 256.1 megawatts, with the construction of a national grid system around Timor-Leste providing nearly 100 percent of the population with power for 24 hours a day.<sup>15</sup> However, in 2013, Timor-Leste's peak level of demand stood at 53 megawatts. There is a huge gap between the current demand and the capacity. Figure 4 shows alternative options of power generation capacity additions, by sequencing based on the projected potential demand growth and energy efficiency and conservation measures. Proper forecasting of power demand with consideration of energy efficiency and conservation measures should inform appropriate power development plan and investment decisions, which could contribute to more efficient allocation of resources at right point of time. In addition, even if the full implementation of Timor-Leste's electricity program does drive economic growth, it still remains to be seen whether the measure can be regarded as cost-effective, or whether the increase in the supply of electricity and related growth could have been achieved at lower cost. (see Chapter 5: Electricity, section 5.3).

---

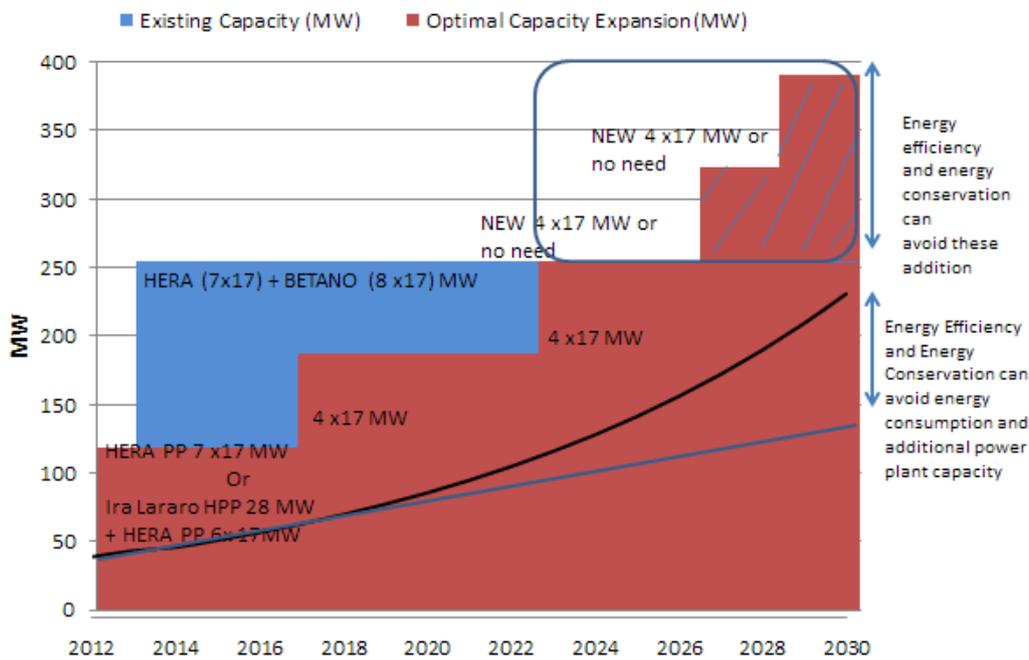
<sup>14</sup> This paragraph is based on data from: "Government of the Democratic Republic of Timor-Leste, Review of Electricity of Timor-Leste (EDTL) April 2011".

<sup>15</sup> Timor-Leste Strategic Development Plan page 87.

**FIGURE 3: ACCESS TO ELECTRICITY (% OF HOUSEHOLDS)**



**FIGURE 4: TIMOR-LESTE POWER GRID SUPPLY-DEMAND BALANCE<sup>16</sup>**



<sup>16</sup> This figure illustrates an indicative electricity supply and demand balance based on a 9.7 percent demand growth per year projected by GoTL for the period of 2012-2029 in the business as usual scenario (indicated by the solid black line) and the lower demand growth scenario (indicated by the solid blue line) in which active promotion of energy efficiency and conservation may be able to avoid wasteful energy consumption and additional investment costs of new power plants capacity. Supply blocks compare the current project (blue) with an alternative that gradually steps up the Betano additional supply.

**In conclusion, it may be argued that the core goal of the SDP could be achieved with a smaller, more focused investment program and with complementary investments in operations and maintenance and human capital, to boost the productivity of physical capital.** The SDP argues that Timor-Leste lacks the core infrastructure necessary to support a modern and productive economy. Roads, electricity and other infrastructure are in themselves beneficial. International evidence supports this argument. However, the full implementation of the SDP would lead to Timor-Leste having much *better* infrastructure than the average middle income country or, in the case of roads, than even the average upper-middle income country. The fact that many middle income countries have less developed infrastructure than that targeted under the SDP suggests that Timor-Leste could achieve middle-income status with a less developed infrastructure than mandated under the plan.

### **1.3 PAST SPENDING, FUTURE SPENDING AND BUDGET EXECUTION**

#### ***1.3.1 OVERALL TRENDS IN INFRASTRUCTURE SPENDING<sup>17</sup>***

**Government expenditure on infrastructure prior to 2008 was limited** (see Figure 5). During this period, most infrastructure projects were funded by development partners and the state budget mainly consisted of recurrent expenditure.

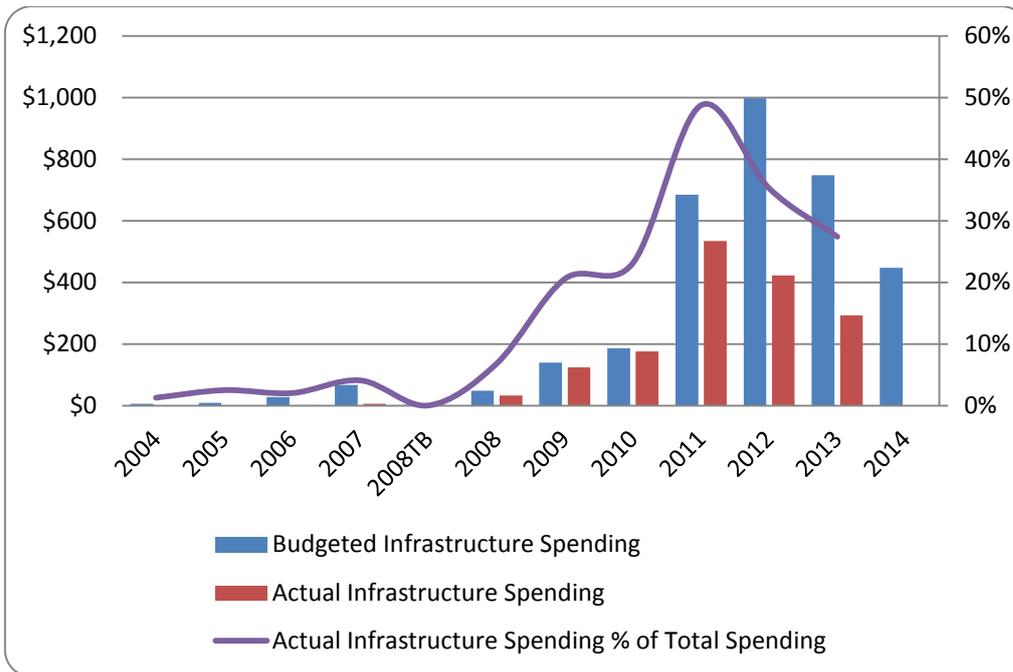
**In the period from 2008 to 2011, expenditure on infrastructure sharply increased, both in absolute terms and as a proportion of total expenditure.** More specifically, expenditure on infrastructure reached 49 percent of total expenditure in 2011, a significantly higher level than in most developing countries.

**However, since 2011, expenditure on infrastructure as a proportion of total expenditure has fallen steadily. In 2013, the total value of expenditure on infrastructure stood at US\$293 million, constituting 27 percent of total expenditure.** In 2014, the Government, partly in response to constrained execution, reduced budgeted infrastructure expenditure to US\$448 million. However, this value is still higher than actual expenditure in either 2012 or 2013. Constraints on execution are discussed in more detail in section 1.3.3 of this report.

---

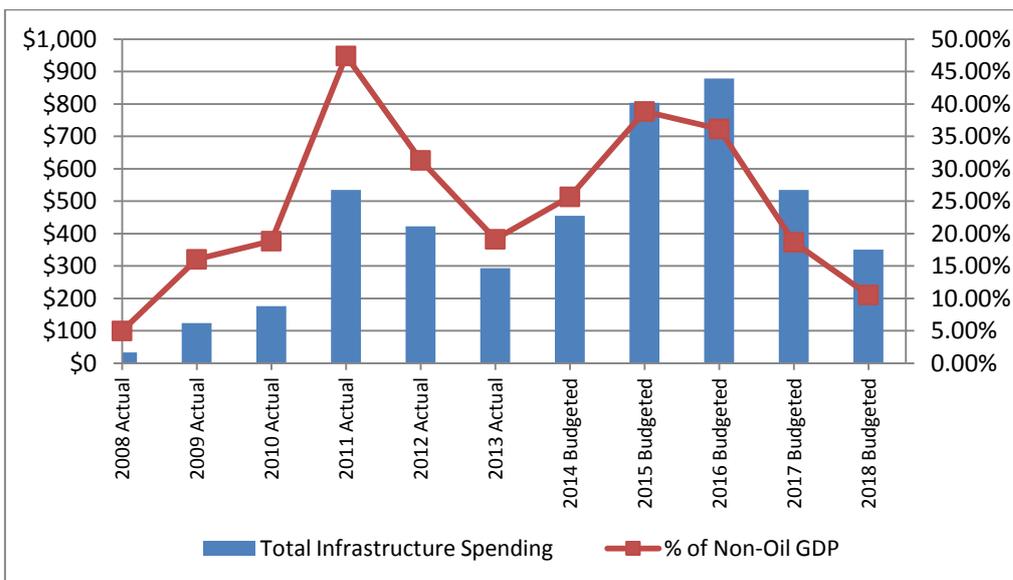
<sup>17</sup> Spending on infrastructure in this chapter refers only to “infrastructure assets”, which is one item below “capital and development” expenditure in the chart of accounts.

**FIGURE 5: SPENDING ON INFRASTRUCTURE ASSETS 2004 TO 2014 (\$ MILLIONS)**



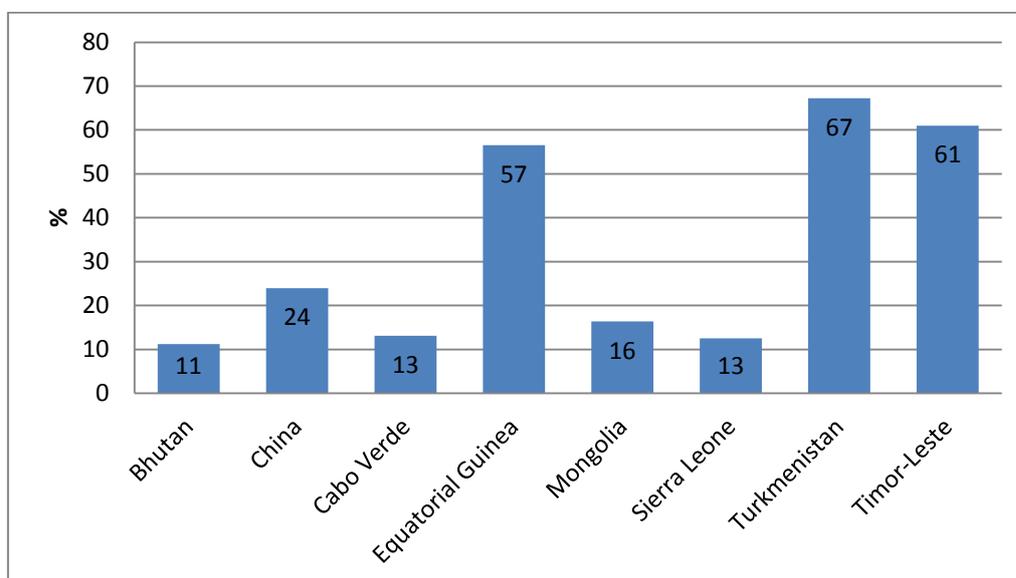
**Expenditure on infrastructure has also been high as a proportion of non-oil GDP, peaking at 49 percent of the value of non-oil GDP in 2011** (see Figure 6). Over the medium term, the Government plans to continue this high rate of expenditure on infrastructure. The value of this expenditure is currently budgeted to peak at US\$878 million in 2016. Expenditure as a proportion of non-oil GDP is budgeted to increase in the medium term, to reach 39 percent in 2015. After 2016, expenditure on infrastructure is budgeted to decline as a proportion of non-oil GDP, due both to lower levels of expenditure in absolute terms and to strong GDP growth.

**FIGURE 6: PAST AND FUTURE INFRASTRUCTURE SPENDING IN US\$ MILLION (NOMINAL) AND AS A % OF NON-OIL GDP**



**The Government’s expenditure on infrastructure has led to Timor-Leste having the second highest rate of investment in the world.** In 2011, Government investment<sup>18</sup> in Timor-Leste reached a value equivalent to 61 percent of non-oil GDP. More than 75 percent of total investment in Timor-Leste was from the general government sector.<sup>19</sup>

**FIGURE 7: GOVERNMENT INVESTMENT AS A % OF NON-OIL GDP IN 2011<sup>20</sup>**



In short, expenditure on infrastructure has been extremely high as a proportion of the budget and in ratio to non-oil GDP, with the rate of expenditure being significantly higher than in many other developing countries. The Government is planning to continue its high level of investment in infrastructure over the medium term.

### **1.3.2 INFRASTRUCTURE SPENDING BY PROGRAM**

**Expenditure on electricity, roads and bridges made up a significant proportion of the total value of expenditure on infrastructure in the period from 2008 to 2013** (see Table 4). Of these sectors, by far the greatest proportion of expenditure has been on electricity, with the value of expenditure on this sector amounting to a total of US\$896.2 million, or 57 percent of total Government expenditure on infrastructure. The value of expenditure on roads and bridges amounts to US\$253.6 million, or 16 percent of total government expenditure on infrastructure. Expenditure on irrigation has been relatively modest, at US\$14.4 million, or less than 1 percent of total expenditure. However, irrigation forms a strong basis for the achievement of SDP’s objective of rice self-sufficiency, with expenditure on irrigation having being supplemented by donor financing.

**The level of expenditure on electricity is budgeted to be much lower over the next five years than in the past.** This is because the construction of two major power plants (Betano and Hera) and the majority of the national grid had already been completed by the end of 2013.

<sup>18</sup> Formally Gross Fixed Capital Formation.

<sup>19</sup> Based on Timor-Leste national accounts data and World Development Indicators.

<sup>20</sup> Formally this is Gross Fixed Capital Formation excluding the private sector. Sources are Timor-Leste’s national accounts and World Development Indicators. GDP was used excluding all natural resources rents.

The level of expenditure on roads and bridges is forecast to increase, both in nominal terms and as a proportion of total expenditure on infrastructure, over the next five years. The allocated budget of US\$516.3 million for the development of roads and bridges during this period represents a substantial investment for Timor-Leste, and are likely to be in excess of optimal levels of US\$78 million per year, based on need and institutional capacity (see Chapter 4: Roads).

The level of expenditure on irrigation is budgeted to increase from US\$14.4 million in the period from 2008 to 2013 to US\$46.5 million over the next five years, with plans for expenditure to a value of ten times that. The total value of expenditure in the period from 2008 to 2013 on irrigation, including financing provided by development partners, amounted to US\$83 million. Furthermore, agriculture sector plans under preparation suggest spending of up to US\$438 million on river-based irrigation, including the construction of large dams.

**TABLE 4: TOTAL EXPENDITURE BY PROGRAM (2008-2018)**

	Total Actual Expenditure 2008 to 2013	Percentage of Total	Total Budgeted Expenditure 2014 to 2018	Percentage of Total
Electricity	896.2	57%	151.3	5.0%
Roads and Bridges	253.6	16%	516.3	17.1%
District Development	169.3	11%	213.2	7.1%
Information Technology / Computer Systems	28.0	2%	26.9	0.9%
MDGs (Mainly Community Housing)	28.7	2%	169.1	5.6%
Education	23.5	1%	144.0	4.8%
Tasi Mane / South Coast Development	21.3	1%	365.2	12.1%
Public Buildings	21.9	1%	213.8	7.1%
Transport (Excluding Roads and Bridges)	19.6	1%	537.5	17.8%
Security and Defense	20.3	1%	45.9	1.5%
Health	13.0	1%	9.6	0.3%
Irrigation	14.4	1%	46.5	1.5%
Water and Sanitation	11.7	1%	130.7	4.3%
All Other Infrastructure	63.4	4%	453.3	15.0%
<b>TOTAL</b>	<b>1,584.8</b>	<b>100%</b>	<b>3,023.3</b>	<b>100.0%</b>

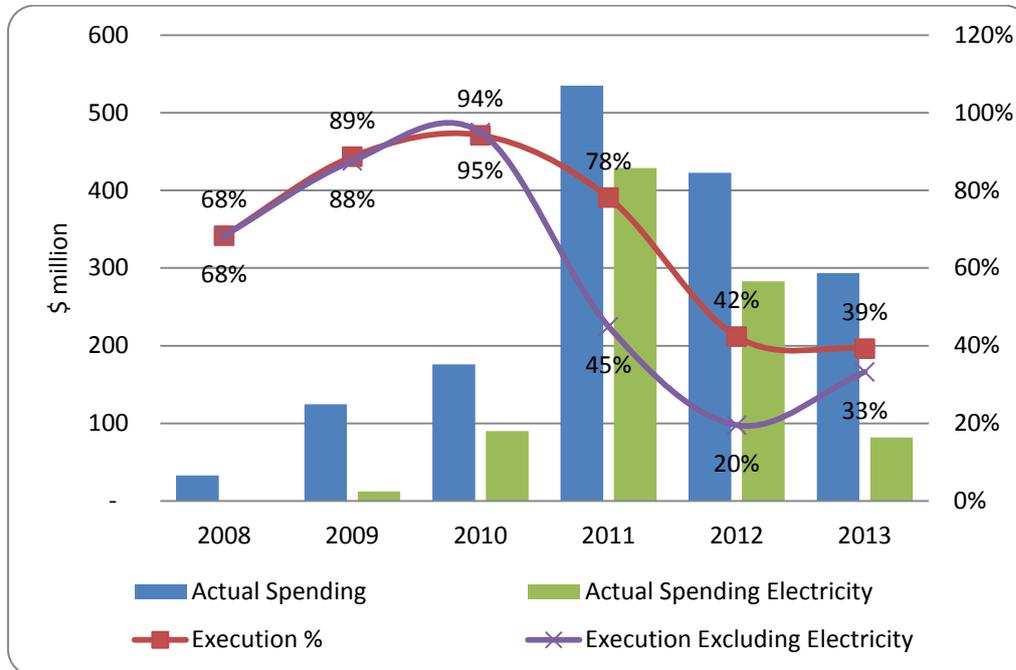
### 1.3.3 BUDGET EXECUTION

Implementing the SDP requires not just the allocation of a large value of funds, but that budgets are executed well. There has been a general concern within Government that the quality of budget execution has been low in recent years. This concern will become increasingly relevant into the future, as the Government plans to spend a total of more than US\$3 billion on infrastructure over the next five years. This is more than double the amount actually spent on infrastructure in the period from 2008 to 2013. This section examines trends in execution and seeks to explain them. It also examines the main reasons for why projects have not been executed in Timor-Leste.

Timor-Leste's record in sharply increasing budgeted and actual expenditure is impressive (see Figure 8). However, a significant proportion of this expenditure has been on a single sector, electricity. In the period from 2010 to 2011, budgeted expenditure on infrastructure increased by 266 percent, while actual expenditure doubled and the rate of execution remained high at 78 percent. However, this high rate of execution was largely due to the high level of expenditure on electricity projects.

**A decline in infrastructure spending on electricity in 2012 and 2013 led to lower overall levels of expenditure and rates of execution.** Without electricity, the rate of execution of the infrastructure budget dropped from 95 percent in 2010 to 33 percent in 2013.

**FIGURE 8: INFRASTRUCTURE BUDGET SPENDING, ACTUAL SPENDING AND EXECUTION**



**This low rate of execution, and not the higher rate including the electricity project, is likely to be indicative of the future constraints on spending for three reasons, as follows:**

1. No single project or program will dominate budgeted expenditure to the same extent over the next five years as the central electricity project did over the last five years. This means that no single project will have as large an impact on the overall rate of execution;
2. Expenditure on the development of electricity infrastructure has been dominated by two contracts, these being a contract with Puri Akraya Engineering to the value of US\$406 million and a contract with CNI-22 to the value of US\$298 million. Much of the value of the Puri Akraya's contract is for generators, which were imported to Timor-Leste, facilitating rapid disbursement. In the future, large infrastructure projects, such as the construction rehabilitation of the road system, are unlikely to require such a significant proportion of expenditure on a few large imported items.
3. The contract with CNI-22 was awarded in 2009, while the contract with Puri Akraya was awarded in 2010. This was prior to the establishment of the Infrastructure Fund. The establishment of the Infrastructure Fund and supporting institutions significantly added to the complexity of the processes through which projects are proposed, budgeted, procured and implemented. This means constraints on the execution of projects procured after 2010 are likely to best illustrate future impediments to execution.

**The low rates of infrastructure execution in the period from 2011 to 2013 (45 percent in 2011; 20 percent in 2012; and 33 percent in 2013) may therefore be indicative of a significant constraint on increasing expenditure to the level needed to construct the infrastructure outlined in the SDP.** This suggests that the institutional constraints on executing the budget need to be better understood and, if possible, ameliorated.

**In Timor-Leste, expenditure on infrastructure occurs through three windows. However, the focus here is on constraints in the Infrastructure Fund process (see Box 1), which was created in 2011 and which has accounted for more than 85 percent of infrastructure expenditure since then.** We first look at some typical constraints that have been ameliorated through the Infrastructure Fund, before turning to the binding constraints.

**Unlike in many developing countries, execution is not constrained by a lack of financing.** The reason for this is that the Government has substantial reserves of relatively liquid financial assets in the Petroleum Fund. The total amount the Government can withdraw from the Petroleum Fund during a fiscal year is shown in the annual budget and must be approved by parliament. However, prior to the establishment of the Infrastructure Fund, the full budgeted value of the withdrawals from the Petroleum Fund was disbursed to the Consolidated Fund for Timor-Leste (CFTL) account, whether or not the previous year's budget had been fully executed. This led to the accumulation of large cash balances in the CFTL.

**The rules governing the Infrastructure Fund also mean it is unlikely that the execution of projects will be constrained by a lack of financing.** The Infrastructure Fund has its own bank account and in the first year of its operation, disbursements to this account were equivalent in value to its total budget. As the rate of budget execution was subsequently below 100 percent, a cash balance has built up. With the approval of parliament, this is rolled over to finance expenditures in the following year, unlike in the case of the CFTL. At the end of 2013, the total value of this cash balance amounted to nearly US\$400 million.

## **Box 1: INFRASTRUCTURE FUND SIMPLIFIED INVESTMENT MANAGEMENT CYCLE**

### **BACKGROUND**

This fund was established in 2011 and includes all multi-year projects with a value of more than US\$1 million. Three institutions, namely the National Development Agency (ADN), Major Projects Secretariat (MPS), and NPC, were established to govern different aspects of the investment management cycle for the fund. The Council for Management of the Infrastructure Fund (CAFI), which acts as the board to the Infrastructure Fund, was also established at this point.

### **STEP 1: PROJECT PROPOSALS**

Projects are proposed by line ministries. A short project brief of two pages is sent by line ministries to the MPS.

### **STEP 2: APPRAISAL**

The MPS appraises all projects proposed by line ministries. Projects to be included in the budget of year X must be received by MPS by February of year X-1. A brief report evaluating each proposal is provided to the Budget Review Committee (BRC) and the CAFI.

### **STEP 3: BUDGETING**

The MPS and the Budget Office work together to present proposed projects to the BRC. The BRC makes

the final decision regarding the inclusion of projects in the budget, which is submitted to parliament for approval. Parliament can revise the IF budget before granting approval.

#### **STEP 4: FURTHER ANALYSIS, DESIGN AND FEASIBILITY STUDIES**

Prior to the procurement of the main construction component of the project, further analysis, design or feasibility studies are undertaken and presented to the CAFI, which then decides whether or not to proceed with the project. In some cases, this decision is taken prior to the project being included in the IF budget.

#### **STEP 5A: PROCUREMENT**

Procurement of Infrastructure Fund projects is undertaken by the PC. The MPS and the ADN sometimes assist in drafting bid documents and in reviewing contracts.

#### **STEP 5B: CONTRACT MANAGEMENT, PROJECT MONITORING AND CERTIFICATION**

Project works are certified by ADN. This institution also approves invoices and sends these to the MPS. The MPS forwards invoices to treasury for payment. The MPS also tracks the progress of projects against their contracts and budget and drafts a quarterly progress report, which is submitted to CAFI. Line ministries also monitor projects and provide information to MPS for this quarterly report.

#### **STEP 6: PROJECT ADJUSTMENT**

Transfers between budgets for projects in different programs can be made with the approval of the CAFI. Within a program, individual projects can overspend or under-spend their budgets without the need for transfers.

#### **STEP 7: PROJECT COMPLETION**

On completion, projects are handed over to line ministries, who are responsible for the operation and maintenance of all infrastructure projects.

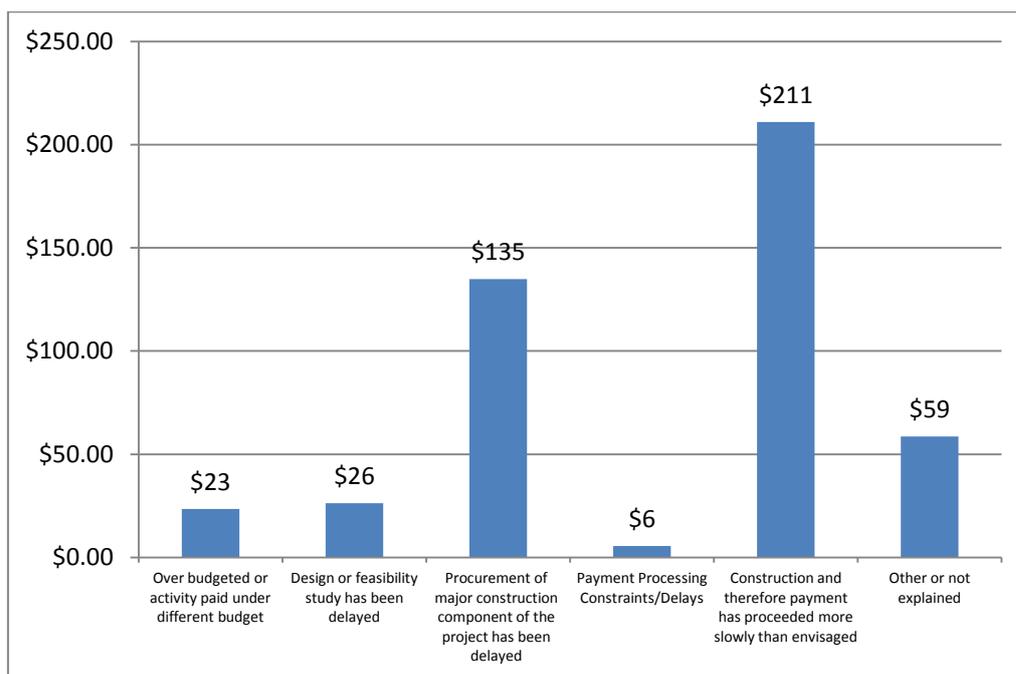
**In addition, the Infrastructure Fund has elements of multi-year budgeting, unlike the CFTL.** More specifically, the Government, when preparing the budget for year X, forecasts the amount by which each project will have overspent or under-spent its budget in year X-1. These unspent funds are then rolled over to year X and added to the new budget for each project to give the final budget for each project. Parliament is then required to approve this final budget. By rolling over the Infrastructure Fund's budget for each project, the Government can ensure that funds to pay contractors involved in multi-year projects are effectively ring-fenced. This form of budgeting can also result in an increased rate of execution, because after being rolled over, the allocated budget should be of sufficient value to cover payments which may become due on existing contracts. Growing concerns regarding the rate of execution in the CFTL could lead to similar principles being used selectively for the CFTL, such as in the case of capital and development projects to a value of under US\$1 million.

**The overall rate of execution in the Infrastructure Fund is also unlikely to be constrained by under-budgeted or over-spent projects within a year, since virements are permitted.** Projects may overspend their budgets as long as there is under-spending on a project within the same program. In addition, transfers between budgets for different programs may be made with the permission of the Council for Management of the Infrastructure Fund (CAFI). For example, in 2011 the total value of transfers between different programs stood at US\$35 million, with the net impact on the total infrastructure budget being zero. These transfers allowed some programs, such as the irrigation program, to exceed their original budget, while no program

had to cancel or delay cash expenditures because of a decrease in its budget. These transfers therefore contributed to a slightly higher overall rate of execution.<sup>21</sup>

**Therefore, the main reasons for constrained execution are likely to be unrealistically high budgets and delays in design studies, procurement, payment or construction.** Figure 9 quantifies these constraints. This figure shows the total amount of under-spending (the budget minus cash expenditure) according to the different forms of constraint on execution.<sup>22</sup> The two main bottlenecks in execution are due to procurement and delays in construction.

**FIGURE 9: CONSTRAINTS ON PROJECT EXECUTION (\$ MILLION) IN 2012**



**The root cause of delays with projects involving procurements to a value of more than US\$1 million is that many projects are poorly designed.** The rapid increase in the size of the budget and the increased emphasis on expenditure on infrastructure has led to some ambitious projects being included in the budget without sufficient attention being paid to the challenges associated with their implementation.

For projects to a value of less than US\$1 million, design documents are occasionally entirely absent, as has been the case with the number of road projects. There is also some evidence that poor quality design studies have been undertaken. Because design studies can be classified as individual projects with budgets to a value of less than US\$1 million, they are sometimes procured by line ministries outside of the Infrastructure Fund's institutions or processes. Some design studies were also undertaken before the Infrastructure Fund was established. The main construction component of the project is then included in the Infrastructure Fund after the design study is completed. The relevant Infrastructure Fund

<sup>21</sup> Numerous virements were made into and out of Infrastructure Fund sub-programs in 2011. The majority of programs that saw increases in their budget executed less than their original budget and therefore the overall impact of these transfers on execution was limited.

<sup>22</sup> This data was collated by the Economic Policy Directorate and Major Projects Secretariat.

institutions (the MPS, the ADN and the National Procurement Commission / NPC) then only see or review the design study during the process of drafting the bidding documentation. Any legitimate concerns and queries they may have related to the design study then delay the procurement process.

**Slower than expected rates of construction have also significantly constrained execution.** This constraint may be being partly caused by weaknesses in the procurement and design processes. However, it is also likely to be at least partly due to the limited capacity of the domestic private sector to construct large scale infrastructure and the difficulties international construction companies face in working in Timor-Leste. These constraints may be difficult to ameliorate in the short term, meaning that execution of the Infrastructure Fund is likely to be constrained over the medium term.

This section has discussed the execution of the Infrastructure Fund budget. Future rates of execution will be dependent on many factors and are difficult to predict. This is especially the case in Timor-Leste, given that the Infrastructure Fund and the institutions which govern it were only established in 2011 and that this system's ability to execute funds may improve over time. However, considerable efforts will need to be made in the short term to ameliorate constraints on procurement and construction, if the Government's plans to sharply increase its level of expenditure on infrastructure over the next five years are to succeed.

## **1.4 OUTPUTS FROM SPENDING AND UNIT COSTS**

This section examines the impact of increased spending on infrastructure, drawing on the sector chapters later in this report. It also presents calculations of the capital expenditure unit costs of road, electricity and irrigation infrastructure in Timor-Leste and comparable countries. The costs associated with operation and maintenance are calculated and discussed in the following section.

Caution should be exercised when drawing conclusions from this data regarding the efficiency and efficacy of expenditure on infrastructure in the past in Timor-Leste. The main reason for this is that, because large infrastructure projects can take many years to complete, much budgeted spending has not yet resulted in concrete outputs. In addition, statistical data is often scarce in Timor-Leste and this inhibits a detailed analysis of the impact of spending on outputs. However, sector chapters do calculate ex ante and ex post economic rates of return in the case of irrigation (see Chapter 3: Irrigation), and ex ante rates of return in the case of roads (see Chapter 4: Roads). The electricity chapter (see Chapter 5: Electricity) conducts a cost effectiveness analysis of options for electricity generation, using screening curves.

### **1.4.1 OUTPUTS FROM SPENDING ON IRRIGATION<sup>23</sup>**

**The vast majority of irrigation systems were constructed during the Indonesian occupation, but were in a state of disrepair at Independence due to poor maintenance.** In the period

---

<sup>23</sup> This sub-section draws heavily on chapter 3 Irrigation.

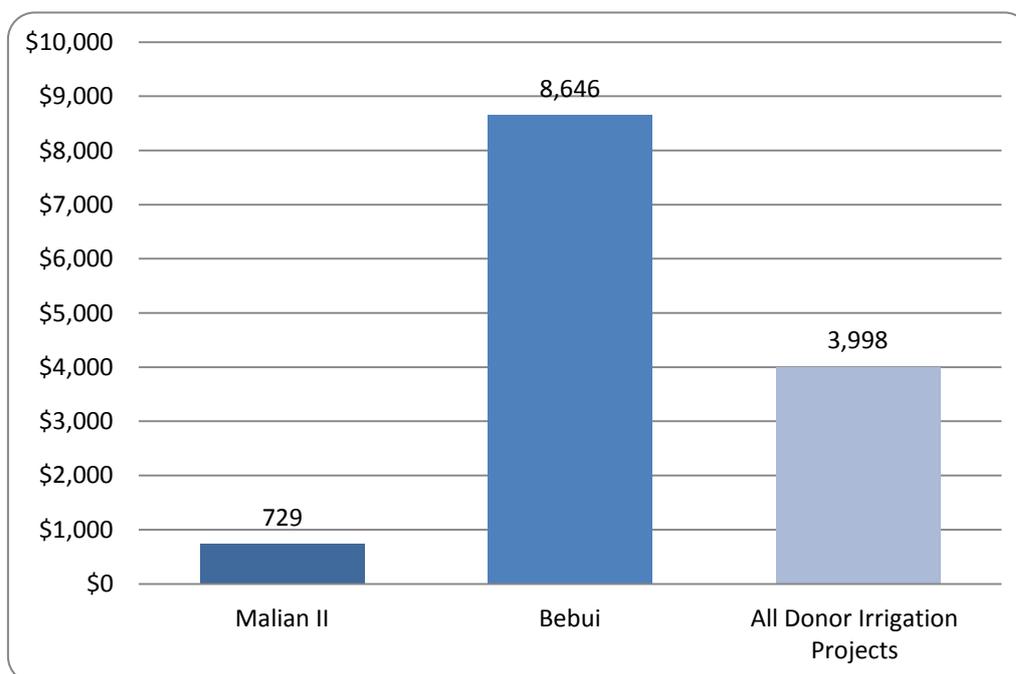
from 2001 to 2013, US\$82 million<sup>24</sup> (at 2013 values) was spent on the rehabilitation of systems that are used to irrigate 9,920 hectares of land. This implies an average unit cost per rehabilitated hectare of US\$8,266 at 2013 values.

**Donors financed the majority of the rehabilitation of irrigation systems.** More specifically, 80 percent of the rehabilitated irrigated land and 74 percent of the expenditure involved in this rehabilitation (in 2013 prices) was financed by donors.

**The Government has financed two completed rehabilitation projects: Maliana II and Bebui.** Figure 10 shows the cost per hectare at 2013 values of the two Government financed rehabilitation projects and the average cost for all donor projects. The rehabilitation costs of the Maliana II project seem quite reasonable, while the large Bebui project seems to have been fairly expensive, at least compared to other irrigation projects in Timor-Leste.

**The MPS recently completed an ex-post evaluation of three rehabilitated schemes including the Bebui scheme.<sup>25</sup> This evaluation concluded that there has been a negative economic rate of return on the investments in these projects and that on that criterion alone, they should not have been implemented.** This negative rate of economic return was partly due to the high cost of the scheme per beneficiary/farmer. Evidence shows that projects resulted in only moderate increases in yields because farmers did not receive an adequate support package of extension services, seeds, fertilizer and marketing assistance.

**FIGURE 10: GOVERNMENT AND DONOR IRRIGATION SCHEMES COST PER HA**



<sup>24</sup> The figures in this section are taken from the irrigation chapter. The actual spending figures are until 2012. Figures could not be updated to 2013 as actual spending data from donor financed projects were not yet available and neither was output data.

<sup>25</sup> The irrigation chapter of this Public Expenditure Review examines the Bebui project in more detail.

**Additional ex ante appraisals have shown similar negative economic rates of return for proposed construction of new schemes and rehabilitation of existing schemes unless the appropriate supportive agricultural policies are implemented.** In the future, the Government is planning to scale up the rehabilitation of major irrigation schemes. There are currently 13 approved irrigation schemes, with the 2014 Infrastructure Fund's budget for irrigation schemes for the period up until 2018 standing at more than US\$46.5 million, with new plans that may result in the expenditure of an additional US\$438 million. Given the negative economic rates of return calculated for these new projects and for previous projects, the Government may wish to consider alternative agricultural policies to achieve its overarching policy goals at a lower cost. These include investigating the potential for supplementary tubewell irrigation, and providing a package of market, input and extension support.

#### ***1.4.2 OUTPUTS FROM SPENDING ON ELECTRICITY***

**The Government has spent more than US\$896 million on the development and rehabilitation of electricity infrastructure since 2008.** The aims of the electricity program were to supply electricity to 100 percent of the population and to build sufficient electricity generation capacity to meet long term demand as Timor-Leste develops and industrializes. The program has involved constructing power plants and a national power grid.

The electricity program has involved the construction of power stations at Hera and Betano.<sup>26</sup> The Hera power plant became operational in October 2011, with the capacity to generate 119.5 megawatts of electricity. With the exception of some fuel storage facilities, the Betano power plant became operational in late 2013, with the capacity to generate 136.6 megawatts of electricity.

The current total electricity generation capacity in Timor-Leste is therefore at least 256 megawatts.<sup>27</sup> This compares to a capacity of 110.5 megawatts<sup>28</sup> in 2010, representing a sharp increase in capacity. The current peak level of demand for electricity is 53 megawatts, so a significantly increased demand driven by substantial industrialization will need to occur to absorb the current generation capacity. However, the Government has recently received proposals for the establishment of a brewery and a cement plant, which if implemented would consume a substantial quantity of electricity. The Government is also encouraging the development of oil refining facilities and a liquefied natural gas processing plant in Timor-Leste. These industries are highly energy intensive, and therefore have the potential to drive increased demand.

---

<sup>26</sup> This paragraph is based on information contained in "The Infrastructure Fund Annual Report 2012 pages 30 to 37.

<sup>27</sup> Exact electricity generation capacity is difficult to state with certainty and is subject to change because electricity supply in districts was, before the start of the current electricity generation program, dependent on a large number of small diesel operated generators. These generators are slowly being mothballed as the national grid connects more consumers to the Betano and Hera power stations. This figure assumes that once the three main power plants are producing electricity all the smaller diesel power stations will be mothballed.

<sup>28</sup> Data supplied by the National Directorate of Statistics.

**FIGURE 11: PER CAPITA ELECTRICITY GENERATION, AND PER CAPITA GDP**

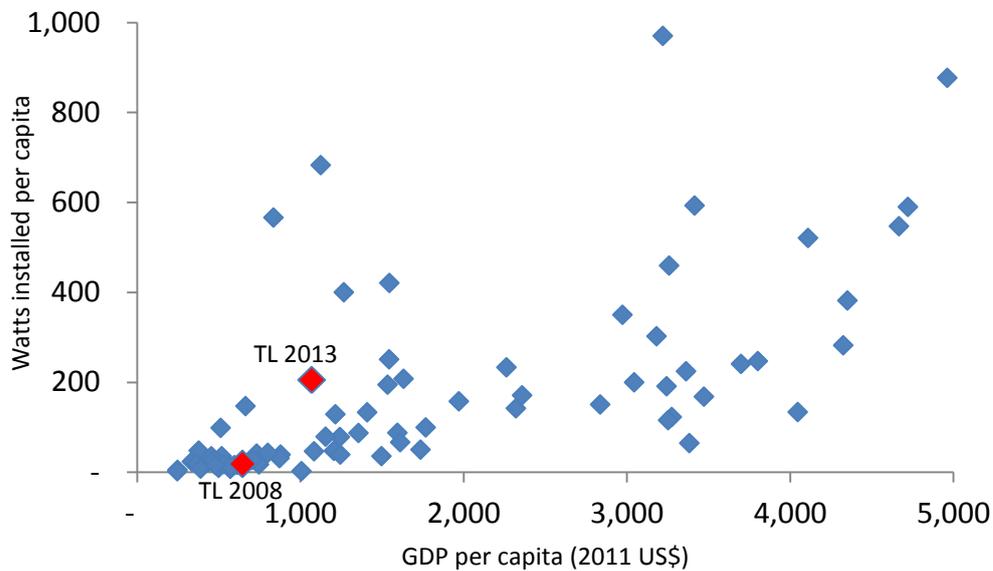


Figure 11 shows per capita electricity generation capacity across a number of countries relative to per capita income. Timor-Leste is shown in 2008 and 2013. The chart demonstrates that the recent expenditure on electricity generation facilities has led to Timor-Leste's electricity generation capacity increasing from below average to above average for a country of its level of income. However, there has been a significant financial cost to this achievement. With the construction of the Betano and Hera plants, Timor-Leste spent approximately US\$1.6 million per megawatt of electricity generation capacity. If the marginal cost of each additional megawatt of generation capacity constructed is calculated, then the unit cost in Timor-Leste is higher, standing at US\$2.8 million<sup>29</sup>. This is because while the two new power stations can generate 256.2 megawatts, they effectively replaced most district and sub-district stations and therefore the net increase in electricity generation capacity resulting from the project is just 145.7 megawatts. The Government was unable to sell the old diesel generators used in the district and sub-district stations and therefore there were no savings to be derived from decommissioning these assets.

**Since 2008, the Government has also financed the construction of a national electricity grid.** The main components of this grid are 150 kilovolt transmission lines which will circle the country; 20 kilovolt distribution lines; and nine sub-stations.

---

<sup>29</sup> Cost of capacity addition per MW is depends on the technology and other specific conditions, such as site, environment, transportation, etc. Efficient and competitive procurement processes can reduce the costs as well. Comparing Timor-Leste with other countries, capital costs for 25 MW at capacity factor 80% were USD 0.393 million per MW in India, USD 0.395 million per MW in Romania had and USD 0.422 million per MW in USA. For 100 MW at capacity factor 80%, capital costs were USD 0.721 million per MW in India, USD 0.726 million per MW in Romania, and USD 0.784 million per MW in USA. These data are based on the data collected by the World Bank.

When complete, the 150 kilovolt transmission line will be 604 kilometers long. By late 2013, 96 percent of the line had been completed. Of the 1,407 pylon towers, 87 percent had been completed and strung. Of the 20 kilovolt distribution lines, 100 percent had been completed and all of the nine sub-stations were operational. With the vast majority of work on this project having been completed, Timor-Leste has made substantial progress towards establishing a national grid.

Chapter 5 (Electricity) undertakes a detailed economic analysis of the electricity project. This analysis concludes that the increased supply of electricity has improved the population's welfare. Many communities, especially in the north of the country, now benefit from a reliable supply of electricity.<sup>30</sup> The rate of access to electricity has jumped from 27 percent in 2007 to 53 percent in 2013.

However, the high financial cost of the project and the current excess generation capacity mean that the project is only likely to generate a positive rate of economic return if demand for electricity from industry and households significantly increases over the medium term. While the potential constraint on development and industrialization from limited electricity supply has been removed by the Government, the high cost of ameliorating this constraint means that industrialization and development *must* now follow for the project to have made economic sense.

### ***1.4.3 OUTPUTS FROM SPENDING ON ROADS***

Data on outputs, in terms of the quality and volume of roads rehabilitated and maintained, is not being systematically collected by MPW technical departments as a means to manage in year spending or to prepare budgets. Chapter 4 (Roads) shows that in the period from 2009 to 2013, 452 kilometers of road had been rehabilitated at a cost of approximately US\$146 million and that 723 kilometers of road had been maintained at a cost of US\$5.6 million.

Chapter 4 (Roads) shows that the overall condition of the road network has deteriorated steadily in the period from 2009 to 2012, despite an increase in expenditure on roads from US\$23 million to US\$89 million over the same period.

## **1.5 OPERATION AND MAINTENANCE**

**Once constructed, infrastructure must be appropriately maintained to sustain and, in many cases, to realize economic returns.** This section examines past actual, optimal and budgeted future operation and maintenance expenditure for roads, electricity and irrigation.

### ***1.5.1 OPERATION AND MAINTENANCE AND OTHER RECURRENT EXPENDITURE ON IRRIGATION***

There have been some concerns regarding the past record of the Ministry of Agriculture, Forestry and Fisheries (MAFF) in the area of the maintenance of irrigation schemes. Routine maintenance on irrigation schemes has not normally been planned, budgeted for or implemented. Rather, the MAFF has on a number of occasions approached parliament or the Ministry of Finance (MoF) for funds to undertake emergency repairs to projects. For example,

---

<sup>30</sup> This paragraph is based on information contained in "The Infrastructure Fund Annual Report 2012 pages 30 to 37.

during 2013, the MAFF requested approximately US\$0.9 million for a hillside stabilization project to protect the main distribution canal at Bebui.

**This report estimates that the cost of maintaining irrigation schemes in Timor-Leste is likely to be equal to 2.5 percent of their original construction costs.**<sup>31</sup> In addition, for irrigation schemes to result in substantially increased production and to therefore generate a positive Internal Economic Rate of Return (IERR), farmers will need to be supported with improved access markets and by a package of inputs paid for out of the line ministry's recurrent budget. This support package should ideally include extension services (training and demonstrations), production inputs (seeds, fertilizer, etc.) and marketing services. These support services are estimated to cost approximately US\$500 dollars per hectare at 2013 prices.<sup>32</sup>

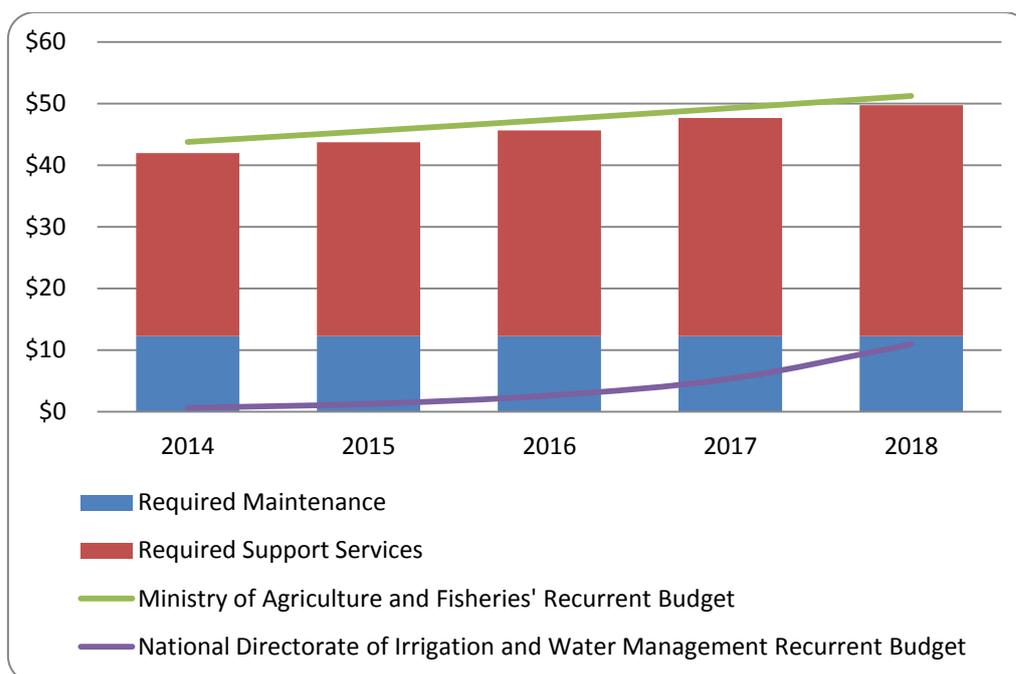
Figure 12 shows Government budgeted expenditure on the operation and maintenance of irrigation facilities. It also shows forecast future expenditure based on the assumption that maintenance costs will be equivalent to 2.5 percent of construction costs; that support services will cost US\$500 dollars per hectare; and that irrigation investments are already included in the Infrastructure Fund. The chart shows that the MAFF' budget will have to be significantly increased in order to maintain planned irrigation schemes and to increase the likelihood that they will generate a positive economic rate of return. The estimated cost of the necessary maintenance and support services already exceed the budget of the National Directorate of Irrigation and Water Management and are only slightly less than the entire budget of the MAFF. One alternative to such a significant growth in recurrent expenditure would be to scale back the existing investment program for irrigation projects. Another option would be to investigate the use of tube wells to irrigate land, as the use of these wells may involve both lower initial investment costs and lower maintenance costs, measured by cost per hectare irrigated. Thus, the plan outlined under the SDP to test tube well irrigation should be accelerated. Chapter 3 (Irrigation) of this public expenditure review contains a more detailed description and analysis of this option.

---

<sup>31</sup> Please see Irrigation Chapter of this report for the methodology underlying these calculations.

<sup>32</sup> Please see Irrigation Chapter of these report for the methodology underlying these calculations.

**FIGURE 12: OPERATIONS AND MAINTENANCE OF IRRIGATION SCHEMES**



### **1.5.2 OPERATION AND MAINTENANCE OF ELECTRICITY INFRASTRUCTURE**

**The choice of diesel-fired generation facilities, while meeting urgent needs, carries a sizable financial cost, including the growing cost of subsidies as demand increases and inefficiencies in the systems become apparent.** In 2012, the value of funding provided to EDTL stood at US\$106 million, equivalent to approximately 8 per cent of the estimated value of GDP. At the same time, the value of revenues collected by EDTL was only US\$14.9 million, implying that the Government provided a subsidy to the value of US\$95 million. The development of improved metering, billing and collection systems are a high priority for reducing the level of this subsidy, although given the high cost of providing electricity services and the limited ability to pay, full cost recovery is unlikely to be possible.

**Expenditure on the operation and maintenance of electricity infrastructure has sharply increased since 2008. This trend is likely to continue into the future.** The trend towards increased expenditure can be seen in Figure 13, which shows actual expenditure in the period up until 2013, the budgeted expenditure in 2014, and then our forecasts for future expenditure on operations and maintenance.<sup>33</sup> Our forecasts are significantly higher than the figures outlined in the Government's outer year budgets for the period from 2015 to 2018, which simply assume increases in the cost of operation and maintenance of 4 percent a year. There are three underlying drivers for the increases in expenditure on operations and maintenance in the past and, most likely, into the future, as follows:

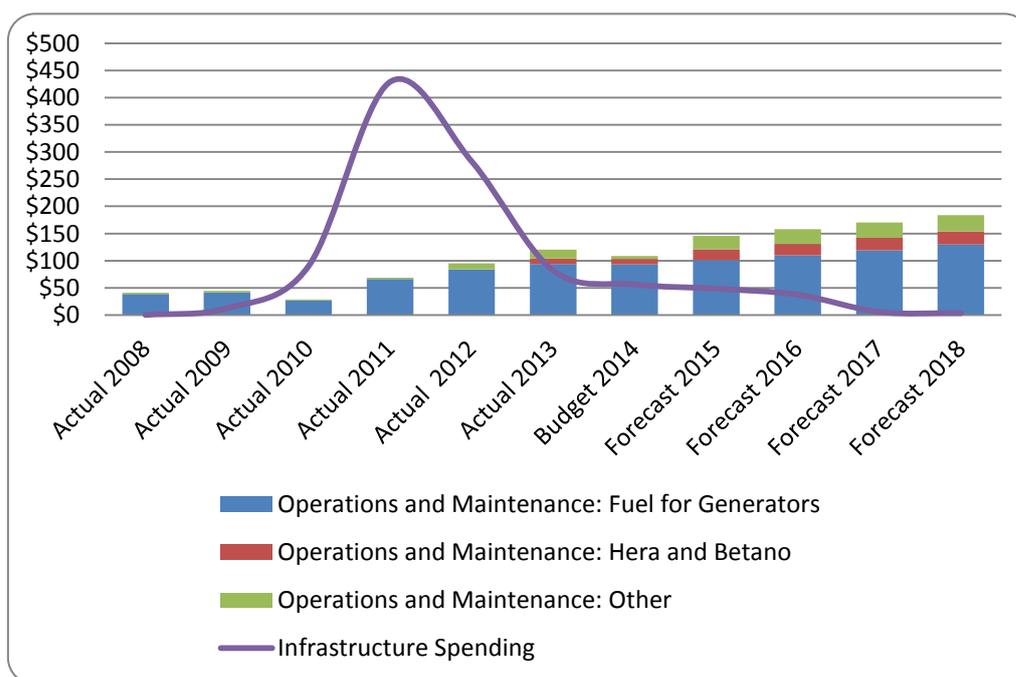
1. Increased electricity generation capacity has resulted in the need to purchase an increased volume of fuel for generators, requiring steady increases in the budget for

<sup>33</sup> These forecasts account for inflation, likely future demand for electricity and international evidence on the costs of maintaining electricity distribution and transmission networks.

this item over the period from 2008 to 2013. The Hera and Betano plants are not currently operating at, or even near to, their full generation capacity. As more households are connected to the national grid, the level of expenditure on fuel is likely to increase further;<sup>34</sup>

2. The 2013 and 2014 budgets included an allocation to a value of US\$10 million to pay for the operation and maintenance of the Hera power plant. In 2015, it is likely that a similar amount will be required to maintain the Betano power plant;
3. The value of the remaining budget available to the MPW<sup>35</sup> for the operation and maintenance of electricity facilities, excluding fuel for generators and the maintenance of the Hera power plant, is US\$1.4 million in 2014. This seems extremely low, given that international evidence suggests that the maintenance of rural electrification systems costs at least 2 percent of the asset value of the network each year.<sup>36</sup> It also suggests that in the future, a further increase in the operations and maintenance budget will be required to maintain the national grid.

**FIGURE 13: INFRASTRUCTURE AND OPERATION AND MAINTENANCE OF ELECTRICITY (\$ MILLION)**



### 1.5.3 OPERATION AND MAINTENANCE: ROADS

**There have been persistent concerns that the budget allocated for the maintenance of road systems in Timor-Leste has been too low.** These concerns seem well-founded, given that in the period from 2008 to 2014, the total budget of the National Directorate of Roads, Bridges

<sup>34</sup> The graph assumes 6 percent inflation in fuel for generators capacity and a 3 percent a year increase in demand for fuel. This 3 percent is the average rate of growth in electricity generation from 2006 to 2011.

<sup>35</sup> Previously the Ministry of Infrastructure

<sup>36</sup> Recurrent Expenditure Requirements of Capital Projects, Hood, Husband and Yu (2002).

and Flood Control Services (DRBFC) was significantly lower than our estimated cost of the required maintenance (see Figure 14). As discussed in the roads chapter of this report, there is much evidence that this under-investment in the maintenance of the road system has led to frequent landslides, erosion and culvert failures, all of which have contributed to the overall deterioration of the road network.

**The SDP mandates the rehabilitation of all national and regional roads to meet international standards by 2015.** The 2014 budget commits the Government to an expenditure of US\$516.3 million on roads and bridges over the next five years. This expenditure is mainly for large Infrastructure Fund projects involving the substantial rehabilitation of the existing road network, rather than for the construction of new routes. The proposed South Coast route is included separately as a component of the Tasi Mane project.<sup>37</sup>

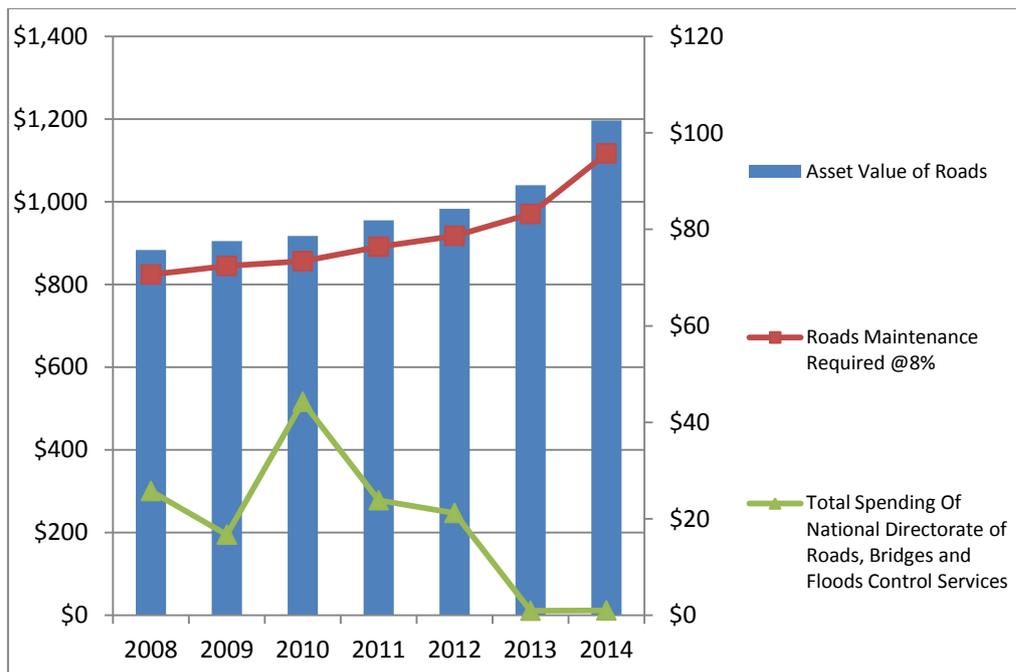
**According to our estimates, the optimal level of expenditure on the maintenance of the road system over the next five years would be US\$78 million.** Roads that are currently in reasonable condition and other roads once they are rehabilitated will need to be maintained. If successfully implemented, the road projects planned under the Infrastructure Fund for the period up until 2018 will result in Timor-Leste having a road network with an asset value of at least US\$1.69 billion (see Figure 14).<sup>38</sup> This implies that the optimal level of expenditure on the operation and maintenance of this road network in the period from 2014 to 2018 will amount to an average of US\$70 million each year. This compares to the total budget of the DRBFC, the entity responsible for operation and maintenance of the road network, of a little more than US\$1 million a year. In short, expenditure on the operation and maintenance of the road system has been significantly under-budgeted. When the MPW sought a budget allocation of US\$25 million for routine and periodic maintenance in 2013, this was diverted to single-sourced rehabilitation works during the year.

---

<sup>37</sup> See the roads chapter of this report for a more detailed discussion of this issue.

