

FINAL REPORT: **Options for increasing the efficiency of Vanuatu's oil and gas supply chain**

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David Butcher and Associates

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Executive Summary

The Government of Vanuatu (GoV) has identified addressing the cost of energy and security of supply as two of Vanuatu's development priorities. In an effort to improve both security and the cost of petroleum supply, the GoV together with the World Bank (WB), launched the Energy Road Map 2012-2022 to lay the foundation for future energy sector policy and investment. The Roadmap aims to identify the energy needs of the sector over the next 10 years, and the policy direction needed to support the required investment plan. Petroleum is a significant part of Vanuatu's energy needs and therefore an important input into the Road Map.

The Road Map Inception Report identified a number of priorities for petroleum including:

- Reduced reliance on imported petroleum
- Strengthening of the legislative and regulatory framework
- Risk management (including physical storage and financial hedging) to reduce exposure to high and volatile petroleum prices

This study assesses Vanuatu's petroleum dependency over the next 10 years, examines the efficiency of the supply chain, identifies areas for improvement and consider options for reducing Vanuatu's vulnerability to high and volatile petroleum prices, including examining the regulatory arrangements required to do so.

Approach and Methodology

An initial visit was undertaken to Vanuatu to meet with stakeholders, outline data requirements and develop plans for site visits. A visit by our engineering and environment experts enabled us to review all facilities from an engineering, environment and safety perspective.

Framework for Setting Petroleum Sector Policy

Our analysis and recommendations have been guided by the following framework, namely that our recommendations to address development priorities should:

- Be driven by economic efficiency;
- Identify the current level of energy security and recommend areas for improvement;
- Identify an appropriate framework for providing environment, health and safety requirements;
- Identify a transparent, workable and effective regulatory regime;
- Be based on robust risk assessment and mitigation; and
- Be guided by implementation ease and time horizon.

In considering options we have aimed to strike an appropriate balance between:

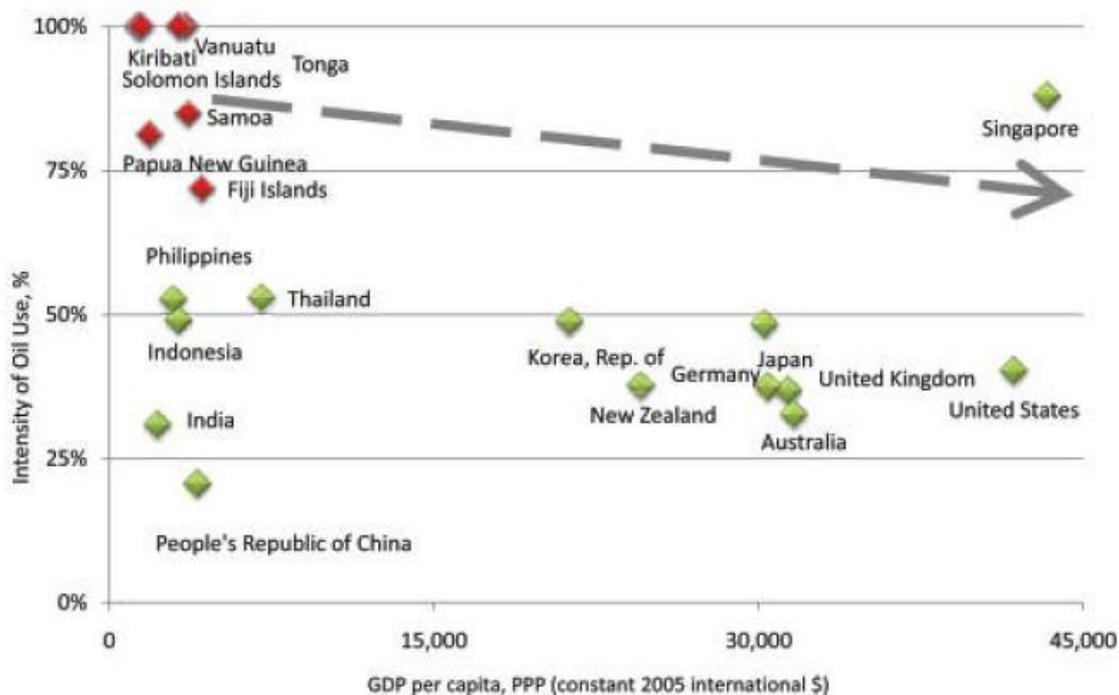
- The needs of the market participants as investors for certainty, appropriate returns and financially sustainable businesses;
- Customers' needs for efficient, safe and reliable supplies of fuel; and
- The energy security interests of the country.

Dependence on Petroleum

From a number of perspectives Vanuatu's dependence on petroleum is high and this looks set to continue. By 2022 our analysis indicates that demand will be nearly double what it is today. High and volatile energy prices are therefore likely to have an on-going and significant influence on the Vanuatu economy.

A recent ADB study ranked Vanuatu's dependence high, as measured by intensity of use relative to per capita income levels.

Intensity of Oil Use



A more recent World Bank study calculated figures for vulnerability of many countries to petroleum price movements and other factors. This too indicates that small island economies are vulnerable, with Vanuatu's vulnerability increasing by a factor of 4 as oil prices rose to historical highs during 2008.

Petroleum Sector Vulnerability

Country	V	V	V	ΔV	ΔV	Data source
	1999	2008	2009	99-08	99-09	
	1	2	3	4	5	
Fiji	2.6	18.1	15.9	15.5	13.3	EIA
Samoa	2.7	7	4.3	4.3	1.6	EIA
Solomon Islands	1.6	7.9	6	6.3	4.4	EIA
Tonga	3	12.2	7.2	9.2	4.2	EIA
Vanuatu	1.1	4	3.8	3	2.7	EIA
Average of Pacific less PNG	1.83	8.20	6.20	6.38	4.37	

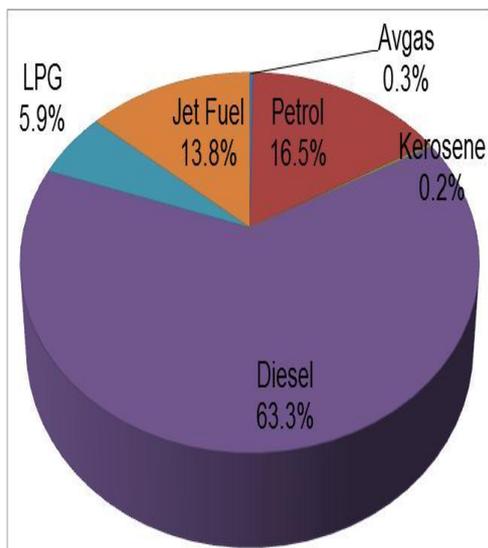
It is notable that in every category, Vanuatu exhibited the lowest vulnerability to petroleum price shocks. Our conclusion is that this is due to Vanuatu's extensive use of biomass for cooking and other household tasks, rather than diesel powered electricity. We cannot identify other significant elements of the supply chain that render Vanuatu less vulnerable than other neighbouring countries.

Market Size

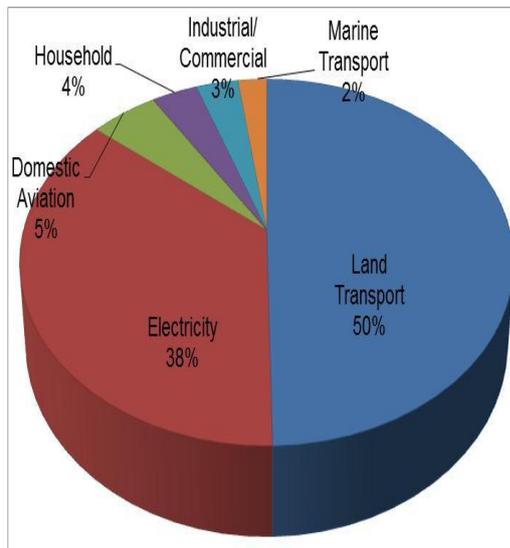
The Vanuatu market for petroleum and LPG is small by regional standards, with annual domestic demand of around 56 million litres (including 3 million litres of LPG) or about 10% of the size of Fiji's market. Assuming sufficient storage was available in Vanuatu, its annual petroleum demand could be met by slightly more than one delivery from the 40,000 tonne MR ocean tanker currently used to deliver fuel to Vanuatu.

Diesel is the largest volume imported (63% or 33 million litres) as it is also used in electricity generation (18 million litres including use for outer islands generation). Land transport fuels make up the biggest demand segment (50%), followed by electricity demand.

Imports (2010)



Market Segments* (Domestic Demand)



*Market Segments excludes bunkering (1.3 million litres) and international aviation (3.6 million litres)

The cost of petroleum is impacted by lack of scale - the same supply infrastructure is required (albeit less than for higher volume countries) but market demand volumes are of a lower order of magnitude, leading to higher per litre costs.

Market Structure

The market is a monopoly with only one supplier for each of petroleum and LPG. This is a concern as most nations in the region have some form of competition. However this needs to be balanced by the consideration that having more competitors in a small market risks duplication of facilities, leading to higher costs because of the lack of scale.

Pacific Petroleum Company (PPC) is the only petroleum marketer, having acquired the marketing assets of each of the three oil majors as they withdrew from the region. Small volumes of

petroleum are imported by a number of fringe players in shipping containers and sold directly to the public. Origin is the sole importer and marketer of LPG.

Regulatory Framework

The regulatory framework specific to the petroleum and LPG sector is poor and the sector appears to be largely self-regulating in terms of environment, health and safety standards including for fuels quality, infrastructure and facilities. Matters such as pricing, risk management, and energy security are also determined by the market participants.

The GoV recovers a significant proportion of revenue from excise, duties and value added tax - in 2010, fuel taxes accounted for 11% of GoV revenue.

Various agencies provided information to assist in compiling this report, including the National Statistics office and Customs and Revenue Department. But much of the information for monitoring the sector is not collected, which makes proper monitoring difficult.

We recommend GoV should gather more comprehensive market information to support its priorities for the petroleum and LPG sector.

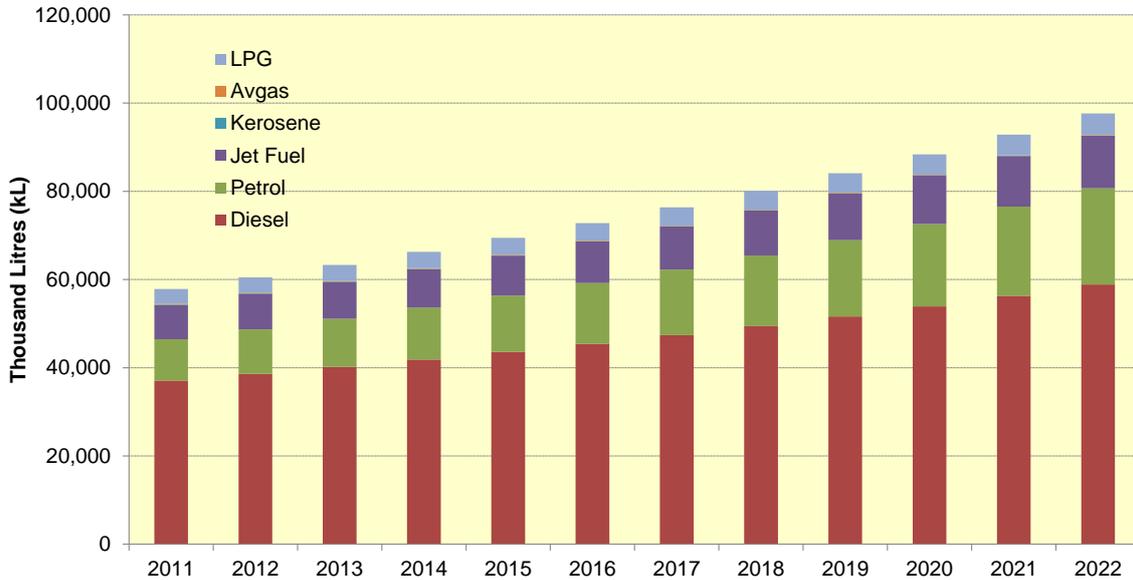
Demand

Vanuatu's energy supply comes principally from biomass and petroleum. Our analysis suggests that petroleum's share continues to grow but it is difficult to be precise, because there is little empirical analysis around biomass use (a large rural population using wood for cooking and crop drying). A 2004 SPREP analysis estimated the biomass proportion to be around 50% of energy supply. Petroleum demand trends where growth has been well above population growth would suggest that the biomass share has reduced - our estimate is that biomass now makes up around 40% of gross energy production.

But petroleum dependence is still the critical issue. For Vanuatu petroleum products are important inputs into major sectors of the economy - tourism, transportation, fishing and agriculture. Petroleum consumption has increased rapidly over the last 10 years, at an annual average rate of 5.7%. Once diesel use for electricity is excluded, consumption of petrol, LPG and diesel has doubled; with the transport sector generating most of the increase (land transport consumes just over 50% of all petroleum products imported for domestic consumption). Diesel used in electricity generation has grown more slowly (dropping a little in the last couple of years) with the introduction of more renewables into the generation mix.

Based on current trends and projected growth rates (GDP growth estimated at 4%), petroleum demand is expected to nearly double by 2022 (~ 100 million litres). Increases are expected to be highest for land transport fuels (petrol and diesel) based on correlation with historical growth rates. Kerosene (for aviation use) will be influenced by operating efficiencies achieved by airlines and may not see substantial increases in demand, despite increases in tourist numbers. Electricity demand for diesel will be subject to development plans for renewables (which does not form part of this report) - assuming continued support for renewables, we expect diesel demand for generation to grow at less than forecast GDP.

Demand Forecast



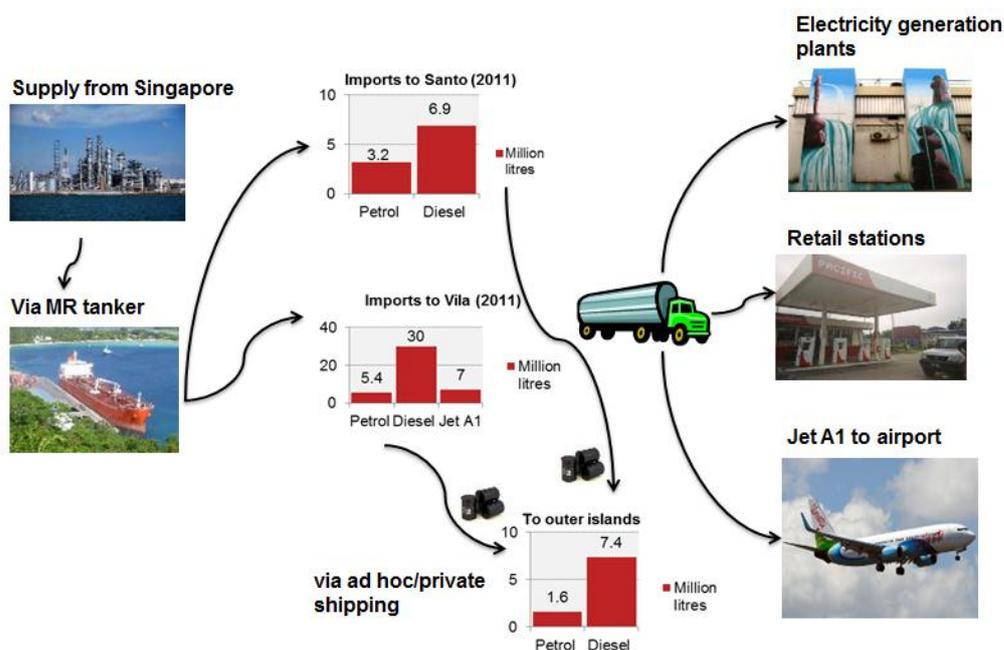
Source: Hale & Twomey

Petroleum and LPG Supply Chain

PPC supplies Vanuatu from Singapore as part of a schedule to its other markets in the Pacific Islands. The cost components flowing through to the price of petroleum include each element of the supply chain - acquisition in Singapore, ocean transport, landing charges in Vanuatu (wharfage), receipt, storage, handling and distribution to market segments. Prices are built up on this basis and adjusted by PPC as re-supply is made. Fuel price changes in Vanuatu reflect international petroleum prices when the cargo was loaded in Singapore.



Port Vila and Santo can accept large Medium Range (MR) petroleum tankers (35,000-45,000 tonnes) provided they are not fully loaded. In 2008 PPC switched to operating these larger vessels rather than the much smaller Local Coastal Tankers (1,500-2,000 tonnes), which are a feature of the hub and spoke supply networks that operate in the region (and which used to supply Vanuatu). Under a hub-and-spoke supply chain arrangement, fuel was shipped in MR tankers from Singapore to Fiji, stored in Fiji and then reloaded onto smaller LCT's for drop-off to Vanuatu and other small island states close to Fiji. The bigger MR tankers ships are more cost effective providing savings in the ocean transport component of supply chain cost.



Petroleum Supply Chain

PPC has invested in infrastructure (pipeline to Main Wharf) to be able to use MR tankers. Our pricing analysis indicates this has improved supply chain efficiency, reducing cost of supply by around VUV 7.0/litre. Pricing analysis indicates that despite PPC being a monopoly, it has allowed these efficiency gains to flow through to consumers.

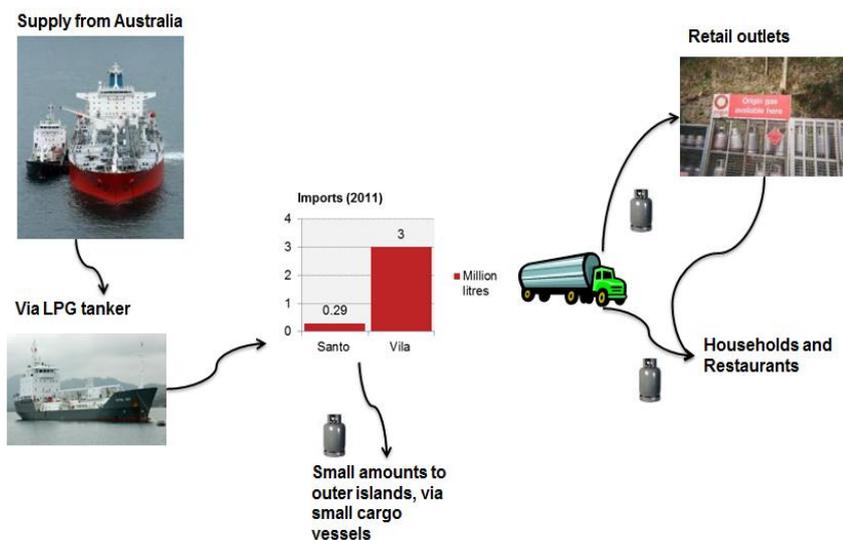
LPG Supply Chain

Origin supplies Vanuatu with LPG from Brisbane as part of a supply schedule covering a number of island countries in the region. LPG pricing in Asia Pacific is determined by posted prices set by Saudi Arabia, which is a dominant supplier of LPG. The price of LPG in Vanuatu will reflect the Saudi price together

with the cost to ship to Brisbane, and then to Vanuatu, along with the handling costs incurred by Origin in transferring the product to smaller ships. The ships used for deliveries to Vanuatu are small (1,000-1,500 tonnes) and stock levels at each of the delivery locations determine delivery schedules.

Deliveries to Port Vila occur once per month

on average (once every three months to Santo). Origin operates bulk storage receiving facilities in Port Vila and Santo, and supply is made to the market via a mix of road tanker and bottles ranging from 4, 9, 11 and 45 kg.



Distribution to outer islands

Distribution of fuel within Vanuatu is done in two ways: Port Vila and Santo use tanker trucks for bulk deliveries; the outer islands are shipped fuel in 200 litre drums and LPG bottles filled from the bulk terminals in Port Vila and Santo. The lack of certainty around schedules for inter-island shipping within Vanuatu has at times caused shortages in fuel supplies on smaller islands.

Anecdotal information indicates that costs for secondary distribution within Vanuatu are high. For fuel drums, the shipping transport charge is typically in the range VUV 3500 to VUV 4000 per drum (17-19 VUV/litre) and a 9kg bottle of LPG costs around VT500 (55 VUV/kg) to ship from Port Vila to Tanna.

PPC has recently entered into a Memorandum of Understanding (MOU) with the GoV (represented by the Minister responsible for Energy), to procure a self-propelled bulk fuel barge. The barge will increase the efficiency of the supply chain by lowering freight costs, improve supply security by establishing more bulk tank receiving facilities, and improve operating and safety standards e.g. by reducing the loading (and back loading) of drums on other domestic shipping.

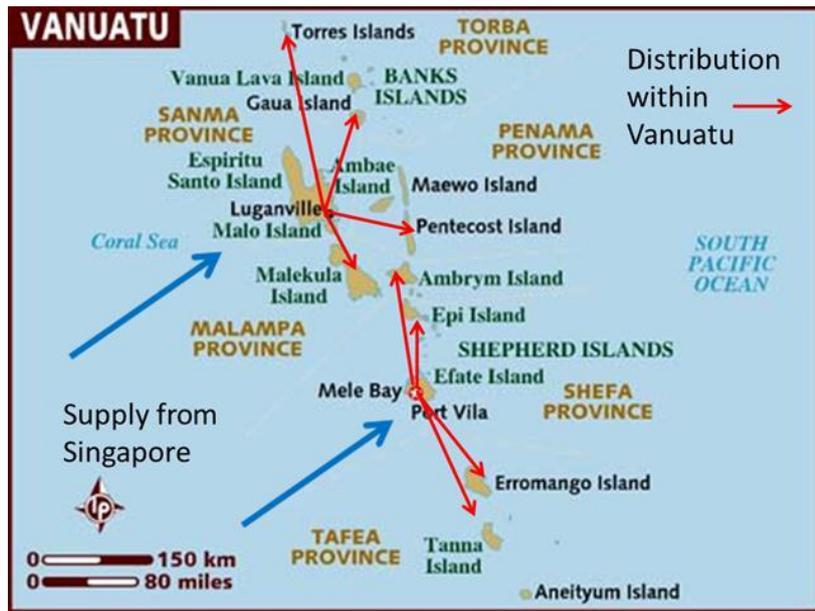
We recommend the GoV work closely with PPC to ensure efficient utilisation of the barge.

Stock Levels

Stock levels are determined by PPC on a commercial basis, where levels are sufficient to be able to meet typical disruptions in the supply chain, taking into account alternative supply options (such as New Caledonia/Fiji) and the cost of holding stock.

The minimum stock level is the number of days' stock available (the buffer) when a replenishment arrives; the average is the minimum plus half the typical parcel discharged (average between replenishments) and is also the measure of working capital tied up in stock.

- Excluding power diesel we consider 21 days minimum stock (see table on next page) before replenishment is efficient (noting an increase in kerosene is required, which is acknowledged by PPC); given Vanuatu is the last discharge port on the current schedule. Disruptions to shipping or refinery supply will likely be known in advance of this time providing PPC with a sufficient timeframe in which to rearrange delivery patterns
- We consider average days cover to be acceptable from a security perspective taking into account the cost of holding stock. We have assessed the cost of holding higher levels of stock but consider this to be inefficient and excessive – for example holding a level equivalent to an IEA 90 day minimum would require 6 million litres of stock together with additional



storage (based on 2011 demand). An investment of this magnitude would cost 1.1 billion VUV (tanks and stock) and increase the fuel price by 5 VUV per litre.

- Having said that, the GoV should always have in place an emergency response plan that addresses deployment of stock during periods of major disruption (e.g. natural disasters, geopolitical events impacting international supply).

As part of re-establishing a comprehensive regulatory approach the GoV should put in place a National Emergency Response Plan that addresses deployment of stock during periods of major disruption (e.g. natural disasters, geopolitical events impacting international supply).

The high minimum days cover for power diesel is by agreement with UNELCO; the current level is significantly higher than the commercial level and carries a significant holding cost. We question whether this is cost effective given PPC's supply flexibility – reducing power diesel minimum stock to 30 days (providing average days cover of 63 days) would reduce holding cost by VUV 1.1 per litre.

Port Vila and Santo Commercial Petroleum Stocks

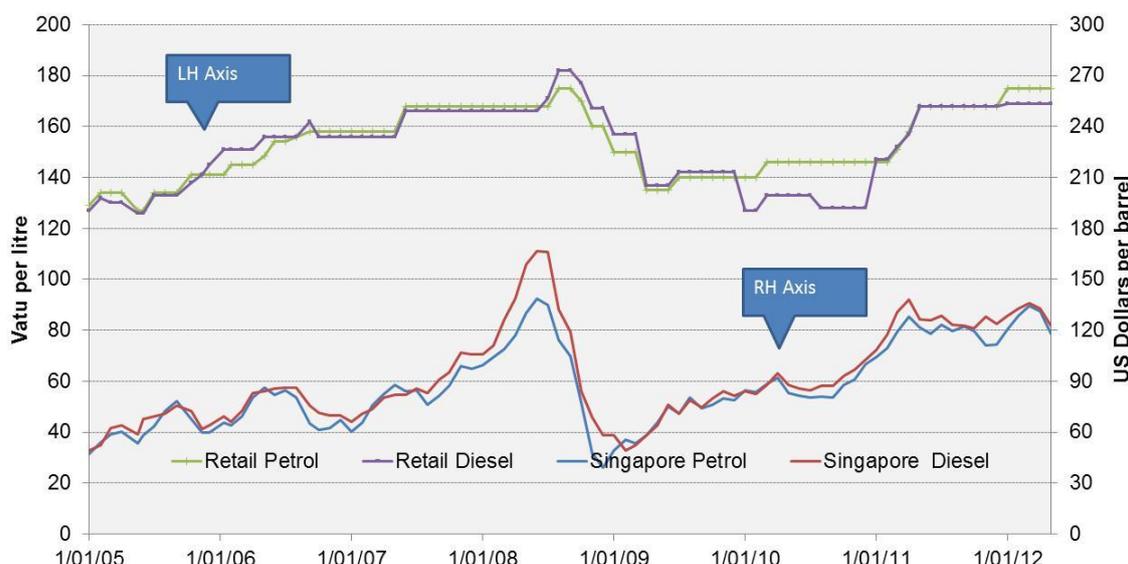
Port Vila Stocks					
	Petrol	Kerosene	Diesel	Power Diesel	Average days cover
Minimum net days cover	21	14	21	60	
Average gross days cover	54	46	52	93	64.4
Santo Stocks					
Minimum net days cover	21	14	21		
Average gross days cover	86	90	83		85
Average days cover for Vanuatu 68.5					

Based on the projections for demand, more storage is likely to be required around 2015/2016 to remain within these parameters. This investment timing is also being driven by UNELCO's requirement, which already places a high working capital cost on Vanuatu.

Pricing

Since 2005, at a high level retail prices for petroleum have broadly tracked international petroleum prices in Singapore. The following diagram illustrates the trends. The left axis shows the Vatu per litre trend in retail prices, and is compared with the Singapore wholesale prices for petrol and diesel on the RH axis.

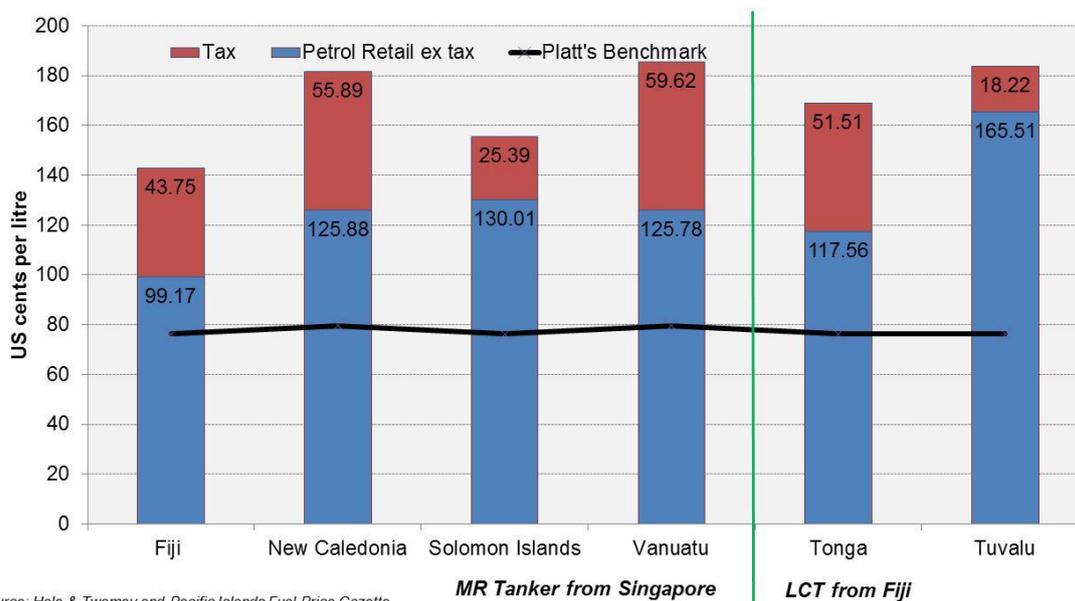
Vanuatu Tracking International Prices



Source: Hale & Twomey

It has been suggested that Vanuatu petrol and diesel retail prices (less taxes) are higher than for some comparable countries such as Tonga and Fiji. Petroleum for these countries is also supplied from Singapore and pricing is built up on a similar basis as for Vanuatu, but the latter is at the end of the supply chain, thus bearing all costs, with little alternatives.

Retail Price Comparison (April – September 2011)



Source: Hale & Twomey and Pacific Islands Fuel Price Gazette

Our analysis of prices (excluding taxes) during this period indicates that while Vanuatu petrol and diesel retail prices are higher, the reasons that explain this are as follows:

- Vanuatu receives the same quality fuels that are used in French Polynesia and New Caledonia. The French territories operate on higher European quality standards compared to Fiji and Tonga which use lower quality fuels, meaning a higher price paid in Singapore for the fuels supplied to French Polynesia and Vanuatu.

- Vanuatu is the last port of call with a relatively small parcel size compared to other MR ports, resulting in a higher freight component (albeit much lower than for LCT delivery).
- There has been more recent investment in assets resulting in a higher asset value by comparison to countries with older assets/no recent investment.
- More stock (especially diesel for electricity generation) is being held than in other countries.
- A lower volume compared with other MR delivered countries resulting in a higher per litre cost.
- A higher exchange rate spread compared to other Pacific Island countries.
- Higher retail margin at the service stations.

Our modelling of PPC's business for 2011, taking into account our professional valuation of the storage assets and investment made over the last five years, together with advice received on costs of operation (including working capital but excluding retail margin), indicates that PPC is returning approximately a 16-17% pre-tax¹ return on assets required to service its business. While this is considered good we note that this is in line with returns of 15% per annum post tax allowed by countries in the region which regulate their markets.

If the market grows in line with our projections for demand, returns to PPC may improve with additional volume and the depreciation of its asset base. We note however that PPC plans to upgrade its facilities in the period to 2022, to cater for additional demand and to achieve greater operating efficiencies and HSE improvements for its facilities.

To be assured that returns for petroleum do not get out of line, and to provide assurance in pricing more generally, we recommend more focussed, regular market monitoring be put in place.

Because of Origin's confidentiality requirements, which prevented us from using Origin's commercially sensitive information during preparation of this report, we applied the same methodology used for petroleum (including taking into account our professional valuation of the LPG storage assets) and basing our assessment on market information, benchmarks and estimates rather than information provided by Origin. Origin has now provided actual revenues and costs data with which we have been able to update our analysis. This indicates pre tax returns of 22% are being generated. Origin disagrees with this assessment and argues that its returns are lower (around 14-15% before tax).²

The main point of difference between our assessment and Origin's is in the value of assets or capital employed to be used for calculating a rate of return. Our assessment uses our professional valuation for the assets required to service Origin's market (taking an approach comparable to that which a regulator would apply in regulating prices). Origin argues that its return should be assessed on the basis of total equity, expressed as total assets less total liabilities. Origin's total equity gives a much higher value and hence a lower calculated return.

Analysis of Origin's financial statements indicates that a substantial proportion of total equity (50%) is reflected in one investment. This investment ceased operation in 2010/2011 when the principal assets, being two gas tankers, were sold. It's not clear why this asset should remain when the principal assets have been sold and the asset is acknowledged as no longer operating.

¹ Income tax is not applied in Vanuatu.

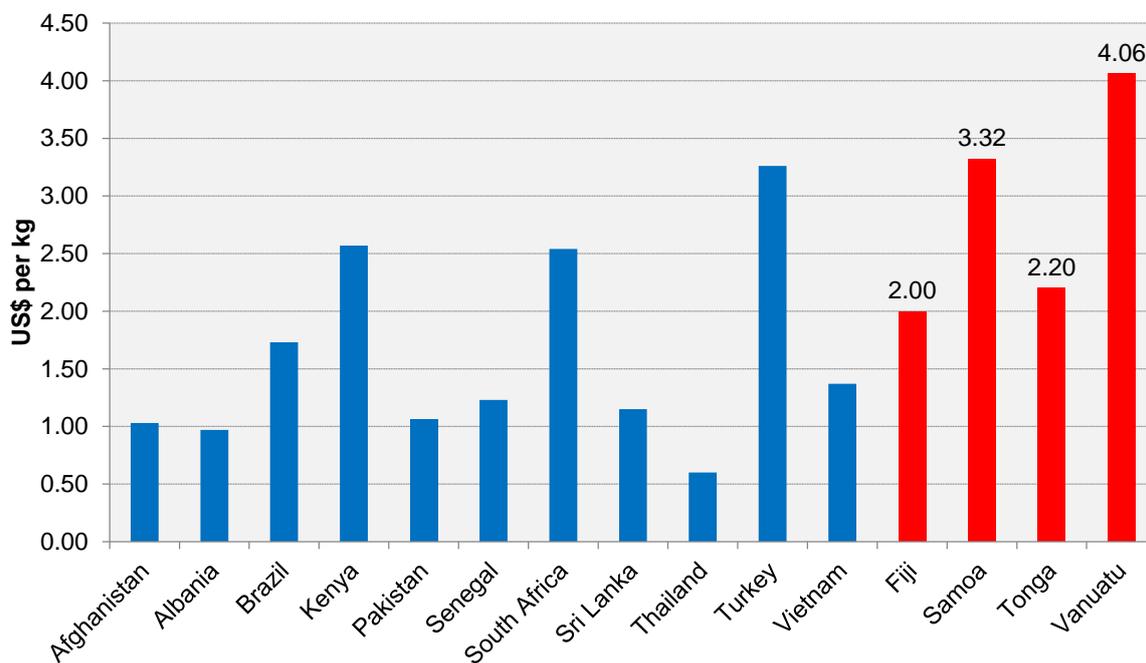
² We discuss these differences in the Addendum to this report.

From a regulatory perspective we doubt that any pricing framework would allow such an asset to be included in a regulated asset base for the setting of prices to be charged. Market prices in Vanuatu already include the cost of shipping in the landed cost, which will include an element for the investment return required by the ship owner. Accordingly we do not accept Origin's assertions that its assessment should include this investment. .

We note that Origin Energy has been investing in the Vanuatu LPG market. However we also note that prices in Vanuatu are high when compared with similar sized markets in the region. Our analysis suggests that returns are higher than for countries where prices are regulated.

Based on our analysis we recommend that the GoV implement price regulation for LPG.

LPG Retail Price Comparison December 2011 including taxes.



Source: World Bank December 2011 LPG Report , Samoa Ministry of Commerce, Tonga Ministry of Commerce and Hale & Twomey

Storage and Distribution Facilities (Capital Stock)

The petroleum and LPG storage facilities in Vanuatu are in a reasonable state. Since the oil majors exited the Pacific Islands region, these facilities have required major upgrades. PPC has invested to improve security of supply, reduce risk and reduce operating cost. This included a new diesel tank in Port Vila (Tank 7), the installation of a product pipeline from the main wharf (to enable use of MR tankers) and the storage compound in Port Vila. Tank 7 has been constructed to current international standards - the compound has been fitted with an impermeable high density polyethylene (HDPE) liner that, given there is no local legal standards in Vanuatu for the construction of fuel storage tanks, reflects PPC's stated intention to operate to international standards.

PPC and Origin have inherited facilities with some fundamental design and construction issues that can only be addressed with major injections of capital. These issues are exacerbated by the residential encroachment which has occurred over time through lack of any zoning restrictions. Addressing these issues cannot be undertaken quickly without increasing the price of the fuels. Therefore a balance needs to be struck between upgrading the assets to improve the integrity of

supply and reduce risk, and limiting cost increases in fuel to pay for the upgrading. Both PPC and Origin are aware of these issues and plan to address them as funding permits. These issues are rated low probability events, except for loading of trucks which is considered medium.

Although these physical/safety risks might be low probability they could nevertheless have high impact, especially with the Port Vila facilities being close to a residential area.

We recommend the GoV discuss these risks with PPC and Origin to understand how these are to be incorporated into each company's long term capital investment plans.

The areas of concern for petroleum and estimated cost for upgrading are:

- Fire protection systems (USD 3.7 million)
- High level alarms for risk of tank overfill (USD 0.26 million)
- Top loading of trucks (USD 0.22 million)
- Upgrade Santo Tank compound with HDPE Liner (USD 1.2 million)
- Proximity of petrol storage to nearby residential areas (USD 0.6 million)
- Seismic ratings of tanks in the event of earthquakes (initial survey USD 0.22 million)

Total estimated investment cost over USD 6.2 million or VUV 611 million

For Origin's facilities issues include:

- Fire protection (including one tank above ground) (USD 0.9 million)
- Proximity to residential areas (Port Vila only)
- No gas leak detection system (USD 0.1 million)

Total estimated investment cost over USD 976,000 or VUV 96.2 million

Our valuation of existing assets required to service the market (which forms part of our pricing analysis) is derived from a fully built up replacement cost for these assets. In our professional view:

- The **replacement cost** for PPC's storage assets (including Port Vila, Santo, and Bauerfield Airport) is estimated at ~ USD 50 million. Operation and maintenance amounts to VUV 330 million per annum.
- The **replacement cost** for Origin's storage assets (including Port Vila and Santo) is estimated at ~ USD 13.5 million.

EH&S Risk in supply chain

Environment, Health and Safety (EH&S) risks occur in the supply chain in shipping fuel to Vanuatu, storage in terminals and depots, distribution within islands of Vanuatu and end use by consumers. Both PPC and Origin Energy have internal policies and procedures for managing risk along the supply chain (which are consistent with industry practice in the region), and these practices are audited annually by independent auditors for insurance purposes.

Vanuatu has experienced the consequences of a number of EH&S risks which had a significant impact on the environment, well-being of people and cost to the economy. Some of the major incidents documented are:

- Jet A1 hydrant line leaked in 1989 at Bauerfield Airport releasing up to 100,000 litres of product to ground.

- LPG explosion at Nasama resort in Port Vila killing two Ni Vanuatu and critically injured a builder in April 2012.

The lack of an appropriate EH&S regulatory framework is a major concern. The current system of relying on petroleum companies to self-regulate EH&S has some evident shortcomings, including allowing competition at the margin to operate with inadequate EH&S safeguards.

A thorough review of Vanuatu's EH&S framework this should be a major point of focus.

PPC has oil spill equipment that it mobilises when discharging tankers. This is the level of response generally operated by the commercial sector in other jurisdictions. Our understanding is that there is no other oil spill equipment available to handle more major events, which would be the responsibility of the Government. A major spill could adversely impact on the Vanuatu fishing industry, tourism industry and public health.

Oil spill response should also be included in developing an appropriate EH&S framework.

Improving security

Options for improving Vanuatu's security need to be weighed against their effectiveness and cost - the greater the level of security sought, the higher the cost. Hence affordability is also a relevant measure. Options include increasing the physical stock held and using financial hedging.

Physical Reserve Stock - In our view the current commercial levels of stock provide an appropriate level of security, when taking into account PPC's current supply chain flexibility to respond to shortages (alternative LCT supply from regional hubs such as Fiji/New Caledonia), the cost of holding additional stock, and the amount of diesel already held for power generation. Nevertheless the GoV should continue to monitor appropriateness of these levels noting that they will reduce with increasing demand and could also be influenced by any changes PPC makes in the way it supplies its markets in the region (e.g. if it moved away from LCTs altogether).

Buying physical stock as reserve is speculative as decisions still have to be made around timing for purchase and/or release. Furthermore, the international approach (IEA) to reserve stocks has changed; the practice now, for members holding stock, is to release into the market rather than reallocate between them. This has the effect in a shortage of countering upwards pressure on prices, because of the extra supply released to the market. Hence an international response affecting prices also benefits Vanuatu. For Vanuatu holding additional stock is more relevant to physical supply security. For managing price exposure financial hedging provides a more tailored and cost effective approach.

Financial Hedging - Financial hedging means taking an equal and opposite position to the commercial terms for purchasing the physical petroleum. It enables a party to remove the risk of loss or limit price volatility of the fuel and hence provide a greater degree of certainty around what the price may be.

The international cost of petroleum makes up around 50% of Vanuatu retail prices and about 40% of the electricity tariff. Currently there is no incentive on fuel and electricity suppliers to manage price risk, as all costs are passed through. Hence hedging would require either agreement with the sector, or appropriate regulation to require the sector to hedge, in order for the price benefits to be passed through to the market.

It is important that the objective for hedging is understood. Objectives could include:

- Reducing exposure to price volatility.
- Accepting some volatility by requiring prices to stay within an acceptable range.
- Allowing prices to flow through to some sectors e.g. transport so that consumers are incentivised to minimise use during periods of high prices.
- Limit hedging to the electricity sector because of its significance to wider public welfare.
- Excluding aviation as the aviation market tends to take its own hedging decisions.

Hedging mechanisms fall into three broad categories including:

Option	Benefits	Risks	Costs
1. Fixing the price	<ul style="list-style-type: none"> ■ No upfront cost ■ Removes volatility 	<ul style="list-style-type: none"> ■ Forgo price downside 	Market determination (fixed priced relative to market)
2. Cap the price	<ul style="list-style-type: none"> ■ Full downside participation 	<ul style="list-style-type: none"> ■ Upfront cost of premium ■ Retain some volatility 	VUV 3-5/litre indicative but subject to term, market
3. Zero Cost Collar - price participation between Cap and Floor	Zero cost	Retain some volatility but limit upside and downside potential	"Call" option and "put" equate to equal zero

Decisions would be required on the objectives for hedging (as outlined above), assessment of the risks, implementation, and framework for administration, monitoring and adjustment over time in light of the experience. Decisions would also be required on the framework for passing on to the market the revenues/costs arising from hedging. Options could include:

- Government directs the supplier to hedge and pass on the benefits/costs to the market – full transparency would be required to ensure the benefits of hedging were passed through to the market.
- Government undertakes hedging and strikes a levy to pay and pays supplier the benefit (or possibly reduces excise) to be passed through to the market – again full transparency would be required.

There is no obvious or specific regulatory framework currently providing the GoV with the authority to undertake hedging activity. Furthermore the ability to undertake hedging is constrained by the lack of a framework to direct the market participants to do so.

Transport Sector Recommendations

Given the transport sector accounts for over half Vanuatu’s domestic demand for petroleum fuels (i.e. excluding bunkering and international aviation), improvements in the efficiency of usage of fuels in the transport sector are a key area for Vanuatu’s energy strategy. Land transportation in particular is an area where improvements in fuel efficiency can have a direct impact on costs to consumers and on Vanuatu’s overall fuel import bill. Understanding the scope for this is difficult however because of the lack of good data on Vanuatu's current vehicle fleet and systems for monitoring continued improvement in the fuel economy of vehicles.

To enable the GoV to understand its transport sector and make decisions on energy efficiency measures, we recommend a comprehensive review of the transport sector over the next two years, also taking into account the capability of the current regulatory framework to provide appropriate data.

Regulatory Framework

We conclude that regulation for the sector is poor. Regulatory status is as follows:

Area	Gap
Licensing	No specific licensing regulations apply to the downstream petroleum sector. This absence allows anyone to trade possibly without appropriate standards or commitment to Vanuatu’s on-going benefit.
Environment Health and Safety	No specific regulations governing standards for the downstream sector. We understand the government has drafted legislation aimed at regulating waste management which would extend to the sector.
Economic Regulations	No specific economic regulations regarding competition, pricing etc. or the rights of the GoV to collect information or intervene when and if necessary.
Emergency Management	No specific regulations guiding control of the sector in an emergency (e.g. fuel rationing in case of a fuel shortage).
Fuel standards	No regulations governing fuels quality.
Financial Authority for Risk Management	No specific regulations.
Transport	No specific regulations governing the energy efficiency in transport sector (vehicle standards).

An effective regulatory framework for the petroleum and LPG sector should be re-established. Because it is largely non-existent or unclear whether existing regulations can meet some requirements we recommend:

1. Policy settings are established for the sector to guide the development of the framework.
2. Use international best practice including proven and effective practice within the region as well as standards and procedures used by the oil majors.
3. Reviewing the existing legislation/regulatory framework to meet regulatory requirements for the sector.
4. Developing the preferred regulatory approach, including guidance on the framework for implementation.
5. Undertake review as a matter of urgency over the next 1-2 years noting that timeframes will depend on both legal and policy input.

We provide our recommendations for actions that can be taken now, as well as the elements that should be included in any regulatory framework for the sector, in the following table.

Recommendations on Priority Short Term Actions

Findings/Recommendations	Priority (0-6 months)
<p>1. Lack of transparency means assurance of fair market pricing is poor</p> <p>Recommendation – reinstate fuel price monitoring with capability to be undertaken at regular intervals.</p> <p>1.1. Petroleum - reinstate fuel price monitoring with capability to be undertaken at regular intervals. As there is no evidence of undue margins at present, monitoring (as opposed to price regulation) is the appropriate measure to increase transparency as a basis for future decision making.</p> <p>1.2. LPG - introduce price regulation - evidence indicates that margins are high and higher than required to provide the market participant with an appropriate return when balanced against consumer needs for efficient, safe and reliable supplies of fuel.</p>	<ol style="list-style-type: none"> 1. Reinstating petroleum price monitoring covering petrol, diesel, kerosene and using benchmarks for supply chain components (to be undertaken monthly, supported by annual review) to increase the transparency of pricing (See Appendix 4: Example of typical price monitoring benchmarks). 2. Introduce LPG price regulation and review quarterly wholesale and retail prices (See Appendix 4: Example of typical price regulation benchmarks). 3. Assign competent resources to undertake benchmarking including regional resources (SPC/PIFS) and external consultants as required (using the supply chain model provided with this report). Adequate monitoring can be undertaken by use of external consultants however resourcing for the wider regulatory framework should include capacity building for locally trained personnel. 4. Develop pricing template for the petroleum products and LPG 5. Investigate with PPC changing pricing on loading in Singapore from 5 days around bill of lading (loading) to month average pricing, to reduce price volatility. 6. Options for monitoring resources include: (1) a levy on fuel sales to cover administration of fuel price monitoring. VUV 0.1/litre (~US\$ 50,000 per annum) would be adequate to undertake monthly monitoring including annual review via external consultants. (2) Alternatively funds could be reallocated from existing fuel taxes.
<p>2. Distribution inefficiency to outer islands within Vanuatu increases costs for consumers</p> <p>Recommendation - undertake scheduling optimization with PPC on barge proposal to ensure relevant components of supply chain optimised (balancing storage with vessel schedule).</p>	<ol style="list-style-type: none"> 1. Pursue barge project with urgency as it will increase efficiency of the supply chain, lower freight costs, improve supply security, improve bulk tank receiving facilities, and improve operating and safety (by reducing loading of drums, on domestic shipping). 2. Jointly with PPC develop full understanding of efficient scheduling of the barge, balancing storage required on the outer islands with the barge schedule to achieve lowest cost barge operation. 3. Support and facilitate requirements for storage investment as appropriate.