<sup>38</sup> This is consistent with the figure of \$1.26 billion for a good quality road network stated in the roads section of this PER in 2012 prices and inflation of 6 percent per annum.

**FIGURE 14: ROADS SECTOR REQUIRED MAINTENANCE**



(\$ Million). Assets to left axis. Maintenance to right axis.

#### **1.5.4 OPERATION AND MAINTENANCE: CONCLUSION**

**The evidence from the roads and irrigation sectors is that Timor-Leste’s past record in the maintenance of its infrastructure assets is poor.** As this chapter has made clear, the quality of the road network has deteriorated significantly since Independence. Similarly, many irrigation schemes have generated low or negative economic rates of returns, partly because the support services required to generate increases in yields and production levels have not been provided. There is also evidence to suggest that irrigation schemes have been poorly maintained in the past, with both the MPW and the MAFF not undertaking the required routine maintenance, resulting in the necessity for emergency repairs. Public investment to develop electricity infrastructure has already led to large increases in the associated operation and maintenance budget. There is also evidence to suggest that the maintenance of the national grid is under-budgeted and will need to be increased in the future.

**The lack of progress in maintaining infrastructure can be partly explained in terms of limited capacities. However, there is also evidence that expenditure on operation and maintenance has been significantly under-budgeted.** This under-spending on operation and maintenance cannot be explained by overall budgetary constraints, as both the level of overall and recurrent expenditure have sharply increased since 2008. Moreover, the Government has significant savings in the Petroleum Fund and has in past years been prepared to make withdrawals in excess of the ESI in order to finance priority expenditures. What then explains the under-budgeting for operation and maintenance? The answer lies in the politics of the budget process.

**Line ministries have concluded, probably correctly, that proposals for new infrastructure projects are much more likely to be approved and funded than proposals of a similar value**

**for operations and maintenance.** This appears to be the case even when the new infrastructure projects are likely to generate a lower economic rate of return than would operation and maintenance projects. The main reason for line ministries reaching this conclusion is the consistent emphasis placed by high level Government policy documents, such as the SDP, on the construction of new infrastructure. The establishment of the Infrastructure Fund, with its own bank account and large reserves of cash that must be spent on large-scale new projects, has probably reaffirmed this view.

**There is even some evidence that line ministries have attempted to classify ongoing expenditure on operations and maintenance as capital and development expenditure in order for it to be approved.** For example, in 2012, the MAFF determined that a budget allocation was required to maintain existing irrigation systems. It considered that if a proposal for this allocation was presented as a recurrent expenditure, it would not be approved by the Budget Review Committee (BRC). Therefore, this irrigation maintenance budget was included as Capital and Development expenditure under the PDD1 and PDD2 programs, managed by different agencies that had different priorities. So the MAFF lost control of how these funds were allocated and hence the maintenance of the irrigation system was not completed.

**In addition, when line ministries make proposals for large-scale infrastructure projects, they are not required to estimate associated recurrent costs.** This means that the MoF does not have a detailed understanding of the likely cost implications of projects in the Infrastructure Fund. Partly because of this, the national budget estimates recurrent expenditures for the outer years at 4 percent of their current budgeted value. This amount is applied to all ministries and is not based on a detailed analysis of their likely expenditures. In addition, in every year in the period from 2010 to 2014, the recurrent budget has been increased by more than 16 percent. Therefore, the figure of 4 percent has not proved to be an accurate estimate of the overall annual increase in recurrent expenditure. It is likely that future recurrent expenditures in ministries with large-scale plans for the construction of new infrastructure are also significantly under-budgeted. It also implies that the Government is embarking on a substantial investment program without fully understanding the associated recurrent cost implications and the impact of this program on fiscal sustainability.

## **1.6 INFRASTRUCTURE AND ECONOMIC GROWTH**

**The SDP argues that expenditure on infrastructure can drive economic growth.** This section evaluates this argument. It starts by examining the theory and international empirical evidence linking public expenditure on infrastructure with economic growth. This is followed by a detailed review of the impact of expenditure on infrastructure on economic growth in Timor-Leste. Lastly, the report examines whether non-oil GDP growth is the best measure of economic development in Timor-Leste.

### ***1.6.1 THEORY AND INTERNATIONAL EVIDENCE***

**There is a strong general argument for the view that public expenditure on infrastructure can increase economic growth.** Telecommunications, electricity, transport and water are key inputs for the production of nearly every good. It is difficult to conceive how there could be high levels of economic activity without firms having access to such infrastructure. In addition,

the public good characteristics of much infrastructure mean that its construction is unlikely to be financed by the private sector. This is especially the case in countries where financial markets are underdeveloped.

Economic theory also links expenditure on infrastructure with economic growth. The main theoretical premises which are relevant to the case of Timor-Leste are as follows: a) infrastructure increases the productivity of firms; b) Government spending crowds in private sector investment; c) increased public expenditure results in increased aggregate demand; and d) 'Dutch Disease' results in a decrease in long term economic growth.<sup>39</sup> The following section examines the validity of each of these premises:

**Public infrastructure can directly increase the productivity of firms.** Factors of production are often gross complements and so a higher stock of public inputs would raise the productivity of labor, land and private capital. This also assumes ex ante appraisals of projects have revealed high economic rates of return. For instance that electricity demands will be realized, roads are in the right place, and irrigation schemes will lead to more rice production.

**The level of increase in productivity is likely to be higher for each dollar spent when infrastructure is initially substandard than when it is already reasonably well developed.** In other words, there are diminishing marginal returns to expenditure on infrastructure. For example, supplying electricity to firms in cases where there was previously no access to electricity is likely to raise levels of productivity by more than reducing blackouts from one to none per month. For many developing countries, the existing stock of infrastructure is low, which implies there could be high rates of return to expenditure on infrastructure.

This argument is supported by studies which show that in developing countries firms face high costs due to poor infrastructure.<sup>40</sup> Poor power supply, for example, often leads to manufacturing firms having to purchase expensive on-site generators. There is also evidence that the impact of expenditure on public infrastructure on economic growth is highest in countries with a low initial capital stock.<sup>41</sup>

**Premise One: Infrastructure can also crowd in private sector investment.** By increasing the marginal productivity of private inputs, public expenditure on infrastructure can increase the perceived rate of return on, and hence the volume of, private sector investment. For example, the rate of return on building a factory is likely to be much higher if the Government has

---

<sup>39</sup> Ageno and Dodson (2006) provide a useful overview of the mechanisms through which public spending on infrastructure can affect productivity and economic growth. The next two paragraphs are based on their study. Pierre-Richard Agéno and Blanca Moreno-Dodson (2006) *Public Infrastructure and Growth, New Channels and Policy Implications*, World Bank Research Working Paper (2006).

<sup>40</sup> A study by the African Development Bank suggests that transport and energy costs, at 16 and 35 percent respectively, represent by far the largest share of firms' indirect costs in Sub-Saharan Africa.

<sup>41</sup> Demetriades and Mamuneas (2000) *Intertemporal output and employment effects of public infrastructure capital: evidence from 12 OECD economies*, *The Economic Journal* 2000 Demetriades and Mamuneas 2000 – evidence that countries with the lowest capital stock have the highest marginal productivity of public capital. And Timor-Leste would likely fall into this group.

already invested in power generation. Case studies<sup>42</sup> and cross-country empirical studies<sup>43</sup> also find evidence that the provision of infrastructure increases private sector investment.<sup>44</sup>

In Timor-Leste, both the direct productivity and crowding in channels are likely to be important. The initial stock of Infrastructure in Timor-Leste is very low, so assuming diminishing marginal returns, expenditure on infrastructure in Timor-Leste could have a greater impact on economic growth than in other countries. In addition, many of the manufacturing industries which are first movers and relatively common in poorer developing countries, such as brewing, water bottling and cement processing, are energy and sometimes water intensive. As such, their levels of productivity are heavily dependent on public infrastructure. Discussions with the MoF indicate that much future foreign direct investment (FDI) is likely to be in these areas and that electricity and water supply has been raised as issues in the MoF's discussions with potential investors.

**In resource rich countries with significant savings, Government can also increase economic growth through a demand effect.** Economic growth in resource rich countries is often measured as a change in non-oil GDP. By definition, non-oil GDP excludes the change in financial assets, or the return on financial assets held in a resource fund. In contrast, Government final consumption expenditure and Government gross fixed capital formation are included in non-oil GDP. Recurrent expenditure is by convention part of final consumption expenditure in the national accounts. Similarly, general government capital and development expenditure is closely related to government gross fixed capital formation. This means that increased government expenditure financed by withdrawals from a resource funds is always likely to lead to increased non-oil GDP growth.

Non-oil GDP is measured in terms of production and income, as well as expenditure. The production approach includes Government output. Because this output is non-market, it is difficult to measure and is sometimes assumed to increase in calculations of national accounts when Government expenditure increases. In other sectors, such as the construction of roads and electricity generation facilities, there is little data on the value of assets produced other than the value of the funds the Government has paid for the construction of these facilities through contracts. This means that the calculation of production in these sectors is also heavily reliant on the level of Government expenditure. On the income side, increased non-oil GDP resulting from Government expenditure is often absorbed by the higher profits by firms.

The impact of the demand effect on non-oil GDP will be weakened if either the import intensity of Government spending is very high or if it causes the non-oil GDP deflator to

---

<sup>42</sup> One interesting example of this crowding in effect is Vietnam's rehabilitation of National Highway number five and Haipong Port in the early 1990s which led to a massive increase in investment from private sector manufacturing. This in turn contributed to economic growth and employment generation.

<sup>43</sup> For example Odedokun (1997) finds evidence for 48 developing countries that public infrastructure facilitates private investment and promotes growth. Odedokun, MO Financial intermediation and economic growth in developing countries, Journal of Economic Studies, 1998.

<sup>44</sup> Romp and Haan (2007) undertake a comprehensive study of the empirical literature testing whether public capital increases economic growth. They conclude that although not all studies find a growth-enhancing effect of public capital there is now more consensus than in the past that public capital furthers economic growth. Romp W and Haan J (2007) Public Capital and Economic Growth a Critical Survey Perspektiven der Wirtschaftspolitik Volume 8, Issue S1, pages 6–52, April 2007.

increase. However, the import intensity of infrastructure spending is unlikely to be 100 percent. Thus, in countries with high level of Government expenditure relative to non-oil GDP, sharp increases in expenditure funded by a reduction in the value of financial assets held in resource funds can substantially increase economic growth in the short term. Any impact of Government expenditure on inflation is likely to occur with a lag and is thus unlikely to completely offset the demand effect, at least in the short term.

However, the increase in non-oil GDP as a direct result of Government expenditure financed by resource revenues does not represent an equal increase in the productive potential of the economy to produce goods and services. Rather, it simply involves moving money from a natural resource fund, which is by definition not a component of non-oil GDP, to Government expenditure, which is by definition a component of non-oil GDP. Such economic growth is not necessarily beneficial. Arguably, it could be said that this growth is merely the result of the application of accounting definitions used in formulating national accounts, rather than being due to a long term increase in production. It could even be argued that such Government expenditure does not *cause* economic growth. Rather, by definition, it *is* economic growth. Alternatively, it could be said that such an increase in non-oil GDP does not result in an increase in the output of goods and a service produced by the economy over time. Therefore, it is not economic growth at all. In addition, this type of growth does not necessarily imply improved living standards for a country's citizens.

This demand effect can only occur in resource rich economies in which the value of financial reserves are high relative to non-oil GDP, such as in the case of Timor-Leste. In most developed economies, any increase in Government expenditure in a particular year is small relative to the value of GDP. In addition, the increase in demand resulting from Government spending is partially or wholly offset by increased taxation and/or domestic debt and interest rates crowding out private sector investment. This is quite different from the situation in a resource rich country, where a sharp increase in Government spending as a percentage of non-oil GDP can be funded by withdrawing from financial savings. It could even be argued that non-oil GDP ceases to be a meaningful measure of economic activity when there are large financial savings in a resource fund.

**In this context, it is important to distinguish between a short-term demand effect and a long-term increase in the productive potential of the economy.** One means of drawing this distinction is to examine the lag between infrastructure spending and economic growth. The demand effect occurs in the year expenditure is made. By contrast, the earliest point at which long-term increases in the productive potential of the economy can occur is when the infrastructure resulting from the expenditure becomes operational. It follows that increases in non-oil GDP that occur at the same time as expenditure on infrastructure, but before that infrastructure becomes operational, indicate that economic growth is being driven through the demand effect.

We can also answer this question by examining economic growth by sector. Nearly all industries in all economic sectors use infrastructure in production. Therefore, improving the quality of infrastructure should boost productivity and growth across many sectors. In contrast, growth through the demand effect is most likely to be concentrated in public administration and among construction companies that benefit from Government contracts. It follows that if

high rates of growth are observed in the public administration and construction sectors, this growth may be due to the demand effect.

**Infrastructure spending can also reduce economic growth due to the 'Dutch Disease'.<sup>45</sup>**

Increased Government expenditure financed from funds derived from natural resources results in increased demand, some of which is for domestic non-traded goods. Such increased demand can push up domestic prices. Domestic wages are likely to increase both in response to higher domestic prices and to encourage scarce skilled labor to move away from the traded sectors and into domestic non-traded production. Increased domestic prices and wages lead to an appreciation of the real exchange rate. This makes exports less competitive and reduces the competitiveness of domestic industries that compete with imports. The end result is that most traded goods are imported.

Dutch disease is harmful to the economy if the increase in demand is unsustainable. In such a case, the economy will go through a painful period of readjustment when demand decreases, the exchange rate depreciates, the volume of imports falls, and workers receive lower wages and have to move back into the traded sector. In addition, even if the increased level of demand is sustainable in the long term, there can still be negative effects if productivity increase through learning-by-doing is concentrated in tradable manufacturing goods.

**It has been argued that increased Government expenditure on infrastructure is unlikely to lead to the occurrence of Dutch Disease.<sup>46</sup> The argument is that expenditure on infrastructure increases the long-term productive potential of the economy and that its impact on demand, inflation and the real appreciation of the exchange rate is limited.** This is likely to be true if increased expenditure on infrastructure quickly results in an increased stock of high quality infrastructure assets and if there is a competitive, well-developed domestic construction sector. It may also be the case if a significant proportion of construction is undertaken by foreign firms using imported goods and expatriate laborers who spend little money in the local economy.

**However, in many developing countries, a large increase in the level of expenditure on infrastructure is likely to run up against the limited capacity of domestic firms to construct the new infrastructure and poor Government capacity to ensure value for money.** This may result in increased profits and wages paid to skilled workers and perhaps a large amount of poor quality construction work. In addition, even if the construction of the new infrastructure does not increase domestic demand, the increases in required expenditure on operation and maintenance that follows may do so. The second round effect would then be increased domestic demand accompanied by only a limited increase in the economy's productive potential, possibly resulting in symptoms of Dutch Disease. In addition, the increased demand resulting from Government expenditure would be likely to occur before new infrastructure was completed and available to support the operations of business enterprises. So even if Government expenditure resulted in the construction of high quality assets, there could still be Dutch Disease type effects in the short term.

---

<sup>45</sup> These paragraphs describe how Dutch Disease would work in a dollarized economy. C Ebrahimzadeh (2012) Dutch Disease: Wealth Managed Unwisely, Finance and Development, IMF, March 2012.

<sup>46</sup> Sachs, Jeffrey D., 2007.

**In summary, economic growth that is concentrated in the public administration and construction sectors and that occurs simultaneously with an increase in public expenditure is indicative of the demand effect. By contrast, broad-based economic growth occurring after high quality infrastructure has become operational is likely to indicate an increase in the productive potential of the economy.** Additionally, Dutch disease is more likely to occur in an environment in which domestic construction firms have limited capacity and in which the Government has a limited capacity to ensure value for money in infrastructure projects. The symptoms would be high inflation, an increase in the real exchange rate, a loss of competitiveness and limited domestic production in tradable goods.

### ***1.6.2 EMPIRICAL EVIDENCE FROM TIMOR-LESTE***

The level of government expenditure has sharply increased since 2007. Expenditure on infrastructure peaked in 2011, although total expenditure continued to grow until 2012 (see Figure 15). This expenditure has been mainly financed by withdrawals from the petroleum fund, resulting in a sharp increase in the non-oil deficit (domestic revenue minus total expenditure). In Timor-Leste the non-oil deficit illustrates the addition to aggregate demand resulting from Government expenditure.

**So far, economic growth has been largely due to a short-term increase in aggregate demand, and for the most part is not yet indicative of improved infrastructure increasing the ability of firms in the economy to increase production.** The sharp increase in both expenditure and the non-oil deficit since 2007 has coincided with increased economic growth.

This view is also supported by a detailed review of infrastructure projects. A large proportion of the total expenditure on infrastructure was on the central electric project, which was not completed until 2013. The Government justified the high cost of this project on the basis of the need to boost long-term generation capacity, rather than on the need to meet short-term demand. While the project has resulted in a significant increase in generation capacity, the use of electricity has increased more modestly, with most of the increase being attributable to increases in residential use. As of yet, there is little evidence that a significant number of manufacturing firms have increased their output due to the increased availability of electricity.

The second largest proportion of the total expenditure on infrastructure was on the development of the road system. There is little evidence that the overall quality of roads has improved, with a general consensus that much work needs to be done in this area. Thus, expenditure on roads has probably not yet significantly reduced transport costs for manufactures, traders or farmers. . This is discussed in more detail in Chapter 4: Roads.

The third largest proportion of the total expenditure on infrastructure was on district development. The principal aim of this expenditure was to provide a window through which domestic contractors could compete for and win contracts, with the building of high quality infrastructure and the creation of employment opportunities being secondary goals. A recent World Bank and MoF study<sup>47</sup> concluded that this program had boosted the number and

---

<sup>47</sup> Sub-national Spending in Timor-Leste: Lessons from Experience. Ministry of Finance and World Bank, 2014.

capacity of domestic contractors, but that the quality of the assets produced was mixed. Some of the infrastructure constructed was not being used at all. Other infrastructure constructed through this program, such as school buildings, health facilities and Government offices, are only likely to increase the productive potential of the economy in the very long term. Overall while this program was successful in boosting employment and increasing the number of domestic contractors, it seems likely that it has not yet resulted in infrastructure that has significantly increased the economies long-term economic output.

**The majority of the recorded economic growth can be explained by increased Government expenditure and investment, with private sector investment lagging.** Figure 16 shows GDP by the expenditure approach in constant prices. As this figure shows, Government consumption and investment<sup>48</sup> have dominated GDP, with household consumption increasing at a slower rate. Government investment is significantly larger than private sector investment and has also grown proportionately over time.

**The GDP expenditure figures show that while private sector investment is increasing it is still relatively small compared to Government investment.** The increase in private sector investment may indicate that a growth trend in private sector investment is beginning to develop.

**Growth in sectors which are directly reliant on Government expenditure has been high.** Figure 17 shows the proportion of total non-oil GDP growth explained by a number of different sectors over the 2007-2012 period. In particular, it shows that construction has driven economic growth, with this sector accounting for 40 percent of the total increase in non-oil GDP. This sector is heavily dependent on public-sector demand, with most large construction projects being financed by the Government. Public administration has also substantially increased, accounting for 27 percent of the increase in production since 2007. Government output is mainly non-market and difficult to measure except in terms of the value of public expenditure.

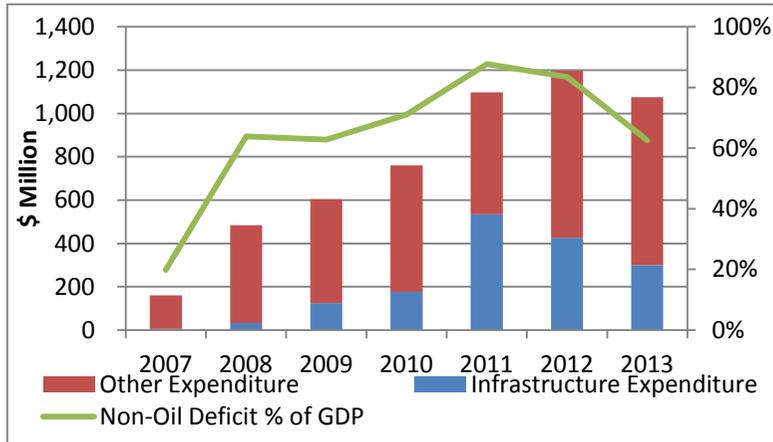
**Growth in sectors which are not directly reliant on Government expenditure but which rely on the existence of developed infrastructure for their production has been low.** The output of the agricultural sector has declined in real terms since 2007. The output of this sector has, however, been volatile across time, making it difficult to differentiate long term trends from year to year changes. This means that lower output in 2012 compared to 2007 is probably not indicative of a sustained decline in productivity. Rather, it is more likely that farming techniques and levels of long-term productivity have remained constant, with the output varying across the different years as a result of fluctuations in prices and weather conditions.

---

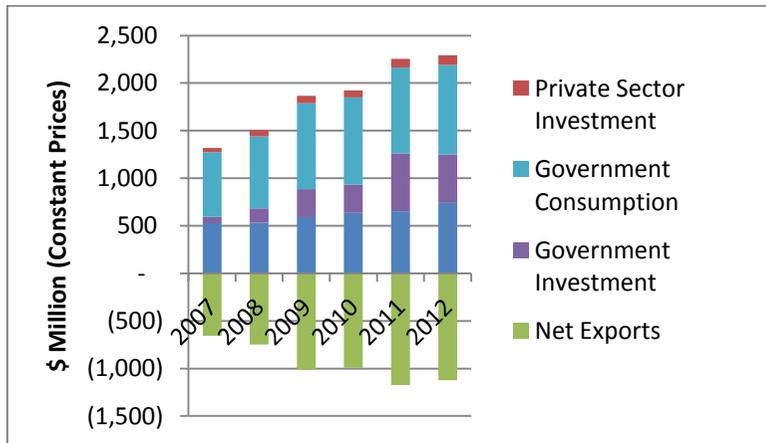
<sup>48</sup> Formally Government Consumption is Government and DP & TA Final Consumption Expenditure. Government Investment is formally Government and DP & TA Gross Fixed Capital Formation. Household and Other Consumption is formally Household Final Consumption Expenditure and NPISHs Final Consumption Expenditure. Private sector investment is formally non-financial and financial corporation Gross Fixed Capital Formation, NPISHs Gross Fixed Capital Formation (although this is all but insignificant) and Household Gross Fixed Capital Formation (although this is also all but insignificant).

This assessment of agricultural production is also consistent with the evidence presented in Chapter 3: Irrigation, which argues that spending on infrastructure in the agricultural sector has mainly been on irrigation schemes that only benefit a small proportion of farmers. In addition, even among those farmers that have benefited, increases in productivity have been limited by a lack of access to extension services, production inputs (such as fertilizer and pesticide) and marketing. Thus, expenditure on infrastructure in the irrigation sector has not led to a significant increase in production.

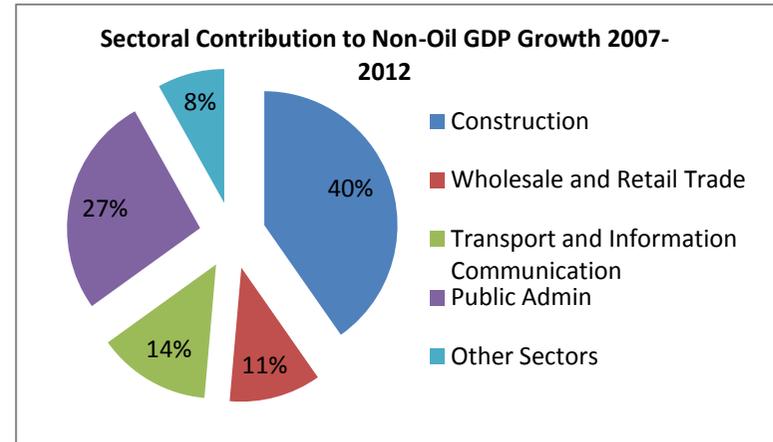
**FIGURE 15: THE PETROLEUM FUND FINANCES INCREASED EXPENDITURE**



**FIGURE 16: INCREASED GOVERNMENT CONSUMPTION AND INVESTMENT**



**FIGURE 17: AND GROWTH IN SECTORS HEAVILY DEPENDENT ON THE GOVERNMENT**



While industrial output has increased, this increase has occurred from an extremely low base and has not significantly contributed to the rate of growth in non-oil GDP, as the contribution of this sector has been dwarfed by that of the construction and public administration sectors.

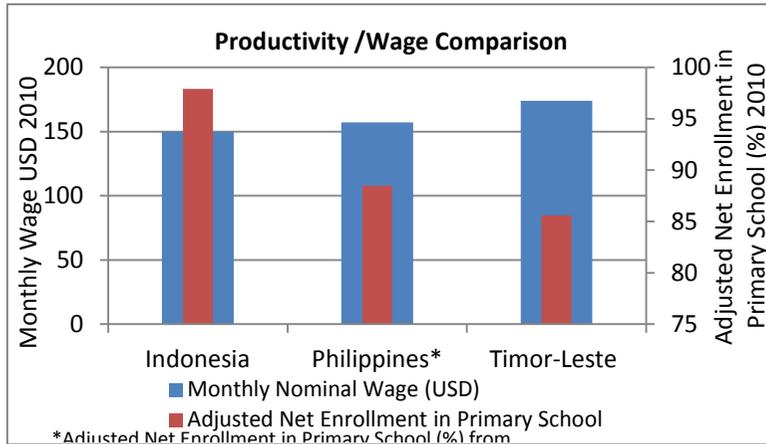
**There is also some evidence of Government expenditure contributing to inflation in Timor-Leste as the increase in Government expenditure financed by withdrawals from the petroleum fund coincided with inflation in the low double-digits.** These rates of inflation were extremely high for a fully dollarized economy (see Figure 19). The rate of inflation began to increase in early 2010. At this time, international foods prices were increasing and the value of the dollar was depreciating against the currencies of some of Timor-Leste's major trading partners. These two factors may partly explain the initial increase in the rate of inflation. However, since mid-2011, the value of the dollar has been appreciating against the currencies of Timor-Leste's major trading partners, while international foods prices have stabilized. Nonetheless, the rate of inflation has remained persistently high (see Figure 19). This suggests that the nexus between high and increasing domestic demand driven by Government expenditure financed by withdrawals from the petroleum fund and supply bottlenecks has increased domestic prices. Econometric work by the MoF and the International Monetary Fund (IMF) has also concluded that increased public expenditure has contributed to the high rate of inflation.<sup>49</sup> A lack of skilled labor is probably playing a significant role in creating supply bottlenecks. Limited competition between domestic firms due to market structures and possibly to the existence of cartels, a poor business environment (without secure land rights), and limited port capacity are also likely to be contributory factors. Further work is required to understand the significance of these supply bottlenecks.

The high rate of inflation has driven increases in the real effective exchange rate and underpinned wages which are high compared to those in many economies in developing Asia. This has undermined competitiveness, especially given that Timorese labor is for the most part poorly educated compared to its international peers (see Figure 18).

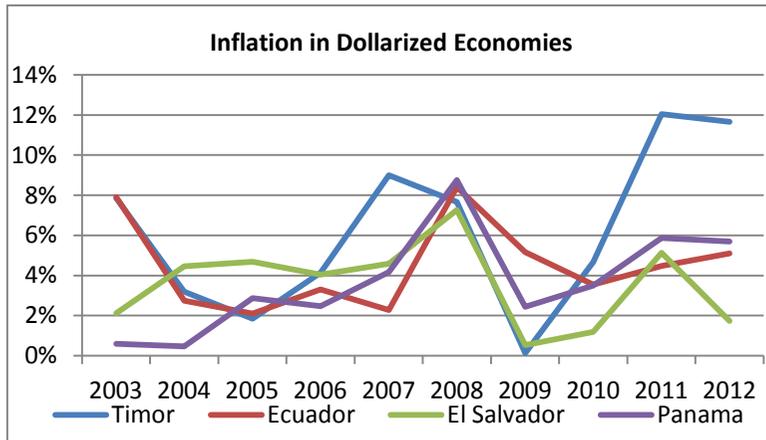
---

<sup>49</sup> IMF, 2013. Article IV Consultation mission report, available on <https://www.imf.org/external/country/TLS/index.htm>.

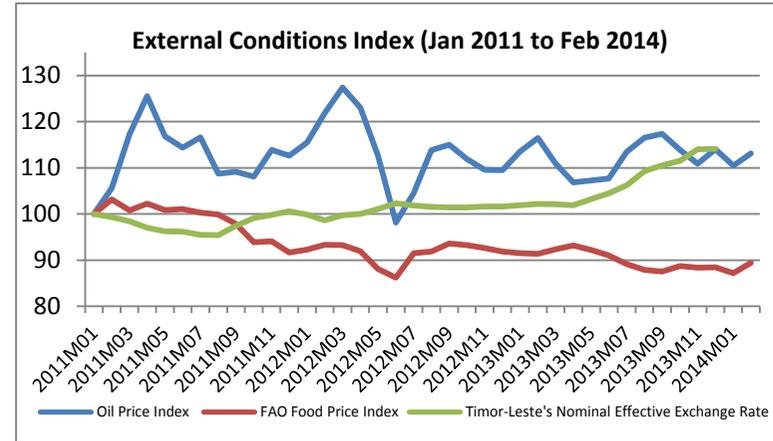
**FIGURE 18: CONTRIBUTING TO LOW COMPETIVENESS**



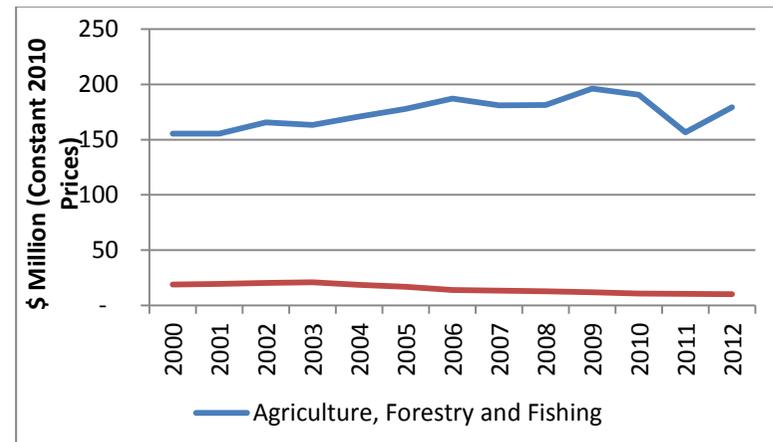
**FIGURE 19: INFLATION INCREASES TO VERY HIGH RATES FOR A DOLLARIZED ECONOMY**



**FIGURE 20: Despite Benign External Conditions Since 2011 (index)**



**FIGURE 21: CONTRIBUTING TO LOW GROWTH IN THE TRADED SECTORS (\$ MILLION REAL)**



Timor-Leste's low level of competitiveness has contributed to slow growth in traded goods. Exports (excluding oil and gas) have grown slowly and remain small compared to the total size of the economy. In contrast, non-traded sectors, such as the retail and construction sectors, have boomed (see Figure 17) and now represent the majority of the economy.

However, since the end of 2013 Timor-Leste has witnessed very low rates of inflation. This has been driven by favorable international conditions such as an appreciation of the US dollar against the country's major trading partners and possibly an increase in the country's absorptive capacity. This will lead to lower business costs and help to improve the international competitiveness of Timorese companies.

**As discussed in Section 1.7 of this report, in real terms, the per capita level of Government expenditure is likely to be unsustainable.** As Government spending is the only mechanism through which financing from oil revenue enters the economy, this implies that the real value of imports per capita will have to decline unless non-oil exports increase. It follows that at some point there will have to be a shift in resources back towards the traded sector and that competitiveness will have to be regained. In a dollarized economy, such an adjustment is likely to involve a decline in wages, with investment and incentives that result in the development of knowledge and skills being required by the traded sector.

**In summary, increased expenditure on infrastructure has driven economic growth. But it has largely done so through an increase in aggregate demand, rather than through new firms utilizing this infrastructure.** The evidence for this is that growth has occurred when expenditure has occurred and not when the construction of infrastructure assets has been completed; and that production has mainly increased in the public administration and construction sectors. Thus, there is as of yet little evidence that firms have utilized newly constructed infrastructure, though the recent large scale investment proposals for a brewery and cement plant may be a sign that improved infrastructure is now beginning to attract private investment.

Expenditure on infrastructure has increased short-run economic growth but there is limited evidence of this newly created infrastructure being used by private firms. This is not surprising as expenditure on infrastructure always occurs before the construction of assets has been completed and it may take time for businesses to increase their levels of production in response to the availability of better infrastructure. High prices and profits are indicative of a current level of demand in the economy commensurate with higher supply. In the future, there may be increased private sector investment and higher levels of production as firms respond to higher levels of demand. High retained profits provide one potential source of funding for this investment. In short, previous high double digit non-oil GDP growth has largely been due to increased demand and not due to an increase in production from new firms utilizing the newly created infrastructure. However, as infrastructure improves and firms respond to market signals, supply may follow where demand has led. If this is the case, relatively strong economic growth may continue over the medium term.

### ***1.6.3 INFRASTRUCTURE SPENDING AND EMPLOYMENT IN TIMOR-LESTE***

**A study shows that public investment can generate jobs in Timor-Leste, but more needs to be done to allow Timorese to access them.** A study by JICA (2014) estimates the impact of Infrastructure spending on job creation from 2014 to 2018. Assuming the full amount of US\$2.5 billion allocated to the Infrastructure Fund for that period is spent, the study estimates that a nearly 112 thousand jobs will be created in the same period. However, of these, expatriates will absorb 82 percent of Manger/Engineer jobs, 67 percent of skilled jobs, 36 percent of semi-skilled jobs and 8 percent of unskilled jobs. Over the same period, the domestic labor supply is estimated to grow by 300,000 persons. It is therefore critical to develop policies that increase the proportion of domestic workers, with consideration for how to maintain the quality of the jobs.

**It is crucial to develop human resources with sufficient technical backgrounds and experience.** The study promotes skill development training by effective Technical and Vocational Education and Training (TVET) institutes as an appropriate policy response. For specific jobs which currently do not exist in Timor-Leste, e.g. jobs for constructing oil refineries and/or LNG terminals, training courses for such jobs could be designed and implemented in the TVET system. Also, training by TVET institutes in neighboring countries, such as Indonesia, Thailand and Malaysia could be an alternative until the domestic TVET institutes are ready to create skilled and semi-skilled Workers. The study also suggests obliging construction contractors in the oil and gas industry to train Timorese semi-skilled and/or unskilled workers prior to the start of construction.

**The study considers Terengganu State in Malaysia and Rayong Province in Thailand, as cases where, the oil and gas industry was intended to promote economic development and indirect employment, through investment promotion.** While the oil and gas industry itself did not directly employ large numbers of workers, indirect employment was created through: (i) linked industries such as machinery, construction, and restaurant and hotel management (ii) investments in other industries such as the automotive industry and home appliance industry that were attracted by well-developed infrastructure. However, both cases demonstrate that the investment in infrastructure development does not automatically lead to employment promotion in other sectors. Thailand and Malaysia undertook extensive investment promotion through such one-stop agencies as the Board of Investment and the Industrial Estate Authority of Thailand, as well as the Malaysian Investment Development Authority and Terengganu State Development Corporation.

## **1.7 FISCAL SUSTAINABILITY**

### ***1.7.1 BACKGROUND, IMPORTANCE AND DEFINITION OF FISCAL SUSTAINABILITY***

**Timor-Leste is simultaneously in one of the strongest and weakest financial positions of any country in the world.** On the one hand, the Government has wisely saved over US\$15 billion in liquid assets in the Petroleum Fund. These savings are enough to pay for the 2014 budget nine times over. On the other hand, domestic revenue in Timor-Leste funds less than 11 percent of the budget. So, if the Petroleum Fund ever ran out of money, expenditure would have to be

sharply cut. And if the Government continually makes withdraws from the fund which are above a sustainable level then it is inevitable that the fund *will* run out of money.

Fiscal sustainability is an important issue in many countries. Resource rich countries often face difficulties in calculating and deciding the optimal level of expenditure given uncertain, finite and volatile revenues. Setting the optimal level of current and future expenditure in Timor-Leste is, however, arguably both more difficult and important than in other countries for three interrelated reasons.

1. *Timor-Leste is by many measures the most or second most oil dependent country in the world.* Oil production accounted for over 80 percent of GDP in 2011 and oil revenue was 31 times greater than domestic revenue in the same year. The ratio of oil revenue collected in Timor-Leste to non-oil revenue is higher than in other heavily oil-dependent countries such as Equatorial Guinea, Libya and Oman.
2. *Timor-Leste now has substantial, highly liquid savings combined with relatively small and finite oil reserves.* Proven reserves per capita in Timor-Leste are much smaller than those of the large Middle Eastern producers (such as Kuwait and Saudi Arabia) and are even smaller than some countries which are not heavily dependent on oil production such as Algeria. Production from currently producing oil fields (Bayu Undan and Kitan) is declining and these fields are likely to have ceased all production between 2021 and 2023. Revenue from these fields peaked in 2012 and is likely to fall below US\$2 billion in 2014.<sup>50</sup> The only other field with proven reserves which is currently judged to be commercially viable is Greater Sunrise and there is some uncertainty regarding when production will commence in this field. The discovery of other commercially viable reserves is possible but uncertain.
3. *Timor-Leste's ability to finance future primary budget deficits is extremely limited.* The Government does not issue treasury bills<sup>51</sup> and the domestic banking system is shallow and underdeveloped. Thus, financing a deficit from domestic debt would be difficult. Dollarization means financing deficits through seigniorage is not a policy option. Timor-Leste's short history as a sovereign nation and past instability would also make borrowing from private international financial institutions difficult in the event that Petroleum Fund savings had been substantially depleted and future oil production was judged to be limited. Financing any future primary deficit is therefore likely to be limited to lending from other nations, the Breton Woods institutions and the Asian Development Bank.

In summary, there is no short term financing constraint to the Government massively increasing expenditure. Yet such an increase in expenditure could eventually lead to the Petroleum Fund balance reaching zero and the Government facing a cash-constrained budget. This would require the Government to sharply reduce spending. Civil servants' salaries, social transfers and other large items of expenditure would have to be severely and suddenly cut.

---

<sup>50</sup> Such projections are dependent on future forecasts of oil prices, which are inherently volatile and difficult to predict.

<sup>51</sup> The term treasury bill is being used here as shorthand for any Government security/domestic debt instrument.

Given that national budget is over 84 percent<sup>52</sup> of non-oil GDP, sharply cutting spending would likely result in a significant contraction in economic activity, household consumption and imports. Standards of living would sharply fall and there would likely be a negative impact on political stability. Ensuring fiscal sustainability is thus of paramount importance in Timor-Leste.

### ***1.7.2 FISCAL SUSTAINABILITY POLICY***

**The Government has long recognized the importance of maintaining expenditure at a fiscally sustainable level in line with ESI.** The previous policy was to constrain expenditure so that withdrawals from the Petroleum Fund did not exceed the Estimated Sustainable Income (ESI). This measure can be thought of as the amount of money the Government can take out of the Petroleum Fund each year, forever without the fund running out of money. Box 3 explains the ESI in more detail.

The definition of the long term is open to interpretation.<sup>53</sup> Our interpretation of Government policy is that excess withdraws should fall to zero by 2030.

Although the Government (and later sections of this report) defines frontloading as referring only to excess withdrawals, the ESI itself arguably involves substantial frontloading. This is because Timor-Leste's population is growing quickly and the ESI only remains constant in real terms and not real terms per capita. In addition, the ESI effectively remains constant in real terms based on forecasts of inflation in the USA. If inflation in Timor-Leste is consistently higher than that of the USA, then the amount of goods and services the ESI can buy in Timor will decrease over time, i.e. ESI is eroding in real terms. In recent years, inflation in Timor-Leste has been much higher than in the USA and even the SDP's target range of inflation of 4 percent to 6 percent is higher than current forecasts of inflation in the USA. In other words an ESI of US\$700 million will likely buy less in Timor-Leste in five years' time than it does today.

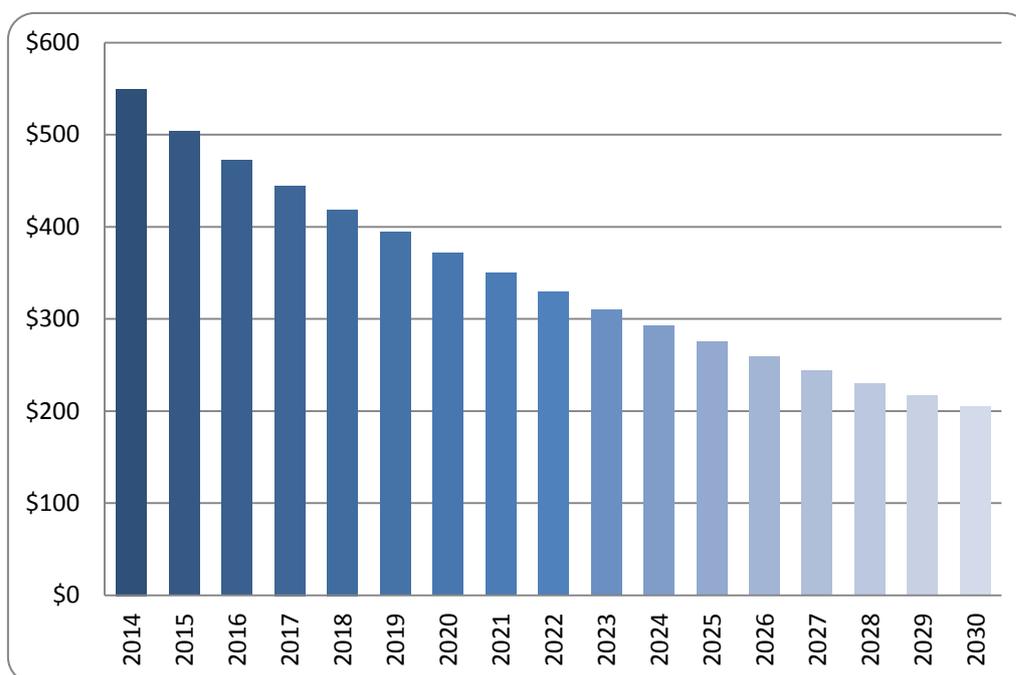
Figure 22 shows the real value of the ESI per-capita assuming that inflation in Timor-Leste averages 6 percent a year and population growth is as currently forecasted by the Government. Under these assumptions every ten years the real value of the ESI per-capita falls by approximately 40 percent.

---

<sup>52</sup> Based on 2014 budget and forecasted nominal non-oil GDP (State Budget 2014, Book 1, Budget Overview, page 16).

<sup>53</sup> Parts of the SDP could be read as suggesting that excess withdraws should fall to zero by 2025 but current spending and the recent downward revision in the ESI means this is now difficult to achieve.

**FIGURE 22: ESI PER CAPITA (WITH WITHDRAWS EQUAL TO THE ESI) IN CONSTANT 2014 PRICES**



**The key question, however, is: *What amount of frontloading, if any, is sustainable?*** The policy of frontloading expenditure to boost economic growth may be logical given the poor state of infrastructure in Timor-Leste and the need to achieve the goals of the SDP. It may be the case that a small amount of frontloading spent on key infrastructure projects would support strong rates of economic growth and higher domestic revenue collections and would not undermine long term fiscal sustainability. But this does not mean that any amount of frontloading is sustainable. There is likely to be a tipping point where the negative impact on fiscal sustainability from the lost yield on savings and required future operation and maintenance spending outweighs any positive impact from economic growth and domestic revenue. Our analysis seeks to find that tipping point. It identifies the amount of expenditure consistent with frontloading in the short term and fiscal sustainability in the long term.

**Box 2: ESTIMATED SUSTAINABLE INCOME**

**DEFINITION**

The ESI is the maximum amount that can be appropriated from the Petroleum Fund in a fiscal year and leave sufficient resources in the Petroleum Fund for an amount of equal real value to be appropriated in all later years. The ESI is set at 3 percent of the total Petroleum Wealth.

**EXCESS WITHDRAWS**

The Government can withdraw an amount from the Petroleum Fund in excess of the ESI provided that a written justification for this excess withdraw is provided to, and approved by, the national parliament

**AIM**

The ESI serves two main purposes. First, it smoothes temporarily high petroleum revenues and aims to ensure that only a sustainable amount is withdrawn from the Petroleum Fund. Second, it delinks Government expenditure from short term volatility in international oil prices.

## FORECASTING PETROLEUM WEALTH

The value of the ESI is dependent on the amount of Petroleum Wealth. Petroleum Wealth consists of the opening balance of the Petroleum Fund (the value of its investments) and the net present value of future revenues. The net present value of future revenues depends on petroleum production volumes, production costs, prices, and the discount rate.

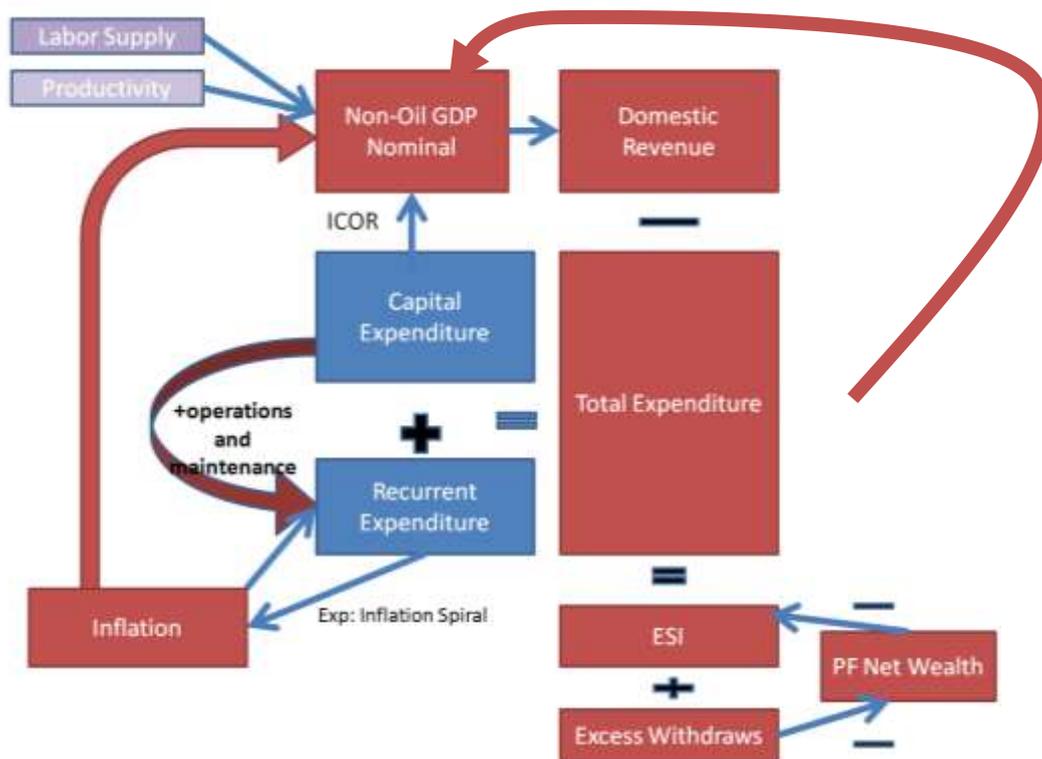
- Production is only forecasted for projects (oil fields) with approved development plans. This currently includes Bayu-Undan and Kitan. It does not include Greater Sunrise. Project operators provide production estimates. A conservative estimate of production is used that is consistent with a 90 percent probability that actual production will exceed the forecast.
- Production Costs. Estimates of future capital and operating costs are provided by the project operators.
- Prices. Oil prices are forecasted using an average of the Energy Information Agency low case and reference case for light sweet crude. Prices for liquefied natural gas and liquefied petroleum gas are based on the historic differential with WTI and the price formulae between the Darwin LNG and Japanese buyer.
- Discount Rate. The discount rate is set at the level of the expected rate of return on the portfolio of financial assets held in the fund. The discount rate is currently set at 5.7 percent.
- Value of the ESI. The ESI value was US\$632 million in 2014. Assuming there are no excess withdrawals, the nominal amount of the ESI will increase slowly over time as the discount rate and nominal rate of return on investments are higher than 3 percent. The long term real rate of return on Petroleum Fund assets is forecasted to be 3.6 percent and the nominal return is calculated using US inflation forecasts from the US congressional budget office.

## Introduction and Key Assumptions

**Modeling a fiscally sustainable level of frontloading is complicated since it must consider the impact of infrastructure spending.** Under the previous policy of not making excess withdrawals, the MoF only had to calculate the ESI. This in itself was no easy task as it involves forecasting future oil production, production costs, oil prices and investment returns. The Government's new frontloading policy adds to this complexity, as any analysis of fiscal sustainability must now account for the impact of infrastructure spending on economic growth, domestic revenue and future operation and maintenance spending.

A detailed Excel-based model was programmed to calculate fiscal sustainability. This model was constructed by the National Directorate of Economic Policy (NDEP) and builds on its existing macroeconomic framework. Diagram 1 presents a simplified version of the model. The key relationships and variables in the model are also described in the next paragraph and discussed in more detail in Annex 2.

**DIAGRAM 1: SIMPLIFIED VERSION OF THE FISCAL SUSTAINABILITY MODEL**



**Expenditure:** Capital expenditure varies by scenario and adds to the capital stock which results in higher future O&M expenditure. Other recurrent expenditure (e.g. not new O&M expenditure) varies by scenario.

**Loans** are as stated in the 2014 Budget until 2018 and are then assumed to finance 19 percent of infrastructure fund spending.<sup>54</sup> Loans repayments are also included in the model.

**Domestic Revenue:** The Government has a long standing policy of increasing domestic revenue. The fiscal model, therefore, assumes that domestic revenue increases steadily until it reaches a maximum of 15 percent of non-oil GDP.

**Financing Gap:** The difference between total expenditure and domestic revenue and loans is financed by withdrawals from the Petroleum Fund. If withdrawals exceed the ESI then the long term value of the ESI declines. If the ESI reaches 0 there is no money left in the fund and expenditure would have to be sharply cut to equal domestic revenue and loan receipts.

**Inflation:** There is a strong theoretical argument and much empirical work supporting the notion that increased recurrent expenditure has contributed to inflation in Timor-Leste. Our fiscal policy model therefore includes a direct link between recurrent expenditure and inflation which is based on work by the NDEP and IMF<sup>55</sup>.

<sup>54</sup> "Analysis of Inflation in Timor-Leste" Ministry of Finance. Available at <http://www.mof.gov.tl/analysis-of-inflation-in-timor-leste-2/?lang=en>

<sup>55</sup> More specifically, each additional million dollars of recurrent expenditures contributes 0.56 units to the actual value of the CPI index. International food and commodity prices are seen as adding on average 4% to inflation each year. A random component is also included in the calculation of inflation to account for unpredictable short term

**Economic Growth:** In the short term Government expenditure financed by the Petroleum Fund increases aggregate demand and non-oil GDP<sup>56</sup> growth. In the long term infrastructure spending results in the construction of assets such as roads, bridges and irrigation which increase the productive potential of the economy and contribute to economic growth. The rate of return on assets each year varies by sector but the assumed un-weighted average is 5 percent. Given the conclusions of the analysis on roads, electricity and irrigation projects contained in this report, 5 percent probably represents the upper case estimate of the impact of capital and development spending on economic growth.

The model forecasts non-oil GDP growth to ensure that for each scenario rates of economic growth are consistent with the fiscal policy being pursued. These forecasts should not be read as accurate predictions or official forecasts of economic growth in the short, medium or long term. The forecasts of economic growth shown in the fiscal model are conservative in order to guard against recommending an unsustainable fiscal policy. In addition, these rates of economic growth effectively assume an unchanged policy environment (apart from levels of expenditure and its distribution between sectors), so they do not take account of reforms which might improve the business climate and increase private sector investment. It may well be possible for Timor-Leste to achieve higher rates of growth if it implements successful reforms to improve the business climate and attract private sector investment.

**Sustainable Income from Oil and Gas Reserves:** in addition to the ESI the model also includes two other measure of sustainable income from petroleum, namely Forecasted Sustainable Income Including Proven Reserves (FSIIPR) and Forecasted Sustainable Income with reference price and production (FSIRPP).

**Two optimistic scenarios are modeled, for an additional field, and for higher prices and production, reflected in two alternatives to ESI as a measure of sustainable income from petroleum revenues (FSIIPR and FSIRPP).** The FSIIPR measure includes revenue from a new additional oil field. The additional oil field used is assumed to have a net present value of US\$13.9 billion. This is equivalent to nominal Government revenue of US\$21.2 billion over a 25 year period. Revenue is initially small for the first few years of production, then increases and then steadily declines until production ceases. This additional revenue is an example only and is not meant to represent an accurate estimate of revenue from any specific field.

The FSIRPP measure uses less conservative estimates of price and production than the ESI. Unlike FSIIPR, it does not include revenues from a new additional oil field. The price estimate used is the AEO reference case, instead of the average of the reference and low case used in the ESI. The production estimate used is the reference case, rather than the low case used in the ESI,

---

changes in international commodity prices. This model is based on detailed econometric work by the Economic Policy Directorate. Statistical analysis by the IMF on inflation concluded that for each 1% increase in recurrent expenditure as a % of non-oil GDP inflation increases by 0.2 percentage points. Using these coefficients results in slightly lower inflation for a given growth rate of recurrent expenditure but does not fundamentally change the conclusions drawn from any of the fiscal sustainability scenarios undertaken in this public expenditure review.

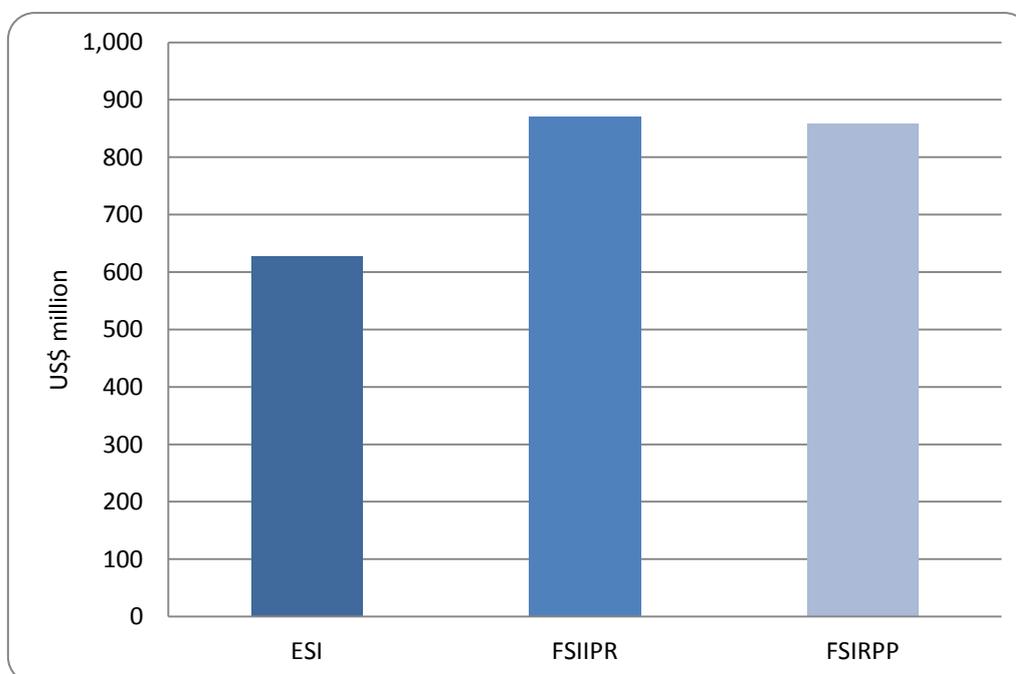
<sup>56</sup> Non-oil GDP converges with Total GDP when income from petroleum production ceases.

**The inclusion of these additional measures of sustainable income from petroleum revenue does not mean we are recommending amending the ESI methodology.** In our opinion, the ESI's conservative assumptions are justified given the long term economic consequences of an unsustainable fiscal policy. The worst case scenario, of the sustainable income being overestimated and the fund running out of money, would be so damaging to Timor-Leste's economy that erring on the side of caution is justifiable.

**Not modeling revenue from proven reserves lends credence to the argument that any level of spending may be fiscally sustainable.** In policy-making and political circles, there is now much discussion about additional oil revenues. In such circumstances, not modeling possible future production from proven reserves allows the notion that any amount of spending can be paid for indefinitely from future oil revenues. Therefore, instead of being fiscally conservative, not modeling revenue from proven reserves lends credence to the argument that any level of spending may be fiscally sustainable.

In addition, in 2014 the low case estimate of oil production used in the ESI was revised downwards. This led to a US\$160 million fall in the ESI. The Government has argued that it would be wrong to reduce actual expenditure in response to an unexpected change in unaudited production figures and has commissioned a physical audit of existing oil fields to verify these figures. This means there is a need to better understand how sustainable income varies with different levels of production. There is also a need to better understand how oil prices are likely to affect sustainable income as oil prices have consistently exceeded prices used in the ESI forecast. Figure 23 shows the ESI, FSIIPR and FSIRPP in 2014.

**FIGURE 23: MEASURE OF SUSTAINABLE INCOME FROM IN PETROLEUM IN 2014 (\$ MILLION)**



### **Concluding Thoughts on the Fiscal Sustainability Model**

An underlying Excel model was programmed to examine fiscal sustainability. This model is best thought of, as most economic models are, as illustrating the key relationships between

different variables. The model is not meant to accurately forecast economic variables in the far future. Accurately predicting exactly what inflation, oil prices, investment returns and non-oil GDP growth will be twenty or thirty years into the future is a difficult, if not impossible, task. At best the model can help us understand the likely relationship between key variables and whether specific levels of expenditure are, or are not, broadly speaking fiscally sustainable.

### **1.7.3 SCENARIO 1: HIGH INFRASTRUCTURE AND RECURRENT SPENDING**

#### *Introduction*

This scenario illustrates whether the amount of frontloading currently planned, while maintaining recurrent expenditure per capita (excluding new O&M) at current levels in real terms, is fiscally sustainable.

#### *Additional Assumptions*

- The budget for capital expenditure is as outlined in the 2014 State Budget until 2018 (the last year of infrastructure fund spending included in that budget)
- Recurrent expenditure (excluding new O&M) spending grows at 9 percent a year (the recurrent budget grew 19 percent from 2013 to 2014).
- The ESI is used as the measure of sustainable income from petroleum revenue

#### *Discussion of Results*

**This scenario is not fiscally sustainable.** Expenditure is higher than total sustainable revenue and the gap increases over time. There are large and growing excess withdrawals leading to a fall in the ESI and Petroleum Fund net wealth to zero by 2032. In 2032 a cash constraint would lead to expenditure having to be sharply cut.