	4. Assign competent resources including using external consultants as required.
3. Fuels quality (petrol) placing unnecessary cost on consumers Recommendation - introduce fuel quality standards; examine scope to alter petrol quality supplied to meet fit for purpose requirements and reducing costs	<ol style="list-style-type: none"> 1. Investigate vehicle fleet capability to accept lower specification petrol 2. Investigate with PPC impediments to supplying lower quality fuel specifications for vessel scheduling and loading; 3. Introduce fuels specifications appropriate to Vanuatu conditions and transport fleet. 4. Align with main fuel specifications within region. 5. Implement fuel testing and compliance framework.
4. Current tank farm operation raises risks with encroachment of residential area Recommendation - review with PPC/Origin future capital investment to reduce risk	<ol style="list-style-type: none"> 1. Engage with market participants (PPC/Origin) to develop asset integrity management plan to minimise risk (high level risk and mitigation identified in this report)
5. High stock holding policies are leading to storage investment earlier than necessary to meet demand growth, causing prices higher than might be the case if the timing of new investment was better aligned to demand expansion. High stock holding policies are leading to storage investment earlier than necessary to meet demand growth Recommendation – examine with PPC scope for deferring storage investment (including constraints driven by UNELCO requirements)	<ol style="list-style-type: none"> 1. Jointly with PPC and UNELCO examine scope for deferring storage investment taking into account current stocks, changing shipping frequency and the need to ensure efficiency of supply chain

Findings/Recommendations	Priority (1-2 years)
6. Land transportation is an area where improvements in fuel efficiency can have a direct impact on costs to consumers and on Vanuatu's overall fuel import bill. The difficulty is lack of good data on Vanuatu's current vehicle fleet and systems for ensuring continued improvement in	<ol style="list-style-type: none"> 1. Review Vanuatu's current vehicle fleet, growth and fuel consumption projections. 2. Regularly estimate and publish projects of fuel demand across stationery and transport sector. 3. Commission a study to assess the costs and benefits of a range of policies that

<p>the fuel economy of vehicles.</p> <p>Recommendation - Review Vanuatu's vehicle fleet and commission a study to assess the costs and benefits of a range of policies that could improve the fuel efficiency of Vanuatu's growing vehicle fleet.</p>	<p>could improve the fuel efficiency of Vanuatu's growing vehicle fleet.</p>
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Recommendations for re-establishing regulatory framework for petroleum and LPG sector

A) Energy security

1. **Petroleum Price monitoring** – establish petroleum fuels price monitoring that meets objective of transparency, taking into account the energy security interests of the country, customer's needs for efficient safe and reliable supply and the needs of market participants as investors to maintain financially sustainable businesses. Regular monitoring provides assurance that prices reflect costs (including international petroleum prices) and should provide evidence of the need for regulatory intervention in the event of proof of undue use of market power resulting in excessive prices.
2. **LPG Price Regulation** - the evidence indicates that LPG margins are high and higher than required to provide the market participant with an appropriate return when balanced against consumer needs for efficient, safe and reliable supplies of fuel. We recommend price regulation using the Price Control Act 1974. This will require inclusion of LPG in the list of goods able to be regulated.
3. **Fuel safety stocks** – confirm minimum levels of fuel safety stocks that should be maintained, including supply chain factors that determine the levels of fuel safety stocks necessary including the appropriate balance of stocks on-shore in Vanuatu and investigating any stocks available off-shore (e.g. Fiji, Tahiti).
4. **Petroleum Emergency Response Strategy** – develop a range of demand restraint mechanisms for responding to fuels shortages and emergencies including publishing and broadcasting information on fuel conservation and efficiency measures and fuel rationing arrangements.
5. **Financial risk management** – Assess financial risks arising from oil price volatility, develop a risk management policy and implement a financial risk management framework enabling risk management to be undertaken by sector participants or GoV, including implementation options, extent of hedging, allocation of responsibilities, financial authorities, powers to levy, and administration.
6. **Land Transport** - review and update the Road Traffic (Control) Act 1962 to ensure all vehicles used in Vanuatu are registered and subject to regular inspection. The Vehicle Fleet data collected in the registration process should also incorporate fuel economy of vehicles.
7. **Fuel standards** – introduce fuel standards taking into account (a) future composition of Vanuatu transport fleet (b) international and regional trends (c) impact on supply chain. Develop appropriate quality testing and compliance framework.

8. **Information Gathering/Monitoring** – Regularly gather data on sector trends/statistics including fuel petroleum supply, demand projections and consumption across all sectors. These data and projections should take into account likely growth in the motor vehicle and marine fleet; population growth, economic growth; energy efficiency and any other related matters.
9. **Regulatory Framework for Control (Price)** - Determine an appropriate forward looking regulatory framework. This should include criteria for triggering options for introduction of price controls as the basis for pricing should monitoring indicate the market's failure to deliver efficient and transparent pricing. Options could include the re-establishment of the former Price Control Bureau (PCB), extending the powers of Utilities Regulatory Authority or that part of the Ministry responsible for price control in Vanuatu.
10. **Powers to levy** – In the event that a levy to fund regulatory activity is chosen, it will be necessary to provide powers to levy to cover the cost of monitoring etc.) as appropriate.

B) Environment Health and Safety

Health & Safety

11. **Review and update the Petroleum Regulations 1997** – bring up to date with international best practice in terms of licensing, safety planning, validation and verification of asset integrity and fuel handling process (including qualification/certification for installers/servicing of end consumer appliances). Where possible investigate and incorporate:
 - (i) International standards (engineering) and operating procedures used by oil companies
 - (ii) Base Vanuatu's downstream petroleum laws on the proven and effective laws in other countries.

Environment Protection

12. **Introduce Waste and Pollutions regulations under Vanuatu Environment Management and Conservation Act 2002 (EMCA)** - developing clear guidelines and regulations on the environmental impacts of above ground and underground storage of fuels and site remediation. The two important regulations of EMCA for the sector are [Section 45(2a)]:
 - (i) importation and transport of dangerous goods
 - (ii) waste management

Fuels Quality

13. **Fuel standards** – overlaps with Energy Security above

Emergency Planning and Response (including Oil Spill)

14. **Strengthen the Disaster Risk Reduction and Disaster Management National Action Plan (2006-2016)** with the objective of incorporating Emergency Response Planning as result of oil spill, an explosion, fire, maritime disaster or accident of any kind relating to petroleum sector. Conduct regular exercises to test effectiveness of National Action Plan and the petroleum spill response plan of downstream petroleum suppliers.

C) Resourcing

15. The nature of the regulatory framework and mandates of regulatory bodies determine the human and financial resourcing required. Decisions around resourcing will need to be taken as part of determining the framework, including the level of technical resource required and extent of local capacity (and any capacity building required).

Table of Contents

Executive Summary	
Abbreviations	
1.0 Introduction	1
2.0 Scope of Work	1
2.1 Methodology	1
2.2 Visit Programme	1
2.3 Approach to this Report	2
3.0 Vanuatu	3
3.1 Vanuatu's Economy	3
3.2 Petroleum Dependency	5
3.3 Earlier Studies	7
4.0 Petroleum Sector Overview	9
4.1 Demand and Usage	9
4.2 Value as Percentage of Imports	11
4.3 Industry Structure	11
4.4 Regulatory and institutional arrangements	13
5.0 Demand Analysis	15
5.1 Methodology	15
5.2 Current demand	15
5.3 Historical demand by sector	16
5.4 Demand by product	20
5.5 Demand forecast	22
6.0 Supply Chain	24
6.1 Overview	25
6.2 Petroleum Supply Chain	25
6.3 LPG	38
7.0 Health, Safety and Environment Risks in Supply Chain	42
7.1 Overview	42

7.2	Shipping Fuel to Vanuatu - Safety and Standards.....	45
7.3	Receiving/ Discharge facility (Port Requirements)	45
7.4	Transport and storage in Bulk Terminals	46
7.5	Distribution within Vanuatu	46
7.6	End users.....	46
7.7	Legislation mitigating HSE risk.....	47
8.0	Capital Stock.....	48
8.1	Methodology	49
8.2	Terminal Safety and Environmental Risk Assessment	49
8.3	Comments on asset age and asset integrity.....	60
8.4	Valuation of existing assets	60
8.5	Safety standards, training, compliance mechanisms and audit arrangements.....	61
8.6	Operation and Maintenance Expenditure with Capital Stock.....	62
9.0	Pricing Analysis	63
9.1	Overview.....	64
9.2	Petroleum pricing methodology	65
9.3	Fuel price analysis and comparison	74
9.4	Impact of petroleum price on Vanuatu's electricity and public transport sector	76
9.5	LPG pricing.....	77
10.0	Options for Improvement.....	82
10.1	Supply Chain Efficiency	82
10.2	Security and reliability of petroleum supply	84
10.3	Managing petroleum price risk.....	86
11.0	Improving the Regulatory Framework.....	92
11.1	Gaps in Policy Framework	92
11.2	Efficiency	93
11.3	Security	95
11.4	Environment Health and Safety	96
11.5	Risk Management	98

11.6	Approach to Regulatory Review	99
12.0	Recommendations and Implementation Plan	100
	Appendix 1: Terms of Reference.....	105
	Appendix 2: Current Regulatory Framework.....	108
	General Licensing	108
	Environmental Health and Safety	108
	Energy Supply	110
	Infrastructure (shipping, ports etc)	111
	Economic regulation	112
	Emergency Management.....	112
	Appendix 3: Comparison of World Bank 1992 and SPREP 2004 report findings.....	115
	Appendix 4: Proposed Monthly fuel price monitoring	118
	Appendix 5: Tax revenue from duties.....	122
	Appendix 6: Hedging Models	124
	Appendix 7: Economic Regulation	126
	Appendix 8: Model Structure	128
	Addendum: Approach to Feedback following Draft Report Consultation.....	129

Abbreviations

ADB	Asian Development Bank
ADO	Automotive diesel oil
AGST	Above ground storage tanks
AS1940	Australian Standard 1940
AusAID	Australian overseas development agency
BLEVE	Boiling liquid expanding vapour explosion
BPSWP	BP South West Pacific
CAS	Condition Assessment Scheme
DBA	David Butcher and Associates
DMNAP	Disaster Management National Action Plan
DoL	Department of Labour and Employment Service
DPK	Dual purpose kerosene
EH&S	Environmental Health and Safety
EMCA	Vanuatu Environment Management and Conservation Act 2002
ERM	Energy Road Map
ETF	Vanuatu Energy Taskforce (ETF)
GDP	Gross Domestic Product (value of all goods and services produced in a period)
GFC	Global Financial Crisis
GoV	Government of Vanuatu
H&T	Hale and Twomey
HDPE	High density polyethylene
HSDF	High Sulphur Diesel Fuel
HSNCOCOP	Secondary Containment Systems Code of Practice 47
HSNO	Hazardous Substances and New Organisms Act 2012
IEA	International Energy Agency
IMDG	International Maritime Dangerous Goods Code
IMO	International Maritime Organisation
ISCOTT	International Safety Guide for Oil Tankers and Terminals
ISPS	International Ship and Port Security Code
Jet A1	Aviation Fuel (also known as DPK)
LCT	Local Coastal Tanker
LPG	Liquid Petroleum Gas
LSADF	Low Sulphur Automotive Diesel Fuel
MARPOL	International Convention for the Prevention of Pollution from Ships
MoI	Ministry of Infrastructure

MOU	Memorandum of Understanding
MR Tanker	Medium Range Tanker
NAP	National Action Plan
NDA	National Disaster Act
NDC	National Disaster Committee
NDMO	National Disaster Management Office
NDOC	National Disaster Operations Centre
NERP	National Emergency Response Plan
OECD	Organisation for Economic Cooperation and Development
Origin	Origin Energy
PacLII	Pacific Islands Legal Information Institute
PCB	Price Control Bureau
PESWP	Pacific Energy SWP Ltd
PHD	Ports and Harbour Department
PIE	Pacific Islands Energy PIE Group (predecessor of PPC)
PNG	Papua New Guinea
PPC	Pacific Petroleum Company (PPC)
PSC	Petroleum Supply Chain
RBF	REEF Bulk Fuels Limited
Saudi CP	Saudi Arabia Contract Price for LPG
Scully	Overfill protection system
SOLAS	Safety of lives at sea
SPC/PIFS	Secretariat of Pacific Community/Pacific Islands Forum Secretariat
SPREP	Secretariat of the Pacific Islands Regional Environment Programme
TSA	Technical Service Agreement
UNELCO	Vanuatu's major power generating company
UNTRTDG	United Nations Transport of Dangerous Goods – Model Regulations
ULP	Unleaded petrol
URA	Utilities Regulatory Authority
URA Act 2007	Utilities Regulatory Authority Act 2007
VFSC	Vanuatu Financial Services Commission
VIPA	Vanuatu Investment Promotion Authority
VLGC	Very large gas containers
VNSO	Vanuatu National Statistics Office
VUI	Vanuatu Utility Infrastructure
VUV	Vatu, Vanuatu Currency
WB	World Bank

1.0 Introduction

The Government of Vanuatu (GoV) has identified the cost of energy and security of supply as two of Vanuatu's development priorities. Energy is an essential requirement for the island nation and a substantial proportion of energy required is imported as petroleum fuel. While petroleum volumes are low relative to international markets, the importance of petroleum supply for Vanuatu is in many ways more critical than larger countries as Vanuatu is highly dependent on petroleum based fuel for both transport and electricity. The cost of petroleum imports, particularly when prices increase rapidly on international markets, places pressure on the national budget and on household incomes.

In an effort to improve both security and the cost of petroleum supply, the GoV together with the World Bank (WB), launched the Energy Road Map 2012-2022. The WB selected David Butcher and Associates (DBA) and Hale & Twomey (H&T) to undertake a Petroleum Supply Chain Study and advise it and the GoV on a range of options for reducing Vanuatu's vulnerability to petroleum price volatility, by improving the efficiency of Vanuatu's fossil fuel supply chains and fuel pricing arrangements.

Our advice is a major input into the wider work under way to develop an Energy Sector Road Map for Vanuatu. The Energy Sector Road Map will set out a long term plan for:

- energy supplies and security;
- reducing dependence on fossil fuels;
- improving energy efficiency;
- increasing the country's use of renewable energy;
- improving the quality of supply; and
- increasing access to reliable energy supplies.

2.0 Scope of Work

2.1 Methodology

The objective of the project is to review and model the existing fuel supply chain and pricing arrangements in Vanuatu and provide advice on a range of options for reducing its vulnerability to petroleum price volatility by improving the efficiency of its fossil fuel supply chains and fuel pricing arrangements. The review covers all petroleum fuels including petrol, jet fuel, kerosene, diesel and liquid petroleum gas (LPG). The Terms of Reference are attached as Appendix 1.

This report has been developed using field work (consultation and independent assessment), analysis and modelling in several steps. The process steps involved:

- Data collection
- Consultation with all stakeholders
- Technical assessment of infrastructure (storage terminal, pipeline and port facilities).
- Analysis of data and preparation of cost models

2.2 Visit Programme

On the first visit of 25-31 March 2012, our field team met with a range of stakeholders to outline the study objectives, discuss and agree (where appropriate) data requirements, engagement timetables, prepare for site visits and prepare an initial assessment and visit report³.

During this visit, the study objectives were outlined to a range of officials at the Prime Minister's office. We then undertook a series of meetings with both government officials and the private sector involved in the petroleum supply and distribution. Government officials (mainly from ports, finance, statistics, labour and customs) also provided information required for the study.

The World Bank requested information from key stakeholders by letter dated 9th February 2012, via the Prime Minister's office. Pacific Petroleum and Origin, the two major suppliers, offered their cooperation in the study but also expressed caution around releasing data and information that might be commercially sensitive. The two electricity providers, Vanuatu Utility Infrastructure (VUI) and UNELCO also had similar views as the petroleum suppliers but agreed to provide data to the request from Prime Minister's office. We received information from PPC but information was not provided for a considerable time and then was made conditional on an undertaking as to confidentiality. In the absence of data from Origin we have relied publicly available benchmark information and information provided by the Department of Customs and Inland Revenue.

During a second visit from 30th April to 5th May, our experts engaged with market participants and gathered assets data, assessed asset condition and reviewed operating standards. Site visits were undertaken to all the petroleum and LPG storage facilities (three sites in Port Vila and one in Santo). Our review examined available documentation covering internal operating standards, maintenance schedules and control of work procedures as well as Vanuatu's legal and regulatory requirements for the sector. Where there were gaps we assessed against external standards including:

- AS/NZS 1596:2008 - Storage and Handling of LP Gas
- AS 1940 – 2004 - Storage and handling of flammable and combustible liquids.

The draft report was presented at the Energy Taskforce Meeting (ETF) on 17th September followed by face to face consultation with government officials, Origin Energy and PPC from 24th through to 27th September 2012. The summary of the feedback received from the stakeholder consultation and the report writer's response is attached in the Addendum of this report. The final draft was circulated for public consultation in November.

2.3 Approach to this Report

This report examines the petroleum and LPG sector in some detail, including the demand profile, the way in which the sector delivers to the market (including the risks), the infrastructure used (the capital stock), and the way in which it prices to the market. This is necessary to inform our overall assessment of the efficiency, and also to provide a perspective on how the sector will contribute in meeting the GoV's objectives for the wider energy road map (VERM).

Some sections are technical in nature, compiled by our technical experts – we have retained these as prepared so as to ensure that their technical integrity is maintained. To assist readers in dealing with the technical nature we have begun each section with a summary of the relevant conclusions.

³ David Butcher and Associates/Hale & Twomey

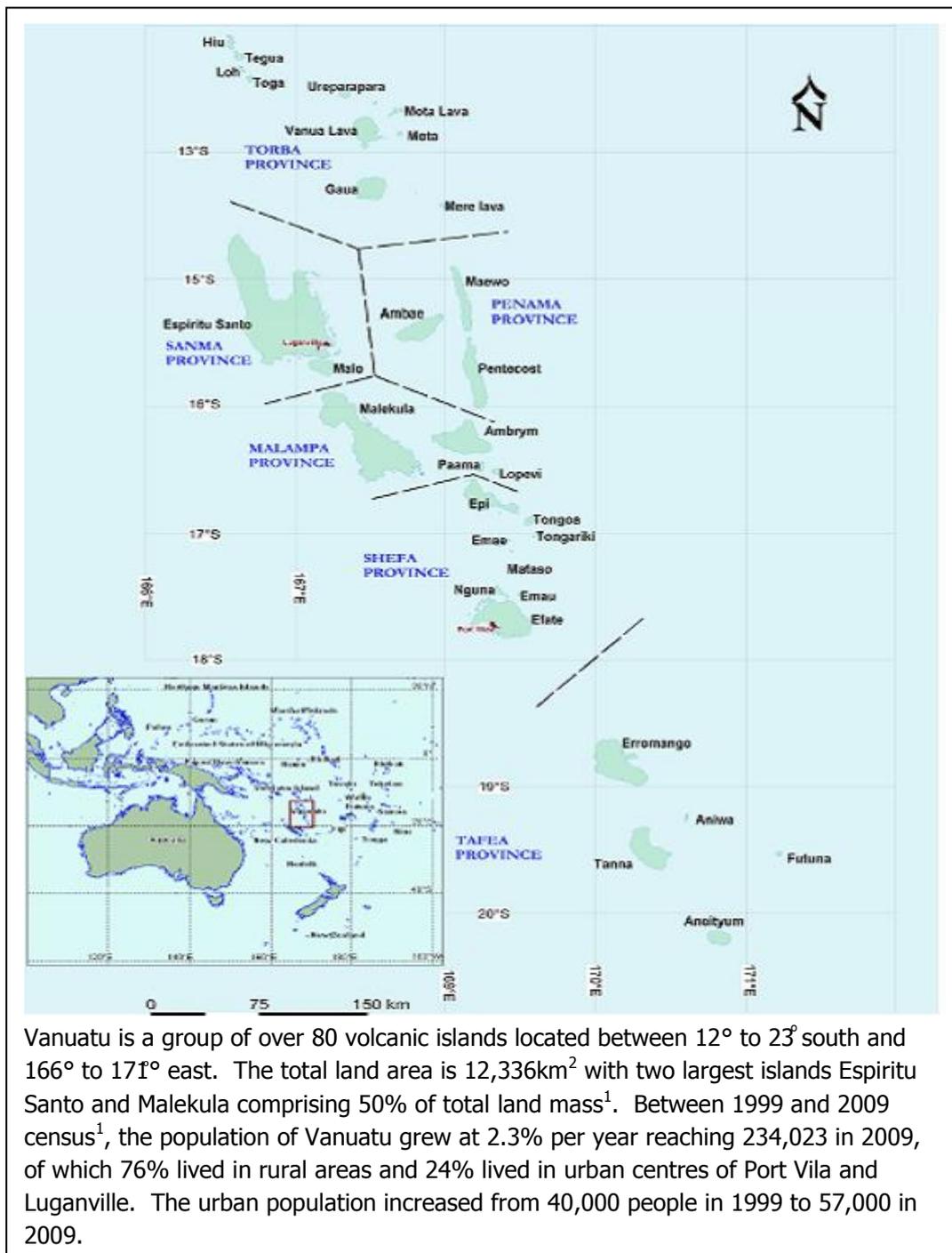
3.0 Vanuatu

3.1 Vanuatu's Economy

Vanuatu is an island nation with a small population (around 234,000) dispersed across many islands (Figure 1). This geography and small market size affects:

- Technological choices for transportation and power generation;
- Choice of fuels for transport and power generation; and
- The economic cost of delivering goods and services, including fuels.

Figure 1: Vanuatu's geography and population

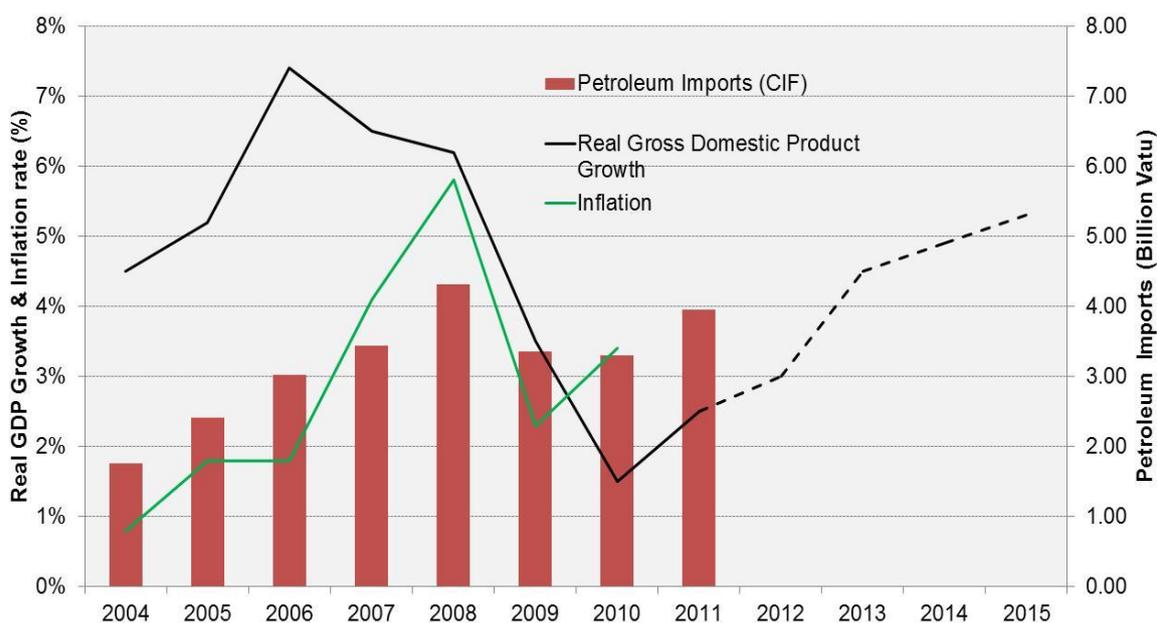


Vanuatu is a small economy that has experienced periods of relatively high growth. GDP per capita was USD 2856 in 2010.⁴ The main drivers of growth have been construction activity, tourism and services with a limited contribution from primary sector resources (copra, cocoa, kava, beef, fishing and forestry).

In 2008 GDP growth at 6.6% was one the highest economic growth rates in the Pacific Islands (AusAID 2008). The International Monetary Fund (IMF) attributed this to continued increases in tourism and construction activity together with higher than expected donor inflows. However the Global Financial Crisis impacted on the economy, starting around in 2009, with GDP dropping to 3.5%, with copra production falling, infrastructure projects delayed and tourism arrivals declining (IMF 2011).

Vanuatu’s economy continues to recover but at a much slower pace. GDP stood at 4.1% in 2010 and 3.7% in 2011. The Government of Vanuatu (GoV) expects growth to remain above the trend (Budget 2011) although the Reserve Bank of Vanuatu's GDP forecast for 2012 (Figure 2) was revised downwards following in March 2012, from the projected 4.5% to 3% prompted by weaker than expected construction activity as donor projects were postponed. Growth is expected to be driven by the services sector (mainly tourism at 63% of total GDP) and expected to increase by 2.5%. Agriculture (19% of GDP) is expected to grow by 3% and the industrial sector (10% of GDP) is forecast to grow 4% up on the previous year. The outlook for growth in the year is expected to be influenced by various on-going work in-progresses which are mainly private sector-led construction projects. Fuel imports are expected to grow in line with GDP growth.⁵

Figure 2: Vanuatu GDP growth rate and fuel imports



Source: Vanuatu National Statistics Office produce actual figures, projection of GDP growth rates from 2011-2015 is done by Ministry of Finance (Treasury Unit).

Taxation of petroleum fuels is a significant source of government revenue, with duty and excise on fuels together accounting for 7.2% of Total Recurrent Revenue in 2010. In addition, VAT

⁴ <http://www.dfat.gov.au/geo/fs/vanu.pdf>

⁵ Reserve Bank of Vanuatu, Quarterly Economic Review, March 2012, Page 16

revenues from sales of petroleum fuel are estimated to be 4.8% of total revenue collections. The total revenue collected in 2011 was VUV 1.259 billion (12% of actual revenue collected). Budget estimates for 2012 is VUV 1.24 billion (11%)⁶.

3.2 Petroleum Dependency

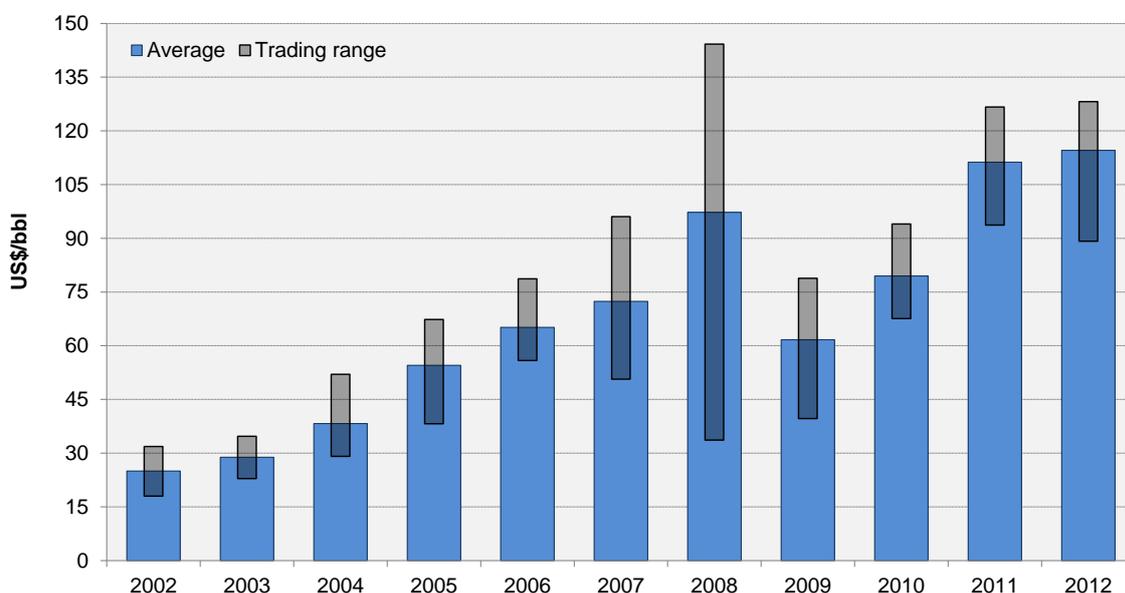
Like many small island nations, Vanuatu became heavily dependent on oil for its energy needs through the course of the 20th century. The very high energy density of oil, its versatility and the ease with which it can be transported and stored, make oil ideally suited for use in both power generation and transportation on islands. Petroleum fuel engines are a mature technology; they have relatively low capital costs, are available in sizes that meet the relatively small sized energy demands of islands and can be readily maintained in remote locations. For most of the 20th century, oil was also relatively cheap.

Vanuatu’s high dependency on imported petroleum to meet its energy needs exposes it to two types of risks:

- Oil price shocks; and
- Interruptions in the delivery of fuel caused by either natural phenomena or by international or domestic political turmoil.

Since the beginning of the 21st century, the price of oil has risen dramatically and the volatility of the world oil price has also increased as can be seen in Figure 3:

Figure 3: World Oil Prices 2002-2012 (Brent Crude USD/bbl)



Source: Hale & Twomey

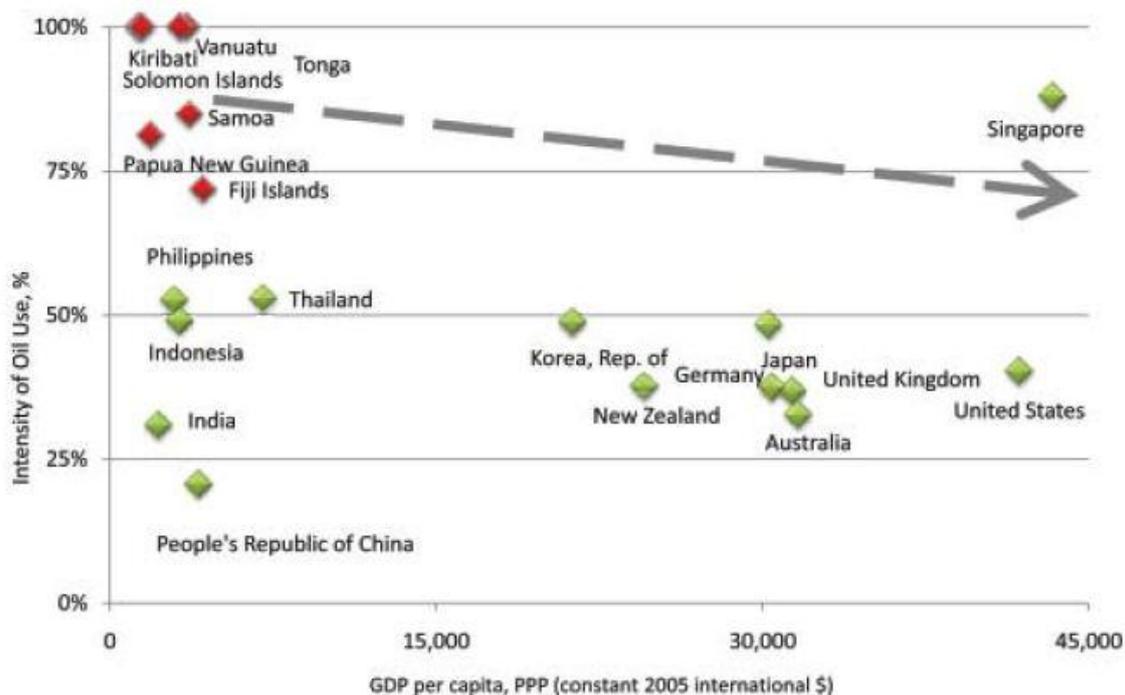
The rise of world oil prices has highlighted structural weaknesses in Vanuatu’s economy, including the strong link between fuel prices and the cost of living, and the negative impact high energy costs can have on the competitiveness of and returns to Vanuatu’s export industries. This indicates that for Vanuatu energy security encompasses both affordability and reliability of supply. Vanuatu has neither indigenous petroleum resource nor refinery capacity and is entirely dependent on imported petroleum products. Increasing energy security therefore needs to address the country's requirements for adequate storage and distribution capacity to service the

⁶ Information provided by Benjamin Mala, Deputy Director Revenue.

market, contingency plans to manage interruptions in supply, options to minimise the impact of price shocks on the economy and a regulatory framework that ensures prices are competitive.

The risks to Vanuatu are illustrated in a 2009 Asian Development Bank report⁷ which measured intensity of oil use relative to per capita income levels for a number of Pacific Island countries. Figure 4 indicates that, similar to other Pacific Island countries, Vanuatu has a very high dependence on petroleum⁸.

Figure 4: Dependence on Oil



Source: Asian Development Bank

The same ADB study also provided a measure of oil price vulnerability for these countries, ranking Vanuatu at 4 on a scale of 1-7 where 1 reflected greatest vulnerability⁹. The report indicated that out of 39 other developing countries all seven Pacific Islands countries were among the 10 most vulnerable.

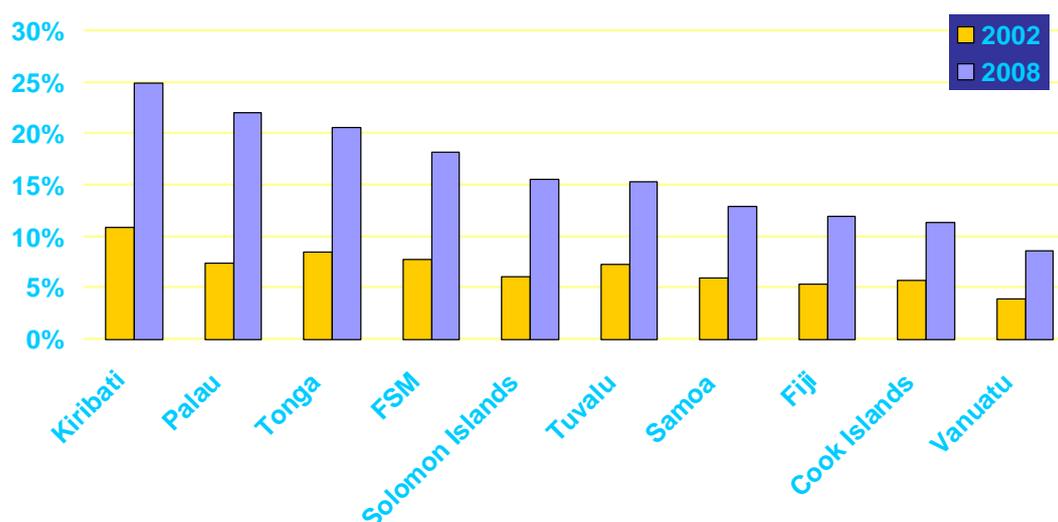
The increase in oil prices since 2000 energy prices has resulted in a doubling of petroleum cost as a proportion of GDP (Figure 5). This compares 2000 with 2008 when oil reached historical highs.

⁷ Taking Control of Oil – Asian Development Bank 2009

⁸ The ADB do not appear to take account of alternative fuels such as biomass. Nevertheless we would expect Vanuatu to remain in the top quartile.

⁹ Ibid, at page 12

Figure 5: Fuel Imports as Percentage of GDP



Source – Roper, T (2009) *Climate Institute and Global Sustainable Energy Islands Initiative*

3.3 Earlier Studies

Other reports have offered insights about Vanuatu’s economy and energy sector, including petroleum that is relevant to our study.

A joint report by the Asian Development Bank and AusAID in 2009¹⁰ made the following comments on Vanuatu’s economy:

- Vanuatu's economic development is hindered by dependence on relatively few commodity exports, vulnerability to natural disasters and the long and the expensive distances to markets and between the country’s islands. Its high-cost structure and underdeveloped infrastructure are also serious constraints.
- Infrastructure managed by governments often operate below optimal levels because government ownership blunts the incentives for efficiency, places non-commercial requirements on management to meet political objectives and are characterised by an inherent tendency to overstaff and underfund maintenance, and,
- Private services, such as telecommunications and utilities may also be deficient if private suppliers have been granted non-transparent, poorly regulated, long-term monopolies. The costly and inefficient services in the capital Port Vila and Luganville (the second largest centre), are symptoms of these trends and furthermore, services in rural areas are underdeveloped¹¹.

A 1992 study examined Vanuatu’s vulnerability to global oil shocks, over which it has no control. The Pacific Islands Development Program of the East-West Centre conducted a study on the policy

¹⁰ Vanuatu Economic Report 2009: Accelerating Reform. Asian Development Bank 2009 and Australian Government (AusAID).

¹¹ Policy Implications of an oil shock in Fiji, Tonga and Vanuatu January 1992 by Mark Sturton.

implications of an oil shock in Fiji, Tonga and Vanuatu.¹² This report was based on the rapid rise in oil prices following the 1991 invasion of Kuwait and the impact of the oil shock from a Pacific Island perspective. The study found that following an oil price shock, Vanuatu would experience deterioration in the terms of trade, reduced income and deterioration in its balance of payments position, worsening of public sector deficit, inflation and a loss in competitiveness. Similar findings were made for Tonga and Fiji. The report suggested the impact of an oil price shock was greater in the Pacific Islands than for more developed economies, largely due to their dependence on petroleum as the main source of energy.

Other studies have been conducted by the World Bank (1992)¹³ and SPREP (2004).¹⁴ These concluded that the three petroleum companies then servicing the market imported fuel separately and due to this overlap and a lack of price control, fuel prices were relatively higher than in other Pacific Islands countries.¹⁵

Security issues are also illustrated by the rapid rise in oil prices from 2000 to the peak in July 2008 which resulted in what has been called the "Food and Fuel Crisis", that hit Pacific Island states particularly hard because of their oil dependency and high level of food and energy imports. The dramatic increase in global oil prices fed into global food prices because:

- Many agricultural inputs are derived from petroleum products (e.g. fertilizers, pesticides);
- Food production is energy intensive (e.g. irrigation pumps, farm machinery & food processing equipment); and
- Agricultural inputs and final goods are often transported large distances to or from markets.

In the geographically remote Pacific Islands, these impacts were magnified; in late 2008 one island nation, the Republic of Marshall Islands, even declared a "State of National Economic Emergency".¹⁶

¹² Pacific Islands Development Programme (1992) Policy Implications of Oil Shock in Fiji, Tonga and Vanuatu. East West Centre, Honolulu Hawaii.

¹³ World Bank (1992), "Pacific Regional Energy Assessment (PREA): Issues and options in the energy sector (Vol. 12 of 13): Vanuatu", World Bank, Washington DC (available at URL <http://go.worldbank.org/QSM4TX5ZU0>).

¹⁴ SPREP (2004), "Pacific Regional Energy Assessment 2004: Vanuatu National Report", Vol. 16, Pacific Islands Renewable Energy Project (PIREP), South Pacific Regional Environment Programme (SPREP), Apia, Samoa

¹⁵ The World Bank report also recommended that the petroleum storage depot be relocated to a deeper port area that is accessible to larger vessels with full load which would reduce secondary storage and freight cost.

¹⁶ Islands Business (2008), "Politics: economic Emergency in Territory - A wake-up call for others".

4.0 Petroleum Sector Overview

Summary:

The Vanuatu market for petroleum and LPG is small by regional standards; with annual demand of around 56 million litres (including 3 million litres of LPG) or about 10% of the size of Fiji's market. Assuming it was feasible, Vanuatu's entire annual petroleum demand could be supplied by a single shipment from the fully laden 40,000 tonne tanker currently servicing the market.

Being small the cost of petroleum is impacted by lack of scale - the same profile of supply infrastructure is required (albeit less than for higher volume countries) but market demand volumes are an order of magnitude lower leading to substantially higher per litre costs.

Diesel is the highest import volume (~ 63%) because it is also used in electricity generation.

The market is a monopoly with only one player each for petroleum and LPG. Pacific Petroleum Company is the only petroleum marketer, having acquired the marketing assets of oil majors as they withdrew from the region. Origin is the sole importer and marketer of LPG. There is small competition at the margin where some parties are distributing diesel from isotainers.¹⁷ This raises serious health, safety and environment issues.

A specific regulatory framework for the sector is non-existent and the sector appears to be largely self-regulating in terms of environment, health and safety standards including for fuels quality, infrastructure and facilities. Matters such as pricing, risk management, and energy security are left to the industry.

The GoV recovers a significant proportion of revenue from excise, duties and value added tax - in 2010 fuel taxes accounted for 11% of GoV revenue.

4.1 Demand and Usage

4.1.1 Size of Market

Annual petroleum product demand for Vanuatu (2010) is around 56 million litres with domestic demand being 51 million litres, and international aviation and marine bunker demand making up the balance. LPG demand is 3 million litres. This demand is relatively small when compared to other markets in the region (Table 1)

Table 1: Regional Fuel Demand Volume Comparison, 2010

Country	Annual Fuel Demand(million litres)	40,000t tankers per annum	Vanuatu as Percentage
Australia	55,755	1161	0.1
New Zealand	8,687	180	0.6
Fiji	870	18	6.4
Vanuatu	56	1	

Source: Hale & Twomey using in country statistics

¹⁷ Isotainer is a transportation vessel contained in a 20 foot shipping container. They contain about 20,000 litres of fuel.

As is the case for other small states in the Pacific Islands, cost of petroleum for Vanuatu is impacted by the lack of scale. The island's demand requires the same profile of supply infrastructure (shipping, storage terminals, distribution assets, retail sites etc.) and while these will be smaller and lower cost than for higher volume countries, market demand volumes are an order of magnitude lower which can result in substantially higher per litre costs.

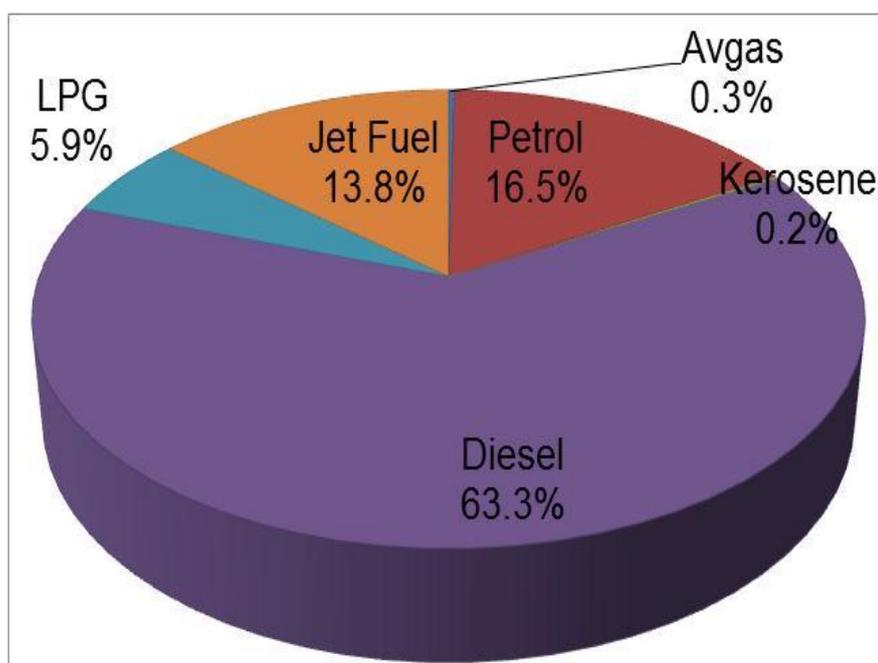
The principal fuels imported are:

- Diesel (sometimes referred to as automotive diesel oil or ADO),
- Unleaded Petrol (sometimes referred to as petrol or gasoline),
- Kerosene (sometimes referred to as Dual Purpose Kerosene [DPK] because it is able to be used for both aviation as Jet A1 and kerosene for domestic consumption), and
- Liquid Petroleum Gas (LPG).

4.1.2 Imports by Product

Figure 6 shows the proportion of imports by product in 2010.

Figure 6: Imports by Product by Volume



Source: Vanuatu Customs

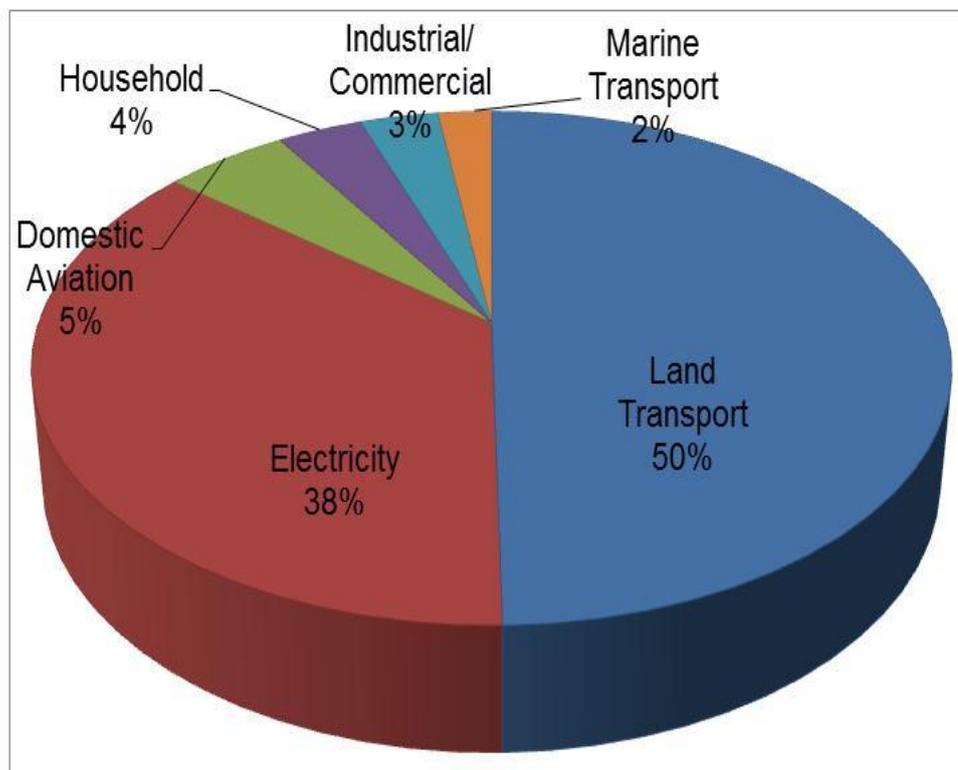
4.1.3 Demand by Sector

Taking out international aviation and marine bunkers, Vanuatu's domestic demand for petroleum products is split into the following main sectors:

- Land transport
- Marine transport
- Domestic Aviation
- Electricity generation
- Household
- Commercial & industry

Figure 7 shows the use of petroleum in Vanuatu by sector.

Figure 7: Breakdown of Domestic Fuel Sector 2011 by Volume¹⁸



Source: Pacific Petroleum, Origin Energy, UNELCO and Hale & Twomey

Diesel is the highest volume of fuel supplied (63%) as it is used for electricity generation as well as land transport (particularly commercial transport).

Land transport is the largest domestic consumption sector followed closely by use in electricity generation. Significant diesel generation is a common feature in the Pacific Islands, although some have a larger commercial/industrial sector where, for example, there are intensive mining activities. The historic profile and outlook for product demand are covered in Section 5.3.

4.2 Value as Percentage of Imports

Imports of petroleum products represent a large share of Vanuatu's total imports, accounting for 13.1% of the total (VUV 27,512 million) in 2010. The value of petroleum product imports in 2010 was VUV 3,615 million (approximately USD 37 million), 89% of which was petroleum fuels (LPG (4.3%), lubricants (3.5%), and bitumen and other products (3.2%) make up the balance). Approximately 90% of all fuels imported into Vanuatu in 2010 were for internal domestic consumption, with the balance re-exported via sales to international aviation and marine bunkers.

4.3 Industry Structure

4.3.1 Overview

In 2011 nearly all petroleum fuels into Vanuatu were imported by two companies, Pacific Petroleum Company (PPC) and Origin Energy (Origin).

¹⁸ Product split based on imports; Sectorial analysis is domestic demand (excludes international bunkers)

PPC imports, stores, and distributes diesel, petrol, and kerosene, but not LPG. It is Vanuatu's sole supplier of land, marine, and aviation fuels.

Origin imports, stores, and distributes LPG. While Vanuatu has historically had a single LPG importer, it is only in the last few years that a single supplier of diesel, petrol and kerosene has emerged; an outcome of the exit of the three major oil companies that used to service the market.

There are small volumes of diesel being supplied by isotainer¹⁹ from New Zealand by REEF Bulk Fuels Limited (RBF). RBF are a division of REEF Shipping, an operator of some of the cargo ships servicing other Pacific Islands. From Customs reports in 2011 this volume is indicated at 276,000 litres (~0.47% of total demand). Isotainer-supplied fuel is being purchased by a variety of parties including Marine Consultancy, Pacific Agricultural Supplies and Windward Holdings. It is difficult to see how the isotainer fuel can be competitive on price with that supplied by Pacific Petroleum but there may be some niche application where the isotainer provides value or they want better quality (10ppm sulphur) diesel. We consider issues with this supply in Section 6.2.4

4.3.2 Pacific Petroleum Company

Pacific Petroleum Company (also known as Pacific Islands Energy PIE Group) was created in 2006, to acquire the Shell group of companies in New Caledonia, French Polynesia and Vanuatu. Shell companies had been operating in the Pacific region since 1928.

Following the acquisition of Shell, PPC purchased ExxonMobil's assets in Vanuatu in 2007. In May 2010 PPC completed the acquisition of BP's South West Pacific (BPSWP) business operation through share sales in American Samoa, Cook Islands, Fiji, Kiribati, Tonga, Tuvalu and Vanuatu. During the acquisition process of BPSWP, the Pacific Island Energy Pte Limited (PIE) Group was formed. It is the holding company of Pacific Energy SWP Ltd. In June 2010 PPC acquired the Shell Aviation business at Jacksons Airport in Port Moresby, Papua New Guinea (PNG). Acquisition made the PPC group bigger than any of its competitors (Total and ExxonMobil) in the South Pacific Islands.

PPC has a long term supply contract and strategic alliance with Shell in Singapore. This gives PPC access to one of the largest refiners and traders in the region and provides some security through the long term relationship. Complementing this supply arrangement, and through the shipping company Petrocean, PPC operates its own ~40,000 tonne Medium Range (MR) tanker, the "Maohi", which delivers to PPC's markets across the region. We understand that PPC plans to purchase a smaller MR tanker. PPC also has operates a small Local Coastal Tanker (LCT) out of Fiji and New Caledonia which can provide back-up if there is an issue with MR tanker supply.

For lubricant products, PPC is an authorised distributor of Shell lubricants in the region with Shell providing technical support. PPC has supply contracts with Shell and also markets other brands. PPC also has an arrangement with Shell to provide technical services in aviation.

4.3.3 Origin Energy

Liquefied Petroleum Gas (LPG) has been used as an energy source in Vanuatu for over 20 years. LPG has primarily been used for household cooking and commercial use, in hotels and restaurants.

¹⁹ Isotainer is a transport vessel contained in the same shape as a 20ft shipping container. They contain about 20,000 litres of fuel.

In the last few years LPG use has increased expanded into fuel for air conditioning units in commercial buildings.

Origin Energy, a large Australian energy company, supplies and markets LPG to a number of countries in the Pacific Islands and is the only supplier of LPG to Vanuatu. There have been occasional small imports of LPG by other commercial operators in Vanuatu, but Origin holds 99% of the market. Origin Energy has storage and distribution facility in Port Vila, on the island of Efate, and a second facility at Luganville on Espirito Santo. There is also a small storage depot on Tanna Island. Origin distributes LPG to the remaining islands of Vanuatu in smaller bottles (11 and 9 kg) via the passenger and cargo ships that service these islands.

LPG can be a blend of propane and butane gas or each type of gas can be sold separately. Historically Vanuatu used butane to service the market. The standards for storage and equipment are lower for butane than for LPG or propane. However expansion of the market into areas such as air conditioning has required propane which requires higher specification equipment; as a result Efate Island supply has shifted to propane. Butane is still supplied in Santo.

4.4 Regulatory and institutional arrangements

There appears to be no specific laws or regulatory framework governing standards and arrangements for the downstream petroleum market²⁰ and the sector appears to be largely self-regulating in terms of fuel quality standards, infrastructure construction and maintenance, pricing, risk management, health, safety and environmental protection, and energy security matters.

We examined a range of general business regulations to assess relevance to the sector, including the Business Licensing Act, Companies Act, Import of Goods (Control) Act, International Companies Act, Maritime Act, Maritime Conventions Act, National Disaster Act, Port Vila Harbour (Prohibited Area) Act, Ports Act, Shipping Act. Our review has not identified significant issues with the way in which the industry is operating, given the lack of regulation. Nevertheless the lack of regulation raises significant questions around the policy settings required to provide assurance and achieve the GoV's objectives in developing the VERM. These are discussed in section 14.0.

Table 2 lists the current legislation we have examined (including Vanuatu's legislation relating to upstream) by reference to its primary purpose. From a revenue perspective we note that:

- Import duty (20 vatu/litre) and excise are levied on diesel and petrol and are currently 35 vatu per litre. Diesel for power generation is subject only to an excise tax of 15 vatu per litre and is exempted from the import duty of 20 vatu per litre.
- Fuel taxes made up 11% of GoV anticipated revenue in 2010.²¹ For budget 2012 the GoV have estimated VUV 1.24 billion to be collected (representing 11% of total GoV revenue).
- Value added taxes (VAT) of 12.5% are levied on fuels.

²⁰ A specific law for upstream petroleum does exist, the Petroleum (Exploration and Production Act (1993); together with its subsidiary Petroleum Regulations Order (Order 30 of 1997) but this review is not concerned with upstream activities.

²¹ Department of Customs, Tariff and Trade.

Table 2: Relevant Legislation Affecting Sector

Primary Purpose	Acts of Parliament	Commencement Date
General Licencing	Business Licence Act 1998	1 August 1998
	Customs Act 1999	1 October 1999
Environment Health and Safety	Environment Management and Conservation Act [Cap 283]	01 March 2003
	Public Health Act 1994	24 April 1995
	Water Resources Management Act 2002	10 March 2003
	Maritime Act [Cap 131]	Repealed
	Health and Safety at Work Act 1986	2 February 1987
Energy Supply	Petroleum (Exploration and Production) Act [Cap 227]	1 August 1997
	Geothermal Energy Act 1987 [Cap 197]	10 August 1987
	Electricity Act	
	Utilities Regulatory Authority Act 11 of 2007	11 February 2008
Infrastructure	Ports Act 1957	31 December 1957
	The Dues, Fees And Charges Order No 14 of 1992	1992
	Port Vila Harbour (Prohibited Area) 1952	9 June 1952
	Maritime Act [Cap 131]	Repealed
Economic Regulations	Price Control Act 1974	29 August 1974
	Vanuatu Financial Services Commission Act 1993	20 December 1993
Emergency Management	National Disaster Act 2000	20 November 2000
	National Action Plan for Disaster Risk Reduction and Disaster Management 2006-2016	Current Policy of Government of Vanuatu
Transport	Road Traffic Control Act 1962 (Chapter 29)	4 June 1962

5.0 Demand Analysis

Summary:

Petroleum consumption in Vanuatu has increased rapidly over the last 10 years, at an annual average rate of 5.7%. Petrol, LPG and diesel demand (when diesel required for electricity generation is separated out) has doubled, with petrol and diesel consumption in the land transport sector accounting for most of the overall increase (land transport consumes just over 50% of all petroleum products imported for domestic consumption). Diesel used in electricity generation has grown more slowly (dropping a little in the last couple of years) with the introduction of more renewables into the generation mix.

Vanuatu's energy supply comes from biomass and petroleum. This analysis suggests that petroleum's share continues to grow but it is difficult to be precise because there is little empirical analysis around biomass use (a large rural population using wood for cooking and crop drying). A 2004 SPREP analysis estimated the biomass proportion of gross energy production to be around 50%. Petroleum demand growth trends where demand growth has been well above population growth would suggest that the biomass proportion has reduced - our estimate is that biomass now makes up around 40% of gross energy production.

Based on current trends and projected growth rates (GDP growth estimated at 4%) petroleum demand is expected to nearly double by 2022 (~ 100 million litres) from current levels. Increases are expected to be highest for land transport fuels (petrol and diesel) based on correlation with historical growth rates. Kerosene used in aviation will be influenced by operating efficiencies achieved by airlines and may not see increases in demand despite increases in tourist numbers. Electricity demand for diesel will be subject to development plans for renewables (which does not form part of this report) - assuming continued support for renewables we expect diesel demand for generation to grow at less than forecast GDP.

5.1 Methodology

The following section describes the current and historical demand for petroleum products and LPG. It also assesses how petroleum products fit into Vanuatu's overall energy demand mix. Using the historical and current demand analysis with performance indicators such as population growth rate and gross domestic product, we then develop a 10 year projection of Vanuatu's petroleum demand which can be used for the Energy Road Map and for forecasting infrastructure requirements. The demand forecast is also compared with existing and historic projections.

5.2 Current demand

To assess the demand for petroleum products we have obtained data from the following sources:

- Vanuatu Customs Trade, Tariff and Compliance Department - Vanuatu petroleum products import, re-export from 2000 - 2012 (April).
- Pacific Petroleum Company (PPC) - petroleum sales from 2007 to 2011. As PPC had 100% ownership of petroleum supply from May 2010, we have used 2011 sales data to calculate demand for petroleum products in the land, marine transport, electricity generation and outer islands segments.
- UNELCO - diesel consumption data from annual technical reports 2001 to 2009, excluding the 2003 report which was not available. H&T was able to extract diesel consumption data for power generation from these reports.

Vanuatu imports petrol, diesel, kerosene, jet fuel, aviation gasoline (Avgas), liquid petroleum gas (LPG) and lubricants. Two grades of diesel are imported; 50 ppm sulphur diesel is used for newly imported vehicles and 5000ppm sulphur diesel is used for electricity generation, industry and the remaining transport fleet of Vanuatu. Until 1986, industrial diesel oil (IDO) was also imported for re-export to the foreign owned, Santo based, fishing company (South Pacific Fishing Company) but this has since ceased its operations. Table 3 shows historical demand.

Table 3: Vanuatu Petroleum Product Demand 2006-2011

Petroleum products	2006	2007	2008	2009	2010	2011
	(Million Litres)					
Aviation gasoline	0.26	0.35	0.40	0.32	0.30	0.15
Petrol	6.21	6.64	7.59	8.15	10.24	9.36
Kerosene	0.59	0.40	0.42	0.29	0.21	0.14
Jet A1 - Domestic	1.55	1.90	1.50	2.17	2.66	2.26
Diesel	27.08	33.24	32.71	35.19	34.44	35.50
LPG	1.68	2.88	2.4	3.34	3.17	3.32
Total Domestic Demand	37.37	44.51	45.02	49.46	51.02	50.73
Jet A-1 international aviation	6.29	5.81	4.70	3.48	3.62	5.28
Bunkering	0.46	0.23	0.84	0.67	1.26	1.60
Total Demand	44.12	50.55	50.56	53.61	55.90	57.61

5.3 Historical demand by sector

To assess historical demand we have reviewed the following reports and also validated data in these reports from data obtained from Vanuatu Customs and Inland Revenue Department:

- Vanuatu Issues and Options in the Energy Sector conducted by the World Bank (1992, 'the World Bank 1992 report') - this report used petroleum import data from 1985 to 1990 to determine the demand for petroleum products.
- Pacific Regional Energy Assessment (2004, 'the SPREP 2004 report'): An assessment of the Key Energy Issues, Barriers to the Development of Renewable Energy to Mitigate Climate Change, and Capacity Development Needs for Removing the Barriers: Vanuatu National Report conducted by the Secretariat of the Pacific Regional Environment Programme (SPREP) - this SPREP report uses petroleum sales data for Vanuatu from 1994 to 2003 received from the Vanuatu National Advisory Committee on Climate Change.

Annex 1 provides a detailed breakdown and comparison of the statistics from the two reports.

Biomass has been estimated by these reports as a major source of energy for Vanuatu with 70% of the population living in rural areas that do not have access to grid connected electricity. In 1989, biomass was estimated to provide 70% of gross energy production but this was reduced to 50% in the last decade according to the 2004 SPREP.

There is little accurate information on biomass use to validate these trends²². However based on 50% of energy coming from biomass in 2003, and forecasting its use to continue growing in line with population growth (the two key uses of biomass are cooking and agriculture for crop drying), we estimate that biomass now provides around 40% of energy due to the corresponding growth in petroleum use over recent years (as shown in Table 4 petroleum growth has been over 5%, well above the population growth rate of 2.3% per year).

Using the biomass historical data we estimate that petroleum use has expanded from around 30% of total energy consumption (when the biomass contribution was estimated at 70% in the 1990's), to 40% in the last decade using the 2004 SPREP report and to over 50% now.

Table 4: Historical petroleum product demand (million litres)

	World Bank Report 1989 Sector Consumption	SPREP Report - 2003 Sector Consumption	2011 Consumption (Customs, PPC, UNELCO)
Avgas	0.80	0.33	0.15
Petrol	4.09	4.62	9.36
Kerosene	0.79	0.44	0.14
Jet Fuel	4.61	8.43	*7.75
Diesel	15.55	21.59	*36.89
LPG	0.75	1.55	3.32
Total	26.59	36.7	57.61
Annual Growth rate		2.33%	5.71%

*Note diesel and Jet fuel includes bunkering for the purpose of comparisons with World Bank and SPREP Report.

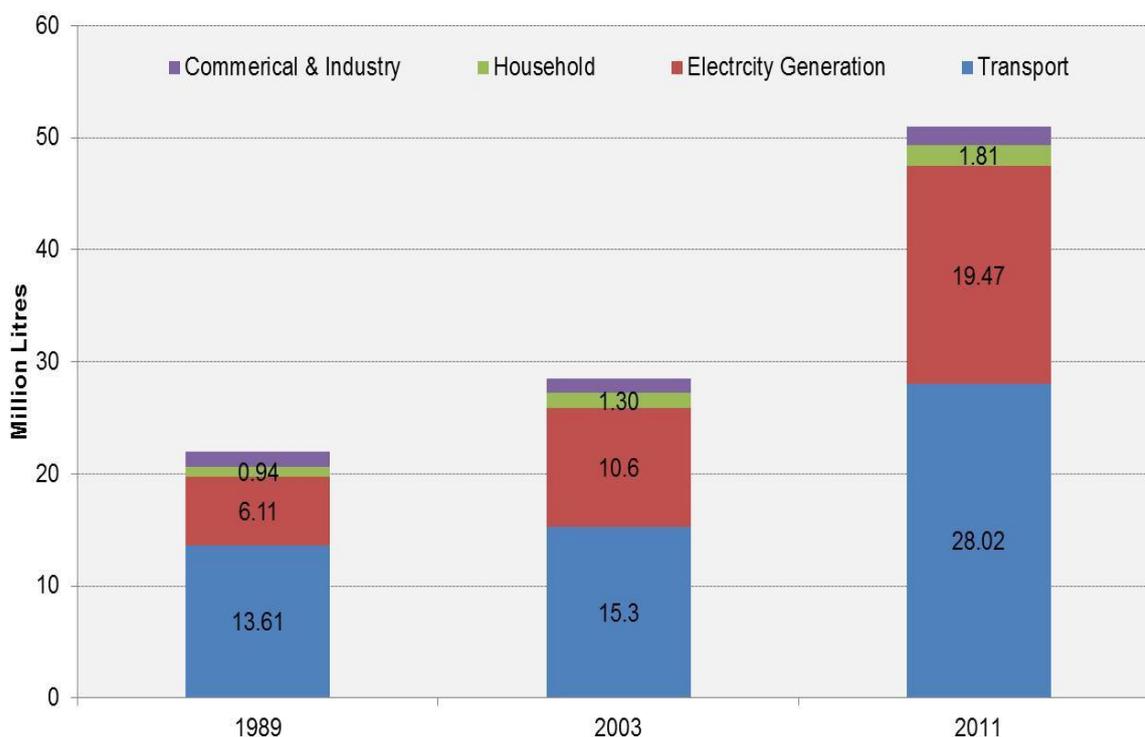
As indicated in Table 3 and Table 4, petroleum consumption has been increasing rapidly, especially in the last 10 years. Petrol and LPG consumption have more than doubled as has diesel (if the component used for electricity is removed). Diesel used for electricity has grown more slowly and actually dropped a little in the last couple of years due to the introduction of more renewables in the generation mix.²³ Jet fuel (domestic and international aviation) has not seen the same growth trend. Increasing consumption for petrol and diesel in the transport sector accounts for most of the overall increase in demand.

Vanuatu's domestic demand is split in four main sectors as shown in Figure 8. Individual sector consumption is analysed the Section 6.3.1 below.

²² We asked the Ministry of Agriculture, Quarantine, Livestock, Forestry and Fisheries but they could not provide any more accurate information.

²³ UNELCO Annual Technical Report 2001-2009

Figure 8: Comparison of historical and current domestic consumption of petroleum by sector



Source: Hale & Twomey, World Bank 1992, SPREP 2004

5.3.1 Land transport

The transport sector has been the largest user as indicated in both the World Bank 1992 report, SPREP 2004 report and our current analysis (Figure 8). The World Bank 1992 and the SPREP 2004 reports did not split out land and marine consumption in transport use. For consistency of comparison we have retained the same method of consumption by sector in Figure 8 [Note - Figure 7 in Section 4 splits the domestic demand for petroleum products into domestic aviation and marine transport].

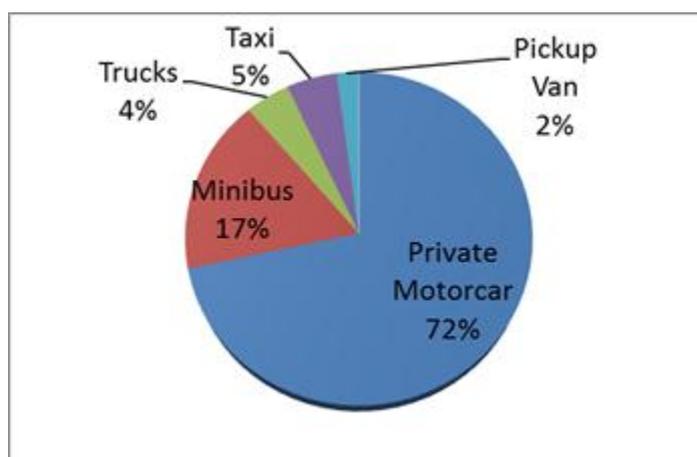
The significant increase in fuel consumption in the last decade can be attributed to the land transport sector due to the increase in number of vehicles. Over 5,500 vehicles are registered in Port Vila²⁴ of which about 72% are privately owned (Figure 9). However the total number of vehicles used Vanuatu is unknown because registration requirements exempt government owned and private vehicles in outer islands.²⁵

Overall land transport consumes about 55% of all petroleum products imported for domestic consumption. We note that land transport use includes domestic, commercial and industrial use because all volume is sold through retail sites.

²⁴ Vanuatu Customs and Inland Revenue Department (Road Tax database)

²⁵ Road Traffic Control Act 1962 (Chapter 29)

Figure 9: Port Vila vehicle mix 2011



5.3.2 Electricity generation

The electricity generation sector is the second largest end user of petroleum products. 86% of power generation is fuelled by diesel.²⁶ Historical data (from 1989) indicates that electricity use was about 30% of domestic petroleum consumption. It is not clear whether diesel used in the outer islands was incorporated into generation sector use in the World Bank 1992 and SPREP 2004 reports; we suspect it wasn't as this generation is dispersed and not part of UNELCO's network (i.e. off grid).

Our analysis indicates that 36% of domestic petroleum consumption is used for electricity generation, when we include the off-grid use. The grid connected power plants in Port Vila, Santo and Malekula and Tanna are estimated to use 76% of this fuel, leaving 24% for outer islands use (or 9% of domestic petroleum consumption).

Using UNELCO's advice that 86% of its generation is fuelled by diesel but including outer island use of diesel for electricity generation, we would estimate that diesel used in electricity generation is closer to 90% with the balance 10% from renewables.

5.3.3 Households

Overall, households consume about 4% of all the petroleum fuels imported in Vanuatu; it has stayed at this proportion over the last decade.

We examined household consumption of petroleum products using data on energy sources for household cooking and lighting published in the Vanuatu National Population and Housing Census reports of 1999 and 2009. Biomass remains the main source of energy for cooking with ~85% of households using wood and coconut shells (Table 5). The use of kerosene for lighting has reduced (48%) and been replaced with increased use of electricity and renewables (solar lighting).

Table 5: Main energy sources for cooking and lighting

Energy Source	Lighting		Cooking	
	1999	2009	1999	2009
Electricity	19%	30%	<1%	1%

²⁶ UNELCO Annual Technical Report 2009

Kerosene	74%	48%	<1%	<1%
LPG	<1%	3%	13%	13%
Wood / Coconut (Biomass)	<5%	2%	86%	85%
Renewables	<1%	17%	<1%	<1%

Source: 1999 and 2009 Vanuatu National Population and Housing Census

5.3.4 Commercial/Industrial Sector

Commercial/industrial use is estimated at 3% of total petroleum consumption. While the split between commercial and industrial use can be estimated for LPG use it is difficult to estimate the split for petroleum. We have assumed this sector would also consume significant amounts of transport fuels (particularly diesel) although these are shown under land transport. Commercial and industrial use of electricity will also impact diesel consumption; this demand is shown under electricity consumption.

5.4 Demand by product

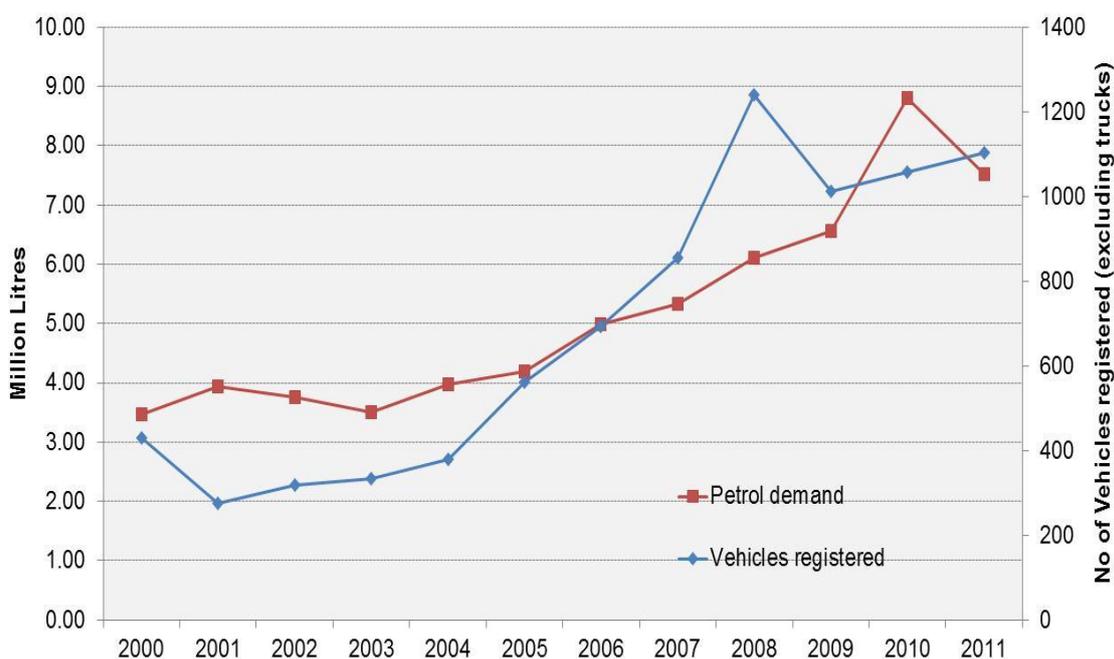
5.4.1 Petrol demand

Of all the petroleum products, demand for petrol has grown fastest with a growth rate of 7% per annum over the last decade. Smoothing the last two years' data indicates that this rate of growth is being sustained. Total consumption in 2011 was 9.36 million litres, accounting for 16% of all fuel imported.

This increase is double the GDP growth rate over the same period and more in line with registered vehicle growth (excluding trucks, which are assumed to consume diesel) as shown in Figure 10 . Vehicle growth would normally also be expected to trend with GDP as a country's wealth increases. It may be that the last decade has seen some 'catch-up' from the previous decade, when petrol growth rates were much lower.

As a country goes through a strong development phase, we expect this growth trend to continue. Unfortunately there is no forecast for vehicle registration to link a consumption trend to, so we assume petrol use will continue to grow at double the GDP growth rate but in time will slow such that it will only be growing in line with GDP by the end of the forecast period.

Figure 10: Petrol demand in transport sector vs. number of vehicles registered in Port Vila (excluding trucks)



Source: Vanuatu National Statistics and Hale & Twomey

5.4.2 Aviation Fuel demand (Jet A1)

While there is yearly variation, demand for international jet fuel has only grown very slowly (1% p.a.) over the last decade. Flights to Vanuatu come from Australia, New Zealand, Fiji and the Solomon Islands. In most cases fuel will be cheaper in the port of origin so Vanuatu lifting's would primarily be top-ups. In addition, unlike petrol and diesel where Vanuatu's consumption growth reflects that of a developing country, efficiencies arise out of international influences rather than any influence from Vanuatu. With the large increase in jet fuel prices over the past 10 years, airlines have been improving fuel efficiencies significantly, such that passenger numbers carried are increasing at a much faster rate than fuel use. From the passenger number arrivals in Vanuatu, we see a similar trend in Vanuatu where tourist arrival numbers have increased (up nearly 6% p.a.) far more significantly than fuel use over the same period.

Tourism is expected to continue to grow in Vanuatu although we expect the efficiency gains of aircraft movements to also continue. Therefore we forecast demand for jet fuel to continue to grow at 1% p.a.

5.4.3 Kerosene demand

The use of kerosene in Vanuatu has been reducing as noted in the household survey (Table 5) by over 13% per annum. Historically, kerosene was used for household cooking and lighting and it is being replaced with renewable energy such as solar lights and LPG for cooking.

5.4.4 Diesel demand

While total diesel consumption has grown by 4% per annum over the last decade, removing the grid electricity demand shows the rest of the diesel market is growing at 6% per annum (primarily transport). Diesel consumption is strongly correlated to GDP growth in most countries. As a

country develops, generally the rate of growth of diesel will reduce as a portion of GDP growth as the economy becomes more efficient in using its energy inputs. For a developing country such as Vanuatu, the diesel growth could be above GDP and that is what is being observed in the non-electricity sectors – it is around 2% higher p.a. We do note that the rate of growth has dropped in the past two years to a little below GDP growth – this could be an impact from the global financial crisis or a reflection of some improvement in efficiency of diesel use and therefore consumption growth relative to GDP growth.

For the forecast, we take a balanced position where we assume growth for the non-electricity diesel consumption sectors move in line with GDP growth. The exception to this is for outer island use where we expect consumption to increase a little faster if a proposed barge project to transport fuel to the outer islands of Vanuatu is approved. The proposed barge project will reduce the price and improve the availability and efficiency of supply. For this segment we assume consumption growth rate of twice the GDP growth rate.

Electricity use will depend on the development plans for renewables. We do not have these plans so take a conservative position and assume that it grows at half the rate of GDP growth, in line with the last decade.

5.4.5 LPG demand

Liquid petroleum gas (LPG) has been used for restaurants and households in the vicinity of Port Vila and Santo as noted in World Bank 1992 report. Census data from 1999 and 2009 indicates that 13% of the households in Vanuatu use LPG for cooking. In the early 1990s, LPG demand was static, possibly due to the high price of LPG in comparison to other petroleum products such as diesel and kerosene. Between 2001 and 2011, LPG imports have increased by 8.3% annually as a result of expanded use in hotels, restaurants and for air-conditioning. Trade Air Engineering Vanuatu, one of the major air-conditioning installation companies, had advised our team that over 50 buildings in Port Vila use LPG for air-conditioning.

We note that the rate of growth has slowed in the last five years following a jump between 2004 and 2007. The jump appears related to the move to propane and the development of the commercial market for air conditioning. Since 2007 the growth has been in line with GDP (~4%). Our forecast is the LPG use will continue to grow in line with GDP.

5.4.6 Lubricants

The major users for lubricants in Vanuatu are motor vehicles and servicing machines such as UNELCO generators. Lubricant demand is just over 1% of total petroleum product demand for Vanuatu.

5.5 Demand forecast

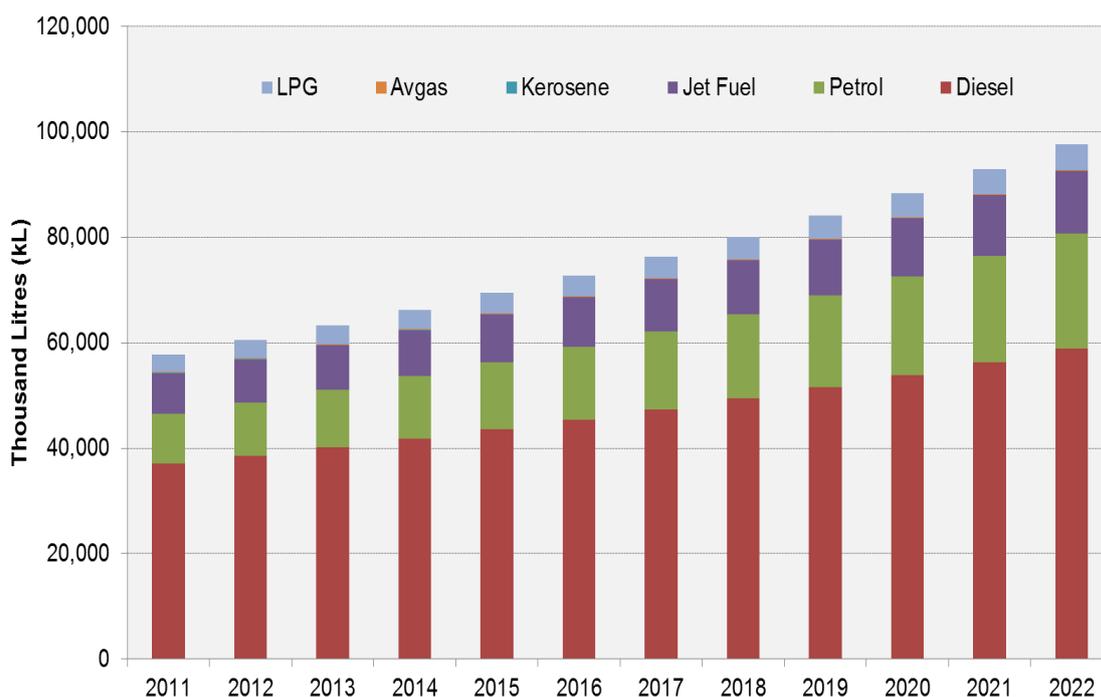
From the individual product forecasts above, we can build up an overall forecast for all petroleum products. Vanuatu is an emerging economy with a projected GDP growth rate of 4%. Although GDP is not forecast beyond 2012, the Finance Minister expects the trend to continue, so we use a 4% GDP trend through to 2022.

Given each product's relationship to GDP growth, (Table 6) we develop a demand forecast for Vanuatu as shown in Figure 11.

Table 6: Petroleum growth projections

	1992 World Bank Report Projection	2004 SPREP Report Project	H&T Projection 2012-2022
GDP growth rate	2-2.5%	2.8%	4%
Population growth		3.5%	2.5%
Petroleum growth projection	Transport sector @ 5% Jet fuel @ 3% Remaining fuel @ 2-2.5%	3.5% per annum	Petrol at @ 8%, declining to 4% Jet fuel @ 1% Diesel: Transport @ 4% Electricity @ 2% Outer Island @ 8% LPG @ 4%

Figure 11: Petroleum Demand Forecast 2012-2022



Source: Hale & Twomey

6.0 Supply Chain

Summary:

PPC supplies Vanuatu from Singapore as part of a supply schedule to its other markets in the region. Singapore is the main oil refining and trading hub in the Asia Pacific region. There are other potential refinery sources for Vanuatu but these are not used at present.

Oil is an internationally traded commodity whose price is set at major trading hubs in the US, Europe, Middle East and Singapore.

The cost components flowing through to the price of petroleum include each element of the supply chain - acquisition in Singapore, ocean transport, landing charges in Vanuatu (wharfage and port charges), receipt, storage and handling and distribution to market segments. Fuel prices are adjusted by PPC as re-supply is made, as pricing is set with reference benchmark prices in Singapore at the time the cargo is loaded.

Port Vila and Santo are able to accept large Medium Range (MR) petroleum tankers (35,000-40,000 tonnes) provided they are not fully loaded. PPC has chosen to operate these larger vessels as a milk run operation rather than the much smaller Local Coastal Tankers (LCT's -1,500-2,000 tonnes) which are a feature of the hub and spoke supply networks that operate for some markets in the region (and used to be the case in Vanuatu). The bigger ships are more cost effective providing savings in the ocean transport component of supply chain cost.

Origin supplies Vanuatu from Brisbane as part of a supply schedule covering a number of island countries in the region. The ships used are small (1,000-1,500 tonnes) and the schedules will be determined in accordance with stock levels at each of the delivery locations. Deliveries to Port Vila occur once per month on average (once every three months to Santo). LPG pricing in Asia Pacific is determined by posted prices set by Saudi Arabia which is a dominant supplier of LPG. The price of LPG in Vanuatu will reflect the Saudi price together with cost to ship to Brisbane and then to Vanuatu, along with the handling costs incurred by Origin in transferring the product to smaller ships. Origin operates bulk storage receiving facilities in Port Vila and Santo and supply is made to the market via a mix of road tanker and bottles ranging from 4, 9, 11 and 45 kg.

Our study has identified key areas for improvement including:

- *The very high cost of fuel in the outer islands where prices can vary by 15-30 Vatu/litre higher than in Vila and Santo; this appears to be due to the high cost and irregular shipping within Vanuatu which results in much higher cost and periodic shortages of fuel*
- *The marketing of diesel from road side isotainers which are imported on general cargo vessels and offered to the consumers without any of the standards or safety protection operated by PPC.*

PPC has recently entered into a Memorandum of Understanding (MOU) with the GoV to procure a self-propelled bulk fuel barge "The MV Pacific Spirit" to deliver fuels to outer islands. Under the MOU PPC would purchase a new double-bottomed barge to carry bulk petroleum products in under-deck tanks as well as packaged products on deck (drums, LPG bottles, and lubricants). The barge is expected to commence delivery to outer islands late 2012 to early 2013. The cost of the barge will be shared between PPC (70%) and GOV (30%) and should improve the efficiency, reliability and cost of petroleum and LPG delivered to the outer islands.

6.1 Overview

The following describes the current steps for supplying petroleum and LPG to Vanuatu. The World Bank defines a Petroleum Supply Chain (PSC) as a "complex assortment of infrastructure and processes whose mainstream begins with the exploration and production of crude oil and finalizes with the delivery of petroleum products to consumers".

However the oil industry divides the PSC into two distinct areas: upstream and downstream. Upstream comprises exploration, production and transport to refining. Downstream comprises oil refining and blending, transport to markets, storage distribution and retail. This study is focussed on Vanuatu's downstream petroleum supply chain only. Put simply the supply chain for the purpose of this review describes the way in which petroleum and LPG is delivered to the market in Vanuatu.

Each component of a supply chain contributes to the cost of supply to the market. It may also influence or be influenced by another component. To understand efficiency it is necessary to examine how each component contributes to overall costs to determine whether costs may be reduced and efficiency increased.

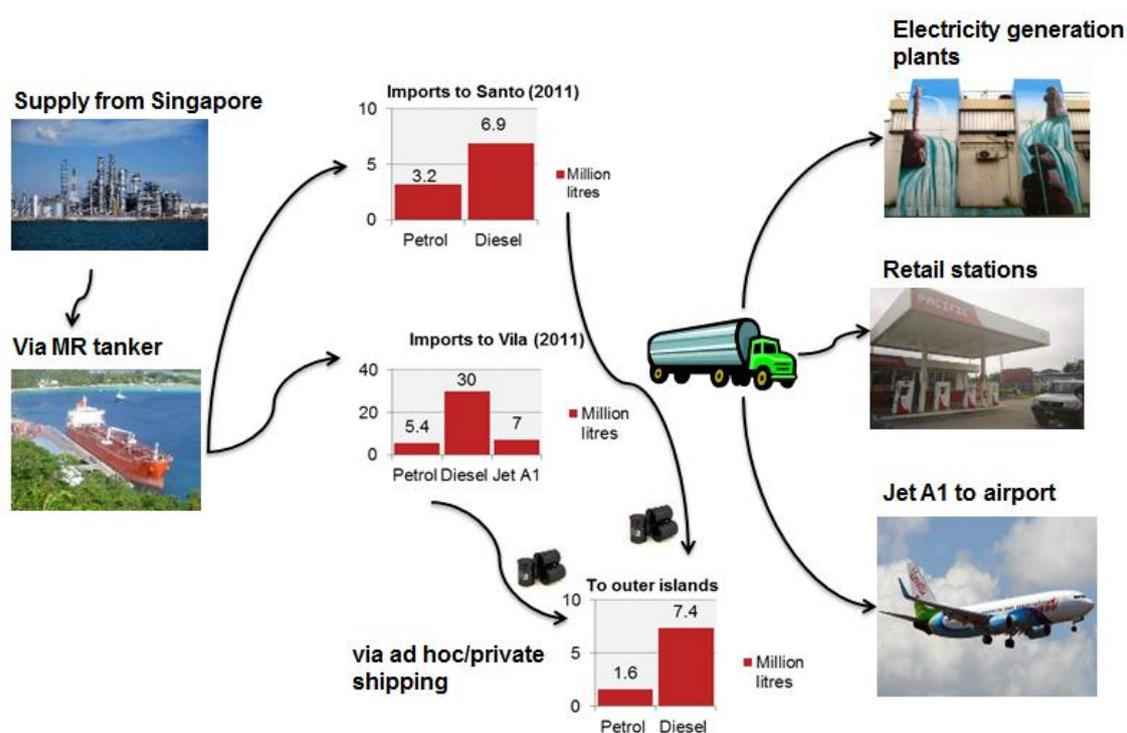
The components of a supply chain can also influence the level of energy security. For example a supply chain based on shipping from Singapore may have a higher risk (from shipping delays, refinery production hiccups, etc.) compared to a supply chain based on smaller shipments from a closer supplying location. Consideration then needs to be given to the appropriate level of stock that should be held in Vanuatu to cover these respective risks. Hence the impact on energy security is an important influence on efficiency.

6.2 Petroleum Supply Chain

Figure 12 illustrates the petroleum supply chain for Vanuatu. The steps comprise:

- Refinery supply,
- Ocean transport to Vanuatu,
- Discharge and transfer to bulk storage terminals in Vila and Santo,
- Distribution within Santo and Vila via road tankers,
- Repackaging (drums) for supply to outer islands,
- Secondary transport to outer islands via general cargo vessels,
- Secondary storage, and finally,
- Wholesale (electricity) and retail market segments to end consumers.

Figure 12: Petroleum Supply Chain



Source: Hale & Twomey

Each of these elements of Vanuatu’s petroleum supply chain is discussed next.

6.2.1 Refinery Supply

Currently PPC sources Vanuatu’s petroleum products from Shell's refinery in Singapore under its term supply contract with Shell. Singapore is a major export refining centre and supply location to the wider Asia Pacific region. Total refining capacity is approximately 1.3 million barrels/day while Singapore’s domestic demand is around 300,000 barrels/day. Singapore is also a major storage and blending location where petroleum products can be stored and blended for distribution within the region.

Petroleum is an international commodity which is traded globally. Trade takes place around a number of regional trading centres or hubs which are linked to each other by the ability to transport crude and products between regions. Singapore is the major trading centre and hub in the Asia-Pacific region and petroleum products refined and traded in this region are linked to the market prices set there.

Other countries have refining capacity in excess to domestic demand and export within the region and further afield. South Korea is an example but others also supply when structural imbalances arise between their domestic market and the amount of refining capacity they have. These countries typically include Japan, Taiwan and China but also include sources closer to Vanuatu such as the refinery in Papua New Guinea.

Regardless of the product's source, pricing is still set by reference to benchmark prices set in Singapore. Differences in cost between refineries will arise (e.g. where the supply point is closer to the demand) and this may translate to a lower landed cost if the supplying refinery is keen to secure a market outlet using this advantage. But pricing will always be set by reference to the

Singapore benchmark. Hence if PPC (or any other supplier) was to source its supply from South Korea the petroleum price build up in Vanuatu would still be based on the Singapore benchmark.

6.2.2 Shipping to Vanuatu

Petroleum supplied in Vanuatu by PPC is shipped from Singapore on Medium Range (MR) tankers that drop off fuel to Vanuatu as part of a wider regional supply schedule (Figure 13). Shipments are delivered to Port Vila around every two months, with fuel drop offs to Santo on every second voyage.

Figure 13: PPC Voyage Delivery Pattern



PPC's typical voyage patterns include the following routes:

- Singapore, Papeete, Port Vila, Santo, Singapore
- Singapore, Papeete, Fiji, Vila, Santo Singapore
- Singapore, Papeete, Noumea, Fiji, Vila, Santo, Singapore.

Petrole Pacific's parent company, PIE, operates its own ~ 44,000 tonne MR tanker, the MV Maohi to perform these voyages. The Maohi was built in 2006 and meets international standards including being double hulled. International shipping practice (including that applied by the oil majors) regards acceptable operating lives for this and similar vessels as being 15 years.

Operation of its own vessel (as opposed to contracting shipping on a spot basis) allows PPC to control the vessel for the required task including scheduling to meet PPC's market requirements (e.g. stock levels on replenishment). Dedicated control also minimises operating risk because the vessel is committed to a regular task with a defined cargo profile and voyages (e.g. risk of product contamination is reduced compared to using ships contracted from the spot market, operation is improved through enhanced familiarity with capability). Minimising operating risk is particularly important for Pacific Islands markets which are 100% reliant on imports and have little scope to

use alternative supply sources to respond to disruptions or issues that may arise in the supply chain from time to time.

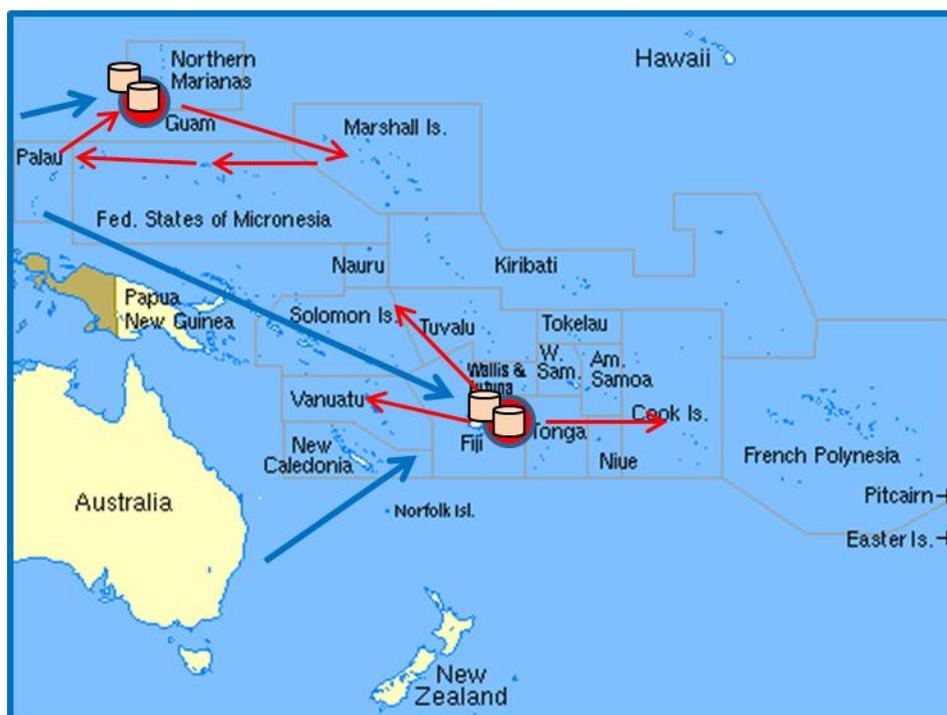
Figure 14: Pacific Petroleum's Tanker Maohi discharging fuel in Vila



Source: Pacific Petroleum

Most of the Pacific Islands, including Vanuatu, have historically been supplied with petroleum products via 'hub and spoke' supply chain networks (Figure 15). Under a 'hub and spoke' model fuel is shipped from Singapore (or Australia) in bulk via Medium Range (MR) tankers (35-40,000 tonnes) to a regional storage hub (such as Fiji, New Caledonia or Guam), then on-shipped via smaller Local Coastal Tankers (LCTs – 1,500 -2,500 tonnes) to the main fuel depots on smaller island markets (including Vanuatu). An LCT would typically supply a group of small island markets on a regional shipping schedule out of the hub. Up until 2008 supply to Vanuatu was made on the hub and spoke basis.

Figure 15: Hub and Spoke Supply Networks



The other supply chain model is delivery of fuel in a MR tanker on a multi-drop/multi-country voyage. From 2008 PPC changed Vanuatu supply to the MR model as part of the wider PIE group's MR shipping schedule. This reduced the need for more expensive LCT shipping together with the cost associated with intermediate storage (through the hub in Fiji).

The cost difference between an MR delivery based on current delivery patterns and a Local Coastal Tanker (LCT) used to ship from Fiji is estimated in Table 7. There will be variability in these estimates because ship size and capability can vary where LCT capacity dimensions are designed specifically for certain locations. Nevertheless the cost for each litre of product carried by the LCT is about 6 to 7 times more expensive than the larger MR tanker.