**Expenditure sharply increases in nominal terms.** In the short term high Infrastructure Fund spending, new additional operation and maintenance spending and growth in other recurrent expenditure drive spending. In the long term growth in other recurrent expenditures and to a lesser extent new O&M expenditure drives spending (Graph S1B). Total annual expenditure reaches nearly US\$5.5 billion in 2031.

**The growth in recurrent expenditure appears high, but it is lower than recent increases.** For example, the 2014 state budget increased recurrent expenditure by 19 percent. In addition, relatively high inflation and population growth mean that recurrent expenditure per-capita in real terms is the same in 2030 as it was in 2013. Expenditure as percentage of non-oil GDP actually falls (Charts S1C and S1D).

**Domestic revenue sharply increases as a percentage of the non-oil GDP (graph S1D).** Because non-oil GDP is itself sharply increasing, this leads to a sustained increase in domestic revenue to nearly US\$2 billion in 2032 (Chart S1C).

**Non-oil GDP growth quickly falls below double digits but remains relatively high.** More specifically non-oil GDP growth is above 7 percent in 2014, 2015 and 2016 due mainly to the short term effect of increased expenditure on economic growth, but then falls to a range of

between 3.4 percent and 5.5 percent between 2017 and 2032 (Graph S1A). These relatively high rates of economic growth are supported by the return on significant frontloaded capital expenditure, labor force growth and total factor productivity increases.

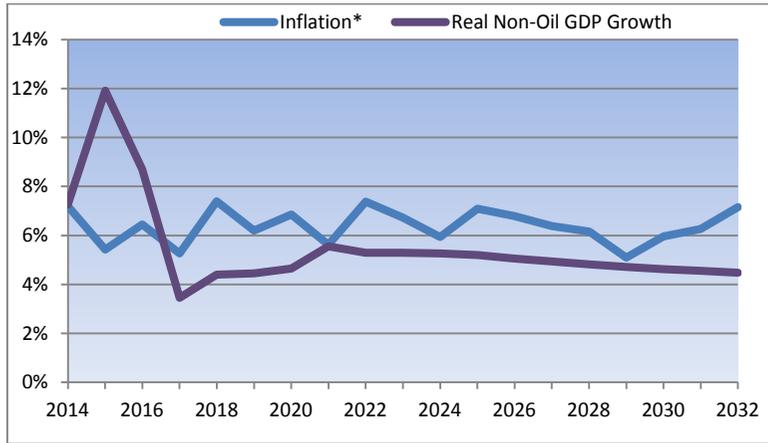
**Inflation ranges from 5 percent to 8 percent each year.** This is a high rate of inflation for a dollarized economy, although it is lower than that experienced in Timor-Leste in some recent years. This inflation is partly driven by the high growth rate in recurrent expenditure (Chart S1A).

**Using the less conservative FSIIPR or FSIRPP as a measure of sustainable income does not fundamentally change the conclusion that this fiscal policy is unsustainable.** The main reason for this is that the gap between sustainable revenue and expenditure is large and growing over time. So the Petroleum Fund balance continues to decrease over time and eventually reaches zero. More specifically, with the FSIIPR measure, Petroleum Fund net wealth reaches zero and expenditure has to be sharply cut in 2038. Using the FSIRPP measure expenditure has to be sharply cut in 2037. Under both measures recurrent expenditure in real terms per-capita is actually slightly lower in 2037 than in 2014. This arguably illustrates that there will be pressure for the Government to increase expenditure by at least the rate assumed in this scenario.

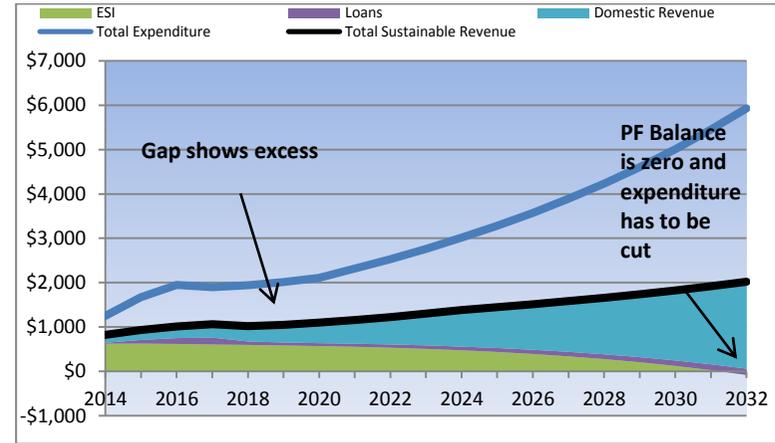
#### *Conclusion*

Inflation in Timor-Leste has been high in some recent years, its population is sharply growing and newly constructed infrastructure needs to be maintained. If the Government responds to these pressures by increasing recurrent expenditure the result might be further upward pressure on prices and demands for higher expenditure. The long term result would be a level of expenditure which is fiscally unsustainable even with strong economic growth, increased domestic revenue collections and higher sustainable income from oil than forecasted using the ESI methodology. The Government may, therefore, wish to reduce infrastructure spending from its FY14 medium term plans, and hence pressure from increased operation and maintenance. It may also want to prioritize between competing demands for recurrent expenditure including operations and maintenance, as going forward recurrent expenditure will not be able to grow in real terms per person. Recent rates of increase in recurrent expenditure are not sustainable.

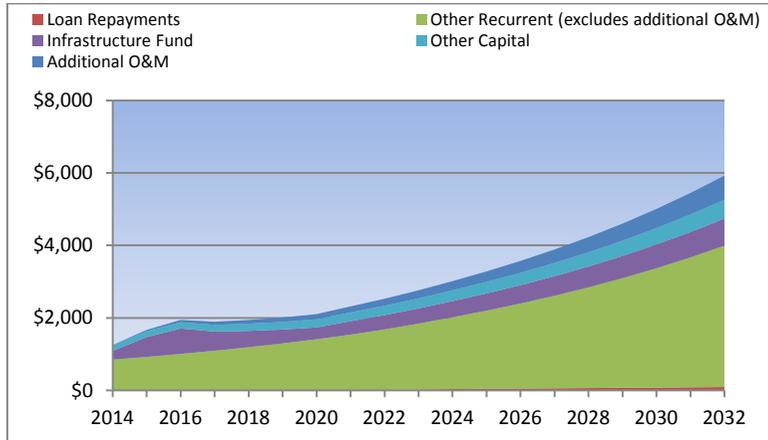
**CHART S1A: ECONOMIC GROWTH AND RATE OF INFLATION**



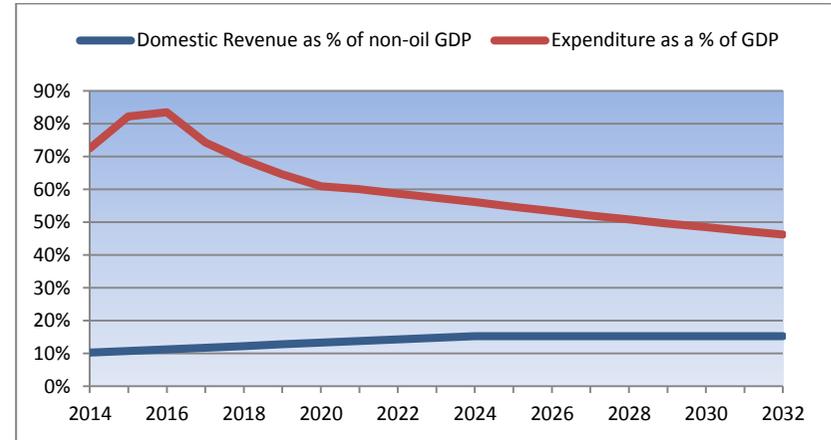
**CHART S1C: FISCAL SUSTAINABILITY (\$ MILLION)**



**CHART S1B: EXPENDITURE COMPONENTS (\$ MILLION) NOMINAL OR REAL?**



**CHART S1D: DOMESTIC REVENUE AND EXPENDITURE % OF GDP**



## **1.7.4 SCENARIO 2: A SUSTAINABLE FISCAL POLICY**

### *Introduction and Assumptions*

This scenario presents a sustainable fiscal policy.

### *Assumptions*

- The budget for infrastructure spending is half of that outlined in the 2014 budget until 2018.
- Recurrent expenditure excluding O&M is constant in nominal terms.
- The ESI is used as the measure of sustainable income from oil reserves
- All other assumptions are as outlined in the fiscal sustainability model

### *Discussion*

**Fiscal sustainability would be achieved in 2030.** The strong growth in domestic revenue and constrained growth in total expenditure would mean that no excess withdrawals are required after 2030 (Chart S2C). After 2030 there would be some fiscal space for new policies.

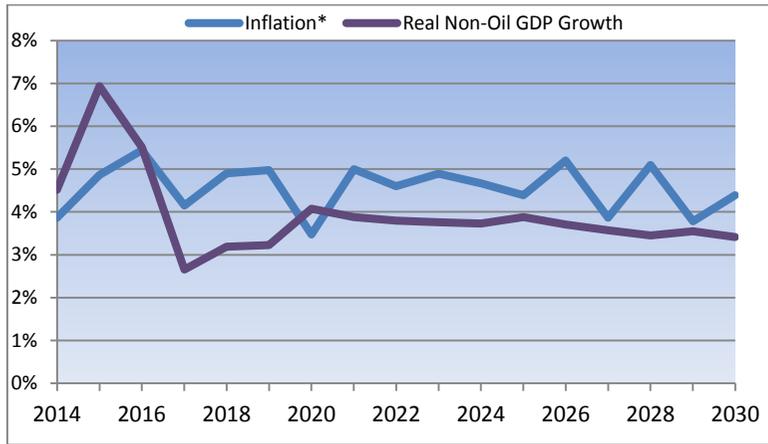
**Total expenditure grows slowly over time from approximately US\$1.1 billion in 2014 to US\$1.7 billion in 2030** (Chart S2B). Infrastructure Fund spending is frontloaded, peaking in real terms in 2016 at US\$351 million. In the short term infrastructure spending drives changes in total expenditure, in the long term additional operation and maintenance spending drives growth in total expenditure.

**Domestic revenue grows quickly in nominal terms from US\$173 million in 2014 to US\$866 million in 2030.** This growth is driven by domestic revenue increasing to 15 percent of GDP and due to relatively strong real non-oil GDP growth (Charts S2C and S2D).

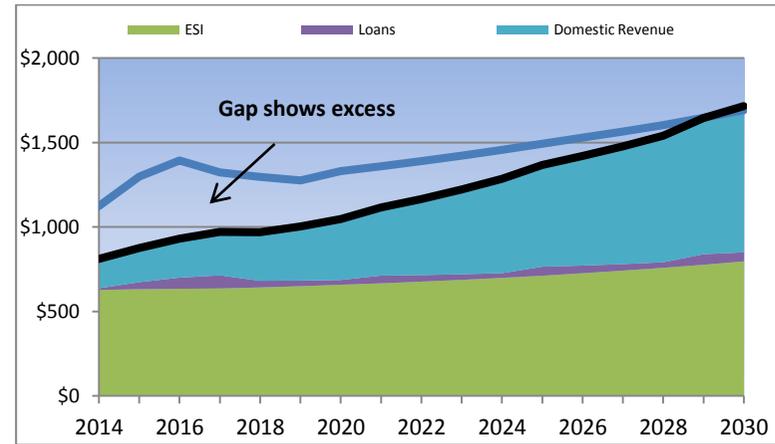
**Inflation falls to within the SDP target range of 4 percent to 6 percent a year.** This decline in inflation is due to slower growth in recurrent expenditure (Chart S2A and S2B).

**Real non-oil GDP growth sharply falls from 7 percent per year in 2015 to between 2.8 percent and 4.1 percent between 2017 and 2030.** This fall in the growth rate for non-oil GDP is due to a sharp decline in the growth rates of both total and capital Government expenditure (Chart S2A).

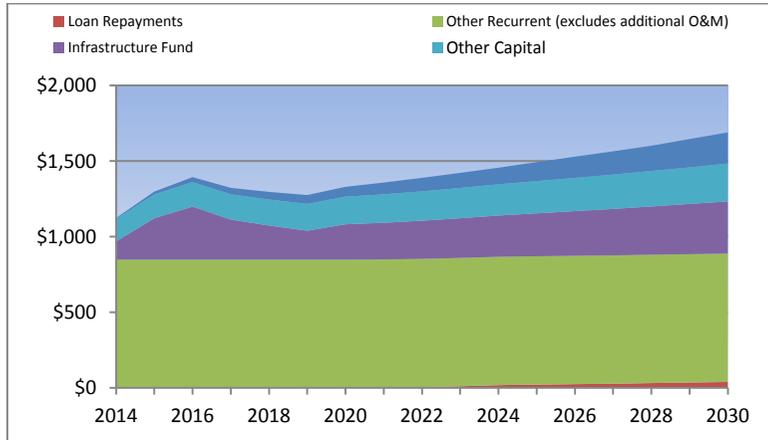
**CHART S2A: ECONOMIC INDICATORS (%)**



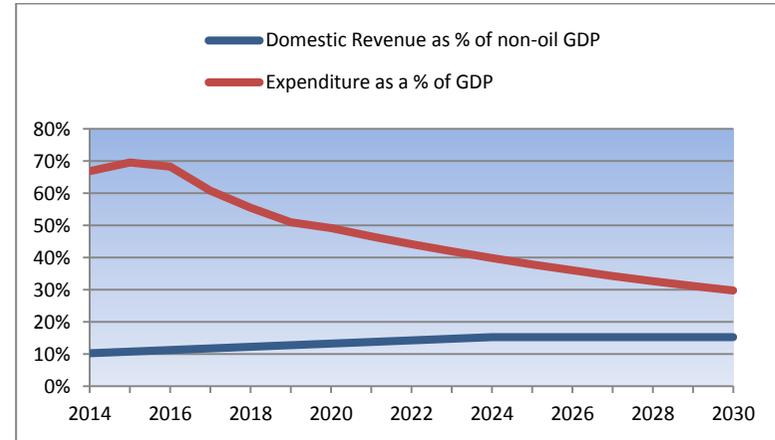
**CHART S2C: FISCAL SUSTAINABILITY US\$ MILLION**



**CHART S2B: EXPENDITURE COMPONENTS US\$ MILLION**



**CHART S1D: DOMESTIC REVENUE AND EXPENDITURE % OF GDP**



**This scenario would, however, involve a significant fall in total per-capita spending in real terms.** Given that this is a difficult reduction to achieve; this scenario was also run using the FSIRPP and FSIIIPR measure of sustainable income from petroleum and higher growth rates of recurrent expenditure. Infrastructure spending and all other assumptions were left unchanged.

**Using the FSIRPP measure, total recurrent expenditure could grow by slightly over 4 percent a year and fiscal sustainability would still be achieved by 2030.** Excluding operation and maintenance spending and loan repayments, recurrent expenditure would be growing at approximately 3 percent a year. Total expenditure could increase to US\$2.3 billion by 2030. Inflation would still fall to the 4 percent to 6 percent range targeted by the SDP and economic growth would likely stabilize in the 3 percent to 5 percent a year range. Total spending per-capita would likely fall from US\$906 to US\$576 in constant 2014 prices. Similar results were found using the FSIIIPR measure of fiscal sustainability.

If a much less conservative measure of sustainable revenue from oil was used that allowed both for reference cases for price and production and an additional oil field (i.e. a combination of FSIRPP and FSIIIPR) then recurrent expenditure could grow by about 6.3 percent a year. Inflation would likely range from between 4.5 percent to 6.5 percent and non-oil GDP growth would be between 4 percent and 5 percent a year in the long term. Total expenditure would still be falling in real terms from about US\$906 to US\$673 dollars per capita.

## **Conclusion**

**This scenario shows that fiscal sustainability is possible but with significantly reduced frontloading in relation to the FY14 medium term budget.** Even with strong domestic revenue growth and less conservative measures of sustainable income from petroleum than the ESI, fiscal sustainability will require a reduction in the size of frontloading and constrained growth in recurrent expenditure. The amount of infrastructure spending for 2014 to 2018 shown in the 2014 budget is probably not sustainable. Spending per capita in real terms will likely have to fall over the medium term and therefore achieving fiscally sustainability will not be easy.

### ***1.7.5 FISCAL SUSTAINABILITY CONCLUSION***

Timor-Leste is not in a fiscal crisis. The Government has wisely saved over US\$16 billion dollars in the Petroleum Fund and total revenues are likely to exceed expenditures over the next few years.

However, proven oil and gas reserves are finite and small compared to other oil producing countries and the national budget is heavily reliant on financing from the Petroleum Fund. Ensuring long term fiscal sustainability is, thus, of paramount importance.

**The Government has outlined a policy of frontloading infrastructure spending.** Initial high spending will be financed by excess withdrawals, but in the long term withdrawals will have fallen back down to the level of the ESI. This policy has much to commend it.

**However, the level of infrastructure spending shown in the 2014 budget, an average US\$510 million a year until 2018, is too high.** This level of spending will lead to high operation and maintenance spending. Domestic revenue will likely not grow fast enough to make those expenditures sustainable. Restricting Infrastructure Fund spending to US\$368 million a year would still involve frontloading, but at a more sustainable level.

**Ensuring fiscal sustainability will also require that growth in recurrent expenditure is carefully controlled to below 4 percent per year.** The Government will have to be careful to avoid a situation where high inflation and increasing demands from a growing population lead to higher expenditure and upward pressure on prices. An expenditure-inflation spiral is possible and maintaining recurrent or total expenditure in real terms per capita is unlikely to be sustainable.

**A more limited average annual expenditure, and greater commitment to operations and maintenance within this, will require the government to carefully analyse tradeoffs with spending on non-infrastructure related needs.** That analysis of tradeoffs is beyond the scope of this report but a broad estimate is possible. This report estimates that \$64 million per year is required to operate and maintain an appropriate road network. In the electricity sector the government's operations and maintenance cost could grow to \$200 million if full electrification is achieved, and greater cost recovery is not pursued. In irrigation, operations and maintenance of the recommended irrigation network will cost \$22 million per year. After recommended Infrastructure Fund spending of \$368m, this leaves \$646 million per annum, or roughly \$540 per capita, to cover all other needs in the budget.

**Sustainable income from petroleum revenues in Timor-Leste is normally measured through the ESI.** This measure correctly excludes revenues from proven reserves currently without signed production sharing contracts and uses conservative measures of prices and production. In any case, using less conservative measures of sustainable income does not fundamentally change what a sustainable fiscal policy would look like. Infrastructure fund spending would still have to be significantly below that outlined in the 2014 state budget until 2018, recurrent expenditure cannot grow by much more than 6 percent a year and total spending in real terms per capita would likely have to fall.

**The amount of infrastructure fund spending shown in the 2014 State Budget is not sustainable because of increased spending in the outer years (2015 to 2018).** The 2014 Infrastructure budget was actually cut compared both to the 2013 budget and earlier outer year budgets. The Government explicitly stated that these reductions were being made in order to ensure fiscally sustainability. The Government is therefore committed to fiscal sustainability and has shown that it is prepared to reduce infrastructure spending in order to achieve fiscal sustainability.

**Finally, the appraisal of annual returns on constructed assets must be central to the public investment policy.** The assumption of 5 percent impact of investment on growth in the fiscal sustainability model may, as noted, be an upper case. This is based on evidence of low proven and anticipated returns to irrigation, roads, and electricity presented in this report's sector chapters. These low returns are in turn explained by nascent, although improving, institutions

and systems for selecting high return projects, and realizing their benefits through supporting policies, and operations and maintenance, also considered in Chapter 2 (Public Investment Management in Timor-Leste).

## CHAPTER 2

### PUBLIC INVESTMENT MANAGEMENT IN TIMOR-LESTE

The purpose of this chapter is to present the findings of a review of Timor-Leste's public investment management institutions in order to provide the Timor-Leste Government with advice on the means to improve the quality of its capital expenditure by selecting the right projects and implementing and maintaining them appropriately.

#### 2.1 THE SDP PROVIDES AN OVERARCHING FRAMEWORK FOR PUBLIC INVESTMENT DRIVEN GROWTH

**The SDP places state-led public investment in asset creation at the center of Timor-Leste's development strategy.** A rapid increase in public capital expenditure, financed by petroleum wealth, will play a critical role in the Government's plan to achieve sustained economic growth over the next twenty years. Effective management of public investment is particularly important for Timor-Leste, given that it has one of the highest ratios of investment to non-oil GDP in the world, with this investment almost entirely financed by the state. As Chapter 1 (Macro Fiscal Analysis) concludes, if the management of public investment in Timor-Leste is not implemented effectively, then the economic rates of return on capital projects will be low, and the rates of economic growth to which the plan aspires will not be achieved.<sup>57</sup>

The SDP is strongly supported by Timor-Leste's Prime Minister and provides highly publicized strategic guidance for public investment decisions. It is comprehensive and authoritative, and has been widely disseminated. The plan provides a general basis for the prioritization of capital expenditure. Subsequent to the formulation of the SDP, the Government has published its Program of the Fifth Constitutional Government. While largely based on the SDP, the Program is more focused and subtly adjusts some of the spending initiatives set forth in the SDP in a way that indicates further reflection and refinement of the development agenda. For example, for the development of the agricultural sector, the approach to achieving food security is more clearly sequenced relative to the achievement of other priorities.

The SDP places a high priority on investment in the development of the country's infrastructure and is based on the premise that the current poor quality of this infrastructure is the key constraint on economic growth in Timor-Leste.

---

<sup>57</sup> Harberger (2005) presents evidence that improved project evaluation that impacts markedly on the rate of productivity can permanently increase a country's economic growth rate

### Box 3: PUBLIC EXPENDITURE MANAGEMENT: AN ANALYTICAL FRAMEWORK

The theory of public expenditure management directs decision makers to consider three types of policy choice. The first type concerns overall questions of macro fiscal management. In Timor-Leste, for example, one of the key questions parliamentarians debate each year is the right balance between spending in the Budget or saving in the Petroleum Fund. The second type concerns questions of allocative efficiency: investing resources in sectors with high rates of economic return. In Timor-Leste, these questions have arisen in debates over whether to spend more on infrastructure or more on health and education; and whether to invest more infrastructure resources in the petroleum corridor or in agriculture. The third type concerns operational or technical efficiency: ensuring the right capital projects are selected, prepared and implemented in a cost-effective way. In Timor-Leste, the Government has invested substantial reform efforts on strengthening central agency institutions involved in public investment management. This chapter of the Public Expenditure Review focuses primarily on the way the Government seeks to achieve efficient allocative outcomes through its strategic and sector planning processes and efficient operational and technical outcomes through its management of the capital project cycle.

Source: World Bank (1998) Public Expenditure Management.

Only a very small number of countries have been able to achieve an economic transformation of the kind envisaged by the SDP, which aims to achieve an exceptionally high annual rate of economic growth for a sustained period, averaging at more than eight per cent for a period of twenty years. The development experience of Japan, Taiwan, South Korea, Singapore and China was extensively analyzed in the *World Development Report 1997: The State in a Changing World*. One of the key features of what has been described as the “East Asian model” has been the role of the ‘developmental state’ in mobilizing public investment in essential infrastructure.<sup>58</sup>

## 2.2 OVERVIEW OF TIMOR-LESTE’S INSTITUTIONS FOR MANAGING THE PUBLIC INVESTMENT CYCLE

**In 2011, the Timor-Leste Government prudently began ‘investing to invest’ by creating new, centralized Public Investment Management (PIM) institutions to provide guidance on expenditure on infrastructure.** The Office of the Prime Minister has been instrumental in promoting the reform agenda, and the influence of this office on the direction of capital expenditure has increased substantially in recent years. To a significant degree, the Prime Minister has invested his personal authority in the SDP. As chair of the Infrastructure Fund, he is at the center of the decision-making process for all large, multi-year projects in Timor-Leste. The Prime Minister has specific ministerial responsibility for the new central agencies established to administer the Infrastructure Fund. He has also experimented with relatively high risk, but

---

<sup>58</sup> Leftwich, Adrian, “The Developmental State”, Working Paper No. 6, University of York, 1994.

innovative and politically significant, capital expenditure initiatives, such as the district infrastructure development programs. In terms of reforming PIM, the principal advantage of the prominent role played by the Prime Minister is that it places the issue high on the political agenda and creates the political will to cut through administrative obstacles to achieve reform.

**In Timor-Leste, expenditure on infrastructure is implemented through three windows, these being line ministries' Consolidated Fund of Timor-Leste (CFTL) budgets; the Infrastructure Fund; and the District Integrated Development Plan (PDID), a district development program which includes the construction of small-scale infrastructure projects with budgets of less than US\$500,000.** Line ministries' CFTL budgets are used to execute all projects that have budgets to a value of less than US\$1 million and which are expected to be completed within a year. The Infrastructure Fund, a multi-year fund that was established in 2011, is used to execute large projects with budgets to a value in excess of US\$1 million and which are expected to take more than one year to complete. The main goal of the PDID is to develop the domestic private sector, with its secondary goals being to create an increased number of employment opportunities in rural areas and to provide high quality infrastructure demanded by the local population in these areas.

**This chapter concentrates on examining the execution of expenditure on capital infrastructure through the Infrastructure Fund window.** The focus on expenditure through the Infrastructure Fund is justified on the grounds that since its establishment in 2011, more than 85 percent of the total value of expenditure on infrastructure in Timor-Leste there has been implemented through this window. In addition, all of the large-scale infrastructure development projects listed in the SDP will be implemented through the Infrastructure Fund. Therefore, understanding the constraints on the execution of the SDP plan requires a strong knowledge of the institutions which govern this fund and the associated processes.

From the viewpoint of the line ministries, the establishment of the Infrastructure Fund and supporting institutions involved a number of changes in the manner in which larger projects were proposed, procured and monitored. Under the new system, line ministries continued to be responsible for proposing and justifying large projects. However, the Major Projects Secretariat (MPS) became responsible for undertaking an ex ante analysis of project proposals and for the presentation of this analysis to the Budget Review Committee (BRC) and the Council for Management of the Infrastructure Fund (CAFI). In the case of a number of proposed projects, including a number of proposed projects for the development of the irrigation sector, the MPS has concluded that the economic returns from the proposed project are not sufficiently high to justify the investment and that the project should not be approved. Although such projects have still been approved, the establishment of the Infrastructure Fund has meant that project proposals are subject to more intense scrutiny. The MPS also reports on the rate of progress and outcome of projects implemented through the Infrastructure Fund.

The CAFI is chaired by the Prime Minister, with the Minister of Finance, the Minister of Public Works and the Minister of Transport and Communications serving as permanent members.

The National Procurement Commission (NPC) is responsible for managing procurement processes for projects implemented through the Infrastructure Fund. Originally, it was intended that line ministries were to be closely involved in these procurement processes. For instance, they were to be responsible for writing the first draft of the bidding documents and were to sit on the board that evaluates proposals. However, in the actuality, in many instances, they have not been involved to this extent. From the viewpoint of the line ministries, the establishment of the Infrastructure Fund and the NPC represents a process of centralization, with a significant loss of their control over the procurement processes. This is a reversal of the decentralization process that occurred in the period from 2009 to 2011, during which period they had a higher degree of control of the procurement processes.

The establishment of the Infrastructure Fund means that the responsibility for the certification and payment of invoices was moved from line ministries to the National Development Agency (ADN). It is possible that ADN is likely to apply a more rigorous standard for certification and to be less concerned with ensuring that construction proceeds quickly than line ministries. To the extent that this is the case, this may result in delays to the execution of projects. ADN's mandate also includes the appraisal of projects, although in practice, such appraisals are implemented by MPS.

### **2.3 RESULTS OF A REVIEW OF TIMOR-LESTE INVESTMENT INSTITUTIONS**

**Institutional capacities in the area of public investment management are still developing, and systems implemented to improve the quality of this management are being bypassed. These are the principal binding constraints on the achievement of the objectives set out in the SDP.** This section summarizes the results of a detailed analysis<sup>59</sup> of Timor-Leste's public investment management system. The analysis reveals gaps across the project cycle, especially in the areas of project appraisal, supervision and asset maintenance. The analysis applies an indicator-based methodology based on recent research conducted by the World Bank into the essential elements of effective public investment management systems, published in the *Diagnostic Framework for Assessing Public Investment Management* (World Bank, 2010).

**In general terms, given that barely a decade has passed since the cessation of conflict in Timor-Leste, Timor-Leste has arguably exceeded expectations, and its peers, in terms of the development of its public investment management systems.** Timor-Leste has learned important lessons from early setbacks with very large projects, such as the national electricity grid project. Subsequently, a number of reforms have been implemented to establish some of

---

<sup>59</sup> The full analysis is in the background paper to this chapter.

the foundations for an effective public investment management system. The Government has experimented with innovative approaches to the development of district infrastructure. These approaches appear to have been somewhat successful in facilitating the implementation of small to medium capital projects and very successful in managing the politics of infrastructure provision. While recent internal audits have revealed serious systemic weaknesses in internal controls and procurement systems in the line ministries in the period from 2009 to 2011, reinforcing public concerns regarding fraud and corruption, the Government appears determined to implement measures to address the findings of the audit and to report back to Parliament on its progress in this area.

**Timor-Leste performs relatively well on upstream public investment management processes such as strategic guidance, project feasibility and design, independent review of project appraisal and project selection and budgeting.** The relatively high ratings the Government has received in these areas reflect well on the reform measures it implemented in 2011. These reforms include systems mandating the preparation of project briefs by line ministries; independent multi-criteria appraisals of most of these briefs by the MPS; and an orderly budget preparation process. However, there are still a number of significant weaknesses in the implementation of upstream processes. For instance, the absence of clearly defined, well considered sector strategies means that insufficient consideration is sometimes given to alternative means of achieving specific goals. One example is the case of the development of irrigation infrastructure, where insufficient consideration has been given to alternative means of irrigating rice production. In a number of cases, large projects are proceeding to implementation with limited or no effective appraisal process. There is evidence that the appraised lists of projects recommended for inclusion in the budget are being disregarded and that the recurrent cost implications of capital projects are not being considered.

**Timor-Leste performs relatively poorly on downstream public investment management processes such as project implementation, project adjustment, facility operation and basic completion reviews.** The relatively poor ratings the Government has received in these areas are indicative of systemic weaknesses in project management at the level of the line ministries included in the review, these being the Ministry of Public Works (MPW) and the Ministry of Agriculture, Forestry and Fisheries (MAFF). Another factor is that a number of reforms to the procurement system, which were originally planned for implementation in 2010, have either been delayed or diverted (see below). Project guidelines are still incomplete, and those that exist have only limited traction, with few designated project managers in line ministries. There is only limited technical support for project implementation from central agencies such as the ADN, and certain line ministries are discouraged from participating in tenders through participation in the NPC. Companies often appear to be involved in technical design and project costing. Contract quality is often poor, while contract management is often weak. There is no clearly established, well formulated policy or guidance on the implementation of post-project reviews. When such reviews are conducted at all, they usually focus on basic engineering

outputs only, rather than on average costs and time over-runs. When projects are implemented by line ministries, project evaluations are generally only undertaken in cases in which projects are financed by donors.

**Timor-Leste performs relatively well in the area of external oversight over the public investment management process.** This relatively good rating reflects recent efforts to establish a new Court of Accounts, as mandated by the Constitution, and the active interest taken by Parliament and its committees in state finances. It also reflects the Ministry of Finance (MoF)'s willingness to initiate and act upon an internal audit of procurement systems that identified systemic weaknesses in procurement and financial management systems across line ministries, including the MAFF and the MPW. The findings of the internal audit played a significant role in informing the 'Opinion on the State Accounts' tabled before Parliament by the Court of Accounts in December 2012. Again, a note of caution is required: substantial progress has been made in terms of ensuring that the formal systems and processes are in place. However, the next vital step is to ensure that these systems and processes have real effect and that they support the efforts of external oversight institutions in the implementation of their functions.

**The newly implemented investment management processes have not yet prevented the selection of large projects with low economic rates of return. This failure continues to limit the Government's ability to achieve its long term development objectives.** For example, a number of large irrigation and roads projects have proceeded through CAFI to funding, despite having very low to negative economic rates of return (see Chapter 3: Irrigation). While the MPS is playing an important role early in the investment cycle, it needs to engage earlier in the project cycle, with its success ultimately depending on the extent to which the CAFI heeds its advice. Understandably, the ADN is primarily focused on the project management of the PDD and MDG Suco programs. It is also actively involved in project supervision, and has on occasion stretched its role to cover the whole project cycle (for example, in the cases of the Dili, Comoro Bridges). While in the context of the current weaknesses in the area of project management on the part of the MPW, the MAFF and elsewhere, in the longer term, the Government should try to normalize this function by returning responsibility for it to the line ministries. After some initial delays, the NPC appears to be performing its role well, although there also appears to be scope to expand technical assistance to the NPC to enable it to act as a procurement agent, a decision which could help to attract international tenders for large contracts.

**The implementation of the new processes is also failing to arrest the growth in single-sourced procurement and to protect maintenance budgets.** Analysis of contracts data indicates that in 2013, 100 per cent of contracts awarded by the Directorate for Roads and Bridges under the Ministry of Public Works (which must be to a value of less than US\$1 million each) were classed as 'emergency works' and as a result, single sourced. This represents a significant increase in the proportion of contracts thus classified, up from 65 per cent in 2010. This is consistent with data

from the procurement portal<sup>60</sup> (see Table 5 and Table 6) that shows that in terms of value, nearly three-quarters of contracts to a value of less than US\$1 million in 2013 were single sourced. In the same year, for projects to a value in excess of US\$1 million, 60 per cent of all contracts (in terms of value) were single sourced, despite the creation of the NPC.

**TABLE 5: CONTRACTS TO A VALUE IN EXCESS OF US\$1 MILLION (US\$ MILLION)**

		2007	2008	2009	2010	2011	2012	2013	Total
Single sourced	Count	0	0	1	4	5	0	32	42
	Value	0	0	1.5	5.2	15.3	0	93.1	115.1
% of all single sourced	Count			100.	6.78	2.37	0.00	1.06	1.27
	Value			100.	17.13	18.99	0.00	28.33	26.09
% of all over 1 million USD	Count	0.00	0.00	20.	8.16	16.13	0.00	76.19	31.34
	Value	0.00	0.00	0.47	0.84	7.16	0.00	60.03	8.59
% of all contracts	Count	0.00	0.00	2.50	0.69	1.36	0.00	0.77	0.81
	Value	0.00	0.00	0.46	0.66	4.76	0.00	19.56	5.91

**TABLE 6: CONTRACTS TO A VALUE OF LESS THAN US\$1 MILLION (US\$ MILLION)**

		2007	2008	2009	2010	2011	2012	2013	Total
Single sourced	Count	0	0	0	55	206	1	2995	3257
	Value	0	0	0	25.2	65.3	0.008	236.2	326.8
% of all single sourced	Count			0.00	93.22	97.63	100.00	99.04	98.82
	Value			0.00	82.87	81.01	100.00	71.87	74.05
% of all under 1 million USD	Count	0.00	0.00	0.00	10.40	61.13	2.70	72.80	64.43
	Value	0.00	0.00	0.00	15.44	60.38	0.26	73.52	53.78
% of all contracts	Count	0.00	0.00	0.00	9.52	55.98	2.56	72.12	62.80
	Value	0.00	0.00	0.00	3.20	20.29	0.07	49.62	16.78

The Government is unlikely to be getting value for money as a result of such an extensive use of non-competitive procurement methods. In response, the 2014 budget execution circular, issued as a decree, restricts line ministries' use of single-sourced procurement to a maximum of 10 per cent of the total value of their contracts.

**Similarly, in the roads and irrigation sectors, funds allocated for maintenance are being diverted to other projects.** In 2013, funds to a value of US\$25 million allocated for routine and periodic road maintenance were instead used for emergency road rehabilitation. In the irrigation sector, attempts by the Ministry to facilitate maintenance through the small scale

<sup>60</sup>Note: Public procurement portal data from 9 January 2014. Attempts have been made to address duplicate data, and misclassification of contract type and appropriation category.

infrastructure program (PDD 1 and PDD2) faltered when those budgets were re-directed by the executing ministry.

**Overlapping mandates hamper project implementation, as does the absence of a formal planning mandate.** Annex 1 describes the *de jure* and *de facto* roles of the new PIM institutions. None of these new institutions fulfils the economic and planning function, which the Government envisages will be fulfilled by an Economic Policy and Investment Agency (EPIA), which will be established in the future. If this function were effectively fulfilled, Timor-Leste's ability to implement effective PIM would be greatly improved, as it would place much greater emphasis on ensuring that sector strategies are formulated with appropriate reference to economic returns and integrated development planning. For example, in the agricultural sector, an EPIA-type unit could play a significant role in calculating the economic returns to be derived from a strategy oriented towards achieving self-sufficiency in the area of rice production through the implementation of large-scale irrigation projects. This would be a major step towards addressing the problem of 'white elephants' discussed in the next section.

## 2.4 CONCLUSION

**Timor-Leste's project investment management challenges occur in three broad areas: inappropriate project selection; failure to consider maintenance costs; and reducing avenues for corruption.** These challenges reflect those in a number of resource-rich, post-conflict states (see Box 5).

### Box 4: LEARNING FROM REFORM IN RESOURCE-RICH POST-CONFLICT STATES

#### Building upon Strengths

Timor-Leste has implemented some important measures to improve transparency and accountability, particularly in the petroleum sector. To improve transparency and accountability in the sector, Timor-Leste took the opportunity to learn from the experience of countries that had succumbed to the 'resource curse' by prioritizing upstream governance in the natural resource value chain and by establishing the Petroleum Fund. Timor-Leste was also the first country in Asia to accede to the Extractive Industry Transparency Initiative (EITI), and only the third in the world.

The political and human resources that are available for reform in post-conflict societies are often extremely limited. Therefore, there is a need for the hard-headed prioritization of reforms, based upon a thorough and realistic assessment of their impact and achievability.

The timeframes for institutional reforms to counter corruption can be very long. The World Development Report on Conflict, Security and Development 2011 presented analysis that showed that the fastest 20 reformers took about 20 years to substantially improve the quality of bureaucracy and 27 years to achieve success in controlling corruption.

Countries characterized by a high level of institutional informality often experience a phenomenon that has been termed 'isomorphic mimicry'. Put simply, this means that countries establish institutions that appear to be modelled on OECD-style governance norms, but which in practice often play no such role.

Rather, they may obscure the frequently informal mechanisms by which governance is affected.

Timor-Leste may achieve the extremely important goal of stability through the use of fast-tracking procedures that are difficult to reverse, hampering the transition towards sustainable growth. As a result, the country may become trapped in a sub-optimal equilibrium. As Putzel and Di John express it in their recent work *Meeting the Challenges of Crisis States* (2013): “Centralized patronage underpinned by an inclusive elite bargain and state control over resources can play an important role in maintaining political stability but may come at the cost of economic development.” The first challenge involves a selection of the right projects, or avoiding ‘white elephants’. Parliament has extensively debated the appropriateness of several very large projects, including the establishment of the south coast industrial zone. Reforms to improve the selection of projects have a very high payoff and are relatively easy to implement, because they can be undertaken by a small number of technical consultants over a relatively short time frame.

The second challenge relates to the failure to preserve physical assets, which in Timor-Leste centers on the ‘Wet Season’. Climate and topography create problems for the effective maintenance of infrastructure assets. The Office of the President and the Parliament have discussed the quality of infrastructure at length, with particular reference to the deterioration of the road network and an emerging culture of ‘build, neglect, rebuild’. The Bebuy irrigation project has been reconstructed on a number of occasions, with these reconstructions being necessitated by flood-related damage. The size of maintenance budgets in the irrigation and roads sectors are roughly one eighth and one quarter of optimal levels respectively. Even with these limited budgets, allocated funds are often diverted to other uses (see irrigation and roads chapters). Reforms to improve the sustainability of projects, such as the implementation of performance-based maintenance contracts systems, also have a high payoff rate, and are being considered by Government. Although potentially complex, such reforms could be effectively implemented by focusing efforts early in the project cycle on design and costing in maintenance, with action in the short term.

The third challenge relates to improving basic public administration systems that impact project management to start to address what in Timor-Leste is called ‘KKN’<sup>61</sup>, or preventing and addressing corruption. While reforms to counter corruption may also have a high payoff rate, they can be very challenging to implement, with results only apparent in the long term. As a result, the reform strategy proposed focuses on getting the basics right, with more sophisticated anti-corruption measures being largely inappropriate for Timor-Leste at this stage. Rather, actions need to be targeted. For example, protecting the process of project selection to prevent capture by business interests is a high priority. It is important to note that in this area, Timor-Leste has some important strengths upon which it can build: most significantly, the Government has indicated its determination to act upon the findings of its own internal audit reports, which reveal systemic weaknesses in procurement processes and internal controls, with the potential for widespread corruption.

---

<sup>61</sup> KKN stands for “korupsaun kolusaun no nepotismu” in Tetum, meaning “corruption, collusion and nepotism”.

## 2.5 RECOMMENDATIONS

**A reform strategy must build on existing institutions and strengths.** The reform strategy should avoid the potential pitfalls of ‘gap analyses’ that seek to identify a solution for every problem. Instead, the reform strategy should build upon the strengths of the Government’s recently implemented reforms. In their formulation, the Government must adopt four criteria to identify reforms. The first criterion is that the political elite in Timor-Leste already recognizes that there is a problem that requires a solution. The second criterion is that from a public policy perspective, the returns on taking action are high. The third criterion is that the actions are achievable with the present level of public administrative capability in Timor-Leste. The fourth criterion is that the actions can be implemented over the next twelve to eighteen months.

On this basis, this report makes three recommendations:

1. The Government must prioritize the selection of projects in order to address the problem of excessive expenditure on projects with low to negative economic rates of return;
2. The Government must build in sustainability, particularly early in the project cycle, in order to address the problem of failure to preserve accumulated capital;
3. The Government must improve project management as part of a strategy to address corruption.

Underlying these three recommendations is the need to enhance the transparency of existing investment management systems by means such as ensuring project recommendations are based on solid economic appraisals; that these recommendations are published and adhered to; and that detailed maintenance budgets are published. The full list of actions necessary to support the implementation of the three recommendations is presented in Annex 4.

## CHAPTER 3

### IRRIGATION

#### 3.1 SUMMARY

**This chapter focuses on the economics of growing irrigated rice in Timor-Leste using rehabilitated and new weir-based river diversion (WBRD) irrigation systems to irrigate areas of flat land along the lower reaches of the country's major river systems.** The current strategy for the development of the irrigation sector is based on the rehabilitation of ex-transmigration irrigation systems that were first constructed during the period of Indonesian occupation, to be followed by the construction of dams and new schemes. The existing systems are now generally non-functional, due to a lack of maintenance and to damage to water intake channels. Therefore, the Ministry of Agriculture, Fisheries and Forestry (MAFF) is progressively refurbishing and re-building these schemes with the objective of increasing the level of domestic rice production. This will be followed by the construction of new irrigation systems in areas which are currently undeveloped ("greenfield"). The analyses completed to determine the economics of growing irrigated rice only focus on this crop, as in most situations the supply of irrigation water in the dry season is insufficient for second crops, and there are no markets for surplus rice (defined as rice production over and above that required for general household subsistence).

**Timor-Leste's current irrigation strategy has not and will not generate acceptable returns on investment in the sector.** Pre- and post-construction appraisals have consistently revealed negative economic internal rates of return (EIRRs) and correspondingly, benefit/cost ratios (BCRs) of less than 1. This is because investment costs are very high and marginal rates of return are low. The latter is due to very low yields and cropping intensities, and low farm-gate prices. The current approach of focusing exclusively on investments in irrigation hardware (river diversion weirs) and not on investments in complementary software (farmer services, production inputs and market support) is unsustainable. This approach will not facilitate the production of a sufficiently large volume of rice to justify the large investments in physical infrastructure, nor will it result in reduced dependency on imported rice to feed the nation.

**From an economic cost perspective, in Timor-Leste, it is much cheaper to import rice (at an average cost of US\$660 per metric ton) than to grow rice (\$1,000 per metric ton), and there are few incentives for farmers to increase domestic production.** In addition, sectoral policies, such as the subsidization of rice for consumption, conflict with sectoral support initiatives that aim to increase the volume of domestic rice production. These conflicting policies should be reviewed.

**The cost of building and/or refurbishing WBRD irrigation systems in Timor-Leste averages approximately US\$10,000 per hectare, which is very high by international standards.** A comparison of construction costs in 33 comparable countries indicates that while small irrigation schemes are generally very expensive to build, medium and larger schemes are much less expensive. For instance, the average per hectare cost of schemes in the range of from 1500 to 2500 hectares, cost as low as \$1,983 per hectare. A comparison of 70 representative schemes, the average size of which was slightly more than 1,000 ha, a size roughly comparable to the larger irrigation schemes in Timor-Leste, shows that the average cost of developing these schemes was US\$5,298 per hectare (at 2013 prices). This is about 65 percent of the cost of building and/or refurbishing irrigation schemes in Timor-Leste.

**The MAFF's current and planned budgets for the operations and maintenance of irrigation schemes are much smaller than those needed to maintain and operate the asset stock adequately** (see Figure 32). We base this calculation on two assumptions, these being: (i) an annual maintenance cost of 2.5 percent of the value of the accumulated investment in irrigation to keep the infrastructure operational (the "hardware" costs); and (ii) public irrigation farming operational costs of US\$500 per hectare (for seed, fertilizer, chemical, etc.)<sup>62</sup>, and for farmer extension and training services and rice market development (the "software" costs). Based on these assumptions, the MAFF annual budget just for the maintenance of irrigation systems will need to increase to approximately US\$16.6 million by 2020, up from US\$2.0 million in 2013. By 2020, it will need an annual operational budget of approximately US\$21.2 million. In other words, if current plans for the development of irrigation systems are implemented, operations and maintenance budgets will need to be very significantly increased.

**If sustainable and affordable progress is to be made towards the achievement of the objective in the Strategic Development Plan (SDP) of self-sufficiency in the area of staple food production, particularly of rice production, then Timor-Leste's irrigation sector strategy must be revised.** The objectives of this revision would be to identify a combination of strategies that would: (i) generate a higher level of returns on the sunk costs that have been invested to-date, the value of which amounts to approximately US\$82 million; (ii) reduce the cost of the planned investment in the expansion of the sector, from a cost currently estimated to reach US\$590 million.

This report shows that it is possible to generate acceptable returns from investment in two essential and complementary software packages, combined with the use of Tube Wells and Small Pumps (TWSPs) for supplementary irrigation.

**This report proposes an alternative hybrid irrigation strategy which builds on past investments in physical infrastructure, while at the same time generating high returns on marginal**

---

<sup>62</sup> MAF's current policy is to provide these crop production MAF inputs free-of-charge to irrigation farmers - 100% subsidized

**investment in tube-well irrigation and in farmer support services and market development programs.** For this strategy to succeed, the Government would need to be prepared to redirect planned capital budgets for the rehabilitation of irrigation schemes to targeted increases in MAFF and MCIE budgets to enable expenditure on (i) two software packages of subsidized inputs and extension services; (ii) investment in TWSPs; and (iii) development of rice markets.

## **3.2 HISTORICAL BACKGROUND**

Irrigation in Timor-Leste began during the Portuguese colonial period, when schemes were constructed at Buluto in Manatuto District and at Dardau in Viqueque District. These schemes were not maintained. Buluto was destroyed by a flood in 1969 and was not rebuilt. It remains non-functional. Numerous small-scale communal irrigation systems were also developed during the Portuguese colonial period, with these systems using simple irrigation technology that relied on water supplies from small springs and run-off from mountain-sides.

This period was followed by the Indonesian occupation in late 1975, when more rice had to be grown to feed military and other personnel. During this period, transmigrants from Java and Bali were settled along the south and north coasts. To support these communities, free-intake river diversion irrigation schemes were constructed on the larger rivers, such as the Beikala scheme on the lower reaches of the Caraulun River.

The next phase of the development of irrigation systems began after Independence, when donors funded a series of Agriculture Rehabilitation Projects (ARPs) in the period from 2000 to 2008. These projects mainly involved small-scale communal irrigation schemes, in addition to one larger ex-Indonesian scheme named Caraulun. In addition, a series of irrigation plans and designs were developed and analyzed during the period the ARPs were implemented, including pre-construction economic appraisals based on Economic Internal Rate of Return (EIRR) for a number of projects, including, most notably, the Bebui, Maliana I and Caraulun schemes. This period was followed by a period during which a considerable degree of bilateral support was provided by the Japanese Government for the rehabilitation of the Lacro and Maliana I irrigation schemes. The ex ante economic appraisal conducted for the Maliana I scheme was ignored. In other words, despite the fact that good quality pre-construction appraisals had been conducted, their predictions of negative returns on investment were not taken into account in the decision as to whether or not to proceed with construction.

## **3.3 PAST LESSONS**

**As early as 2002, irrigation designers and economists had begun to question the economic feasibility of rehabilitating damaged and non-functional irrigation schemes.** Table 7 summarizes the findings of some of the early evaluations of irrigation economics in Timor-Leste

and shows estimates<sup>63</sup> that even according to optimistic scenarios that assumed high crop yields and cropping intensities, the Maliana I, Bebui and Caraulun irrigation schemes would be uneconomic for cross river, weir-based irrigation systems, due to their high costs. However, all three schemes have been rehabilitated, with Caraulun undergoing repairs for the second time in 2013.

**TABLE 7: SUMMARY OF EX ANTE ESTIMATED EIRRS FOR THREE ARP IRRIGATION DESIGNS**

Scheme		Est. EIRR (%)			
		Action	Cost a/	Conservative	Optimistic
Maliana I	Option 3	New Weir	\$2,657.0	-2.54	-1.11
Bebui	Option 5	New Weir	\$4,164.9	-7.34	-5.79
Caraulun	Option 5	New Weir	\$5,858.2	0.60	1.70

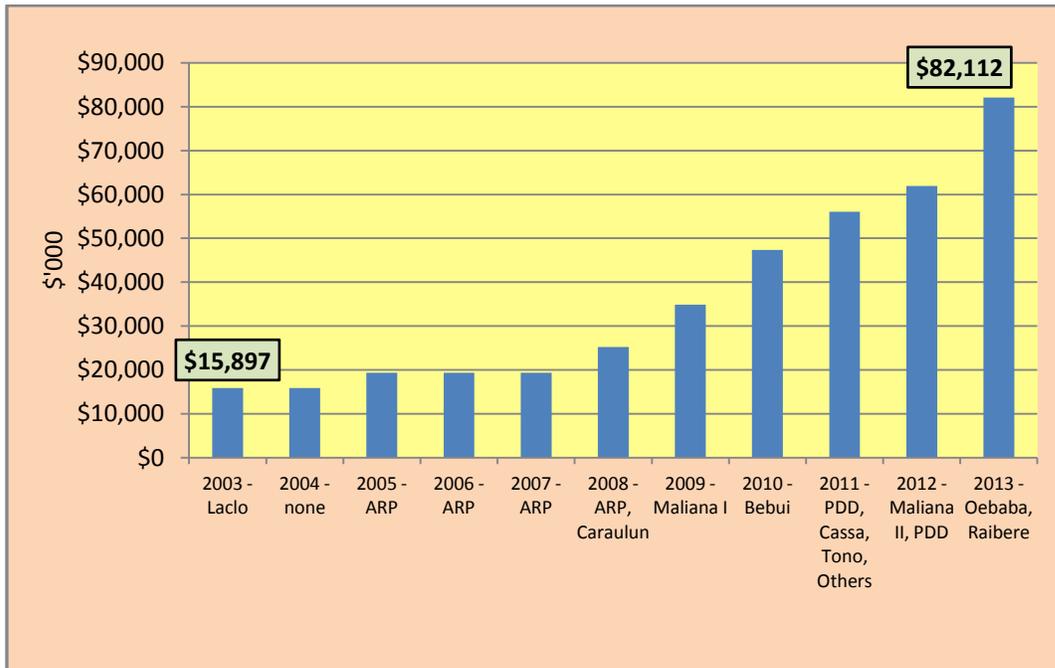
Source: Tables 7 and 8, SMEC, October 2002, Agriculture Economics Report.

**The current strategy for the development of irrigation systems has not been guided by these early experiences.** Timor-Leste’s irrigation strategy continues to be based on the rehabilitation of large, damaged irrigation schemes “hardware”); with little Government support for two essential and complementary packages, consisting of farmer support (production inputs and training) and marketing support (public sector rice purchases). The latter are referred as “software packages” throughout this chapter.

**Lessons from the failure of past schemes to increase rice production should be considered before new investments are undertaken.** In the period from 2003 to 2013, funds to the value of US\$82 million have been invested by donor and government in the rehabilitation of a number of large irrigation schemes (see Figure 24). Despite this significant investment, levels of rice production have risen only modestly (see Figure 25). To date, other than for small community-based irrigation schemes, no investment in the rehabilitation of large damaged irrigation schemes has generated acceptable EIRRs (see Table 10).

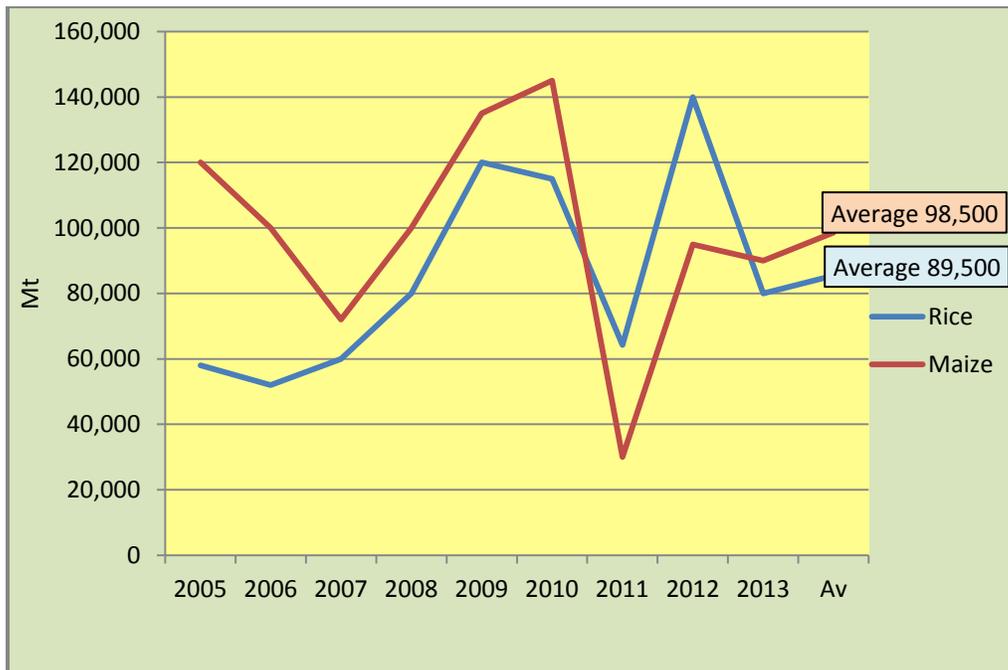
<sup>63</sup> Snowy Mountains Engineering Corporation (SMEC)

**FIGURE 24: ACCUMULATION OF IRRIGATION ASSETS**



Source: Derived from irrigation expenditure information and data supplied by MAFF's Finance, and Irrigation and Water Management, National Directorates.

**FIGURE 25: TRENDS IN RICE PADDY AND MAIZE PRODUCTION, AFTER LOSSES AND ALLOWANCES FOR SEED (MT) (REDUCED PADDY PRODUCTION IN 2011)**



Source: Extracted from MAFF's Food Security Bulletin, January – March, 2013, Figure 2, page 2.

### 3.4 FUTURE PLANS

**There are ambitious and expensive plans for the future development of the irrigation sector in the period from 2014 to 2021, with these plans involving 38,400 hectares of newly irrigated land and an investment of approximately US\$590 million (at 2013 prices).** Table 8 and Figure 26 summarize MAFF's large and ambitious plans for the development of the irrigation sector, with these plans feeding into the SDP planning exercise in 2010, together with a list of a series of planned activities, including: (i) further sectoral planning; (ii) completion of a master plan (by Japan); (iii) farmer resettlement in irrigation schemes which are sparsely populated; (iv) rehabilitation of nine schemes which are in the approved pipeline; (v) a study of 20 new schemes for which sites have been selected; (vi) studies for and the construction of 12 large multi-purpose dams; (vii) irrigation schemes associated with these dams; (viii) ongoing PDD I and PDD II programs, and PNDS support for irrigation; and (ix) the funding of maintenance and operational costs.

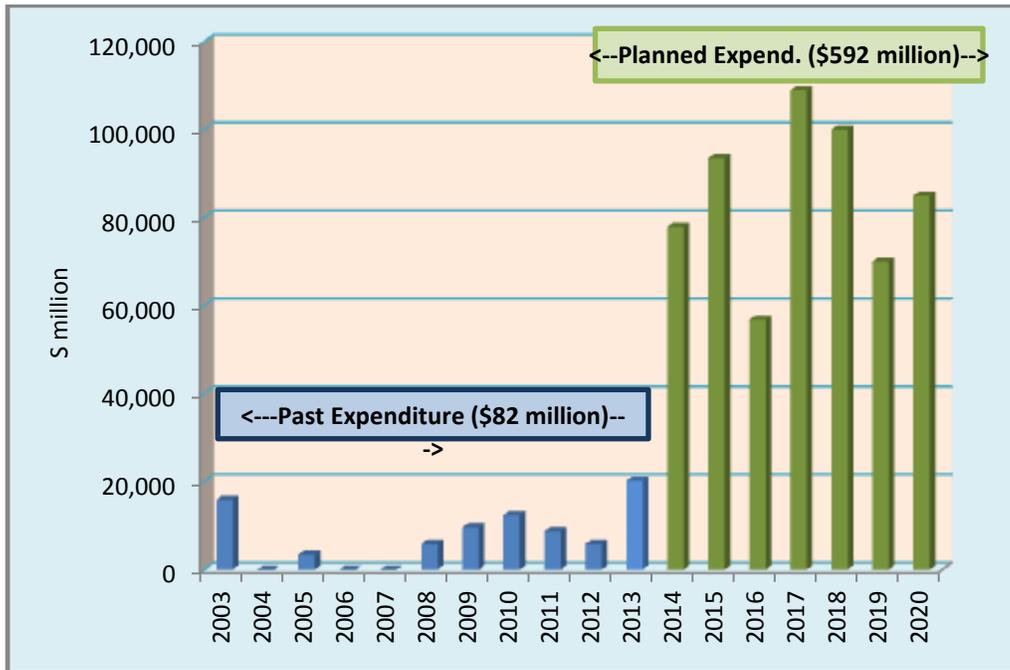
This plan is questionable for two reasons. Firstly, as outlined above, there have been disappointing results from past investments in the rehabilitation of irrigation schemes, as indicated by negative EIRRs and the low rates of increase in levels of staple food production. Secondly, there is another, more cost-effective irrigation strategy which should be investigated before commitments to further large-scale investments in irrigation hardware are entered into. This more cost-effective irrigation strategy would involve the use of TWSPS to supply supplementary wet and dry irrigation season water and the provision of the two software packages described earlier, together with the implementation of the current river WBRD irrigation strategy.