Table 7: Comparison of shipping costs

	Typical all inclusive cost per day	Cargo size fully utilised (litres)	Cost per litre (US c/litre/day)
MR tanker	USD 30,000	45,000,000	0.066
LCT	USD 13,000	3,000,000	0.433

PPC will still have access to the PIE Group's Fiji-based LCT, the MV Anatolia Sea, to supply Vanuatu. This could be used as an alternative supply option but the cost effectiveness of MR versus LCT supply combined with the set scheduling suggests this would be only in exceptional circumstances.

6.2.3 Port Charges

Port costs are charged for the services (pilots, pilot vessels, navigation aids, harbour lights, tugs, lines handling etc.) and infrastructure (berth) necessary for a vessel to enter a port, precede to a berth, tie up safely and discharge its cargo. Services are normally referred to as wet charges and wharfage is referred to as dry charges. Typically wet charges are the responsibility of the vessel owner and will be incorporated in the rate for the vessel.²⁷ Wharfage is the responsibility of the cargo owner. Ultimately all charges flow through to the landed cost of the fuel.

Wet charges are generally charged on certain vessel dimensions, for example, length, or by its gross or net registered tonnage. Tug charges are incurred on a per movement basis. Wharfage is charged per unit of product handled across the wharf.

Port fees and wharfage in Vanuatu have remained the same since 1992. The Ports and Harbour Department (PHD) is currently in the process of reviewing these fees and charges. We were advised that draft regulations proposing new fees were being prepared, to come into effect by mid-2012.

The PHD is responsible for port services across Vanuatu and is responsible to the Ministry of Infrastructure (MoI). There are four declared international ports for which it has responsibility including:

- Port Vila
- Luganville
- Tanna (Lenakel Wharf – a roll-on/roll-off facility)
- Malekula (Litzlitz wharf – a roll-on/roll off facility)

The PHD owns two pilot boats (one for Port Vila and one for Luganville) and one tug boat for Port Vila. The Port Vila pilot boat and tug are new and are restricted to providing services in Port Vila. A privately owned tug operates in Port Vila but also offers services outside Vila. When PPC discharges petroleum in Luganville its only option is to use the privately operated tug to assist berthing. We understand that the rate charged by the private provider for Vila is nearly three times that of the PHD tug. Given these costs are passed through to the market it seems sensible to consider options for more effective use of tugs, including relaxing the restriction on the PHD tug being used for Luganville.

Facilities for connecting to the pipeline to PPC's storage facilities are located on the main wharf which also receives tourist vessels. The adjacent wharf operates as a container wharf is operated by a private concession which also owns the other tug available in Port Vila (and that provided for discharges at Luganville).

Port operating restrictions include:

- A draft constraint at Port Vila in the channel of 10.7 metres at high tide and 9.5 metres alongside at the Government Wharf (we are not aware of any draft restrictions at Santo)
- Tankers can only enter and leave the berth in daylight hours. Tankers like MV Maohi with no bow thrusters²⁸ are restricted to berth no later than 6pm.

²⁷ As PPC owns the vessel we presume these charges are passed on in its freight component.

²⁸ A bow thruster is a transversal propulsion device built into the bow of a ship that makes it more manoeuvrable.

- Passenger liners also receive priority over tankers. Hence there will be an element of waiting time in the course of delivering petroleum to Vanuatu (normally referred to as demurrage) - we would expect PPC to build in an element of waiting time to cover the costs of demurrage.

The current draft restriction at Port Vila prevents the Maohi from making Vanuatu a first port of call. Fully laden (at around 44,000 tonnes) the Maohi's maximum draft is 12.2 metres. To meet a draft restriction of 9.5 metres as first port would require a reduction in cargo size by about 14,000 tonnes. While it is more cost effective to use an MR vessel to deliver to Vanuatu as part of a number of ports rather than via an LCT, using an MR to deliver as a first port would be inefficient or would require significant dredging to achieve the optimum tanker loading.

6.2.4 Storage

We discuss storage (including providing site photos) in detail under the Capital Stock analysis (Section 8). The following is a brief overview.

PPC has two storage facilities terminals, one in Port Vila and the other in Luganville. Each facility is connected via by a pipeline from the main wharf. The combined storage capacity on a gross basis (including heels or unumpables) is over 17 million litres (Table 8). Unpumpables would be approximately 5 % of the gross volume.

Table 8: Petroleum Storage (Litres)

	Petrol	Diesel	Jet A1
Port Vila	1,721,493	8,334,729	*2,142,528
Santo	1,800,000	2,800,000	910,000
Total	3,521,493	11,134,279	2,929,528
17,708,300			

*Jet A1 Storage includes Bauerfield International Airport Tanks (123,000 litres).

There is also small storage tanks at commercial customer sites discussed in section 6.2.6.

6.2.5 Stock Levels

Storage of 17.7 million litres would provide sufficient stock to meet 111 days of sales ($\text{Storage} \div \text{Imports} [\text{Annual imports} \div 365]$) if all tanks were filled to the safe fill level. However, some stock is unpumpable (tank heels) which we have assumed as 5% of the gross volume of the tanks (agreed by PPC). In addition, PPC maintains a minimum stock of each product prior to replenishment to provide a contingency in the event of typical delays to shipping or as agreed with specific customers. PPC will schedule replenishment timings to ensure stocks levels do not go below these minimum thresholds.

The appropriate way to measure stock cover is to calculate on an average days of sales basis. This includes the minimum days cover operated by PPC at time of replenishment together with 50% of the typical parcel received for each product (the average between replenishments). Current days cover on this basis is indicated in Table 9.

Table 9: Storage in Days Cover

Port Vila					
	Petrol	Kerosene	Diesel	Power Diesel	Average days cover
Minimum days cover	21	14	21	60	
Average days cover	54	46	52	93	64.4
Spare Capacity (days)	34	20	4	2	10
Santo					
Minimum days cover	21	14	21 ²⁹		
Average days cover	86	90	83		85
Spare Capacity	62	267	18		44
Average days cover for Vanuatu 68.5 days					

From our modelling analysis and keeping the shipping frequency and parcel size same with projected demand for the next 10 years, Port Vila diesel and petrol tank spare capacity will be constrained by 2015 and 2016 respectively. Kerosene storage is already constrained (July 2012) as PPC only utilise four of the eight tanks. It is noted that PPC will invest in the jet tanks subject to long-term commitment from Air Vanuatu. PPC had built Tank 7 when UNELCO signed a long term contract for supply and 60 days stock requirement. The Santo Terminal does not have adequate spare capacity and will constrain diesel (2013) and petrol (2016) supply if continued with current shipping frequency. The Santo Terminal would need an additional storage tank for diesel.

PPC advised that within its projected capital investment for the next five years there will provision to build two new 5 million litre tanks (one for diesel/one for petrol) to cover for increased demand.

6.2.6 Other small storage

UNELCO

UNELCO has diesel storage tanks at all its power plants. There are four storage tanks in Port Vila (218 kL), five tanks in Tagebe (320 kL) and one tank each in Tanna (10 kL) and Malekula (10 kL) giving a combined storage capacity of 558,000 litres.

We understand there is no other bulk storage on the outer islands with exception to UNELCO which has small storage tank on Tanna and Malekula for its diesel generators. Fuel is supplied by drums and decanted into day tanks but we have not been provided with information on the size of these tanks.

Isotainer

²⁹ Santo Terminal has only one diesel tank which is used for storage. Santo supplies diesel to VUI for power generation.

We also observed the distribution and marketing of diesel from isotainers on Santo as shown in Figure 16. Isotainers are built for transportation only, and pose a safety concern if used as a mobile retail site. Isotainers used this way are risky for several reasons:

- Unless an isotainer allows petroleum fumes to be adequately vented to air, it will contain volatile and flammable fumes, which will make a partially filled isotainer more dangerous than a fully filled isotainer.
- Special care (including training, safety clothing, and breathing apparatus) must be given to workers that enter empty isotainers for the purpose of cleaning or inspecting them to ensure that they are not overcome by toxic vapours inside the container.
- As shown in Figure 16, there is no spill containment or fire safety measures in place around this retail site; which is operating beside the main public road and a public drain. A spill there could result in toxic fuel going into the town drainage system, across a public road, and into the Sarakata River and Santo Harbour.

Figure 16: Diesel Stored and Marketed from Isotainer



6.2.7 Shipping within Vanuatu

Supply to the outer islands is provided by petroleum products in drums and LPG in bottles, filled from the bulk terminals in Port Vila and Santo and then carried on both on small cargo ships and passenger vessels operating privately. Anecdotal information indicates that freight rates charged are high.

Table 10 shows additional transport costs per litre for Malekula and Tanna - this is a significant factor on the cost of fuel for the outer islands. PPC launched its first service station on Tanna operated from an above ground container tank. This site is supplied via drums and fuel is

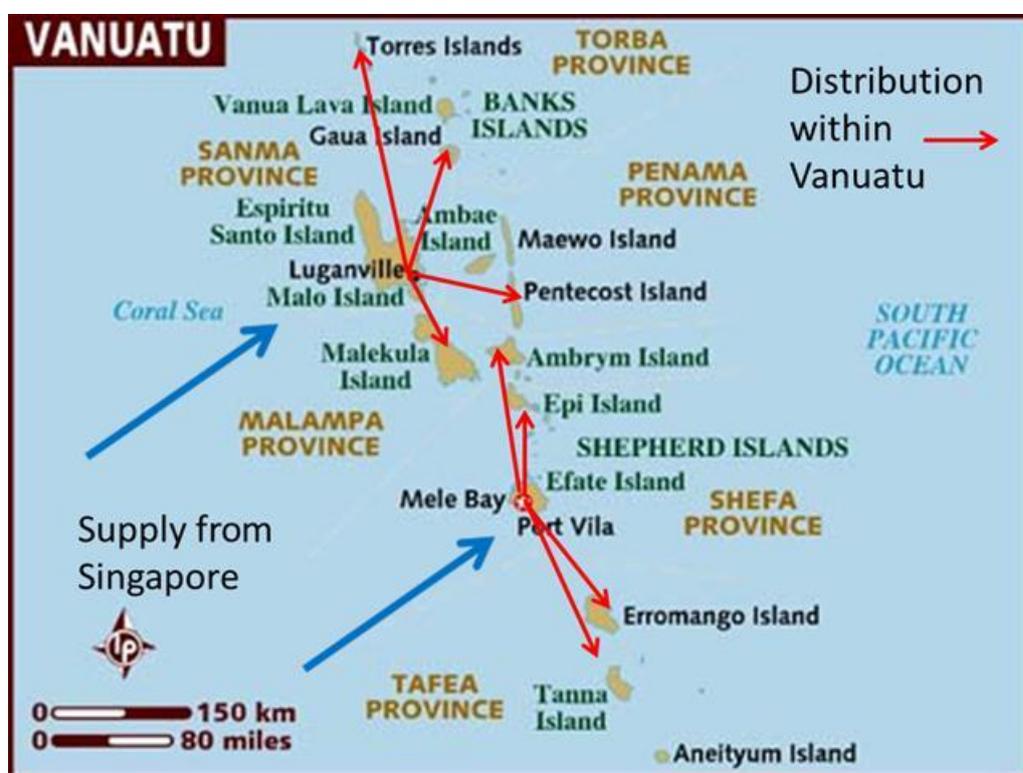
pumped into tanks using a manual pump. The retail price of both petrol and diesel is VUV 300 per litre. Investment in storage tanks and equipment for service station will be a major cost challenge for outer islands. The Tanna service station is a pilot project for PPC and the cost of equipment is shared 50/50 between the dealer and PPC.

Table 10: Estimated transport cost to selected Outer Islands

Diesel Fuel Distribution	Additional transport cost per litre
Port Vila and Luganville	Base Price
Malekula	Base Price plus 15.8 Vatu transport and fees
Tanna	Base Price plus 33.30 Vatu transport and fees

Source: UNELCO Tariff submission to Utility Regulatory Authority (URA) Electricity

Figure 17: Distribution of Fuels within Vanuatu



The interisland shipping undertaking this task currently consists of about 40 vessels with a combined cargo capacity of 2,350 dead weight tonnes (dwt)³⁰ and is supported from the two main ports of Port Vila and Luganville³¹ (Figure 17).

The lack of certainty around schedules for inter-island shipping within Vanuatu has at times caused shortages in LPG supplies on smaller islands. For example, the island of Tanna is frequently out of LPG for up to two weeks due to irregularities in the frequency of shipping from

³⁰ A dead weight tonne (dwt) is a measure of how much weight a ship is carrying or can safely carry which is the sum of weight of cargo, fuel, ballast water and provision for passengers and crew.

³¹ Ministry of Infrastructure and Public Utilities (2011) Van: Interisland Shipping Support Project Lenakel. Initial Environment Examination Report prepared for Asian Development Bank

Port Vila. Deliveries of between 300 to 400 9kg cylinders to Tanna occur every 1 to 2 months, with the uncertainty in shipping resulting in shortages.

Inter-island shipping of drums and LPG cylinders across the islands of Vanuatu is also relatively costly. A 9kg bottle of LPG costs around VUV 500 to ship from Port Vila to Tanna, excluding road transport at each end of the journey. Since 2007, shippers have moved to charging LPG shipments on a fixed charge per bottle, rather than charging for the basis of the area occupied by the bottles (\$/square metre).

For fuel drums, the shipping transport charge is typically in the range VUV 3500 to VUV 4000 per drum (VUV 17-19 /litre). Since 2007, the model for drum usage has switched from one where consumers were required to pay a refundable deposit on fuel drum (VUV 8500/drum) to one where consumers purchase drums outright (VUV 7500/drum).

Around 3500 drums of fuel per month are sold by PPC. Pacific Petroleum is contracted by both UNELCO and Air Vanuatu to deliver fuel in drums to some of the smaller islands and arranges domestic shipping of drums on their behalf. PPC usually delivers drums to Tanna and Banks every two months, where these drums form a strategic store for UNELCO and Air Vanuatu. Other customers typically arrange their own shipments of drums.

The PPC Santo Terminal supplies fuel in drums to all central and northern islands which include Malo, Malekula, Ambae Maewoo, Pentecost, Ambrym and Banks Islands as indicated in Table 11.

Table 11: Supply of Fuel to Outer Islands from Vila and Santo Fuel facility

Island	Supply Route	Supply mode	Total Volume (million litres)	Transport (Marine & Land)	Electricity (Diesel generators)
Tanna	Port Vila to Tanna	Ship storage tank & drums	1.3	70%	30%
Shepard's Islands	Port Vila to Shepherd	Drums	0.08	40%	60%
Malekula	Port Vila (7%) Santo (93%)	Drums	0.87	35%	65%
Pentecost Islands	Port Vila (8%) Santo (92%)	Drums	0.375	30%	70%
Ambrym	Port Vila (11%) Santo (89%)	Drums	0.137	40%	60%
Ambae	Santo (100%)	Drums	0.807	35%	65%
Malo Island	Santo (100%)	Drums	0.200	40%	60%
Banks Islands	Santo (100%)	Drums	0.166	60%	40%
Maewo	Santo (100%)	Drums	0.144	50%	50%
Other Small Islands	Vila and Sato	Drums	0.04	50%	50%

Table 12 shows additional transport costs per litre for Malekula and Tanna - this is a significant factor on the cost of fuel for the outer islands. PPC launched its first service station on Tanna operated from an above ground container tank. This site is supplied via drums and fuel is pumped into tanks using a manual pump. The retail price of both petrol and diesel is VUV 300 per litre. Investment in storage tanks and equipment for service station will be a major cost challenge for outer islands. The Tanna service station is a pilot project for PPC and the cost of equipment is shared 50/50 between the dealer and PPC.

Table 12: Estimated transport cost to selected Outer Islands

Diesel Fuel Distribution	Additional transport cost per litre
Port Vila and Luganville	Base Price
Malekula	Base Price plus 15.8 Vatu transport and fees
Tanna	Base Price plus 33.30 Vatu transport and fees

Source: UNELCO Tariff submission to Utility Regulatory Authority (URA) Electricity

6.2.8 PPC's Barge Project

PPC has recently entered into a Memorandum of Understanding (MOU) with the GoV (represented by the Minister responsible for Energy) to procure a self-propelled bulk fuel barge "The MV Pacific Spirit" to deliver fuels to outer islands. PPC will purchase a new double-bottomed barge that will carry bulk petroleum products in under-deck tanks as well as packaged products on deck (drums, LPG bottles, and lubricants). The barge is expected to commence delivery to outer islands late 2012 to early 2013. The cost of the barge will be shared between PPC (70%) and GOV (30%).

The barge will increase the efficiency of the supply chain by lowering freight costs, improve supply security by establishing more bulk tank receiving facilities, and improve operating and safety standards by e.g. reducing the loading (and back loading) of drums on other domestic shipping.

6.2.9 Land Transport

Land transport of fuels is by tanker truck for bulk deliveries, and smaller trucks and other vehicles are used to transport drums and gas cylinders.

PPC Port Vila has five road tankers of which four road tankers are used for delivering petrol and diesel for retail service stations and commercial sites. A dedicated 14,000 litre road tanker is used to deliver to Bauerfield Airport. PPC also has on order a 22,000 litre tanker, expected to arrive in December. The current total capacity of the five tankers is 92,100 litres.

The PPC Santo Terminal has three road tankers; one is dedicated for delivering petrol and diesel to retail sites and two tankers are used for Peko International Airport. The total capacity of the three tankers is 42,000 litres.

6.2.10 Sales Channels

PPC sells fuels (i.e. ADO, ULP and DPK) through a network of branded service stations in Port Vila and Santo as shown in Table 13 as well as other branded service stations and fuel distributors across Vanuatu. Marine and aviation fuels are sold at ports and airports. In addition, individual customers purchase drums that can be refilled at PPC's depots in Port Vila and Santo.

Table 13: Petroleum Service Stations in Vila and Santo

Island	Service Station	Storage Capacity (kL)	Throughput Volume	Mode of delivery
Sites delivered from Port Vila Terminal	Chialee Station	30	Medium	Road Tanker
	Paray Station	60	Medium	Road Tanker
	Tropical - Au Bon Marche	49	High	Road Tanker
	D'Dock (Asco Motors)	45	Medium	Road Tanker
	Tebakor Station	30	High	Road Tanker
	Manples - Au Bon Marche	30	High	Road Tanker
	Natraz	30	Medium	Road Tanker
	Korma	30	High	Road Tanker
	Centrepoint Station	35	Medium	Road Tanker
	Savannah	10	Low	Road Tanker
Service Stations delivered from Santo Terminal	Luganville Petrol Station	30	Medium	Road Tanker
	Unity Shell	25	Medium	Road Tanker
	Au Bon Marche	10	Medium	Road Tanker
	Paradise	5	Low	Road Tanker

The commercial customers such as UNELCO (Port Vila), VUI (Santo) and Air Vanuatu are also supplied fuel via road tankers into day tanks on customer sites. Bauerfield International Airport has an aviation storage depot with a combined volume of 123,000 litres operated by PPC. A dedicated road tanker supplies fuel from PPC Port Vila Terminal to Bauerfield Depot.

6.2.11 Pricing

Prices in Vanuatu reflect the various components of the supply chain including the international price in Singapore, any quality differences between the Singapore benchmark and the quality specification to be supplied, the cost of shipping to Vanuatu, landing charges, storage and handling costs, secondary distribution costs to other locations (outer islands) and the supplier's margin. International petroleum is typically traded in US dollars so prices for any country will also depend on the strength or otherwise of its currency against the US dollar.

These components are similar for Australia, New Zealand and the larger Pacific Islands. Differences occur where for example there is demand for even higher fuel quality, larger parcels increase shipping efficiency or throughput (as a function of demand) is relatively small and economies of scale are reduced because of the size of the facilities required. But these are relatively small compared to the changes that can occur in the underlying international price, which changes on a daily basis. Hence changes in price in the region will be mainly influenced by international prices.

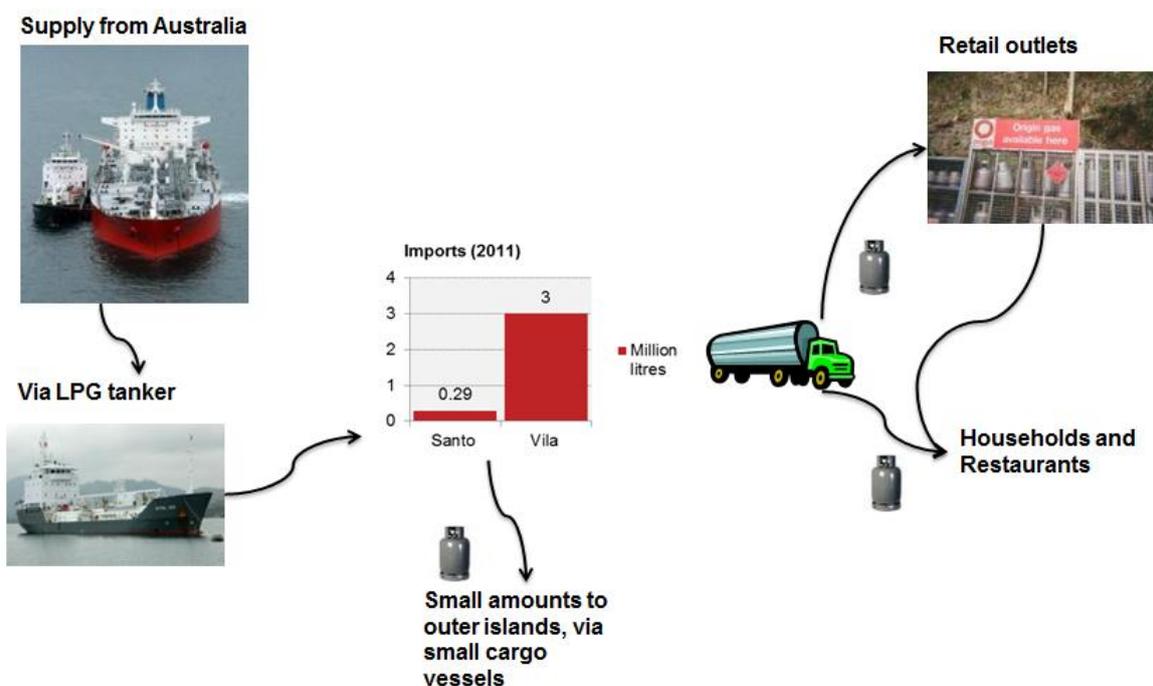
Supplier pricing practice in Singapore can also lead to differences. Practice varies between using the average of the month's prices (regardless of when the vessel loads) to a narrow window (e.g. 5 days around the loading date). The narrower window increases risk, particularly in volatile periods, and average month versus 5 days can result in significant differences. PPC's current pricing practice uses 5 days around the bill of lading or loading date. This increases risk for Vanuatu, which is heightened further because of Vanuatu's relatively small market and the extended time between replenishment; prices in Vanuatu are not changing in step with other markets. This may be affecting various economic activities (e.g. aviation, international bunkering) where the market is able to select fuel sources more in step with market changes.

6.3 LPG

6.3.1 Supply to Vanuatu

LPG is primarily shipped to Vanuatu (Figure 18) on two LPG tankers, the MV Boral Gas and the MV Pacific Gas both of which can transport 1000-1500 tonnes of LPG. Until the end of 2010 these vessels were owned by Origin Energy and used across the South Pacific, they have since been sold to Petredec, a Singaporean company, and chartered back by Origin.

Figure 18: LPG Supply Chain



Deliveries to Port Vila and Santo are made as part of regional supply voyages out of Brisbane that cover ports in Papua New Guinea (PNG), Solomon Islands, Fiji, Tonga, Samoa and Vanuatu. The exact schedule and routing of the voyages change every month, depending on LPG stock levels in each location (Figure 19).

In 2007, the Port Vila market and facilities were converted to use propane, rather than the heavier butane.³² The Santo market remains butane therefore each market is supplied by different ships with different voyage patterns.

Origin imports LPG to Brisbane on large tankers (commonly referred to as Very Large Gas Carriers or VLGCs) from Saudi Arabia or elsewhere in the Middle East. These tankers provide a ship-to-ship transfer (STS) to the smaller tankers that service the Pacific Islands, in effect a hub for supply to the region.

In 2011 LPG was shipped to Port Vila about once a month on average with deliveries typically between 100-150 tonnes. Santo gets deliveries of 45-50 tonnes once every three months.

Figure 19: LPG supply route to Vanuatu



Source: <http://www.originenergy.com.au/1863/Pacific-Islands>

6.3.2 Pricing

The Asian LPG market is linked to a monthly price set by Saudi Arabia known as Saudi Contract Price (Saudi CP). Asia imports a lot of its LPG from the Middle East both for traditional LPG use (transport, heating, commercial) and as feedstock for petrochemicals production.

Pricing of Origin's imports into Brisbane will be based on the monthly Saudi CP price plus a margin reflecting the freight cost (including demurrage) for the tanker from the Middle East and the time it is used as floating storage in Morton Bay.

From investigations on other LPG studies we were informed that the LPG premiums would be +USD 50-60/tonne in Brisbane.³³ (This is different from the level of about +USD 20/tonne from

³² Liquefied petroleum gas (LPG) is used as a common term to refer to propane, butane or a blend of the two.

³³ Prior to establishing the hub in Brisbane, in the early 2000s, supply came from the Bass Strait and was priced at about +US\$20/tonne premium.

Westernport, Victoria, where LPG is produced, and from where Origin used to get supply from earlier in the 2000s).

The delivered cost into Vanuatu then includes the freight cost plus any associated charges. LPG freight on small vessels such as the Boral Gas and Pacific Gas is expensive as the volumes carried are small. In addition, the delivery parcel is only about 10% of the ship capacity (for Port Vila) or 4% for Santo. The impact of requiring a small portion of cargo is minimised by Origin linking Vanuatu voyages with larger LPG markets such as Fiji or PNG. However the extra time taken for Vanuatu discharge and local port costs still need to be recovered over the small volume.

The LPG price is analysed in more detail in Section 9.

6.3.3 Distribution within Vanuatu

Bulk storage terminals in Efate (Port Vila Terminal) and Santo Islands (Luganville) receive LPG. The facility in Port Vila was upgraded to handle propane in 2007 and has a storage capacity of 190 tonnes. Santo has a storage capacity of 120 tonnes capacity (2 x 60 tonne tanks) although generally only one tank is used at any one time. To provide most flexibility in supply, given the relatively restricted storage compared to demand (in Port Vila), generally the ships will discharge sufficient cargo to leave the facilities full.

Commercial customers are mainly supplied via truck, which refills LPG tanks at customer's sites. These tanks range from one to five tonnes. The storage terminals also refill LPG in bottles ranging from 4, 9 and 11kg for residential customers and 45kg for commercial customers. These are distributed within Efate and Santo Island via truck.

Outer Islands are shipped LPG in bottles filled either from Efate and or Santo depending on shipping schedule. Both cargo ships and passenger vessels carry LPG to outer islands. These ships are operating privately in Vanuatu and charge a higher freight rate for loose cargo in comparison with bulk shipping.

6.3.4 Sales channels

Table 14 indicates Origin's sales by channel for 2012.

Table 14: Origin LPG sales by channel, 2012

Customer type	Percentage of total sales
Residential (Door to Door Delivery)	10
Resellers (Dealers)	23
Bulk	15
Commercial	41
Auto Gas	0.05
Espiritu Santo Island Sales	10.95

LPG is sold primarily through resellers (e.g. service stations) and on-sold to consumers (mainly households who use LPG for cooking). Bulk sales of LPG to hotels and other businesses account for 56% of sales. Tourist resorts use LPG extensively for hot water, cooking, laundry and gas lighting. Several banks and hotels have installed LPG air conditioning or heat pumps (e.g. Reserve

Bank, ANZ Bank, BRED Bank, National Bank, Eratap Resort, and Grand Casino). Sales of LPG for automotive use are small at 0.05%, primarily because the cost of converting vehicles to run on LPG is high.

In the household cooking market, LPG is facing increased competition from increasing usage of charcoal stoves. In May 2011 the retail price of charcoal was around 100 Vatu/kg, compared to retail LPG of 370 Vatu/kg – noting that the heating value of these fuels differs. Firewood is also used for cooking purposes, and in May 2011 it sold for around 300 Vatu per bundle (10 to 15 kg).

7.0 Health, Safety and Environment Risks in Supply Chain

Summary:

Health, safety and environmental (HSE) risks are major issues in any petroleum and LPG supply chain. Vanuatu has experienced a number in recent years, which have had a significant impact on the well-being of people, the environment, and cost to the economy. Some of the major incidents documented are:

- Jet A1 hydrant line leaked in 1989 at Bauerfield Airport releasing up to 100,000 litres³⁴ of product to ground.
- LPG explosion at Nasama Resort in Port Vila killing two Ni Vanuatu and critically injured a builder in April 2012³⁵.

EH&S risks exist throughout the supply chain, including in shipping fuel to Vanuatu, in storage terminals and depots, distribution within the islands and at end use by consumers. Both PPC and Origin Energy adopt international and regional standards and have internal procedures for managing these risks, which is similar to the practices adopted by the multi-national oil companies in the region. These risk management practices are audited annually by independent auditors for insurance purposes.

However, the Government of Vanuatu does not have a specific HSE regulatory framework that can be applied to the sector. Any spill into the marine environment would be governed by international conventions but local regulations are lacking as the Maritime Act of Vanuatu has been repealed and the GoV is reliant entirely on the industry to meet contingencies such as oil spills. A major spill could seriously impact on Vanuatu fisheries, the tourism industry and public health.

7.1 Overview

Petroleum products are inherently dangerous and have potential to cause significant damage if they are mishandled, stored improperly or used incorrectly. Vanuatu has experienced a number of incidents arising from the use of petroleum and LPG that has had a significant impact on the environment and well-being of people. Some of the major incidents were:

- Jet A1 hydrant line leaked in 1989 at Bauerfield Airport releasing up to 100,000 litres³⁶ of product to ground.
- LPG explosion at Nasama resort in Port Vila killing two Ni Vanuatu and critically injured a builder in April 2012³⁷.

As noted in Section 4.4 there is no specific legal framework setting standards on how HSE risks should be handled. Instead Vanuatu has relied on the petroleum suppliers themselves to manage safety and environmental standards and risks.

The following provides our assessment of the safety and environmental risks in the current supply chain and how these are being managed or mitigated by the sector. We have divided the supply chain into four segments:

³⁴ Remediation of Aviation Fuel Spill in Groundwater Aquifer, Vanuatu (May 1994) Jamieson D& Hassan M.

³⁵ <http://www.dailypost.vu/content/lack-smell-gas-concern-over-explosion-killed-two>

³⁶ Remediation of Aviation Fuel Spill in Groundwater Aquifer, Vanuatu (May 1994) Jamieson D& Hassan M.

³⁷ <http://www.dailypost.vu/content/lack-smell-gas-concern-over-explosion-killed-two>

- Shipping to Vanuatu
- Receipt, storage, handling and distribution from main storage
- Distribution within Vanuatu
- Consumer's standards

Table 15 illustrates the range of risks and associated mitigation strategies.

Table 15: Environmental and safety risks in petroleum and LPG supply chain

Supply Chain	Risk	Key Risk	Impact	Likelihood	Mitigation strategies
Shipping from Singapore to Vanuatu	Spill	Ship grounding and/or leakage	Product to marine environment/potential for fire	Low	Shipping meeting international maritime requirements (MARPOL) Adequate oil spill response/pollution insurance cover
Receipt, storage, handling etc.	Spill/leak	Failure of receiving/ discharging infrastructure (Ports) Explosion (LPG) Tank overfill or pipeline leak	Product to ground and marine environment/potential for fire	Medium	Port facilities comply with international practice requirements Regular maintenance and audits of equipment Regular pressure testing of pipelines.
	Fire	Tank fire may not able to be extinguished	Fire spreads to adjacent tanks/facilities	Low	Construction standards, fire water and fixed foam systems LPG tanks – tanks buried
Distribution within Vanuatu	Spill, vehicle accident and/or fire	Ship grounding, road tanker accident Drum spill	Product to ground and marine environment and potential for fire	High	Appropriate standards/practices
		Underground tank leak or tank overfill on a retail site	Product to ground and marine environment and potential for fire	Medium	Some stations have monitoring wells
End User	Fire and product contamination	Fuel or LPG contamination and or failure of equipment	Fire and or explosion that could harm people and spread to surrounding environment	High	Education awareness.
	Inhalation	Improper labelling of fuel storage containers	Affect human health	Medium	Education awareness.

7.2 Shipping Fuel to Vanuatu - Safety and Standards

The two major risks associated with shipping petroleum products to Vanuatu are:

- Spill to the marine environment arising from ship equipment failure or ship grounding
- Spill or fire resulting from failure of receiving/discharge infrastructure (port facilities)

The shipping of petroleum products is governed under international convention under the auspices of the International Maritime Organisation (IMO). The IMO oversees a number of conventions including MARPOL, which is the main convention covering pollution from ships (including petroleum tankers). The MARPOL convention³⁸ places a number of requirements on vessels covering both construction standards and operation. The most widely known requirement is that petroleum product tankers be double hulled. Vanuatu is a member of the MARPOL convention therefore all tankers arriving in Vanuatu must comply and should be maintained under MARPOL requirements. Although a signatory, the relevant local legislation, the Maritime Act of Vanuatu, has been repealed, so we are uncertain what implications this would have where there were operators which did not comply with MARPOL requirements.

MARPOL sets out requirements for vessel design, construction and operation of cargo areas and machinery spaces, survey and certification requirements, and also requirements for the ship's oil and ballast water, including oil spill emergency response. There are three categories of oil tankers in the MARPOL convention, namely:

- Category one: pre MARPOL vessels (pre 1982)
- Category two: post MARPOL vessels (post 1982)
- Category three: smaller tankers (5,000 to 20,000 DWT)

Vessels below 5,000 deadweight tonne are not categorised under MARPOL. All category one and two vessels must be double hull compliant. For category three vessels while these must be double hull compliant from 2010, individual flag states can delay this requirement till 2015 provided the calling vessels comply with the Condition Assessment Scheme (CAS) survey requirements. There is also a requirement for vessels over 600 DWT carrying heavy (or persistent) grade oils to be double hulled.

These requirements can be complex where smaller LCTs are operating. However PPC's MV Maohi is fully compliant with MARPOL. Our understanding is that LCTs operated in the region (which PPC could use if an MR tanker was unavailable) are also double hulled as the companies supplying the Pacific Islands already operate to international standards. Nevertheless these should be made specific requirements in any re-enactment of the Maritime Act.

7.3 Receiving/ Discharge facility (Port Requirements)

A number of international maritime organisations including the IMO and Oil Companies International Marine Forum (OCIMF) have been instrumental in providing guidelines for wharf provision and operation of port discharge including the Marine Terminal Baseline Criteria and Assessment Questionnaire and the International Safety Guide for Oil Tankers and Terminals (ISGOTT). These are typically not regulated but are adhered to by the industry as accepted international practice.

These guides provide operational advice to assist personnel involved in tanker and terminal operations. It is a recommendation that a copy of ISGOTT is kept and used on-board every

³⁸ MARPOL Annex I Regulations for the Prevention of Pollution by Oil: INTERTANKO

tanker and in every terminal so that there is a consistent approach to operational procedures and shared responsibilities for operations at the ship/shore interface.

Vanuatu is a member of the International Maritime Organisation's (IMO) SOLAS (Safety of Lives at Sea) and also complies with the International Ship and Port Security CODE (ISPS code) which is a comprehensive set of measures to enhance the security of ships and port facilities. The ISPS code applies to both ships and ports.

The two major ports, Port Vila and Luganville, do not have their own spill equipment and rely on the PPC and Origin to supply their spill equipment during discharge which both companies do. The companies also manage and supervise discharges, and engage ports staff in annual spill response training.

7.4 Transport and storage in Bulk Terminals

Analysis of the risks in the transport and storage in bulk terminals is also discussed in Section 8.2 and not discussed here.

7.5 Distribution within Vanuatu

The distribution of petroleum and LPG is explained in Section 6.2.7. The risks identified are mainly spill and fire. The main risk areas and issues are:

- **Marine transport:** Petroleum and LPG are shipped to the outer islands together with general cargo on passenger vessels. The interisland shipping fleet consists of 12 large vessels, 8 medium and 20 small. The median age of the fleet is 28 years³⁹. This mode of transport poses risks associated with both spill and fire. Also there is neither segregation of petroleum from general cargo nor any special vessel designated to carry petroleum (due to small demand and high cost of shipping to outer islands of Vanuatu).
- **Remote Storage:** Fuel shipped to outer islands is stored in drums and isotainers. An empty isotainer, unless it has been adequately vented to air, can contain flammable fumes and is potentially even more dangerous than a filled container. Similarly drums can leak to ground due to wear and tear.
- **Containers/ bottles:** Refilling drums can cause product contamination if the drum is not thoroughly cleaned. Likewise leaking LPG and petroleum drums can cause fire and spill to ground. PPC has drum filling facilities at both Santo and Vila terminals. All drums and aluminium containers used to ship aviation gasoline, petrol and diesel fuel from Port Vila and Santo to the outer islands are cleaned and checked by PPC drum filling staff at each terminal. Origin has a similar practice where all LPG bottles are tested for leaks before refilling. Any LPG bottle that does not pass the leak test is condemned and discarded for recycling. These practices reduce the risk of spill and leakage.

7.6 End users

The risks from use of petroleum products by consumers can be wide ranging. For the purpose of this report we have considered two likely E&S risks at household level and their mitigation.

- **Use of kerosene and LPG in households** - Kerosene is often sold by refilling in unlabelled containers and poses a risk of both inhalation and product contamination (e.g. if the

³⁹ Ministry of Infrastructure and Public Utilities (2011) Van: Interisland Shipping Support Project Lenakel. Initial Environment Examination Report prepared for Asian Development Bank.

container was used for petrol and later refilled with kerosene). There have been such incidents reported in Tuvalu and Fiji. During our visit to Vanuatu we noted that PPC subcontracts Azure Waters, which is a manufacturer of plastic bottles for dangerous goods, to refill kerosene in small bottles. This is consistent with practice with countries that have dangerous good regulations.

- **LPG Bottles exposed to fire/heat** - LPG is refilled in bottles and sold to households for cooking. There is a risk of explosion if the LPG bottles come in contact with fire or heat. Most households do not have smoke alarms or fire extinguishers in Vanuatu although Origin provides awareness on the safe use of LPG in Vanuatu.

7.7 Legislation mitigating HSE risk

Table 16 summarises the areas of regulation expected to cover HSE risk in the downstream sector (noting storage facilities are discussed in Section 8).

Table 16: Summary of regulations required to mitigate safety and environmental risks

Legislation	Purpose	Status for Vanuatu
Maritime Legislation/ International conventions	<ul style="list-style-type: none"> ■ types of vessels that can transit territorial waters (e.g. doubled hulled) ■ minimum level of vessel safety and condition ■ ability to detain, remove or penalise non-compliant vessels ■ require vessels to also comply with international shipping laws/conventions 	Member of IMO since 1986 but repeal of the Vanuatu Maritime Act raises questions around effectiveness
Port requirements	The standards are not always regulations (e.g. OCIMF) although for members of SOLAS ⁴⁰ they need to meet the ISPS code.	Member of SOLAS and meets the ISPS code
Oil spill response	To ensure Vanuatu has appropriate spill response plans	PPC and Origin have internal spill response plan but GoV does not have national spill response.
Dangerous goods licenses for service stations, bulk storage terminals and other storage locations	<ul style="list-style-type: none"> ■ Up to date test certificates for primary storage, secondary containment systems and pipelines ■ Hazardous atmosphere zones identified and ignition sources managed ■ Sufficient and appropriate fire fighting equipment ■ Appropriate signage on hazardous substances sites ■ Approved emergency response plan 	None
Emergency powers	To enable government to direct fuel suppliers, terminal operators and other related companies to take immediate actions during a state of emergency	National Disaster Act 2000 and Action Plan for Disaster Risk Reduction

⁴⁰ International Maritime Organisation: Safety of Lives at Sea (Vanuatu is a member of SOLAS)

8.0 Capital Stock

Summary:

An examination of the existing petroleum and LPG storage facilities in Vanuatu found the facilities to be in a reasonable state. It is believed that one of the reasons for the oil majors exiting the region was that the terminals and related facilities required major upgrades, requiring significant capital expenditure. Faced with the fact that more investment would do nothing to increase market share or profitability, they chose instead to exit the market to pursue investments in markets with higher growth potential.

Since purchasing these assets PPC has invested considerable sums to reduce risk, improve security of supply and reduce operating cost of the facilities. This is evident with the construction of a new diesel tank (Tank 7), the installation of a product pipeline from the main wharf (to enable use of MR tankers) and also the compound in Port Vila. Tank 7 has been constructed to current international standards and the compound has been fitted with an impermeable high density polyethylene (HDPE) liner that, given there is no applicable legal standards, reflects PPC's stated intention to operate to international standards.

PPC and Origin are in a situation where they have inherited facilities with some fundamental design and construction issues that can only be addressed with major injections of capital. This cannot be undertaken quickly without increasing the price of the fuels. Therefore a balance needs to be struck between upgrading the assets to improve the integrity of supply and reduce risk, and limiting cost increases in fuel to pay for the upgrading.

The areas of concern for petroleum and estimated cost for upgrading are:

- *Fire protection systems (USD 3.721 million)*
- *High level alarms for risk of tank overflow (USD 0.256 million)*
- *Top loading of trucks (USD 0.22 million)*
- *Upgrade Santo Tank compound with HDPE Liner (USD 1.2 million)*
- *Proximity of petrol storage to nearby residential areas (USD 0.6 million)*
- *Seismic ratings of tanks in the event of earthquakes (USD 0.15 million)*

Estimated investment cost over USD 5.3 million or VUV 522 million

PPC is aware of these issues and plan to address them as funding permits.

For Origin's facilities issues include:

- *Fire protection (including one tank above ground) (USD 876,000)*
- *Proximity to residential areas (Port Vila only)*
- *No gas leak detection system (USD 100,000)*

Estimated investment cost over USD 976,000 or VUV 96.2 million

These are rated low probability events except for loading of trucks which are considered medium. Although low probability they could have high impact -given the site in Port Vila, being close to a residential area, the issues of fire and spill protection suggest the Government should discuss these risks with PPC and Origin to understand how these are to be incorporated into each company's long term capital investment plans.

The replacement cost for PPC's storage assets (including Port Vila, Santo, and Bauerfield Airport) is estimated at ~ USD 50 million. The replacement cost for Origin's storage assets (including Port Vila and Santo) is estimated at ~ USD 13.5 million.

8.1 Methodology

This section examines the assets (the 'capital stock') used for the storage and distribution of petroleum within Vanuatu. Both PPC and Origin provided access to their sites although Origin would not provide requested documentation pending signing of a confidentiality agreement.

We evaluated the capital stock through a two-step process:

- **Information gathering:** our technical team visited each fuel storage site to create an inventory and assess for adequacy, integrity and basis for valuation. We examined all fixed assets used in fuel storage such as tanks, pipeline and gantries. We excluded office buildings, goodwill (normally associated with the capital base of a company but difficult to quantify) and retail assets (dealer owned therefore it is recovered in retail margin).
- **Information analysis, valuation and modelling:** Using the information gathered our engineering expert determined a replacement cost for the facilities. In other Pacific Island countries where fuel prices are regulated, the operators often provide audited financial reports and asset registers to assist in assessing capital stock. In the absence of detailed submissions from PPC and Origin we relied on our engineering expertise for valuation. The valuation is used in our pricing analysis in Section 9.

8.2 Terminal Safety and Environmental Risk Assessment

8.2.1 Port Vila Terminal Site location and Layout

The site is located within the city of Port Vila, on the south western side of Efate Island. The site is located approximately 1km south of the main administrative centre of Port Vila, on a parcel of land between the Lini Highway, and the Ekasuvat Lagoon to the east, and the Port Vila Harbour (Paray Bay) to the west.

The site is used for storage and distribution of all ground (petrol and diesel) and aviation fuels for PPC customers. Fuels are distributed to nine service stations within the Port Vila area, as well as to various commercial customers. Aviation product is supplied to the PPC aviation fuel facility at the Bauerfield International Airport, approximately 10km north of Port Vila. The site is also used for drum filling (205 litres) and storage, and subsequent delivery to intra and inter-island customers.

The site covers an area of approximately 15,500 m² (Figure 20).

Figure 20: Aerial view of Port Vila Terminal



The site is gently sloping to the west, and surfaced with a mix of concrete, gravel, and grass. The above ground fuel storage tanks (AGSTs) are located within a concrete and earthen bund wall, on concrete tank stands with the exception of Tanks 6 and 7 which are fully bunded, with impermeable material. All other infrastructure including gantry shed, drum filling platform and lube storage shed are located on concrete surfaced areas. The site office, workshop, and amenities are located in the north eastern portion of the terminal. The terminal compound is bounded by a three metre mesh and barbed wire fence.

The Port Vila terminal was observed to contain the following features and petroleum infrastructure:

- 16 above ground storage tanks (ASTs) on site as summarised in Table 17;
- Two operational triple interceptor pits with associated drains;
- Site office, workshop and amenities located in the north eastern corner;
- Two fire water pumps (250m³) located in the north western corner;
- Drum cleaning facility located in the northern corner.
- Three Gantries, two operational and 1 is not working and due to be removed.
- Drum refilling and lubricant storage in the western corner.
- Wharf fuel line connecting the main Port Vila wharf to Terminal across the south western site boundary about 2 km long;
- Two spill boats and three containers of spill equipment located in the western corner.

Table 17: Port Vila Terminal Storage Tanks

Tank Ref	Tank Type	Fuel Type	Capacity (Kilo litres)	Tank Heel	Construction Date	Status
1	AST	ULP	300		1961	In use
2	AST	ULP	200		1961	In use
3	Removed					

4	AST	LSADF	500		1970	In use
5	AST	ULP	1,200		1980	In use
6	AST	HSDF	1,700		2004	In use
7	AST	HSDF	6,000		2010	In use
8	AST	SLOP	12		Unknown	In use
9	AST	Jet A1	214		1974	In use
10	AST	Jet A1	208L		1961	In use
11	AST	Jet A1	576		1961	In use
12	AST	Jet A1	576		1961	In use
13	AST	Jet A1	214		1961	In use
14	AST	Jet A1	55		1961	In use
15	AST	Jet A1	55		1961	In use
16	AST	Jet A1	50		2005	In use
17	AST	Jet A1	50		2005	In use

Notes: Jet A1 - Aviation jet fuel; LSADF - Low Sulphur Automotive Diesel Fuel; HSDF - High Sulphur Diesel Fuel; ULP - Unleaded Petrol; Age of Tanks are approximate only.

Site History

Historical information relating to the property was not available during the assessment. The site was operated by three separate multinational oil companies. The southern end of the terminal was believed to be purchased by British Petroleum South West Pacific (BPSWP) in the 1960s with the fuel storage infrastructure installed in 1968. BP SWP sold its Vanuatu business to PPC in 2010.

The northern and central part of the terminal was shared by Shell and Exxon Mobil. Shell exited the Vanuatu market in 2006, selling its business to the PPC. In 2007 Mobil's Vanuatu business was also acquired by the PPC. After this acquisition, PPC invested in a new tank (Tank 7 in 2010) and a fuel pipeline (2008) from the Main wharf to the fuel terminal facility, to enable discharge by MR tanker (Figure 21).

Figure 21: Pipeline and new storage installation



PPC designed and constructed two 2 kilometre pipelines, one of 8 inch diameter for fuel, and a 4 inch diameter gas pipeline for Origin. The cost for the petroleum line was advised by PPC at approximately USD1.8 million.

PPC designed and constructed the Tank 7 to API 650 which included impermeable bunding. PPC advised total project cost of over USD 3 million. This tank has enabled PPC to meet demand and storage commitments to UNELCO. This will have further improved the efficiency of MR tanker deliveries which began in 2008.

Figure 22: New storage tank and tank floor replacement



In 2007 PPC also undertook two tank floor replacements as part of the upgrading of its Santo Terminal at a cost of USD 300,000. In Port Vila, PPC has also commenced a reimagining program whereby service stations in the country are being rebranded to PPC brand.

Site surrounding Environment

The site slopes at a low to moderate grade to the west towards the Port Vila Harbour. Storm water runoff within the site drains directly into the underlying sandy soils. The interceptor captures oily water drainage from around the bulk fuel tanks only (not storm water).

The current land uses surrounding the site are detailed below:

- North: Marina and residential;
- East: residential;
- South: Bitumen roadway, then steep embankment; and
- West: Vanuatu Department of Geology, Minerals and Water Resources workshop, then Department of Fisheries and sea.

Surface hydrocarbon staining exists in several locations across the site, most notably around the drum storage areas, drum filling areas, and around the overhead fill gantry, which are all located in the central portion of the site and another gantry towards the East. Staining was also observed around the interceptor. Overall, degraded concrete and gravel surfaces, and poor housekeeping practices, over the lifespan of the site's operation has resulted in the negative visual effect in several areas across the site.

There were no other visible signs of vegetation stress within the site, or in areas located down gradient of the site. The concrete slab across the drum storage area, overhead gantry, and truck turning/parking bay was considered to be in poor condition.

The nearest environmentally sensitive area that could receive spilled product receptors is Paray Bay (approximately 50m west of the site), and the residential areas immediately across the site's eastern boundary.

Safety issues

The key safety issues (including issues arising because the site comprises a number of older terminals that have been rationalised and amalgamated to form one terminal) are:

1. A large number of small Jet A-1 tanks, which is not efficient from an operating and maintenance perspective. PPC believes that one large and one small Jet A-1 tank would be sufficient. However consideration should also be given to two tanks half the size and one small tank. This would be better from a security of supply perspective and would permit one tank to be taken out of service for inspection and maintenance.
2. The tanks are fitted with high level alarms but the alarms have been isolated due to repeated false alarms. While it is accepted that unreliable high level alarms provide more risk than no alarms, as operators tend to ignore them when they go off, statistically, a tank over fill is the most likely cause of loss of containment in a fuel terminal. Having a large number of Jet A-1 tanks of different heights further increases the risk of a tank overfills. New fail safe high level alarms using a SIL 2 rated probe should be installed.
3. The fixed fire protection cooling systems may comply with AS1940 but are unlikely to be effective in cooling adjacent tanks in the event of a tank fire, especially if there is a significant wind blowing. The foam system should be tested by making foam into each tank as part of the tank's off-stream inspection process.
4. The older tank compounds do not have effective compound liners, as is common for terminals of this age. The tank compound may not be large enough to retain the contents of the largest tank without overtopping and it may leak. The new compound constructed by PPC appears well made and includes an HDPE liner, which is current industry best practice.
5. Jet A-1 is top loaded into tank wagons. Bottom loading should be adopted for all products because of the health and safety benefits.
6. There is no overfilling protection system used for tank wagon loading. While it is acknowledged that tank wagon loading is undertaken with two operators in attendance, one on top of the tank wagon, a Scully (or similar) overfill protection system with a fast shut-off valve would be safer and avoid the need to have someone on top of the truck, which is undesirable because of the fumes that are present during loading and the inability for the operator to move away quickly in the event of an emergency.
7. Ideally, the petrol tank (and the tank compound) should be further from the boundary fence. It is acknowledged that PPC has erected a gas break fence along the boundary and this helps but does not eliminate the risk. Consideration could also be given to installing an internal floating blanket to the petrol tank to minimise vapour discharge during tank filling.

8. Quick-flush water draw-off tanks are only fitted to Jet A-1 tanks. It would be beneficial to fit these to all bulk tanks to avoid good product entering the drainage system during the water draw-off process.

Table 18: Pacific Petroleum Port Vila Terminal risk matrix

Risk Area	Key Risk	Impact	Likelihood	Mitigation Strategies	Estimated Upgrade cost (USD)
Fire	A tank fire may not be able to be extinguished	Fire could spread to adjacent tanks	Low	Upgrade tank cooling and fixed foam systems.	2.2 million
Spill	Tank overfill	Product to ground and potential for fire	Low	Install fail safe high level alarm systems to SIL 1, or better.	152,000
Top loading of trucks	Tank overfill and health and safety issues for operators	Potential for injury or death	Medium	Upgrade to bottom loading and fit overfill protection to tank trucks.	220,000
Petrol tanks close to boundary	Explosion	Terminal and neighbouring houses at risk. Potential for injury or death	Low	Install internal floating blankets, vent tanks away from boundary or relocate tanks.	600,000
Earthquake	Ability of the tanks and pipework to resist a major seismic event unknown	Tank or pipework rupture.	Low	Review seismic design of tanks and pipework and lower safe fill levels if necessary.	150,000
Total investment (USD)					>3.34 million
Total investment (VUV)					>329 million

8.2.2 Santo Terminal

PPC owns a petroleum storage terminal located on the southern coast of the island of Espiritu Santo. The site is located approximately 1.5 km east of the town of Luganville. The site is used for storage of petrol, diesel (5000ppm), DPK, aviation gasoline and lubricants.

The site covers an area of approximately 16,900m². It slopes at a high grade towards the east. Four above ground tanks (partially bunded) sit on top of the hill approximately 30 metres above sea level. The fuel loading gantry, drum filling and lubricant storage are located downhill in the centre of the terminal. A wharf product pipeline, approximately 1 kilometre long, connects the terminal to the tanker discharge point towards the south east. The entire site is grass or gravelled surface with exception of the lubricant storage and loading gantry.

Figure 23: Santo petroleum terminal



Figure 23 shows the depot. It contains the following features and petroleum infrastructure:

- Six above ground storage tanks (AGSTs) on site (Table 19);
- One operational triple interceptor separator pit and associated drains.
- Water holding tank, equipment shed and fire hose located in southeast of the site;
- Fuel loading gantry and adjacent pump shed
- Three lubricant and drum storage sheds
- Office shed in south portion of the site near main road.

The site is believed to be built around 1950 by British Petroleum. Shell Pacific may have purchased the terminal from BP but the history is not clear.

Table 19: Santo Petroleum Storage Tanks

Tank Ref	Tank Type	Fuel Type	Capacity (Kilo litres)	Construction Date	Status
1	AST	Jet	800	1962	In use
2	AST	ULP	1,800	1962	In use
3	AST	HSDF	2,800	1962	In use
4	AST	Jet A1	110	2010	In use
5	AST	Slops	20	Unknown	In use
6	AST	Slops	20	Unknown	In use

Notes: Jet A1 - Aviation jet fuel; LSADF - Low Sulphur Automotive Diesel Fuel; HSDF - High Sulphur Diesel Fuel; ULP - Unleaded Petrol; Age of Tanks are approximate only and cannot be relied on.

Santo Terminal Environmental and Safety Assessment

The key issues with the Santo terminal are considered to be (Table 20):

- No high level alarms fitted to the bulk tanks.
- The fixed fire protection systems are unlikely to comply with AS1940 and are unlikely to be effective in extinguishing a tank fire or cooling an adjacent tank. In the event of a tank fire the entire terminal storage could be lost.
- The tank compound appears to have insufficient capacity to hold the contents of the largest tank. The tank compound has no impermeable liner, which is not uncommon for compounds of this vintage.
- There is no overfilling protection system used for road tanker loading.
- Quick-flush water draw-off tanks are only fitted to the Jet A-1 tank. It would be beneficial to fit these to all bulk tanks to avoid good product entering the drainage system during the water draw-off process.

Table 20: Pacific Petroleum Santo Terminal risk matrix

Risk Area	Key Risk	Impact	Likelihood	Mitigation Strategies	Estimated Upgrade cost (USD)
Fire	A tank fire may not be able to be extinguished	Fire could spread to adjacent tanks	Low	Upgrade tank cooling and fixed foam systems.	1.49 million
Spill	Tank overfill	Product to ground and potential for fire	Low	Install fail safe high level alarm systems (SIL 2 probe).	62,000
Overfill of tank trucks	Spill from tank overfill	Potential for contamination and fire	Low	Fit overfill protection to tank trucks.	unknown
Earthquake	Ability of the tanks and pipework to resist a major seismic event unknown	Tank or pipework rupture	Low	Review seismic design of tanks and pipework and lower safe fill levels if necessary.	40,000
Spill	Tank compound integrity and capacity	Product to ground and over topping of the tank compound	Low	Upgrade tank compound, fit HDPE liner and ensure capacity is 110% of the largest tank.	1.2 million
Total investment (USD)					>2.79 million
Total investment (VUV)					>275 million

8.2.3 Bauerfield Airport Terminal

PPC supplies and distributes aviation fuel at Bauerfield facility (Table 21), servicing Bauerfield International Airport. Supply and distribution of aviation fuels was formerly shared by Shell

Aviation, Exxon Mobil and Air BP as part of a Joint User Hydrant Installation (JUHI) arrangement⁴¹, which ceased on 31st December 2005. The commercial refuelling facility (fuel farm) at the airport was operated by Air BP until May 2010 when BP sold its business to PPC. The fuel farm aviation facility is now operated by PPC under Shell aviation standards (as part of its Technical Services Agreement with Shell Aviation).

The airport property, including the fuel farm compound is owned by the Republic of Vanuatu Government. PPC owns all fuel storage and dispensing equipment at the site, including bulk fuel storage tanks, products transfer pumps and hydrant line.

The fuel farm facility covers an area of approximately 1800 m² and is located within the Bauerfield International Airport precinct, approximately eight kilometres north of Port Vila, in the south western corner of Efate. This area is generally flat, and surfaced with a mix of concrete, gravel and grass. The above ground storage tanks (AGST) and hydrant pump are located within a concrete bund area. The Bridger truck discharge point is located east of the AGST within a concrete bund area and drains on the site oil/ water separator. The office and adjacent grassed area are located to the west of the fuel storage area. The fuel farm is bounded by a three metre mesh and barbed wire fence.

Table 21: Bauerfield Petroleum Storage Tanks

Tank Ref	Tank Type	Fuel Type	Capacity (Kilo litres)	Tank Heel (litres Kilo litres)	Construct-ion Date	Status
BAU 1	AST	Jet A1	46		1972	In use
BAU 2	AST	Jet A1	57		1980	In use
V6503	Isotainer	Avgas	20		Unknown	In use

Site History

- Bauerfield Airport has been in operation since 1942, when it was constructed by the US military for use during World War 2.
- The fuel farm was commissioned in 1972 and owned by GoV.
- A Jet A1 leak in the hydrant line between the fuel farm and the airport tarmac was identified in 1989. Between 1989 and 1994, a product recovery operation was installed which recovered approximately 21,000 litres of product.
- Site upgrade works were conducted in 2006 and hydrostatic pressure testing conducted periodically on the underground fuel hydrant line has indicated the hydrant line is maintaining product integrity.

Bauerfield Terminal Environmental and Safety Assessment

The following comments are made with respect to the site (key issues listed in Table 22):

⁴¹ A fixed hydrant system is a buried pipeline that connects the bulk storage terminal and fuel tank of an aircraft. Larger international airports transfer Jet A1 (flammable or combustible liquid fuel) between storage tank and aircraft via the hydrant system.

- The Bauerfield airport terminal consists of two horizontal Jet A-1 tanks and a 100 mm nominal bore (NB) carbon steel hydrant line.
- The majority of the terminal pipework is stainless steel, which is ideal for an airport facility.
- The shell of one of the Jet A-1 tanks is dented but this is unlikely to be an issue for a tank of this size.
- The Avgas is stored in an isotainer, which is not ideal unless it has been modified to meet all aviation requirements. The Avgas compound seems too small to provide sufficient secondary containment.
- There are no fixed fire protection systems to protect the tanks in the event of a fire. This is normal for facilities of this type and vintage. Because it is not cost-effective to install fixed fire protection systems to tanks of this size it is now common practice to use insulated tanks such as the Super Vault brand. These tanks have a four-hour fire rating and the advantage of also having integral secondary containment.

Table 22: Bauerfield Terminal Risk Assessment

Risk Area	Key Risk	Impact	Likelihood	Mitigation Strategies	Estimated Upgrade cost (USD)
Fire	A fire may not be able to be extinguished	Fire could destroy the terminal	Low	Remove Avgas from the existing terminal, which presents the highest risk.	\$21,000
Spill	Tank overfill	Product to ground and potential for fire	Low	Install fail safe high level alarm systems to SIL 1, or better.	\$42,000
Total investment (USD)					>\$63,000
Total Investment (VUV)					6.2 million

8.2.4 Origin Energy - Vila Terminal

The Origin Vila terminal comprises three bulk LPG tanks, cylinder and truck filling systems and associated equipment, connected by a 4 inch buried pipeline to the petroleum wharf.

Two of the LPG tanks are buried but the most recent tank is an above ground tank. This seems unusual as this tank has no fixed spray cooling system to minimise the risk of a boiling liquid expanding vapour explosion (BLEVE) in the event of a fire at the terminal. Given the proximity of neighbouring businesses and residences consideration should be given to earth mounding the third tank.

The terminal appears to be reasonably well maintained. Table 23 identifies the following issues.

Table 23: Origin Vila Terminal Risk Matrix

Risk Area	Key Risk	Impact	Likelihood	Mitigation Strategies	Estimated Upgrade cost (USD)
Fire	Boiling liquid expanding	Fire could destroy the whole	Low	Fit fixed water drench cooling	453,000

	vapour explosion (BLEVE)	terminal and impact on neighbours		to tank 3 or earth mound tank.	
Leak	Explosion	Large fire and damage to neighbouring facilities	Low	Consider installing gas detection system.	58,000
Total Investment (USD)					511,000 or
Total Investment (VUV)					VUV 50.3 million

8.2.5 Origin Energy - Santo Terminal

The Origin terminal at Santo comprises two 60 tonne butane tanks and cylinder filling equipment. There are also cylinder testing facilities.

Two butane tanks are above ground and mounted on pedestals. There are no fixed fire protection systems on site nor is there any suitable water supply for fire protection, other than the harbour. However, access to the harbour would be difficult in the event of a fire. It is interesting to note that one of the drawings supplied by Origin for the terminal shows a fire water tank and fixed spray cooling on the tanks. It is not known if this fire protection equipment was installed and then removed at a later date or if it was ever installed. The physical isolation of the terminal lessens the need for fire protection but a large fire could have catastrophic results and result in a BLEVE⁴².

The terminal appears to be reasonably well maintained. Table 24 identifies the following issues.

Table 24: Origin Santo Risk Matrix

Risk Area	Key Risk	Impact	Likelihood	Mitigation Strategies	Estimated Upgrade cost (USD)
Fire	Boiling liquid expanding vapour explosion (BLEVE)	Fire could destroy the whole terminal and impact on neighbours	Low	Fit fixed water drench cooling or earth mound each tank.	423,000
Leak	Explosion	Large fire and may lead to BLEVE	Low	Consider installing gas detection system.	42,000
Total Investment (US)					465,000
Total investment (VUV)					45.8 million

⁴²A boiling liquid expanding vapour explosion (BLEVE) is an explosion caused by the rupture of a vessel containing a pressurised liquid above its boiling point.

8.3 Comments on asset age and asset integrity

Petroleum storage terminals are highly asset oriented. Failure to implement effective petroleum asset integrity management systems can eventually result in spills and shutdowns which can affect supply, profitability, personal and public safety and environmental regulatory compliance. To minimise costly disruptions, routine monitoring of the assets is essential and should be a high priority for the owner, employees and operators.

The PPC Vila and Santo terminals were built by multinationals in the early 1960s and the tanks were constructed in 1961 and 1962 respectively. The PPC Port Vila terminal had undergone major refurbishment with construction of two new tanks, Tank 6 and 7 built in 2004 and 2010 respectively. The Santo Terminal tank floor was replaced tested in 2007. Although the age of assets is over 50 years PPC is aware of the risks and has plans to further upgrade the storage facility. The assets are audited by external auditors every two years for the purpose of insurance.

Although a relatively young company PPC had the benefit of purchasing business multinationals with the experienced personnel and technical Service Agreement with Shell for Aviation fuels. The PPC operating standards are covered in section 8.5.

8.4 Valuation of existing assets

There were two options to value the current assets:

1. Acquire an independent asset valuation report from operators or
2. Assess the cost of building a new facility similar to existing terminal and accounting for depreciation.

Both PPC and Origin did not provide asset valuation reports and the technical team undertook the latter option. Table 25 shows the value of both company assets. It is possible that the asset owners may challenge the cost of capital reflecting the costs and risks considered acceptable by the oil industry, which may be higher than what an infrastructure business might consider acceptable for a reliable throughput charge. This may prompt both operators to provide their own valuation report which can be further investigated in reaching the final value of assets to be used for the purpose of fuel pricing.

Table 25: Estimated asset valuation

Terminal	Replacement Cost (USD)	Annual Depreciation over last 20 years (USD)	Estimated optimised depreciated replace cost (USD)
PPC Port Vila Terminal	27,198,000	679,950	13,599,000
PPC Santo Terminal	15,936,000	121,200	2,424,000
PPC Bauerfield Airport Terminal	4,840,000	398,400	7,968,000
Current Total Value of PPC Assets (USD)			23.9 million
Current Total Value of PPC Assets (VUV)			2.3 Billion
Origin Vila Terminal	9,327,000	233,175	4,663,500
Origin Santo Terminal	4,122,000	103,050	2,061,000

Current total Value of Origin assets (USD)	6.7 million
Current total Value of Origin assets (VUV)	662 million

8.5 Safety standards, training, compliance mechanisms and audit arrangements

PPC operates its current aviation facilities under the Shell International Group standard operating procedures and practices. The PIE Group has a Technical Service Agreements (TSA) signed with Shell Aviation which ensures that Shell Group Aviation operating standards and practices are consistently applied and practiced at all operating airport facilities.

For ground fuels such as petrol, diesel and kerosene PPC uses a combination of Shell Mobil and BP standards as the PIE is still in transition from the multinationals. Table 26 summarises PPC's current approach.

Table 26: PPC guidelines and operating standards

Operating Standards	Guidelines
Facility Operating Manual	Guidelines for the safe management and operations of terminals
Acceptance Test Methods for main fuels	The test methods described in this document are tests required at the terminal prior to discharging products from ships, release from storage prior to delivery to customers and for general quality checks to ensure products are fit for purpose.
ASTM Test Reference manual	These are a compilation of the most ASTM fuel tests methods used as a reference to support PIE testing manuals.
Fuels Quality Control Procedures	Quality control procedures for handling product at facilities
Shell Aviation Quality Standards Shell Airports Operations Manual	Procedures for handling aviation product from receipt at facilities to final dispensing into aircraft including engineering standards. Provided for an Part of the TSA with Shell Aviation
ISGOTT Manual	Safe practice aspects of tanker loading and discharge
Control of Work (Work Permit System)	System that allows non-routine works to be conducted safely by the proper identification and control of potentially hazardous work conditions.
Driver Manuals	Instructions and supporting information covering the safe operation of all bulk fuel vehicle deliveries.
Light Vehicle Driver Handbook	Guidelines covering light vehicles driving standards.
Health Safety Security and Environment (HSSE)	Yearly road map.

For HSE PPC and implements a yearly road map programme and regular tool box meeting with its employees.

8.6 Operation and Maintenance Expenditure with Capital Stock

PPC had provided an estimated operating cost of VUV 475 million for all its petroleum operations in Vanuatu of which 70% of the operating cost (VUV 332.5 million) accounts for operation and maintenance of the assets.

8.6.1 Petroleum Standards and Infrastructure Upgrade

The technical assessment showed that the petroleum and LPG assets were in a reasonable state. The major risks identified were fire and spill protection. We recommend that the Government of Vanuatu discuss these risks with both PPC and Origin Energy so they can be incorporated into the future capital investment plans of both companies.

From our modelling analysis, if the shipping frequency and parcel size are kept the same as current and using our projected demand for the next 10 years, diesel and petrol storage capacity in Port Vila will be constrained by 2015 and 2016 respectively. Kerosene storage is already constrained (July 2012) as PPC only utilise four of the eight tanks. It is noted that PPC intends investing in more Jet A1 storage subject to a long-term commitment from Air Vanuatu. PPC had built Tank 7 when UNELCO signed a long term contract for supply and 60 days stock requirement.

The Santo Terminal does not have adequate spare capacity and will be constrained on diesel (2013) and petrol (2016) supply if the current shipping frequency continues. The Santo Terminal would need an additional storage for diesel.

PPC advised the following projected capital investment in the next five years to address the increasing demand for fuel:

- Changing high risk underground storage tanks and pipeline on retail sites;
- Two five million litre replacements tanks for ground fuel;
- Replacement of the floors of five existing tanks with epoxy lining, and repainting of all tanks;
- New fire system for Santo and Vila Terminals;
- Bunker facility at the Port Vila main wharf; ;
- Storage facility in outer islands;
- Increased distribution in the outer islands through building new service stations; and
- HSSE equipment

9.0 Pricing Analysis

Summary:

The petroleum industry had prices determined by the Government of Vanuatu until 1989⁴³, when the Price Control Unit ceased to perform its duties and was eventually abolished in May of that year. After that time the petroleum industry itself set the fuel prices and this position holds today. The Energy Unit has been monitoring petroleum prices but due to lack of staff and expertise the office has been unable to validate retail prices against benchmarks on an on-going basis. The Vanuatu Customs and Inland Revenue Department continues to monitor imports of petroleum products for the purpose of collecting duty, excise and value added tax but other than that no monitoring occurs.

We have reviewed actual prices over the period of 2011 to determine how costs of supply (including all the supply chain steps) have flowed to the market. The objective was to review how pricing has tracked supplier's costs (including international petroleum prices), how pricing in Vanuatu compares with like markets in the Pacific Islands and to estimate the level of return derived by market participants in order to understand the financial sustainability of these businesses and the incentive for continued investment.

Petroleum:

Our analysis indicates that Vanuatu petrol and diesel retail prices (less tax) are higher than for comparable countries such as Tonga and Fiji. Petroleum products are supplied from Singapore and pricing is built up on a similar basis, reflecting cost of acquisition in Singapore and the elements of the supply chain required to deliver to end consumers, including storage and handling and contribution to profit. We deconstructed each price component and our analysis indicates that while Vanuatu petrol and diesel retail prices are higher this is due to:

- *A higher quality fuel (petrol) is being supplied in Vanuatu that necessary because the French territories operate on European quality standards meaning a higher price paid in Singapore for the fuel*
- *Vanuatu is the last port of call with a relatively small parcel size compared to other MR ports, resulting in a higher freight component (albeit much better than LCT delivery)*
- *There has been more recent investment in assets resulting in a higher asset value by comparison to countries with older assets/no recent investment*
- *More stock (especially for diesel for electricity generation) is being held than in other countries)*
- *A lower volume compared to other MR delivered countries resulting in a higher per litre cost*
- *A higher exchange spread compared to other Pacific Island countries*
- *Higher retail margin at the service stations*

Our modelling of PPC's business since 2001, taking into account our professional valuation of the storage investment made over the last five years, together with advice received on costs of operation (including working capital but excluding retail margin) indicates that PPC is returning approximately a 16-17% return to its shareholders. While this is considered good we note that this is in line with returns of 15% allowed by countries in the region which regulate their markets.

If the market grows in line with our projections for demand, returns to PPC are likely to improve further with additional volume and the depreciation of its asset base.

⁴³ Pacific Regional Energy Assessment Report 2004 (SPREP) Vanuatu National Report Volume 16. Page 10.

We note that PPC has plans to upgrade its facilities in the period to 2022 to allow for additional demand and to achieve greater operating efficiencies and HSE improvements for its facilities. Our analysis would also indicate that despite being a monopoly PPC has allowed cost efficiencies arising from the switch from LCT to MR shipping to flow to the market.

LPG:

Origin Energy imports LPG (propane for Port Vila and butane for Santo) from Brisbane, Australia and is shipped in small LPG tankers that service the Pacific Islands. The loaded cost out of Brisbane is linked to Saudi Contract Price (Saudi CP) available on the LPG Australia website⁴⁴ and is used by markets in the region to establish the benchmark cost of LPG.

Vanuatu charges no government duty on LPG and VAT is the only revenue generated from the retail price. We deconstructed the LPG retail price and our findings indicated that LPG costs and margins were high.

Because of Origin's confidentiality requirements, which prevented us from using Origin's commercially sensitive information during preparation of this report, we applied the same methodology used for petroleum (including taking into account our professional valuation of the LPG storage assets) and basing our assessment on market information, benchmarks and estimates rather than information provided by Origin. Origin has now provided actual revenues and costs data with which we have now updated our analysis. This indicates pre tax returns of 22% are being generated. We note that LPG pricing tends to track changes in international markets as expected.

Origin Energy has been investing in the Vanuatu LPG market through converting the market to propane and developing new uses for LPG such as air-conditioning. They also provide equipment (e.g. tanks and pipelines) to commercial customers such as hotels and restaurants.

9.1 Overview

In this section we review the current method for setting prices. This is done by reviewing the cost of the individual supply chain components that contribute to the setting of retail and wholesale prices, reviewing historical trends to assess how they have influenced the price of fuels in Vanuatu over time, including whether any efficiencies identified in Section 4 have led to improved pricing.

We examine the cost of the components according to the steps of the supply chain as discussed in Section 4. These include:

- Refined product in Singapore;
- Ocean transport to Vanuatu;
- Port charges;
- Taxes and duties;
- Storage and distribution costs;
- Wholesale and retail margins (including returns on investment);

We then examine how prices in Vanuatu compare with other similar jurisdictions to understand any difference and reasons that might explain divergences. We examine costs to the outer islands separately as these reflect the local cost of transport added to the cost of the components identified above.

⁴⁴ www.lpgaaustralia.com.au/site/industry_data

9.2 Petroleum pricing methodology

PPC provided 2011 pricing information to H&T for analysis including:

- Voyage details (date of loading, arrival, volume and value).
- Estimated operating cost
- Sales volume by major end users (Service stations, marine, electricity & bunkering).
- Debtor days and retail margin were estimated based on discussions with PPC.

From the information provided and validation of landing cost from Vanuatu Customs, the retail price of fuel in Port Vila was deconstructed as shown in Table 27. The current methodology is compared to that build up given in the 1992 World Bank Report.⁴⁵

Table 27: Vanuatu Price Build Up

Pricing Parameters	1992 World Bank Report	Current methodology
Base Price	Cost price supplied by oil companies	Platt's published prices - 5 days around loading date in Singapore: Petrol (97 RON), Jet/Kero, Diesel 50 & 5000ppm (Gasoil)
Product Quality Premium	As above	The product premium charged by PPC supplier. H&T assumptions are: <ul style="list-style-type: none"> ■ Petrol = USD3.50/bbl ■ Kerosene/Jet A1 = USD 0.05/bbl ■ Diesel (50ppm) = USD 1.20/bbl ■ Diesel (5000ppm) = USD 0.50/bbl
Ocean Freight	Due to limited Port Vila harbour channel depth tankers only carry 40% of load increasing freight cost by 3-6 vatu per litre ⁴⁶	Worldscale published rates for 3-4 port discharge (Singapore/Tahiti/ Vuda/Vila) <ul style="list-style-type: none"> ■ Actual freight 2011 = USD 46-53/MT
Insurance and Ocean losses	Cost price includes freight and insurance	Cost price includes freight and insurance. H&T assumptions are: <ul style="list-style-type: none"> ■ Insurance 0.05% of Cost + Freight ■ Ocean losses 0.40% of Cost, Freight and Insurance
Exchange rate		Commercial exchange rate available has wide buy/sell spread.
Demurrage and wharfage		<ul style="list-style-type: none"> ■ Wharfage = 395 Vatu per tonne, ■ Demurrage USD0.25/bbl (H&T estimate)
Government duty (Calculated on landed cost)	<ul style="list-style-type: none"> ■ Petrol: VUV 32 /L (1990) ■ Kerosene: VUV 8 /L 	Petrol: VUV 15 /L Avgas, Jet and Kero: 5% Diesel : VUV 20 /L

⁴⁵ Ibid, at page 11

⁴⁶ The real incremental freight cost at this time was due to supply coming from Fiji in LCTs. This meant there was incremental cost from Fiji storage and handling along with the secondary freight leg.

Government Excise (Calculated on landed cost)	<ul style="list-style-type: none"> ■ Petrol: VUV 5 /L ■ Avgas, Jet and Kero: VUV 5 /L ■ Diesel: VUV 15 /L 	Petrol: VUV 20 /L Avgas, Jet and Kero: VUV 4 /L Diesel: VUV 15 /L
Distribution Cost	Oil company cost plus margin estimated at VUV 18 /L	Set by PPC. 2011 - Distribution cost = VUV 470 million (Volume 53 ml litres giving VUV 8.96 /L estimate)
Return on investment		Set by PPC. H&T estimate approximately 11 VUV/L based on: <ul style="list-style-type: none"> ■ VUV 2,187 million assumed asset value ■ 20 average debtor days ■ 72.5 average net stock days and ■ 17% estimated return of assets
Retailers Margin	VUV 7 /L (based on 1990 prices)	VUV 10-15 /L ⁴⁷
Value Added Tax (VAT)	Not applicable	12.5%

9.2.1 Fuel Quality

As noted in 6.2.2, PPC's petroleum products are imported from Shell in Singapore and shipped in MR tankers that service the Pacific Islands (French Polynesia, Fiji and New Caledonia). The cost of cargoes in Singapore is reported by Platt's⁴⁸ and used by the market to establish the value of their product. The Platt's quotes used for the price basis in Vanuatu are set out in Table 28. PPC buy product based on five days quotes around the bill of lading date and this is also used as the basis for petroleum prices in Vanuatu.

Table 28: Platt's quotes used for price basis in Vanuatu

Petrol	Kerosene	Low Sulphur Diesel	High Sulphur Diesel
Mogas 97	Jet/Kero	Gasoil 50 ppm	Gasoil 0.5% (5000ppm)

Vanuatu is supplied high quality premium petrol which we assume is because it has been supplied along with French Polynesia and New Caledonia, whose product qualities are following European trends (as a small market Vanuatu is dependent on the qualities set by the larger countries they are supplied with). The quality of petrol being supplied is similar to Australian and New Zealand premium (Euro 4 specification) which also trades in Singapore against the Platt's 97 octane marker along with a premium of approximately USD 3.50/bbl. Although the actual petrol quality supplied

⁴⁷ Larger retailers get larger retail margin. Assumed average of 12.5 VUV/L in analysis.

⁴⁸ Platt's are a worldwide reporting agency covering energy and commodity markets. They are part of the McGraw-Hill group of Companies.

in Vanuatu is only 95 octane it trades against the higher octane Singapore quote because MTBE⁴⁹ is not allowed as a blend component in the fuel. It also incurs a premium to the Singapore to reflect other quality enhancements such as low benzene (<1%) and low sulphur (50ppm).

Vanuatu imports two grades of diesel; 5000ppm and 50 ppm sulphur. 5000ppm sulphur diesel is cheaper than 50ppm sulphur as the lower sulphur grade requires more refining. Over the past two years the Platt's price differential between 5000 and 50ppm sulphur diesel has been approximately USD 2.0/bbl (1.2 VUV/L). This higher cost along with the extra cost associated with the volume of 50ppm diesel being a small, is reflected in the retail price of low sulphur diesel in Vanuatu.

9.2.2 Ocean Freight

The typical cost for freight, insurance, loss and demurrage has been around USD 7/bbl (based on 2011 voyage analysis) or approximately 4.5 VUV/L. This reflects a three or four port voyage based on Worldscale voyage costs and market freight rates.

9.2.3 Exchange rate

The rate the petroleum marketer is able to convert Vanuatu income back to US dollars to pay for the cargo is a key component in the price build up. Advice received from ANZ Bank indicates a significant margin between the mid-point set by the Reserve Bank and the commercial sell rate available (selling VUV) of around 5 VUV. This is due to the substantial imbalance between imports and exports - exports in Vanuatu are only about 19% of imports so there are a lot less buyers⁵⁰.

The margin based on the ANZ information is about 5%, much higher than for most Pacific Islands and certainly larger than commercial margins in developed countries. Our assessment of PPC cargo values is that the margin they use to set cargo value (which we then use for the retail price margin analysis) is closer to VUV 3 /L (3 %).

An exchange rate margin of 5 VUV/L increases the calculated cost of landed fuel by around 4 VUV/L so the margin PPC is using is around 2.5 VUV/L or a 1.5 VUV/L benefit against ANZ posted commercial rates.

9.2.4 Landing charges in Vanuatu

Wharfage is the only landing charge incurred in Vanuatu and this is set by the Vanuatu Ports and Marine Authority. A wharfage charge of VUV 395 per freight tonne (around 0.4 vatu per litre) is charged for discharging fuel in Vanuatu as prescribed in the dues, fees and charges order No 14 of 1992. As noted in Section 6.2.3, the charges have been the same since 1992 and are currently being reviewed.

9.2.5 Operating cost of PPC

PPC provided an operating cost of VUV 475 million or around 9 vatu per litre for 2011. The operating cost is averaged over PPC's Santo and Port Vila terminals, including the aviation facility. We note that 2011 would have a high operating cost due to rebranding of BP SWP to PPC.

⁴⁹ Methyl Tertiary Butyl Ether is used as a petrol blending component. It is a volatile, flammable and colourless liquid that is soluble in water and is not allowed in various countries. MBTE is a banned substance in fuel for Pacific Islands that rely on ground water for drinking.

⁵⁰ Information provided by Merilyn Malas ANZ Bank Vanuatu.

We had requested PPC for a breakdown of the operating cost but this information was not provided. Given this it is difficult to assess if operating cost is reasonable or to analyse for any trends over time.

For our analysis we assume the costs will be weighted towards retail fuel with a lower per litre charge for high volume demands such as jet for aviation and power station diesel.

9.2.6 Return on investment and inventory held

The return on investment covers the return the supplier makes on their assets and stock held. Given the rest of the cost build up reflects actual costs incurred this provides the only opportunity for the supplier to generate profit.

PPC has made significant investment in Vanuatu as explained in section 8.4 which included converting Vanuatu to an MR port, building a new tank and upgrading the facilities taken over from the multinationals. We estimate these investments are taken into account by the way we have calculated the ODRC asset value for all the assets.

Another component requiring a return is the level of debtors. PPC advised that it allows 30 days payment to high volume service stations (over 2 million litres annual sales) and cash on delivery to low volume sites. We assume an average of 20 debtors' days for our pricing analysis.

The supplier also needs to hold inventory for on-going supply, including buffer stock to ensure supply security. For all supplies except UNELCO, PPC set safety stock levels using a commercial rationale (where the business imperative is to ensure supply security but taking into account the cost of stock holding). UNELCO has a contract with PPC to hold 60 days stock for its power plant. Based on the supply dynamic for both Port Vila and Santo we estimate the average onshore stock holdings are about 68.5 days. Petroleum market supply terms (from Singapore) normally allow a 30 day credit before the supplier has to pay the seller. On average, cargoes take about 30 days to reach Vanuatu from Singapore (as it is the last port discharge) so we assess the credit offsets the stock held on the water.

Based on analysis of 2011 cargoes our modelling indicates a return on investment of around 17%. This is close to the 15% regulated level used in many Pacific Islands.

9.2.7 Government duty, excise and value added tax

Duty, excise and value added tax is set by the Ministry of Finance (prescribed in Schedule 1 of Vanuatu Import Duties Act Cap 91). Vanuatu duty and excise is similar to Pacific Island French territories but high relative to neighbouring Melanesian countries such as Fiji and Solomon Islands.

Diesel sales for power generation and international marine transport do not incur the VUV 20 /L duty. We understand similar exemptions were given to interisland shipping operators and small domestic fishing up until 1st January 2010 when they were halted after a review in 2009 (on grounds of abuse of fuel for other purposes, drop in duty rates for shipping industry and increase in Customs compliance to outer remote islands). Any request for exemptions are approved by the Minister responsible for finance and decisions are based on a case by case basis.⁵¹

9.2.8 Retailers' margin

⁵¹ Information provided by Mr George Pakoa, Vanuatu Customs, Trade, Tariff and Compliance.

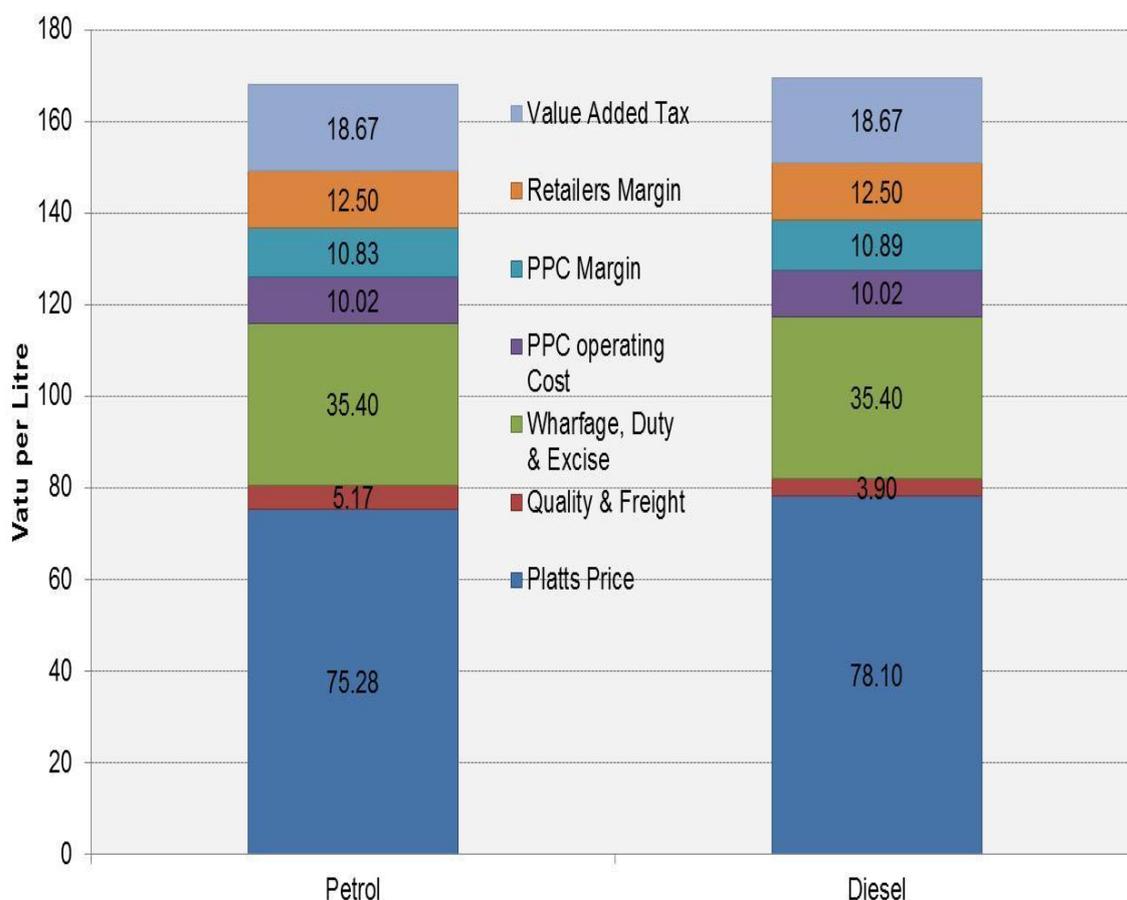
Retail margins are set by agreement between PPC and individual retailers. These reflect the costs to service the required customer base, return on investment and margin. There are nine retail service stations in Port Vila and three on Santo. Compared to other Pacific Islands, Vanuatu has a higher standard of service stations; in particular the Bon Marche service stations are built to Australian standards, which is a significant investment. The higher investment will be offset by higher volumes - the limited number of retail stations Vanuatu will have higher average throughput than in most other Pacific Islands.

PPC has advised us that each retail site has a supply contact with PPC and low and high volume sites receive 10 and 15 vatu per litre margin respectively. We have averaged the retail margin to 12.5 vatu per litre for our pricing analysis. This retail margin is high compared to other Pacific Islands and similar size service stations in Australia and New Zealand.

9.2.9 Price build-up

Figure 24 shows the estimated breakdown of the July 2011 retail price of petrol and high sulphur diesel. In this case, the Singapore product pricing used is the five days around 12th of June which is the loading date provided by PPC. 45% of the fuel price is the base price for Singapore petrol and diesel ; approximately 3% is the cost to land fuel in Vanuatu; Government duty, excise tax, wharfage and VAT account for 32%; PPC costs and margin are about 12.5% (\approx VUV 21 /L) and the retailers' margin is around 7.5 % (VUV 12.5 /L).

Figure 24: July 2011 petrol and high sulphur diesel retail cost breakdown



Source: Hale & Twomey

9.2.10 Secondary distribution

Limited data is available on the secondary distribution cost to the outer islands. Based on the UNELCO cost of diesel for electricity generation we assume:

- The retail price of fuel in Port Vila and Santo is the same. The freight cost to Santo would be a little higher but this and all operating costs are averaged between both locations.
- Malekula has an additional cost of VUV 16 /L which we assume covers drum cost, handling and transport on the ferry.
- Tanna has additional cost of VUV 34 /L which we assume covers drum cost, handling and transport on the ferry.

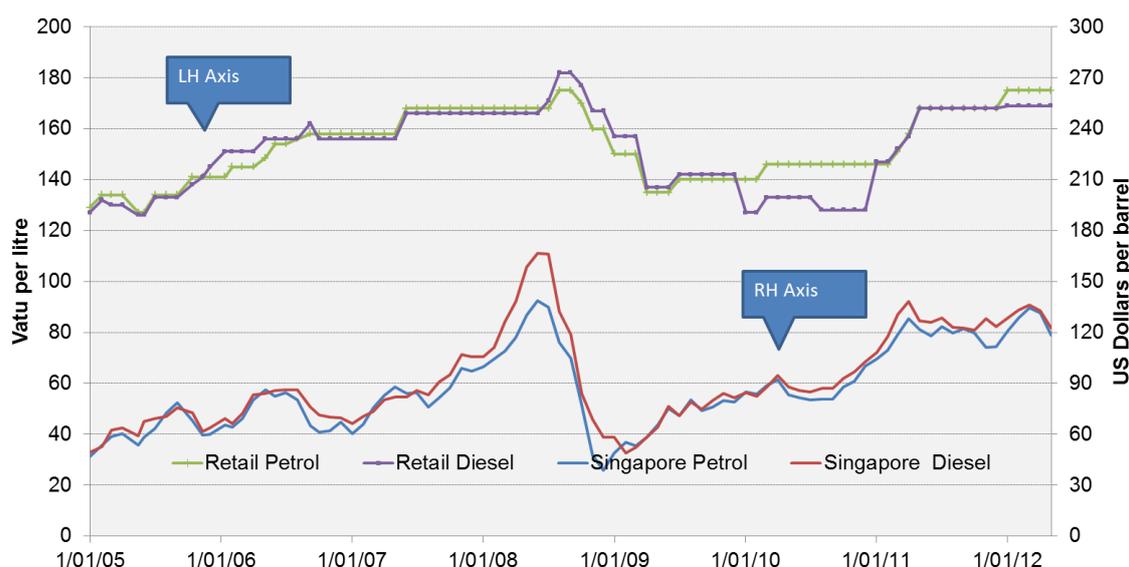
The above increments for Malekula and Tanna are based on the incremental cost for UNELCO. Anecdotal information indicates that the retail increment for Malekula and Tanna can be significantly higher again, particularly if supply runs low on these islands. PPC in July 2012 launched its first outer island service station on Tanna and the retail price of petrol and diesel is 300 VUV per litre, over 125 VUV higher than retail price in Port Vila.

9.2.11 Historical pricing trends

Vanuatu fuel prices were regulated under the Price Control Act 1974 until May 1989, when the government abolished the Price Control Unit. Prior to 1988, the Ministry of Finance was responsible for price control and recruited three staff⁵² to monitor and set retail and wholesale prices for petrol, diesel and kerosene. The components of pricing were similar to those that are identified in Figure 24; the price was set by the price control unit from information provided by the oil companies. After that point the price control unit appears to have been dissolved and the oil companies have set the price since.

Figure 25 illustrates at a high level how retail prices (LH axis) have tracked international petroleum product prices set in Singapore (RH axis) since 2007. Retail prices are as provided to us by PPC. We expect these would be reflective of the average prices given the nature of competition.

Figure 25: Vanuatu Petroleum product retail price 2007-2011 vs. Singapore price

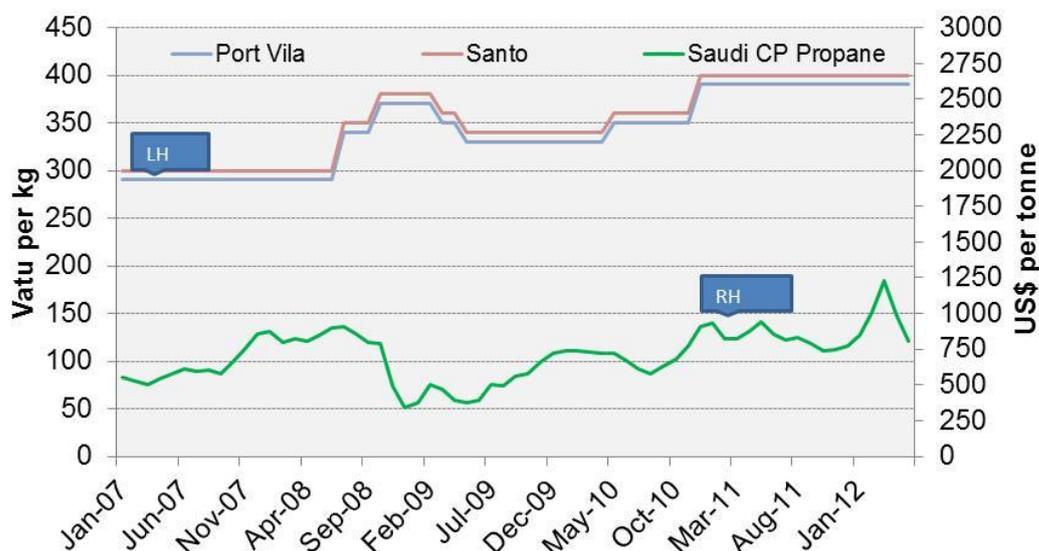


Source: Hale & Twomey

⁵² Information provided by Leo Moli Director of Energy dated 4th May 2012.

Figure 26 illustrates at a high level how LPG retail prices in Santo and Vila (LH axis) have tracked international benchmark LPG prices based on Saudi Contract Price (RH axis) since 2007. Retail prices are as provided to us by origin Energy Vanuatu.