Table 9 summarizes Timor-Leste's irrigation development plans in terms of area (ha) and shows that over the next eight years, there are plans to rehabilitate/develop about 38,400 ha. Note that the current irrigated area is reported by MAFF to cover approximately 46,300 ha. However, recent investigations (Freach 2013)<sup>64</sup> indicate that the currently irrigated area may cover only 33,300 ha.

---

<sup>64</sup> See: "Rice in Timor: Area, Cropping and Economics", an internal Seeds of Life Report, Joe Freach, August 2013.

**FIGURE 26: CAPITAL INVESTMENT ON IRRIGATION: PAST AND PLANNED**



\$'000/year, 2013 prices; excludes O&M

Source: Derived from irrigation expenditure information and data supplied by MAFF's Finance, and Irrigation and Water Management, National Directorates.

**TABLE 8: MAFF’S IRRIGATION DEVELOPMENT PLANS AND REQUIRED MAINTENANCE AND OPERATIONS BUDGETS (2013 – 2020)**

Summary of MAFF’s Irrigation Plans									
	2013	2014	2015	2016	2017	2018	2019	2020	Total
Cost Item	(US\$ million)								
Irrigation planning by MAFF a/		1	2	3	4				10
JICA’s Irrigation Master Plan b/	1								1
Farmer resettlement a/		35	40	45	50	30			200
Nine schemes in MPS pipeline c/	14	37	47	4					102
20 new schemes to be studied d/					25	25	25	25	100
Twelve large dams e/					20	30	30	40	120
Irrigation associated with large dams f/					10	15	15	20	60
Ongoing PDD I and II expenditure g/	5	5	5	5					20
<b>TOTAL</b>	<b>20</b>	<b>78</b>	<b>94</b>	<b>57</b>	<b>109</b>	<b>100</b>	<b>70</b>	<b>85</b>	<b>613</b>
Annual maintenance cost h/	2	4	6	8	10	13	14	17	74
Annual operational cost i/	12	13	15	17	18	19	20	21	136
<b>Total (US\$ million)</b>	<b>34</b>	<b>95</b>	<b>115</b>	<b>81</b>	<b>137</b>	<b>132</b>	<b>105</b>	<b>123</b>	<b>823</b>

a/ From MAFF’s 2010 Irrigation Plans submitted for inclusion in the SDP; 2010 costs inflated to 2013 costs.

b/ Due to commence in 2013 , but currently delayed.

c/ These are the nine Group C schemes listed in Table 9.

d/ Assumes 20 x 500 ha each, US\$10,000/ha = US\$5.00 million each = total of US\$100 million.

e/ Assuming US\$10.00 million per dam = US\$120 million (ignores hydro works and non-irrigation infrastructure).

f/ Assuming 1,000 ha per dam @ US\$10,000 per ha = US\$10.00 million per dam; assume six schemes; total = US\$60 million.

g/ Based on the average PDD I and II expenditure in the past two years. Could be some double-counting with h/.

h/ Based on 2.5 percent of cumulative capital cost, including existing schemes.

i/ Based on US\$500/ha/year, including existing large and small rehabilitated schemes; required to generate reasonable yields.

**TABLE 9: PLANS FOR IRRIGATION DEVELOPMENT – AREAS TO BE IRRIGATED (HA)**

<b>Area Irrigated (ha) a/</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Total</b>
Area currently irrigated, inc. Bebui	46,300	46,300	46,300	46,300	46,300	46,300	46,300	46,300	46,300
Nine Schemes in pipeline - lagged		2,488	5,946	11,909	12,409	12,409	12,409	12,409	12,409
Twenty new schemes to be studied - lagged					2,500	5,000	7,500	10,000	10,000
Six schemes associated with new dams - lagged					1,500	3,000	4,500	6,000	6,000
PDD I & II schemes	2,500	5,000	7,500	10,000	10,000	10,000	10,000	10,000	10,000
<b>Total ha irrigated</b>	<b>48,800</b>	<b>53,788</b>	<b>59,746</b>	<b>68,209</b>	<b>72,709</b>	<b>76,709</b>	<b>80,709</b>	<b>84,709</b>	<b>84,709</b>
<b>Incremental ha irrigated</b>	<b>2,500</b>	<b>4,988</b>	<b>5,958</b>	<b>8,463</b>	<b>4,500</b>	<b>4,000</b>	<b>4,000</b>	<b>4,000</b>	<b>38,409</b>

a/ Source: Derived from MAFF's 2010 Irrigation Plans submitted for inclusion in the SDP; 2010 costs inflated to 2013 costs.

**The approved project pipeline for 2014 onwards includes nine projects, all of which have been appraised as being economically unviable** (see Table 11).<sup>65</sup> Furthermore, current irrigation planning has not considered the impact of climate change and land degradation on sustainable supplies of irrigation water. These factors have increased seasonal flooding and reduced basal stream flows to the point where only one crop of rice can be grown each year in some areas. In other words, in these areas, the rate of cropping intensity is 100 percent, when it is generally considered that cropping intensities need to be of the order of 200 percent for investment in irrigation infrastructure to be warranted.<sup>66</sup> On this basis, consideration to dry season, supplementary TWSPs is warranted.

**The current WBRD irrigation strategy is very expensive to implement, with associated construction costs of around US\$10,000 per hectare and maintenance costs of approximately US\$250 per hectare per year. In addition, it neglects the needs of non-rice growing families.** WBRD schemes are often not productive when water supplies are inadequate for high cropping intensities. Therefore, the Government should evaluate alternative irrigation strategies, such as increasing levels of production in existing irrigated areas, or a rice bowl approach that builds on scale and regional comparative advantages. In addition, consideration should be given to the achievement of higher levels of water-use efficiency by growing crops other than rice, using supplementary irrigation. A rice-centric approach tends to neglect the poorer non-rice growing families who do not receive any direct benefits from Government's investment in the development of irrigation systems.

### **3.5 CURRENT IRRIGATION STRATEGY**

**The current irrigation strategy is based on the rehabilitation of irrigation schemes that were developed during the period of Indonesian occupation.** However, in the period since this occupation, designs have changed from free-intakes to WBRD systems. While the latter are more reliable in terms of ensuring sustainable water supplies, these schemes are much more expensive to construct and maintain, mainly because of the added cost of cross-river diversion weirs. In addition, as climate change and land degradation begin to reduce basal stream flows, even these more robust irrigation systems will be unable to ensure reliable supplies of irrigation water late in the growing season and, more importantly, in the dry season, as crops mature. This means that second and perhaps third season crops will only be able to be grown in very limited areas.

**As shown in Table 11, the current irrigation strategy is very expensive, both in terms of the total expenditure required to rehabilitate a scheme and the cost per irrigated hectare of land.** For example, the rehabilitation of the Lacro scheme cost US\$15.9 million (at 2013 prices), which

---

<sup>65</sup> Note: this includes two irrigation schemes (Raibere and Oebaba) which are not listed in Table 11. These have been "fast-tracked" through the MPS system and are under tender.

<sup>66</sup> Paul Van Hofwegen, Irrigation Advisor to the World Bank, Indonesia.

is equivalent to US\$16,400 per irrigable hectare of land. Thus, the high cost of rehabilitating these schemes makes it difficult to achieve high rates of return.

**Post- and pre-construction appraisals confirm that irrigation rehabilitation schemes implemented in the early 2000's have generated low rates of return** (see Section 3.3). Section 3.5.1 summarizes the results of post-construction evaluations of three completed irrigation schemes using reported yields and cropping intensities; and 3.5.2 summarizes the results of pre-construction investment analyses for seven approved irrigation schemes which remain on the Government's approved 2013 Infrastructure Fund list. The analysis includes a sensitivity analysis of the appraisal of WBRD schemes from a base case, which progressively lowers assumptions for (i) crop yields; and (ii) cropping intensities. The base case assumes a cropping intensity of 225 percent, with paddy yields increasing from 3.00 to 5.00 metric tons per hectare and maize yields increasing from 1.50 to 3.00 metric tons per hectare. The sensitivity analyses focus is on the 'most probable outcome' scenario, which assumes a 120 percent cropping intensity, paddy yields increasing from 3.00 to 3.75 metric tons per hectare and maize yields increasing from 1.50 to 1.88 metric tons per hectare. Note that maize cropping only comes into the production equations when cropping intensities approach 150%, hence the concentration on rice as the key crop in the analysis.

### ***3.5.1 EX POST ECONOMIC APPRAISAL OF THREE COMPLETED IRRIGATION SCHEMES***

The MPS's 2012 Appraisal Team calculated post-construction EIRRs for three irrigation schemes that were rehabilitated in the period from 2003 to 2010. Their findings are listed in Table 10, which shows that the Laclo, Bebui and Maliana I schemes were generating negative EIRRs in 2013. The reasons are the same as those listed above: the costs of developing the schemes were very high; potential benefits were unrealized due to inadequate attention and funding for investments in software; and there was a lack of financial incentives for farmers to produce rice surplus to their family's subsistence requirements. It is noteworthy that two of these three schemes (Maliana I and Bebui) were subjected to pre-rehabilitation analysis by SMEC in 2002 (see Table 7). This analysis drew the same conclusions as the conclusions drawn in 2012: that these projects were associated with negative or very low EIRRs (see Scenarios 3 – 7 in Table 10). Similarly, the benefit/cost ratios for these three schemes (at 10 percent discount) were well below 1, standing at 0.2 and 0.3 respectively.

**TABLE 10: SUMMARY OF APPRAISAL OF THREE REHABILITATED IRRIGATION SCHEMES**

Evaluation/Ranking Criteria	Completed Irrigation Schemes		
	Laclo	Bebui	Maliana I
Scheme/ road construction cost (\$'000)	\$15,897	\$13,591	\$9,663
Potential area irrigated (ha)	970	1,300	1,050
Current area irrigated (ha)	485	520	525
Construction cost (\$/ha) 2013 prices	\$16,389	\$10,455	\$9,203
Construction cost (irrigation/road) (\$/household)	n.a.	n.a.	n.a.
1. Base EIRR (%): key assumptions (yields and cropping intensity) hold	4	11	12
2. EIRR (%): construction costs + 10% (two key assumptions hold)	3	10	11
3. EIRR (%): yield assumptions fail (cropping intensity assumptions holds)	Negative	3	4
4. EIRR (%): cropping intensity assumptions fail (yield assumptions hold)	Negative	Negative	Negative
5. EIRR (%): incremental yield and cropping intensity assumptions both fail	Negative	Negative	Negative
6. EIRR (%): grain price falls by 20%, two key assumptions hold	Negative	4	5
<b>7. EIRR (%): most probable outcome</b>	<b>Negative</b>	<b>Negative</b>	<b>Negative</b>
Benefit/Cost Ratio (Scenario 1) a/	0.65	1.07	1.14
Benefit/Cost Ratio (Scenario 2)	0.59	0.97	1.04
Benefit/Cost Ratio (Scenario 3)	0.39	0.65	0.68
Benefit/Cost Ratio (Scenario 4)	0.24	0.43	0.43
Benefit/Cost Ratio (Scenario 5)	0.07	0.18	0.15
Benefit/Cost Ratio (Scenario 6)	0.41	0.67	0.71
<b>Benefit/Cost Ratio (Scenario 7 - most probable outcome)</b>	<b>0.18</b>	<b>0.32</b>	<b>0.31</b>
<b>Total Benefits (\$'000)</b>	<b>\$3,108</b>	<b>\$4,672</b>	<b>\$3,365</b>
<b>Total Costs (\$'000)</b>	<b>\$17,252</b>	<b>\$14,830</b>	<b>\$10,703</b>

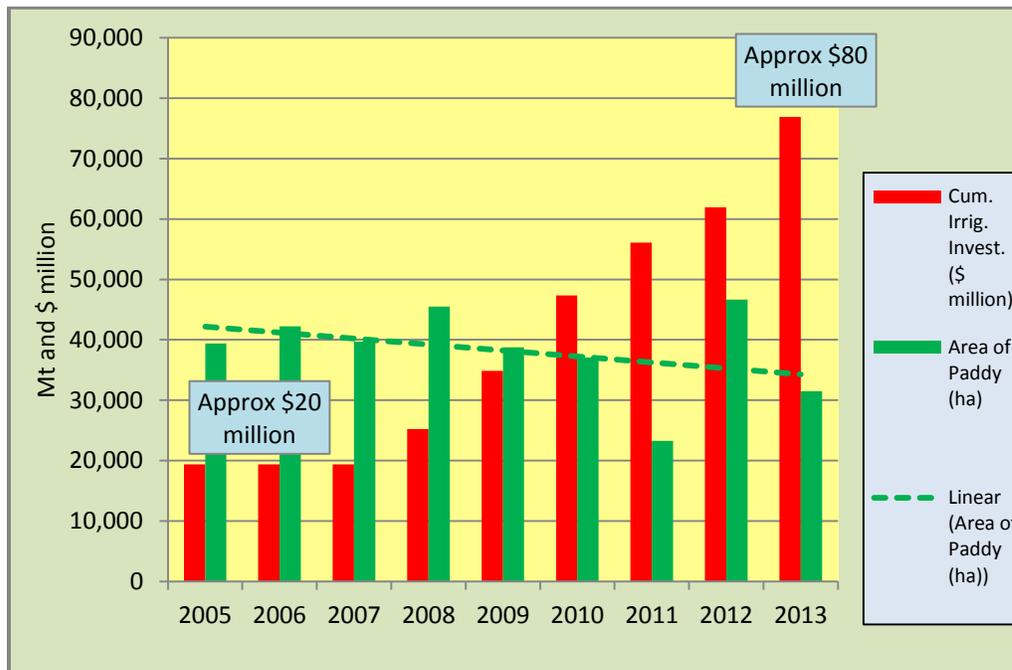
Source: "Final Appraisal Report – Appraisal of Seven Irrigation Schemes", October 2012, MPS; plus the addition of Benefit/Cost Ratios. Updated by PERI team including the addition of BCRs.

**The negative returns on these completed schemes can be explained by the high associated construction costs and their limited impact on rice production levels.** Figure 27 shows the trends for the area utilized for the cultivation of rice in Timor-Leste, together with the value of the annual rice deficit (imports) in the period from 2005 to 2013, with cumulative investment in irrigation growing from roughly US\$20 million to US\$82 million between these two points. As investment in irrigation has grown, the annual area irrigated has trended downwards, while the rice deficit has remained at approximately the same level, at around 80,000 metric tons. The fact that the rice deficit has remained more or less constant can be partly explained by population growth and changes in staple food consumption patterns, with a trend towards the increased consumption of rice. Nonetheless, it should be expected that a four-fold increase in the value of investments in irrigation would lead to some increase in the area irrigated and

hence to increased levels of domestic production and a decline in imports, as targeted under the SDP.

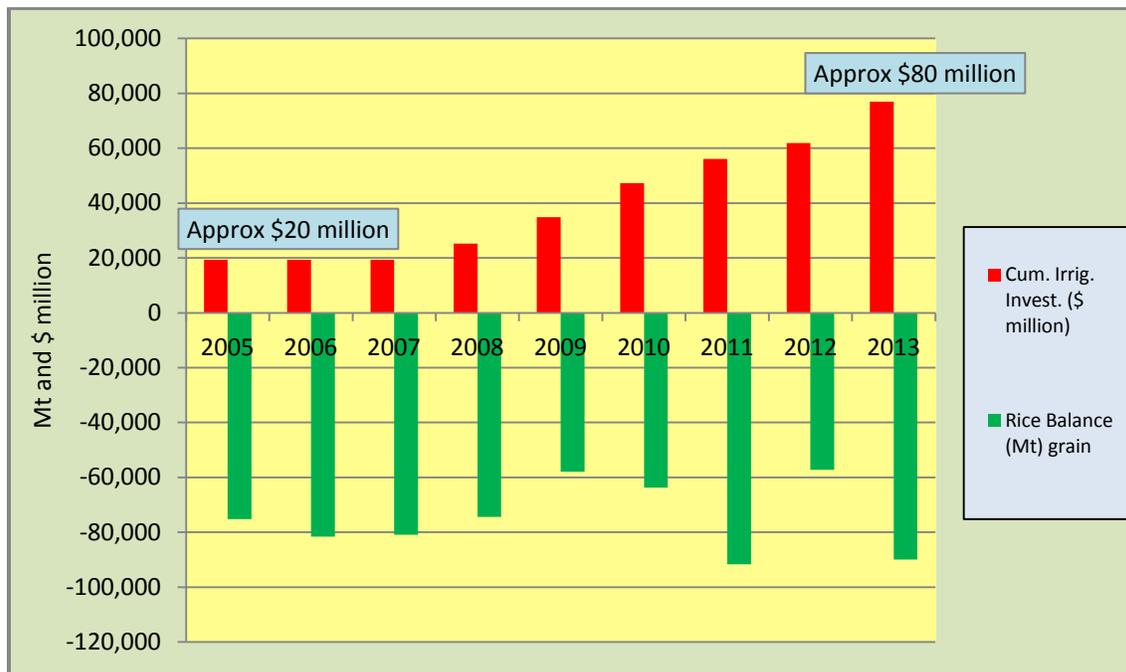
**These results indicate that factors other than sectoral investments alone are influencing how rice farmers respond to increased supplies of irrigation water.** Section 3.10 outlines the potential disincentives to production from imported rice sales and as a result of government cash transfers.

**FIGURE 27: CUMULATIVE INVESTMENT IN IRRIGATION REHABILITATION (US\$ MILLION, 2013 PRICES) AND AREA OF PADDY PLANTED (HA)**



Source: TLFSB, No 3. Jan-Mar 2013(MAF-NDAH), FAOSTAT, and MoF and WB PERI (2013)

**FIGURE 28: CUMULATIVE INVESTMENT (INCLUDES O&M) IN IRRIGATION REHABILITATION (US\$ MILLION, 2013 PRICES) AND ANNUAL RICE BALANCE**



Source: TLFSB, No 3. Jan-Mar 2013(MAF-NDAH), FAOSTAT, and MoF and WB PERI (2013)

### 3.5.2 EX ANTE APPRAISAL OF SEVEN APPROVED IRRIGATION SCHEMES

The results from ex ante appraisals of seven irrigation schemes approved for construction show that software interventions have the potential to make investment in rehabilitation viable (see Table 11). These appraisals were completed for the MPS in 2012 and shows positive EIRRs for the appraised schemes (see Scenarios 1 and 2 in Table 11) *if and only if* two key assumptions related to farmer services and markets hold true. However, experience to date suggests that these assumptions will *not* hold true unless there is a significant change in MAFF’s budget allocation policies and if farmers are given an incentive to grow more paddy. In other words, irrigated yields and cropping intensities will not increase unless there is increased investment in: (i) farmer services and training; and (ii) improved crop product markets (see Section xx for details). Note that all seven schemes generate benefit/cost ratios of less than 1.00, at a 10 percent discount rate, in the case of the most likely scenario, Scenario 7.

More specifically, this complementary software support for irrigation hardware needs to be in the form of: (i) improved farmer training by MAFF’s Suco Extension Officers who are backed up with results from good adaptive research on irrigated agriculture production; (ii) increased and

more reliable provision of crop production inputs such as seed, fertilizer and chemicals<sup>67</sup>; and (iii) improved and much larger market support to buy farmers' "surplus"<sup>68</sup> paddy – either through MCIE or private rice traders.

---

<sup>67</sup> These inputs are currently (partially) supplied free of charge by MAF, which in effect competes with the emerging private sector to service rural communities.

<sup>68</sup> "Surplus" in this sense is defined as paddy production over and above the amount required for household subsistence.

**TABLE 11: SUMMARY OF RESULTS FROM APPRAISAL OF SEVEN PRIORITY IRRIGATION SCHEMES**

Evaluation/Ranking Criteria	Proposed Irrigation Schemes							
	Tono	Larisula	Buluto b/	Galata	Maukola	Dardau	Beikala	Total/Av.
Scheme/ road construction cost (\$'000)	\$16,885	\$6,102	\$14,725	\$7,774	\$21,999	\$4,350	\$18,056	<b>\$89,891</b>
Potential area irrigated (ha)	1,700	387	1,370	1,500	2,916	500	1,547	<b>9,920</b>
Current area irrigated (ha)	850	194	685	750	729	75	774	<b>4,056</b>
Construction cost (\$/ha) 2013 prices	\$9,932	\$15,766	\$14,725	\$5,183	\$7,544	\$8,700	\$11,672	<b>\$10,503</b>
Construction cost (irrigation/road) (\$/household)	\$3,715	\$25,745	\$15,339	\$6,041	\$207,537	\$12,393	\$17,931	<b>\$10,584</b>
1. Base EIRR (%): key assumptions (yields and cropping intensity) hold	11	4	8	20	18	15	9	
2. EIRR (%): construction costs + 10% (two key assumptions hold)	10	3	7	17	16	14	7	
3. EIRR (%): yield assumptions fail (cropping intensity assumptions holds)	6	Negative	2	13	12	10	1	
4. EIRR (%): cropping intensity assumptions fail (yield assumptions hold)	Negative	Negative	Negative	3	5	3	Negative	
5. EIRR (%): incremental yield and cropping intensity assumptions both fail	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
6. EIRR (%): grain price falls by 20%, two key assumptions hold	4	Negative	1	11	10	7	2	
<b>7. EIRR (%): most probable outcome</b>	<b>Negative</b>	<b>Negative</b>	<b>Negative</b>	<b>Negative</b>	<b>Zero</b>	<b>Negative</b>	<b>Negative</b>	
Benefit/Cost Ratio (Scenario 1) a/	1.07	0.67	0.90	1.80	1.57	1.36	0.92	
Benefit/Cost Ratio (Scenario 2)	0.97	0.61	0.83	1.65	1.43	1.25	0.84	
Benefit/Cost Ratio (Scenario 3)	0.74	0.46	0.63	1.20	1.15	1.01	0.54	
Benefit/Cost Ratio (Scenario 4)	0.40	0.25	0.34	0.56	0.70	0.63	0.34	
Benefit/Cost Ratio (Scenario 5)	0.20	0.12	0.17	0.19	0.43	0.42	0.12	
Benefit/Cost Ratio (Scenario 6)	0.66	0.42	0.56	1.05	0.98	0.85	0.57	
<b>Benefit/Cost Ratio (Scenario 7 - most probable outcome)</b>	<b>0.29</b>	<b>0.18</b>	<b>0.42</b>	<b>0.42</b>	<b>0.50</b>	<b>0.45</b>	<b>0.25</b>	

a/ Discount rate of 10 percent.

b/ Construction costs as announced by JICA in late 2013.

Source: "Final Appraisal Report – Appraisal of Seven Irrigation Schemes", October 2012, MPS; updated by the PERI team including the addition of BCRs.

### **3.6 THE DIFFICULTY OF ACHIEVING IMPORTS SUBSTITUTION UNDER THE CURRENT STRATEGY**

**The current strategy for the development of the irrigation sector, with its emphasis on the ‘hardware’ approach and its neglect of farmer services, means that the cost of growing rice in Timor-Leste is approximately double the cost of importing it.** In order to test the economic validity of the assumed complementarity outlined above, a static, 1,000 hectare irrigation rehabilitation model was developed using data collected during irrigation appraisal work for the MPS. The results, shown in Table 12 and Figure 28, confirm that the current irrigation strategy, with its near exclusive focus on the development of irrigation infrastructure and its almost complete lack of attention to farmer services and market support, means that it currently costs about US\$1,000 per metric ton to grow rice in Timor-Leste, compared to the cost of approximately US\$500 per metric ton to import rice to Dili from Vietnam (mid-2013 prices, based on US\$425 per metric ton FOB). In other words, it costs approximately US\$1.00 per kilogram to grow rice which could be imported at a cost of approximately US\$0.50 per kilogram and delivered to rural areas for a farm-gate import parity price of about US\$0.66 per kilogram, a substantial cost differential. This leads to the conclusion that Timor-Leste needs to identify ways to grow rice much more cheaply.

In terms of benefit/cost ratios (BCRs), the only model in Table 12 that has a BCR greater than 1.0, with an economic rice production price of US\$437 per metric ton (compared with a farm-gate import parity price of US\$660 per metric ton), is the “theoretical maximum” model which assumes that all key assumptions hold true (see section 3.5 for the base case assumptions). Current experience indicates that this situation is unrealistic. Therefore, a more realistic model is the “current situation” model, which generates a BCR of only 0.66 (see the bottom rows of Table 12). In other words, while benefits are positive, they are only about 66 percent of the size of the costs.

**TABLE 12: COST OF GROWING IRRIGATED RICE USING CROSS-RIVER DIVERSION WEIRS – CURRENT SYSTEM IN TIMOR-LESTE**

<b>1,000 ha Generic Irrigation Scheme - River Diversion Weirs - STATIC MODEL</b>	<b>Model 1 a/</b>	<b>Model 2 b/</b>	<b>Model 3 c/</b>	<b>Model 4 d/</b>	<b>Current e/</b>
2013 Construction costs	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000
Km of road required	5	5	5	5	5
MAFF Suco Extension Officer cost (\$25,000/SOE)	\$75,000	\$75,000	\$75,000	\$75,000	\$75,000
Total area of paddy land (ha)	1,000	1,000	1,000	1,000	1,000
Current % use paddy land (season 1) (WOP)	50	50	50	50	50
Current % use paddy land (season 2) (WOP)					
Number of households	1,000	1,000	1,000	1,000	1,000
Number of people	6,000	6,000	6,000	6,000	6,000
Irrigation % (1st season) (WP)	100	100	100	100	100
Irrigation % (2nd season) (WP)	<b>75</b>	75			<b>20</b>
Irrigation % (3rd season) (WP)	<b>50</b>	50			
WOP maize yield (Kg/ha)	1,500	1,500	1,500	1,500	1,500
WP maize yield (Kg/ha)	<b>3,000</b>	1,500	3,000	1,500	1,875
WOP rice yield (Kg P/ha)	3,000	3,000	3,000	3,000	3,000
WP rice yield (Kg P/ha)	<b>5,000</b>	3,000	5,000	3,000	3,750
WP legume yield (Kg/ha)	<b>750</b>		750		
Base EIRR (%)	10	negative	3	negative	negative
EIRR (%): construction costs + 10%	9	negative	2	negative	negative
<b>1,000 ha Generic Irrigation Scheme - Based on River Diversion Weirs - STATIC MODEL</b>	<b>Model 1 a/</b>	<b>Model 2 b/</b>	<b>Model 3 c/</b>	<b>Model 4 d/</b>	<b>Current e/</b>
2013 Construction costs	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000	\$10,000,000
Without Project food production (Mt)	825	825	825	825	825
With Project food production (Mt) - situations vary	5,750	3,263	2,750	1,650	2,475

Incremental staple food production (Mt)	4,925	2,438	1,925	825	1,650
Demand for staple food (Mt) based on 250 kg/pp/yr.	1,500	1,500	1,500	1,500	1,500
Staple food balance in village (Mt) (surplus/ deficit)	3,425	938	425	-675	150
<b>Incremental benefits = Incremental Mt food @ US\$660/Mt</b>	<b>\$3,251</b>	<b>\$1,609</b>	<b>\$1,271</b>	<b>\$545</b>	<b>\$1,089</b>
<b>Irrigation Investment costs/inc. Mt staple food production (\$/Mt)</b>	<b>\$2,030</b>	<b>\$4,102</b>	<b>\$5,195</b>	<b>\$12,121</b>	<b>\$6,061</b>
<b>Government costs, including return on investment</b>					
MAFF incremental irrigation maintenance (\$'000/year)	\$263	\$263	\$263	\$263	\$263
MAFF incremental agriculture extension costs (\$'000/year) f/	\$75	\$38	\$75	\$38	\$75
MAFF incremental fertilizer costs (\$'000/year) g/	\$554		\$277		\$139
Opportunity cost of incremental farm family labor (est. to be US\$1.50 per day)	\$263	\$263			\$174
Return on investment in irrigation infrastructure (10%) (\$'000)	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
<b>Total MAF, MCIE and Government costs (\$'000)</b>	<b>\$2,154</b>	<b>\$1,563</b>	<b>\$1,615</b>	<b>\$1,300</b>	<b>\$1,650</b>
<b>TOTAL COST (\$/INCREMENTAL MT STAPLE FOOD) h/ i/</b>	<b>\$437</b>	<b>\$641</b>	<b>\$839</b>	<b>\$1,576</b>	<b>\$1,000</b>
<b>Simple Benefit/Cost Ratio - STATIC MODEL</b>	<b>1.51</b>	<b>1.03</b>	<b>0.79</b>	<b>0.42</b>	<b>0.66</b>

a/ Two key MAFF (yield) and MCIE (cropping intensity) assumptions hold - THEORETICAL MAXIMUM

b/ MAFF incremental yield assumptions fails; MCIE assumption (= cropping intensity) holds.

c/ MAFF incremental yield assumptions holds; MCIE assumption (= cropping intensity) fails.

d/ MAFF incremental yield and MCIE increased cropping intensity assumptions both fail.

e/ Current situation with most rehabilitated irrigation schemes - CURRENT SITUATION - assuming some improvement in crop productivity

f/ Assumes 50% of MAFF's SEO cost for Models 2 and 4.

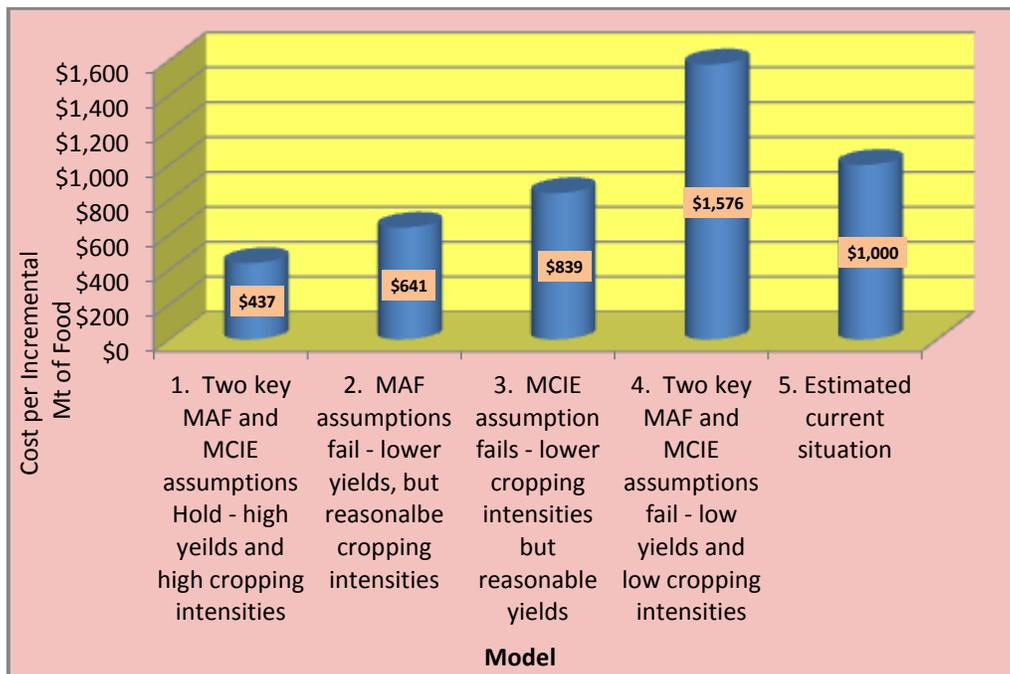
g/ Assumes that fertilizer is used in proportion to cropping intensity

h/ Excludes depreciation of irrigation infrastructure.

i/ Excludes costs (direct and indirect) of MCIE buying, storing and redistributing "surplus" staple food.

Source: "Final Appraisal Report – Appraisal of Seven Irrigation Schemes", October 2012, MPS; updated by the PERI team including the addition of BCRs.

**FIGURE 29: COST OF GROWING IRRIGATED RICE USING CROSS-RIVER DIVERSION WEIRS – CURRENT SYSTEM IN TIMOR-LESTE**



Source: Summarized irrigation models – see table 13.

### 3.7 FINANCIAL RETURNS TO FARMERS FROM GROWING RICE

As the model described above demonstrates, current investments in WBRD irrigation systems are not economically viable due to the high costs involved. Similarly, without the provision of the necessary support, there are limited financial incentives for farmers to grow rice, given the low prices they receive for their crops and potential alternative sources of income available to them. Table 13 details the gross margins and returns to family labor for paddy production on a one hectare plot of land for two scenarios, one involving subsidized inputs and the other involving non-subsidized inputs. The main subsidized production inputs are free seed, fertilizer and some chemicals, which are distributed by MAFF.<sup>69</sup> The “without project” model is for the pre-irrigation rehabilitation situation and the “with project” model is for the post-rehabilitation situation, which assumes that both software packages are available to support the hardware package.

<sup>69</sup> Note: MAFF currently supplies significantly less seed and fertilizer than the national demand – because the Ministry’s annual budget for these items is only about \$3.0 million, whereas if the total demand was met for (say) 50,000 ha of paddy, the budget for these subsidized items would need to be \$15.0 million.

**TABLE 13: FINANCIAL RETURNS TO FARMERS FROM GROWING IRRIGATED RICE**

Item	Unit	Unit price (\$)	Without Project		With Project	
			Financial	Quantity	Amount (\$)	Quantity
Unit income	Kg	\$0.36	2,620	\$943	4,450	\$1,602
Total farm inputs		Financial--> Subsidy		<b>\$390</b>		<b>\$667</b>
Net benefit per ha				<b>\$553</b>		<b>\$935</b>
Inc. benefit per ha						<b>\$382</b>
		<b>\$/ labour day (subsidized)--&gt;</b>		<b>\$5.53</b>		<b>\$9.35</b>
		<b>\$/ labour day (unsubsidized)--&gt;</b>		<b>\$5.53</b>		<b>\$6.21</b>

a/ After allowances for retained seed and harvest and storage losses.

Source: Derived from crop production models prepared for MPS – see “Final Appraisal Report – Appraisal of Seven Irrigation Schemes”, October 2012, MPS. Note: these models have been changed slightly since 2012.

The financial models described in Table 13 demonstrate that Timor-Leste’s rice farmers are not responding to increased supplies of water from the rehabilitation of irrigation schemes because there are limited financial incentives to do so. The gross margins and returns on family labor from growing paddy rice in Timor-Leste are about: (i) US\$5.50 per day “without project”, irrespective of the level of subsidy; (ii) US\$9.30 per day “with project” and 100 percent subsidy;<sup>70</sup> and (iii) US\$6.21 per day “with project” and zero subsidy. However, realistically, due to budget limitations, the MAFF is only able to fund a very small percentage of crop production inputs, so US\$6.2 is the most likely financial return to family labor. Given the risks and uncertainties associated with WRD systems, it is reasonable to conclude that expected incomes will be lower. A financial margin of US\$1.21 per day over traditional labor-based works daily wage, may therefore not be sufficient to entice rice farmers to maximize production. Farmers are better off if they seek off-farm employment, as the minimum daily wage for informal employment on labor-based construction projects is around US\$5.00. The national minimum wage is US\$115 per month paid for 13 months each year, or roughly US\$4 per day on a 365 day basis. Similarly, many families are eligible for, or able to access, various types of pensions. These sources of income enable farmers to purchase cheap imported rice.<sup>71</sup>

Another financial scenario worthy of consideration is one based on “with project” financial returns to rice farmers if the Government’s paddy support prices were increased to US\$500 per metric ton (equivalent to US\$0.91 per kilogram for grain) and if production subsidies withdrawn.

<sup>70</sup> Note footnote 86 – very few farmers actually receive full subsidies.

<sup>71</sup> Background paper.

Under this feasible scenario, returns to family labor would increase to approximately US\$13.00 per day, which is more than double the value of a day's labor in non-agricultural pursuits.

In other words, a combination of Government investment in irrigation hardware and software *and* market and price support for farmers might be a logical combination of strategies, comparing favorably with the cost of importing rice on a continuous basis. This option warrants further analysis and investigation, as it may be a means of identifying a middle-way solution to the current dilemma of negative returns from investment in irrigation infrastructure. The following section explores this option in greater detail.

### **3.8 IRRIGATION ECONOMICS: ALTERNATIVE STRATEGIES**

There are alternative, but not necessarily mutually exclusive, irrigation strategies that could be implemented to generate complementarity between investment in irrigation infrastructure (hardware) and the missing software, thereby reducing the cost of growing irrigated rice in Timor-Leste. These include:

1. ***A “concentrated rice bowl” approach which maximizes rice production on existing functional irrigated areas:*** This could be a viable alternative to the current wide-geographic approach of rehabilitating irrigation schemes across the country, an approach which generates low yields and cropping intensities because of a lack of software. This rice bowl approach is described through Model 1 (see figure 29 and 30, and table 12), which shows that it is theoretically possible to grow rice in Timor-Leste at an economic cost of approximately US\$437 per metric ton. This price is very competitive with the current farm-gate rice import parity price of approximately US\$660 per metric ton (farm-gate economic price), provided that the sector receives the budget for the necessary hardware and software and the resources it requires to achieve high yields and cropping intensities. However, this approach to rice production needs to be cognizant of the fact that Timor-Leste may not need to grow any rice in excess of the quantity required for self-sufficiency. Once the substitution of rice imports has been achieved, it is assumed that Timor-Leste will not competitively export rice surpluses. This rice ceiling approach implies that there is a maximum area of irrigation required. In other words, if Timor-Leste adopted a rice bowl approach, it would only be necessary to provide irrigation for approximately 76,000 hectares of land for the country to achieve self-sufficiency in rice production. By contrast, the current plan is to develop about 85,000 hectares of irrigated land.
2. ***Supply supplementary irrigation water to farmers by using TWSPs that access aquifers that underlie paddy land:*** The SDP proposes to conduct the necessary drill-tests to determine the viability of aquifers (including location, re-charge rates, etc.). This irrigation strategy is used widely throughout Africa, the Indian subcontinent and Cambodia and is generally considerably cheaper in terms of capital investment costs per irrigated hectare – at about US\$2,000 per hectare compared with about US\$10,000 per hectare for irrigation based on cross-river weir-based irrigation systems. The data presented in Table 14 and Figure 30 show that if this irrigation strategy were implemented in Timor-Leste *as a supplementary strategy to investment in WBRD irrigation systems and in conjunction with*

*the provision of the two previously-described software packages*, the economic cost of growing rice would be about US\$690 per metric ton. At the same time, the BCR would increase from 0.66 for WBRD systems to 0.95 for what might be termed a “hybrid” irrigation system, involving a combination of WBRDs and TWSPs, with complementary software. This represents a substantial reduction in the cost of rice production, compared with the equivalent cost of production for the WBRD irrigation systems on a stand-alone basis. As noted, the availability of aquifer water would have to be tested before commencing the implementation of this hybrid irrigation strategy on a large scale, but preliminary studies suggest that Timor-Leste does in fact have substantial reserves of under-ground water.

**TABLE 14: COST OF GROWING IRRIGATED RICE USING TUBE-WELLS AND SMALL PUMPS TO SUPPLEMENT WEIR-BASED IRRIGATION SYSTEMS, PLUS PROVISION OF “SOFTWARE PACKAGES”**

<b>1,000 ha Irrigation Scheme - WBRD + TWSPs + Software - STATIC MODEL</b>	<b>Model 1 a/</b>	<b>Model 2 b/</b>	<b>Model 3 c/</b>
<b>2013 Construction costs; including tube-wells and small pumps</b>	<b>\$12,000,000</b>	<b>\$12,000,000</b>	<b>\$12,000,000</b>
Km of road required	5	5	5
MAFF Suco Extension Officer cost (\$25,000/SOE)	\$75,000	\$75,000	\$75,000
Total area of paddy land (ha)	1,000	1,000	1,000
Current % use paddy land (season 1) (WOP)	50	50	50
Current % use paddy land (season 2) (WOP)			
Number of households	1,000	1,000	1,000
Number of people	6,000	6,000	6,000
Irrigation % (1st season) (WP)	100	100	100
Irrigation % (2nd season) (WP)	<b>75</b>	20	<b>66</b>
Irrigation % (3rd season) (WP)	<b>50</b>		
WOP maize yield (Kg/ha)	<b>1,500</b>	1,500	1,500
WP maize yield (Kg/ha)	<b>3,000</b>	1,875	<b>2,500</b>
WOP rice yield (Kg P/ha)	<b>3,000</b>	3,000	3,000
WP rice yield (Kg P/ha)	<b>5,000</b>	3,750	<b>4,500</b>
WP legume yield (Kg/ha)	750		750
Base EIRR (%): two key assumptions hold	5	Negative	2
EIRR (%): construction costs + 10% (2 assumptions hold)	4	Negative	1
EIRR (%): construction costs - 10% (2 assumptions hold)	6	Negative	3
<b>1,000 ha Irrigation Scheme - WBRD + TWSPs + Software - STATIC MODEL</b>	<b>Model 1 a/</b>	<b>Model 2 b/</b>	<b>Model 3 c/</b>
2013 Construction costs	\$12,000,000	\$12,000,000	\$12,000,000

Without Project food production (Mt)	825	825	825
With Project food production (Mt) - situations vary	5,750	2,475	4109
Incremental staple food production (Mt)	4,925	1,650	3,284
Demand for staple food (Mt) based on 250 kg/pp/yr.	1,500	1,500	1,500
Staple food balance in village (Mt) (surplus/ deficit)	3,425	150	1,784
<b>Incremental benefits = Incremental Mt food @ US\$660/Mt</b>	<b>\$3,251</b>	<b>\$1,089</b>	<b>\$2,167</b>
<b>Irrigation Investment costs/inc. Mt staple food production, (\$/Mt)</b>	<b>\$2,437</b>	<b>\$7,273</b>	<b>\$3,654</b>
<b>Government costs, including return on investment</b>			
MAFF incremental irrigation infrastructure maintenance (\$'000/year)	\$263	\$263	\$263
MAFF & farmer TWSPs irrigation operation costs (\$'000/year) - 20% of investment cost	\$400	\$400	\$400
MAFF incremental agriculture extension costs (\$'000/year) d/	\$75	\$47	\$75
MAFF incremental fertilizer costs (\$'000/year) e/	\$554		\$163
Opportunity cost of incremental farm family labor (est. to be US\$1.50 per day)	\$263		\$174
Return on investment in irrigation infrastructure (10%) (\$'000)	\$1,200	\$1,200	\$1,200
<b>Total MAF, MCIE and Government costs (\$'000)</b>	<b>\$2,754</b>	<b>\$1,910</b>	<b>\$2,275</b>
<b>TOTAL COST (\$/INCREMENTAL MT STAPLE FOOD) f/ g/</b>	<b>\$559</b>	<b>\$1,157</b>	<b>\$693</b>
<b>Simple Benefit/Cost Ratio - STATIC MODEL</b>	<b>1.18</b>	<b>0.57</b>	<b>0.95</b>

a/ Two MAFF (yield) and MCIE (cropping intensity) assumptions hold - THEORETICAL MAXIMUM. Costs are higher than for WBRD only.

b/ Yield and cropping intensity assumptions fail - CURRENT SITUATION. Costs are higher than for WBRD only.

c/ Most likely outcome (increased yields and cropping intensity) from use of TWSPs - MOST LIKELY OUTCOME

d/ Assumes 50 percent of MAFF's SEO cost for Model 2.

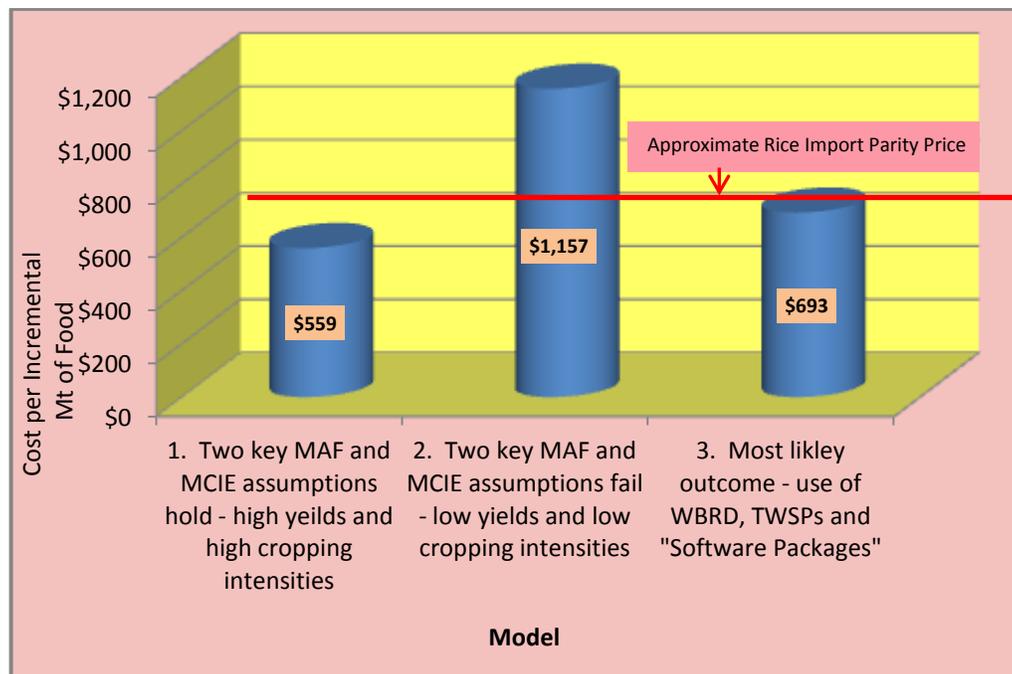
e/ Assumes that fertilizer is used in proportion to cropping intensity.

f/ Excludes depreciation of irrigation infrastructure.

g/ Excludes costs (direct and indirect) of MCIE buying, storing and redistributing "surplus" staple food.

Source: "Final Appraisal Report – Appraisal of Seven Irrigation Schemes", October 2012, MPS; updated by the PERI team including the addition of BCRs.

**FIGURE 30: COST OF GROWING IRRIGATED RICE USING TUBE-WELLS AND SMALL PUMPS TO SUPPLEMENT WEIR-BASED IRRIGATION SYSTEMS, PLUS PROVISION OF SOFTWARE PACKAGES**



Source: summarized irrigation models – see Table 14.

In order to gain a better understanding of possible outcomes from this hybrid irrigation strategy, this note includes the calculation of the BCR of the *incremental benefits* generated from supplementary investment in tube-well irrigation and in the two software packages. The results, which are summarized in Table 15, show a high rate of return (BCR ratio of 1.50 at a 10 percent discount) from investments in items which add value to what might be considered as sun costs (investments in hardware only).

Another way of describing this scenario is as follows. Investment in TWSPs and two software packages as part of an overall hybrid irrigation strategy that includes the infrastructure hardware package would generate reasonable returns and in effect recover some of the sunk investments in the hardware. Combining these two approaches to irrigation through the development of a new hybrid strategy might be the solution to the current dilemma, which can be expressed as follows: *“How can reasonable returns to investment in the rehabilitation of irrigation infrastructure be generated”?*

1. The main reason why this question needs to be answered is summarized in Table 16, which compares the economic costs of importing and growing rice. The key conclusion from the comparison of the economic cost of growing irrigated rice in Timor-Leste using either a stand-alone WBRD approach or the hybrid approach described above (WBRD plus TWSPs strategy with “software packages”), is that if Timor-Leste requires an

average of 80,000 metric tons of imported rice per year to meet domestic demand, it would cost US\$27.2 million per year more if WBRD irrigation is used on a stand-alone basis than if a comparable volume of rice was imported.

If the hybrid strategy approach were adopted, the additional cost would only be US\$2.61 million. Therefore use of the hybrid strategy could result in annual savings of approximately US\$24.59 million, if all imports, amounting to a total of 80,000 metric tons per year, were replaced by domestically grown rice, produced using the hybrid strategy. In addition, based on the models presented in Table 15, the BCR from investing in irrigation infrastructure would improve from a low 0.24 to a reasonable 0.73 (at 10 percent) under this scenario, and the returns from incremental investment in TWSPs + “software packages” would be high, with a BCR of 1.50. Figure 31, a bar chart based on Table 15, illustrates how these figures relate to one another.<sup>72</sup> In other words, building on the sunk costs of WBRD, an investment of roughly US\$12.3 million in complementary TWSPs and software can release benefits of US\$18.4 million, implying a BCR of 1.5 for this complementary investment.

---

<sup>72</sup> Note that the models in Table 15 are not quite the same as those in Table 12 and Table 14, because the latter are static and former are time-phased.

**TABLE 15: RETURNS FROM INVESTING IN “HARDWARE” AND “SOFTWARE, SUPPLEMENTED WITH TUBE-WELLS AND SMALL PUMPS**

Year ----->	1	2	3	4	5	10	15	20
<b>WBRD Model only (1,000 ha) a/</b>	(\$'000)							
<b>Total Costs (WBRD System)</b>	<b>\$10,547</b>	<b>\$1,297</b>	<b>\$1,297</b>	<b>\$1,297</b>	<b>\$1,297</b>	<b>\$1,297</b>	<b>\$1,297</b>	<b>\$1,297</b>
Inc. rice production with WBRD (Mt)	825	825	825	825	825	825	825	825
Inc. economic value of rice production (\$'000)	\$545	\$545	\$545	\$545	\$545	\$545	\$545	\$545
<b>WBRD Model (1,000 ha) plus TWSP plus two Software Packages</b>								
<b>Total Costs (WBRD System + TWSPs)</b>	<b>\$13,648</b>	<b>\$2,548</b>	<b>\$2,548</b>	<b>\$2,548</b>	<b>\$2,548</b>	<b>\$2,548</b>	<b>\$2,548</b>	<b>\$2,548</b>
Inc. rice production with WBRD + TWSPs (Mt)	4,109	4,109	4,109	4,109	4,109	4,109	4,109	4,109
Inc. economic value of rice production (\$'000)	\$2,712	\$2,712	\$2,712	\$2,712	\$2,712	\$2,712	\$2,712	\$2,712
<b>BCR WBRD System Only</b>	<b>0.24</b>							
<b>BCR WBRD + TWSPs + Software</b>	<b>0.73</b>							
<b>NPV Incremental Costs</b>	<b>\$12,332</b>							
<b>NPV Incremental Benefits</b>	<b>\$18,453</b>	<b>BCR--&gt;</b>	<b>1.50</b>					

Source: prepared by PERI Irrigation Team using data and information collected from MAFF and the MPS appraisal work; revised by PERI team.

**TABLE 16: SUMMARY OF ECONOMIC COST OF GROWING RICE (TWO SYSTEMS) COMPARED WITH RICE IMPORTATION**

Economic Costs of Rice - Import or Grow	WBRD Alone					WBRD + TWSPs + Software		
	Model 1 a/ b/	Model 2 c/	Model 3 d/	Model 4 e/	Current Sit'n f/	Model 1 g/	Model 2 h/	Model 3 i/
Estimated rice imports (Mt) i/	80,000	80,000	80,000	<b>80,000</b>	<b>80,000</b>	80,000	80,000	<b>80,000</b>
Economic cost of rice imports (\$/Mt) j/	\$660	\$660	\$660	<b>\$660</b>	<b>\$660</b>	\$660	\$660	<b>\$660</b>
Economic cost of rice imports (\$ millions)	\$52.80	\$52.80	\$52.80	<b>\$52.80</b>	<b>\$52.80</b>	\$52.80	\$52.80	<b>\$52.80</b>
Estimated domestic rice production to meet demand (Mt) k/	80,000	80,000	80,000	<b>80,000</b>	<b>80,000</b>	80,000	80,000	<b>80,000</b>
Economic cost of domestic rice production (\$/Mt) l/	\$437	\$641	\$839	<b>\$1,576</b>	<b>\$1,000</b>	\$559	\$1,157	<b>\$693</b>
Annual rice production cost for each model (\$ millions)	\$34.99	\$51.27	\$67.10	<b>\$126.06</b>	<b>\$80.00</b>	\$44.74	\$92.58	<b>\$55.41</b>
<b>Differential - growing cost less import cost (\$ millions)</b>	<b>-\$17.81</b>	<b>-\$1.53</b>	<b>\$14.30</b>	<b>\$73.26</b>	<b>\$27.20</b>	<b>-\$8.06</b>	<b>\$39.78</b>	<b>\$2.61</b>
<b>Annual "savings" by growing rice with WBRD + TWSPs and all "software" (\$'million)</b>								<b>\$24.59</b>
<b>Benefit Cost Ratios (at 10%)</b>	<b>1.51</b>	<b>1.03</b>	<b>0.79</b>	<b>0.42</b>	<b>0.66</b>	<b>1.18</b>	<b>0.57</b>	<b>0.95</b>

a/ Assumes increased budget for MAFF and MCIE so these ministries can fulfil their mandates - THEORETICAL MAXIMUM

b/ Assumes increased budget for MAFF is not provided, and that MCIE does receive additional budget.

c/ Assumes increased budget for MAFF is provided, and that MCIE does not receive additional budget.

d/ Assumes that neither MAFF or MCIE receive additional budget and cannot fulfil their mandates

e/ Estimated CURRENT SITUATION

f/ Two key MAFF (yield) and MCIE (cropping intensity) assumptions hold - unrealistic

g/ Yield and cropping intensity assumptions fail

h/ Increased yields and cropping intensity from use of TWSPs and two "Software Packages"- MOST LIKELY OUTCOME

i/ Imports required to balance calculated rice supply and demand - on average per year.

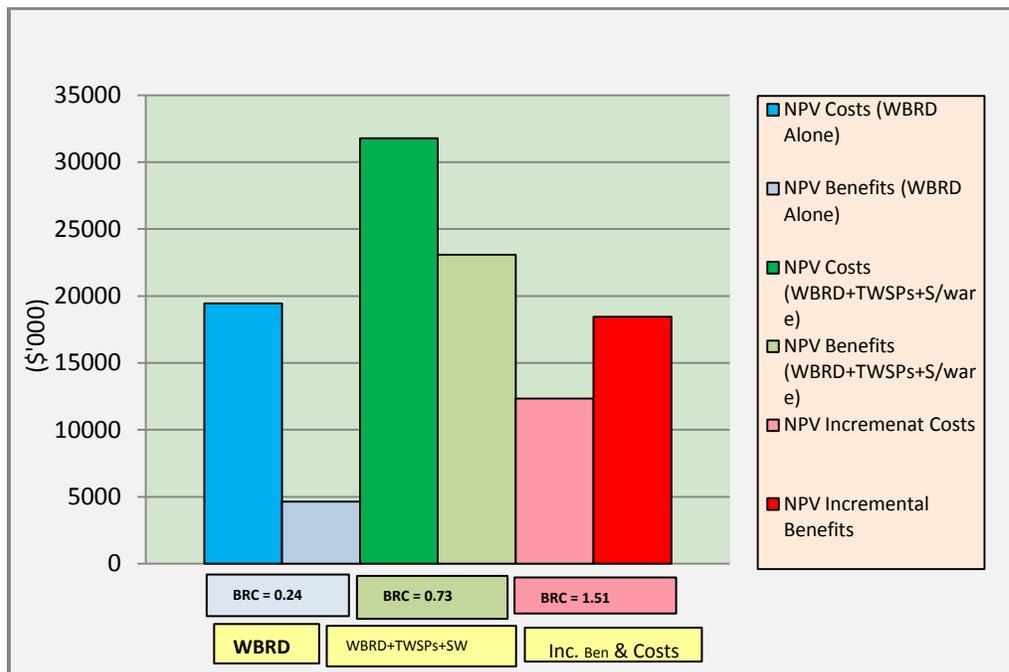
j/ US\$660/Mt, farm-gate import parity price.

k/ To balance supply and demand.

l/ From WBRD; and WBRD + TWSPs + Software models

Source: Derived from Table 14.

**FIGURE 31: BAR CHART OF MARGINAL COSTS AND BENEFITS FOR DIFFERENT IRRIGATION SYSTEMS (1000 HA IRRIGATION SCHEMES)**



Source: prepared by the PERI team

### 3.8.1 Irrigation Operations and Maintenance Budgets

The MAFF’s current and planned irrigation operations and maintenance budgets are much smaller than those actually needed to maintain the estimated asset stock (see Figure 32). Note that the MAFF defines operational costs as the costs required to enable farmers to grow irrigated crops - essentially, the cost of MAF-supplied free seed, fertilizer, chemicals, fuel, and other inputs, while maintenance costs are defined as the costs required to keep the irrigation hardware functional and operational.

Assuming an annual asset maintenance cost equivalent to 2.5 percent of cumulated capital cost, the MAFF’s annual irrigation maintenance budget alone will need to increase to a value of approximately US\$16.6 million by 2020, up from US\$2.0 million in 2013. Similarly, the MAFF will require an operations budget of about US\$21.2 million by 2020 (see Table 17), based on a cost of US\$500 per hectare of irrigated land.

However, MAFF’s total budget in 2013 was only US\$24.2 million, a sum which is estimated to increase to US\$28.3 million by 2018. If MAFF’s irrigation plans are implemented according to the schedules described in Table 17 and Figure 32, the annual requirement for irrigation operations and maintenance funds will reach approximately US\$36.8 million by 2020, more than

the MAFF's total annual budget in 2013. These numbers, and the data set out in Table 17 and Figure 32, show the limitations the MAFF's current overall budget poses.

It is informative to compare the above irrigation maintenance budget (\$16.6 million by 2020) with the budgets available from all National Directorates with irrigation mandates. The MAFF's 2013 budget for these Directorates is about US\$8.0 million (see Table 18). Furthermore, the budget for the Directorate of Irrigation and Water Management (see Table 18) is just over US\$1.0 million, consisting of US\$0.15 million for salaries and wages, and US\$0.88 million for the procurement of goods and services. Therefore, even if the goods and services budget is doubled to allow for the fact that some maintenance budget is allocated through the PDD programs for sub-national infrastructure, the total annual irrigation maintenance budget in 2013 was only about US\$1.75 million, compared with a required budget of about US\$2.0 million. The scenario in Table 17 depicts a steadily worsening situation, with the required budgets for annual irrigation maintenance requirements to US\$16.6 million by 2020.