Figure 26: Vanuatu LPG retail price 2007-2012 vs. Saudi CP Propane



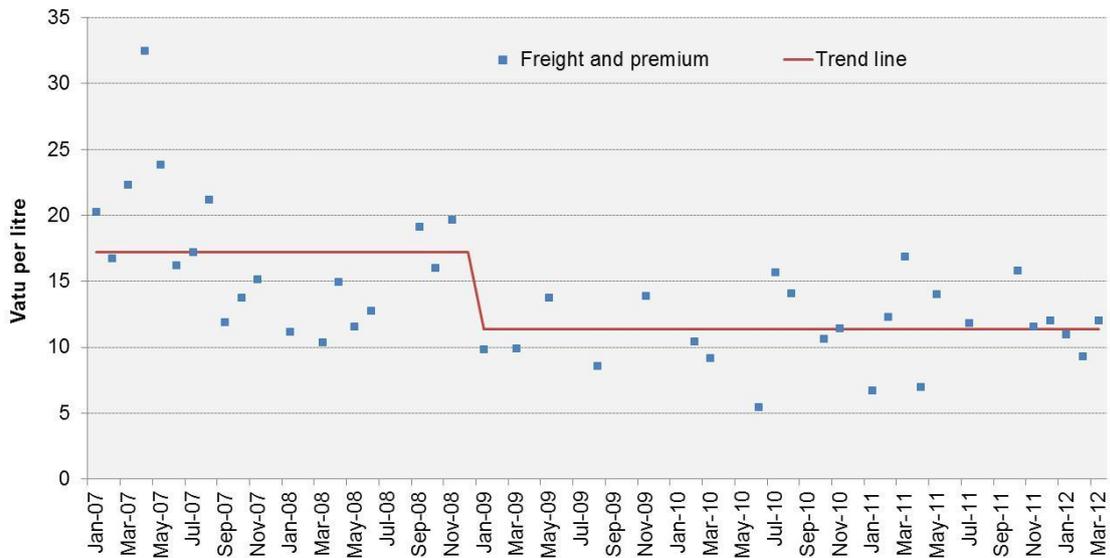
Source: Origin Energy Vanuatu and Hale & Twomey

Delivery change LCT versus MR tanker

The major change to Vanuatu's petroleum supply in recent years has been the change to supply by MR tanker from Singapore rather than secondary freight (Local Coastal Tanker) from an intermediate location such as Fiji. This change should be reflected in a lower freight cost component with the removal of the secondary freight leg. Storage and handling costs at the intermediate location would also be saved although this would be offset by the extra storage investment required to be able to receive larger parcels on MR tankers.

Analysis of the freight component between LCT delivery to the end of 2008 and MR tanker from then on shows that freight cost dropped by approximately 6 VUV/L (shown for petrol in Figure 27). Focussing the analysis on 2008 was difficult due to the volatile and rapidly changing market prices in that year (which makes the lag assumption critical). Removing this data (comparing 2007 average with 2009 forward) increases the benefit assessed to 8-10 VUV/L. This is in line with the savings we would expect from removing the cost of the LCT leg and the associated intermediate storage costs.

Figure 27: Freight cost trend with change to MR supply



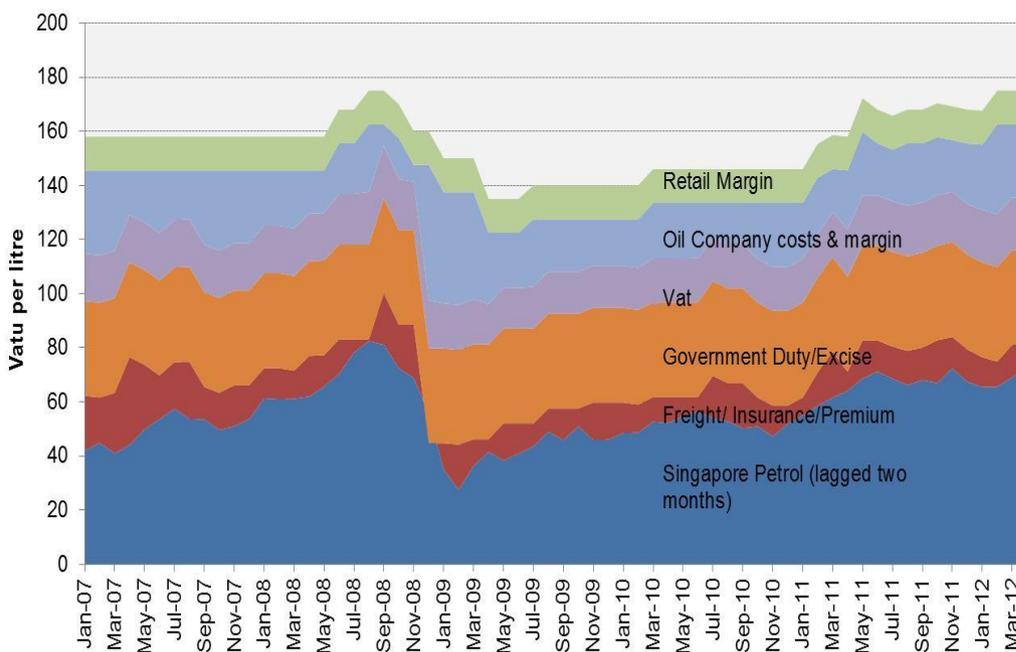
Source: Hale & Twomey

From the analysis of total price build up (Figure 28) the oil company margin is similar before and after this change indicating that this benefit has been passed through to the market.

9.2.12 Petrol price

The trend of the various components making up the retail price of petrol is shown in Figure 28. The petrol price tracks Singapore premium petrol (RON97) due to the quality supplied.

Figure 28: Petrol retail price component trend

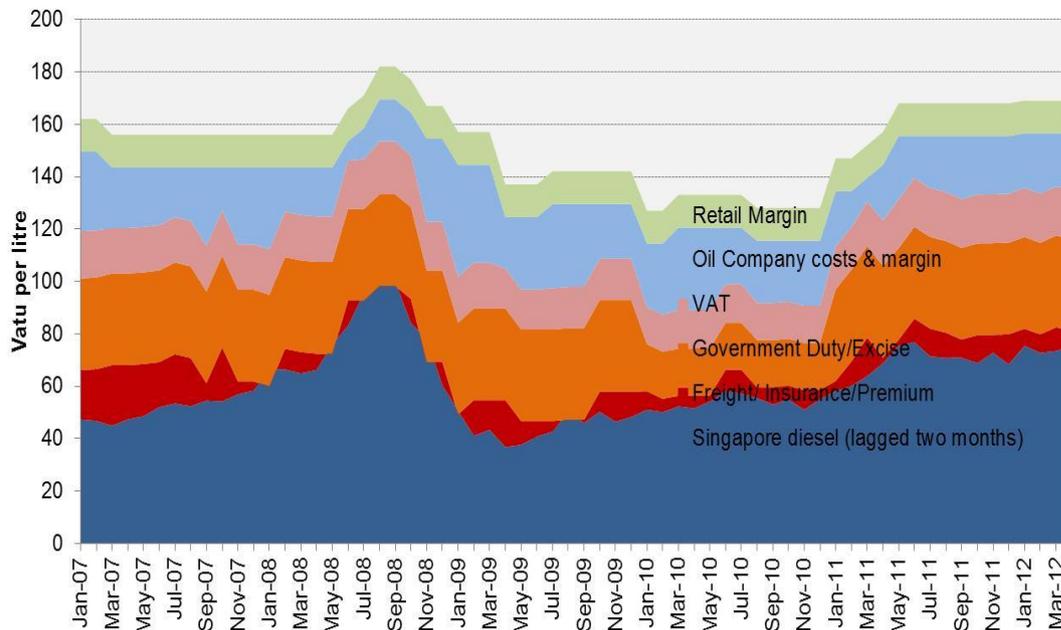


Source: Hale & Twomey

9.2.13 Diesel Price

The trend of the various components making up the retail price of diesel is shown in Figure 29. Vanuatu receives two grades on diesel (5000ppm and 50ppm sulphur). Figure 29 is based on 5000ppm (noting Vanuatu receives both 5000ppm and 50ppm sulphur diesel. Figure 29 is based on 5000 ppm; over the past two and half years the price increment for the low sulphur diesel has been USD 2/bbl higher (or just over 1 VUV/litre).

Figure 29: Diesel retail price component trend



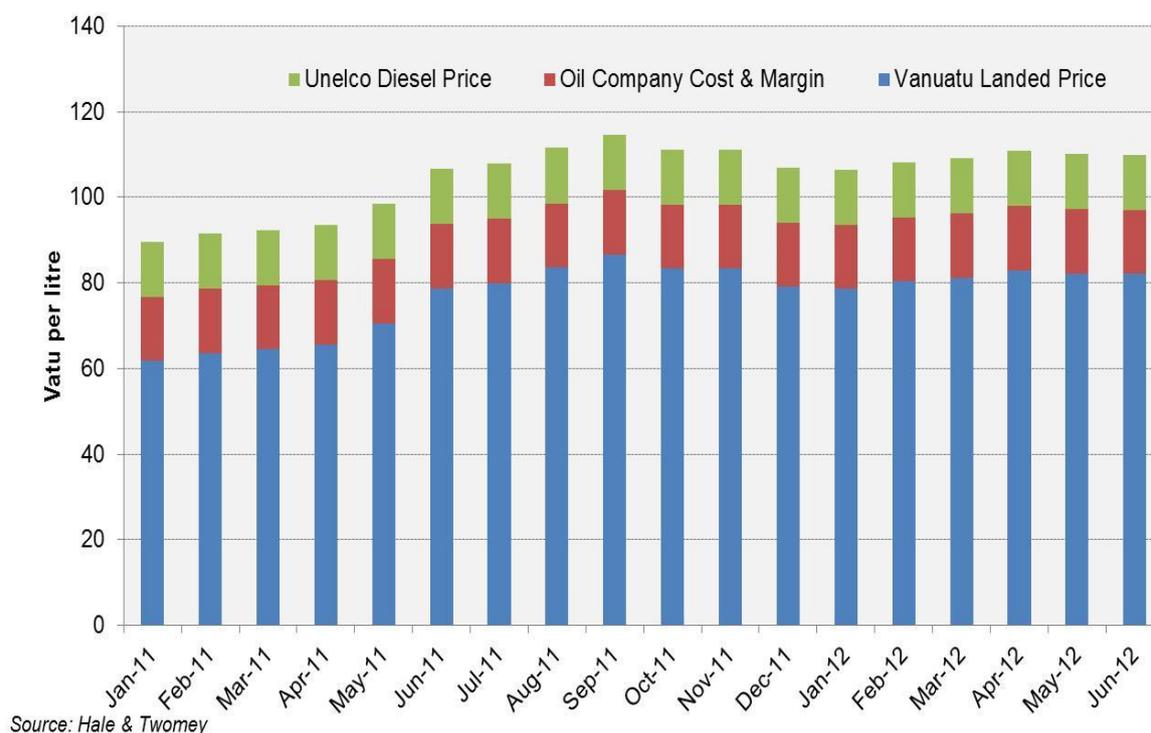
Source: Hale and Twomey

9.2.14 Diesel price for electricity generation in Port Vila

The price of diesel used in the electricity tariff is built from three main components: Landed cost of diesel, excise tax and PPC operating cost and margin (Figure 30). The excise tax is fixed at 15 vatu per litre and we estimate that the PPC local cost plus margin is 13 VUV/L. UNELCO had confirmed that the supply agreement with PPC has a 60 day stock holding requirement which is built in to the cost of fuel.

UNELCO also has power plants on Tanna and Malekula, also supplied by PPC. Due to the smaller demand and the requirement to ship in drums on the local ferry service, the additional cost to Malekula and Tanna is estimated at 16 and 34 VUV/L respectively. PPC provides one month's stock on these islands.

Figure 30: UNELCO diesel price build-up for Port Vila



9.3 Fuel price analysis and comparison

9.3.1 Modelling

H&T has built a supply and financial model of the Vanuatu fuel supply.⁵³ This model examines PPC sales in 2011 and estimates a return based on the cost of cargoes (using Platt's prices, premiums and freight), operating costs and returns available given the retail pricing over this period. A return on capital employed is then calculated.

As noted in 9.2.3 the exchange rate achievable by PPC for the conversion has a significant impact on their return. Based on the margin above the Reserve Bank rate calculated from the cargo by cargo analysis, the return on asset achieved by PPC in 2011 was around 16%, close to the level set in regulated markets in the Pacific Islands.

9.3.2 Pacific Islands comparison

Figure 31 and Figure 32 compare Vanuatu petrol and diesel retail prices (excluding duties and taxes) with selected other Pacific Islands. This analysis indicates that Vanuatu prices are higher than for some comparable countries (Tonga, Fiji). However our analysis indicates that there are factors contributing to a higher price including:

- Higher quality fuel (petrol) supplied, meaning a higher price paid in Singapore for the fuel;
- Last port of call and relatively small drop size compared to other MR ports, resulting in higher freight component (albeit much better than LCT delivery);
- More recent investment in assets resulting in a higher asset value by comparison to countries with older assets/no recent investment;

⁵³ The model structure is explained in Appendix 5.

- More stock (especially for diesel for power supply compared to some other countries);
- Lower volume compared to other MR delivered countries resulting in a higher per litre cost
- A higher return on assets based on H&T estimate;
- A higher exchange spread compared to other Pacific Island countries; and a
- Higher retail margin

Figure 31: Retail Petrol fuel price in Pacific Islands excluding taxes (average April - September 2011)

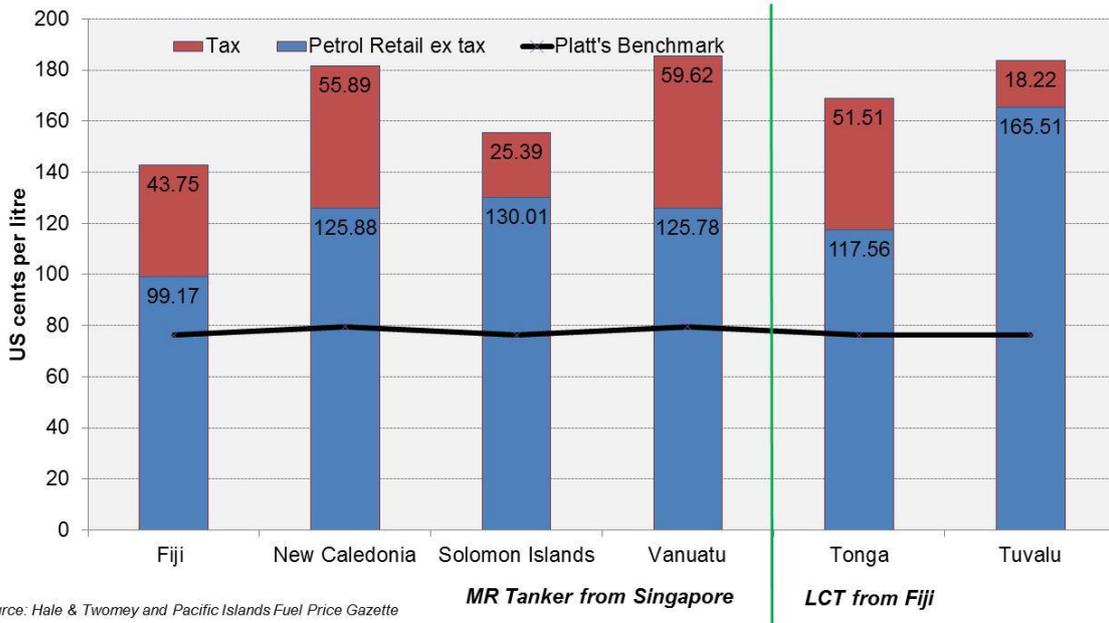
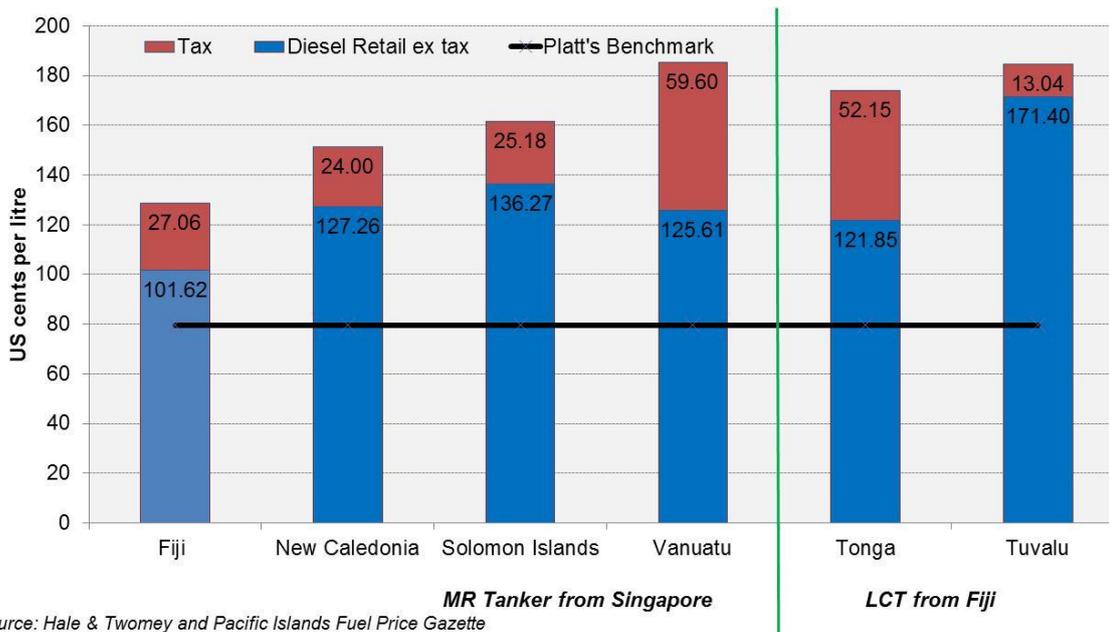


Figure 32: Retail Diesel fuel price in Pacific Islands excluding taxes (average April - September 2011)

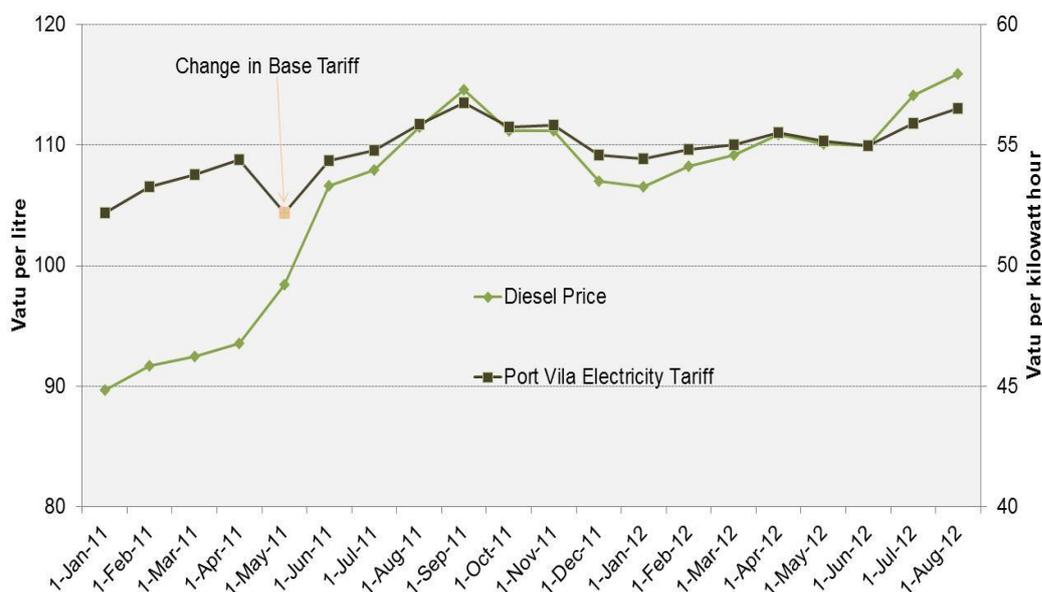


9.4 Impact of petroleum price on Vanuatu's electricity and public transport sector

9.4.1 Electricity

The Utilities Regulatory Authority of Vanuatu published a position paper on the Electricity Tariff Review⁵⁴ in March 2010 and estimated that diesel costs account for about 40% of the revenue generated from the Port Vila Electricity tariff. Figure 33 would also indicate that electricity tariff trends follow changes in diesel prices.

Figure 33: Price of diesel vs. Port Vila Electricity Tariff 2011- June 2012.



Source: UNELCO and Vanuatu Utility Regulatory Authority

9.4.2 Public Transport

Unlike the electricity sector, the price of transport services such as buses, taxis, airfares and shipping are not regulated or are regulated in part. The public transport system in Vanuatu consists of privately owned minibuses that run unspecified routes through Port Vila and Santo. Taxis are available in both urban centres.

The Land Transport Board (LTB), an independent authority established under the Taxi Act 1966 in each municipality (Port Vila, Santo and Tanna), is responsible for setting fares for public transport. We were unable to meet the LTB officials although the Port Vila Town Clerk⁵⁵ advised that the LTB office lacks specialised personnel to regulate fares taking into account changes in fuel prices.

Minibus fare starting rates increased from VUV 100 to VUV 150 in January 2010 in Port Vila⁵⁶ and the starting rate for a taxi fare is VUV 500 within two kilometres. However taxis are not fitted with meters and therefore charges are entirely dependent on the driver. Nevertheless it would

⁵⁴ Utilities Regulatory Authority of Vanuatu 2010. Electricity Tariff Review Position Paper

⁵⁵ Meeting with Mr Mandes K Tangaras, Town Clerk of the Port Vila municipal council on 25th September 2012.

⁵⁶ Information provided by Department of Energy in an email dated 17th July 2012.

appear that charges are dependent on distance travelled, the condition of road, load carried etc. Furthermore fares vary from island to island.

The cost of fuel and transport costs are also seen as substantial cost items for the tourism industry, ranging from 31% for hotels and 25% for tour operators⁵⁷. It is difficult to quantify the impact of rising fuel prices as tourism has continued to grow. This may have reduced the impact of rising fuel prices on Vanuatu's economy given the significance of tourism as we would expect that, as for larger economies, growth in demand for fuel would reduce as price increased.

9.5 LPG pricing

Origin did not provide LPG pricing within appropriate timeframes for this review so LPG prices are analysed by comparing with the regional price benchmark Saudi CP (see Section 6.3.2), the cost of the cargoes received in Vanuatu (using Customs data which includes product cost and freight) and data on retail prices received from the World Bank.

A build-up of LPG prices should include the following:

- Saudi CP (effective market value of LPG)
- + Brisbane premium (cost premium reflecting LPG's value in Brisbane)
- + Freight (cost to transport to Vanuatu)
- = Landed cost (CIF value)
- + Wharfage
- + Duty (zero on LPG)
- + Operating cost recovery
- + Capital recovery factor
- = Wholesale cost
- + Retail costs and margin
- = Retail cost

9.5.1 Build-up of landed cost

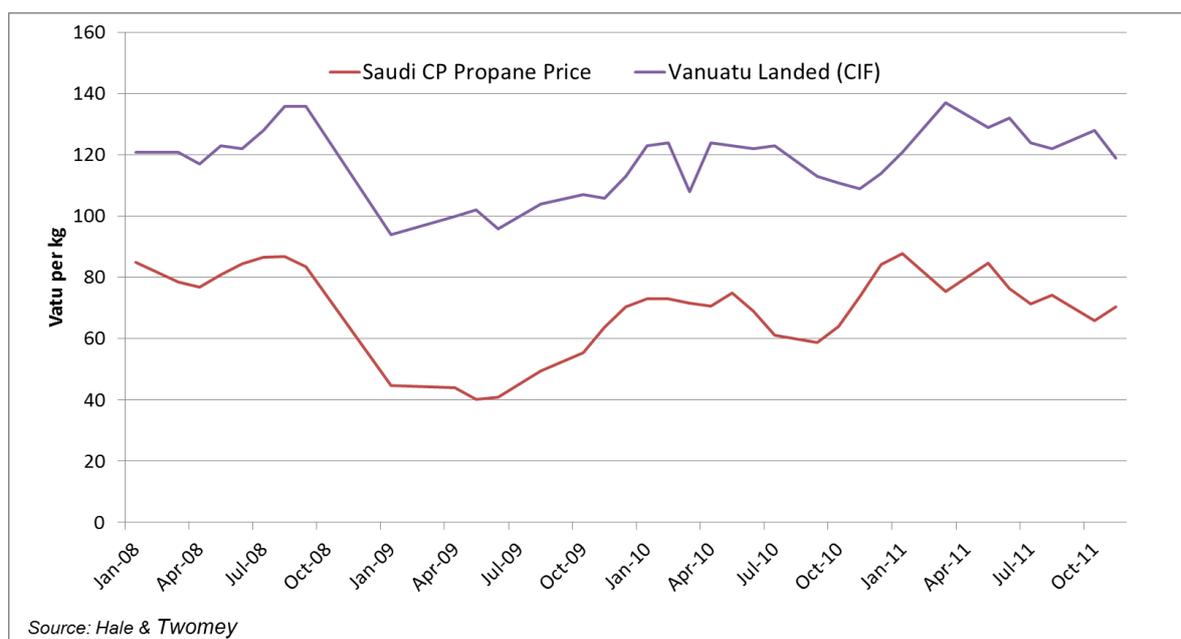
As noted in Section 6.3.1, Origin's LPG supply is imported from the Middle East into Morton Bay (Brisbane) where it is transhipped to the small LPG tankers that service the Pacific Islands. The landed cost out of Morton Bay will be linked to the Saudi CP cost plus a premium which we estimate to be USD 50-60/tonne.

Figure 34 charts Saudi CP against landed cost of LPG in Vanuatu⁵⁸ to establish the typical margin to cover freight and premium. Note that the price of propane is used for the analysis (Saudi Arabia sets a price for propane and butane separately) and cargoes for Port Vila are analysed; deliveries to Port Vila have been propane over this period.

⁵⁷ MCA Vanuatu Tourism Survey Baseline Study Final Report June 2008

⁵⁸ Information provided by Customs

Figure 34: LPG landed cost versus Saudi CP



The landed cost closely correlates to movement in the international price of LPG and confirms our understanding that Origin is pricing based on the Saudi CP benchmark. Landed prices lag movements in the international market, usually by one to two months, reflecting the time for the cargoes to get to Vanuatu.

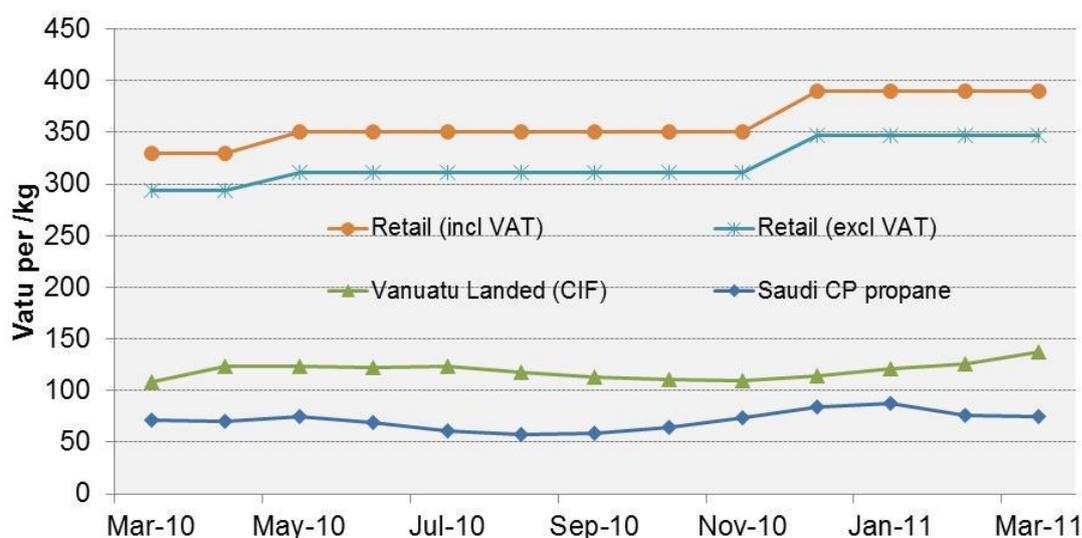
The Vanuatu landed cost increment above Saudi CP (using a one month lag), has averaged about 49 VUV/kg or around USD 500/tonne. We believe about USD 55/tonne relates to the premium for the product in Brisbane, with the rest covering the freight cost (close to USD 450/tonne). Analysing this trend over time we estimate the freight component has increased from around USD400/tonne in 2008 to nearly USD500/tonne in 2011.

It is difficult to state if these costs are reasonable as the LPG freight market is not transparent and there are no international freight benchmarks to assess it against. H&T does analyse LPG rates based on estimates of time charter rates, fuel costs and port costs although for small drops such as Vanuatu this is approximate as it depends how the supplier allocates costs between the ports on a multi-discharge voyage. Making some assumptions on these variables, H&T estimates the freight cost is defensible, and we expected to see a rise in price over the period as has occurred (primarily from bunker costs as 2008 freight rates were probably still based on 2007 bunker costs).

9.5.2 Costs within Vanuatu

Without any information from Origin on cost components, we estimate the margin by analysis of the retail and commercial prices against landed cost. Figure 35 shows the trend over the period March 2010 through March 2011.

Figure 35: Commercial and retail LPG prices versus landed cost



Source: Origin Energy, World Bank and Hale & Twomey

Vanuatu charges no duty on LPG so the price difference between the VAT exclusive commercial and retail prices and the landed cost is all applied to Origin’s cost and margin. Prices rose in May 2010; this increase related to an increase in cargo cost seen in April, although the cargo increase was not particularly correlated to a Saudi CP change. Landed prices then drifted lower in line with (after a lag) Saudi CP before starting to rise in December 2010. Commercial and retail prices increased sharply in December; much more significantly and much more sharply than would be explained by either the cargo costs or Saudi CP.

Analysing the later part of this period, the difference between our assessment of the weighted average selling price (prices are discounted from retail prices for different market segments) and the landed cost gives the average margin over the period of around 185 VUV/kg⁵⁹. This margin would be expected to cover wharfage, terminal operating costs, distribution cost and a capital cost recovery.

Our estimates for these components are as follows⁶⁰:

- Wharfage: 0.4 VUV/kg (395 VUV/tonne)
- Operating cost estimate excluding depreciation: 26 VUV/kg (approx. VUV 47 million or USD 500,000) [Note - Origin advised that their operating cost was higher at 63 VUV/kg because they comply with Australian storage and handling standards and more staff to service their market compared to similar sized markets in the region]
- Depreciation: 23 VUV/kg [Note - Origin advised that their depreciation was 15 VUV/kg because of their lower historic cost basis for valuation of fixed assets]
- Capital recovery on terminal assets: 52 VUV/kg (based on approx. USD6.7 million asset value and 15 % return)
- Capital recovery other assets: VUV 15/kg (based on USD 2 million asset value and 15 % return)

⁵⁹ Analysis of 2011/2012 data provided by Origin gives a similar gross margin.

⁶⁰ During the Draft Report Stakeholder consultation dated 24-26th September 2012 Origin advised that its operating cost was well above our estimate.

- Inventory cost recovery: 1.6 VUV/kg (150 tonnes or 30 days average stock⁶¹)
- Debtor days recovery: 1.7 VUV/kg (assume 20 days; normally a mix of cash, i.e. 0 days, and up to 40 days for commercial customers)

In total this explains approximately 149 VUV/kg of the 185VUV/kg margin identified in the analysis. A margin of this level would generate a pre-tax return of 22%.

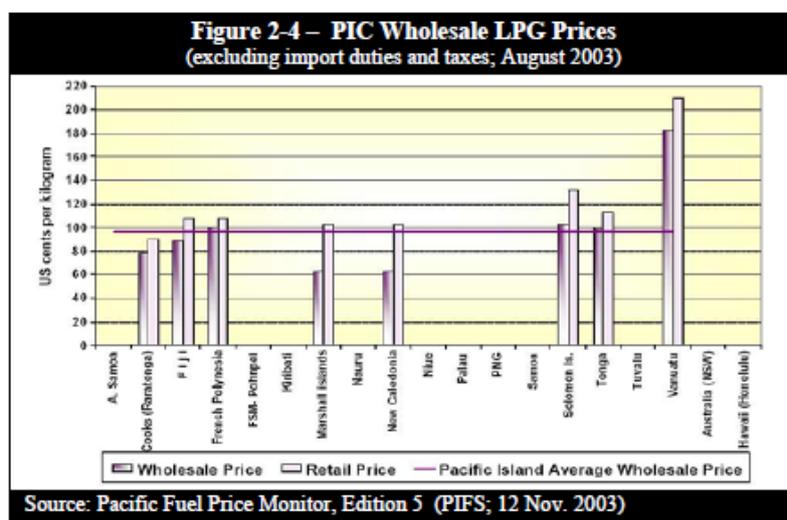
Our capital cost valuation uses a depreciated replacement cost approach to calculate capital recovery, similar to that which would be used by a regulator under a regulated pricing framework. We would expect our valuation to be higher than Origin's, assuming they would value a significant proportion of their assets at historical book value. We note that Origin has been investing to convert the facilities to handle propane, including adding storage and customer facilities which they own.

Origin also advised they make a provision for tax due on profits repatriated to Australia and that their asset base is higher. We discuss this in Addendum.

By comparison, Tonga which is a similar sized LPG market but regulated and has a retail margin of 84 VUV/kg. We would expect Vanuatu's margins to be higher because of the investment Origin has made recently and recognising the commercial market needs to recover the equipment investment.

Despite this our findings are confirming the findings from the Pacific Regional Energy Assessment 2004, which showed that Vanuatu's LPG costs are higher than other Pacific Islands (Figure 36).

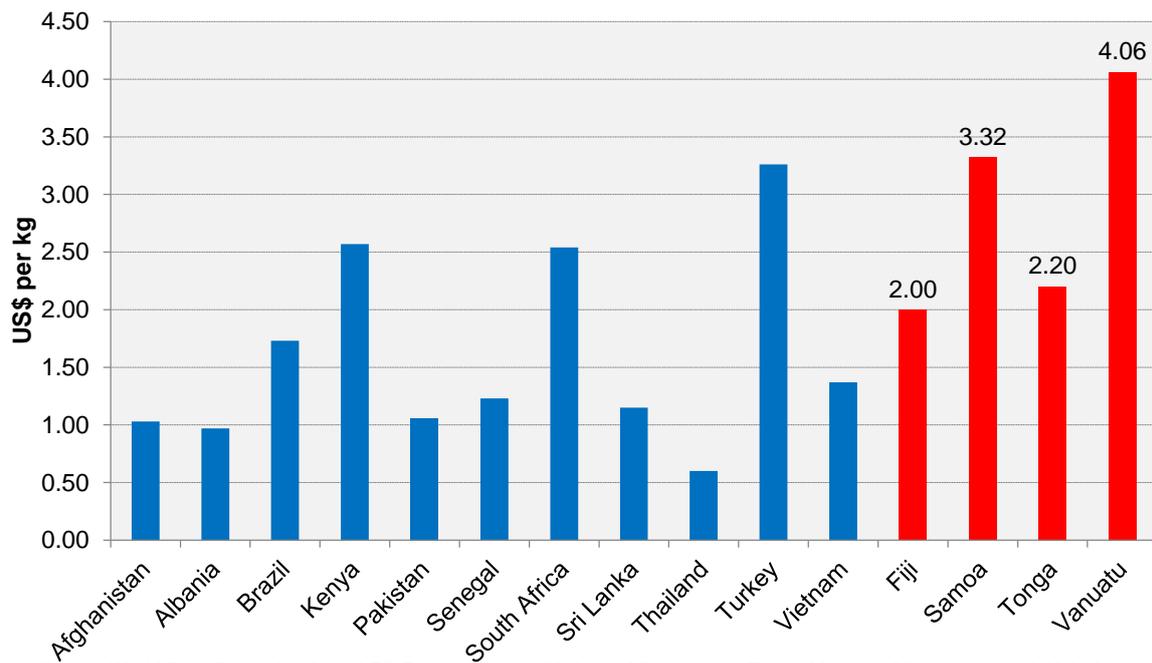
Figure 36: LPG Pacific Island cost comparison



Similarly, Figure 37 provides a more recent comparison with selected Pacific Island countries which also indicate Vanuatu LPG retail prices are high.

⁶¹ Calculated from actual delivery cycle assuming shipments generally leave both facilities close to full after discharge)

Figure 37: LPG retail price December 2011 including taxes.



Source: World Bank December 2011 LPG Report , Samoa Ministry of Commerce, Tonga Ministry of Commerce and Hale & Twomey

10.0 Options for Improvement

Summary:

Options for improving efficiency of the current supply chain exist but these need to be evaluated in more detail. Improving port efficiency will increase shipping flexibility and lead to lower shipping costs but significant improvements, where, for example, PPC is able to reduce shipping cost through assigning Vanuatu as first port, are likely to require dredging to improve draft constraints, which could be expensive. However our very preliminary analysis of the barge concept indicates that the high cost of distributing product to the outer islands could be substantially reduced – we recommend this continues to be examined as a matter of priority.

The technical review of the main storage and distribution facilities in Port Vila and Santo indicates areas of safety and environmental concern. For petroleum storage key amongst these are inadequate fire protection systems, which is important for Port Vila given the proximity of storage to nearby residential areas. There is a similar concern for LPG storage in Port Vila where one tank is above ground.

Options for improving security and reducing vulnerability to high and volatile prices suggest the focus should be using financial hedging rather than carrying increased levels of security stock. Current stock levels held are considered to be adequate when taking into account flexibilities that exist within the supply chains and financial hedging provides the opportunity to be more flexible and targeted.

To enable the Vanuatu government of understand its transport sector and make decisions on the energy efficiency measures, we recommend a study of the transport sector. Given the transport sector accounts for over half of Vanuatu's domestic petroleum demand (which excludes bunkering and international aviation), improvements in the efficiency of usage of fuels in the transport sector are a key area for Vanuatu's energy strategy. Land transportation in particular is an area where improvements in fuel efficiency can have a direct impact on costs to consumers and on Vanuatu's overall fuel import bill. Understanding the scope for this is difficult however because of the lack of good data on Vanuatu's current vehicle fleet and systems for monitoring continued improvement in the fuel economy of vehicles.

10.1 Supply Chain Efficiency

Volume discounts via demand aggregation

Can PPC achieve more buying power through greater demand aggregation?

In effect PPC aggregates demand now. In doing so PPC is able fill out the vessel, access the Singapore cargo market and cheaper MR shipping. Put another way it avoids the extra costs of the double handling implicit if the "hub and spoke" using LCTs.

The Singapore market is a cargo market and there are no discounts to benchmark prices as such. Rather there are likely to be additional charges for handling smaller or operationally complex parcels that don't meet the supplier's minimums. Quality and small parcel premiums will tend to occur in these circumstances but our analysis of pricing suggests premiums charged to PPC are in line with those seen for much larger importers in Australia and New Zealand.

The question remains whether PPC is maximising any competitive leverage it has in aggregating demand?

One option to test competitiveness would be if the GoV instituted a form of control so that it could require regular tendering (i.e. competition for the market as opposed to competition within it). The difficulty with this approach is that it would require changing the current market structure and the regulatory environment to be able to dictate such an outcome. Furthermore it could compromise or dis-incentivise PPC from continuing to improve efficiency and to meet customer needs that require a whole supply chain approach. In any event the most competitive suppliers are likely those already supplying the region (e.g. Mobil, PPC or Total) but any efficiencies they can bring will be determined by the markets they operate in and the synergies they can create around those markets.

We consider aggregation to be already operating and unlikely to improve on market price. However given it is an accepted efficiency driver it should be inherent in PPC's approach to the market. Monitoring prices would be the way to provide assurance around this dynamic.

Shipping

MR's versus LCTs - PPC is now using MR shipping, having moved away from LCTs. There will be times when LCTs provide additional flexibility e.g. cover for disruptions in the shipping schedule and short notice changes in demand. However these should be the exception. The factors which influence the choice between the two options include (Table 29):

Table 29: MR vs. LCT Shipping

	MR	LCT
1. Source of Supply	Enables uplift direct from refinery	Involves intermediate handling from another location (double handling)
2. Shipping frequency	Less frequent (every 55 days)	More (every 20 days depending on LCT size)
3. Shipping cost	Lower - only one shipping movement	Higher - still requires the MR leg to the hub port
4. Storage	More required in country	Less required in country because of access to hub storage
5. Stock	More held in Vanuatu	Less held in Vanuatu because stock held in hub location

PPC is now using MR tankers and our analysis (Figure 27: Freight cost trend with change to MR supply) confirms this is an efficient response and has been beneficial.

Port Efficiency - after storage, ports are the second most important piece of infrastructure in the petroleum supply chain. The level of port efficiency can affect shipping cost (increased demurrage, tug availability) and supply chain flexibility (flexibility to change vessel rotation). For example enabling PPC to treat Vanuatu as first port for discharge could provide more efficient shipping through greater flexibility (vessel rotation is no longer constrained). But this will need to be discussed with PPC. Smaller efficiency improvements can also assist as well. We recommend that work is undertaken to:

- Assess whether removal of some of the operating constraints (e.g. night time berthing, priority berthing ahead of cruise vessels) is feasible. If the proposed port development at the Ifira Wharf goes ahead this may create an additional berth for oil tankers.

- Examine scope to improve draft – the Maohi is not currently draft constrained but only because it is scheduled as the last port of call (minimal cargo on board).
- Examine scope for rationalising tug operation to improve access to more cost effective tug options in Santo

Storage

Efficiency of Investment - In time projected demand increases will necessitate building additional storage for the same shipping frequency. Based on our forecast for demand this would be about 2015/2016 (Table 9).

Storage investment is lumpy with a significant impact on cost. Increased demand could be met by increasing the delivery frequency of the vessel as an initial response. This would then determine the most efficient timing for storage investment. This may not be possible with the current shipping schedule and may require changes. Port efficiency may also be a relevant factor. All these factors should be part of the dialogue with PPC.

Distribution within Vanuatu

Road transport - Distribution within Port Vila and Santo is most efficient via road tanker. Given retail sites are clustered close to the urban centre and have small storage tanks, tankers often deliver to more than one site as a “milk run”. Port Vila has four road tankers which deliver an estimated 30 million litres annually (equating to 388 loads per year on a one to one basis or about 1.06 loads per day). The entire volume can be delivered by one road tanker (32,000 litre capacity) making 2.5 deliveries per day. We estimate that two road tankers (32kL and 18.9 kL) are sufficient to deliver Port Vila. In an event that one tanker is taken off for servicing or has a breakdown the second tanker is available as a backup. Having four road tankers and PPC's proposed plan for the purchase of an additional tanker adds to distribution cost and prices.

We recommend that PPC should review its distribution network within Port Vila.

Barge Project – In principle we support the proposed barge project (Section 6.2.8) – it should provide more efficient and safer distribution to the outer islands. However we have not seen any cost benefit analysis (CBA) at this stage to identify potential savings. A CBA should quantify cost of operation, amount of time required to undertake the task (to determine spare time available for other activities) and the appropriate level of stock at individual locations taking into account the needs of individual outer island markets, the cost of storage and the alternative of increasing frequency of delivery to minimise storage required. These considerations need to be balanced to ensure:

1. That the efficient scheduling of the vessel is not impacted by lack of storage
2. That these storage levels are set in a way that provides adequate buffer at time of barge arrivals to limit price gouging because of uncertainty around the barge schedule.

The GoV should work closely with PPC and undertake a CBA as soon as practicable before making further significant commitments to the project.

10.2 Security and reliability of petroleum supply

Diversifying sources - Some Pacific Islands countries import fuel from South Korea. Suppliers are able to aggregate demand in the same way PPC does around Singapore. But as with PPC, using MR shipping could be compromised, as could the incentive to invest in efficiency across the whole supply chain (e.g. optimising storage to improve shipping efficiency). Care also needs to be

taken in encouraging diversity as other factors may be compromised e.g. security - we note that in September 2011 production was disrupted from Shell's refinery in Singapore (PPC's supplier) but Shell was still able to provide supply because of the range of alternatives available out of Singapore.

Increase storage capacity - Storage capacity is discussed in Section 6.2.4 and shows Vanuatu has 121 days of storage if all tanks are fully utilised (based on 2011 demand). In our view the storage available in Port Vila and Santo is adequate - it would be difficult to justify additional investment.

The optimisation of jet storage at Port Vila is discussed in Sections 8.2.1 and 8.6.1. Building a large storage tank (5 million litres as proposed by PPC) and keeping two of the existing kerosene tanks would be an ideal long term solution. As noted earlier, PPC will only invest in new jet tankage subject to a long-term commitment from Air Vanuatu. PPC had built Tank 7 when UNELCO signed a long term contract for supply and 60 days stock requirement.

The high minimum days cover for power diesel is by agreement with UNELCO; the current level is significantly higher than the commercial level and carries a significant holding cost. We question whether this is cost effective given PPC's supply flexibility – reducing power diesel minimum stock to 30 days (providing average days cover of 63 days) would reduce holding cost by VUV 1.1 per litre.

Based on the projections for demand more storage is likely to be required around 2015/2016 to remain within these parameters. This investment timing is also being driven by UNELCO's requirement, which already places a high working capital cost on Vanuatu.

The Santo terminal will be constrained for diesel by 2013 and petrol in 2016 assuming the current shipping frequency therefore will need additional storage capacity for diesel. In the short term, we assume PPC could increase the shipping frequency from 3 shipments to 4-6 shipments to extend this timing.

Infrastructure planning and zoning - Vanuatu does not have an infrastructure or land use plan for its major cities⁶². We have noted in Section 8 that some of the concerns with the storage facilities in Port Vila are heightened because of proximity of residential areas. We understand there have been discussions on zoning in Vanuatu and the Asian Development Bank is providing technical assistance to the Port Vila Urban Development Project.

It is a common in other countries for petroleum storage facilities to be located near to urban environments. The appropriate response is to ensure that safety and environment standards are used to ensure that risks are managed to an acceptable level.

In the course of consultation with stakeholders the possibility of relocating the terminal to Forari has been suggested. We doubt that this would ever be considered cost effective when taking into account the following:

- Cost of relocation taking into account the relatively small petroleum and LPG demand in Vanuatu
- On-going cost impact of being more distant from demand where product would be required to be trucked over longer distances
- Cost of dismantling and remediating the existing site.

⁶² Asian Development Bank (2009) Port Vila Urban Development Project: Vanuatu.

LPG Storage Security - Santo gets deliveries of 45-50 tonnes once every three months and with storage capacity of 120 tonnes, the shipping frequency and storage capacity is adequate. Port Vila receives a parcel about once a month, with deliveries typically between 100-150 tonnes. We estimate that the minimum stock level on replenishment in Port Vila is about 8 to 10 day's supply, which would be constraining if there is any disruption in the supply chain. In the short term the options to improve security would be to increase shipping frequency. The feasibility should be checked with Origin.

Origin Energy has plans to build another 50 tonne storage tank in Port Vila and in the short term until this is built, uses 5 tonne tanks on site.