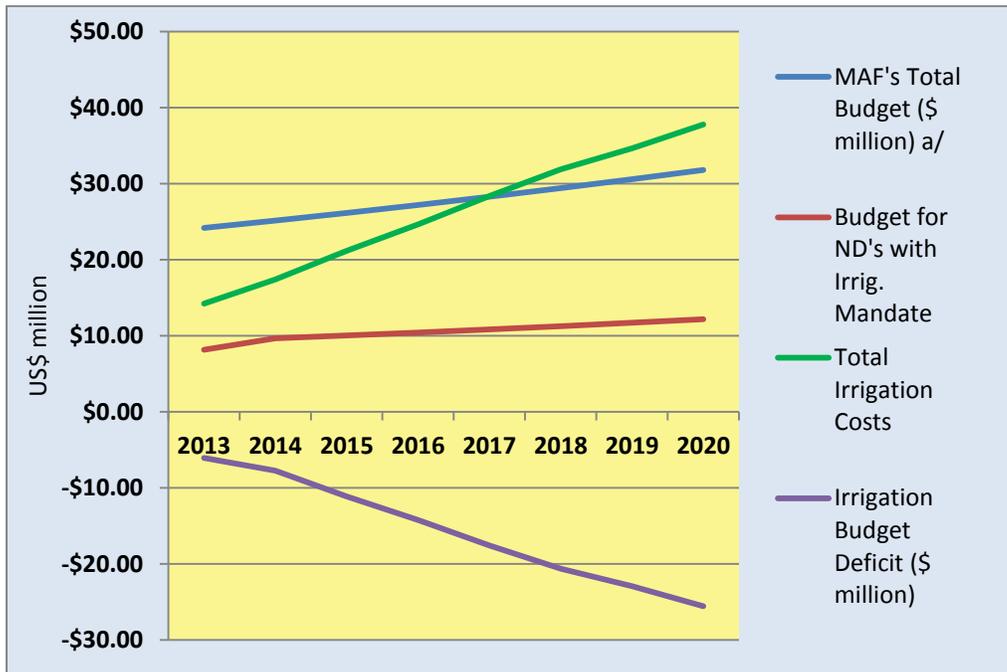
**TABLE 17: MAFF'S TOTAL AND IRRIGATION BUDGETS, IRRIGATION BUDGET REQUIREMENTS, AND IRRIGATION BUDGET DEFICITS**

	2013	2014	2015	2016	2017	2018	2019	2020
	(\$ millions)							
<b>MAFF's Total Budget (\$ million) a/</b>	<b>24.18</b>	<b>25.14</b>	<b>26.15</b>	<b>27.20</b>	<b>28.28</b>	<b>29.41</b>	<b>30.59</b>	<b>31.81</b>
Budget - ND Technical Agric. Training b/	0.86	0.90	0.94	0.97	1.01	1.05	1.09	1.14
Budget - ND Agric. % Horticulture	6.22	6.47	6.72	7.00	7.27	7.56	7.86	8.18
Budget - ND Irrig. Water Management	1.03	1.07	1.11	1.15	1.20	1.25	1.30	1.35
Budget - ND Agric. & Community Devel.	0.06	1.21	1.26	1.31	1.36	1.41	1.47	1.53
<b>Budget for ND's with Irrig. Mandate</b>	<b>8.17</b>	<b>9.65</b>	<b>10.03</b>	<b>10.43</b>	<b>10.84</b>	<b>11.27</b>	<b>11.72</b>	<b>12.19</b>
Annual Irrigation Maintenance Costs c/	2.03	3.95	6.24	7.59	10.21	12.71	14.46	16.59
Annual Irrigation Operations Costs c/	12.20	13.45	14.94	17.05	18.18	19.18	20.18	21.18
<b>Total Irrigation Costs</b>	<b>14.23</b>	<b>17.40</b>	<b>21.18</b>	<b>24.64</b>	<b>28.39</b>	<b>31.89</b>	<b>34.64</b>	<b>37.76</b>
<b>Irrigation Budget Deficit (\$ million)</b>	<b>-6.06</b>	<b>-7.75</b>	<b>-11.15</b>	<b>-14.21</b>	<b>-17.55</b>	<b>-20.62</b>	<b>-22.92</b>	<b>-25.57</b>

a/ Inflated by 4.0% p.a. from 2017.

Source: extracted from MoF's Annual Budget Papers.

**FIGURE 32: MAFF'S TOTAL AND IRRIGATION BUDGETS, IRRIGATION BUDGET REQUIREMENTS, AND IRRIGATION BUDGET DEFICITS**



Source: based on Table 17.

Discussions with the MAFF during the preparation of this report, in conjunction with discussions related to the preparation of the 2014 budget, have led to some review of policy. The approved 2014 budget of the National Directorate of Irrigation and Water management was US\$4.0 million, four times the 2013 figure, largely due to a provision for capital and development to cover the cost of studies valued at below US\$1.0 million for new irrigation schemes.

**TABLE 18: MAFF’S ANNUAL BUDGET FOR DIRECTORATE OF IRRIGATION AND WATER MANAGEMENT**

Budget Item	2009 a/ b/	2010 b/	2011	2012	2013	2014 c/	2015 c/
Salaries and wages	\$102	\$113	\$137	\$148	\$150	\$156	\$162
Goods and services	\$759	\$924	\$394	\$316	\$875	\$910	\$946
Minor capital	\$300	\$23	\$11				
Capital and development	\$4,257	\$2,664					
<b>Total</b>	<b>\$5,418</b>	<b>\$3,724</b>	<b>\$542</b>	<b>\$464</b>	<b>\$1,025</b>	<b>\$1,066</b>	<b>\$1,108</b>

a/ US\$’000

b/ Before MPS and CAFI took over the Infrastructure Fund.

c/ Forward estimates only.

Source: MAFF and MoF Annual Budget Books.

### **3.9 PROJECT CYCLE PROCEDURES AND COMPLIANCE WITH GOVERNMENT SYSTEMS**

#### ***3.9.1 IDENTIFICATION AND SELECTION PROCESS: CONCEPT STAGE***

The selection processes used to identify and prioritize irrigation projects has varied over time, deteriorating as the investment ramp up coincided with the creation of the Infrastructure Fund and related investment management institutions. While the early irrigation project selection process was not formalized or recorded, it did involve target communities and local MAFF staff with knowledge of schemes, and was therefore logical and to some extent free of political influences. However, the one tool which seems not to have been used or heeded during the project identification and concept and feasibility phases was the application of economic appraisal to aid decision-making and ranking processes.<sup>73</sup> As shown in Table 7, early estimates of EIRRs, conducted in the 2000s, were negative for three weir-based irrigation schemes. Despite this, all three have now been rehabilitated. Similarly, post-construction appraisals of the Lacro, Maliana I and Bebu schemes confirmed very low EIRRs and BRCs. Also, the results of the pre-construction appraisal of the seven pipeline irrigation projects (see Table 11) were not heeded when deciding whether to proceed with the rehabilitation of these schemes.

The irrigation selection processes applied prior to and during the ARPs was acceptable for the smaller, community-based schemes. However, once larger schemes were identified and designed in 2008 and 2009, the need for hasty, and sometimes politically motivated, decisions in order to list schemes with the MPS, and to prepare for presentation to the Council for Management of the Infrastructure Fund (CAFI), resulted in a loss of rigor. The selection process

<sup>73</sup> The exception was during the ARP’s when proposed irrigation schemes were subjected to sound Cost/Benefit analyses. However the finding of negative returns was not heeded and construction proceeded.

seems to have gradually worsened to the point where nine schemes with predicted negative EIRRs have been listed for construction in 2014 and onwards.

### ***3.9.2 DESIGN, PRE-CONSTRUCTION APPRAISAL AND APPROVAL***

Generally, the design stage in the irrigation investment cycle has been sub-standard. The early ARP-funded schemes were designed by well-qualified engineers. However, the nine schemes which were designed by CWN were deficient in many areas. For instance, the same unit costs were used for all schemes and there were errors in the economic models, including overly optimistic assumptions for cropping intensity and crop yields.

Despite its mandate, MPS seems to have little influence in the selection of priority irrigation projects. To the agency's credit, it commissioned the appraisal of the nine schemes proposed for 2014 onwards. Following this appraisal, two of these schemes were approved, and the other seven remain in plans for construction in the future, despite all nine being assessed with negative economic rates of return. The MPS was unable to argue for their rejection on the grounds of the appraisal showing negative EIRRs, and virtually no MAFF budget for essential operations or maintenance. In summary, this stage of the project cycle has not been implemented to an acceptable standard. This stage of the project cycle should be reviewed, with all involved institutions accepting the need for changes and adhering to agreed upon irrigation investment selection criteria.

### ***3.9.3 TENDERING AND PROCUREMENT***

Prior to 2011, when the MAFF was responsible for the tendering of irrigation schemes of all values, acceptable international procurement procedures were implemented. However, since the Infrastructure Fund management system commenced in 2011 for projects to a value in excess of US\$1.0 million, weaknesses have emerged. For example, when the initial tenders for the Oebaba and Raibere Schemes were received, the bids were much higher than the Owners' Estimate. Therefore the contract was "split in half" under an agreement that the successful tenderer would commence work for less than the total bid price, and that the MAFF would apply to the Council of Ministers for additional funding over a period of two or more years.

### ***3.9.4 CONSTRUCTION, SUPERVISION AND CERTIFICATION OF WORKS***

The quality of construction supervision during the implementation of the ARPs was of a good standard. However, since then, there seems to have been a decline in the quality of construction, construction supervision and sign-off. Supervising engineers' reports on construction progress are mechanical and pro forma: they do not contain any critical analysis of construction quality and simply track physical progress against the contracted schedules. There are no mentions of penalties for poor quality work (some of which is inevitable) nor are penalties imposed for failure to adhere to contracted milestones.

### **3.9.5 POST-CONSTRUCTION EVALUATION**

In the area of project selection, there has been a significant failure to learn from past experiences. By the end of 2009, it was apparent that investment in the rehabilitation of large, ex-transmigration, irrigation schemes was uneconomic. However, this fact seems to have been ignored in the process of selecting new projects. Similarly, the negative outcomes from the post-project evaluations completed by MPS in 2012 for the Laclo, Bebui and Maliana I schemes also seem to have been ignored in the process of on-going irrigation planning in Timor-Leste. In addition, it seems that essential irrigation operations and maintenance budgets have not increased in phase with investment in the sector (see Figure 32).

### **3.10 IMPACT OF CURRENT GOVERNMENT POLICIES ON RATES OF RETURN ON INVESTMENT**

**Rice imports and the distribution of subsidized rice are having a severe and negative impact on the development of the irrigation sector in Timor-Leste.** Consumer and producer rice prices need to be de-coupled to maintain an incentive for domestic production. Other forms of support, such as food vouchers, could be used to protect the poor, rather than the distribution of subsidized rice.

**Data deficiencies mean it is difficult to equate rice demand, supply, production and imports.** The figures reported by the MAFF and Customs vary from source to source and there appears to be some occasional confusion between paddy and grain. This situation could lead to incorrect Government decisions on rice importation. Depending on the direction of the error, these incorrect decisions could penalize either consumers or producers. Furthermore, if rice production figures are not known with a reasonable degree of accuracy, it is difficult for the Government to identify logical investment strategies for the sector.

**Transfer payments in the form of social assistance and cash-for-work programs may also have a negative impact on Timor-Leste's irrigated rice sector.** In informal surveys, farmers reported using their own (or shared) transfer receipts to buy imported rice, rather than increasing domestic production. Figure 27 shows that the area of paddy planted each year declined in the period from 2005 to 2013 while at the same time, the cumulative investment in irrigation infrastructure increased to about US\$82 million (2013 prices). Similarly, Figure 28 shows that even though about US\$82 million has been invested in the development of the irrigation sector since 2005, the level of the annual rice deficit has not changed. Over the same period, the annual budget for social transfers grew from US\$6 million to US\$150 million. This, combined with the data presented in Figure 27 and Figure 28, suggests that rice imports and subsidization, together with other exogenous factors such as transfer payments, are having a negative effect on the production of staple foods in Timor-Leste. The 2014 Living Standards Survey will provide more information in this regard. However, at present there is little incentive for farmers to grow more than their subsistence requirements of rice when there are no markets for local surpluses.

In addition, MCIE is unable to fulfill its rice marketing mandate, with even remote rural areas having access to cheap imported and/or subsidized rice.

**All of the policy issues and constraints listed above are either impacting negatively on rates of return from investment in irrigation or are failing to have a beneficial impact.** This policy environment will need to be clarified and then stabilized if future investment in irrigation infrastructure is to generate EIRRs which are higher than the opportunity costs of capital, which is at least 10 percent for Timor-Leste's agricultural sector.

### **3.11 CONCLUSIONS AND RECOMMENDATIONS**

Based on the analysis presented in this chapter, the following conclusions and recommendations can be drawn:

1. Timor-Leste's current strategy for the development of the irrigation sector, which strongly emphasizes the rehabilitation of ex-transmigration irrigation schemes and the construction of new dams and schemes, has not generated acceptable returns to investments in the sector and is unlikely to do so in the future.
2. In Timor-Leste, from an economic cost perspective, it is much cheaper to import rice (at an average cost of US\$660 per metric ton) than to grow rice (\$1,000 per metric ton). There are few incentives for farmers to increase domestic production.
3. In Timor-Leste, at approximately US\$10,000 per hectare, the cost of building and/or refurbishing WBRD irrigation systems is very high by international standards.
4. The MAFF's current and planned budgets for the operations and maintenance of irrigation systems are much smaller than those required to maintain and operate the estimated asset stock
5. If sustainable and affordable progress is to be made towards achieving the objective defined by the SDP objective of self-sufficiency in staple food production, with a strong focus on the production of rice, then Timor-Leste's irrigation sector strategy should be revised.
6. An effective means of revising the irrigation sector strategy could involve the implementation of a hybrid strategy that builds on past investments in physical infrastructure, while at the same time generating high returns to marginal investment in tube-well irrigation and in farmer support services and market development programs.

Based on these conclusions, the recommended strategy for the development of the irrigation sector into the future should be based on the following steps:

1. The development, funding, implementation, and monitoring of the impact of improved software packages for selected existing WBRD systems;
2. The introduction and testing of TWSP irrigation systems in selected non-irrigated areas, with measures to monitor outcomes and impacts;
3. The introduction of TWSP systems into existing WBRD systems following testing and a positive determination regarding the TWSP system's technical, financial and economic viability, especially for dry season crop production; and
4. Following the development of rice markets and domestic rice price increases, together with increases in the level of production of non-rice crops, the introduction of an irrigation service fee, tested for welfare effects, to recover some of MAFF's irrigation operations and maintenance costs.

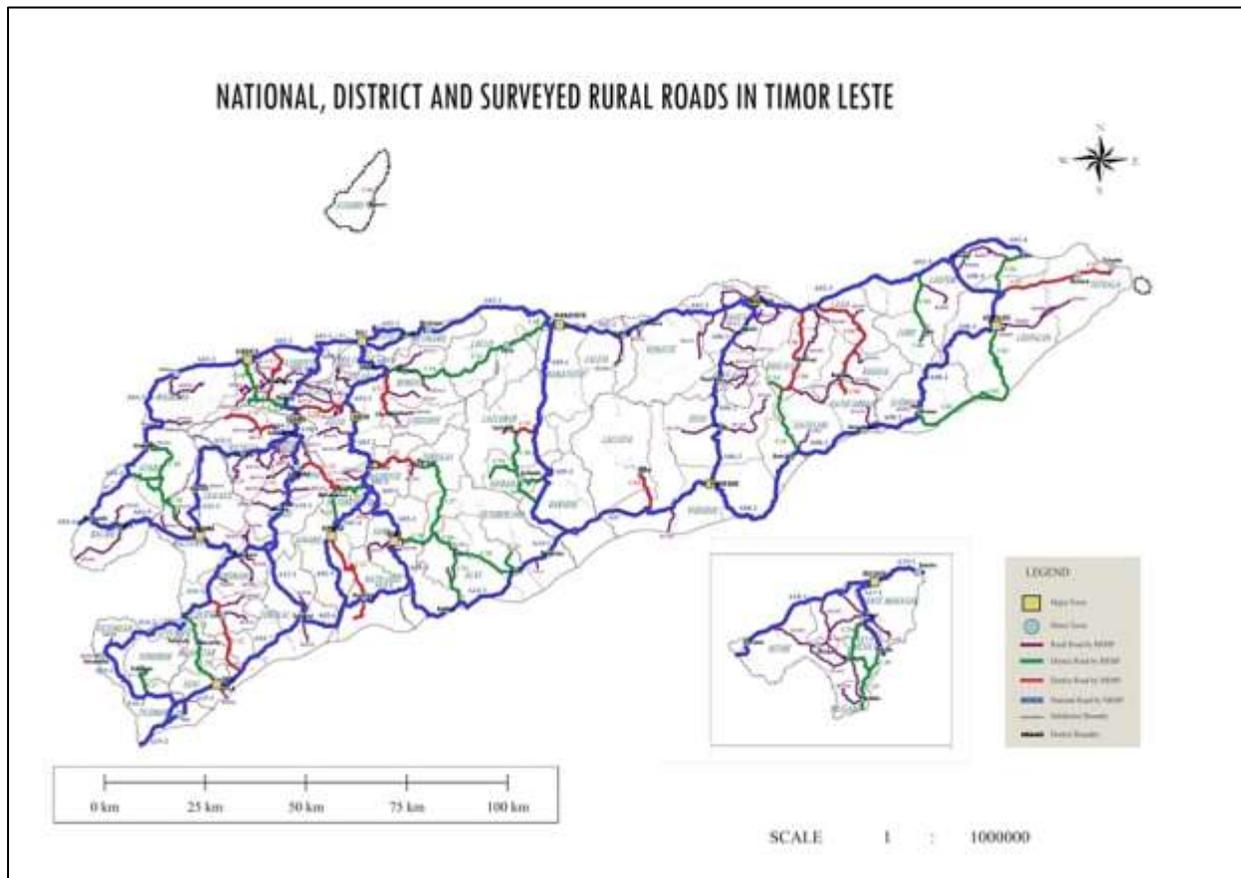
# CHAPTER 4

## ROADS

### 4.1 BACKGROUND

Since the last World Bank Public Expenditure Review (PER) in the roads sector, which was conducted in 2004, Timor-Leste has formulated a Strategic Development Plan (SDP) for utilizing its petroleum windfall as a basis for improving development outcomes for current and future generations. The previous review identified issues related to maintenance as a key challenge for the country's road sector. This challenge remains. Lack of effective road maintenance has led to a gradual but inexorable decline in the value of Timor-Leste's largest asset, its road system. In all countries, the road system is the most valuable non-resource related asset that the country owns and operates as a public good. The extent of the road network in Timor-Leste is illustrated in Figure 33, with a break down by administrative class provided in Table 19.

**FIGURE 33: TIMOR-LESTE NATIONAL ROAD NETWORK**



**TABLE 19: LENGTH OF ROADS BY ADMINISTRATIVE CATEGORY (KM)**

Regional Office	National	District	Urban	Rural	Total
Baucau	373	270	158	810	1,611
Dili	293	157	315	710	1,475
Same	246	205	97	655	1,203
Maliana	423	164	106	740	1,433
Oecussi	91	73	40	110	314
<b>Total</b>	<b>1,426</b>	<b>869</b>	<b>716</b>	<b>3,025</b>	<b>6,036</b>

## 4.2 SUMMARY

**Timor-Leste should define and plan a rational, multi-criteria justified road hierarchy to guide the development and rehabilitation of the country's road network.** A balance must be struck between road assets that are critical to the economic and social development of Timor-Leste and those that are not critical in these terms. Critically important roads should be upgraded, while those that are not critically important should be repaired and rehabilitated at a lower level of service. Road width should be based on the expected need, volume and composition of traffic. The rule should be maintain and rehabilitate first, and add new capacity second, in order to get the network back to a sustainable basic condition that matches the needs of the economy. The roads asset should be limited to a rate of the GDP to guarantee that the Government will be able to meet demand for infrastructure, and maintain the asset.

This would result in a hierarchy of roads, with a distinction drawn between roads that provide a high level of connectivity between major centers and others that are recognized as less important. To meet an appropriate level of need, the value of a country' road assets should be in the range of 20 to 40 percent of its Gross Domestic Product (GDP).<sup>74</sup> The ratio for Timor-Leste, if all roads were in good condition, is 109 percent. The fully restored road network would be larger than the economy would need, and maintenance would require significant financing from the petroleum fund and tradeoffs with other critical areas, such as the health and education sectors. Therefore, not all roads should be rebuilt to an unnecessarily high standard.

**Within this carefully justified road hierarchy, increased national commitment can improve the road network, as a means of unlocking the economic and social potential of the country.** International donors have committed or are planning to spend in excess of US\$500 million over the next five years to rebuild key national roads, with donor financing most likely coming in the form of loans. Combined with appropriate levels of well-targeted government spending identified in this chapter, overall improvements in road sector accessibility in Timor-Leste can be achieved. International experience, particularly in the USA, with the Interstate Highway System in the 1960s, and in China, with its entire road system in the period from 1990 to 2010, suggests that a sum equivalent to 6 to 7 percent of GDP can be sustainably spent on roads in a period until the road network and the economy are balanced. If

<sup>74</sup> For the purposes of this report, the term "GDP" refers to non-oil GDP.

that ratio were applied to the case of Timor-Leste, a total expenditure of US\$840 million could be justified for the maintenance, rehabilitation and reconstruction of all roads and bridges over the next five years.<sup>75</sup> Of that total, expenditure on the maintenance and rehabilitation of roads and bridges should constitute from between 60 to 70 percent of the total until the network becomes stable.

**To achieve optimal results, ongoing, continuous, well-planned maintenance and rehabilitation is the most important aspect to the development of Timor-Leste's road network<sup>76</sup>.** However, no consistent infrastructure maintenance concept is implemented in Timor-Leste, particularly for the road network. To be effective, consideration to maintenance must be given on a daily basis. Each year, a significant proportion of the maintenance budget is diverted to other uses, particularly for emergency works. It is very important to utilize the budgets for maintenance for their intended purpose and not to divert these funds to other spending. Longer term routine and periodic maintenance should be incorporated into road rehabilitation and construction contracts. The contractor that implements the rehabilitation or construction of roads could be further contracted to implement longer term routine and periodic maintenance work. The analysis conducted by the World Bank and the Asian Development Bank, as described in Section 4.4, suggests that according to a rational allocation of funds, funds to the value of US\$350 to US\$400 million are required just for the maintenance of roads over the next five years. If an additional 20 percent for bridge maintenance is added, the US\$480 million is about half of the planned International Financial Institution (IFI) and recommended Government funding illustrated in Figure 47.

**The planned expenditure on roads needs to be carefully evaluated, monitored and verified on an ongoing basis.** At present, other than for the work funded by the IFIs, the road planning and design process is not producing a well-packaged set of investment briefs as a basis for viability analysis. While priorities are developed on the basis of defined key criteria, interagency communication to ensure those projects are appropriately budgeted often breaks down. Without approved designs and quantities, competitive contracts cannot be bid and let. Ultimately, payments are made for single-source contracts for work which was not appropriately planned, designed, evaluated, monitored and vetted. Breakdowns in one or more of the approval steps results in the lumping spending into emergency works or hastily approved contracts and invoices. This has become the default approach and results in spending with little or no accountability for the works completed or for the quality of those works. Emergency spending has accounted for 65 percent (2010), 76 percent (2011), 83 percent (2012) and 100 percent (2013) of the total value of the National Directorate of Roads, Bridges and Flood Control (DRBFC) expenditure over the past four years.

**A more efficient system for the planning and delivery of road infrastructure is needed to overcome the limitations to human and system capacities.** The DRBFC currently lacks the appropriate resources to

---

<sup>75</sup> The SDP high growth scenario estimates approximately \$12 billion for total GDP between 2014 and 2019.

<sup>76</sup> The issue is how to get the network back to a sustainable basic condition that matches the needs of the economy and grows with the GDP. New works need to be carefully staged and only considered where the need is strategic until the network is back in good condition. The rule should be maintain and rehabilitate first and add new capacity second when a higher level of economic activity and growth demands it.

fulfill its mandate and needs to be strengthened. However, such strengthening is not likely to be achieved through hiring and training alone, particularly given staff cost constraints. However, it should be noted that the *number* of staff is not as important as the *quality* of staff. DRBFC currently has 222 staff managing roughly 1400 kilometers of national roads. By contrast, the South African National Road Agency Limited (SANRAL) manages 20,000 kilometers of national roads at a high standard with only 187 staff. To achieve the necessary outputs, DRBFC staff need to better manage the project development and delivery cycle. Many activities in that cycle should be outsourced, including data collection, the planning and prioritization of projects, the design of works, costing and bid specification, works contracting, contract supervision, contract management and performance monitoring. Where it is feasible, performance-based contracts need to be established on a multi-year, area-wide basis, particularly for routine and minor maintenance. Framework agreements can also be used to transform the current uncontrolled emergency works approach into a cost competitive, accountable and transparent structure.

**In order to achieve these efficiency improvements, a rethinking of how DRBFC selects and utilizes its human resources is needed.** Current staff should be provided with additional training to enable them to define, procure and manage the use of outside resources efficiently and effectively. This cuts across all steps in the project delivery cycle. Existing and new staff should understand that the DRBFC is a road *management* agency, not a road *execution* agency. The project steps, from planning and design to performance monitoring and handover, should be implemented under contract. Many road management agencies around the world follow this model, so Timor-Leste could learn from international experience. Senior staff of the DRBFC could participate in international training and study tours to determine how their own organization could be structured to achieve maximum levels of efficiency and effectiveness.

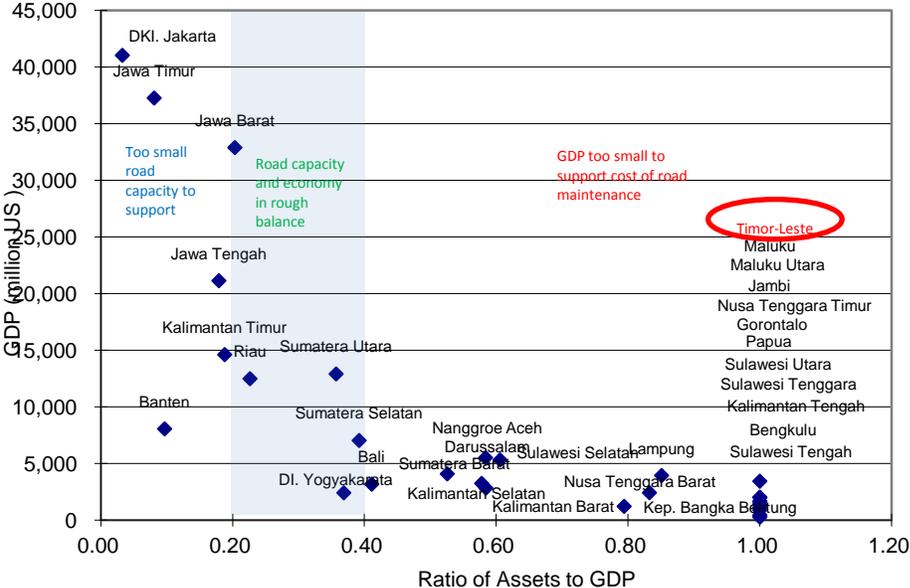
**The creation of a clear separation between road system governance and management on the one hand and the execution of specific projects on the other requires a capable, active private sector.** Over the past few years, the private sector in Timor-Leste has expanded its capacity with the acquisition of new equipment and the implementation of improved management. Joint ventures between smaller companies have been established to enable these companies to participate in larger projects. International contractors are now working on major projects, such as the Comoro Bridge. Joint ventures are being established between local and international firms. These are positive developments towards greater capacity and competition, and should be encouraged. An increase in the proportion of planning, engineering, accounting and monitoring work contracted out by DRBFC will stimulate increases in investment, growth and ultimately the level of competitiveness in the private sector. This should also be encouraged.

### **4.3 THE CURRENT AND PROJECTED ROAD ASSETS BASE**

**If Timor-Leste's road network is rehabilitated to a maintainable standard, then the country will have a more extensive road network than the current size of the economy warrants and can support.** At Independence, Timor-Leste inherited an asset with a value far larger than the annual GDP, and this ratio

has remained high, despite rapid non-oil GDP growth. The data depicted Figure 34<sup>77</sup> show the road asset stock<sup>78</sup> to non-oil GDP ratio for each province in Indonesia in 2008 and Timor-Leste in 2011. The ratio that balances assets to need is considered to be between 20 percent and 40 percent of GDP, as shown in the shaded area. The ratio for Timor-Leste is 1.09, meaning that the value of its roads assets is slightly higher than its annual non-oil GDP (2011), if the roads were all in good condition. Such a high ratio is not unusual in developing countries. However, in order to sustain that asset base, a larger share of the national budget would need to be allocated for road maintenance than would be justified if the economic return was the only investment criteria.

**FIGURE 34: ROAD ASSETS TO GDP RATIO - INDOONESIAN PROVINCES AND TIMOR-LESTE (TRUNCATED X-AXIS)**



In the medium term, until 2024, on current growth projections in the SDP, Timor-Leste should focus on the rehabilitation of its existing road network, expanding network capacity only in cases where such an expansion is appraised to be economically viable.<sup>79</sup> Approximately 70 percent of the network depicted above is in poor condition. If all roads in Timor-Leste were in 'good' or 'fair condition', it would have a sufficiently extensive road network system to keep the economy moving forward smoothly for a number of years. There is a strong justification for repairing and, where necessary, rehabilitating or

<sup>77</sup> Horizontal axis truncated at 1.0

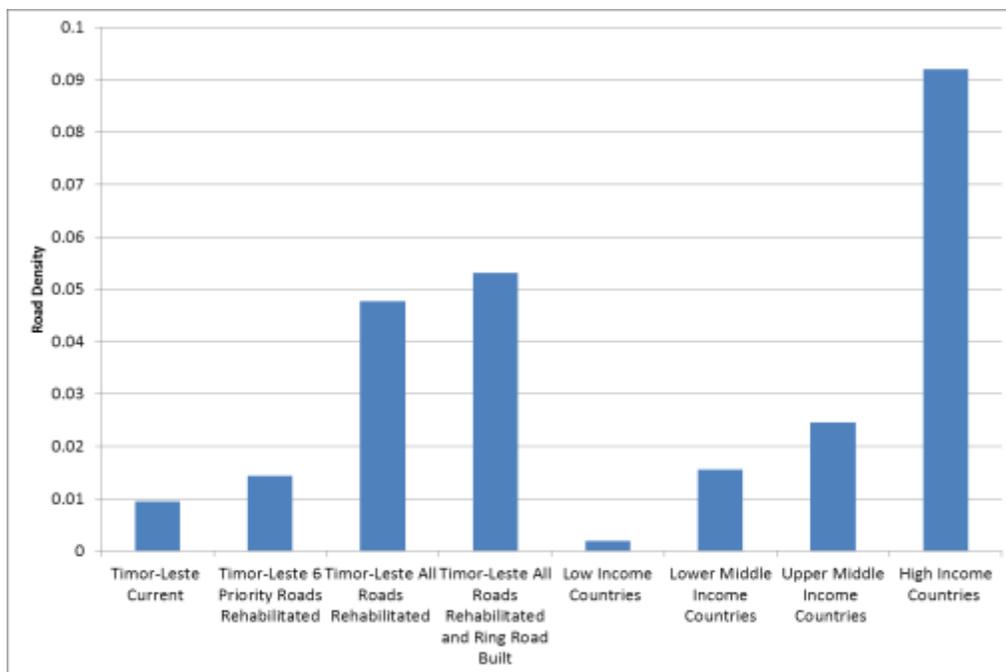
<sup>78</sup> The value of the roads when they are in good condition, measured by replacement cost.

<sup>79</sup> Increased network capacity can be the result of new or longer roads or from widening existing roads. The models that are used in this report measure increased capacity through the average cost of replacement of that road. As the road extends or expands, the sunk cost of the road increases as does the replacement cost. This in turn increases the asset value of the road.

reconstructing the current asset base through a strong program of road maintenance to allow the network to serve the needs of the economy before slowly expanding the network capacity, in line with the GDP growth.

**By 2030, if it meets the targets for the expansion of the road system outlined in the SDP, Timor-Leste is likely to have a higher road density than many other middle income countries.** The SDP argues that Timor-Leste's road network will need to be significantly rehabilitated and expanded in order for it to become a middle income country. Figure 35 compares the density of paved roads in 'good condition' in Timor-Leste to that of a number of low, middle, upper-middle and high income country groups. Timor-Leste currently has a much lower level of density of paved roads in 'good condition' than the average level for middle or low income countries. The reconstruction of the six roads prioritized under the SDP would lead to Timor-Leste having a similar level density of paved roads in good condition to that of the average lower-middle income country, while the reconstruction of all the roads included in the plan would lead to Timor-Leste having a much higher level of density of such roads than most upper-middle income countries.

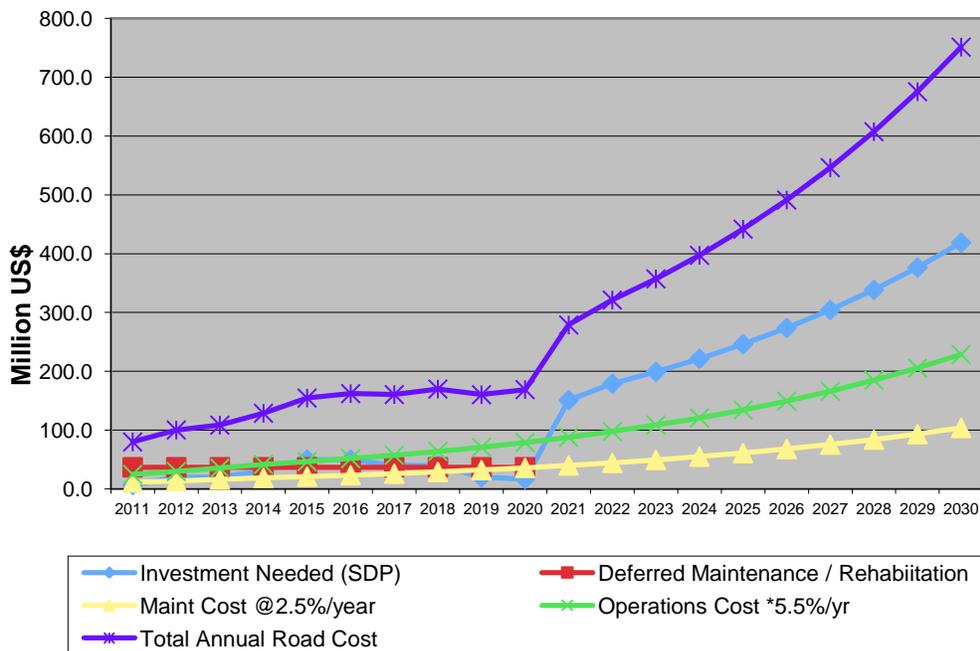
**FIGURE 35: PAVED ROAD DENSITY BY GDP PER CAPITA**



**In addition, the full cost of expanding, rehabilitating, operating and maintaining the roads included in the SDP is likely to be fiscally unsustainable over the longer term.** Once the roads in Timor-Leste have been returned to a stable level that balances with the size of the economy, the ongoing cost of maintenance, operations and expansion, in line with economic growth, requires that expenditure is

equivalent to 20 percent of the asset value per year.<sup>80</sup> With the asset value kept at the equivalent of 40 percent of non-oil GDP, the upper limit of the optimal 20-40 range, this implies that funds to a value equivalent to 8 percent of GDP will be needed for the road budget. By 2030, the compounding effect of the 11.3 percent growth rate mandated in the SDP takes the annual road cost to over US\$600 million (see Table 20 and Figure 36).<sup>81</sup> While creating a larger road asset base per unit of GDP is within Timor-Leste's overall fiscal capacity, given the prevalence of petroleum revenues, it will crowd out expenditure in other critical sectors, including health, education, water and sanitation and agriculture. The trade-off involved needs to be carefully assessed.

**FIGURE 36: TOTAL ANNUAL ROAD BUDGET REQUIRED TO ACHIEVE SDP TARGETS (US\$ MILLION; GROWTH AT 11.3%)**



<sup>80</sup> This total derives from 2.5% maintenance, 5.5% operations and 11.2% capital expenditure illustrated in Table 20 and Figure 36.

<sup>81</sup> These numbers result from an investment analysis (simulation) using assumptions based on SDP targets for roads infrastructure.

**TABLE 20: TOTAL ANNUAL ROAD BUDGET REQUIRED TO ACHIEVE SDP TARGETS (US\$ MILLION; GROWTH AT 11.3%)**

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2024	2025	2029	2030
<b>TL GDP 2010 to 2030</b>	\$855	\$951	\$1,128	\$1,355	\$1,615	\$1,901	\$2,114	\$2,351	\$2,614	\$2,907	\$5,496	\$6,111	\$9,344	\$10,391
<b>Roads</b>														
<b>Road Asset Base Including SDP</b>		1,152.8	1,152.8	1,159.7	1,179.7	1,199.7	1,230.7	1,280.7	1,330.7	1,370.7	1,976.9	2,198.3	3,361.3	3,737.8
<b>Non Rural Assets (Mil)</b>		1,062.8	1,062.8	1,069.7	1,089.7	1,109.7	1,140.7	1,190.7	1,240.7	1,280.7	1,879.9	2,101.3	3,264.3	3,640.8
<b>Asset Base Needed by GDP (0.4) (Mil)</b>	\$342.00	380.3	451.2	542.0	646.0	760.4	845.6	940.3	1,045.6	1,162.7	2,198.3	2,444.5	3,737.8	4,156.4
<b>New Capacity Investment</b>									0.0	0.0	221.4	246.2	376.5	418.6
<b>Tibar Port Access</b>						10.0	10.0	10.0						
<b>Southern Coastal Road</b>						1	20	20	20	20				
<b>Bridges</b>			6.9	20.0	20.0	20	20	20	20	20				
<b>Investment Needed (SDP)</b>		<b>0.0</b>	<b>6.9</b>	<b>20.0</b>	<b>20.0</b>	<b>31.0</b>	<b>50.0</b>	<b>50.0</b>	<b>40.0</b>	<b>40.0</b>	<b>221.4</b>	<b>246.2</b>	<b>376.5</b>	<b>418.6</b>
<b>Deferred Maintenance / Rehabilitation</b>			37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0				
<b>Maint Cost @2.5%/year</b>	\$6.84	9.5	11.3	13.6	16.2	19.0	21.1	23.5	26.1	29.1	55.0	61.1	93.4	103.9
<b>Operations Cost *5.5%/yr</b>		20.9	24.8	29.8	35.5	41.8	46.5	51.7	57.5	63.9	120.9	134.4	205.6	228.6
<b>Total Annual Road Cost</b>		<b>30.4</b>	<b>80.0</b>	<b>100.4</b>	<b>108.7</b>	<b>128.8</b>	<b>154.6</b>	<b>162.2</b>	<b>160.6</b>	<b>170.0</b>	<b>397.3</b>	<b>441.8</b>	<b>675.5</b>	<b>751.1</b>

### **4.3.1 CONCLUSION: FIX THE ROAD NETWORK, ALLOW THE ECONOMY TO GROW**

Expenditure on electricity, considered in Chapter 5: Electricity of this PER, accounted for 57 percent of total expenditure on infrastructure in the period from 2008 to 2013, with impressive gains in electrification rates over that period. However, maintaining this asset will be constrained by the lack of all-weather road access. In addition to the electricity sector, other sectors, such as agriculture, would benefit from improved all-weather roads. Improved access to all-weather roads would contribute to the promotion of economic activities through a reduction in transportation and logistics costs, as well as providing residents of rural areas with improved access to markets, educational and health facilities and other social infrastructure. In other words, removing the next major constraint to economic expansion will require a national commitment to ensuring the existence of a usable and accessible national road network. The present is a good time for this initiative for a number of reasons:

1. In the period from 2014 to 2017, there will be significant investment by the Timor-Leste Government and donor partners to rehabilitate at least 50 percent of the national road network. The target should be 80 percent by 2017;
2. The MPW has formulated a five-year road investment plan. While that plan may be more ambitious than required, it can form the basis of a longer-term strategy to upgrade all levels of road in the national network. The national and rural roads master plans prepared with Asian Development Bank (ADB) and European Union (EU) funding in 2009 and 2010 can be used to help prioritize investment into those roads that will have the most significant economic impact. This will help to ensure that expenditure is on the roads that will have the most significant positive impact on Timor-Leste's economic growth.

## **4.4 APPROPRIATE ROAD SECTOR INVESTMENT TO CREATE A STABLE MAINTAINABLE ROAD NETWORK**

**Every dollar spent on the rehabilitation of the current road network to its original condition and at a maintainable standard, and ensuring that it stays in this condition, provides estimated savings to road users of US\$ 2.18.** The related optimal spending levels depend on the target condition and the urgency of rehabilitation. World Bank analysis suggests spending roughly US\$ 78 million per year on all roads for the first five years, with this sum declining to US\$48 million per year from years 6 to 20 (see Table 21). This figure does not include expenditure on bridges, which according to a conservative calculation would add an additional 20 percent to the planned budget, leading to a total annual expenditure of just under US\$100 million during the first five years.

**TABLE 21: SPENDING FOR SUSTAINABLE ROAD NETWORK (WORLD BANK RNET<sup>82</sup> 2013; US\$ MILLION)**

<b>Budget Strategy ( all roads)</b>	<b>Annual Cost years 1 to 5 (US\$ million)</b>
-------------------------------------	--

<sup>82</sup> Road Network Evaluation Tools model, developed by Sub-Saharan Africa Transport Policy Unit

	Rehabilitation	Periodic Mtc	Recurrent Mtc	Total
Optimal	61.6	10.4	5.9	77.9
Improve Condition	9.8	1.5	5.9	17.2
Keep Current Condition	8.4	0.4	5.9	14.7
Do Minimum	0.0	0.0	5.9	5.9
	<b>Annual Cost years 6 to 20 (US\$ million)</b>			
Optimal	24.0	18.4	5.9	48.3
Improve Condition	45.1	3.9	5.9	54.9
Keep Current Condition	45.4	4.2	5.9	55.5
Do Minimum	45.4	3.9	5.9	55.2

A similar analysis conducted by the ADB,<sup>83</sup> based on the restoration of only *national* roads to their original condition, seeks to address the rehabilitation backlog more quickly and reduce the roughness of roads to an International Roughness Index (IRI) of 3.7<sup>84</sup> (an IRI of 4.0 indicates that roads are readily usable by two wheel drive vehicles and that travel is fast and safe using such vehicles) from current levels of over 6.0 (usable by two wheel drive vehicles, but at low speeds), and in some cases over 10 (usable only by four-wheel-drive vehicles travelling at no more than 10 kilometers per hour). This approach would involve an initial investment to the order of US\$120 million in the first year. This would drop back to approximately US\$ 55 million per year during a four-year recovery program and a lower level of US\$40 million per year during a six year program.

**Rehabilitation and maintenance also avoids higher (per unit) emergency rehabilitation costs.** The lack of road maintenance contributes to drainage and culvert failure, leading to frequent local road-related landslides and the erosion of roads. These failures often result in the need for emergency repairs. Waiting to implement emergency repairs rather than implementing the appropriate rehabilitation and maintenance work is an expensive way to manage a road system. In 2010, the cost of emergency repairs on roads and bridges was US\$29 million, which amounted to 65 percent of the total ministry budget of US\$ 48 million.

#### ***4.4.1 CONCLUSION: THE FIRST PRIORITY IS TO MANAGE RECURRENT COST RATHER THAN BUILD NEW ROADS***

**This report continues the long tradition of focusing on road maintenance, as the most important component of a road asset development and management system.** Unless maintenance begins on the day that construction work finishes, the road will not be sustainable. Thus, routine maintenance is the key to ensuring sustainability. The investment program should also be supported by establishing a district-wide maintenance program, using contractors and community labor.

World Bank and ADB studies show that over the next five to ten years, Timor-Leste's road system could be bought back to reasonable condition with the expenditure of US\$78 million per year, if these funds were spent wisely. If the rehabilitation of bridges is undertaken simultaneously, the necessary

<sup>83</sup> ADB Road Outlook 2011

<sup>84</sup> As measured by the international roughness index (IRI) – ADB Timor-Leste road outlook 2011. Most stable road systems with 80 to 90% of the network in fair to good condition achieve an average roughness index of 3 to 4

expenditure would increase by 20 percent to roughly US\$100 million per year. However, the prioritization of roads for development and the standard to which they will be developed is often determined by both economic and other criteria, such as community impact and linkage. The addition of the current IFI commitments to expand and extend the current road network will add a further US\$100 million per year to the above estimate. The combined total expenditure of US\$1 billion in the period from 2014 to 2019 is equivalent to approximately 8 percent of the total GDP for this period,<sup>85</sup> matching the overall road investment and maintenance profile of both the US and China during their large expansion periods, discussed above and in section 4.6.

The second recommended maintenance initiative involves the establishment of district-wide contracts for the rehabilitation and maintenance of local, district and national roads in three districts as a pilot to be implemented with ADB and World Bank support. Integration of the planning and management of the overall road network is vitally necessary, as all components of the road network need to work together. The current fragmentation of development, maintenance and management of the district and rural road network needs to be addressed.

#### **4.5 PAST GROWTH IN PLANS FOR ROAD SECTOR INVESTMENT**

**Planning remains a challenge in the roads sector.** Table 21 lays out the range of unit and average costs quoted by various reports and plans, while Table 22 lists the budget attached to the MPW's current Five Year Road Development Action Plan.

**TABLE 22: RANGE OF ROAD IMPROVEMENT COST (US\$)**

---

<sup>85</sup> GDP as forecasted in the SDP.

Source	Assumptions	Cost per Km <sup>86</sup>	Single	Average Cost per Km for Road <sup>87</sup>
<b>Basic National Road Network Master Plan (NRNMP)</b>	Stay within existing alignment and return to maintainable standard			\$110,000 for all road classes
<b>RONET Model – ADB Model</b>	Simple repair and rehabilitation of existing roads	\$150,000 for 3.5m width reconstruction \$350,000 for 4.8m width reconstruction	road	Assumes 70% of overall road condition is poor \$105,000 for 3.5m width \$250,000 for 4.8m width
<b>Improved NRNMP</b>	Improve alignment where needed and improve drainage			\$206,000 for all road classes
<b>DRBFC</b>	Rehabilitate to Indonesian functional standards of 4.5m width for the complete road link.	\$400,000		Depends on bidding prices
<b>ADB Rehabilitation</b>	Expand paved road width to 6m width and realign as needed. Applied to complete road link	\$750,000 to US\$850,000	to	\$750,000 to US\$850,000
<b>DRBFC 5 Year Road Investment Plan</b>	Assumes expansion of national roads to 6m width and upgraded alignment	\$850,000		\$850,000
<b>JICA National Roads</b>	Expand to 7m width alignment and major slope adjustment	Greater than US\$1 million	US\$1	Greater than US\$1 million

The 2009 National Roads Network Master Plan envisaged the incremental repair of roads to a decent condition, within the existing alignment of 4.5 meters, which is equivalent to the current functional Indonesian provincial roads standard.<sup>88</sup> The estimated cost of that rehabilitation was US\$ 110,000 per kilometer for all classes of roads combined. This expenditure would double to approximately US\$206,000 per kilometer if changes in alignment, or improved drainage or slope stability, were required.

Subsequently, the SDP in 2011 set a much higher target standard for the rehabilitation of key national roads of either six or seven meter carriageway. These standards were subsequently used in the design of ADB, World Bank and Japan International Cooperation Agency (JICA) funded road projects. This specification raises the average costs to US\$ 0.8 million per kilometer, since good stretches are fully rebuilt during the widening process.

<sup>86</sup> Cost for one kilometer of road

<sup>87</sup> Cost for an overall road improvement. Not all sections of the road need to be rebuilt so the average cost per km is less than the cost for one km.

<sup>88</sup> The Indonesian Road Regulation PP 34 Tahun 2006 specifies a normal aspirational target for provincial roads connecting major provincial centers as having a road bed of 9m. However, in practice, because of cost and topographic restrictions, the functional norm is between 4.5 and 5 meters of paved surface on a 6.5 to 7.5 roadbed.

TABLE 23: FIVE YEAR ROADS INVESTMENT PLAN<sup>89</sup>

**MINISTRY OF PUBLIC WORKS  
BUDGET OF NATIONAL ACTION PLAN OVER 5 YEARS**

**SUMMARY**

Sector	Target		Cost Estimation USD	Action Plan
	PED	Program 5 Years		
Major Roads	National & District Roads:	Upgrade national roads to an international standard over the next 5 years.	\$ 944,960,000.00	<b>Program 1</b>
	Fully rehabilitate all national and district roads to an international standard by 2020	National highway ring road		Progressive Upgrading of 1,369.1 km of National Roads over 5 years
Regional Roads		Upgrade regional roads to an international standard over the next 5 years.	\$ 198,600,000.00	<b>Program 2</b> Progressive Upgrading of 395 km of Regional Roads over 5 years
Urban Roads		Upgrade urban roads to an international standard over the next 5 years.	\$ 237,571,500.00	<b>Program 3</b> Progressive Upgrading of 319 km of Urban Roads over 5 years
RURAL Roads			\$ 23,521,000.00	<b>Program 4</b> Improve and maintain rural roads networks
Bridge Construction			\$ 87,452,000.00	<b>Program 5</b> Bridge Construction
Flood Control			\$ 120,000,000.00	<b>Program 6</b> Improve Flood Control
Routine maintenance			\$ 170,160,000.00	<b>Program 7</b> Roads and Bridges
Periodic maintenance			\$ 61,700,000.00	<b>Program 8</b> Roads and Bridges
<b>GRAND TOTAL</b>			<b>\$ 1,694,812,500.00</b>	

The SDP and the Ministry's five-year action plan provides for the development of a road network in excess of the optimal levels identified in Section 4.4. The Government has also formulated longer-term plans for the rehabilitation of the rural and district road network and major repairs and reconstruction to national and regional bridges. The Government's five-year Road development action plan, as described in Table 23, involves an estimated budget of approximately US\$340 million per year.<sup>90</sup> Based on the data for China and the USA, during periods of rapid growth in road sector spending, a target figure equivalent to approximately 6 to 7 percent of GDP would be appropriate. If this rule of thumb

<sup>89</sup> Ministry of Public Works Action Plan 2013-2017

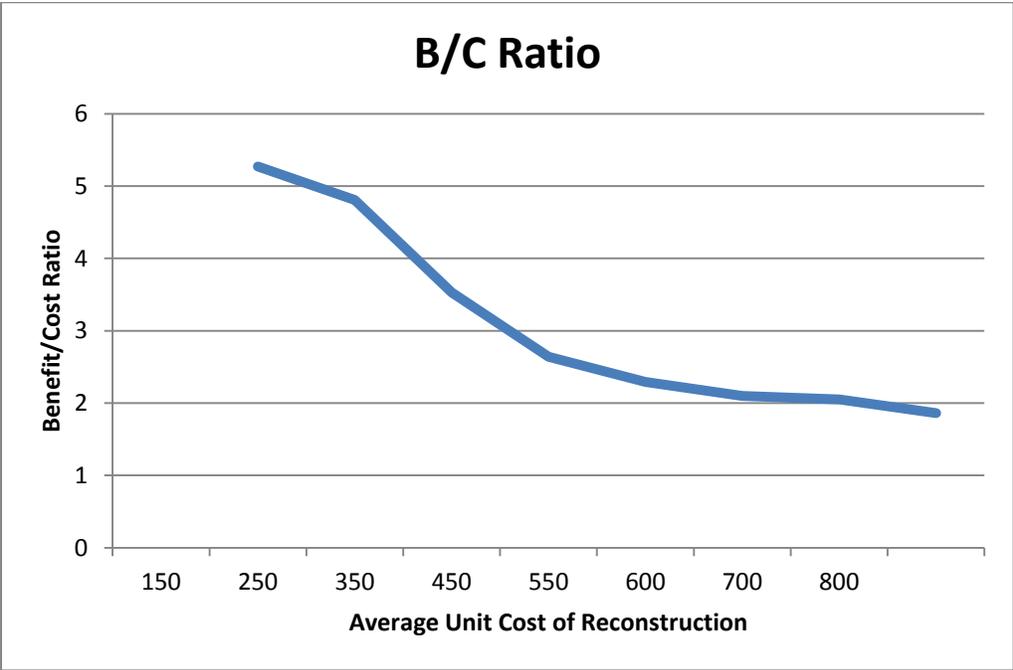
<sup>90</sup> The list of projects included in the Five Year Action Plan is taken directly from the projects prepared by the ADB for the National Roads Master Plan in 2009. However, costs have been increased significantly from the 2009 estimates - assuming \$800,000 per km for all national roads. This assumes that all roads will not be rehabilitated as needed, but fully reconstructed. The costs in the table assume that all national roads will be expanded to either 6 or 7m width and with alignment changed – essentially new roads in each case.

were applied to the 2013 non-oil GDP, then the appropriate level of expenditure on roads and bridges would be US\$107 million. The optimal figure developed by the Road Network Evaluations Tools (RONET) model in Section 4.4 (see Table 21) for roads would be approximately US\$78 million per year, or US\$ 100 million if bridges are included, which is a similar figure.

**At present, the higher level of expenditure is not achievable.** The Government’s plan includes both the rehabilitation of the road network and the expansion and extension of current roads. Achieving such a target will involve significant implementation challenges.

**When the cost of improving roads increases faster than the level of benefit resulting from those improvements, the benefit/cost ratio declines.** The RONENT model was used to simulate the increase in average road rehabilitation and reconstruction costs from a low of US\$150,000 per kilometer to a high of US\$800,000 per kilometer, as shown in Figure 37. The result suggests that a strategic rationalization of future road spending is required, with only those truly essential high volume national links being rebuilt to a standard that requires the higher average unit costs.

**FIGURE 37: BENEFIT COST RATIO, WITH INCREASING COST OF RECONSTRUCTION (US\$ ‘000)**



**4.6 ACTUAL PAST SPENDING ON ROADS AND BRIDGES**

A summary of Government’s overall road spending accumulated from various sources is presented in Table 24.

**TABLE 24: ROAD BUDGETS AND EXECUTION (US\$ '000)**

Ministry	2008		2009		2010		2011		2012		2013	
	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense
Ministry of Infrastructure /Public Works <sup>[1]</sup>	30,833	23,259	18,293	15,959	48,587	43,525	25,848	23,161	25,726	20,548	43,997	23,710
Infrastructure Fund <sup>[2]</sup>							36,148	8,497	168,626	38,378	116,352	70,299
Min. State Admin/DRBF <sup>[3]</sup>	2	2	2.6	1	6	1.8	6	2	0	0	0	0
PDD I <sup>[4]</sup>									0.633	0.526	0.913	0.913
PDD II									0.28	0.28	0	0
Dev. Partners <sup>[5]</sup>	30	30	7,149	7,149	11,710	11,710	21,634	21,634	30,457	30,457	38,582	38,582
Total Roads & Bridges (\$000)	30,865	23,291	25,445	23,109	60,303	55,237	83,636	53,294	224,811	89,384	198,932	132,592
Total State Budget US\$M <sup>[6]</sup>	553.2		680.9		1,094.70		1,578.80		1,451.20		1,892.30	
% Roads/State Budget	5.58	4.21	3.74	3.39	5.51	5.05	5.30	3.38	15.49	6.16	10.51	7.01
National GDP (non oil)	635	635	790	790	934	934	1128	1128	1350	1350	1534	1534
% Roads/GDP	4.86	3.67	3.22	2.93	6.46	5.91	7.41	4.72	16.65	6.62	12.97	8.64

Notes:

1. Data from MOF Proclarity Financial Reports
2. Data from MOF Proclarity Financial Reports
3. Free Balance Financial System
4. National Development Agency (ADN) Database
5. State Budget 2013 – Book 5 – Loans only
6. State Budget 2013 – Combined Government Budget

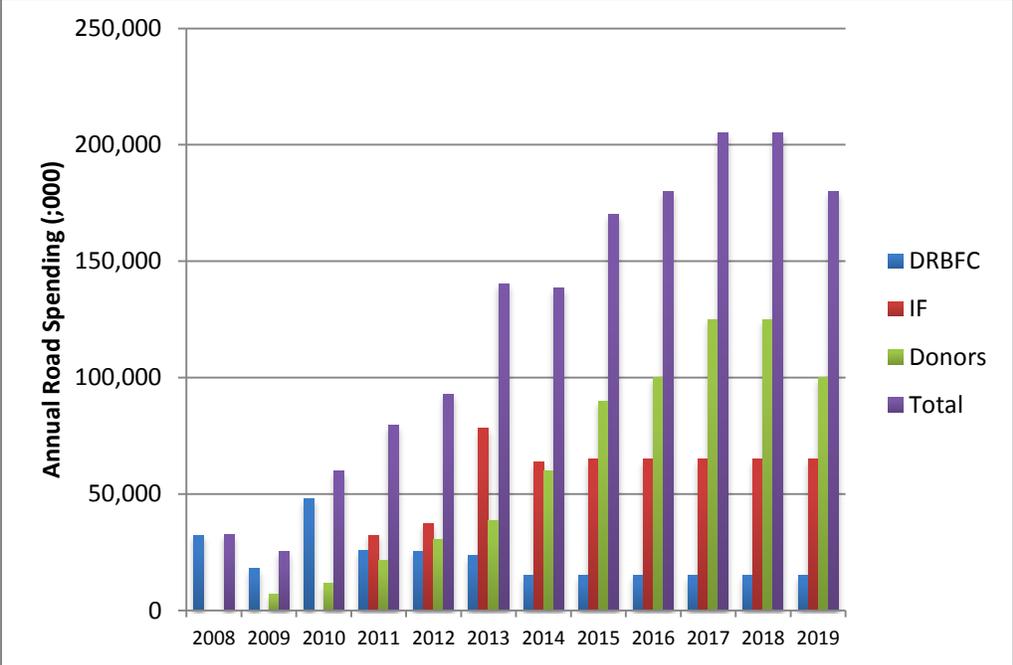
The total budget on roads and bridges increased by a factor of 6.5 in the period from 2008 to 2013, increasing from US\$ 31 million to US\$ 198 million in nominal terms. This increase reflects increasing national budgets, IFI investment and increased focus on the road sector. However, execution rates have been low, with only US\$ 89 million (40%) of the budget executed in 2012 and US\$ 133 million (67%) in 2013.

The total budget for roads and bridges has grown as a proportion of the state budget and as a share of non-oil GDP over the same period. As a proportion of the total state budget, the budget for roads and bridges has increased from 3.74 percent in 2009 to a high of more than 15.49 percent in 2012. This indicates that the development of the road system is considered a national priority. However, as noted above, execution rates are low. In relation to non-oil GDP, road spending ranged from a low of 2.9 percent in 2009 to a high of 8.6 percent in 2013.

**4.7 BUDGET FORECASTS AND THE COMPOSITION OF SPENDING**

Figure 38<sup>91</sup> presents a forecast budget to a total value of approximately US\$ 1 billion for the road sector over the next five years. However, it is not clear what proportion of this will be dedicated to maintenance.