10.2.1 Safety

Vanuatu's current approach to petroleum safety relies entirely on the fuel companies themselves. The minimal regulatory framework and lack of oversight raises a number of issues including:

- Niche players operating at the margins with little or no standards (including maritime transportation within Vanuatu) - this raises environmental risks as well
- Transportation safety within Vanuatu - 17 per cent of fuel distributed to outer islands of Vanuatu is in drums on local vessels with no spill protection.
- Governance impacts where the societal expectation is placed on the fuel companies but there are risk areas (other operators) over which they have no influence or control.

Improvements in Vanuatu's petroleum safety and environmental practises would contribute to the understanding of and mitigation of environmental and safety risk discussed in section 7.0. Table 16 provides example of improvements in other Pacific Island locations. The safety and environmental issues should be considered together. In the first instance we recommend a review of downstream petroleum safety to fully scope the issue and assess its significance. Elements for a proposed TOR should include:

- Review and incorporate downstream petroleum international practices in the Vanuatu Petroleum Regulations 1997, covering for example international practises for licensing, safety planning validations and verification of asset integrity and fuel handling process.
- Consider international standards and operating procedures used by oil majors (i.e. Australian Standard AS1940 the storage and handling of flammable and combustible liquids - PPC complies with AS1940 therefore incorporating this international standard in Vanuatu will be acceptable by the operators.
- Base Vanuatu's downstream petroleum laws on the proven effective laws in other countries. For example New Zealand Hazardous substances and New Organisms Act 1996 (HSNO Act) and Secondary Containment Systems Code of Practice 47 (HSNOCOP approved in April 2012).

10.3 Land Transport Sector Efficiency

Given the transport sector accounts for over half of Vanuatu's domestic petroleum demand (which excludes bunkering and international aviation), improvements in the efficiency of usage of fuels in the transport sector are a key area for Vanuatu's energy strategy. Land transportation in particular is an area where improvements in fuel efficiency can have a direct impact on costs to consumers and on Vanuatu's overall fuel import bill. Understanding the scope for this is difficult however because of the lack of good data on Vanuatu's current vehicle fleet and systems for monitoring continued improvement in the fuel economy of vehicles.

To enable the Vanuatu government of understand its transport sector and make decisions on the energy efficiency measures, we recommend a study of the transport sector. The specific measures government can use include:

- Review and upgrade if necessary the Road Traffic (Control) Act 1962 to put in place appropriate centralised data gathering obtained from vehicle registration and inspection.⁶³ The details of the regulatory measures are discussed in 11.2.3.
- Review Vanuatu's vehicle current vehicle fleet, its growth and likely future composition to inform:
 - a. the review of Vanuatu's fuel standards; and
 - b. fuel consumption projections.
- Regularly estimate and publish projections of Vanuatu's fuel demand across both the stationary and transport sectors. These projections should take into account: likely growth in motor vehicle and marine fleets; population growth; economic growth; and energy efficiency initiative; and other relevant matters.
- Commission a study to assess the costs and benefits of a range of policies that could improve the fuel efficiency of Vanuatu's growing motor vehicle fleet, including:
 - a. gradual shift to using more modern and efficient engine technology, particularly for diesel engines;
 - b. restrictions on the maximum age of second hand motor vehicles imported into Vanuatu;
 - c. minimum engine efficiency standards;
 - d. vehicle registration fees;
 - e. tax incentives for the importation of more fuel efficient vehicles; f) provision scheduled public transport services and
 - f. improved driver training in fuel efficient driving techniques and vehicle maintenance.

10.4 Managing petroleum price risk

The international petroleum cost of petroleum makes up close to 50% of Vanuatu retail prices and about 40% of the electricity tariff. Currently fuel and electricity suppliers pass any changes in cost through to the market. There is no incentive not to and no active management of price is required.

PPC may smooth pricing from month to month (adjusting local prices taking into account prices movements in Singapore as replenishments are being loaded) but as illustrated in Figure 25 generally price changes will broadly followed changes in international petroleum markets.

The following examines the range of options, discusses the risks, and considers how hedging might be undertaken given the current market arrangements and regulatory setting

10.4.1 Risk Management Options

Physical Reserve Stock

⁶³ The current fleet database is administered by three different agencies.

Vanuatu could hold additional physical stock to release when it was considered warranted (shielding Vanuatu from excessive prices). Assuming the legislative authority was in place this could be done by placing an obligation on the supplier or by the GoV itself investing in the storage and product. Some major economies (US, Japan, China) do hold more stock for strategic reasons like this, but more to provide supply security in the event of disruption to international supply. For a small economy like Vanuatu holding additional stock raises significant issues of affordability and operation as indicated in Table 30.

Table 30: Reserve Stock Holding Risk

Issue	Cost/Risk
1. Investment	Additional storage would be required. For example to provide a level of stock equivalent above that currently held to meet to the IEA 90 day minimum would require an additional 6 million litres of storage, or a fuel price increase of 5 VUV/litre to cover the cost.
2. Timing of acquisition and/or release	A decision will need to be made on the appropriate timing (at what price) to acquire and/or release into the market.
3. Stock to be held	<p>Decisions will be required on the type of stock to be held:</p> <ul style="list-style-type: none"> ■ Given the significant role diesel plays in the profile of demand this is likely to be preferred but the country already holds high stocks as a result of arrangements between UNELCO and PPC. ■ Managing stock - once in place stock would need to be refreshed periodically to maintain quality. This factor tends to see the market participants used as the point of obligation.

The IEA approach to the release of reserve stocks has changed; the practice now is for members holding stock to release into the market rather than reallocate between themselves. This has the benefit of countering upwards pressure on prices in a shortage because of the extra supply released to the market. The whole market is influenced; non IEA members benefit as well.

In our view the current level of stock held provides a reasonable level of security, noting that this should be reassessed from time to time, including cost effectiveness. The GoV might still want to consider financial hedging as a way to manage exposure to high and volatile prices.

Financial Hedging

Financial hedging means taking an equal and opposite position to the commercial terms for purchasing the physical petroleum. It enables a party to remove the risk of loss or limit price volatility of the fuel and hence provide a greater degree of certainty around what the price may be.

A range of hedge products are available providing different levels of flexibility, value and risk. These can be categorised broadly into three (a diagram illustrating characteristics for each is attached in Appendix 6):

Swap (or Fixed Price)

A buyer fixes the purchase price of the physical petroleum by entering into a separate arrangement or "swap", where the value or cost generated by the swap offsets the change in cost

of the physical petroleum transaction. The swap is referenced to the same price benchmark as for the physical supply.

Benefits	Risks	Costs
<ul style="list-style-type: none"> ■ No upfront cost ■ Price fixed - most certain form of hedging for the swap volume 	<ul style="list-style-type: none"> ■ Forgo price downside ■ Miss-match between physical supply and swap volume ■ Hedge market product liquidity (diesel more liquid than petrol) 	<ul style="list-style-type: none"> ■ Cost is effectively in the foregoing of downside below the agreed swap price

Call Option (or Cap)

A call establishes a maximum ceiling price but allows the buyer to benefit from decreases in petroleum prices. A premium is paid upfront for the call option. The premium charged will depend on how close the ceiling (or strike price) is to the current market.

Benefits	Risks	Costs
<ul style="list-style-type: none"> ■ Price protection at cap ■ Full price downside participation 	<ul style="list-style-type: none"> ■ Upfront cost of premium ■ Cost significant ■ Miss-match between market and swap volume ■ Hedge market product liquidity (diesel more liquid than petrol) 	<ul style="list-style-type: none"> ■ Cost dependent on proximity of cap option to strike (ceiling) - closer the more costly ■ VUV 3-5/litre indicative but subject to term, market

Zero Cost Collar

A Collar is an adaptation on a Cap. Against the maximum ceiling price there is a floor – the ability of the buyer to benefit from price decreases is constrained by the floor. The premium paid upfront for the call (the cap) is offset by the value the Buyer sells the floor.

Benefits	Risks	Costs
<ul style="list-style-type: none"> ■ Price participation between cap and floor ■ Zero cost ■ 100% protected above cap 	<ul style="list-style-type: none"> ■ 100% exposed below the floor ■ Miss-match between market and swap volume ■ Hedge product liquidity (diesel more liquid than petrol) 	<ul style="list-style-type: none"> ■ Call option and put equate to equal zero

Implementation

Currently there is no incentive on petroleum and electricity suppliers to manage price risk, as all costs are passed through to the market. So requiring the sector to hedge would require either

sector agreement, or appropriate regulation to require the same, in order for the costs and benefits to be passed through to the market.

Alternatively the GoV could undertake the activity but an appropriate framework would still be required to pass through costs/benefits in a transparent way.

Decisions would be required on the objective for hedging which could also influence implementation. Objectives could include (Table 31):

Table 31: Determining Hedging Objectives

Objective	Preferred Hedging Approach/Issues
Reduce exposure to volatility	Fixed price <ul style="list-style-type: none"> ■ Frequency of changes and pass through to market (could be high) ■ Mechanism to pass through to market
Accept some volatility within an acceptable range but retain ability to access lower prices	Cap or zero cost collar <ul style="list-style-type: none"> ■ Mechanism to pass costs through to market
Limit hedging to some sectors but allow flow through to others e.g. <ul style="list-style-type: none"> ■ Hedge electricity demand given significance to wider public welfare ■ Pass through to transport (consumers are incentivised to minimise use during periods of high prices) and aviation (market tends to undertake its own hedging) 	Consider each depending on extent of volatility desired <ul style="list-style-type: none"> ■ Mechanism to pass through to market

Implementation options could include (Table 32):

Table 32: Financial Hedging Implementation

Implementation Options	Issues
1. Supplier undertakes and passes costs/benefit to market in price	<ul style="list-style-type: none"> ■ No regulation enabling GoV to direct this ■ Would require full transparency of supplier pricing to ensure costs/benefits passed through to market
2. GoV undertakes and passes cost/benefits to market by e.g. <ul style="list-style-type: none"> ■ Cost - charge a levy or increase taxes ■ Benefit - reduce tax/pass to supplier to offset supplier price increase 	<ul style="list-style-type: none"> ■ Unclear whether GoV has appropriate governance in place to undertake this ■ Would require full transparency of supplier pricing to ensure costs/benefits passed through to market

Risks/Issues with in Hedging

Ideally the best hedge contract is one which is based on a market using the same benchmark (e.g. Singapore 5000 ppm sulphur diesel) for physical supply. This minimises any price difference between the transaction for the physical product and the hedging offset.

In practice mismatches can arise, for example, where pricing for physical supply does not match typical hedge markets. Hedge providers based around Singapore will prefer pricing to operate on a monthly average basis whereas PPC currently prices its acquisition on the 5 day delivery period around vessel loading in Singapore. The options are either to accept the risk, or seek PPC's agreement to changing its current pricing from the 5 day period to full average of the month pricing.

Month average pricing also reduces price volatility more generally so changing to month average pricing should be pursued with PPC in any event.

Hedge markets can be less transparent over longer timeframes (market prices are only quoted 3-6 months out). Also hedge markets can be less liquid where there is greater multiplicity of particular grades for the generic product such as gasoline; by contrast aviation and diesel paper markets are more liquid because the range of quality variances is much reduced.

In addition hedge providers typically require appropriate counter party credentials (credit approvals, maximum/minimum volume parameters, payment terms, general terms and conditions etc) before agreeing to enter into an on-going commitment. Minimum volume commitments could also be required.

11.0 Improving the Regulatory Framework

Summary:

There is minimal and in some cases poor regulation for a sector that markets dangerous goods. Petroleum fuels and LPG as dangerous goods can have extreme consequences if handled poorly or incorrectly. Nevertheless, and despite the lack of regulation, both industry participants operate to standards which are consistent with operating practices in the industry more widely.

A lack of proper regulation does however create risks and costs including:

- *No regulated specifications for the fuels to be supplied*
- *Market entry by fringe operators who market petroleum products with minimal and/or unacceptable safety and environmental protection measures.*

Our technical review of the main storage and distribution facilities (Section 8) suggests that while industry participants are operating to industry accepted practices the lack of an appropriate regulatory framework should be addressed. Our analysis of the wider market indicates that lack of a comprehensive framework is likely to prevent or undermine the ability of the GoV to achieve its objectives for the ERM. Hence we recommend a complete review and updating of the existing framework including the policy settings that should be included. Recommended policy settings include:

- *Regular price monitoring (including back-up regulation allowing control if monitoring suggests prices are diverging from a level that would indicate acceptable returns)*
- *More comprehensive information gathering for monitoring and evaluating alternative policy approaches for the sector*
- *Demand restraint mechanisms (rationing) to handle emergencies*
- *Comprehensive environmental, health and safety framework*
- *An appropriate framework enabling the GoV to implement risk management policies for high and volatile petroleum prices.*

11.1 Gaps in Policy Framework

Appendix 2 examines the current regulatory framework for the downstream petroleum and LPG sector including:

- General licensing (business licence, Customs requirements)
- Environment, Health and Safety (standards)
- Energy security (including for high and volatile prices) and emergency response
- Economic regulation
- Infrastructure
- Institutional capability

This examination indicates that sector policy is not well defined and that the regulatory framework has significant gaps as follows (Table 33).

Table 33: Gaps in policy and legal framework

Area	Gap
Licensing	No specific licensing regulations applying to the downstream petroleum sector. This absence allows anyone to trade possibly without appropriate standards or commitment to

	Vanuatu's on-going benefit.
Environment Health and Safety	No specific regulations governing standards on the downstream sector (although we understand legislation aimed at regulating pollution and controlling waste management has been drafted)
Economic Regulations	No specific economic regulations although price can be regulated using the Price Control Act 1974 – the Act has not been used for many years.
Emergency Management	No regulations giving government control of the petroleum sector in an emergency (such as rationing procedures in case of a shortage.)
Fuel standards	No regulations governing fuels quality.
Financial authorities/implementation mechanisms to undertake risk management	No active regulation
Transport	No specific regulations governing the energy efficiency in transport sector (vehicle standards).

From our analysis in the preceding sections we conclude that:

1. The petroleum market is efficient in that returns are comparable to other Pacific Islands countries where pricing is regulated, that it is operating to international standards and that investment is continuing to be made. Furthermore our analysis indicates that the benefit of improvement in efficiency is being passed to consumers.
2. For LPG Origin is continuing to make investment and is operating to international standards but that a comparison of returns with other Pacific Islands countries where price is regulated shows that LPG margins are high in Vanuatu.
3. The sector is self-regulating despite a lack of an appropriate regulatory framework and this is a serious concern and poses risks for the sector. It is also an obstacle to the GoV taking steps that would assist in achieving its objectives for the VERM.

Our recommendation from a regulatory perspective is to retain the way in which the market is currently operating for petroleum (but not in the case of LPG), and to address those areas where the policy settings (and associated regulation) are poor or non-existent. In doing this we have been guided by the following framework, namely that the regulatory environment should seek to strike an appropriate balance between:

- the needs of investors for certainty, appropriate returns and financially sustainable businesses;
- customers' needs for efficient, safe and reliable supplies of fuel; and
- the energy security interests of the country.

11.2 Efficiency

11.2.1 Pricing

Petroleum - this review finds that, for petroleum at the wholesale level, an appropriate balance is being struck between the needs of consumers and the need for investment certainty. From a

regulatory perspective there would be little benefit to offset the potential costs of significant regulatory intervention - intervention is unlikely to improve the overall costs for consumers.

However a lack of transparency in the way pricing operates and how costs are passed through means assurance around this is poor.

We recommend that price monitoring for petroleum is introduced to ensure that returns remain at acceptable levels and prices continue to be reflective of costs. As market volumes grow, costs on a per litre basis should come down and we should be seeing the benefit of additional volume being passed to consumers. To ensure this we recommend:

1. **Regular fuel price monitoring** - this should be based on a transparent price methodology (a guide to price monitoring is provided in Appendix 4). Monitoring should be undertaken monthly with a more comprehensive review every 12 months. This is done in other countries in the region and can be undertaken relatively cheaply with the use of external expertise.
2. **Comprehensive and regular information gathering** – monitoring will require more information from the sector (see also our discussion more widely on information gathering requirements – Section 11.2.2)
3. **A regulatory framework to enable government intervention** – the option of introducing price controls should be available to the GoV should market monitoring fail to deliver efficient and transparent pricing. This should be considered as part of a wider regulatory review for the sector, including alternative approaches to economic regulation. On the face of it, the Price Control Act 1974 provides this ability, but it is unclear if the institutional infrastructure exists to enable the process described in the Act to occur (e.g. the Price Control Bureau within a Ministry and the staff to monitor the process).

LPG - the evidence indicates that LPG margins are high and higher than required to provide the market participant with an appropriate return when balanced against consumer needs for efficient, safe and reliable supplies of fuel. We recommend price regulation using the Price Control Act 1974. This will require inclusion of LPG in the list of goods able to be regulated. A guide for the price settings is provided in Appendix 4).

There is a need to ensure that commercial operators are not discouraged by the threat of regulatory action that would have a negative impact on investment decisions. A transparent formula, industry consultation, and verification by independent third parties should provide some reassurance to operators.

11.2.2 Information Gathering

Currently there is a lack of comprehensive information on the sector. This makes monitoring difficult but also prevents consideration of the issues and trends that could improve sector performance and the appropriate policy settings to bring this about. This lack of data applies not only to market participants but also to areas which influence petroleum demand (e.g. age and profile of transport fleet).

Information gathering is a common feature for many countries. We recommend a comprehensive assessment be undertaken on the data requirements necessary to meet the GoV's objectives in the VERM. Typically data required should include:

- Consumption across all sectors by fuel type (e.g. enable demand projections and trends to be regularly updated)
- Petroleum sales
- Retail prices

- Costs of supply
- Stocks levels at regular intervals
- Statistics influencing petroleum and LPG requirements including population growth, economic growth, and energy efficiency trends.

This may require the Government to pass specific legislation enabling it to require the provision of information where it is required from market participants.

11.2.3 Land Transport Policy

Vehicle trends - numbers imported along with make, age, fuel used, engine size etc (e.g. to understand transport trends and impacts on the transport fleet in changing policy settings). We understand a vehicle registration process is in place administered by the Public Works Department. Custom collects road taxes and municipal council's issues public transport permits. However this information is not held centrally nor is all relevant information e.g. fuel used, vehicle fleet etc.

Therefore we recommend GoV to review and upgrade if necessary the Road Traffic Control Act 1962. This should include:

Vanuatu's vehicle registration system so that it:

- provides an accurate record of the number of vehicles in use (i.e. to ensure all vehicles in use are registered and that those that cease to be used are removed from the register);
- consistently records vehicles with similar characteristics (e.g. engine type, vehicle type, engine size, passenger capacity, type of use, weight, etc.) under the same category; and
- can provide an effective means for generating revenue to recover the costs of road and maritime infrastructure maintenance, rehabilitation and new construction.

Vehicle inspection

- Public transport vehicles should be inspected twice annually to ensure that they meet specific minimum standards for:
 - a) safety (i.e. seating, seatbelts, tyres, steering, brakes, lights and indicators);
 - b) engine and fuel efficiency; and c) exhaust emissions.
- Private transport vehicles should be subject to an annual inspection, covering:
 - safety (i.e. seating, seatbelts, tyres, steering, brakes, lights and indicators);
 - engine and fuel efficiency; and
 - exhaust emissions.
- Enhanced quality and quantity of police checking of defective vehicles, via random inspections and enforcement of safety and emissions standards.

11.3 Security

11.3.1 Fuels Security

1. **Fuel Safety Stocks** - Currently the levels of stock held in Vanuatu are determined by the market participants, where they take into account flexibilities provided by other parts of their supply chain. Australia and New Zealand does not legislate minimum security levels

but there is an understanding of the levels held by the industry on a commercial basis. Vanuatu should establish the same including understanding the supply chain approach on which they are based. This should form part of the on-going monitoring as the cost of holding stock will form part of the template.

2. **Petroleum Demand Restraint** – Many countries have a range of demand restraint measures that complement stock security by providing the basis for responding to fuels shortages and emergencies (including disruptions to international supply). Any framework should include a range of responses, depending the scenario and likely seriousness. For less serious scenarios, measures would include public dissemination of information on fuel conservation and efficiency measures, and for more serious events, specific fuel rationing arrangements. Rationing can serve a two-fold purpose – it can be used to ensure minimum supplies during a crisis but it can also be used to prevent hoarding, which but for rationing, might exacerbate the problem.

11.3.2 Disaster Planning and Response

Vanuatu's Disaster Risk Reduction and Disaster Management National Action Plan (2006-2016) identify Vanuatu as one of the most vulnerable nations in the world. Its geographical location is within the 'ring of fire' and the cyclone belt area of the Pacific. It regularly suffers from volcanic eruptions, cyclones, earthquake, droughts and floods.

The National Disaster Act is the main law for emergency management and is administered by the National Disaster Management Office. This Act establishes the National Disaster Committee, National Disaster Operations Centre and that National Disaster Management office with its Director. Under the Act, disaster means an actual or imminent occurrence of one of the following:

- An earthquake, tsunami , cyclone, storm, flood, volcanic eruption, drought, bush fire or other natural happening;
- An explosion, fire, oil spill, chemical spill, air disaster, maritime disaster or accident of any other kind;
- An infestation, plague or epidemic being an occurrence that;
- Endangers or threatens to endanger, the safety or health of people in Vanuatu; or
- Destroys or damages, or threatens to destroy or damage, property in Vanuatu.

While the Act contemplates disasters associated with petroleum we recommend the Action Plan is strengthened to include:

- Appropriate risk assessment of the consequences a spill, on people, their values and the marine environment;
- Specific response planning; and
- Regular exercises involving market participants to test effectiveness of response.

11.4 Environment Health and Safety

11.4.1 Fuels Quality

Currently there are no quality standards for imported petrol and diesel products. Standards are set by market participants. It is standard practice within most economies to regulate minimum specifications for petrol, diesel and LPG (including monitoring and penalties for non-compliance), to ensure acceptable quality for the intended use, and to minimise the health impacts from emissions. Countries will also be guided by fuels quality trends internationally and within their region.

Vanuatu imports two grades of diesel; 50ppm sulphur for newly imported vehicles and 5000 ppm sulphur for electricity generation, industry and the remaining transport fleet. Most countries are now moving towards lower sulphur content (10-500ppm) in recognition of the environmental and health benefits of reduced sulphur emissions. In turn refineries are shifting their manufacturing profile to meet the increasing demand for cleaner fuels; the predominant grades are becoming the higher quality grades and the benchmarks for pricing are also shifting in that direction. While there may be a current cost benefit in remaining with the lowest quality (5000 ppm), in time restricted availability and the associated handling costs will outweigh any price benefits. Reporting agencies also will cease reporting lower quality benchmark.⁶⁴

Vanuatu also imports higher quality petrol than most non-French Pacific Islands. Fiji uses regular petrol (91 octane) which is cheaper. This petrol would likely be suitable for the Vanuatu fleet as it is also the main grade in Australian and New Zealand.

Being out of step with changes in quality or not examining whether fuels meet fit for purpose requirements may impose costs, lead to false economies or less than optimal outcomes. A framework for establishing acceptable standards provides the basis for determining what is most efficient for the country's needs.

Equally fuel quality should be monitored to ensure consumers are not consuming sub-standard products. We do not have any evidence that this is occurring but it is a situation which should be monitored.

We recommend the introduction of fuels quality standards that are:

- Appropriate for Vanuatu's conditions and engine fleet.
- Aligned with changes in fuel standards in Asia Pacific which are moving towards high quality of fuel.

This should include implement a fuel quality testing and compliance framework.

11.4.2 Dangerous Goods

There are a range of areas where regulation concerning dangerous goods needs to be strengthened in the interests of safety. These include

Building standards - there is no specific regulatory framework governing construction and maintenance standards to be applied for petroleum and LPG infrastructure including storage. Nor is there any inspectorate with responsibility to oversee licensing and certification.

Currently the industry operates to the legal standards and international practice applying in countries such as Australia and New Zealand. However there are risks that new market entrants will not operate to these standards.

Dangerous Goods Handling - there is no specific regulatory framework governing dangerous goods handling. This affects a number of areas including:

- **Transport** – this raises the risk of transport operators operating to lower safety standards to minimise costs. Standards for transport of dangerous goods can be based on international codes such as the International Maritime Dangerous Goods Code (IMDG) and the United

⁶⁴ Platt's have advised they will cease reporting the 5000 ppm benchmark in January 2013.

Nations recommendations for the Transport of Dangerous Goods – Model Regulations (UNRTDG) although it is likely they would need to be adapted to Vanuatu’s needs.

- **General licensing to import, store, handle** – we note again the example referred to in Section 6.2.6 where fuel was being dispensed and sold directly from an isotainer, which is a dangerous and environmentally risky practice. This illustrates the risks that are created without an appropriate zoning framework and the ability to require standards as part of licensing the activity.
- **Technical certification of dangerous goods equipment servicing including work permitting practices** – it is unclear how certification and standards apply to people engaged in servicing dangerous goods equipment beyond the responsibilities assumed the industry. This should be more clearly understood to ensure that all parts of the delivery of energy services have an appropriate standard of safety and technical expertise.

As noted in the Section 10.2.1 discussion on safety we recommend that the Petroleum Regulations 1997 be extended (noting that it only includes upstream at this point) to provide the regulatory framework for all dangerous goods requirements including construction standards, standards for licensing, dangerous goods handling, safety planning, and validation and verification of asset integrity. Where possible this should be guided by and incorporate:

- International standards (engineering), operating procedures and best practice used by oil companies
- Proven and effective laws in other countries.

11.4.3 Environmental Protection

International Conventions - Section 7.2 identifies that while the PPC and Origin adhere to international marine environment protection conventions (MARPOL) the legislation that would require this for Vanuatu no longer exists. The status for Vanuatu is unclear which may undermine the ability of regulatory authorities to require appropriate standards as part of licensing new activities in the sector.

Environment protection – this is provided by the Environment Management and Conservation Act 2002. Importantly the Act contains provisions requiring environmental impact assessments to be performed for any new development, which would include the petroleum sector.

The Act contains provisions for introducing regulation covering importation and transport of dangerous goods and waste management. We understand that the Vanuatu Environment unit is drafting regulations on pollution control and waste management specifically for the petroleum sector. Specific standards did not exist previously but generic environmental regulation did exist. We understand that this regulation will cover the gaps and specifically capture the downstream petroleum sector.

We recommend that waste and pollution regulations be introduced under the Act. This should have clear guidelines and regulations on the environment impacts of above ground and underground storage of fuels and site remediation.

11.5 Risk Management

Section 10.3 discusses the option of using financial risk management tools. Our assessment is that the regulatory framework required to deliver an appropriate hedging strategy is not in place. Developing a hedging strategy should include:

- Assessing the financial risks from oil price volatility;

- Determining an appropriate risk management policy; and
- Implementing a framework that enables enabling risk management to be undertaken, either by the GoV or sector participants.

Such a framework would include implementation options, extent of hedging, allocation of responsibilities, financial authorities, powers to levy and administration. Until this framework is in place it would be premature to propose financial hedging.

11.6 Approach to Regulatory Review

11.6.1 Framework for the Sector

An effective regulatory framework for the petroleum and LPG sector should be re-established. Because there are significant gaps or there is lack of clarity whether existing regulations can suffice a more comprehensive approach is required including legal and policy input. We recommend:

1. Policy settings are established for the sector to guide the development of the framework.
2. Use international best practice including proven and effective practice within the region as well as standards and procedures used by the oil majors
3. Reviewing the existing legislation/regulatory framework to meet regulatory requirements for the sector
4. Developing the preferred regulatory approach, including guidance on the framework for implementation.
5. Undertake review as a matter of urgency over the next 1-2 years noting that timeframes will depend on both legal and policy input.

This regulatory review should also consider options for economic regulation that are appropriate to Vanuatu's circumstances should the market fail to deliver efficient and transparent pricing. Appendix 7 provides a discussion of alternative approaches to regulation.

12.0 Recommendations and Implementation Plan

12.1 Priority Short Term Actions

Findings/Recommendations	Priority (0-6 months)
<p>1. Lack of transparency means assurance of fair market pricing is poor</p> <p>Recommendation – reinstate fuel price monitoring with capability to be undertaken at regular intervals.</p> <p>1.1. Petroleum - reinstate fuel price monitoring with capability to be undertaken at regular intervals. As there is no evidence of undue margins at present, monitoring (as opposed to price regulation) is the appropriate measure to increase transparency as a basis for future decision making.</p> <p>1.2. LPG - introduce price regulation - evidence indicates that margins are high and higher than required to provide the market participant with an appropriate return when balanced against consumer needs for efficient, safe and reliable supplies of fuel...</p>	<ol style="list-style-type: none"> 1. Reinstate petroleum price monitoring covering petrol, diesel, kerosene and using benchmarks for supply chain components (to be undertaken monthly supported by annual review) to increase the transparency of pricing (See Appendix 4: Example of typical price monitoring benchmarks). 2. Introduce LPG price regulation and review quarterly wholesale and retail prices (See Appendix 4: Example of typical price regulation benchmarks). 3. Assign competent resources to undertake benchmarking including regional resources (SPC/PIFS) and external consultants as required (using the supply chain model provided with this report). Adequate monitoring can be undertaken by use of external consultants however resourcing for the wider regulatory framework should include capacity building for locally trained personnel. 4. Develop pricing template for the petroleum products and LPG (draft template provided with this report) 5. Investigate with PPC changing pricing on loading in Singapore from 5 days around bill of lading (loading) to month average pricing, to reduce price volatility 6. Options for monitoring resources include: (1) a levy on fuel sales to cover administration of fuel price monitoring. VUV 0.1/litre (~US\$ 50,000 per annum) would be adequate to undertake monthly monitoring including annual review via external consultants. (2) Alternatively funds could be reallocated from existing fuel taxes.
<p>2. Distribution inefficiency to outer islands within Vanuatu increases costs for consumers</p> <p>Recommendation - undertake scheduling optimization</p>	<ol style="list-style-type: none"> 1. Pursue barge project with urgency as it will increase efficiency of the supply chain, lower freight costs, improve supply security, improve bulk tank receiving facilities, and improve operating and safety (by reducing loading of drums, on

Findings/Recommendations	Priority (0-6 months)
<p>with PPC on barge proposal to ensure relevant components of supply chain optimised (balancing storage with vessel schedule).</p>	<p>domestic shipping).</p> <ol style="list-style-type: none"> 2. Jointly with PPC develop full understanding of efficient scheduling of the barge, balancing storage required on the outer islands with the barge schedule to achieve lowest cost barge operation. 3. Support and facilitate requirements for storage investment as appropriate. 4. Assign competent resources including using external consultants as required.
<p>3. Fuels quality (petrol) placing unnecessary cost on consumers</p> <p>Recommendation - introduce fuel quality standards; examine scope to alter petrol quality supplied to meet fit for purpose requirements and reducing costs</p>	<ol style="list-style-type: none"> 1. Investigate vehicle fleet capability to accept lower specification petrol 2. Investigate with PPC impediments to supplying lower quality fuel specifications for vessel scheduling and loading; 3. Introduce fuels specifications appropriate to Vanuatu conditions and transport fleet. 4. Align with main fuel specifications within region. 5. Implement fuel testing and compliance framework.
<p>4. Current tank farm operation raises risks with encroachment of residential area</p> <p>Recommendation - review with PPC/Origin future capital investment to reduce risk</p>	<ol style="list-style-type: none"> 1. Engage with market participants (PPC/Origin) to develop asset integrity management plan to minimise risk (high level risk and mitigation identified in this report)
<p>5. High stock holding policies are leading to storage investment earlier than necessary to meet demand growth, causing prices higher than might be the case if the timing of new investment was better aligned to demand expansion. High stock holding policies are leading to storage investment earlier than necessary to meet demand growth</p> <p>Recommendation – examine with PPC scope for deferring storage investment (including constraints driven by UNELCO requirements)</p>	<ol style="list-style-type: none"> 1. Jointly with PPC and UNELCO examine scope for deferring storage investment taking into account current stocks, changing shipping frequency and the need to ensure efficiency of supply chain

Findings/Recommendations	Priority (1-2 years)
<p>6. Land transportation is an area where improvements in fuel efficiency can have a direct impact on costs to consumers and on Vanuatu's overall fuel import bill. The difficulty is lack of good data on Vanuatu's current vehicle fleet and systems for ensuring continued improvement in the fuel economy of vehicles.</p> <p>Recommendation - Review Vanuatu's vehicle fleet and commission a study to assess the costs and benefits of a range of policies that could improve the fuel efficiency of Vanuatu's growing vehicle fleet.</p>	<ol style="list-style-type: none"> 1. Review Vanuatu's current vehicle fleet, growth and fuel consumption projections. 2. Regularly estimate and publish projects of fuel demand across stationery and transport sector. 3. Commission a study to assess the costs and benefits of a range of policies that could improve the fuel efficiency of Vanuatu's growing vehicle fleet.

12.2 Recommendations for re-establishing a regulatory framework for petroleum and LPG sector

A) Energy security

1. **Price monitoring** – establish petroleum fuels price monitoring that meets objective of transparency, taking into account the energy security interests of the country, customer's needs for efficient safe and reliable supply and the needs of market participants as investors to maintain financially sustainable businesses investors. Regular monitoring provides assurance that prices reflect costs (including international petroleum prices) and should provide evidence of the need for regulatory intervention in the event of proof of undue use of market power resulting in excessive prices.
2. **Fuel safety stocks** – confirm minimum levels of fuel safety stocks that should be maintained, including supply chain factors that determine the levels of fuel safety stocks necessary including the appropriate balance of stocks on-shore in Vanuatu and investigating any stocks available off-shore (e.g. Fiji, Tahiti).
3. **Petroleum Emergency Response Strategy** – develop a range of demand restraint mechanisms for responding to fuels shortages and emergencies; including: publishing and broadcasting information on fuel conservation and efficiency measures and fuel rationing arrangements.

4. **Financial risk management** – Assess financial risks arising from oil price volatility, develop a risk management policy and implement a financial risk management framework enabling risk management to be undertaken by sector participants or GoV, including implementation options, extent of hedging, allocation of responsibilities, financial authorities, powers to levy, and administration.
5. **Land Transport** - review and update the Road Traffic (Control) Act 1962 to ensure all vehicles used in Vanuatu are registered and subject to regular inspection. The Vehicle Fleet data collected in the registration process should also incorporate fuel economy of vehicles.
6. **Fuel standards** – introduce fuel standards taking into account (a) future composition of Vanuatu transport fleet (b) international and regional trends (c) impact on supply chain. Develop appropriate quality testing and compliance framework.
7. **Information Gathering/Monitoring** – Regularly gather data on sector trends/statistics including fuel petroleum supply, demand projections and consumption across all sectors. These data and projections should take into account likely growth in the motor vehicle and marine fleet; population growth, economic growth; energy efficiency and any other related matters.
8. **Regulatory Framework for Control (Price)** - Determine an appropriate forward looking regulatory framework. This should include criteria for that would trigger consideration of options for reintroduction of price controls as the basis for pricing should monitoring indicate the market's failure to deliver efficient and transparent pricing. Options could include the re-establishment of the former Price Control Bureau (PCB), extending the powers of Utilities Regulatory Authority or that part of the Ministry responsible for price control in Vanuatu.
9. **Powers to levy** – In the event that a levy to fund regulatory activity is chosen, it will be necessary to provide powers to levy to cover the cost of monitoring etc.) as appropriate.

B) Environment Health and Safety

Health & Safety

10. **Review and update the Petroleum Regulations 1997** – bring up to date with international best practice in terms of licensing, safety planning, validation and verification of asset integrity and fuel handling process (including qualification/certification for installers/servicing of end consumer appliances). Where possible investigate and incorporate:
 - (i) International standards (engineering) and operating procedures used by oil companies
 - (ii) Base Vanuatu's downstream petroleum laws on the proven and effective laws in other countries.

Environment Protection

11. **Introduce Waste and Pollutions regulations under Vanuatu Environment Management and Conservation Act 2002 (EMCA)** - developing clear guidelines and regulations on the environment impacts of above ground and underground storage of fuels and site remediation. The two important regulations of EMCA for the sector are [Section 45(2a)]:
 - (i) importation and transport of dangerous goods
 - (ii) waste management

Fuels Quality

12. Fuel standards – overlaps with Energy Security above

Emergency Planning and Response (including Oil Spill)

13. **Strengthen the Disaster Risk Reduction and Disaster Management National Action Plan (2006-2016)** with the objective of incorporating Emergency Response Planning as result of oil spill, an explosion, fire, maritime disaster or accident of any kind relating to petroleum sector. Conduct regular exercise to test effectiveness of National Action Plan and the petroleum spill response plan of downstream petroleum suppliers.

C) Resourcing

13. The nature of the regulatory framework and mandates of regulatory bodies determine the human and financial resourcing required. Decisions around resourcing will need to be taken as part of determining the framework, including the level of technical resource required and extent of local capacity (and any capacity building required).

Appendix 1: Terms of Reference

Study objectives

Review existing fuel supply chain and pricing arrangements in Vanuatu and provide advice on a range of options for reducing its vulnerability to petroleum price volatility by improving the efficiency of its fossil fuel supply chains and fuel pricing arrangements.

Scope of Work

1. Sector framework:

- a) Review Vanuatu's existing petroleum product supply, demand and usage;
- b) Provide an overview of Vanuatu's existing:
 - i. legal, regulatory and institutional arrangements governing the petroleum sector; licensing and safety regulation of the petroleum sector;
 - ii. energy security policies and practices;
 - iii. petroleum sector players;
 - iv. petroleum procurement practices;
 - v. economic regulation of shipping, ports and petroleum and LPG and distribution networks;
 - vi. price regulation of petroleum and LPG.

2. Demand analysis

- a) Analyse Vanuatu's historical demand for petroleum and LPG and usage of these products.
- b) Assess how liquid fuels and LPG have historically fitted into Vanuatu's respective overall energy demand mixes.
- c) Critically review existing projections of Vanuatu's demand and usage of petroleum products, including LPG.
- d) Assess Vanuatu's potential market for additional LPG applications (e.g. LPG air-conditioning chillers for commercial buildings); what it would take to open that market and what level of impact this would have on the demand for electricity and the level of diesel consumption used for power generation.

3. Supply chain analysis

Assess the costs, frequency, efficiency and adequacy of Vanuatu's existing petroleum and LPG supply chains, from product source to final end-user:

- a) Shipping to Vanuatu and across the islands of within Vanuatu;
- b) Storage — on way to Vanuatu, and across the various islands within Vanuatu; and
- c) Distribution networks within Vanuatu — land and sea.

4. Safety and environmental risks in the petroleum and LPG supply chain

- a) Identify the safety and environmental risks along the supply chain and discuss how these are currently mitigated.
- b) Discuss existing arrangements for enforcing safety standards.

5. Capital stock analysis

Assess the existing capital stock used for fuel storage and distribution, including its age, integrity and safety relative to international standards, value, operating costs and the capital expenditures needed over the next ten years.

- a) Age of assets;
- b) Asset integrity and safety relative to international standards;
- c) Valuation of existing assets and assessment of remaining life;

- d) Appropriateness of existing storage capacity for national energy security;
 - e) Safety standards, safety training, compliance mechanisms, and safety audit arrangements;
 - f) Operation and Maintenance expenditures (Opex) associated with existing capital stock;
 - g) Projected Capital Expenditure (capex) requirements, 2012–2022, to meet needs arising from:
 - i. Increased (or reduced) demand;
 - ii. Changes in energy security policy;
 - iii. Replacement of aged assets;
 - iv. Asset replacement to meet safety standards;
 - v. Potential impacts on capex requirements arising from changes in fuel demand in the power and transport sectors, including bunkering operations.
 - vi. Potential efficiency improvements arising from a switch to using small tankers or fuel barges to supply small islands that are currently supplied using fuel drums.
 - vii. Easing shipping channel, port, wharf or storage constraints within Vanuatu.
6. **Pricing analysis**
- a) Critically review the current methodologies used in Vanuatu to set wholesale and retail prices for petroleum products including LPG. These pricing methodologies build up final prices by taking the ex-refinery prices in Singapore (or elsewhere in the case of LPG), then adding on series of margins for shipping, storage, handling, and different profit margins for wholesalers and retailers.
 - b) Review historical trends in Vanuatu’s fuel prices, decomposing the impact of the various cost supply chain cost components that affect the regulated price of fuels.
 - c) Discuss impacts of petroleum price changes on Vanuatu’s electricity and transport prices.
7. **Options for improving efficiency along the petroleum supply chain, including:**
- a) Volume discounts via demand aggregation;
 - b) Shipping;
 - c) Storage; and
 - d) Distribution network within Vanuatu.
8. **Options for improving the safety of the petroleum product supply chain**
9. **Options for managing oil price risk**, including fuel price hedging, involving a mix of contract cover and spot exposure.
- a) Provide advice on possible commercial/institutional arrangements that Vanuatu could enter into to manage its fuel price hedging, and the potential costs of entering into and managing a hedging portfolio.
 - b) Outline, at a high level, the risks, costs and benefits associated with hedging.
 - c) Investigate and assess whether there commercial or other impediments to financial hedging in Vanuatu, including:
 - i. Disincentives to hedge because changes in fuel costs can be 100% passed through by major businesses;
 - ii. A lack of understanding about risk management, hedging products that can assist in risk management, and the benefits and costs of hedging;
 - iii. Any regulatory impediments, such as restrictions on foreign exchange transactions, in particular currency hedging, or restrictions on commodity price hedging.
10. **Options for increasing the security and reliability of petroleum supplies** to and within Vanuatu, including:
- a) Diversifying the source of products, where possible;
 - b) Increasing storage capacity in parts of Vanuatu where it might be inadequate;

- c) Infrastructure planning to ensure supply meets demand and adequate reserves are held;
 - d) Shipping frequency is appropriate and timely.
11. **Options for changing the regulation of Vanuatu's petroleum sector**, so that regulations can transparently seek to strike an appropriate balance between:
 - the needs of investors for certainty, appropriate returns and financially sustainable businesses;
 - Customers' needs for efficient, safe and reliable supplies of fuel; and
 - The energy security interests of the country.
 12. Discuss packages of combinations of the various options above that are consistent and mutually reinforcing.
 13. Provide preliminary estimates the costs and benefits of each of the above individual options and sets of packaged options. Also estimate the time it would take to implement each package of options, with critical steps along the implementation path.
 14. Describe the range of business and institutional structures that would be put in place to support each packaged option.
 15. Provide high-level outlines of implementation plans for the three packages of options that provide the greatest net benefits.

Appendix 2: Current Regulatory Framework

General Licensing

There appears to be no specific licensing legislation for the downstream sector in Vanuatu. The Petroleum Regulations 1997 regulates upstream activities and issues two types of licence; a petroleum prospecting licence for the purpose of exploration, and a petroleum production licence.

The two general licensing legislations which apply to the downstream are the Business Licences Act 1998 and Customs Act 1999.

Business Licence Act 1998

The Business Licence Act 1998 is the general law for registering a business in Vanuatu, and is administered by the Vanuatu Customs and Inland Revenue under the Ministry of Finance. All businesses are required to register and obtain a business licence. Licences are issued for a period of 12 months which expires on the last day of December of the year of issue and can be renewed. The business licence is specific for categories of business activities specified in the licence, and is issued subject to the regulations and conditions endorsed on the licence.

To obtain a business license the applicant needs the following documents:

- Vanuatu Investment Promotion Authority (VIPA) approval certificate [applicable only to Non-Citizen Investors]
- Vanuatu Financial Service Commission (VFSC) business name certificate/certificate of incorporation [only required if business trading under a name or being a legal entity]

The two major fuel companies, Pacific Petroleum and Origin Energy, are obliged to have standard business licenses covering the specific categories for importing, wholesaling and retailing but licensing requirements specifically for fuel importation and distribution do not appear to exist.

Customs Act 1999

Bonded warehouse licences are issued under Section 41 of the Customs Act 1999. The Director of Customs can approve a premise, building, an enclosure or a storage tank as a private or public bonded warehouse for the deposit and storage of imported goods without payment of duty and tax subject to conditions specified in the approval. Each facility is required to pay processing fees of 20,000 Vatu and annual licence fees of 260,000 Vatu. The licence holder also provides a bank guarantee to Vanuatu Customs for the equivalent value of duty and tax in the bonded facility at any point in time.

Pacific Petroleum's facilities in Vila and Santo Terminal are bonded warehouses. Excise and import duty is paid as the fuel is removed from the tanks. These licences are renewed annually. Origin Energy is not required to have a bonded warehouse licence as LPG is exempted from import duty and excise.

Environmental Health and Safety

There is no specific environmental law covering the existing downstream sector in Vanuatu. However there are three environmental protection laws that make general references on environmental activities and pollution in Vanuatu:

- Environmental Management and Conservation Act 2002

- Public Health Act 1994
- Health and safety at Work Act 1987
- Water Resources management Act
- Maritime Act Cap [131] repealed

Vanuatu Environmental Management and Conservation Act 2002

The Environment Management and Conservation Act (EMCA) provides for the conservation, sustainable development and management of the environment of Vanuatu and the regulation of related activities. The Act is primarily focussed on three areas: developing environmental instruments, environmental impact assessment, and biodiversity and protected areas. The Minister may make regulations for the purpose of mitigating environmental effects such as waste management, however to date no such regulations have been gazetted.

Environmental instruments under the Act include:

- Establishment and operation of a registry of all records of activities including licence permits, national polices and reports.
- Preparation of National State of the Environment Reports
- Development of National Policies and National Plans.

To date only Part 3 of the Act, which deals with Environmental Impact Assessments (EIA), has been implemented. Any Ministry, Department, Government Agency, local government or municipal council that receives an application for any project, proposal or development activity, which is not exempted, must undertake a preliminary EIA (Section 14).

To date the Environment Unit has not developed a comprehensive Environmental Policy. A state of the Environment Report is to be tabled this year required by under EMCA 2002. The Environment Unit is not a fully-fledged department and has only four professional staff members.

Public Health Act 1994

Vanuatu has no existing legislation regulating waste management. Instead, the Public Health Act provides the basic requirements for sanitary systems for all dwellings in rural and urban areas. This is lengthy legislation with 130 sections and provides for public health in Vanuatu including prohibition to pollution of water resources and regulation of adequate sanitary systems. The Act comes under the general administration of the Minister of Health. The Minister can request any local authority to act as an agent for the government pursuant to the provisions of this Act.

The provisions relevant to the petroleum sector include:

- Protecting water supplies used for human consumption;
- Pollution of all watercourses including ground water;
- Littering on the foreshore, estuary and harbour; and

A person knowingly and wilfully defiling or polluting any water-course, stream, lake, pond, or reservoir is guilty of an offence and liable to a fine not exceeding Vatu 1,000,000 or to imprisonment for a term not exceeding 5 years (or both).

Health and Safety at Work Act 1987

This Act provides for the health, safety and welfare of persons at work in Vanuatu. Administration falls to the Department of Labour and Employment Services (DoL), a part of the Ministry of Internal Affairs. Sections 8(1) provides the Minister with powers to prescribe regulations but to

date there has been no regulations introduced to control dangerous goods and there are no licensing requirements focussed on dangerous goods in workplaces.

DoL inspectors undertake regular inspections of workplace and encourage constant safety and health inspections to ensure workers are assured of their protection against work hazards. However, the inspectors lack training on hazardous substances, necessary regulations and code of practise that can guide inspectors in performing their duties.