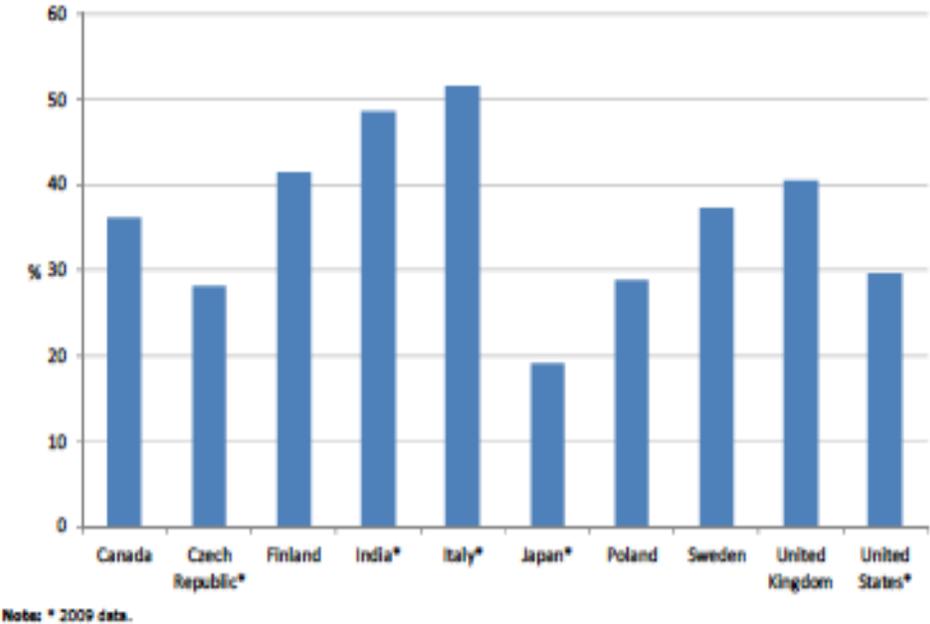
**FIGURE 38: ROAD SECTOR BUDGETED SPENDING (US\$ '000) FROM ALL SOURCES 2008-2019 (AS IN GOTL STATE BUDGET)**



<sup>91</sup> The data in the Figure are taken from the 2014 National Budget Book 5.

The Government's five-year road investment plan, described in Table 23, allocates a total of US\$ 234 million for routine and periodic maintenance, or 14 percent of the total of US\$ 1.7 billion for the plan. The portion allocated for routine and periodic maintenance is low by international standards. Figure 39 illustrates the proportion of total road expenditure allocated for routine and periodic maintenance in a number of countries. At 14 percent, Timor-Leste's allocation ranks last out of all the listed countries. Even when compared to other countries with a high proportion of sub-standard roads, such as India, there is ample room to increase the proportion of funding allocated for maintenance and rehabilitation. All the countries listed, other than India, have well developed and stable roads that do not require extensive repair. Therefore, it is not unreasonable to suggest that expenditure on the maintenance and rehabilitation of roads in Timor-Leste should be increased to up to 80 to 90 percent of the total expenditure on the road system until the network becomes stable.

**FIGURE 39: ROAD MAINTENANCE: SHARE OF TOTAL ROAD EXPENDITURE ON ROADS (2010)**



**4.7.1 CONCLUSION: ENSURE BUDGETS ARE ADEQUATE, DELIVERABLE AND MAINTAINABLE**

In Timor-Leste's road sector, a 'build, neglect, rebuild' culture is emerging. This should be corrected, as should the emerging bias towards uneconomical road construction or reconstruction. The sustainability of the road network depends on maintenance. Often, this involves mere routine maintenance, which is less visible to the public than the development of new roads, but also less costly. Unless maintenance is programmed to begin on the day that construction ends, there is a significant risk that roads will suffer severe damage during the next rainy season.

Thus, it is very important to ensure adequate budgets for maintenance and not to divert these budgets to other purposes. Longer term routine and periodic maintenance could also be incorporated into rehabilitation contracts. The contractor that carries out the rehabilitation could be contracted to continue to implement longer term routine and periodic maintenance work. This is a sound strategy. Performance-based maintenance contracts (PBC) have become a common feature in other similar countries. For example, Laos now maintains approximately 4,000 kilometers of its roads through PBC. Commitment to multi-year contracts plays a positive role in removing the risk that maintenance budgets will be reallocated for other purposes.

## **4.8 IMPLEMENTATION CHALLENGES THAT CONSTRAIN EXECUTION**

**Systems of financial management and for the preparation, implementation and monitoring of road projects need to be better applied to ensure that expenditure achieves value for money.** Under the SDP, the Government has established procedures and institutions to ensure that investments in major capital works are assessed to determine their effectiveness in economic, social and development terms (see Chapter 2: Public Investment Management in Timor-Leste). Expenditure should be formally authorized and implemented efficiently by applying competitive pressure through the involvement of the private sector. Strong supervision and monitoring systems should be implemented.

### ***4.8.1 FINANCIAL MANAGEMENT***

Table 25 and Figure 40 depict the DRBFC and Infrastructure Fund roads budgets, summarized earlier in Table 24. They describe financial management problems that have become increasingly critical in the period from 2009 to 2013. These financial management problems occur at all stages of the project delivery cycle, including planning, the evaluation of priorities, contracting and the monitoring of the delivery of works.

**TABLE 25: DRBFC AND IF BUDGET COMMITMENT AND EXPENDITURE 2009-2013<sup>92, 93</sup>**

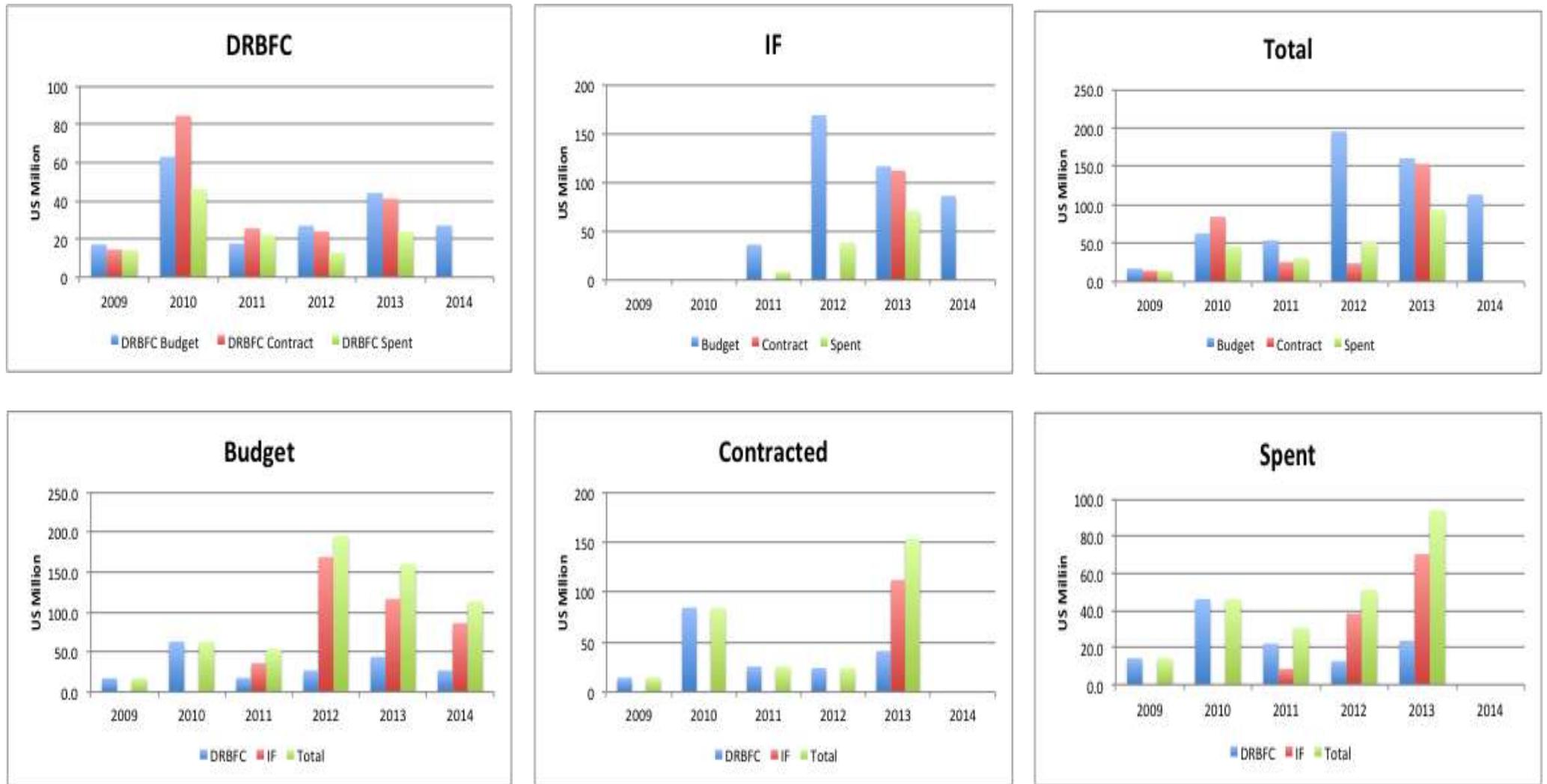
Program Element	2009			2010			2011			2012			2013		
	Plan	Contract	Execute	Plan	Contract	Execute	Plan	Contract	Execute	Plan	Contract	Execute	Plan	Contract	Execute
Subtotal	10,649,000	8,001,896	7,794,304	62,906,000	84,454,827	40,204,904	17,625,000	14,646,748	11,241,581	15,652,178	12,772,503	2,108,959	33,997,000	8,827,915	6,308,083
Catch-up Emergency from Previous Year								10,837,113	10,837,113	11,250,000	11,250,000	10,606,582	10,000,000	32,142,979	17,402,032
<b>Total DRBFC Budget</b>	<b>17,077,000</b>	<b>14,429,896</b>	<b>14,179,043</b>	<b>62,906,000</b>	<b>84,454,827</b>	<b>46,074,291</b>	<b>17,625,000</b>	<b>25,483,861</b>	<b>22,078,694</b>	<b>26,902,178</b>	<b>24,022,503</b>	<b>12,715,541</b>	<b>43,997,000</b>	<b>40,970,894</b>	<b>23,710,116</b>
DRBFC Realization	0.83			0.73			1.25			0.47			0.54		
<b>Total IF Budget</b>							78,645,238	135,460,499	32,349,664	83,333,130		43,996,172	114,906,230	112,000,000	83,745,530
IF Realization							0.41			0.53			0.73		
<b>Total Budget (R&amp;B) DRBFC and IF</b>	<b>17,077,000</b>	<b>14,429,896</b>	<b>14,179,043</b>	<b>62,906,000</b>	<b>84,454,827</b>	<b>46,074,291</b>	<b>113,895,239</b>	<b>186,428,221</b>	<b>54,428,358</b>	<b>137,137,486</b>	<b>48,045,006</b>	<b>56,711,713</b>	<b>148,712,640</b>	<b>40,970,894</b>	<b>107,455,646</b>
Total Realization Rate	0.83			0.73			0.48			0.41			0.72		
Emergency Works Plus Carryover															23,710,116
Percentage of DRBFC Annual Spending						64.75			75.67			83.41			100.00

Notes: Data from DRBFC

<sup>92</sup> The data recorded in Table 24 and 25 are not identical for DRBFC and numbers available in <http://budgettransparency.gov.tl/public/index>. The difference is in the way that the data are recorded in DRBFC to include contract commitments, and percent complete commitments. The data in Table 25 records only the budget and invoiced and paid annual expenditure. The number of categories of data in the DRBFC financial records is also more precise and can illustrate budget flows from item to item, which is not possible to visualize in the portal.

<sup>93</sup> The IF budget contracted and expended data were not complete for 2011 and 2012. The data for 2013 are complete and show a normal profile. Hopefully the data for future years will also be available using a budget, commitment and expended format.

**FIGURE 40: DRBFC AND IF BUDGET COMMITMENT AND EXPENDITURE**



**The lack of effective planning and design is reflected in the falling rate of execution for DRBFC budgets since 2011.** As discussed in Chapter 1, lack of proper project preparation at all stages, including planning, design and costing, limits the ability of the MPS to properly evaluate the viability of a project and the ability of CAFI to approve it for subsequent contracting. Procurement of the contractor depends on a project's specification and bill of quantities. Without those components of the project, no bidding documents can be prepared. In the case of projects valued at over US\$ 1 million this leads to considerable delays in procurement. For smaller projects, DRBFCs inability to produce those documents often then leads to Ministerial direct procurement on a single source or limited competition basis bypassing the NPC. This is often done under the umbrella of emergency works.

**There is a general proliferation of works classified as 'emergency works', a classification which permits the use of single source direct awards. Without adequate specifications, such awards are likely to result in high cost, low quality works. In addition, these awards make it difficult to accurately analyze outputs.** In 2013, the entire roads budget was contracted as 'emergency works'. The proportion of such contracts relative to the allocated budget has increased steadily over the years, from 76 percent in 2010; 83 percent in 2012; to 100 percent in 2013. The classification of work as 'emergency work' is seen as a means to provide direct contract awards and to spend quickly, given the long lead in time to design and contract projects through the regular process. In a positive development, the 2014 budget execution circular restricts the use of single source works by line ministries to a maximum value of 10 percent of their total budget.

**A high level of debt has resulted from the granting of directly awarded emergency works contracts.** Despite the annual budget process, the 2014 DRBFC budget is nearly completely absorbed by 'dividas,' or debts carried over from the previous year or years in the form of payments due for emergency works carried out by direct order, outside the budget process.

The main issue in the execution of projects is the degree to which uncontracted and unmonitored work is conducted. In the past, some road work has been implemented by contractors with no authority other than a verbal agreement or an informal 'orden de servisu' from a senior government official, with no contract and no monitoring. Payments are then made against contracts prepared ex post. This has also undermined ADN's mandate to monitor results and to ensure that the work done complies with normal contract and design manual standards.

#### **4.8.2 MEASUREMENT OF OUTPUTS**

Data on outputs (in terms of kilometers of roads rehabilitated and maintained and the quality of these roads) are not being systematically collected by MPW technical departments or used to inform planning and budget preparation processes. Table 26 using data from the DRBFC budget is limited, but illustrates the level of data available from 2009 to 2012.

**TABLE 26: WORKS COMPLETED BY CATEGORY/CONTRACT 2009-2012**

Year	Works	Length of Works (km)	Expenditure (\$000)
2009	Periodic Maintenance of Urban Roads	20.5	2,010
	Bridge Construction	3	271
	Rehabilitation of Rural Roads (13 dist)	169	991
	Routine Maintenance	666	1,089
	Emergency Works		2,066
2010	Periodic Maintenance of Urban Roads	12.5	2,395
	Emergency Works (13 districts)		29,832
2011	Routine Maintenance (Dili)	24	154
	Rehabilitation of Dili Roads	13.95	1,500
	Rehabilitation of Hera Road	1.5	609
	Emergency Works		5,870
IF	Rehabilitation of Bridges	(5)	1,304
2012	Emergency works (2011)		10,606
	Emergency works (2012)		8,425
IF	Rehabilitation of Roads (partial completion)	197	22,070
	Construction of Bridges (partial completion)	9	20,925
	Rehabilitation of Bridges	8	5,145
	Dili Asphalt Roads (partial 40%)		12,710
	Repair Dili-Bacau Road	Patching	4,000
	Dili Liquica and Tibar Emera Road Rebuild	In progress	3,000
2013	Liquica-Maubara Road Upgrading (ADB)	16	20,000 approx.
	Maliana – road rehabilitation (ADB)	30 (approx)	6,000

In addition to the data presented above, a road condition survey conducted in the period from 2010 to 2013 is the other source of impartial data related to the improved condition of the roads. The information presented in Table 27 shows the proportion of roads in each condition category in the period from 2010 to 2012. This database should be an important input for the effective management of the road development and management system. As a means of identifying roads in emergency or near emergency conditions, it is an essential tool for the prioritization of maintenance work. However, until recently, it has not been used by DRBFC. The use of this database should now be supported and incorporated into normal DRBFC annual planning and prioritization processes.

**TABLE 27 ROAD NETWORK CONDITION<sup>94</sup>**

Road Condition	2010		2011		2012	
	Km	%	Km	%	Km	%
Assumed IRR						
Condition A (3.0)	0	0	0	0	2	0
Condition B (4.5)	243	17	180	12	96	7
Condition C (6.0)	832	58	960	66	1002	69
Condition D (8.0)	279	19	207	14	259	18
Condition E (10)	89	6	99	7	100	7
Total	1443	100	1446	100	1459	100
Net IRR		6.38		6.37		6.53

Note: Condition A – Leave as is; B – Monitor; C- Action near future; D- Action Immediately; E – Emergency action

**The condition of national roads deteriorated in the period from 2010 to 2012, which is the period for which we have independent data on road conditions.** On average, road conditions remained stable in the period from 2010 to 2011, but declined significantly in the period from 2011 to 2012, with the average International Road Roughness Index (IRR) increasing from 6.37 to 6.53 over that period. The percentage of the network in very poor condition has remained relatively stable, but a significant proportion of roads that were previously in a better condition, in categories A and B, have declined in quality and now fall into category C. Roads normally deteriorate over time, as a natural consequence of the effects of an increasing volume of traffic and the occurrence of potentially significant environmental damage. However, routine and periodic maintenance should be implemented to address that problem. Despite the significant expenditure on emergency works in the period from 2010 to 2012, road conditions have not measurably improved.

There is no attempt by the DRBFC to link expenditure to the achievement of results. The overspending on emergency works has dominated the financial system of the DRBFC and, given that contracts for emergency work are often ex post, targets and measures of achievement have not been established. This is an area that will require significant improvement in the future. The road condition database is one tool to help measure improvements to the overall road system by helping to set targets and measures of achievement.

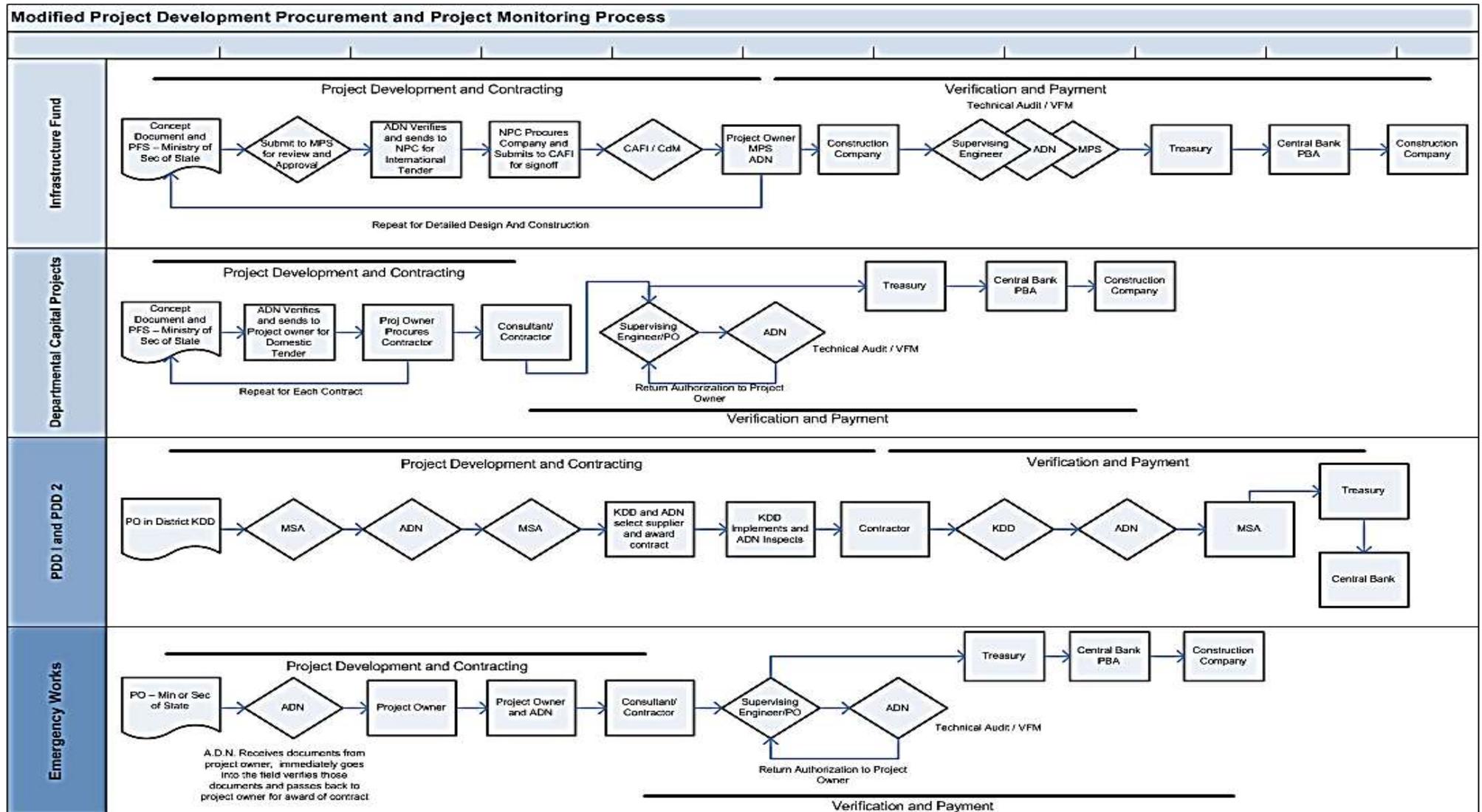
The road condition and costing system is a work in progress. It has only recently been transferred to the planning and budgeting unit of the DRBFC and is not yet used as a planning tool. However, over the coming months, the DRBFC plans to improve the quality of this data and to begin to use it for the prioritization and costing of annual and longer term road maintenance plans.

<sup>94</sup> The IRR (International Road Roughness Index ) figures quoted in the table 27 in column 1 are approximate. The IRR numbers are not meant to be definitive but to illustrate the approximate condition of the roads over time. Further, these figures depend also on the analyst. Different analyst will judge a specific kilometer of road differently. Damage may only apply to part of the kilometer. Further environmental and traffic damage are constant and normally lead to a degradation of the road annually. This is why annual maintenance is so critical.

### ***4.8.3 MANDATES AND SYSTEMS FOR IMPLEMENTATION AND SUPERVISION***

Chapter 2 of the PERI provides an outline of the new public investment management agencies created in 2011 as a means of delivering better infrastructure outputs. Four new agencies were established in 2011 to manage multi-annual projects with a value in excess of US\$ 1 million and funded through the Infrastructure Fund. The procedures to be followed in the implementation of those projects over the project management cycle are illustrated by project type in Figure 41.

**FIGURE 41: PROJECT DEVELOPMENT, PROCUREMENT AND MONITORING PROCESS**



The allocation of responsibility for projects remains complicated. The line ministry, in this case the MPW, through the DRBFC, prepares project briefs and should conduct project appraisals for all projects of any size. Projects with a value of less than US\$1 million can be programmed and scheduled as part of the direct DRBFC budgeting process. Projects with a value in excess of US\$1 million are submitted to the MPS for appraisal review and prioritization.<sup>95</sup> Following the appraisal process, these projects are returned to the DRBFC for discussion regarding their possible inclusion in the forthcoming Infrastructure Fund budget.

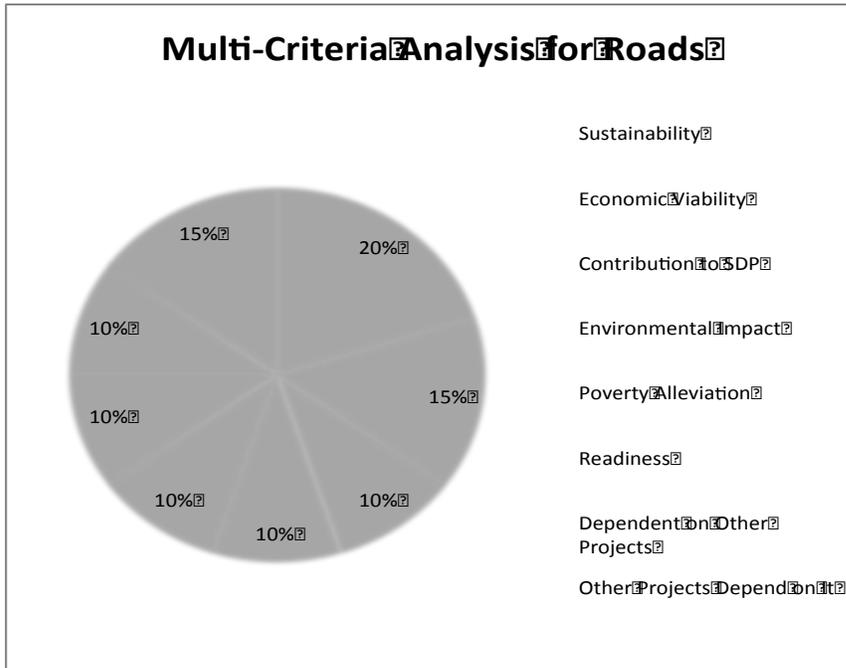
The selected projects are then incorporated into the MPS report, which is presented to the Budget Committee and the CAFI for approval and for incorporation into the draft budget for the coming year. Once the budget has been approved by the Government, the projects are then designed, bidding documents are prepared in cooperation with the NPC, contractors are selected by the NPC, contracts are let, and work is executed by contractors, with support from the DRBFC. The role of the DRBFC is therefore quite broad. The linkage with the MPS and the Infrastructure Fund is through the appraisal review process and the combined allocation of funding through the budget. There is evidence that the MPW, as the owner of the project, is excluded from the NPC bid evaluation committee. All other activity takes place within the DRBFC.

The MPS appraises road projects in terms of a multi-criteria framework that measures eight criteria, with each criterion scored on a scale of 1 to 4 and weighted as shown in Figure 42. There are now approximately 25 staff working within the MPS, of whom three are full time appraisal staff and a further seven are on shared duty with payment services. This is a modest number, given the work allocated to them.

---

<sup>95</sup> At the moment, MPS carries out project appraisal based on the project brief. However, in future an improved pre-feasibility analysis by the line ministry can reduce the MPS appraisal workload and allow an increased focus on verification and checking, rather than of carrying out the direct appraisal.

**FIGURE 42: MULTI-CRITERIA ANALYSIS FOR ROAD PROJECTS IN TIMOR-LESTE**



In the road sector, as in irrigation (Chapter 3), solid appraisals undertaken by the MPS, including those based on explicit criteria related to regional development and special interests, provide evidence that does not appear to have been acted upon by decision makers. In the process of preparing the 2014 budget, a collection of 25 project briefs were provided to MPS by the DRBFC for appraisal.<sup>96</sup> Those projects were appraised and prioritized, but time constraints limited further coordination with the DRBFC. Additionally, the recommendations presented to CAFI for the 2014 budget do not appear to have been accepted. Instead, the road projects in the 2014 budget are the remaining unexpended components of the 2013 Infrastructure Fund road budget, extended as needed and approved by Parliament.

Currently, the role of the ADN and the DRBFC in supervising works overlaps. The roles of these respective agencies should be clarified. At the moment, both agencies are involved in supervising construction processes and the monitoring of contractors. Over time, the responsibility and authority for project supervision and monitoring is likely to be left with the DRBFC, in its role as the line department. It is likely that the ADN will assume control only over fiscal probity, conducting technical and financial audits to ensure that value for money is achieved. Such a division of labor and responsibility is common in other similar international monitoring and verification bodies.

<sup>96</sup> Generally the Pre-Feasibility Study and project appraisal should be carried out by the DRBFC with appraisal review by the MPS. However, at this time, the project briefs have been submitted without accompanying pre-feasibility study.

#### **4.8.4 CONCLUSION: ENSURE EFFICIENCY IN PROJECT DELIVERY**

**The adequate monitoring and supervision of civil works, including road works, is fundamental to the achievement of acceptable outcomes.** Recent statements by the President of Timor-Leste have drawn attention to the fact that the road works completed over the past few years are of inadequate quality. Timor-Leste has too few field staff to adequately monitor and supervise works. The DRBFC has five engineers who are each allocated to one of the five districts. In addition, it has two to three supervising technicians working under each of those engineers. There is little developed capacity within the private sector engineering profession to undertake this kind of hands-on work. The ADN has overall responsibility for ensuring that contracted work is delivered according to the specified level of quality. However, with poor or non-existent designs, limited staff capacity, and inadequate domestic private sector capacity to fill this role through outsourcing, poor quality roads will continue to be constructed. As in other countries, the outsourcing of supervision processes to qualified engineers should become the norm. In Timor-Leste, in the short term, such work could be conducted by international consultants, with local consultants playing an increasingly important role over the longer term. This is a key issue that will need to be addressed as part of the process of strengthening institutions and building capacities over the coming years.

**The use of emergency procedures for the contracting and implementation of work should be limited.** Valid emergency road work, such as work necessitated by weather events, should become less frequent as the road network is rehabilitated to a maintainable standard and as routine and periodic maintenance is implemented.

**Emergency procedures are also utilized as a means of overcoming delays in the tender preparation process.** While the implementation of more accountable project assessment, selection and funding procedures is a positive development, the time required to add the central service layer of specific project review to the normal budget process creates the risk of delays to project execution therefore to project delivery. In addition, the need to implement the design processes for relatively small projects may overburden the DRBFC, with its limited planning capabilities.

A number of approaches can be adopted to ensure efficient delivery:

1. A five-year works program for the DRBFC is now in place. Projects need to be designed to the appropriate level of quality and to be suitable for implementation. In the absence of qualified engineering design and quantities survey expertise within the DRBFC, this work should be outsourced to a domestic or international consultant. The added cost will be well spent if the annual works program can proceed on time;
2. The NPC is willing to work with the MPW to prepare framework contracts with domestic contractors, with these contracts based on best unit price for works. Those contracts can be developed against the total work target, as included in the above designs. The

- capacity of the contractors is used as a basis for deciding how many contractors should be included in the framework contracts. Because these contracts will be to a value in excess of US\$1 million in each case, it is anticipated that the process would involve international competitive bidding. This is advisable in any case to reduce the potential for collusive bidding by domestic contractors;
3. The work can be initiated on the basis of the engineer's estimate of the volume of work, using a task order authorization to proceed under the framework agreement. Modifications to the volume of work can be authorized by the DRBFC's engineer in charge, based on actual field conditions as they arise during construction. However, the unit rate remains the same, with amendments only permissible in the case of inflation or force majeure events. This allows the work to be implemented in a manner similar to the current uncontrolled approach, but with full and transparent competition, contracting and work completion.
  4. The framework contracts can be vetted by the ADN and the Audit Board, with the evaluation of the overall performance of the works to be conducted by the ADN.

#### **4.9 STAFFING CAPACITY OF THE DIRECTORATE OF ROADS, BRIDGES AND FLOOD CONTROL**

**The DRBFC is planning a significant increase in the number of its staff in response to pressures to improve expenditure.** Current plans call for an increase in the number of the DRBFC's staff by 151, based on the unfilled vacancies in 2013, with an additional 506 members of staff to be appointed in the period from 2014 to 2017, to reach a total of 879 by 2017. A significant component of that increased staff complement will be deployed to provide support to regional and district administrations in matters related to the road system. This move will need to be consistent with emerging plans for pre-deconcentration which will involve shifting the mandates for service delivery to the sub-national level. Furthermore, with the current level of 13 engineers, including five assigned for regional road support, increased head office engineering and other professional input is a priority.

**While the DRBFC needs a greater number of capable and trained staff , it is possible to keep the size of the DRBFC to a minimum if all non-administration activities are outsourced.** For instance, all activities related to design, feasibility study, supervision, auditing, and the monitoring of contracts could be outsourced to consultants, although the strong capacity to manage these consultant contracts must be developed. A good example is the South African National Road Administration Limited (SANRAL), which manages a 20,000 kilometer national highway system at high quality with 187 staff, a significantly smaller number than the 879 staff employed to manage 1400 kilometers of national roads in Timor-Leste. In South Africa, all the non-planning and management activities are outsourced to consultants or executing agencies, with performance standards built into those contracts. Since it is inevitable that Timor-Leste will

pass through a period where skilled and trained staff is in short supply, an outsourcing model may be the most viable option.

Furthermore, with a total of 897 staff employed at the DRBFC, the staff payroll will increase significantly. In addition, it is not clear that sourcing this number of staff will be easily achieved. The cost of one permanent staff member is approximately US\$2,400 per year. This implies that an increased staff budget of US\$1.8 million will be required, in addition to the cost of office space and office operating expenses to support those staff.

**Using local content can help build the private sector's contracting capacity.** Procurement analysis shows that roughly 86 percent of the value of contracts awarded in the period from 2008 to 2013 was awarded to local companies. This volume of work can already be seen to have resulted in the improved availability of equipment and in the consolidation of smaller companies into larger and more stable joint ventures. This is a positive development.

#### ***4.9.1 CONCLUSIONS: MAXIMIZE THE VALUE OF HUMAN RESOURCES***

**International experience suggests that a well-trained and committed workforce with a strong commitment to outsourcing most of the necessary technical services, from project assessment to design, contracting and monitoring, is an effective model.** This model may also be attractive to the MPW – DRBFC, but it will require highly qualified and well-trained staff within the core unit of the DRBFC. With the right staff, the number of staff is less important than their quality. An aggressive outsourcing program implemented by the MPW may be an effective means both to accelerate the work that needs to be done (project design and specification) and to create sustainable capacity to support all components of the road program within Timor-Leste's private sector.

**The MPW may be able to use procurement policy to prioritize international consortia that emphasize the development of local skills through apprenticeship and internship programs.** Recent spending on roads, including through the IFIs, has allowed domestic private companies to invest in equipment and to expand their operations. If the capacities of the private-sector engineering consultants, training centers, accountants, information systems professionals and contractors can be strengthened, more road related services can be provided locally, substituting for imports, and allowing greater local participation in the increase in activity. Sub-contracting to the private sector will also enable the MPW to transit into a modern system similar to the system implemented in South Africa and New Zealand.

Timor-Leste's neighboring countries, including Malaysia, Thailand and Indonesia, offer useful examples of how to integrate education into the expanding technical economy. In particular, Malaysia is an interesting case. In addition to language advantages, Malaysia also has excellent roads and training centers that focus on transport and particularly the road network.

Both overseas fellowships and the use of short courses facilitated by incoming professors from international institutions may be effective additions to the services provided by domestic educational institutions. Again, Australia, Malaysia, Indonesia, Thailand and the Philippines can offer useful educational models and support to the universities and training centers in Timor-Leste.

## CHAPTER 5 ELECTRICITY

### 5.1 SUMMARY

**The Timor-Leste Government has set itself the urgent and ambitious goal of achieving universal, 24-hour access to electricity by 2015 to improve livelihoods and attract investment.** However, the achievement of this goal carries a sizable and potentially increasing financial cost to the Government. A significant proportion of this cost comes from the cost of the subsidization of the provision of diesel-generated electricity, forecast increases to demand, and from the prevalence of inefficiencies.

**The high cost of the subsidization of electricity is largely driven by the high fuel costs per unit of electricity produced and the low rate of cost recovery. These issues require urgent action.** In particular, systems for the procurement of diesel fuel and associated practices should be fully assessed. The installation of meters and the development of improved billing and collection systems should be prioritized, as should the formulation of a transparent tariff and subsidy structure and the provision of consumer education. Measures should be taken to avoid choking a nascent private sector and compromising household incomes. The focus of the Government's actions should be on reducing fuel costs. To achieve this, consideration should be given to alternative generation options, to reducing losses and, in the longer term, to improving end-user efficiency.

The Government sees the achievement of universal access to electricity by 2015 as a means of driving economic growth in the period up to 2030. It has made significant investments in electricity infrastructure to pursue these goals. While the rate of access and the level of efficiency has improved, these investments have placed a heavy financial burden on the budget, especially in terms of recurrent cost implications and hidden costs<sup>97</sup>. To address the financial deficit resulting from the high cost of the subsidization of the electricity sector, it is crucial to address the following issues:

1. The high cost of electricity service, which is largely due to excessive reliance on diesel-fired generating plants;
2. The high cost of imported diesel fuel, which partly results from the high costs of procurement;
3. Inadequate metering and billing systems and the low collection rate for delivered energy, which also affects demand efficiency;
4. The sub-optimal tariff structure.

---

<sup>97</sup> See section 5.3.1 for an elaboration of the Hidden Cost Framework. The term 'Hidden Costs' refers to implicit costs, rather than costs that are concealed.

**If the Government had made different choices and sequenced its investments in the electricity sector differently, it could have delivered electricity at a lower cost and avoided over capacity. However, the alternative service based on renewables may have taken longer to deliver than was felt needed at the time, and been less stable.** If, in 2010, instead of making the decision to develop diesel-fired facilities to generate 256 megawatt in the context of a peak demand of 53 megawatts, the Government had opted to construct the Ira Lalaro hydropower plant to complement diesel-fired power plants, it could have cut the 2012 subsidy bill by nearly 50 percent. A figure equivalent to roughly 20 percent of the value of the investment in the Hera and Betano power plants and transmission facilities could have been saved if the Betano power plant's 136 megawatts had been phased in in 2017 and in 2023.

**The high cost of diesel-fired generation facilities could be reduced by lowering fuel procurement costs and improving fuel efficiency in power generation processes.** The Government should assess the tender processes associated with the import of diesel oil to ascertain that these practices comply with good International Competitive Bidding (ICB) practices and that fuel price risks are managed effectively. The Government should carefully monitor the fuel efficiency targets of the contractor for the operations and management at Hera and Betano power plants. It should be noted that replacing the Comoro power plant with the Hera power plant has resulted in improvements to the rate of fuel efficiency of 17 percent, which has reduced the cost of subsidization.

**In order to reduce the cost of subsidization, improvements to metering, billing and collection should be implemented as a matter of high priority.** In 2012, the Hera power plant expanded service dramatically. However, this unmetered and unbilled expansion also resulted in increases to the level of non-technical losses, resulting from factors such as electricity theft, no-billing, under- and non-metering. About half of the electricity generated in 2012 was lost through non-technical losses. It has been estimated that only around 14.9 percent of the cost of the provision of electricity was recovered from customers in 2012. However, given the high cost of electricity services (\$0.42 per kilowatt-hour in 2012) and consumers' limited ability to pay, it is by no means certain that full cost recovery is possible.

**Despite the below-cost recovery tariff, the level of unaccounted-for electricity generation is still high.**<sup>98</sup> In short, the current tariff regime is neither efficient nor equitable. The average tariff in 2012 was US\$0.19 per kilowatt-hour, which means that about 45 percent of the cost of the provision of electricity service could have been recovered from customers. Under- or non-metering of customers is the major reason for this gap. There is evidence that poor citizens of Timor-Leste, who previously used kerosene, batteries, and candles for lighting, are willing to pay for electricity at the lifeline level.

---

<sup>98</sup> The large part of unaccounted losses is non-technical losses: theft and leaks in the form of inadequate measurement, i.e. no-billing, under-metering or non-metering. And the large part of non-technical losses is losses from under- or non-metering. More specifically, EDTL had about 43,000 customers in 2012. Of this customer base, EDTL had installed pre-paid meters for about 15,000 customers. At the same time, a vigorous electrification campaign has been pursued by the Government and about 100,000 households had been connected to the electricity grid by mid-2013. The additional 57,000 customers are 'under-metered or un-metered'

**As a result of these issues, Timor-Leste may have one of the highest levels of hidden cost as a proportion of GDP of any country, with hidden costs reaching to as high as the equivalent of 5.8 percent of GDP in 2012.** The hidden costs consist of: (i) below-cost recovery electricity tariffs; (ii) unaccounted losses (thefts and leaks resulting from inadequate measurement practices, such as no-billing, under-metering or non-metering); and (iii) poor rates of collection from billed consumers. In Timor-Leste, the hidden costs resulting from the below-cost recovery tariff contributed 28 percent of the total value of hidden costs, while unaccounted losses contributed 69 percent, and the poor rate of collection to 3 percent.

**Restructuring tariffs to enable small consumers to pay less per unit of electricity and to require large consumers to pay more could generate increased revenues. However, the greatest gains could come from an expansion of metering and billing.** Two adjustments to tariff structures are illustrated. First, the threshold for the lifeline tariff could be increased from 20 kilowatt-hours per month to 50 kilowatt-hours per month. Second, those consuming more than 1,000 kilowatt-hours per month could be required to pay higher tariffs. The first of these two options could result in additional revenues of US\$1 million per year, while the second could result in additional revenues of US\$2 million per year. While significant, far greater sums of revenue could be generated if a higher proportion of consumers were billed.

**Diversification of the means by which power is generated could reduce generation costs, resulting in a reduction in the cost of subsidization.** This is not a suggestion that additional generation capacity be created, but that alternative generation methods be considered as part of any future planning. Indicative generation costs for a range of generation options for 2015 and 2020 are illustrated. Among the options, the generation of power from diesel-fired plants only would be the most expensive option, while the most diversified option is the cheapest option for both 2015 and 2020. The difference in the cost between these two options amounts to US\$59.6 million in 2015 and US\$61.7 million in 2020 (at 2010 prices). Based on the estimated cost of electricity service of US\$0.422 per kilowatt-hour in 2012, the cost of the provision of electricity services for the most diversified generation mix would be US\$0.23 per kilowatt-hour in 2015 and US\$0.30 per kilowatt-hour in 2020. While these figures are estimates based on currently available data and while actual costs will be different, the ranking order of costs differences is likely to be similar. However, more analysis is required in this area.

**The Government is well aware of the need to improve demand-side management and to increase levels of energy efficiency and conservation. If these improvements are achieved, they could reduce the cost of the provision of electricity services and hence the cost of subsidization.** For example, in the Prime Minister's speech at the inauguration of the Betano power plant on 20 August 2013, he referred to the former President's request to the heads of Suco and to administrators in Timor-Leste to control the use of electricity within the community. The Prime Minister also noted that: "Often, we see that even in broad daylight, lamps remain lit. The Government has already begun to require the payment of tariffs. I am

sure that from the moment that people have to pay tariffs, they will reduce their usage of electricity.”<sup>99</sup>

**Granting financial autonomy to Electricidade de Timor-Leste (EDTL) may increase incentives to reduce costs and to improve the performance of the power sector.** The current high level of dependence on diesel-fired power plants means that EDTL cannot be totally financially independent of the Government. However, financial autonomy for managing costs other than fuel may be possible. This level of financial autonomy would prepare EDTL to better allocate financial resources for required operations and maintenance and to better plan the necessary capital investments. Well-planned capital investment would also enable the bulk procurement of required spare parts, resulting in significant savings compared to the more expensive practice of conducting ad hoc purchases, which entail slow delivery due to the lengthy required approval process.

## **5.2 STRATEGY: EXPANDING ACCESS**

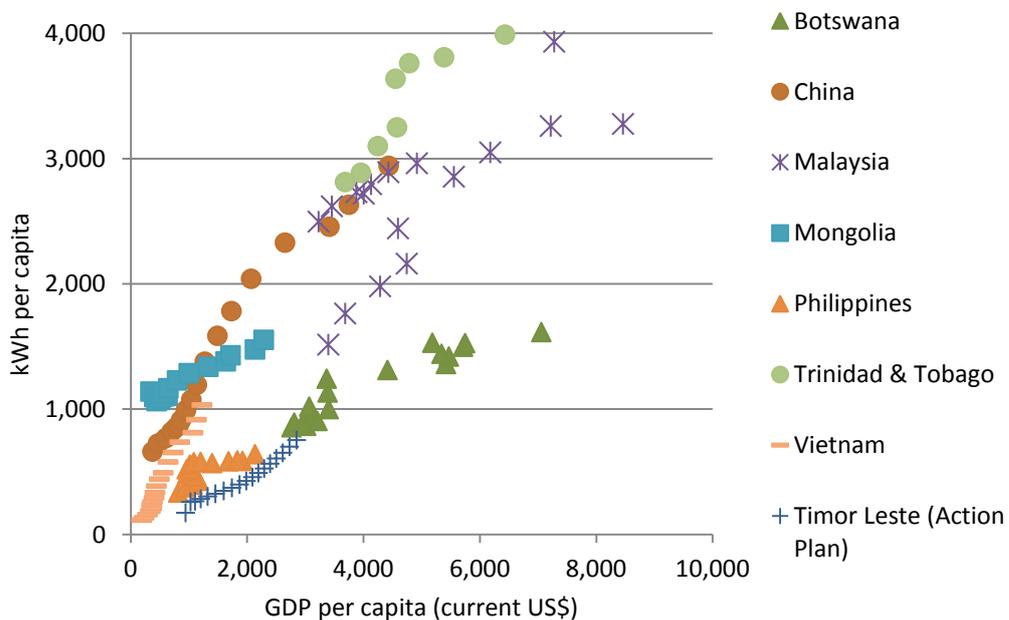
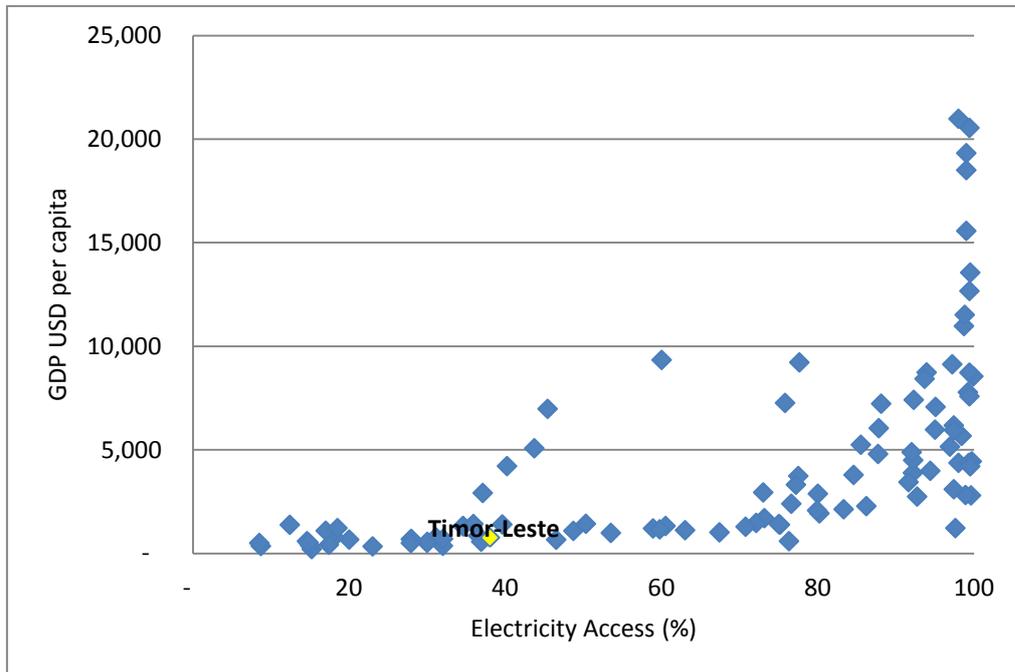
**In 2007, the rate of access to electricity in Timor-Leste was only around 22 percent, one of the lowest rates in the world.** Especially outside Dili, those with any access at all seldom received service on a 24-hour basis. This low rate of access and poor quality of service was largely due to the destruction of infrastructure assets in the period leading to Timor-Leste’s Independence in 2002 and to the upheavals in 2006.

The SDP sets a goal of universal access to 24-hour electricity by 2015, with sufficient generation capacity to meet the needs created by country’s economic growth and by its social welfare commitments. By 2013, the rate of access had risen to an estimated 53 percent (see Figure 43, top). Beyond the goal of universal access, the Government plans to facilitate accelerated economic growth in the period up to 2030, with the availability of electricity forming a significant component of these plans.

---

<sup>99</sup> <http://timor-leste.gov.tl/?p=8714&lang=en>

**FIGURE 43: ELECTRICITY ACCESS VS. GDP PER CAPITA (TOP) AND ELECTRICITY USE PER CAPITA VS. GDP PER CAPITA (BOTTOM)**



As the Government's projected non-oil per capita GDP<sup>100</sup> increases from approximately US\$1,000 per capita in 2012 to US\$ 4,000 per capita in 2030, the Government expects the average per capita rate of electricity consumption to increase from approximately 174 kilowatt hours in 2012 to more than 750 kilowatt hours in 2030 (see Figure 43, bottom). This is a

<sup>100</sup> In this chapter, GDP in Timor-Leste means non-oil GDP.

modest increase in relation to the heavily industrialized growth patterns seen in other countries, but requires attention to both the supply structure and levels of efficiency, financial costs, and the management of demand.

**To meet the goals of improving rates of access and facilitating economic growth, the Government has invested more than US\$814 million in electricity infrastructure since 2008 through EDTL, which operates under the Ministry of Public Works (MPW).** In 2011, US\$477 million, or roughly two-thirds of the total value of the year's infrastructure budget was allocated to the construction of the Hera and Betano power plants and the national transmission network, while in 2012, US\$282 million was allocated to the construction of plants and grid.<sup>101</sup> In 2012, to fund recurrent expenditure, US\$106 million was provided to EDTL, a sum equivalent to approximately 8 percent of the estimated GDP. However, in the same year, EDTL collected own revenues to a value of only US\$14.9 million. Figure 44 shows fuel costs over time.

**The additional generation capacity resulting from the development of the Hera power plant, together with the expansion of the nationwide transmission and distribution network, has met the needs of consumers whose demand for electricity was previously suppressed.** The Government has been able to increase the country's household electrification rate from around 22 percent in 2007 to 53 percent in 2013. In the next two to three years, the Government plans to connect all sub-districts to the national electricity grid. With this additional demand, the MPW's Action Plan 2013-17 includes additional electricity loads to the national grid.

While the new Hera power plant has increased the rate of fuel efficiency of power generation, it is likely that the increase in demand for electricity will outweigh the associated fuel cost savings unless improved levels of energy efficiency and energy conservation are achieved.

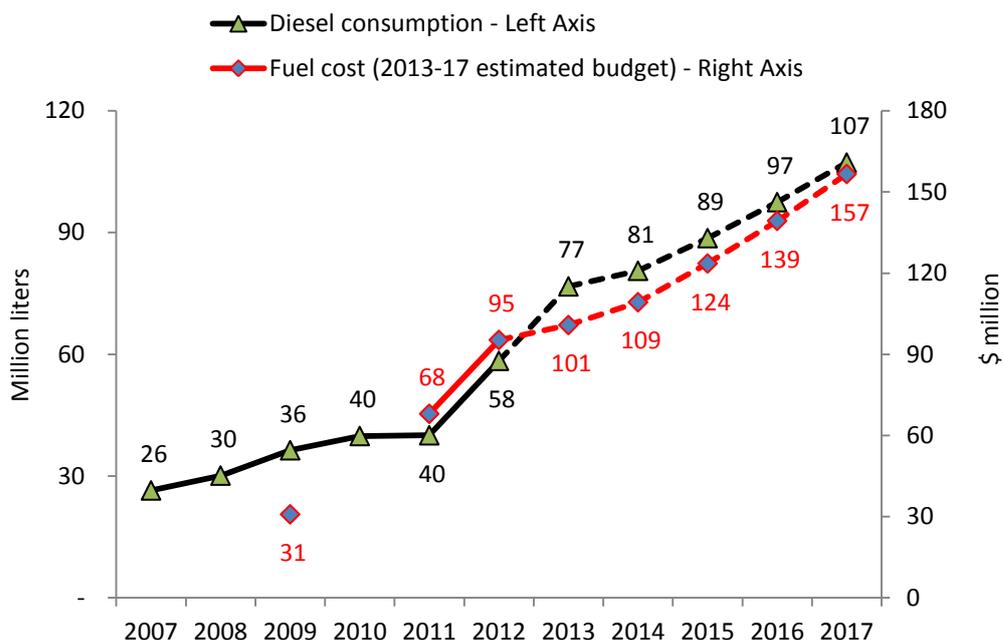
**Expenditure on diesel is increasing with the increased consumption of this fuel projected in the Government's Action Plan, including a sharp rise in the period from 2011 to 2012, when previously unmet demand was met** (see Figure 44). The Government has allocated US\$630 million for the purchase of diesel for the generation of electricity over the period from 2013 to 2017. In 2013, the allocation for fuel for the generation of electricity amounted to US\$100.8 million.<sup>102</sup>

---

<sup>101</sup> State Budget 2012, Budget Overview Book 1. Ministry of Finance. Democratic Republic of Timor-Leste. November 2011; and IMF Country Report No. 12/24, Democratic Republic of Timor-Leste: 2011 Article IV Consultation—Staff Report; Informational Annex; Debt Sustainability Analysis; and Public Information Notice.

<sup>102</sup> Budget Book Update of 17 April 2013, Attachment III, page 99.

**FIGURE 44: FUEL COST TO RISE WITH RISING DEMAND**



Source: MPW Action Plan 2014-2017

### 5.3 COST DRIVERS

The rest of this chapter examines in greater detail the nature and cost of the factors driving Timor-Leste's high electricity subsidy bill and proposes mitigating actions. The Government's investments in the electricity sector have placed a heavy financial burden on the budget, especially in terms of recurrent cost implications. It is crucial to address the following drivers of the financial deficit:

1. The high cost of electricity service, which are largely due to excessive reliance on diesel-fired generating plants;
2. The high cost of imported diesel fuel, which partly result from the high costs of procurement;
3. Inadequate metering and billing systems and the low collection rate for delivered energy, which also affects demand efficiency;
4. The sub-optimal tariff structure.

#### 5.3.1 AGGREGATE EFFICIENCY ANALYSIS: THE HIDDEN COST FRAMEWORK

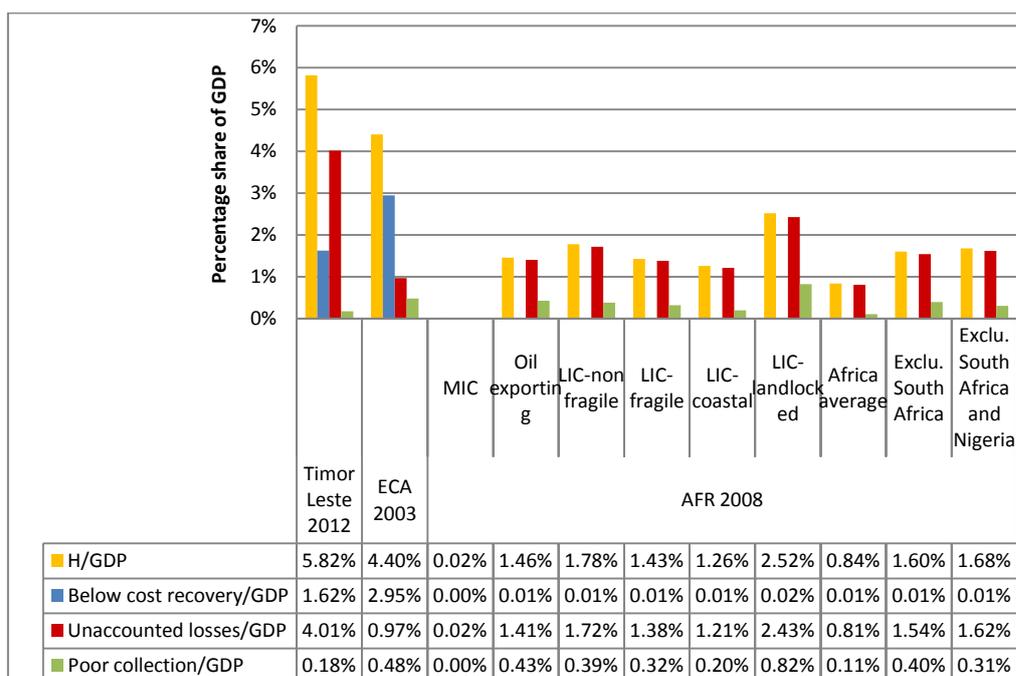
The Hidden Cost Framework<sup>103</sup> is one way to aggregate these drivers of the financial deficit and to benchmark Timor-Leste. The report will utilize this framework before examining each

<sup>103</sup> Hidden Briceño-Garmendia, et al. 2008. Africa Infrastructure Country Diagnostic, Background Paper 15 (Phase I), Financing Public Infrastructure in Sub-Saharan Africa: Patterns and Emerging Issues. Cecilia Briceño-Garmendia,

**specific driver in more detail.** Timor-Leste could be among the countries with the highest level of hidden costs in ratio to GDP, with this ratio reaching as high as 5.8 percent in 2012 (see Figure 45). In 2012, hidden costs are estimated for Timor-Leste through an application of the end-product approach, by monetizing the costs of three quasi-fiscal activities, as follows: i) *excessive unaccounted losses* (unbilled electricity generation, largely due to non-metering, under-metering, theft and leakage, and to a certain level of technical loss beyond normative loss<sup>104</sup>; ii) *underpricing* (charging less than the cost recovery tariff); and iii) *under-collection* (billed amount of electricity generation, but not collected).

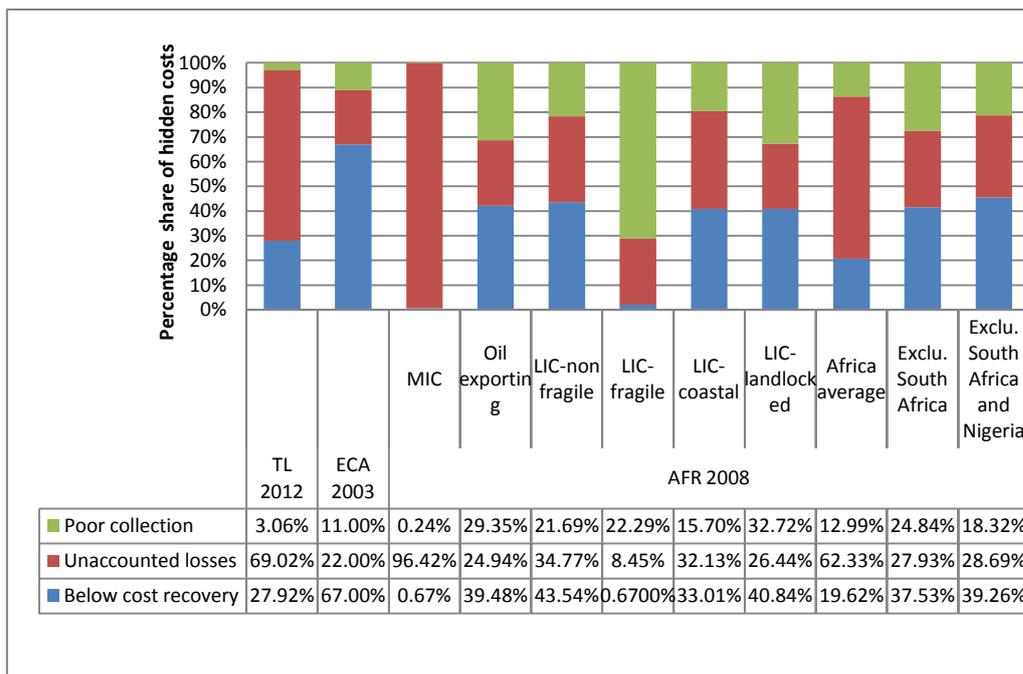
In many countries in Europe and Central Asia (ECA), the data were collected after a few years of recovery from the transition period, after the end of Soviet era. In these countries, the hidden costs were significantly reduced by 2003. In Africa, many countries were dependent on diesel-fired power generation, while some of them were oil exporting countries or recovering from security upheavals similar to those experienced by Timor-Leste.