Pacific Petroleum states that they operate under international standards for petroleum storage and handling and their insurance companies require annual independent safety audits of their facilities and safety processes. Similarly Origin Energy operates under the standards set by the LPG Australia. In summary, the model for ensuring compliance with safety standards appears to be one of self-enforcement by the oil and gas companies under the oversight of internationally accredited and independent auditors.

Water Resources Management Act 2002 (WRMA)

This Act provides for the protection, management and use of water resources in Vanuatu. The Minister responsible appoints the members to the National Water Resources Advisory Committee and can gazette Water Protection Zone under WRMA. Petroleum facilities would need to comply with WRMA requirements if the facility is located in the water protection zone.

Maritime Act Cap 131 (No.8 of 1981 & 36 of 1982)

The Maritime Act has been repealed and the functions of the Act have been delegated as follows:

- The Vanuatu Ports Authority is responsible for carriage of goods at sea and administration of ship wrecks, salvages and regulating shipping Act CAP 53.
- The Vanuatu Police Maritime wing is responsible for search and rescue (SAR)
- The Ministry of Finance is responsible for maintaining the ship registry.

It is not clear how, if at all, Vanuatu's commitment to any international treaties governing environmental protection for maritime activities is incorporated into the regulatory framework.

Energy Supply

There are three areas regarding energy legislation which have limited relevance to the petroleum supply including:

- Petroleum Regulations 1997
- Electricity Supply Act (No 17 of 1971 and 21 of 2000)
- Utility Regulatory Authority
- Geothermal Energy Act 1987

Petroleum Regulations 1997

The Petroleum Regulations 1997 regulates upstream activities only. The administration of this act falls under the Ministry of Lands and implemented by the Department of Geology, Mines & Minerals.

Electricity Supply Act (No 17 of 1971 and 21 of 2000)

The Electricity Supply Act provides for matters connected with the generation and supply of electricity at Port Vila, Luganville and other areas of Vanuatu. The Minister responsible for power, on behalf of government of Vanuatu, can enter into an agreement granting a person the sole concession for manufacture and supply electricity with Port Vila, Luganville and related areas for a specific period of time. The company that receives the concession is then responsible for generating and selling including maintaining power lines. The administration of the Act falls under the Ministry of Lands and is implemented by the Department of Energy. The department is staffed by four permanent and three temporary project staff.

The Electricity Supply Act does not specify how the concessionary will manufacture electricity or whether renewable or non-renewable energy sources will be used for generation of electricity.

Utilities Regulatory Authority Act (Act no. 11 of 2007)

Under the Utilities Regulatory Authority Act 2007 the authority controls electricity and water services, including price. Its authority does not extend to petroleum products.

The purpose of the Act is to ensure the provision of safe, reliable and affordable regulated services; and maximise access to regulated services throughout Vanuatu. Responsibility falls under two ministries, Ministry of Infrastructure and Public Works Utilities in respect to water and Ministry of Lands with respect to electricity. The functions of the Authority are:

- Provide advice, reports and recommendations to the government relating to utilities
- Inform the public of matters relating to utilities
- To assist consumers to resolve grievances
- Investigate and act upon offences.

Geothermal Energy Act 1987

The Geothermal Energy Act No.6 of 1987 [CAP.197] regulates the exploitation of geothermal energy. Geothermal energy is derived from within the ground by natural heat. The responsibility for the implementation of this Act falls under the Ministry of Geology and Mines. Geothermal energy is covered in the energy road map and hence it is not discussed in this report.

Infrastructure (shipping, ports etc)

Maritime Act (Cap 131)

The Maritime Act has been repealed and the functions have been split between the ports and harbour, Ministry of Finance and the Maritime police.

Ports Act 1957

Port Vila and Santo are the only ports of entry for Vanuatu and masters of all vessels entering Vanuatu from foreign ports report first to the customs authorities at either port. All vessels leaving Vanuatu for foreign ports have to clear from the ports. The Ports Act requires any vessels carrying dangerous goods to seek permission from Harbour Master before berthing at the wharf (Section 17).

The Act also specifies port levies and charges. The following sections of the legislation state type of charges:

- Section 27: Government wharves and purlieus.
- Section 28: Vessels to obtain permission to berth at Government wharf.
- Section 29: Tonnage dues paid on vessels berthed at a Government wharf, tonnage and berthing dues according to a scale prescribed by Order.
- Section 30: Wharfage charges paid in respect of all goods and produce loaded or discharged at a Government wharf.
- Section 31: Port charges paid in respect of goods and produce loaded or discharged in a port, other than at a Government wharf, such charges as may be prescribed by Order.

The operation of the two commercial ports has been contracted out to the private sector on a concessional basis. Port Vila has three wharves. The main wharf takes international cargoes and cruise ships; the Ports Authority owns it but contracts out all services to a private company, Ifira Wharf and Stevedoring. There are two domestic wharves: one owned outright by Ifira, which operates it as a commercial enterprise, and one owned and operated by the private sector. The Espiritu Santo port is owned by the Ports Authority but operated by the Northern Islands Stevedoring Co. (NISCO).

Petroleum products are received at the main wharf of Port Vila and Santo. During our consultation with the Ports and Harbour department we were advised that the ports dues fees and charges order 14 of 1992 is currently under review and new charges are expected to be gazetted upon approval from cabinet.

Economic regulation

Price Control Act 1974

Petroleum products were under price control until 1989⁶⁵, when the Price Control Unit ceased to perform its duties and was transferred from Ministry of Finance to Ministry of Internal Affairs in 1988⁶⁶. Later it was transferred to the Ministry of Trade and Industries and eventually abolished in May 1989. After this time the marketers of petroleum have set the fuel price.

The Energy Unit has been monitoring petroleum prices although due to lack of staff and expertise the office is unable to validate the retail price against benchmark prices. The Vanuatu Customs and Inland Revenue Department monitors the imports of petroleum products for the purpose of collecting duty, excise and value added tax.

Vanuatu Financial Services Commission Act No. 35 of 1993

The VFSC Act was enacted to establish an independent body, the VFSC responsible for supervision of financial business in Vanuatu. The main function of VFSC is to operate an effective and efficient business register. It also promotes the industry overseas and protecting its reputation from undesirable business persons.

Emergency Management

National Disaster Act 2000

The National Disaster Act is the main law for emergency management in Vanuatu, and it is administered by the National Disaster Management Office. This Act establishes the National

⁶⁵ Pacific Regional Energy Assessment Report 2004 (SPREP) Vanuatu National Report Volume 16. Page 10.

⁶⁶ Information provided by Mr Leo Moli, Director of Energy dated 4th May 2012

Disaster Committee, National Disaster Operations Centre and that National Disaster Management office with its Director.

Under the Act, disaster means an actual or imminent occurrence of one of the following:

- An earthquake, tsunami, cyclone, storm, flood, volcanic eruption, drought, bush fire or other natural happening;
- An explosion, fire, oil spill, chemical spill, air disaster, maritime disaster or accident of any other kind;
- An infestation, plague or epidemic being an occurrence that;
- Endangers or threatens to endanger, the safety or health of people in Vanuatu; or
- Destroys or damages, or threatens to destroy or damage, property in Vanuatu.

For the downstream petroleum sector, the first two above mentioned disasters are most relevant.

Land Transport

Road Traffic (Control) Act 1962

The Road Traffic Control Act was introduced to register all vehicles and set conditions for both the driver and type of vehicle used on the roads of Vanuatu. The act has established an annual registration process for all vehicles, third party insurance and driving licences.

In order to issue an annual registration all vehicles must undergo an inspection (certificate of road worthiness) issued by a reputable vehicle inspection garage. The Public Works Department is responsible to approving an inspection garage that can then inspect vehicles in Vanuatu.

Foreign and government owned vehicles are exempted from payment of registration and annual tax. The implementation of the Act is limited to Port Vila, Santo and Tanna. It is not clear how the Act is implemented in outer islands.

The administration of the Act is shared between the following:

- The Director of the Department responsible for public works authorise officers/garages to examine vehicles for annual road worthiness.
- The Director of Vanuatu Customs and Inland Revenue collects annual tax.
- Vanuatu police is responsible for issuing driving licence and investigate breach of any conditions of the Act

Energy security policies and practices

The government of Vanuatu does not have an energy security policy (UNELCO has a minimum sixty day stock holding requirement with Pacific Petroleum). This minimum stock requirement is stored in PPC tanks on its Port Vila storage terminal.

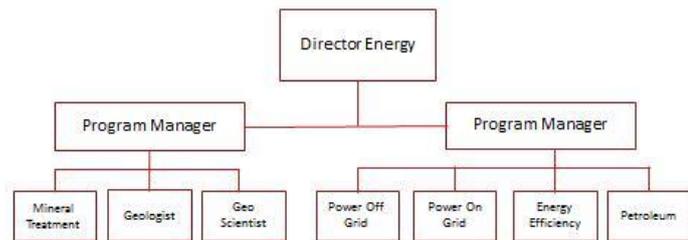
Petroleum procurement practices

There are no known regulation or government policies for procurement of petroleum products. The Department of Energy has tendered for fuel supply for government use in the early nineties but currently all fuel is purchased from services stations for government purposes. The GoV has no control on procurement practice for either Pacific Petroleum or Origin energy.

Institutional Arrangements

A Council of Ministers' policy decision in 2009 approved a major restructuring within the Department of Geology, Mines, Minerals & Water Resources and the Energy Unit. A new department structure was approved by the Public Service Commission in September 2011. This restructuring meant that sections of Geology, Mines & Minerals amalgamated with the Energy Unit which is now known as Department of Energy, Mines & Mineral Resources. The department is now under the Ministry of Lands & Natural Resources and is responsible for identification, implementation, management and evaluation of energy projects, monitoring energy activities, administering mining, quarrying, petroleum and geothermal activities as well as mineral and research developments in Vanuatu (see organisation chart).

Energy Organisation Chart



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Appendix 3: Comparison of World Bank 1992 and SPREP 2004 report findings

World Bank 1992 Report	SPREP 2004 Report
<p>Energy Sector constraints</p> <ul style="list-style-type: none"> ■ Fragmentation of energy supply/consumption due to smallness /isolation. ■ Small size market for commercial energy. ■ Government's shortage of manpower and expertise. ■ Government' financial constraints. ■ Dominant and largely unregulated energy suppliers (both petroleum companies and electricity) 	<p>Energy Sector constraints</p> <p>Economic growth faster than population.</p>
<p>Improvement</p> <ol style="list-style-type: none"> 1. Improvement using contractual and regulatory tools - competition & cost information on petroleum. 2. Strengthen government expertise and skilled human resources in petroleum & electricity. 	
<p>Total Energy Consumption</p> <ul style="list-style-type: none"> ■ Total = 57 mtoe ■ 70% biomass based fuels. ■ 25% petroleum for transport &electricity (26.59 mtoe). ■ 5% others & renewables 	<p>Total Energy Consumption</p> <ul style="list-style-type: none"> ■ 50% Biomass ■ Petroleum imports 2003 = 47 million ■ LPG =1300 tonnes ■ Solar & Hydro 1%
<p>Energy Supply</p> <ul style="list-style-type: none"> ■ Importers -BP, Shell & Mobil (Petroleum), Boral - LPG ■ Source: Australia and Singapore. ■ Ports: Vila (70%) and Santo (30%). ■ LCT from Fiji & New Caledonia. ■ Increase of 3-6 vatu per litre in CIF. 	<p>Energy Supply</p> <ul style="list-style-type: none"> ■ BP, Shell & Mobil ■ Origin Energy sole supplier of LPG. ■ Source: Singapore (petroleum), LPG (Australia). ■ LCT from Fiji & New Caledonia
<p>Storage facilities</p> <ul style="list-style-type: none"> ■ Covers three months demand. ■ BP and Mobil own terminal. ■ Shell share with Mobil. ■ BP owns aviation equipment and share with Shell on both Islands. ■ Separate LPG Port Vila and Santo owned by Boral. ■ Government owns its own storage for Petrol and ADO on Port Vila, Luganville, Malakula and Tanna. 	
<p>Distribution</p> <ul style="list-style-type: none"> ■ Service stations on Vila and Santo owned by 3 oil companies. ■ Outer islands supplied by local dealers - transport in 200L steel drums (empty drum a problem) 	<p>Distribution</p> <ul style="list-style-type: none"> ■ Outer Islands supplied via drums.

<ul style="list-style-type: none"> ■ LPG retailing managed by Boral and Speed-e-Gas, a subsidiary of Boral. ■ Large consumers like UNELCO supplied on bulk contracts. ■ Government's own use (17% of total imports) & procured on basis of international competitive bidding assisted by Pacific Energy Development fund (Mobil won both two year contract). 	
<p>Energy consumption by sector</p> <ul style="list-style-type: none"> ■ Domestic sector 46% energy consumption (95% is biomass, 3% Petroleum, 2% electricity). ■ Agriculture - 26% energy majority via biomass for crop drying. ■ Transport Sector - 21% of total energy exclusively petroleum products. (ADO 60%, Petrol 43%, aviation 4% and lubricants 2%). ■ Transport sector energy consumption increased by 70% since 1983. ■ Commercial/industrial Sector. 7% of total energy, using 2.3 mtoe via petroleum products. ■ - 2% increase from 1983 	
<p>Petroleum Demand</p> <ul style="list-style-type: none"> ■ Transport sector 68% of total imports= 18.22 million litres. [56% of ADO = 8.72 ML, 100% Petrol = 4.09, Jet & avgas 5.41 ML]. ■ Electricity 23%. ADO imports = 6.11 ML. ■ Industrial /commercial 5%. ■ Household 4% ■ LPG imports 1.28 ML (4%). 	<p>Petroleum Demand</p> <ul style="list-style-type: none"> ■ Transport sector 64% of total imports= 18.22 million litres. [56% of ADO = 8.72 ML, 100% Petrol = 4.09, Jet & avgas 5.41 ML]. ■ Electricity 30% of ADO imports = 10.6 ML. ■ Industrial /commercial 4%. ■ Household 4% ■ LPG imports 1.55 ML (included in household & commercial)
<p>Demand Forecast</p> <ul style="list-style-type: none"> ■ GDP - 2-2.5% ■ Transport - ADO 5% over 10 years ■ Petrol, LPG, Avgas and Kerosene will follow anticipated GDP grow at 2-2.5%. ■ Jet will grow at 3% ■ 1990 = 32.34 ML ■ 1991 = 33.58 ML ■ 1995 = 39.17 ML ■ 2000 = 47.61 ML 	<p>Demand Forecast</p> <ul style="list-style-type: none"> ■ Population growth @ 2.6% ■ GDP growth @2.8%. ■ Petroleum growth 3.5% ■ Assumptions: No major technological changes or investment in energy sector
<p>Petroleum prices</p> <ul style="list-style-type: none"> ■ Government abolished price control in May 1989. 	<p>Petroleum prices</p> <ul style="list-style-type: none"> ■ No change

<ul style="list-style-type: none"> ■ Marketing and retailers are free to set prices. ■ Price structure prior to 1989 ■ CIF ■ Duty (Petrol 32 VUV/L, ADO12 VUV, Kero 8 VUV, LPG 17 VUV/kg). ■ Service Tax 5 VUV/L ■ Wholesale - Petrol VUV80.5/L ■ ADO VUV61.50, kero 65.50 ■ Retail Petrol VUV87.70, ADO 67, Kero 70.4, LPG 164/kg. 	
<p>Factors affecting price</p> <ul style="list-style-type: none"> ■ Crude + Freight cost. ■ Port Vila Channel not deep enough to receive bigger Tanker. ■ Steel drums to outer island =15% product loss and 20% on empty drums. Increasing cost 20VUV/L ■ Secondary freight via LCT = additional cost of VUV80-100 Million per year 	
<p>Policy/Institutional Issues</p> <ul style="list-style-type: none"> ■ Electricity pricing agreement allows all cost to be passed to consumers so no incentive to achieve efficiency. ■ Petroleum wholesale margin increasing steadily. ■ Relocation of storage facilities to port accessible to larger vessel. ■ Petroleum exploration. ■ Lack of Environmental regulation to deal with storage, handling and disposal. ■ Three companies, small import volume constrained by demand 	<p>Policy/Institutional Issues</p> <ul style="list-style-type: none"> ■ No tax incentive provided to blend fuel with coconut oil. Diesel fuel is duty free. ■ Lack of transparency on exemption of duty and taxes. ■ No National Energy Policy. ■ No up to date Energy Act. ■ Energy Unit has limited authority and lack staff and finance. ■ Small manufacturing capacity
<p>Petroleum Sector Priority</p> <ul style="list-style-type: none"> ■ Petroleum Exploration ■ Petroleum transport cost reductions (either relocate or construct a pipeline from deeper harbour to current storage). ■ Public sector investment and trial for fabric container distribution in outer islands. ■ Energy unit staffing - Petroleum cost analyst. 	

Appendix 4: Proposed Monthly fuel price monitoring

The Ministry responsible for monitoring fuel price in Vanuatu can use the following pricing instruments and data sources to help re-establish a monthly price monitor. An example of the fuel price monitor can be found on the New Zealand Ministry of Business Innovation and Employment website⁶⁷ that monitors weekly oil prices and import margins.

Fuel cost component	Suggested pricing instruments based on market practise in the region	Data Source/Comments
Base Price	Review monthly price by averaging Singapore Mean of Platts (MOPS) published prices.	Platt's daily published prices for Gasoline 97 RON (Unleaded Petrol), Jet/Kero, Gasoil 50 & 5000ppm sulphur (Diesel)
Product Quality Premium	Reviewed annually based on supply contract. H&T estimates based on 2011 average Platts benchmark premium: <ul style="list-style-type: none"> ■ Petrol = USD3.50/bbl ■ Kerosene/Jet A1 = USD 0.05/bbl ■ Diesel (50ppm) = USD 1.20/bb ■ Diesel (5000ppm) = USD 0.50/bbl 	H&T assumptions are based on similar premiums used in New Zealand and Pacific market.
Ocean Freight	<ul style="list-style-type: none"> ■ Worldscale flat rate published rates for 3-4 port discharge (Singapore/Tahiti/ Vuda/Vila) ■ Singapore to Australia quote as Worldscale benchmark freight marker for Vanuatu with an adjustment factor of 15 points. 	Typically Platts based escalation (Sing-Australia) used but may be differences in approach (number of ports assumed, notional Worldscale voyage used).
Insurance	Assume a percentage of cost plus freight. H&T recommends an Insurance 0.05% of Cost + Freight	Difficult to access market rates because participants self-insure. In regulated market participants provide copy of supply agreement to validate insurance cost.
Ocean losses	Ocean losses are based on a percentage landed cost. H&T recommends 0.30% of landed cost	0.2% should be operationally achievable; above 0.4 % is excessive.
Exchange rate	Monthly average commercial bank exchange rate used by the supplier	Commercial exchange rate available has wide buy/sell spread.
Demurrage	Demurrage USD0.25/bbl (H&T estimate). Vanuatu port requirements for berthage and discharge will affect demurrage	Demurrage is charges by ship owner to the oil company chartering the ship if they do not discharge the cargo in time allowed in the agreed charter party.

⁶⁷ <http://www.med.govt.nz/sectors-industries/energy/liquid-fuel-market/weekly-oil-price-monitoring>

	charge.	Supplier can provide actual demurrage paid to shipper for verification.
Wharfage	<ul style="list-style-type: none"> ■ Wharfage = 395 Vatu per tonne published on the dues, fees and charges order no. 14 of 1992. 	Vanuatu Port dues fees and charges published order.
Government duty (Calculated on landed cost)	Petrol: 15 VUV/L Avgas, Jet and Kero: 5% Diesel :20 VUV/L	As Vanuatu Customs annual duty rate
Government Excise (Calculated on landed cost)	Petrol: 20 VUV/L Avgas, Jet and Kero: 4 VUV/L Diesel: 15 VUV/L	As Vanuatu Customs annual excise tax rate
Distribution Cost	2011 - Distribution cost = VUV 470 million (Volume 53 ml litres giving 8.96 VUV/L estimate)	The distribution cost is based in operating expenses and transportation cost within Vanuatu. The cost per litre is calculated cost using operating expenses incurred in last financial year divided by volume. This information is provided by the supplier can be verified by audited financial report.
Return on investment	H&T estimate approximately 11 VUV/L based on: <ul style="list-style-type: none"> ■ VUV 2,187 million assumed asset value ■ 20 average debtor days ■ 72.5 average net stock days and 17% estimated return of assets	Return on investment is currently set by PPC and can be verified with audited financial report and stock reconciliation. H&T estimates are based on combined cost of PPC Port Vila and Santo terminals.
Retailers Margin	10-15 VUV/L ⁶⁸	H&T estimate based on discussion with PPC and retailers.
Value Added Tax (VAT)	12.5%	Set by Ministry of Finance and VAT is collected by the Vanuatu Customs and Inland Revenue.

⁶⁸ Larger retailers get larger retail margin. Assumed average of 12.5 VUV/L in analysis.

LPG Price regulation parameters

LPG cost component	Suggested pricing instruments based on market practise in the region	Data Source/Comments
Base Price	Quarterly review average monthly Saudi CP Propane (Port Vila) and Butane (Santo) prices	Saudi Contract Price (Saudi CP)
LPG Brisbane premium	Yearly negotiate premium on LPG	LPG premium freight market is not transparent and there are no international freight benchmarks to assess it against. This report analyses LPG rates based on estimates of time charter rates, fuel costs and port costs although for small drops such as Vanuatu this is approximate as it depends how the supplier allocates costs between the ports on a multi-discharge voyage.
Freight (cost to transport to Vanuatu)	Quarterly review freight rate based on data supplied by shipper and market assessment.	
Exchange Rate	Monthly average commercial bank exchange rate used by the supplier	Commercial exchange rate available has wide buy/sell spread.
Wharfage	Wharfage = 395 Vatu per tonne published on the dues, fees and charges order no. 14 of 1992.	Vanuatu Port dues fees and charges published order.
Government duty and excise tax	Zero	As Vanuatu Customs annual duty and excise tax rate
Distribution Cost	Total operating cost of 135,829,313 VUV (2011) or 78 VUV/kg	The distribution cost is based in operating expenses and transportation cost within Vanuatu. The cost per kilogram is calculated cost using operating expenses incurred in last financial year divided by volume. This information is provided by the supplier can be verified by audited financial report.
Return on investment	This report calculated ROI of 22%	Return on investment is currently set by Origin Energy and can be verified with audited financial report and stock reconciliation.

Retailers Margin	30-35 VUV/kg	The estimate based on discussion with LPG retailers.
Value Added Tax (VAT)	12.5%	Set by Ministry of Finance and VAT is collected by the Vanuatu Customs and Inland Revenue.

Appendix 5: Tax revenue from duties

Table 34: Tax revenue from petroleum fuel import duties and excise, 2007-2010

Year	Fuel tax revenue by tax type, excluding VAT (Vatu million)			Total recurrent revenue (Vatu million)	Fuel taxes (excl VAT) as a % of total recurrent revenue		
	Motor Spirit Import Duties	Excise Motor Spirit	Total Import Duty and Excise on Motor Spirit		Motor Spirit Import Duties	Excise Motor Spirit	Total Import Duty & Excise on Motor Spirit
2007	683.9	-	684	11,041	6.2%	0.0%	6.2%
2008	607.3	-	607	12,659	4.8%	0.0%	4.8%
2009	758.1	-	758	12,290	6.2%	0.0%	6.2%
2010	244.9	616.8	862	12,021	2.0%	5.1%	7.2%

Source: Vanuatu Ministry of Finance.

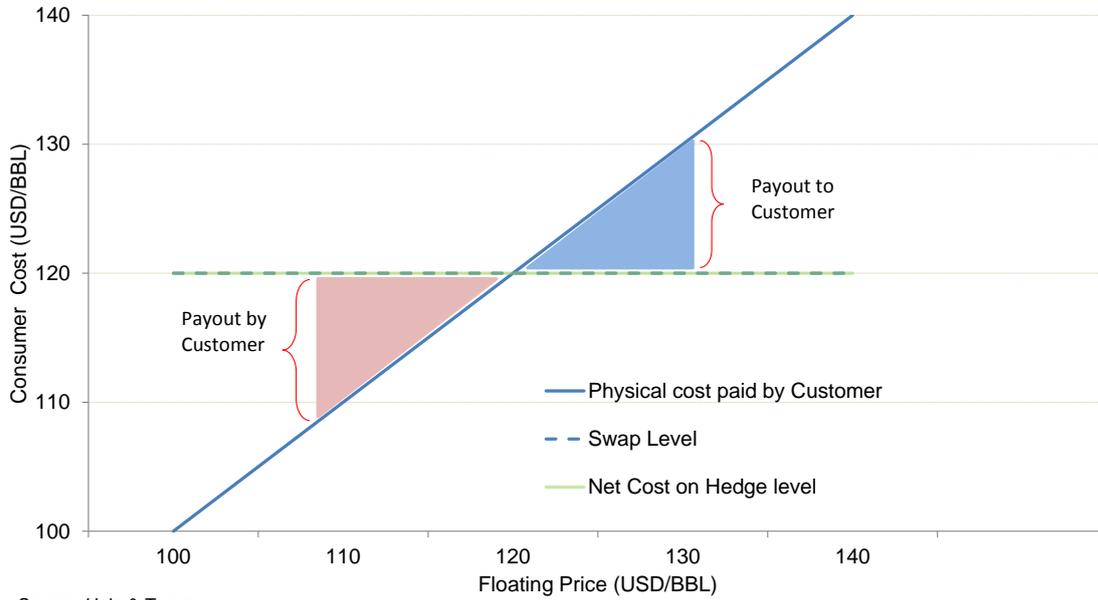
Table 35: Vanuatu petroleum fuel prices, retail and for power generation, Mar 2010-Mar 2011

Month	Retail prices of petroleum fuels (VUV/L)			Wholesale diesel for power generation (VUV/L)	LPG prices (VUV/kg)		
	Petrol	Kerosene	Diesel		Diesel	Commercial	Domestic
Mar-10	130	151.11	118.22	84.83	284	293	227
Apr-10	130	151.11	118.22	85.79	284	293	227
May-10	130	151.11	118.22	87.08	302	311	240
Jun-10	130	151.11	118.22	87.72	302	311	240
Jul-10	130	151.11	113.78	88.59	302	311	240
Aug-10	130	151.11	113.78	91.05	302	311	240
Sep-10	130	151.11	113.78	89.72	302	311	240
Oct-10	130	151.11	113.78	90.68	302	311	240

Nov-10	130	151.11	113.78		90.82		302	311	240
Dec-10	130	151.11	130.67		90.63		338	347	271
Jan-11	130	151.11	130.67		89.87		338	347	271
Feb-11	134	151.11	135.11		92.35		338	347	271
Mar-11	140	151.11	139.56		93.16		338	347	271

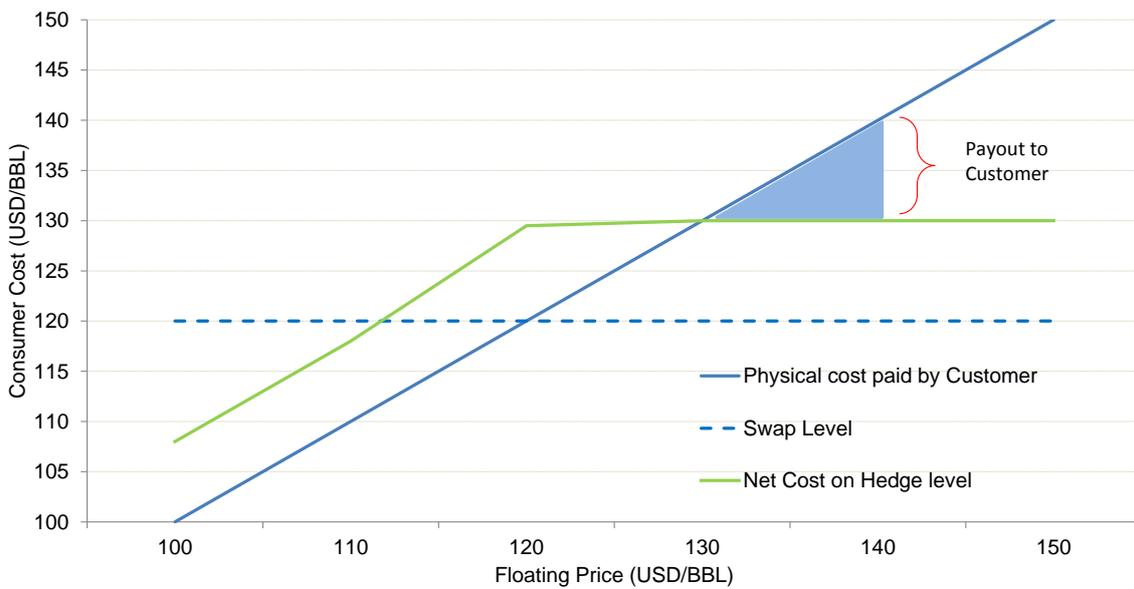
Appendix 6: Hedging Models

1. Fixed Price



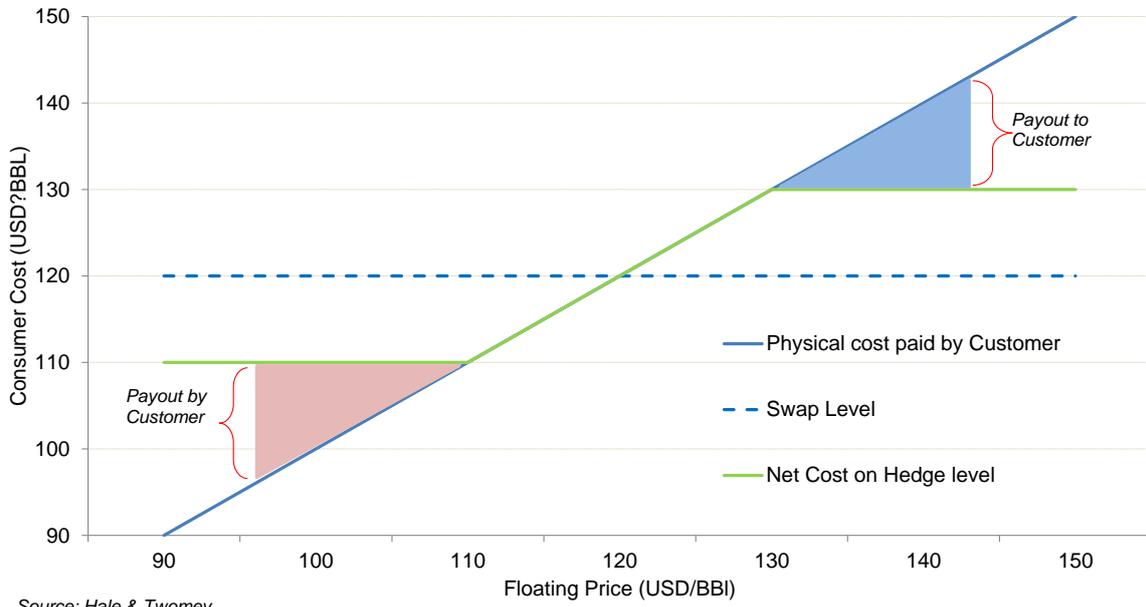
Source: Hale & Twomey

2. Cap



Source: Hale & Twomey

3. Zero Cost Collar



Source: Hale & Twomey

Appendix 7: Economic Regulation

Competition is the principal economic regulator of most economies most of the time. Competition can be:

1. For the market (where alternative suppliers compete to be the only supplier to the market (i.e. a legally protected monopoly));
2. In a market (where prices and quality of goods and services are determined by many suppliers offering goods and services for sale to willing buyers); and
3. The threat of competition (this can be as effective as actual competition if there is no competition at present, but no legal barrier to competition entering the market).

With competition, if profits arising from transactions are substantially greater than costs (including the cost of capital and a reasonable profit) they are competed away. The result of competition is lower prices (and enhanced service) to the benefit of the final consumer. However, in industries with high entry costs or declining average costs and in small markets like Vanuatu's oil and gas sector, duplicated facilities only add costs. In these cases regulation can help achieve some of the benefits of competition.

Regulations can be of various kinds. Broadly, there two types behavioural and structural:

1. Behavioural regulation: uses the law to constrain commercial behaviour with regulations stipulating price caps or other economic criteria;
2. Structural regulation: constrains commercial behaviour of competitors by a market design such as ownership separation between different market segments: wholesale and retail or between facilities and services.

The simplest form of behavioural regulation is a price cap that sets a limit on price increases. Alternatively, regulated profits or rates of return on an asset base can set prices that allow a specified rate of return on the company's capital. Highly sophisticated models can define an agreed capital base, rates of return and regulated prices or these can be arrived at by benchmarking against other industries or markets. Benchmarking provides a basis of comparison for regulation, but sometimes price caps are arrived at by informed guesswork.

Behavioural regulation may focus on the variable authorities wish to control, namely the retail price. A good regulator can facilitate a consensus on what is fair and reasonable, reassure consumers they are getting a good deal and this form of regulation is employed in many places. However, disagreement with decisions may result in litigation, the process may create costly delays, a rate arrived at by consensus may be similar to a market determined rate. Regulated rulings tend to be on the upside (compensating for costs, delays) and consumers pay and may discourage new investment or keep inefficient suppliers in business.

Structural regulation focuses on market segmentation. It encourages sharing expensive infrastructure allowing more intensive use, lowering costs and prices. It often involves discouraging vertical integration of businesses (allowing retail competition from a single supplier). With cost elements subject to disclosure or negotiation, transparency is increased and reduces the need for day to day regulatory involvement. On the other hand, suppliers may be less familiar with this approach than with well managed price regulation, loss of vertical integration may make raising capital more expensive or difficult.

There are examples of these options in the various Pacific countries, individually or in combination. Cross country comparisons are inexact as there are always factors unique to each country. Samoa for example uses competition for the facilities market. The Government owns facilities and

operation and supply are tendered every 5 years. Competition for the market does bring competition benefits and maximises opportunities for reducing costs. However the government is liable for capital and operating costs meaning the model may not be easily reproducible or transparent. New tenderers operate at a big disadvantage.

PNG uses behavioural regulation in a partly competitive market. There is a regulated monopoly for upstream activity (only one refiner operates) and all wholesalers supply the market via the refiner. Downstream (retail prices) are regulated. PNG uses a consultation process for regulatory decisions in a transparent process and it appears to have support from the industry, maybe indicating a small impact on final prices. PNG has the largest population in the Pacific so there is some scope for declining costs as the market expands. However, its system is highly dependent on political commitment to independence and good quality regulation.

Fiji has a similar system but there the lack of transparency undermines the process. Tonga has a process similar to Fiji and the process is more transparent. The Solomon Islands does have competitive supply and regulated prices are gazetted on 1st of each month. There is acceptance in Tonga and the Solomon Islands that prices derived are fair and acceptance may indicate a lack of impact. In New Caledonia there is competition at wholesale level with 3 suppliers, although prices are regulated with monthly revisions of wholesaler and retail margins. Similar methods are used in the other French territories. Although consumers have assurance of fair treatment, controls may stifle new initiatives and keep inefficient operators in business.

In Vanuatu we have a private monopoly not subject to price regulation. However the suppliers have been active investors in improving the market and facilities. Our analysis indicates that cost savings from efficiency gains have been passed on. Regulation is already applied to Vanuatu's electricity and telecommunications. However, we need to identify shortcomings in the petroleum and LPG sector that might call for regulation before concluding regulation is required.

Appendix 8: Model Structure

A full product supply chain and financial model for Vanuatu has been prepared as part of this work. This model draws on data from Vanuatu Customs and Inland Revenue Department, Vanuatu National Statistics office (VNSO), Pacific Petroleum Company, Origin Energy, UNELCO and Author's knowledge of Pacific oil markets. A high level summary is outlined below.

Base Information

For the model to be able to accurately estimated future supply, demand and price requirements for given scenarios, a good understanding of the current situation is required. The initial part of the model focuses on getting accurate picture of each of the product by islands of Vanuatu. To do this a supply demand balance is achieved by reconciling demand, imports and re-exports (international bunkering). The data collection mechanisms and method of analysis was discussed with World Bank and the layout of model was submitted in the inception report.

This section of the model also assesses impact of duties and taxes charged imposed by government on fuel and the estimated profit and loss of Pacific Petroleum. The data is reconciled with petroleum retail price and collection of revenue from government.

From this data the model is able to determine government revenue generated from projected demand and the consumer price for each product.

Future situation

This part of the model allows a future base situation to be set. Changes could include demand growth or decline (by product), crude price of petroleum products, foreign exchange rate, freight cost and return on investment. With these conditions set the model then determines government revenue generated from fuel and the consumer price (vatu/ litre).

Scenarios

Stepping off from the future situation (as defined above) the model allows further changes to be made on the impact of these compared. Similar to the future situation, changes can include demand growth or decline (by product), increase or decrease in crude price and number of ports allocated for discharge of fuel.

Freight cost and Stock impact

The final part of the model assess the potential tank investment required arising from changes in fuel demand and aligning shipping from 3 or 4 port discharge to 1 or port. This draws on the valuation of Pacific Petroleum Infrastructure to assess the return on investment and stock holding with future stock holding levels (both for the future and the scenario) determined from the terminal storage and the type and size of product shipping used.

Addendum: Approach to Feedback following Draft Report Consultation

An Executive Summary and PowerPoint Presentation of this report were submitted to the World Bank on 17th September 2012. Mr Tendai Gregan, Energy Specialist of the World Bank presented the findings of this study to the Vanuatu Energy Taskforce (ETF) meeting on 17th September 2012.

Face to face consultations were also held with market participants, PPC and Origin Energy, and government officials from 24th through to 27th of September 2012. This was followed by circulation of the draft report on 10th October 2012 to ETF, PPC and Origin Energy for comment by 16th October 2012. Written comments were received only from Origin Energy and PPC.

Mr Randell Vallete, Director of PPC, in an email dated 16th October raised two concerns:

- Stock holding requirement for UNELCO power diesel (Section 6.2.5 & 10.2) is part of a commercial supply agreement hence any savings from holding lower levels of stock would require renegotiation of the agreement.
- Assurance that commercially sensitive or confidential data and information contained in this report is not released to potential competitors.

Regarding the first concern our Recommendation 5 simply suggests that PPC and UNELCO jointly examine the scope for deferring storage investment taking into account current stock levels. We think this clarification should meet PPC's concern and do not propose amending the report.

For the second concern we have recast Appendix 4 to provide a list of the elements that would be included in any monitoring framework. The draft report initially used a price template used in regulated markets to describe these elements. We have redrafted Appendix 4 in the manner indicated above to avoid any inference that we were recommending price regulation as opposed to price monitoring.

Origin Energy made two submissions as summarised below:

- In a letter dated 5th October 2012 responding to the Executive Summary Origin disagreed with our assessment of the level of return on investment (ROI) being generated, indicating that ROI before tax of 14-15% was a more accurate level for its operation in Vanuatu. Our Executive Summary assessed ROI before tax at 25%. Origin noted that its lower returns were due to higher operating cost (resulting from compliance with the Australian standard for storage and handling LPG) and based on total shareholders' equity as the measure for return. Origin provided its annual audited accounts in support of its assertion.
- After examination of Origin's data we amended our assessment of ROI to 22% before tax, taking into account the higher operating costs than originally assumed. This was included in the Draft Report issued by the World Bank on 10 October 2012 for comment. In a letter dated 15th October 2012, responding to the Draft Report, Origin reiterated their disagreement with the ROI estimated by this report. Origin advised their own assessment showed 14.3% ROI pre-tax for financial year to June 2012 and 15.3% for the year to June 2011. There were two major differences between this report methodology and that of Origin Energy:⁶⁹

⁶⁹ Origin Energy advised that the report authors could use publically available information including Origin's financials lodged with the VFSC. This report uses Origin's financial statements for the year ended June 2011.

Origin in its letter of the 15 October made a number of comments on the Draft Report, which for the sake of clarity we respond as follows:

1. Comments relating to data not supplied - Section 6.3.2 of the Draft Report states that "Origin has not supplied data for the LPG cost to Brisbane (or landed cost in Vanuatu)".

Origin's response: *We have supplied all the information for the FY 2012-11 which is as per the worksheet forwarded to us. We have also engaged discussions with the author of the report relating to our accounts and highlighted several areas where we find differences to our actual results:*

Report Writer's response: *At the time of writing this Draft Report (May-July 2012) we didn't have the information requested. Information was provided on 1st (retail prices) and 13th August (price data) respectively. We compared the information provided with our draft report to test for any anomalies or inconsistencies with the H&T data. We have amended the report in various sections where we have noted the lack of information from Origin at the time we were writing the report.*

2. Comments relating to Section 9.5.2 - Origin's query regarding Figure 33 which shows a sharp increase in prices in December 2010.

Origin's response: *"The issue with the above graph is it only shows a portion of a certain period to highlight the alleged "sharp" increase in our prices. We do not remember at any stage that this was clarified from us. We also do not know the USD exchange rate used to determine the Vanuatu landed (CIF) figure utilized. Our version of the graph which is based on actual landed cost (CIF) is as follows and it does not seem to look as sharp as the graph above. We were unable to include the Saudi CP we do not have this on record".*

Report Writer's response: *We have used landed cost data provided by Vanuatu Customs. Saudi CP butane and propane prices used as a benchmark were converted using Vanuatu Reserve Bank rates and adjusted by 3 vatu to reflect the an appropriate commercial (rather than the Reserve Bank rates) spread between buying and selling rate. Origin Energy did not provide any landed cost data in local currency - this was provided in US dollars per tonne only.*

Against the last five year's data, Origin's retail price doesn't appear to directly follow Saudi CP price, which indicates some price smoothing where Origin has chosen to limit price fluctuations (both up and down).

Origin's response: *" In addition, during the period the effects of the global financial crisis was underway and during the period the said price increase occurred our operating cost per kg increased by 10%, our gas cost per kg increased by 11% and our volume decreased by 2% and therefore an increase of 11% per kg on our price."*

Report Writers response: *We have obtained Origin Energy Vanuatu's audited financial statement for the year ended June 2011 from the Vanuatu Financial Services Commission (VFSC). A comparison of operating cost for the years ended June 2011 versus June 2010 indicate that operating cost increased by 5% which is at odds with Origin's assertion. We note that profit from operations increased by 13%.*

3. Comment's relating to Section 9 and 10 - Origin disputes any implied inference that LPG margins are high when considered in the context of comments made about returns for PPC.

Origin's response: *" Our actual margins are around 15% before tax and operating cost in Vanuatu are high compared to other Pacific Islands countries in the region due to the following reasons:*

- *High cost of Health and Safety and Environmental compliance to Australian and Origin Energy standards;*

- *Inter-island freight rate due to its geographical locations and its islands;*
- *Cost of bringing skilled labour;*
- *Risk management factors associated with higher insurance costs;*
- *High cost of utilities and services*
- *High project development cost*
- *High maintenance costs due to unavailability of parts and services*
- *High cost of living due to reliance on imported goods*
- *High cost of recovery in case of disaster or emergency situation*
- *Limited market*

Report Writers response:

We note Origin refers to margins when we suspect they intended to refer to ROI. This is discussed below. We note also Origin's comments that operating cost is high in Vanuatu. As discussed we have amended our analysis and incorporated operating costs as indicated by Origin's audited financial statements. Our calculated ROI reduces to 22% but this is still high.

We compared Origin Energy's audited financial statements and our analysis and found two major differences. These are:

- *Capital Employed - we calculate ROI on the assets required to service the LPG market - the report uses a depreciated replacement cost approach, valuing the assets required to service the market similar to the approach that would be used by a regulator under a regulated pricing framework (Origin's value for these assets is lower because based on historical cost).*

However Origin calculates ROI using total shareholder equity as recorded in its financial statements, which is a significantly higher value. This report uses a value for capital employed of 870,241,589 VUV; Origin Energy's shareholders' equity for June 2011 is 1,251,472,000 VUV.

- *Operating Cost - Origin Energy had higher operating cost (153,154,000 VUV) than H&T's estimated operating cost (135,829,313 VUV). This report has used Origin's operating cost but reduced by 11% to reflect cost to service the gas market only.⁷⁰ Both estimates include depreciation.*

The relevant financial parameters that indicate the difference between Origin's assessment and this report are summarised in

Table 36.

Table 36: Extract from Origin Financial Statements Compared to this Report

Period July 2010 to June 2011	Report	Origin(year ended June 2011)
Operating cost including depreciation	135,829,313 VUV or 78 VUV/kg	153,154,000 or 88 VUV/kg
Assets	821,735,370 VUV	269,449,000 VUV
Capital Employed	870,241,589 VUV or 499 VUV/kg	1,251,472,000 VUV Or 722.98 VUV/kg

⁷⁰ We also reduce income by the same proportion to ensure consistency of the financial analysis.

Profit or loss for year	188,460,150 Or 108 VUV/kg	191,438,000 VUV or 110 VUV/kg
ROI before tax	22% H&T calculation = Profit/capital employed	15.3% Origin= Profit/Total shareholders' equity

We note that in Origin's balance sheet 50% of total assets are reflected in one item, being the investment value in its ownership of Origin Energy Leasing Ltd. This is valued at 729,717,000 VUV. Notes to the accounts record that this company ceased operations in 2011 and the principal assets, being two gas tankers were sold. We note in 6.3.1 that the MV Boral Gas and MV Pacific Gas were sold to a Singapore company and leased back. The financial statements retain the investment company as a Non-current asset although it's not clear why this should remain when the principal assets have been sold and the leasing company is acknowledged as no longer operating. As noted in Table 36 Total Shareholder Equity is recorded as 1,251,472,000 VUV - without the leasing entity Total Shareholder Equity would be closer to 522,000,000 VUV.

From a regulatory perspective we doubt that any regulatory pricing framework would allow such an asset to be included in any regulated asset base in the setting of prices to be charged by a monopoly supplier. Market prices in Vanuatu already include the cost of shipping in the landed cost, which will include an element for the investment return required by the ship owner. Accordingly we do not accept Origin's assertions that its returns around the 14-15% level.

We have noted in Section 9.5.2 that prices in Vanuatu are high when compared with similar sized markets in the region. Our analysis suggests that returns are higher than for countries where prices are regulated. Accordingly we recommend that the GoV implement price regulation for LPG noting that there will be a need to strike an appropriate balance between:

- *The needs of the market participants as investors for certainty, appropriate returns and financially sustainable businesses;*
- *Customers' needs for efficient, safe and reliable supplies of fuel; and*
- *The energy security interests of the country.*

4. A comment implying only the petroleum company (PPC) is operating efficiently and accordingly in Vanuatu. Section 11.0 of this report states: "From our analysis in the preceding sections we conclude that, at least for petroleum, the market is efficient in that returns are comparable to other Pacific Islands countries where pricing is regulated, that it is operating to international standards and that investment is continuing to be made. Furthermore our analysis indicates that the benefit of improvement in efficiency is being passed to consumers".

Origin's response: *We disagree with this statement because we are doing everything the petroleum company is doing as stated above. By implication some users/readers of the report may read this the other way.*

Report Writers response: *We agree in part with Origin's comments and we have updated the report accordingly stating the following:" For LPG Origin is continuing to make investment and is operating to international standards but that a comparison of returns with other Pacific Islands countries where price is regulated shows that LPG margins are high in Vanuatu".*