**FIGURE 45 HIDDEN COST OF THE ELECTRICITY SECTOR IN TIMOR-LESTE, EASTERN EUROPE AND CENTRAL ASIA AND AFRICA REGIONS (TOTAL HIDDEN COSTS SHARE OF GDP AT THE TOP AND EACH CATEGORY OF HIDDEN COST SHARE OF THE TOTAL HIDDEN COSTS AT THE BOTTOM)**



Karlis Smits, and Vivien Foster, June 2008. World Bank; and Ebinger, J. 2006. Measuring Financial Performance in Infrastructure. Working Paper Series, World Bank, Washington, DC.

<sup>104</sup> Normative losses are that component of total losses that accrue due to system design and technology constraints; they are inevitable and predictable. In Timor-Leste, it is set at 10 percent for this assessment based on the recommendation by Ebinger, 2006.



Source: The World Bank, 2009. Financing Public Infrastructure in Sub-Saharan Africa: Patterns and Emerging Issues.

Note: Annual averages over the period 2001-06. Averages weighted by countries' GDP. Totals may not add up.

**In Timor-Leste, compared to other countries, the share of hidden costs resulting from unaccounted loss (unbilled amount of electricity) was very high, reaching 69 percent of the total value of these hidden costs.** The main determinant of this unaccounted loss is under- or non-metering following the sharp increase in the supply of electricity in 2011-2012. Without meters, it is not possible to know what proportion of electricity generated by the Hera and Betano power plants actually reaches households. So, even legitimate, but non-metered, electricity usage is measured as 'theft' or 'leakage'. In 2007, Timor-Leste's annual electricity system loss stood at 59 percent. Although this figure declined to 36.7 percent in 2011, it increased to 60 percent in 2012, mainly due to the lack of billing in the expanded service areas and the increased reactive power affected by the system expansion.

**The second main contributor to hidden costs is below-cost recovery pricing, largely caused by the very high cost of generating electricity in Timor-Leste.** Finally, while the hidden cost resulting from poor rate of collection of bills is low, very few users are billed, as reflected in the high level of unaccounted losses. With EDTL ramping up the installation of pre-paid meters, the unaccounted loss is expected to be reduced. EDTL needs to ensure that the installation of pre-paid meters includes public buildings, where there are currently no meters and thus no billing, despite the high levels of consumption by these buildings.

### 5.3.2 SPECIFIC ANALYSIS OF EFFICIENCY

#### 5.3.2.1 Choice of generation method, and over-capacity

**The high cost of the subsidization of electricity is driven by generation at high fuel cost, forecast demand growth, and limited cost recovery. These issues require immediate action.** The focus should be on reducing fuel costs, including through the consideration of alternative generation options, measures to reduce losses and, in the longer term, improvements to end-user efficiency, including through greater use of pricing.

**While the choice and sequencing of diesel fuel generation was critical in order to quickly provide power and essential for development, the financial impact of this choice and sequencing was significant.** The urgent need to provide a reliable source of electricity was a major determinant in the selection of the current generation method in Timor-Leste, which provides 256 megawatt of diesel-fired generation for a peak demand of 53 megawatts. However, it is important to recognize the potential alternatives for base load considered at the time.

The Ira Lalaro hydropower option of 28 megawatt capacity was assessed to have a firm capacity of 13 megawatts and an estimated generation average of 189 GWh per year. Updating the 2008 options analysis shows that Ira Lalaro hydro power option had a levelized electricity generation cost of US\$0.07 per kilowatt-hour, with an Economic Internal Rate of Return (EIRR) of 19 percent. The Heavy Fuel Option (HFO) needed to generate an equivalent 189 GWh would have had a levelized electricity generation cost of US\$0.26 per kilowatt-hour, with an EIRR of 16 percent.

Instead, the Government decided to resolve the power supply shortage by sole-sourcing diesel-fired power plants with a total capacity of 256 megawatts through the development of the Hera and Betano power plants in 2010. While these power plants currently run on diesel oil, they may later be converted later to use HFO or natural gas. The Hera power plant became operational in November 2011, while the Betano power plant became operational in August 2013.

**The potential financial savings from alternative renewable base-load options could have been considerable, but may not alone have met the country's urgent needs.** Since the diesel fuel cost was US\$0.24 per kilowatt-hour in 2012,<sup>105</sup> Timor-Leste could have achieved fuel cost savings to a present value of US\$365 million (in 2012 prices) over a period of 25 years, or an annual fuel saving of US\$45.8 million (in 2012 prices), if Timor-Leste had chosen to construct the Ira Lalaro hydropower plant. This means that the Ira Lalaro hydropower plant could complement the diesel-fired power plants, potentially reducing the cost of the 2012 subsidy and of the fuel import bill by nearly half. While essential to integrate into the broad electricity supply strategy, it is also true that the Ira Lalaro plant, with a capacity of 28 megawatts, would not have produced sufficient electricity to meet Timor-Leste's peak demand of 53 megawatts in 2012. Further, while the Ira Lalaro hydropower plant was estimated to have a firm (all year, base-load) capacity of 13 megawatts, it would still be susceptible to the impact of unusual dry

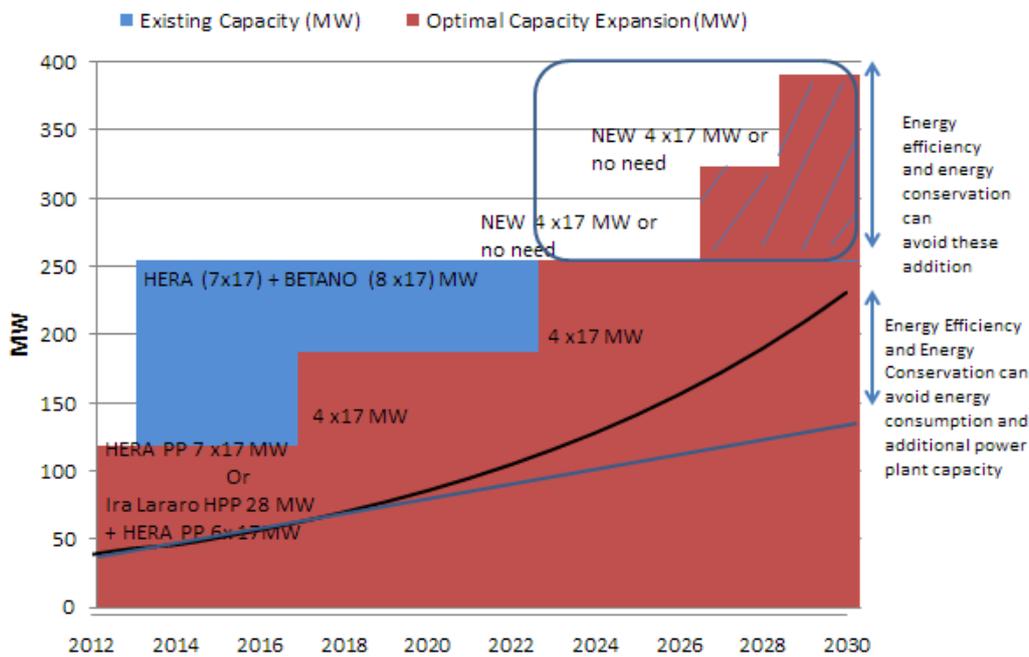
---

<sup>105</sup> Using \$0.969/liter on October 4, 2012 (excluding tax and duties), fuel cost should be \$0.242/kWh using the Hera plant's heat rate of 0.25 liters per kWh.

years or climate change. In short, additional generation capacity to complement the hydropower plant would have still been needed.

Figure 45 illustrates an indicative electricity supply and demand balance based on the annual 9.7 percent rate of growth in demand projected by the Government in the period from 2012 to 2029 under the business-as-usual scenario (indicated by the solid black line); and the lower growth in demand scenario (indicated by the solid blue line), in which the active promotion of energy efficiency and conservation measures may achieve reductions in the level of wasteful energy consumption and in the cost of additional investments in new power plants capacity.

**FIGURE 46: TIMOR-LESTE POWER GRID SUPPLY-DEMAND BALANCE**



In Figure 46, the Hera power plant's addition of 119 megawatts in 2011, using seven generation sets with a capacity of 17 megawatts each, is shown, with the alternative option considered above of the Ira Lararo plant generating for part of the year and six generation sets with a capacity of 17 megawatts each at the Hera power plant. Timor-Leste's existing capacity of 256 megawatts is indicated in blue, being the sum of the capacities of the Hera power plant (7 x 17 MW) and of the Betano power plant (8 x 17 MW). Electricity generation can be considered 'over-capacity' if the capacity is in excess of that needed to meet demand, plus reserve margins (a cushion above the forecasted peak demand). Figure 46 suggests that with the projected annual growth in demand of 9.7 percent, Timor-Leste has invested in over-capacity.

**Alternatively, if the Hera and Betano power plants had been built in phases, nearly US\$97 million (in 2013 prices) of capital expenditure<sup>106</sup> would have been saved.** This implies that roughly 20 percent of the US\$477 million spent on these power plants and on transmission in 2011 could have been saved if the Betano power plant's capacity of 136 megawatts had been phased to 68 megawatts (4 x 17 MW) in 2017, with the addition of another 68 megawatts (4 x 17 MW) in 2023. Comprehensive demand growth forecasts and avoided energy consumptions and costs need to be assessed further. For instance, capacity may be required to attract industry, triggering large increases in demand, although the cost of electricity is a disincentive. However, based on the assumption of an annual rate of growth of 9.7 percent in the period up to 2029, the additional 68 megawatts would only be needed by 2027, with another 68 megawatts in 2029 to maintain the reserve margins.

### ***5.3.2.2 Competitive fuel sourcing***

**The cost of generation could be reduced by sourcing diesel oil through strategic contracting and competitive tendering.** The cost of generation is typically the largest cost component in any diesel-dominant power generation system, contributing to up to 70-80 percent of the total cost of delivering electricity to the end user. Therefore, reducing the cost of generation is usually a major priority in endeavors to reduce the overall cost of providing diesel-generated electricity. Of these generation costs, the cost of the diesel oil is the largest single component, typically contributing to around 80-90 percent of the total cost of generation. In other words, the cost of fuel accounts for two-thirds of the total cost of delivering electricity in a typical diesel-dominant power system.

Broadly, the cost of diesel-based generation has two important 'moving parts', these being: (i) the cost of fuel procurement; and (ii) the level of efficiency of conversion of energy from fuel to electricity, which can be measured in terms of the units of electricity generated for each unit of fuel. To lower the cost of generation, the priority must be on keeping the cost of fuel procurement as low as possible and on keeping the level of efficiency of conversion as high as possible. Once these major cost drivers have been optimized, the non-fuel costs of generation (cost of maintenance, personnel, and all other costs) can be optimized to achieve further savings.

Diesel oil, a relatively expensive fuel, is currently the only form of fuel that Timor-Leste utilizes for the generation of power. Therefore, it is critical that Timor-Leste look at all means to reduce the cost of diesel procurement. As a case study, a recent tender process conducted by the Government is considered here. In September 2012, the Government tendered a contract for the supply of 47 million liters of High-Speed Diesel (HSD)<sup>107</sup> over a six-month period, from 1 November 2012 to 30 April 2013, to be delivered to the existing storage tanks at the Hera

---

<sup>106</sup> Discount rate of an estimated economic opportunity cost of capital (EOCK) of an average value of EOCK for 2008-2010, 11.76 percent. If the cost is adjusted to foreign exchange premium (FEP) of Timor-Leste at 6.7 percent, it will be \$103 million in 2013 prices.

<sup>107</sup> Tender ID No. ICB/024/MPW-2012 issued by the National Procurement Commission on behalf of the RDTL Ministry of Infrastructure to be funded from current year appropriations of Secretary of State for Electricity, Ministry of Public Works.

power plant. The tender was designed to evaluate two elements: (i) the benchmark price for diesel in the East Asia and Pacific region (EAP), which is called Mean of Platts Singapore (MOPS); and (ii) a 'fixed fee', which included all profit, transportation costs, insurance costs, testing fees, customs, all duties and taxes inside and outside of Timor-Leste, and all other operational costs required to deliver the contracted supplies of HSD to the Hera power plant.

We first consider the MOPS component. Diesel, like other fuels, is a commodity and in the East Asia and Pacific (EAP) region is traded through a liquid market in Singapore. The price of diesel in this market reflects the cost of crude oil plus a refiner's margin. As in Timor-Leste, many Asian countries use MOPS as the benchmark for their diesel purchases.<sup>108</sup> However, this cost element was fixed for the six-month life of the supply contract at the level prevailing one week before the bid closing date for the tender. Consequently, the benchmark price of diesel for the six-month contract period was US\$0.804 per liter, resulting in a total MOPS-based cost component of US\$37.8 million. However, diesel is a product of the crude oil refining process, with its regional price basically depending on the underlying price of crude oil. Therefore, like the price of other oil-based fuels, the international price of diesel cannot be predicted, and fluctuated over the six-month contract period. Rather than fix the level of MOPS in advance, it is common for buyers to make fuel payments based on the levels of MOPS realized at specified points in time during the supply contract.

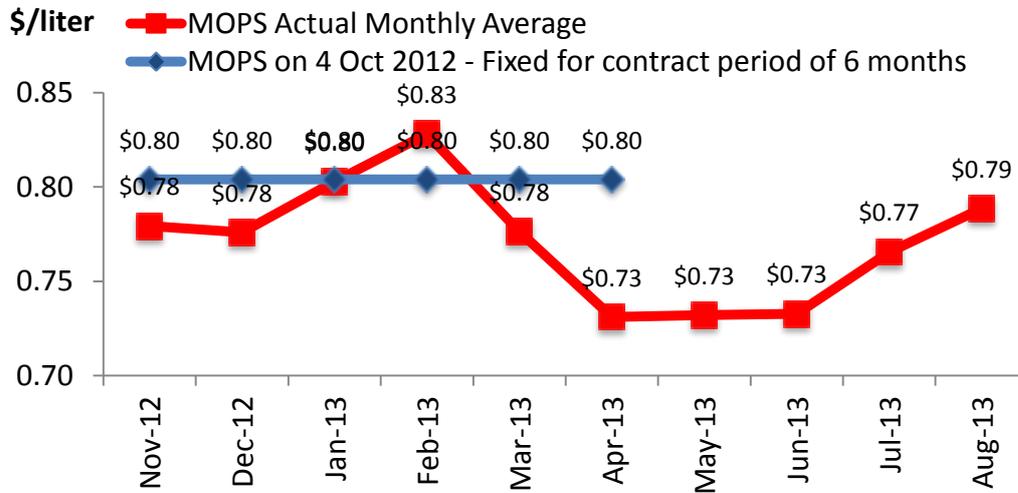
Figure 47 shows the actual monthly average MOPS diesel oil prices in the period from November 2012 to August 2013. During this period, the Government could have achieved savings when the actual average monthly MOPS was below the US\$0.804 per liter price fixed in the contract, had they not fixed the contract. Conversely, the supplier could be seen to have paid out of pocket when the actual average monthly MOPS was above the US\$0.804 per liter price fixed in the contract. Figure 47 shows that if the actual average monthly MOPS had been used, about US\$1 million could have been saved over the six-month contract period, or 2.6 percent of the MOPS-based component of the tender cost. The regional price of diesel is volatile. Since oil is a commodity, the price of oil (and its refined products) does not need to be the source of profit or loss in a supply contract, or of tension between the buyer and the seller.

The analysis above is not meant as a criticism of the current approach, but a suggestion that floating MOPS in the contract could avoid tensions between government and the supplier. Timor-Leste could therefore shift from fuel contracts with pre-fixed MOPS over the entire contract period to contracts that allow payments to be made against actual MOPS. Actual MOPS could be taken as spot or an average, as determined by the contract.

---

<sup>108</sup> MOPS includes the price of crude oil plus the refiner's margin. MOPS is a reasonable proxy for the international prices of oil products in the region because it reflects the market price for petroleum fuels produced in the Asia-Pacific region's refineries. The refineries are typically price-takers for their largest cost element: crude oil purchases. Therefore, MOPS reflects the price of diesel from a refinery which has the 'average efficiency' of the region's refineries.

**FIGURE 47 MOPS: FIXED IN OCTOBER 2012 VS. ACTUAL AND POSSIBLE SAVINGS BY USING ACTUAL MONTHLY AVERAGE MOPS**



	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	Total possible savings if actual MOPS was used
Fixed MOPS	0.804	0.804	0.804	0.804	0.804	0.804	
Actual MOPS	0.779	0.776	0.803	0.828	0.776	0.731	
Difference	0.025	0.028	0.001	-0.024	0.028	0.073	
Liters	7,833,333	7,833,333	7,833,333	7,833,333	7,833,333	7,833,333	
<b>Possible saving</b>	<b>\$193,222</b>	<b>\$219,974</b>	<b>\$11,722</b>	<b>-\$185,583</b>	<b>\$219,476</b>	<b>\$573,623</b>	<b>\$1,032,435</b>

We next consider the fixed cost component. The regional benchmark reflected in MOPS is the base diesel price. All other costs are labeled 'fixed cost' and amount to US\$0.269 per liter in the contract for the period from November 2012 to April 2013. Using this contract as a case study, fixed cost can be divided into three components: (A) transport-related costs; (B) Government taxes and duties; and (C) supplier's costs/profit margin. As Table 28 shows, the fuel price component (MOPS component) of the supply contract constituted about 75 percent of the total value of the contract (or US\$37.8 million). The costs of freight, insurance, inspection, etc., comprised nearly 8 percent of the total value of the contract (or US\$4 million). This leaves some 17 percent of the contract value.

**TABLE 28: COMPONENTS OF NOV 2012-APRIL 2013 DIESEL SUPPLY CONTRACT (LITRES TO BE SUPPLIED UNDER SIX-MONTH CONTRACT PERIOD: 47 MILLION)**

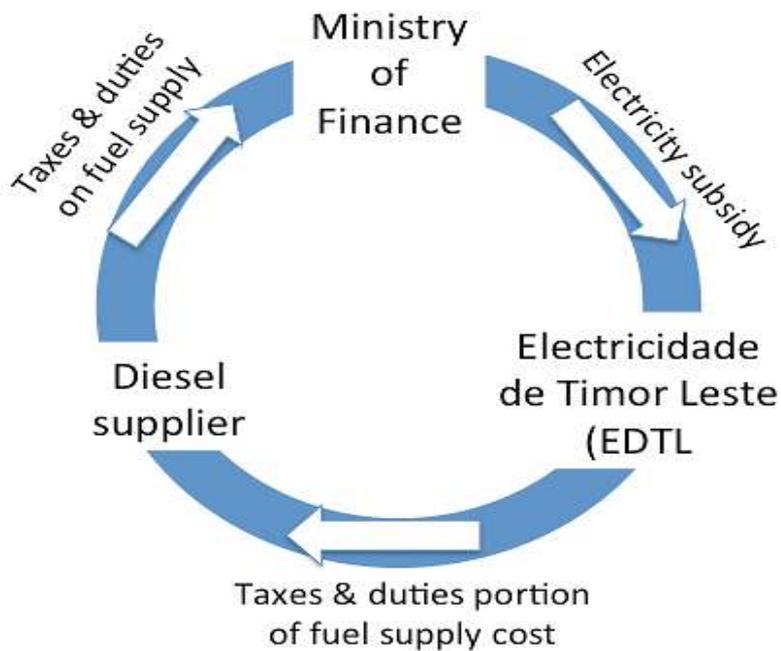
COST ELEMENT	Per liter cost	Total Per liter cost	Value in contract	% of contract value
MOPS fixed at		\$0.804	\$37.8	75.0%

<b>"Fixed fee": elements A, B, and C</b>	<b>A.</b>	<b>Transport-related costs</b>				<b>\$0.085</b>	<b>\$4.0</b>	<b>7.9</b>
			Freight, insurance, inspection, etc.					
	<b>B.</b>	<b>RDTL taxes &amp; duties</b>	Import duty	2.50% of (MOPS+A)	\$0.022			
			Sales tax	2.50% of (MOPS+A)	\$0.022			
			Excise	\$0.06 per liter	\$0.060			
			<b>Total for B</b>			<b>\$0.104</b>	<b>\$4.9</b>	<b>9.7</b>
	<b>C.</b>	<b>Supplier's costs &amp; profit margin</b>	Operational costs		\$0.035			
			Financial costs		\$0.020			
			Profit margin		\$0.025			
			<b>Total for C</b>			<b>\$0.080</b>	<b>\$3.8</b>	<b>7.5</b>
<b>Total for "Fixed fee" components</b>						<b>\$0.269</b>	<b>\$12.6</b>	<b>25.1</b>
<b>Total cost = MOPS + "Fixed fee"</b>						<b>\$1.073</b>	<b>\$50.4</b>	<b>100</b>

Note: Totals may not match due to rounding

The larger component of the fixed cost is due to Government taxes and duties, which account for nearly 10 percent of the contract value (or US\$4.9 million), including import duty of 2.5 percent; sales tax of 2.5 percent; and excise duty of US\$0.06 per liter on this imported diesel oil. However, the resulting cost of the imported diesel oil is borne by the Government itself, since the Government has to cover EDTL's financial gap in providing electricity. This means that, under the Nov 2012-Apr 2013 diesel supply contract, about 10 percent of the Government's payment for diesel supply was intended to be returned by the diesel supplier to the Government. A simple graphic (see Figure 48) shows how the taxes and duties component of the diesel cost would be paid by the Ministry of Finance (MoF) to EDTL as part of the electricity subsidy payment. In turn, EDTL would pay this portion of the diesel cost to the fuel supplier. Finally, the fuel supplier would pay the same amount to the MoF. Therefore, it is recommended that payments on such diesel supply contracts be made net of the taxes and duties to keep the cash outflows for the electricity subsidy lower. It is important to note that this recommendation is purely about cash flows, and must not be understood to be some form of tax exemption.

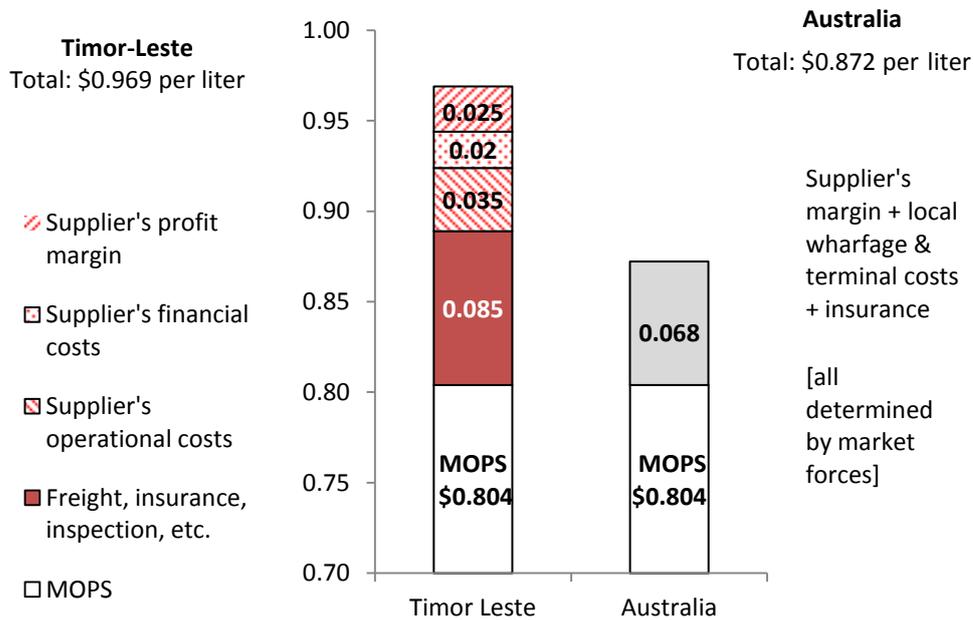
FIGURE 48 FLOW OF TAXES AND DUTIES IN-BUILT IN FUEL COST



The two non-tax components of the 'fixed fee', the transport-related costs (A) and the supplier's cost/profit margin (C), are best determined by market forces. A useful comparator for these costs can be taken from the Australian fuel market, which also uses MOPS as its reference fuel price and allows all other components of its retail fuel costs except taxes and duties (A+C) to be determined by competitive market forces on a daily basis. Figure 49 shows that, on 4 October 2012, the total wholesale cost of diesel in Australia (excluding taxes and duties) was an estimated US\$0.872 per liter<sup>109</sup> compared to US\$0.969 per liter in Timor-Leste.

<sup>109</sup> The cost of insurance, local wharfage & terminal costs, and a wholesale supplier's margin represent 5 percent of the total wholesale price of diesel in Australia. The remaining 95 percent is MOPS diesel plus shipping costs plus Australian taxes. (Source: section titled Wholesale Diesel Prices in the Australian Petroleum Institute's *Facts about Diesel Prices and the Australian Fuel Market*, page 2). ([http://www.aip.com.au/pricing/facts/Facts about Diesel Prices and the Australian Fuel Market.htm](http://www.aip.com.au/pricing/facts/Facts%20about%20Diesel%20Prices%20and%20the%20Australian%20Fuel%20Market.htm)). The total wholesale price of diesel in Australia on 4 October 2013 is from <http://www.aip.com.au/pricing/tgp.htm>

**FIGURE 49 COMPARISON OF WHOLESALE COSTS OF IMPORTED DIESEL ON 4 OCTOBER 2012  
(EXCLUDING TAXES & DUTIES)**



Since MOPS diesel is common to both Australia and Timor-Leste, the costs of shipping, insurance, port costs at the receiving country's port, wholesale supplier's margin, etc., can be compared. For the six month contract for the period from November 2012 to April 2013, Timor-Leste fixed these costs at US\$0.165 per liter on 4 October 2013, while in Australia these costs were US\$0.068 per liter on that date. The Australia number represents an average for diesel delivered at seven ports around the Australian continent (Sydney, Melbourne, Brisbane, Adelaide, Perth, Darwin, and Hobart). For the six-month contract under consideration, the difference in the cost of delivery for 47 million liters of diesel at the Australian cost compared to the Timor-Leste cost would be US\$4.6 million.<sup>110</sup> The Australian cost is achievable due to international competition at every stage of the diesel import value chain and to scale effects due to larger orders.

The analysis above is not meant to provide a conclusion on whether TL has overpaid for Transport-related costs and supplier related costs/profit margin, but to suggest that the government reviews its tender processes for the wholesale import of diesel. This would ascertain if international competitive pressures are being effectively incorporated into the procurement process. Timor-Leste may be able to reduce its cost by effectively applying international competitive bidding for diesel import tenders.

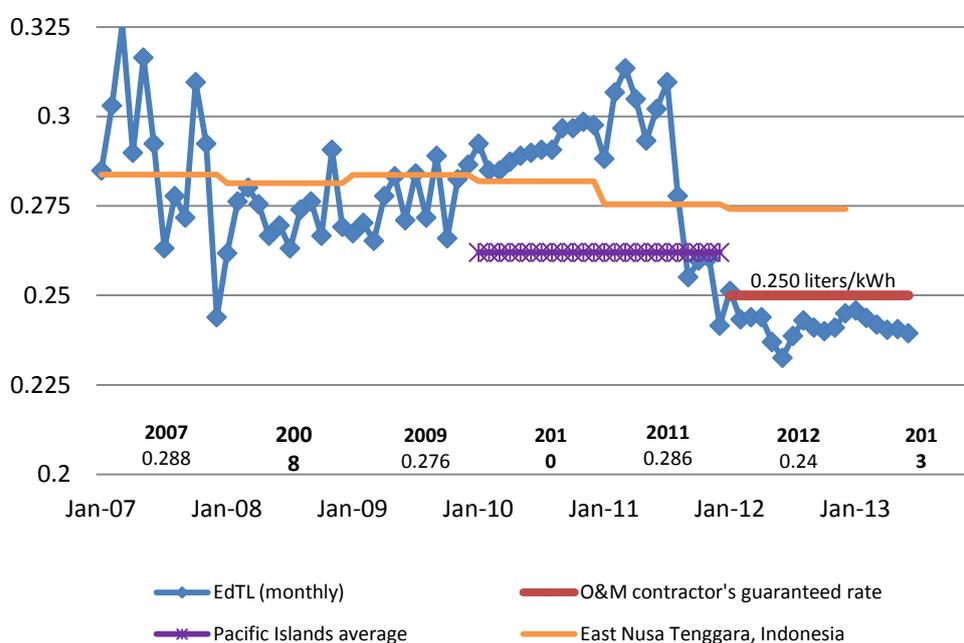
<sup>110</sup> Estimated difference = 47 million liters of diesel x (Timor-Leste cost of \$0.165 per liter minus Australia cost of \$0.068 per liter)

### 5.3.2.3 Efficient conversion of fuel to electricity

#### Replacing Comoro plant with Hera has improved generation efficiency

After the cost of fuel, the key driver of the cost of generation is the rate of conversion efficiency of the generation plant. If the generation plant produces less units of electricity from each liter of fuel, the unit cost of the electricity generation (in US cents per kilowatt-hour) is higher, and vice versa. In late 2011, Timor-Leste improved its level of fuel efficiency by installing the new 119 megawatts plant at the Hera power plant, which was significantly more efficient than the ageing Comoro power plant. Figure 50 shows the positive impact of this measure, with comparators of diesel generation efficiency in average and median for the Pacific Island countries and East Nusa Tenggara (Indonesia). EDTL's rate of conversion efficiency has improved by about 17 percent after the Hera power plant replaced the Comoro power plant in late 2011. The Hera plant is newer than the Comoro power plant, and was commissioned in November 2011. The Hera power plant has a larger capacity (119 MW) than the Comoro power plant (32 MW rated capacity in 2009). This 17 percent improvement in fuel efficiency reduced the cost of generation and therefore the cost of the subsidization of electricity.

**FIGURE 50 EDTL'S FUEL GENERATION EFFICIENCY HAS IMPROVED (LITERS OF DIESEL CONSUMED FOR GENERATING EACH KILOWATT-HOUR)\***



Notes: \*1 liter of high-speed diesel weighs 0.832 kilograms.

Source: Bank staff estimates from data of EDTL, Indonesia Perusahaan Listrik Negara (PLN, State Electricity Company) and Pacific Power Association (PPA) (2013).

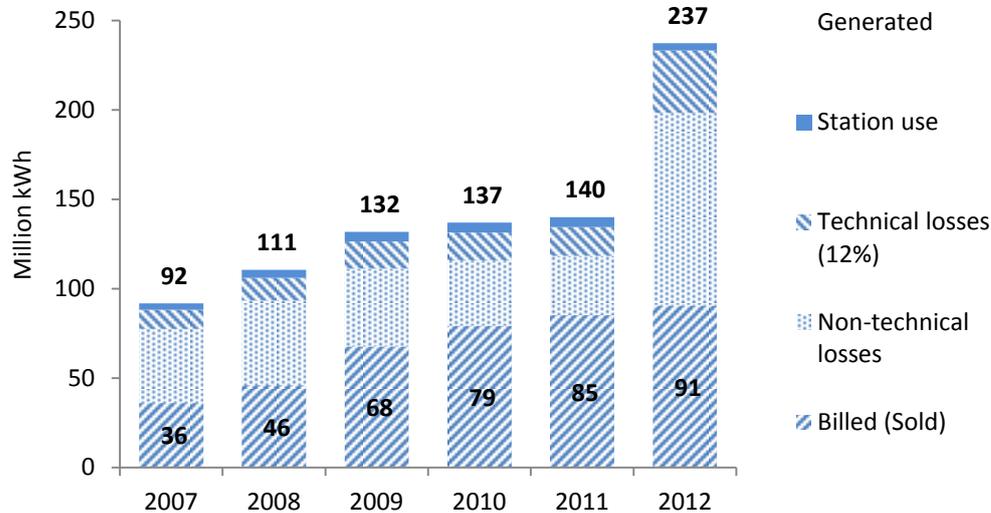
The operations and maintenance contractor for the Hera power plant is required to guarantee that the level of fuel efficiency remains high, and is subject to penalties if the conversion rate exceeds 0.25 liters per kilowatt-hour (or 208 grams per kilowatt-hour). This compares favorably with the average conversion rate among Pacific Island nations in the period from 2010 to 2011, which was above 0.26 liters per kilowatt-hour, although it should be noted that size of generators in Pacific Islands is on average much smaller than the Hera and Comoro power plants. So far, the contractor has been able to achieve this target. At this stage, the peak level of electricity demand in Timor-Leste (about 53 MW) is far below the Hera plant's capacity of 119 megawatts. As the demand rises, the fuel efficiency of the Hera plant is expected to improve slightly. The Government should monitor the contractor's performance in terms of this efficiency target.

#### ***5.3.2.4 Non-Technical Losses***

**The Hera power plant expanded service dramatically in 2012. At this point, non-technical losses also increased significantly, mainly because the expansion was not metered, let alone billed.** EDTL generated some 237 million kilowatt hours of electricity in 2012. Of this, only 91 million kilowatt hours was billed by EDTL to its metered customers. This means that the proportion of electricity reported as sold was only 38 percent of the total of the electricity generated. It is important to account for the rest of EDTL's electricity. Figure 51 shows the estimated uses of the electricity generated by EDTL in the period from 2007 to 2012 and the increase in both technical and non-technical losses in the period from 2011 to 2012.

The 'station use', or own consumption, of the Comoro power plant was estimated by EDTL to reach 4 percent of the total generated electricity in the period from 2007 to 2011. In an important improvement, the Hera power plant's own consumption is reported to be an average of 1.7 percent of the electricity generated. Therefore, in 2012, station use is estimated to be 1.7 percent of the 237 million kilowatt hours generated, or a total of approximately 4 million kilowatt hours.

**FIGURE 51 GENERATION & USE OF EDTL'S ELECTRICITY 2007-2012**



Source: EDTL

For the period from 2007 to 2011, EDTL has estimated its technical losses<sup>111</sup> to be 12 percent of the total volume of electricity delivered to the transmission and distribution network. This estimated figure also applies to the total volume of electricity generated in 2012, or 35 million kilowatt hours. The rest of EDTL generation of some 237 million kilowatt hours of electricity in 2012, which amounts to about 108 million kilowatt hours, would fall under the category of non-technical losses, which are typically a mix of electricity theft and inadequate measurement (under- or non-metering) of electricity.

It is difficult to determine the exact portions for each element of non-technical losses, but a large portion of these losses was attributable to the expansion of service without corresponding metering and billing. EDTL, with support from the World Bank, introduced measures, including meters, to reduce the annual system loss from 59 percent in 2007 to 37 percent in 2011. The system loss increased to 62 percent in 2012. This happened because the Hera power plant expanded services without commensurate billing data (due to the lack of meters), particularly outside Dili. This means that data on the amount of power being generated is not reflected in the amount of power received by users. Therefore, this was

<sup>111</sup> Electricity is a form of energy. When it passes through wires, transformers, and other equipment in a transmission and distribution (T&D) network, some of the energy gets converted to heat and is lost. Such losses are called technical losses and are usually measured as a percentage of the electricity delivered to the T&D network. Technical losses can generally be reduced by optimizing the transmission and distribution systems to the load but a minimum level of technical losses is unavoidable. The best electric utilities in the world have technical losses of a few percent (e.g., Chilectra of Chile 4 percent, Electricity de France 7 percent, etc.). The better utilities in the developing world typically have technical losses of 8-12 percent (e.g., Indonesia Perusahaan Listrik Negara (PLN, State Electricity Company) 9.4 percent).

recorded as an increase in non-technical losses. We look at the non-technical losses in greater detail below.

First, in 2011, it is estimated by EDTL that non-technical losses amounted to approximately 33 million kilowatt hours. In all likelihood, these losses were due to the combined impact of electricity theft and under-metering or non-metering in the network that existed at the time. EDTL had been successful in reducing the volume of non-technical losses from 47 million kilowatt hours in 2008 to 33 million kilowatt hours in 2011. A similar level of non-technical losses can be assumed to have occurred in 2012. This 33 million kilowatt hours accounts for a third of the total volume of non-technical losses in 2012, which amounted to 108 million kilowatt hours.

Second, EDTL had about 43,000 customers in 2012. Of these customers, EDTL had installed pre-paid meters in about 15,000 cases. At the same time, the Government pursued a vigorous electrification campaign, with about 100,000 households having been connected to the electricity grid by mid-2013. These additional 57,000 customers are under-metered or un-metered. Under the Government's plan to provide universal 24-hour access to electricity, these customers have also benefited from the significantly larger generation capacity brought on-line in late 2011 with the commissioning of the Hera power plant. Some portion of what are referred to as non-technical losses here is the consumption of electricity by these consumers.

Finally, EDTL reports that it conducted load-shedding for about 2,100 hours in each year of 2010 and 2011, or a quarter of the total number of hours in each year. This indicates a suppressed demand that existed before the Hera power plant came on-line with its additional capacity. However, the volume of energy billed by EDTL in 2012 was only 5 percent higher than that in 2011. When this suppressed demand was served by the Hera power plant's additional capacity, it seems to have accounted for some of the additional non-technical losses.

The large load inflows resulting from the commissioning of the Hera power plant would also have increased the technical losses. Nevertheless, it can be observed that the system losses have been dramatically reduced in spite of the tariff increases.

Beyond considerations of operational costs, the maintenance of an adequate level of service quality to meet rising demand is critical if EDTL is to support economic growth in Timor-Leste. Currently, EDTL's distribution system struggles to keep up with growing demand. For example, transformer burnouts are common in areas where the electricity load has risen at a faster rate than the upgrade of the distribution network. The optimization of the distribution network is required to reduce power cuts due to such reasons.

#### ***5.3.2.5 Pricing and cost recovery***

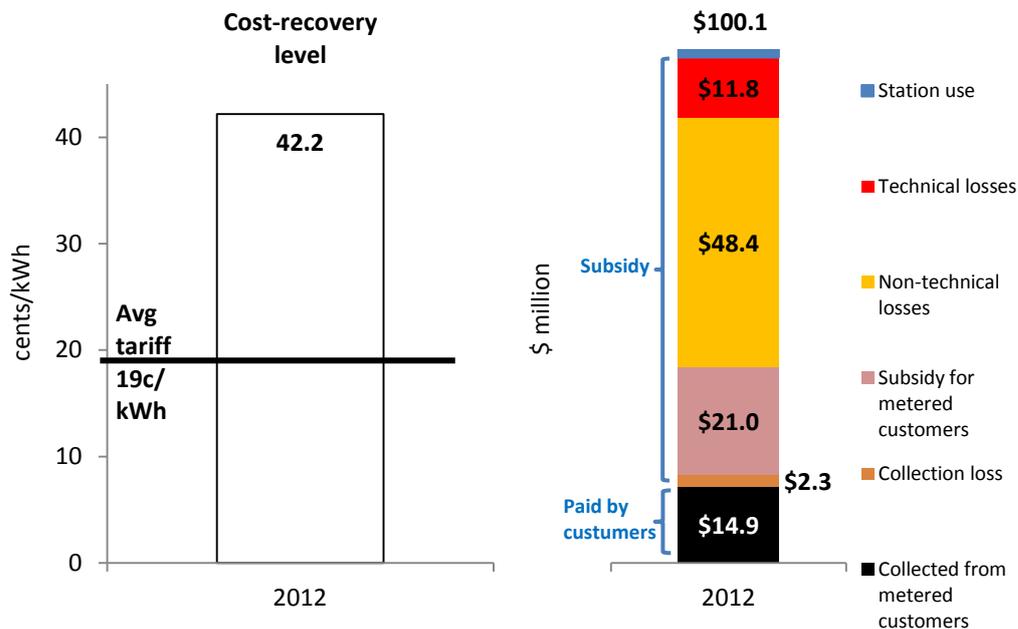
**Diesel-based operational costs are too high to be fully recovered from consumers. However, the large volume of unaccounted electricity means the Government is unable to design an efficient and equitable subsidy and tariff regime.**

Timor-Leste's reliance on diesel oil to generate electricity means that the cost of electricity service is very high. In most countries, it would be difficult to recover the entire cost of purely diesel-fired generation from electricity consumers, based on their ability to pay. Given the low average per capita income of EDTL's private customers and the cost disadvantages to commercial consumers, the full recovery of this cost would be very challenging. In 2012, EDTL's operational costs totaled US\$100.1 million (\$95.3 million for fuel; US\$1.8 million for salaries; US\$1.8 million for non-fuel goods and services; and US\$1.8 million for minor capital development).<sup>112</sup> These operational expenditures were incurred to generate 237 million kilowatt hours. Therefore, the operational cost of electricity service delivery by EDTL is estimated at US\$0.422 per kilowatt-hour in 2012. By comparison, the average tariff was about US\$0.19 per kilowatt-hour. As shown in Figure 51, this seems to indicate that about 45 percent of the cost of electricity service delivery could have been recovered from customers in 2012 with a subsidy equivalent to 55 percent of actual costs provided to the average electricity consumer. However, in practice, as shown in Figure 52, only about 14.9 percent of the cost of electricity service delivery was recovered from customers in 2012. As stated previously, this was primarily due to under-metering or non-metering of customers, and therefore the lack of opportunity to bill them for the electricity they received.

---

<sup>112</sup> Major capital development expenditures of \$5.0 million for EDTL in 2012 are not included here since only operational expenses are being presented.

**FIGURE 52 COST VS. TARIFF 2012 AND WHAT THE SUBSIDY FUNDED IN 2012**



Source: EDTL

Out of the total 237 million kilowatt hours generated, only 91 million kilowatt hours (38 percent) was billed to EDTL consumers. If the entire cost (\$0.422 per kilowatt-hour) of these 91 million kilowatt hours were charged to customers, EDTL would have collected about US\$38 million from its customers. But these 91 million kilowatt hours were billed at an average of US\$0.19 per kilowatt-hour, yielding a possible US\$17.2 million of revenue in 2012. The remaining US\$21 million was the implicit subsidy allocated to these EDTL customers. However, in actuality, the entire US\$17.2 million of revenue was *not* collected by EDTL in 2012. The total value of actual collections was only US\$14.9 million, leading to a collection loss of US\$2.3 million, due to the inability of the utility to collect bills or due to irregularities. As discussed in the previous section, station use accounted for US\$1.7 million, while technical losses accounted for US\$11.8 million. The remaining US\$48.4 million is the cost of the non-technical losses among the unaccounted losses (theft, non/under metering, etc.). This significant amount could be recovered through the implementation of adequate metering, billing and collection systems.

A survey among households in the Babulo, Leorema and Aidabaleten Sucos conducted for the Rural Electrification Master Plan Updates in 2007<sup>113</sup> indicates that average household expenditure on kerosene is close to US\$5 per month. In addition, the average household spends US\$2-3 on dry cell batteries and US\$2.5-3 on candle lights. The families that

<sup>113</sup> Ministry of Natural Resources, Minerals and Energy Policy of Timor-Leste, 2007. Rural Electrification Master Plan Timor-Leste Update Rural Electrification Master Plan Report. Prepared by the Norplan. October, 2007

participated in the survey indicated their willingness to pay around US\$3 per month for electricity. Most families said they would use electricity for 2-5 lights at night, with some families indicating that they would use it also for radio, television and mobile phones. These levels compare favorably with the US\$1 per month expenditure by households consuming below the 20 kilowatt hours per month lifeline tariff. It also compares favorably with a US\$2.5 per month expenditure of lifeline consumers if the lifeline is raised to 50 kilowatt hours per month as analyzed below. Such households are being electrified, and metering these households could help generate additional revenue without exceeding the level that they are willing to pay.

If in 2012, all users of EDTL's electricity service were metered, the black bar in Figure 52 ('Collected from metered customers') may have been only slightly larger, considering that customers paid 19 cents per kilowatt-hour for electricity that cost 42 cents per kilowatt-hour to deliver. However, the pink bar ('Subsidy for metered consumers') would have been larger and the yellow bar ('Non-technical losses') would most likely have been smaller.

Therefore, it is crucial to complete the installation of 70,000 additional pre-paid meters, as mandated by the MPW's Action Plan for 2014-2017. This should include the installation of such meters in public buildings, where levels of electricity consumption are high. Even if significant subsidies are provided to electricity consumers in Timor-Leste, all consumers should be brought into EDTL's consumer database and every kilowatt-hour being generated should be accounted for. This would allow for an accurate assessment of the level of benefit the electricity subsidy is providing, and to which consumers. The installation of meters for all those using EDTL's electricity service is a high priority and should be implemented to gain a better understanding of the explicit and implicit subsidy and to design a more suitable tariff structure. Electrification can be accompanied by consumer education campaigns on the actual cost of electricity services and the benefit and measures of energy efficiency and conservation.

**Tariff restructuring that would enable a greater number of small consumers to pay less while requiring large users to pay more could result in an increase in revenues. However, the greatest gains would come from the expansion of metering and billing.**

It is critical to conduct an analysis of the consumption patterns of EDTL's customer base and of the tariff structure in Timor-Leste to identify which customer category could pay more and which ones must be protected from higher electricity costs. To pursue this, a study of the June 2013 consumption data of all 14,623 EDTL customers with pre-paid meters (about a third of EDTL's 38,728 residential customers at the time) was conducted. Timor-Leste's metered tariff structure (see Table 29) divides residential customers into only two categories: those consuming up to 20 kilowatt hours per month (charged at US\$0.05 per kilowatt-hour, the 'lifeline tariff') and those consuming more than 20 kilowatt hours per month (charged US\$0.12 per kilowatt-hour). Given EDTL's cost of delivering electricity service is at US\$0.422 per kilowatt-hour, all residential customers benefit from the implicit subsidy. In the sample under consideration, the majority of customers were consuming more than 20 kilowatt hours per month.

The Government is subsidizing the installation of meters. New customers are charged US\$10 including connection and the installation of a master circuit breaker (MCB) for monthly payment based on ampere (see Table 29) or conventional meters. In most cases, especially in the rural areas, the MCB-type meter is installed. However, a verification process to determine the consistency of the collection of US\$10 charge and the actual amount collected is ongoing. The actual cost of connecting and installing an MCB meter is US\$83, including US\$45 for conductors and other equipment, and US\$25 for conventional meter (\$69 for a pre-paid meter) (World Bank 2012; 2013).

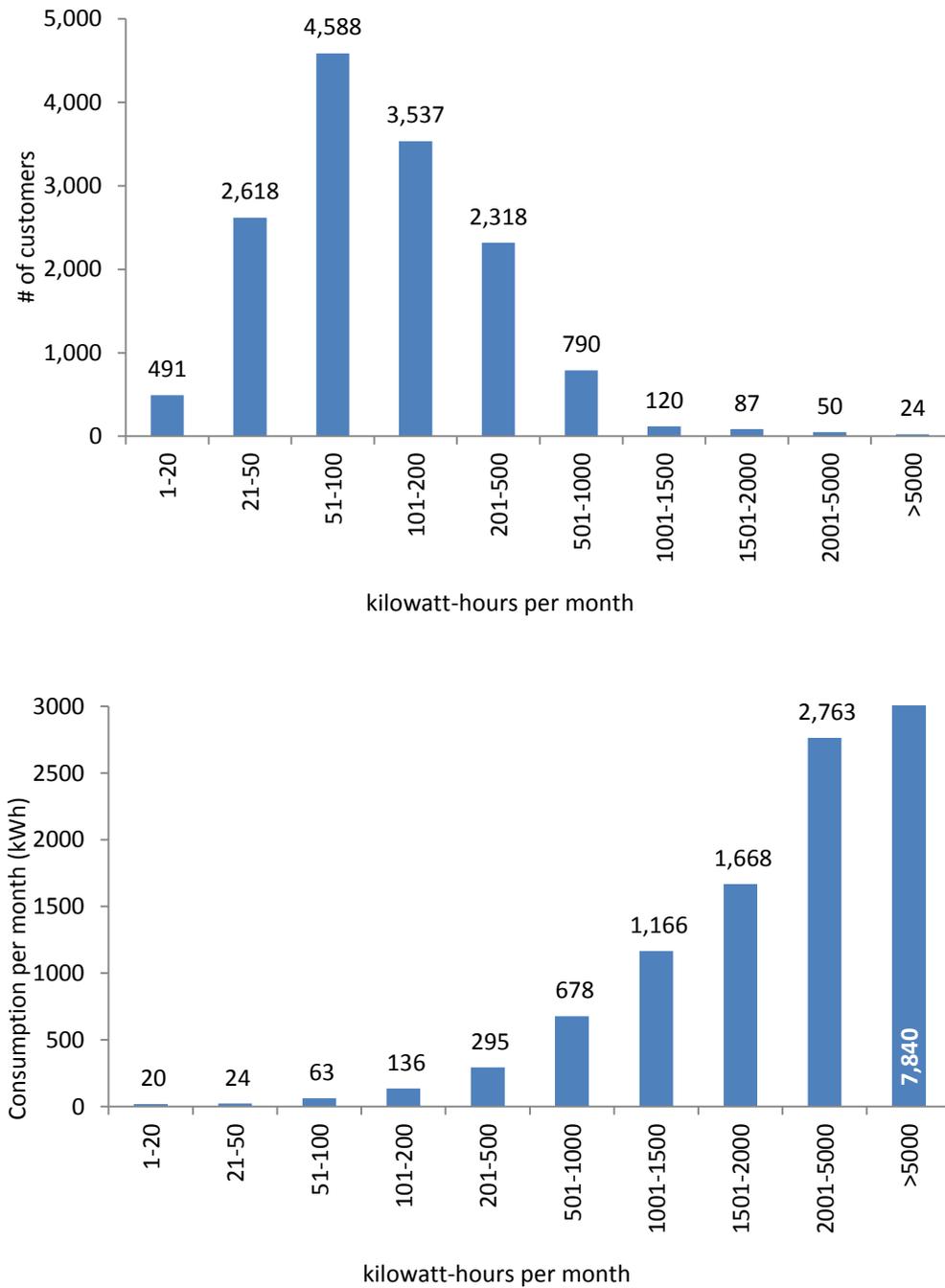
**TABLE 29: TIMOR-LESTE’S TARIFF STRUCTURE FOR RESIDENTIAL HOUSEHOLDS (LEFT) AND AMPERE BASED MONTHLY PAYMENT (USD) FOR ELECTRICITY SERVICE (RIGHT)<sup>114</sup>**

Tariff Category	Tariff USD per kilowatt-hour	Distribution by number	Distribution by kilowatt hours billed		6 hours	12 hours	18 hours	24 hours
Up to 20kilowatt hours/month	0.05	3%	0.3%	2A	2.25	3.00	4.50	6.00
>20kilowatt hours/month	0.12	97%	99.7%	4A	4.50	6.00	9.00	12.00
				6A	6.00	7.50	11.25	18.75

There is a need to more accurately assess the level of consumers’ ability to pay for electricity services to enable the optimal recovery of the cost of electricity supply services. Since the monthly level of household electricity consumption is a good proxy for the economic status of a household, an investigation into monthly electricity consumption should provide an indication of households' ability to pay. A simple histogram of the customers in the sample (see Figure 53) shows that some 93 percent of these residential customers consumed less than 500 kilowatt hours per month in June 2013, with most customers using very little. The customers using up to 20 kilowatt hours per month most probably use only four 15 watt compact fluorescent lights (CFLs) (see Figure 53). The customers using 21 to 50 kilowatt hours per month most probably use four 15W CFLs and a fan. At the other end of the spectrum, the customers using more than 2,000 kilowatt hours per month most probably had more than one air-conditioner running all month. But these customers pay the same tariff as the consumers in all other categories except those with the very lowest level of usage. This analysis shows that there is a wide variation in the patterns of consumption amongst customers using more than 20 kilowatt hours per month. In particular, the 281 biggest consumers consumed more than 16 percent of the total electricity delivered to household consumers with pre-paid meters that month, while paying the same as all but the smallest consumers. This wide variation in the pattern of usage indicates that there is some room for price differentiation within the consumption range above 20 KWh per month.

<sup>114</sup> Data from EDTL in preparing an Implementation Completion and Results Report (ICR) of Timor-Leste Gas Seep Harvesting Project (Data required for Gas Seep ICR).

**FIGURE 53 DISTRIBUTION OF 14,623 SAMPLE EDTL CUSTOMERS BY CONSUMPTION CATEGORY (TOP) AND CUSTOMER DISTRIBUTION BY CONSUMPTION CATEGORY (BOTTOM) IN JUNE 2013**



Source: EDTL

Two illustrative options for tariff structures were developed to estimate how much more revenue could be collected without placing a burden on those consuming at the lowest levels. The threshold for the 'lifeline' tariff was increased from 20 kilowatt hours per month to 50

kilowatt hours per month to allow more customers to enjoy the lower tariff level of US\$0.05 per kilowatt-hour under both options. For those consuming more than 1,000 kilowatt hours per month (who are unlikely to be poor), each option added a couple of tariff categories: 1,001-2,000 kilowatt hours per month, 2,001-5,000 kilowatt hours/month, and over 5,000 kilowatt hours per month. These categories (which comprise only 2 percent of the customers in the sample), were assigned higher tariffs to allow a higher level of cost recovery from them. Option B assigns a full cost-recovery tariff to customers consuming over 5,000 kilowatt hours per month. The results show that estimated additional revenue of US\$1 million per year could be achieved with option A and an additional US\$2 million with option B (see Table 30).

**TABLE 30: TARIFF STRUCTURE-ILLUSTRATIVE OPTIONS A AND B (US\$)**

Option A		
Tariff category	Tariff cents per kilowatt-hour	% of customers
Up to 50 kilowatt hours/month	5	21
51 - 1,000 kilowatt hours/month	12	77
1,001-2,000 kilowatt hours/month	15	1.4
2,001-5,000 kilowatt hours/month	20	0.3
Over 5,000 kilowatt hours/month	32	0.2

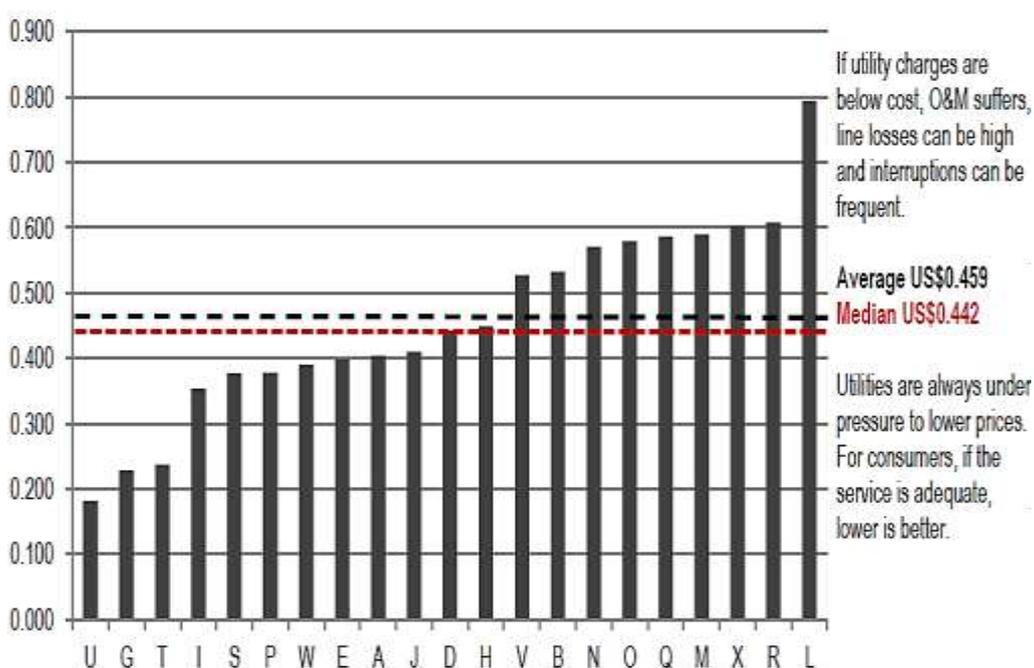
Option B		
Tariff category	Tariff cents per kilowatt-hour	% of customers
Up to 50 kilowatt hours/month	5	21
51 - 1,000 kilowatt hours/month	12	77
1,001-2,000 kilowatt hours/month	15	1.4
2,001-5,000 kilowatt hours/month	30	0.3
Over 5,000 kilowatt hours/month	42	0.2

Additional revenue: US\$1 million per year    Additional revenue: US\$2 million per year

A higher degree of dependence on diesel power plants essentially requires high tariffs; below-cost recovery levels; and/or less than 24 hours of power per day. Many Pacific Island countries are similarly dependent on imported diesel-fired power plants, with many imposing much higher tariffs, with the average tariff standing at US\$0.459 per kilowatt hour and the median tariff standing at US\$0.442 per kilowatt hour in 2011, with some utilities charging as much as US\$0.8 per kilowatt hour, compared to Timor-Leste's average tariff of US\$0.19 per kilowatt hour (see Figure 54). Even the higher tariffs imposed by Pacific Island countries are below the actual cost of providing electricity services. These Pacific Island countries are introducing more renewable forms of energy due to the increasing prices of imported fuel and their volatility.

Renewable energy fed into all grids, totaling 26 per cent of generation in 2011 (22 per cent fed into the main grid in 2010) in the 22 utilities in the Pacific Island countries. Seventeen of the 22 utilities remain almost entirely dependent on petroleum in 2011, with fuel costs accounting for up to 78 per cent of the cost of electricity provision in one case. Tuvalu ambitiously aims to achieve 100 percent renewable energy generation and a 30 percent improvement in energy efficiency by 2020. Other measures are to use HFO or residual fuel oil, which are cheaper than diesel fuel, but which may involve some adjustment costs due to the necessary modification of the power plants and which may also involve higher operations and maintenance costs. Examples of jurisdictions that have implemented this form of electricity generation include Hawaii and Guam.

**FIGURE 54: PACIFIC ISLANDS COUNTRIES AVERAGE TARIFF IN 2011**



Source: PPA, 2013

It is important to bear in mind that perhaps except in the cases of a number of small countries, in many, countries, especially island nations, diesel-fired power plants are limited to serve as peaking capacity. In many of these cases, the generation mix is more diversified, with a much lower levelized power generation cost and with expensive diesel fuel contributing a lower share of total costs. While the cost of providing electricity service is specific to each country's resource endowments and while each country's tariff scheme is influenced by many other factors, including widely varying social, political, and environmental factors, there is a clear tendency for countries to rationalize tariff rates; to make the rates more transparent; and to set the cost recovery tariff. In particular, driven by rising fuel prices, many countries have implemented measures to promote energy efficiency, to improve supply- and demand-side management, and to conserve energy, leading to lower costs and tariffs than in the case of countries dependent on diesel-fired power plants.

By comparison, in Indonesia, where per capita GDP is more than three times that of Timor-Leste's, the average tariff is about US\$0.08 per kilowatt-hour. In 2011, more than 40 percent of Indonesia's generation mix consisted of domestic, relatively low cost coal-fired power plants, with the remainder consisting of gas, oil, hydro, and geothermal power generation systems (International Energy Agency, 2013a). In Vietnam, in 2014, the tariff is US\$0.08 per kilowatt-hour, which will be increased to US\$0.091 by 2015. In 2014, the tariff more or less covers operational expenses and financing costs, but does not cover capital expenditures. In Vietnam, in 2010, about 27 percent of total generation was from hydro power, with the remainder being derived from gas, coal and oil systems. On the other hand, in the Philippines, in 2014, the tariff is about US\$0.35 per kilowatt-hour, with more than 30 percent of its generation mix in 2011 consisting of imported coal fired power, with another 30 percent being derived from gas systems, the final 30 percent being from hydro and geothermal systems, and with the remaining 10 percent utilizing imported oil (IEA, 2013a).<sup>115</sup>

#### **5.4 DIVERSIFYING THE GENERATION MIX TO REDUCE COSTS**

**The diversification of the power generation mix could reduce the cost of provision of electricity service, and hence the cost of its subsidization.** Timor-Leste may wish to look at another option to reduce the gap between the actual cost of provision of electricity service and the value of collected tariffs by diversifying the generation mix. For instance, if US\$630 million is to be spent on diesel to generate electricity in the period from 2013 to 2017 and if the average bill for diesel to generate electricity beyond this period remains close to US\$100 million a year, a complementary solar farm could become an economically justifiable addition to Timor-Leste's power generation system.

In Figure 55, screening curves and levelized power generation costs illustrate indicative<sup>116</sup> alternative options to complement the Betano and Hera power plants.<sup>117</sup> The analysis is based on the addition of the solar power plant and the wind power plant listed in MPW's Action Plan for 2013-2017 and on available data for the Hera and Betano power plants, the Ira Lararo hydro power plant and fuel conversions from diesel to HFO or residual oil at the Hera and Betano power plants. The latter will require adjustment costs and higher operations and maintenance costs.

Based on the indicative levelized costs estimates illustrated in Figure 55, Figure 56 illustrates indicative generation costs for various generation mix options for 2015 and 2020, based on the Government's estimate that the average annual rate of increase in the demand for electricity will stand at 9.7 percent. Additional solar power of 6 megawatts (consisting of three sets of 2 megawatts and excluding four small sets of 50KW) and wind power of 16 megawatts have

---

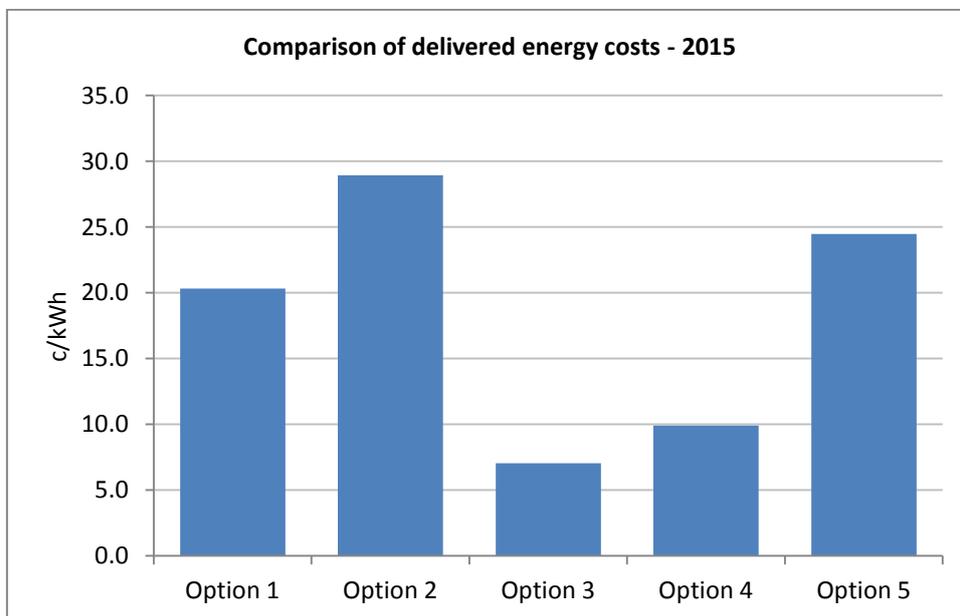
<sup>115</sup> Sources: [http://en.wikipedia.org/wiki/Electricity\\_pricing](http://en.wikipedia.org/wiki/Electricity_pricing); <http://business.inquirer.net/155363/meralcos-generation-charge-to-rise-by-record-p3-4kwh>

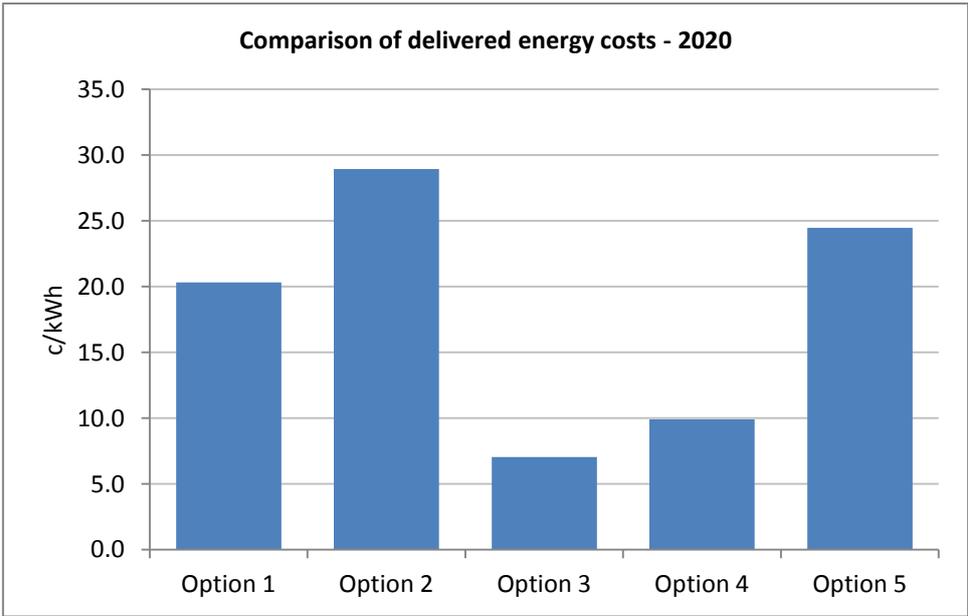
<sup>116</sup> More comprehensive analyses of the costs of conversion to other fuels, electricity demand growth, avoided demand from energy efficiency and energy conservation measure and the least cost electricity system need to be conducted to establish the diversification options reliably.

<sup>117</sup> Data obtained from the World Bank Energy Sector Management Assistance Program (ESMAP) Model for Electricity Technology Assessments 2012 and available data for Timor-Leste were incorporated.

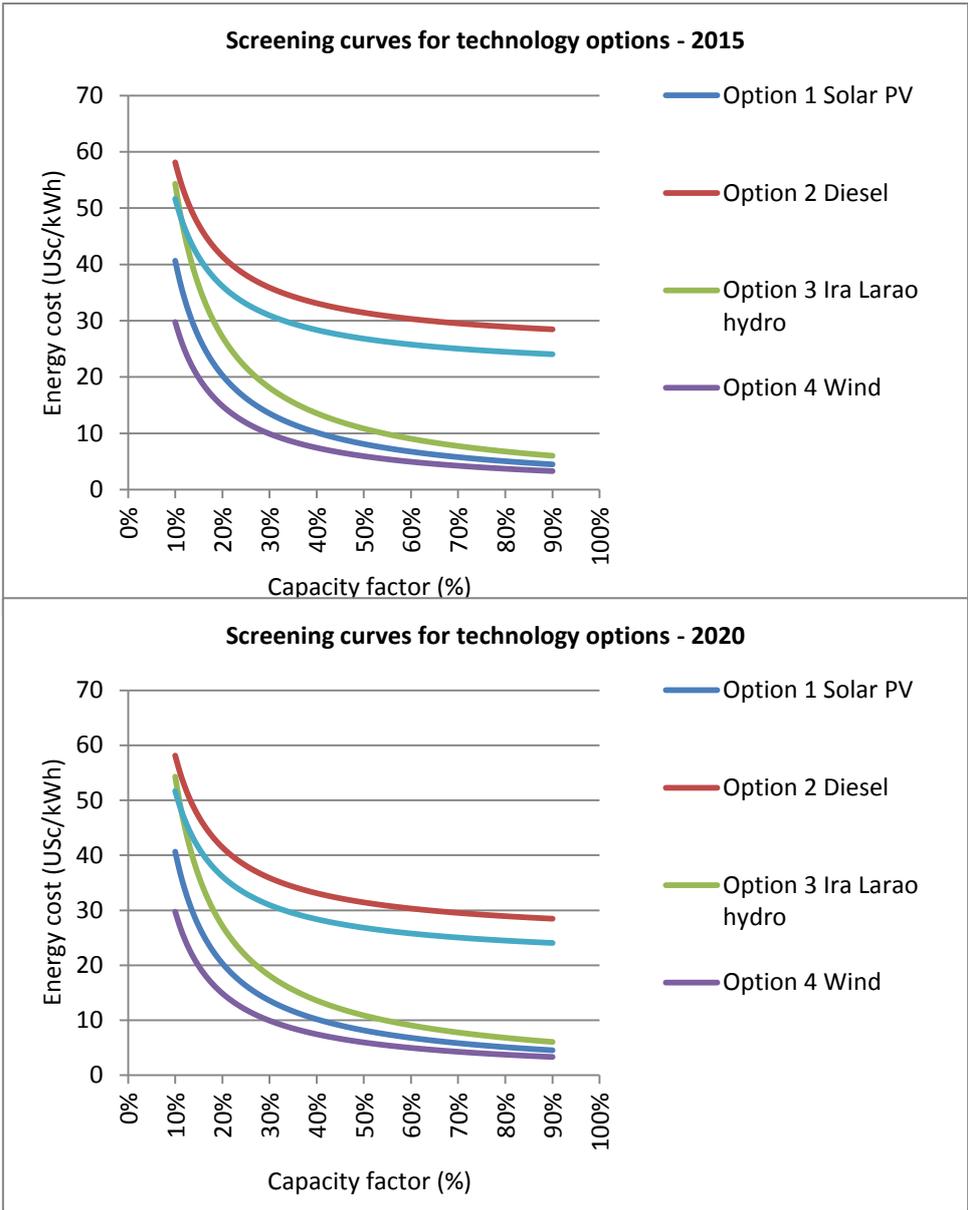
been listed in different years during the Action plan for 2013-2017 but for illustrative purpose, these are included in the generation mix for 2015 and 2020. Figure 56 indicates that power generation from diesel fuel only would be the most expensive option, with the more diversified option, based on the use of HFO or residual fuel options, being the cheapest options for both 2015 and 2020. The cost differences are US\$59.6 million in 2015 and US\$61.7 million 2020 (in 2010 prices). Based on the estimated cost of electricity service of US\$0.422 per kilowatt-hour in 2012, the cost of electricity services for the most diversified generation mix would be US\$0.23 per kilowatt-hour in 2015 and US\$0.3 per kilowatt-hour in 2020. While these estimates are based on available data and actual costs would be different, the ranking order of costs differences would be likely to be similar.

**FIGURE 55: ILLUSTRATIVE SCREENING CURVES AND COMPARISON OF DELIVERED ENERGY COSTS (LEVELIZED COSTS) FOR POWER GENERATION TECHNOLOGY OPTIONS FOR TIMOR-LESTE 2015 AND 2020 (\$2010 PRICES)**



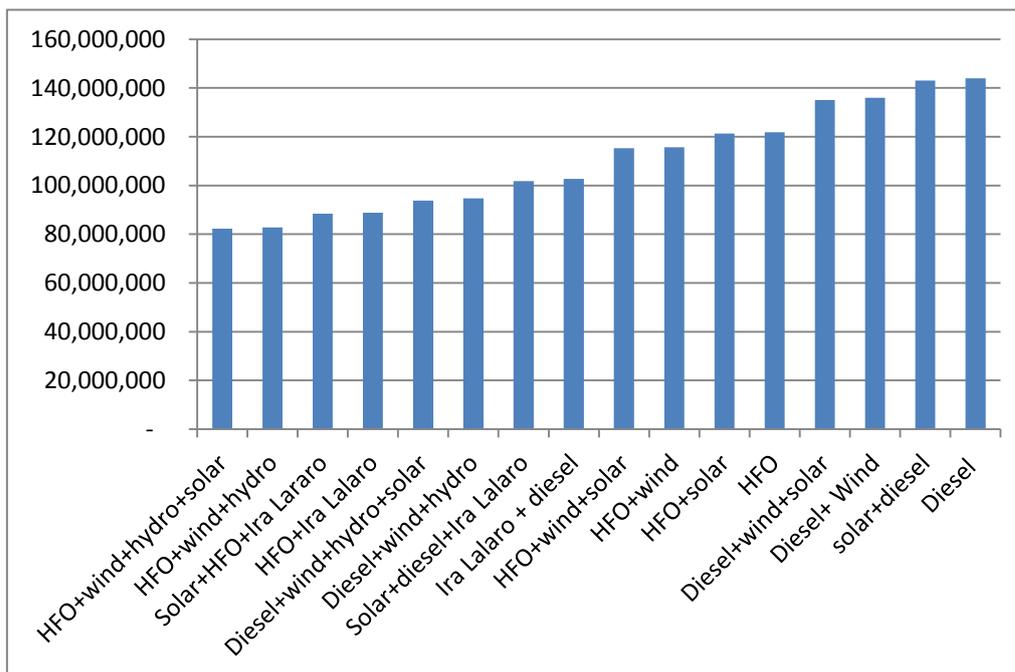
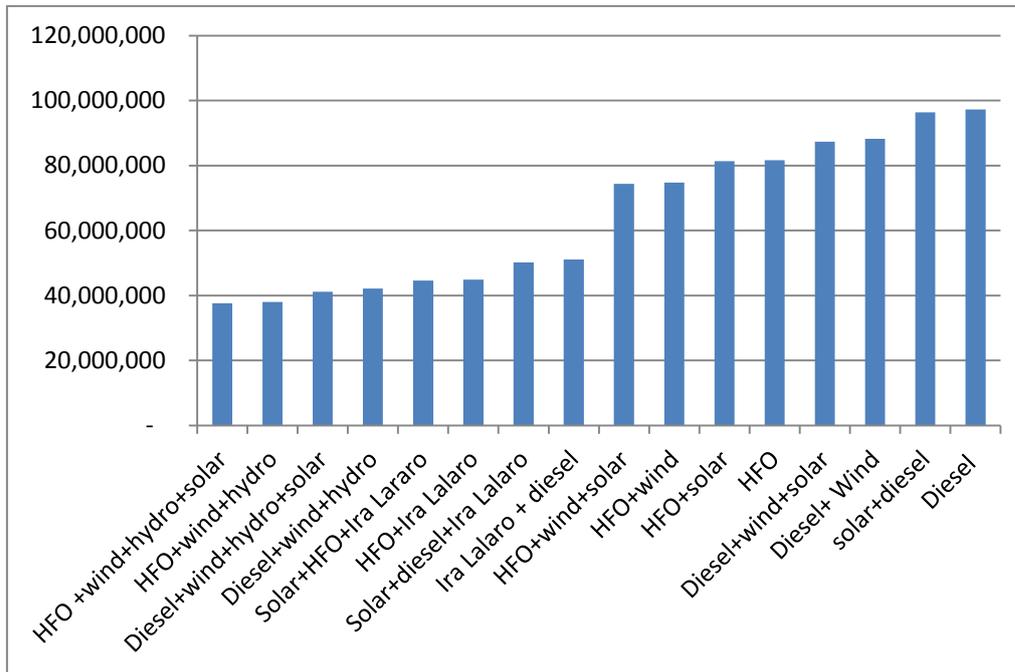


Notes: Option 1: Solar PV 2 MW, at 20 percent Capacity Factor (CF); Option 2 (Hera/Betano): Diesel generator 17 MW unit, at 80 percent CF; Option 3: Ira Lararo Hydro 28 MW, at 77 percent CF; Option 4: Wind onshore 16 MW, at 30 percent CF; Option 5 (Hera/Betano: HFO or Residual Fuel Oil, at 80 percent CF (cheaper than diesel oil but require more O&M and adjustment costs).



Notes: Option 1: Solar PV 2 MW, at 20 percent Capacity Factor (CF); Option 2 (Hera/Betano): Diesel generator 17 MW unit, at 80 percent CF; Option 3: Ira Lararo Hydro 28 MW, at 77 percent CF; Option 4: Wind onshore 16 MW, at 30 percent CF; Option 5 (Hera/Betano: HFO or Residual Fuel Oil, at 80 percent CF (cheaper than diesel oil but require more O&M and adjustment costs).

**FIGURE 56: INDICATIVE COSTS (\$2010 PRICES) OF VARIOUS OPTIONS OF GENERATION MIX FOR TIMOR-LESTE 2015 (TOP) 2020 (BOTTOM)**



## 5.5 DEMAND MANAGEMENT

Increasing the level of energy efficiency and conservation and improving demand side management would deliver multiple benefits, reducing the cost of providing electricity and hence the cost of subsidization.

Increasing the level of energy efficiency and improving demand-side management would reduce the unnecessary and wasteful consumption of electricity. The avoided consumptions could be used for vital services and productive activities, reducing the peak demand and costs for new capacity investments and enabling the integration of renewable energy into the power system by reducing the impacts of system destabilization caused by the higher rate of penetration of renewable energy. Improved energy efficiency could help EDTL provide better energy services for its customers and reducing operating and capital expenditures. Figure 44 illustrates how in Timor-Leste, demand efficiency could take the tip off long term demand and reduce the cost of providing electricity.

The Government is well aware of the need to improve demand-side management and energy efficiency, which could reduce the cost of providing electricity services and hence the cost of subsidization, as well as producing other co-benefits. For example, in the Prime Minister's speech at the inauguration of the Betano power plant on 20 August 2013, he referred to the former President's request to the heads of Suco and administrators in Timor-Leste to control the use of electricity within the community. The Prime Minister also noted that: "Often, we see that even in broad daylight, lamps remain lit. The Government has already begun to require the payment of tariffs. I am sure that from the moment that people have to pay tariffs, they will reduce their usage of electricity."<sup>118</sup>

## 5.6 CONCLUSION

**Since Timor-Leste is growing, the cost of improving the country's provision of electricity will be less if it acts sooner rather than later.** Having achieved its Independence following the Indonesian occupation in 2002, Timor-Leste is an emerging economy and society. The Government has been making great efforts to provide vital electricity services to its citizens to facilitate the achievement of social and economic development. However, without correct price signals and transparency in matters related to the cost of providing electricity services, the electricity services will not be financially and operationally sustainable and consumers may waste electricity. Given the prevalent inefficiencies outlined in this chapter, action must be taken to reduce the gap between the cost of service and the price consumers pay. This chapter has set out options to make the electricity sector more sustainable, with the principal recommendations being: (i) to diversify the generation mix; (ii) to improve procurement systems and practices; (iii) to implement measures to restructure tariffs, improved billing, and to reduce interruptions and outages; and (iv) to promote energy efficiency.

---

<sup>118</sup> <http://timor-leste.gov.tl/?p=8714&lang=en>

## References

- Adriaan van der Welle and Bob van der Zwaan. Energy research Centre of the Netherlands (ECN), Policy Studies Department. Working Paper. Amsterdam, 15 November 2007
- Atkinson, G., and Hamilton, K., 2003. "Savings, Growth and the Resource Curse Hypothesis". *World Development* Vol. 31, No. 11, pp. 1793–1807.
- Baunsgaard, T., Villafuerte, M., Poplawski-Ribeiro, M., and Richmond, C., 2012. "Fiscal Frameworks for Resource Rich Developing Countries". Fiscal Affairs Department, International Monetary Fund.
- Berg, A., Portillo, R., Yang, S-C S., Zanna, F., 2012. "Public Investment in Resource-Abundant Developing Countries". IMF Working Paper, International Monetary Fund.
- Bolt, K, Matete, M., and Clemens, M., 2002. "Manual for Calculating Adjusted Net Savings". Environment Department, World Bank.
- Cherif, R., and Hasanov, F., 2012. "Oil Exporters' Dilemma: How Much to Save and How Much to Invest". IMF Working Paper.
- Collier, P., 2011. "Savings and Investment Decisions in Low-Income Resource-Rich Countries". Centre for the Study of African Economies, Department of Economics, Oxford University.
- Collier, P., Ploeg, F. van der, and Venables, A. J., 2009. "Managing Resource Revenues in Developing Economies". University of Oxford.
- Dixon, J., K. Hamilton, and A. Kunte, 1997. "Measuring the Wealth of Nations," Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development. *Environmentally Sustainable Development Studies and Monographs*, Series 17. Washington, DC: World Bank.
- European Commission, Food and Agriculture Organization, International Monetary Fund, Organisation for Economic Cooperation and Development, United Nations, World Bank, 2012. *System of Environmental-Economic Accounting (SEEA) 2012: Central Framework - white cover publication*.
- Ferreira, S., K. Hamilton, and J. Vincent, 2003. "Comprehensive Wealth and Future Consumption." Photocopy. World Bank, Washington, DC.
- Hamilton, K., and Clemens, M., 1999. "Genuine Savings Rates in Developing Countries". *The World Bank Economic Review*, Vol. 13, No. 2: 333–56.
- Hamilton, K., and Ley, E., 2010. "Measuring National Income and Growth in Resource-Rich, Income-Poor Countries". Economic Premise, Poverty Reduction And Economic Management (Prem) Network, World Bank.
- Hamilton, K., and Naikal, E., 2014. "Comprehensive Wealth Accounting and Sustainable Development". In *Handbook of Sustainable Development*, 2nd Edition. Forthcoming.
- Hamilton, K., and Naikal, E., 2014. "Genuine saving as an indicator of sustainability". In *Handbook of Sustainable Development*, 2nd Edition. Forthcoming.

Hartwick, John M., 1977. "Intergenerational Equity and the Investment of Rents from Exhaustible Resources", *American Economic Review*, v67, December, pp. 972-74.

IMF, 2013. Article IV Consultation mission report, available on <https://www.imf.org/external/country/TLS/index.htm>.

Insight Series, OECD/IEA, Paris.

JICA, 2014. Data Collection Survey on Pragmatic Framework Study of Labour Force Plan. Dili, March 2014.

Kunte, A., K. Hamilton, J. Dixon, and M. Clemens, 1998. "Estimating National Wealth: Methodology and Results." Environment Department Paper 57, World Bank, Washington, DC.

London Economics, 2011. Estimating Value of Lost Load (VoLL). Final report to OFGEM. London Economics. July 5, 2011.

London Economics, 2013. Estimating the Value of Lost Load. Briefing paper prepared for the Electric Reliability Council of Texas, Inc. London Economics International LLC. June 17th, 2013

Makenzie, G. A., and P. Stella. 1996. Quasi-Fiscal Operations of Public Financial Institutions.

Washington, DC: International Monetary Fund (IMF).

Ministry of Natural Resources, Minerals and Energy Policy of Timor-Leste, 2007. Rural Electrification Master Plan Timor-Leste Update Rural Electrification Master Plan Report. Prepared by the Norplan. October, 2007

Ministry of Finance and World Bank, 2014. Sub-national Spending in Timor-Leste: Lessons from Experience.

OECD (Organisation for Economic Co-operation and Development) (2010), OECD Environmental

Odedokun, MO Financial intermediation and economic growth in developing countries, *Journal of Economic Studies*, 1998.

Performance Reviews: Japan 2010, OECD, Paris.

Pacific Power Association (PPA), 2013. Pacific Power Utilities Benchmarking Report 2012, prepared by the Pacific Power Association (PPA) with the technical support of The Pacific Infrastructure Advisory Centre (PIAC), March 2013

Petri, M., and G. Taube. 2003. "Fiscal Policy Beyond the Budget." *Emerging Markets Finance and Trade* 39(1).

Pierre-Richard Agéno and Blanca Moreno-Dodson (2006) Public Infrastructure and Growth, New Channels and Policy Implications, World Bank Research Working Paper (2006).

Ploeg, F. van der, 2010. "Why do many resource-rich countries have negative genuine saving? Anticipation of better times or rapacious rent seeking". *Resource and Energy Economics* 32, pp. 28–44.

Ploeg, F. van der, 2012. "Bottlenecks In Ramping Up Public Investment". Department of Economics, University Of Oxford.

Ploeg, F. van der, and Venables, A.J., 2011. "Harnessing windfall revenues: optimal policies for resource-rich developing economies". *Economic Journal*, 121, pp. 1-31.

Romp W and Haan J (2007) Public Capital and Economic Growth a Critical Survey Perspektiven der Wirtschaftspolitik Volume 8, Issue S1, pages 6–52, April 2007.

Ryan, L. and N. Campbell (2012), *Spreading the Net: the Multiple Benefits of Energy Efficiency*, IEA.

Sachs, Jeffrey D., 2007. How to handle the macroeconomics of oil wealth. Humphreys, M.; Sachs, J.D.; Stiglitz, J.E. (Ed.) (2007): 173-193.

The National Statistics Directorate General Directorate for Analysis & Research Ministry of Finance Timor-Leste, 2011. Timor-Leste Household Income and Expenditure Survey 2011

Toba, N., 2007. Welfare impacts of electricity generation sector reform in the Philippines. *Energy Policy* 35 (2007) 6145–6162.

Van der Welle, and van der Zwaan, 2007. An Overview of Selected Studies on the Value of Lost Load (VOLL).

World Bank, 1994. Philippines Power Sector Study. Structural Framework for the Power Sector. November 30, 1994. Mimeo. Industry and Energy Operations Division. Country Department I. East Asia and Pacific Regional Office. World Bank, Washington, D.C.

World Bank 2004. Timor-Leste Power Sector Priority Investment Project, Project Appraisal Document. July 30, 2004.

World Bank, 2009. Reducing Technical and Non-Technical Losses in the Power Sector. July 2009, World Bank.

World Bank, 2012. Timor-Leste Gas Seep Harvesting Project Implementation Completion and Results Report, June 25, 2012.

World Bank, 2013. Timor-Leste Energy Delivery Services Project Implementation Completion and Results Report, March 31, 2013.

World Economic Forum, 2011. The Global Competitiveness Report 2011-2012

World Bank, 1997. *Expanding the Measure of Wealth: Indicators of Environmentally Sustainable Development*. Environmentally Sustainable Development Studies and Monographs Series No. 17. Washington, DC: World Bank.

World Bank, 2006. "Where is the Wealth of Nations? Measuring Capital for the 21<sup>st</sup> Century", Washington, DC: World Bank.

World Bank, 2011. "The Changing Wealth of Nations. Measuring Sustainable Development in the New Millennium", The World Bank: Washington DC

World Bank, 2013a. "How wealthy is Mozambique after the discovery of coal and gas? Measuring wealth in Mozambique using the wealth accounting framework", The World Bank: Mozambique.

World Bank, 2013b. "Malaysia Economic Monitor. Harnessing Natural Resources". The World Bank: Bangkok.

## ANNEX 1: SDP PILLARS AND TARGETS

SDP Pillar	Sector	Key Target	Specific Project / Activity	Date of Project Completion	Project Cost Stated in SDP
Infrastructure	Roads and Bridges	All national and regional roads will have been fully rehabilitated to international standards	The Dili – Manatuto – Baucau Road Link will have been fully upgraded and widened to international standards	2015	\$100 million,
Infrastructure	Roads and Bridges	All national and regional roads will have been fully rehabilitated to international standards	The Manatuto-Natarbora Road Link will have been fully upgraded and widened to international standards	2015	In excess of US\$60 million,
Infrastructure	Roads and Bridges	All national and regional roads will have been fully rehabilitated to international standards	The Dili – Liquiça – Bobonaro Road links will be fully rehabilitated	2015	Around US\$82 million.
Infrastructure	Roads and Bridges	All national and regional roads will have been fully rehabilitated to international standards	The Pante Makassar – Oesilo   Pante Makassar – Citrana   Oesilo – Tumin Road links will be completed	2015	
Infrastructure	Roads and Bridges	All national and regional roads will have been fully rehabilitated to international standards	All rural roads will have been rehabilitated by locally based contractors	2015	
Infrastructure	Roads and Bridges	All national and regional roads will have been fully rehabilitated to international standards	Road condition monitoring surveys will have been carried out each year on all improved roads for determining maintenance needs	2015	
Infrastructure	Roads and Bridges	All national and regional roads will have been fully rehabilitated to international standards	The Dili – Aileu – Maubisse – Aituto – Ainaro – Cassa rehabilitation project will have been completed	2020	
Infrastructure	Roads and Bridges	All national and regional roads will have been fully rehabilitated to international standards	The Suai – Cassa – Hatu Udo – Betano – Natarbora – Viqueque – Beaço rehabilitation project will have been completed	2020	

SDP Pillar	Sector	Key Target	Specific Project / Activity	Date of Project Completion	Project Cost Stated in SDP
Infrastructure	Roads and Bridges	Bridge Construction program	New bridges will have been constructed to provide all-weather access on all national and district road routes	2030	
Infrastructure	Roads and Bridges	National Ring Road	The plan for a National Ring Road will have been completed	2015	
Infrastructure	Roads and Bridges	National Ring Road	The National Ring Road will have been completed	2030	
Infrastructure	Electricity	All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	Two new power stations will have been constructed in Hera and Betano providing 250 MW of electricity to support social and economic development across Timor-Leste	2015	
Infrastructure	Electricity	All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	The Lariguto wind farm will be constructed	2015	
Infrastructure	Electricity	All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	A Solar Centre will be established in Dili	2015	
Energy Policy	Electricity	All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	Feasibility studies will have been conducted on the long-term prospects of attracting gas processing facilities to Timor-Leste; on potential mini-hydro sites throughout Timor-Leste; and on the viability of building a thermoelectric power plant to generate electricity from Dili's household and industrial rubbish	2015	
Energy Policy	Electricity	All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through the use of renewable energy	At least half of Timor-Leste's energy needs will be provided by renewable energy sources	2020	
Energy Policy	Electricity	All households in Timor-Leste will have access to electricity either by the conventional expansion of the electricity system or through	Approximately 100,000 families will have access to solar powered electric light	2020	

<b>SDP Pillar</b>	<b>Sector</b>	<b>Key Target</b>	<b>Specific Project / Activity</b>	<b>Date of Project Completion</b>	<b>Project Cost Stated in SDP</b>
		the use of renewable energy			
Agriculture/Rural Development	Agriculture	The food supply will exceed demand	A comprehensive irrigation scheme inventory will have been assembled	2015	
Agriculture/Rural Development	Agriculture	The food supply will exceed demand	Dam and groundwater pilot projects will have been developed and the results used to inform further development	2015	
Agriculture/Rural Development	Agriculture	The food supply will exceed demand	The area of irrigated rice will have increased by 40% from 50,000 ha to 70,000 ha	2020	

## ANNEX 2: FISCAL MODEL ASSUMPTIONS

### *Capital Expenditure*

Capital expenditure varies by scenario. Infrastructure Fund spending is assumed to be executed at 65% and any unspent amount rolls over and increases the following year's budget. This assumption is based on the rules governing the Infrastructure Fund's budget.

### *Operation and Maintenance and Other Recurrent Expenditure*

Operation and maintenance spending is calculated as a set percentage of the capital stock for each sector, each year. Sectors are as defined in the Infrastructure Fund and include electricity, agriculture and roads. The capital stock is the running cumulative total of actual capital and development spending in each sector and is adjusted to account for inflation. The O&M percentage varies by sector and is based on the analysis contained in the relevant section of this PER for electricity, roads and agriculture. For all other sectors the set percentage is taken from an earlier costing of the SDP, the academic literature<sup>119</sup>, or an average of the two. The un-weighted average of operation and maintenance spending on all sectors is 5% of the capital stock. Other recurrent expenditure grows by a set percentage which varies by scenario.

### *Loans*

All loan financing is assumed to have a grace period of 8 years, a total repayment of thirty years and a total interest rate of 4%. These loan terms are broadly similar to those Timor-Leste is likely to achieve on its most recent loan with the IBRD and represent a fair estimate of the terms of future loan agreements.

### *Domestic Revenue*

There is currently no GST in Timor-Leste and corporate and personal income taxes are set at 10%. Achieving the 15% of non-oil GDP target may then be difficult without increasing tax rates or introducing new taxes such as VAT. The current low levels of income and corporate tax do, however, mean that these taxes could be increased without significantly harming economic growth.

### *Real Non-Oil GDP*

In the model two exogenous variables are seen as driving real non-oil GDP growth.

First, growth in the supply of labor (due to Timor-Leste's high population growth) is seen as driving on average a total of 1.7 percentage points to non-oil GDP growth each year. Second, total factor productivity growth adds 1.2 percentage points to real non-oil GDP growth per year. These factors are taken directly from the NDEP economic model.

---

<sup>119</sup> Recurrent Expenditure Requirements of Capital Projects, Hood, Husband and Yu (2002).

Government spending is also seen as driving non-oil GDP growth in the short and long term. In the short term a US\$1 million dollar increase in Government expenditure adds US\$0.3 million to nominal non-oil GDP. The other US\$0.7 million (i.e. 70%) of increased Government spending is assumed to be spent on imports. The import intensity of Government spending is based on recent work by the IMF.

A direct short term link between non-oil GDP growth and Government spending is supported by our earlier analysis. In Timor-Leste the Government can sharply increase Government expenditure by making withdrawals from the Petroleum Fund. The Petroleum Fund balance is not a component of non-oil GDP, but Government expenditure (net of exports) is a direct component of non-oil GDP through the expenditure approach. On the production side Government administration (where value added is difficult to measure) and construction (through Government contracts) will increase. Due to the structure of Timor-Leste's economy an *increase in* (as opposed to the level of) Government spending *is* an increase in non-oil GDP. But this effect is more of an accounting identity than an indication that the long term ability of the economy to produce goods and services has increased.

Our model also includes a long term link between Government spending and economic growth. Infrastructure spending results in the construction of assets such as roads, bridges and irrigation which increase the productive potential of the economy. This relationship is modeled by showing capital and development spending increasing the capital stock for a sector, and there being a consequent annual contribution to non-oil GDP equal to the capital stock times the rate of return. **The rate of return on assets each year varies by sector but the un-weighted average is 5%. Given the conclusions of the analysis on roads, electricity and irrigation projects contained in this report, 5% probably represents the upper case estimate of the impact of capital and development spending on economic growth.**

### *Inflation*

At the risk of over-simplifying: when the Government takes money out of the Petroleum Fund and gives it to Timorese companies or residents it is increasing the level of aggregate demand in the economy. The supply side response to this increased demand may be limited in the short and medium term because of infrastructure bottlenecks (such as limited port capacity), a lack of competition in key markets and a poor business environment. Increased demand with inelastic supply can result in inflation.

Recurrent expenditure is likely to increase domestic demand and inflation. The reasons for this is that much recurrent expenditure, especially transfers and salaries and wages, is directly distributed to resident Timorese citizens who use this money to buy local goods. Some goods and services expenditure, such as local travel allowances, is also directly distributed to resident Timorese citizens. In addition, procurement contracts for many goods and services items such as office stationary and supplies are won by local companies and likely increases domestic demand.

Capital expenditures impact on inflation is more complex. Much capital and development expenditure does not increase domestic demand. Spending on the central electric project for

example was directly paid to firms' foreign bank accounts and much of this money was spent on generators constructed in Finland and imported to Timor-Leste. Substantial expatriate labor was also used on this project and many workers were housed by CNI22 and likely spent little of their wage in Timor-Leste. Some infrastructure projects are won by local firms and use local labor, but spending on these projects is small compared to total infrastructure spending. Infrastructure spending also increases aggregate supply, which reduces inflationary pressure. Overall our view is that even if infrastructure spending has some impact on domestic demand its overall impact on inflation is most likely not significant. This view is supported by econometric work by the NDEP<sup>120</sup> and IMF<sup>121</sup> which finds that recurrent expenditure, but not capital expenditure, is a significant determinant of inflation. Our fiscal policy model therefore includes a direct link between recurrent expenditure and inflation which is based on work by the NDEP and IMF<sup>122</sup>.

---

<sup>120</sup> "Analysis of Inflation in Timor-Leste" Ministry of Finance. Available at <http://www.mof.gov.tl/analysis-of-inflation-in-timor-leste-2/?lang=en>

<sup>121</sup> The IMF Article IV 2013 Report (IMF Country Report 13/338) states "There is strong evidence that the growth in recurrent expenditure in Timor-Leste has contributed to high inflation. Statistical analysis suggests a one percent increase in recurrent expenditure as a percent of GDP causes 0.20 percent increase in the inflation rate"

<sup>122</sup> More specifically, each additional million dollars of recurrent expenditures contributes 0.56 units to the actual value of the CPI index. International food and commodity prices are seen as adding on average 4% to inflation each year. A random component is also included in the calculation of inflation to account for unpredictable short term changes in international commodity prices. This model is based on detailed econometric work by the Economic Policy Directorate. Statistical analysis by the IMF on inflation concluded that for each 1% increase in recurrent expenditure as a % of non-oil GDP inflation increases by 0.2 percentage points. Using these coefficients results in slightly lower inflation for a given growth rate of recurrent expenditure but does not fundamentally change the conclusions drawn from any of the fiscal sustainability scenarios undertaken in this public expenditure review.

## ANNEX 3: CHAPTER 2 PIM INDICATOR ANALYSIS

<b>8.1.2 STEP 1: STRATEGIC GUIDANCE FOR PUBLIC INVESTMENT</b>	
A high level authoritative statement of the Government's economic and social priorities can help to strategically align investment planning by ministries, agencies and development partners and screen out low priority spending initiatives. A brief project profile should be submitted by line ministries to central agencies that includes basic project information such as the link to the SDP, problem analysis, objectives, activities, results and costs together with a summary of alternative options for addressing the development problem. A preliminary screening should be undertaken to ensure that the project proposal meets minimum criteria, namely consistency with strategic goals and budget classification as a capital project.	
<b>PIM 11 – Strategic Guidance, Project Proposals, Preliminary Screening</b>	
i) Strategic Guidance	C
ii) Project Profiles	C
iii) Preliminary Screening	B
<b>8.1.3 STEP 2: PROJECT APPRAISAL</b>	
A high quality project preparation process forms a critical part of the public investment management system. A regulated set of steps should include pre-feasibility and feasibility studies that include preliminary design, environmental and social impact assessments. It is important to identify relevant alternatives early in the project preparation process. Social and economic appraisal should also be undertaken at this point. There is evidence that shows that improved project appraisal can have a marked impact on economic productivity and increase a country's economic growth rate. <sup>123</sup>	
<b>PIM 12 – Formal Project Appraisal</b>	
i) Clarity of planning roles	B
ii) Defined procedures for the preparation and appraisal of projects	C
iii) Availability of technical guidance on project appraisal	C
iv) Quality of project appraisal	C
<b>8.1.4 STEP 3: INDEPENDENT REVIEW OF APPRAISAL</b>	
Review of project appraisal by a central agency independent of the project sponsor in the line ministry allows projects to be 'challenged' on strategic relevance, design quality and costings. "Optimism bias" refers to the tendency of sponsoring agencies to overestimate project benefits and underestimate project costs; a recent study of transport projects found that nine out of ten projects underestimated costs – by an average of 20 per cent for roads and 34 per cent for bridges. <sup>124</sup>	
<b>PIM 13 – Independent Review of Appraisal</b>	
Project Appraisals are subject to Independent Review	B
<b>8.1.5 STEP 4: PROJECT SELECTION AND BUDGETING</b>	
Effective capital budgeting requires a well-designed budget calendar that allows the executive to determine the total capital spending envelope, line ministries to prepare and submit project proposals up to their indicative ceiling on capital spending, and central agencies to appraise proposals prior to the budget review committee. A multi-year perspective is particularly important for capital spending given both asset creation and asset maintenance have long time frames. Selection of projects to go into the budget is the last key decision point therefore it is important that there are clear selection criteria.	

<sup>123</sup> Harberger, Arnold (2005) 'On the Process of Growth and Economic Policy in Developing Countries' PPC Issue Paper No. 13, USAID: Washington DC

<sup>124</sup> Flyvberg, Bent (2007) 'Policy and planning for large infrastructure projects: problems, causes, cures' in *Environment and Planning B: Planning and Design*

	<b>PIM-14 Orderliness and Participation in the Annual Budget Process</b>	
	i) Project Planning and Budget Calendars	B
	ii) Guidance on preparation of capital spending proposals	B
	iii) Time for central agency analysis and advice	B
	iv) Timeliness of budget approval by legislature	B
	<b>PIM-15 Multi-year Perspective in Fiscal Policy and Management</b>	
	i) Multi-year fiscal forecasts and functional allocations	B
	ii) Costed sector strategies consistent with fiscal forecasts	C
	iii) Multi-year project databases	C
	iv) Quality of a Public Investment Plan	C
	<b>PIM-16 Project Selection and Budgeting</b>	
	i) Transparent criteria for project selection	B
	ii) On-going projects receive sufficient funding	B
	iii) Multi-year budget authority	A
	iv) Capital and current spending fully integrated	C/D
8	<b>8.1.7 STEP 5: PROJECT IMPLEMENTATION</b>	
	Project implementation focuses on the actual asset creation process, which is an important yet complex step in the overall PIM cycle. A number of different but related issues have been included here: project manuals; project completion processes; the predictability of funds; value for money in procurement; internal controls and internal audit. As part of this review, the focus on project implementation and project evaluation was on the Ministry of Agriculture and the Ministry of Public Works.	
	<b>PIM-17 Project Implementation</b>	
	i) Guidelines on project implementation	D
	ii) Clear accountability and implementation plans	D
	iii) Formal project completion and handover	C
	<b>PIM-18 Predictability in the availability of funds for commitment of expenditures</b>	
	i) Monitoring of cashflows	B
	ii) Ceilings for expenditure commitments	A
	iii) Adjustments to Budget Allocations	A
	<b>PIM-19 Value for money in procurement</b>	
	i) Legal and regulatory framework transparent, comprehensive and competitive	C
	ii) Procurement methods competitive	D
	iii) Public access to procurement information	D
	iv) Independent procurement complaints mechanism	D
	<b>PIM-20 Effectiveness of Internal Controls and Internal Audit for Capital Spending</b>	
	i) Effectiveness of expenditure commitment controls	C
	ii) Degree of compliance with rules for processing and recording transactions	D
	iii) Coverage and quality of the internal audit function	C
	iv) Extent of management response to internal audit findings	C
	<b>8.1.8 STEP 6: PROJECT ADJUSTMENT</b>	
	Capital projects often take some time to complete during which the situation in the field may change and unforeseen issues are likely to arise. For this reason, continuous progress reports on financial and physical issues, risks arising and mitigation actions taken should be circulated to senior management in line ministries and central agencies. Sponsoring agencies can sometimes be reluctant to acknowledge that a project is going off course and therefore it can be extremely helpful to convene peer reviews at key decision points such as a mid-term review. It can also be helpful to introduce 'triggers' that give rise to a review of the initial project rationale and / or design such as major cost over runs or time delays.	
	<b>PIM-21 Project Adjustment</b>	
	i) Project progress reports and monitoring	C
	ii) Virements between projects	D

iii) Nature of project adjustments	C
iv) Mechanism to trigger review of project justification	D
<b>8.1.9 STEP 7: FACILITY OPERATION</b>	
Once new physical assets are created, the wider public investment management focus moves towards examining the extent to which the assets are used to deliver public services and ultimately result in improved social outcomes. At asset handover, the line ministry formally takes responsibility for asset maintenance and operations. New assets should be included on an asset register, which can help with asset preservation by informing O&M planning. Adequate recurrent funding is required. And service delivery should be monitored over time	
<b>PIM-22 Facility Operation</b>	
i) Asset registers	C
ii) Assets fit for purpose	B
iii) O&M funding sufficient	D
iv) Service delivery monitored	C
<b>8.1.10 STEP 8: BASIC COMPLETION REVIEW AND EVALUATION</b>	
Basic completion review should apply to all projects in a systemic way. Unfortunately this step in the public investment management cycle is too often undervalued. Failure to check experience against what was expected, and relate the results to the design of new projects is, according to a World Bank report, like 'flying blind'. <sup>125</sup> Impact evaluations are much more demanding and often take place three to five years after the close of the project. In Timor-Leste, these could be initiated for systemic evaluations of high value projects.	
<b>PIM-23 Basic Completion Review and Evaluation</b>	
i) Policy & guidance on post-project review	D
ii) Completion of basic post-project reviews	B
iii) Completion of impact evaluations	C
<b>8.1.11 STEP 9: EXTERNAL OVERSIGHT</b>	
Legislative oversight of capital spending is necessary to ensure the Government is accountable to the public. Parliament has a responsibility to review spending proposals prior to approval of the budget and convene hearings on the external audit. External audits by the Court of Accounts should be timely, cover all government entities each year, and include some element of performance audit as well as financial audit. The Government should act promptly on recommendations in the audit report, and report back to parliament on progress.	
<b>PIM-26 External Audit</b>	
i) External audit performed	B
ii) Audit reports submitted to legislature	C
iii) Executive follows up on audit recommendations	B
<b>PIM-27 Legislative Scrutiny of Capital Spending in the Annual Budget Law</b>	
i) Scope of legislative scrutiny	B
ii) Adequacy of time and procedures for legislature to respond to budget law	B
iii) Extent to which legislature adds or amends projects not subject to appraisal	A
iv) Rules for in-year amendments to the budget without ex ante legislative approval	B
<b>PIM-28 Legislative Scrutiny of External Audit Reports on capital spending</b>	
i) Timeliness of examination of audit report by the legislature	A
ii) Extent of hearings on key findings undertaken by the legislature	A
iii) Executive follows up on audit recommendations	B

<sup>125</sup> World Bank (2010) *A Diagnostic Framework for Assessing Public Investment Management*

## ANNEX 4: SUMMARY OF CHAPTER 2 RECOMMENDATIONS

SUMMARY OF RECOMMENDATIONS			
#	POLICY RECOMMENDATIONS AND ACTIONS	PRIORITY	AGENCY
<p><b>First Issue: Addressing the Challenge of ‘White Elephants’</b>            Problem: The country is spending on projects with low to negative economic rates of return            Recommendation: To improve the prioritization of spending</p>			
✓	<i>Continue the Government’s overall strategy of centralizing major project preparation capacity in central agencies</i>	Continue	OPM
1.1	Prepare sector investment plans for roads, agriculture and electricity that present a strong economic rationale for proposed capital investments, and preliminary costs.	Very High	MPW, MAFF
1.2	Initiate a public Gateway Review process for very large projects, starting with the designs of projects that are pending (the south coast road and the irrigation projects, the Oecusse special zone for social market economy)	Very High	PMO (MPS)
1.3	Initiate a holistic multi-project appraisal process for the south coast corridor that seeks to capture and assess synergies that tend to be undervalued by conventional project appraisal	Very High	PMO (MPS)
1.4	Involve the Major Project Secretariat early in the project cycle to help improve the quality of project preparation at the phases of project profiles, feasibility and design	Very High	PMO (MPS)
1.5	Undertake feasibility studies as part of project preparation to ensure that other options are considered and social and economic analysis underpins designs. Publish summary findings on economic returns.	High	MPW, MAFF
1.6	Undertake mid-term reviews of large projects to ensure that they do not go ‘off track’ during implementation	High	PMO (NDA) MPW, MAFF
1.7	Establish an EPIA-style agency with expertise in economics and planning to sharpen the emphasis on rates of return and inter-sectoral planning for capital projects and sector strategies	High	PMO (NDA)
1.8	Establish a ‘project bank’ as part of a Public Investment Plan, a portfolio of pre-qualified projects from which the Infrastructure Fund Committee is able to select priority projects	High	PMO (MPS)
1.9	Engage in periodic, high priority, system evaluations such as sector evaluations to inform future sector strategies. In agriculture, undertake a systemic evaluation of the return on irrigation schemes	High	PMO (MPS) MPW, MAFF
1.10	Incentivise the Major Project Secretariat to provide technical assistance to line ministries to help them with project preparation to strengthen the quality of the project pipeline	High	PMO (MPS)
1.11	Prepare a Project Manual for line ministries that includes technical guidance on project preparation: how to prepare project profiles, feasibility studies, design studies	High	PMO (MPS)
1.12	Manage carefully the cost-benefit appraisal of Public Private Partnerships given the systemic tendency to under account for contingent liabilities	Medium	PMO (MPS)
1.13	Ensure that the justifications for decisions taken by the Infrastructure Fund Committee are documented in accordance with Decree Law 8/2011	Medium	PMO (MPS)

<b>Second Issue: Addressing the Challenge of the 'Wet Season'</b>			
Problem: The country is not preserving its capital assets			
Recommendation: To build in sustainability early in the project cycle			
2.1	Increase immediately the operation and maintenance budgets for irrigation by 100 per cent and roads and bridges by 75 per cent so that capital assets are not prematurely degraded, while staying within the recurrent budget ceiling.	Very High	MOF MPW, MAFF
2.2	Reinforce the unified budget process so that recurrent budgets fully reflect the implications of increased capital budgets. Consider innovative approaches, such as including O&M budgets for first three years with project proposals considered by CAFI.	High	MOF PMO (MPS) MPW, MAFF
2.3	Ensure that new sector strategies include a strong emphasis on the sustainability of the infrastructure options proposed. Include recurrent cost estimates in sector investment plans.	High	MPW, MAFF
2.4	Involve MPS early in the project preparation cycle to ensure that feasibility and design studies prioritize sustainability and consider not only engineering analysis but also social, economic analysis.	High	PMO (MPS) MPW, MAFF
2.5	Maintain the asset register in the Ministry of Finance. Include information on the current condition of assets and record spending on capital improvements and maintenance, to help the Budget Office improve estimates of recurrent financing requirements	Medium	MOF
2.6	Maintain the project data base managed by MPS and link it more closely to the Budget Office to improve estimates of future recurrent spending.	Medium	PMO (MPS) MOF
2.7	Engage line ministries actively in project supervision, even where NDA and MSA are playing a leading role, so that they have a strong commitment at handover to ongoing maintenance.	Medium	PMO (NDA) MPW, MAFF
2.8	Ensure line ministries start formally collecting basic data on service delivery to ensure remain focused on O&M for service delivery	Medium	MPW, MAFF
<b>Third Issue: Addressing the Challenge of 'KKN'</b>			
Problem: Extensive non-compliance with basic public administration standards contributes to perceptions of widespread corruption			
Recommendation: Strengthening project management to improve the essentials of public administration as part of a strategy of getting the basics right on anti-corruption			
✓	<i>Continue to progress improvements to systems and processes such as finalizing the new Procurement Law, procurement guidelines, and financial management instructions</i>	<i>Continue</i>	MOF
✓	<i>Continue to support prevention efforts of institutions such as new Court of Audit, the Anti-Corruption Commission, and Parliamentary committees</i>	<i>Continue</i>	Court of Audit, Anti-Corruption Commission Parliament
✓	<i>Continue with Civil Service Commission efforts to improve professionalism of civil service through for example management training, codes of conduct, duty statements</i>	<i>Continue</i>	Civil Service Commission
3.1	Council of Ministers to prioritize its decision to engage in a comprehensive follow up on findings of the internal audit of procurement systems, and report back to Parliament	Very High	PMO (SoS IS) MOF (TSY)
3.2	Review the policy, regulatory and operational aspects of procurement to ensure that essential central agency procurement functions continue to be performed	High	PMO (NPC) MOF (TSY)
3.3	Parliament to ensure the Government tables each year the action it has taken in response to the previous year's Opinion on the State	High	Parliament

	Accounts, initially prioritizing the introduction of internal controls		
3.4	Review apparent proliferation of MPW functions in other line ministries as well as ADN. If possible, directly address perceived weaknesses in MPW rather than create new ministries of infra.	High	PMO
3.5	Align government audit functions with the newly established Court of Audit	High	Court of Audit MOF (Audit), OPM (OIG)
3.6	Prepare a Project Manual for line ministries that includes technical guidance on project management: the responsibilities of project directors, project managers, procurement and FM officers.	High	PMO (MPS)
3.7	Establish a firewall between government and business at the project preparation phase to ensure that the upstream project cycle process is not captured by vested interests	Medium	PMO (NDA) MPW, MAFF
3.8	Train civil servants in line ministries on project management	Medium	PMO (MPS)
3.9	Mandate and resource MPS, NDA, NPC to provide technical assistance to line ministries on project management	Medium	PMO (MPS, NDA, NPC)
3.10	Engage the ADN in reviews of the original business case when costs exceed more than 30 per cent of the initial cost estimates	Medium	PMO (NDA)
3.11	Court of Accounts to participate in peer networks of supreme audit institutions to help strengthen its nascent capabilities	Medium	Court of Audit
3.12	Follow up on procurement-specific actions: line ministries to submit procurement plans to NPC; clarify the limited circumstances in which direct awards can be considered (Article 92); monitor decentralized procurement by NPC using the Performance Framework included in the draft new law.	Medium	PMO (NPC)

## ANNEX 5: DE JURE AND DE FACTO ROLES OF NEW PIM AGENCIES, ILLUSTRATING OVERLAPS

Institution	<i>De Jure</i>	<i>De Facto</i>
<b>Major Projects Secretariat (MPS)</b>	<p><b>Decree-Law 44/2012; and Terms of Reference:</b></p> <ul style="list-style-type: none"> <li>▪ Preliminary appreciation of major projects to be funded by the IF, including: technical and financial feasibility; means of financing for concept design, detailed design and construction contracts; economical social development impacts and benefits; environmental and social safeguards impact assessment;</li> <li>▪ Review all project briefs for submission to the CAFI, commenting on the possible temporal, social, and economic impacts described in the brief and make recommendations on the allocation of resources, with active liaison with relevant line ministries and agencies preparing these briefs;</li> <li>▪ Determine the scheduling or returning of projects;</li> <li>▪ In close collaboration with the relevant line ministry, develop the terms of reference for the major projects for procurement;</li> </ul>	<ul style="list-style-type: none"> <li>▪ It has been undertaking social and economic impact assessment, which by law should also have been completed by AND (that doesn't have the needed capacity or capability in economic or social analysis);</li> <li>▪ It is not resourced to provide technical assistance on project feasibility and design. Only some large projects are subject to in-depth appraisal;</li> <li>▪ There are many instances where MPS has been approached only once the project design is well advanced;</li> </ul>
<b>National Development Agency (NDA)</b>	<p><b>Decree-Law 11/2011:</b></p> <ul style="list-style-type: none"> <li>▪ Review the merit and feasibility of capital development projects, taking into account: estimated impact on development; cost-benefit analysis; budget impact and ancillary costs; compliance with quality standards and rules; technical, commercial and financial capacity of the executor;</li> <li>▪ Issue opinions both during the pre-project and project stages;</li> </ul>	<ul style="list-style-type: none"> <li>▪ It has exercised the review function in part, working with the MPS at times to provide additional independent costing of project designs;</li> <li>▪ The focus has been exclusively on the technical and cost aspects of projects, through technical evaluation prior to procurement; and through monitoring and certification of the quality and progress of projects prior to payment;</li> </ul>

	<ul style="list-style-type: none"> <li>▪ <a href="#">Supervising, verifying and certifying capital development projects, and their execution</a>, in coordination with relevant ministry;</li> <li>▪ <a href="#">Assessing, verifying, and recommending necessary changes or adjustments in the construction or implementation stages</a>;</li> <li>▪ <a href="#">Recommending project payments</a> in the view of the execution level and required quality;</li> <li>▪ <a href="#">Proposing quality certification</a> and the adoption of special quality certification standards and rules;</li> <li>▪ Managing constructions projects up to US\$250,000.00 allocated to local companies in the sub-districts, within the scope of the <a href="#">District Development Program II (DDP II)</a>, including: Participating in the special procedure to classify and select companies and to award the construction works; Monitoring the evolution of projects and approving progress and quality reports, so that payments can be made;</li> <li>▪ Provide support to the Millennium Development Goals Program for the sucos (<a href="#">MDG Sucos</a>), including: promoting and monitoring the procedure for executing low cost projects under the direct administration of local authorities; monitoring project execution and ensuring control over the respective payments;</li> </ul>	<ul style="list-style-type: none"> <li>▪ There are no SOPs developed for impact assessments, cost-benefit analysis and evaluation of the capacity of the executor;</li> <li>▪ Currently no economic and social planning expertise and expertise in policy development; need for clear and transparent operating procedures (JICA has developed a Manual of Policy, Processes and Procedures, and Products, but in its current form the Manual is beyond the grasp of the majority of ADN engineers);</li> <li>▪ Issues with the quality of some final documentation approved by ADN - technical specifications requiring re-work;</li> <li>▪ It has been actively involved in project supervision, certifying payments for works;</li> <li>▪ There is some confusion created by the role of ADN relative to line ministries in relation to project supervision, though attempts have been made to address this through joint project monitoring visits;</li> <li>▪ Timeframes for certification for payment frequently not met (subjective judgment of “percentage of work completed” present in contracts may favor delayed payments, as well as tensions in relation to coordination with relevant ministries);</li> <li>▪ Ability to produce processes and procedural guidelines that will bring a standard approach to quality assurance, monitoring and evaluation of projects, has been identified as an issue of concern;</li> <li>▪ Much of its focus has been on the DDP, which delivers a significant part of line ministry capital works activities. It has been facing challenges coping with the volume of work associated with PDID;</li> <li>▪ The MDG Suco Support Team has been falling short of targets for housing construction (ADN target for 2013 is 4,673 compared with Government target of 11,000);</li> </ul>
--	---	---

		<ul style="list-style-type: none"> <li>▪ More recently, it has been asked to step beyond its legal mandate to directly identify, design and implement major capital projects such as the Comoro Bridge;</li> </ul>
<p><b>National Procurement Commission (NPC)</b></p>	<p><b>Decree-Law 15/2011:</b></p> <ul style="list-style-type: none"> <li>▪ Carry out <b>procurement procedures worth at least US\$1,000,000</b> (one million dollars);</li> <li>▪ Provide <b>technical assistance and advisory to procurement procedures up to US\$1,000,000</b>, and monitor and provide technical assistance to other procurement procedures done within the scope of all public entities;</li> <li>▪ Collaborate with the NDA, the MPS, Ministries and other public entities according to the law. I.e., submit its recommendation to the CAFI or to the Council of Ministers for approval.</li> </ul>	<ul style="list-style-type: none"> <li>▪ It understands itself to have a procurement role in relation to all projects financed by the IF, which includes multi-year projects less than US\$1,000,000 as well as large projects over US\$1,000,000. And it is the Prime Minister who approves contract awards;</li> <li>▪ It is not yet performing either the monitoring or technical assistance roles.</li> </ul>

Label: **Main roles**; **Overlapping**.

Sources: Chapter 2 of this report; AUSAID, Timor-Leste National Development Agency Rapid Organisational Assessment, 2013; HOOK, David, A Report on Public Investment Management in Timor-Leste, 2013; and respective legal documents.