Final Report

Phase 1 Report – Study of Energy Security and Resilience in Jersey

for

The States of Jersey

1 November 2013

IPA Energy + Water Economics GB

Study of Energy Security and Resilience in Jersey

for

The States of Jersey

IPA Advisory Limited
74 Wigmore Street
London W1U 2SQ
United Kingdom
Tel: +44 (0) 20 7659 9888
Fax: +44 (0) 20 7962 1321
Email: contact@ipaadvisory.co.uk
Web site: http://ipaadvisory.co.uk/

DISCLAIMER

IMPORTANT NOTICE

Review or use of the Report by any party other than the client constitutes acceptance of the following terms.

Read these terms carefully. They constitute a binding agreement between you and IPA Energy + Water Economics Limited ("IPA"). By your review or use of the report, you hereby agree to the following terms.

Any use of the Report other than as a whole and in conjunction with this disclaimer is forbidden.

The Report may not be copied in whole or in part or distributed to anyone.

The Report and information and statements herein are based in whole or in part on information obtained from various sources. IPA makes no assurances as to the accuracy of any such information or any conclusions based thereon. IPA is not responsible for typographical, pictorial or other editorial errors. The report is provided as is.

No warranty, whether expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose is given or made by IPA in connection with the report.

You use the Report at your own risk. IPA is not liable for any damages of any kind attributable to your use of the Report.

EXECUTIVE SUMMARY

IPA Energy + Water Economics and Currie and Brown have been commissioned by the States of Jersey to investigate and report on long-term energy security and resilience of the Island of Jersey's energy supply to future shocks.

Given the small scale of Jersey's energy sector, disruptions to individual pieces of infrastructure can have a huge impact on the Island. This leaves Jersey vulnerable to disruptions, as the cost of redundancies on the system are extremely high. Based on our understanding of the Jersey energy sector, existing reports, stakeholder consultation, and risk profiles set out in the UK's National Risk Register a number of risks specific to Jersey were identified.

Risk likelihood and impact matrix

Relative impact \ Relative likelihood of occurrence	Low	Medium	High
High	Loss of more than one interconnector Loss of fuel storage Damage to port infrastructure	Damage to transmission/distribution infrastructure	Severe weather event*
Medium	Terrorist attack	Simultaneous loss of more than one generating unit Loss of one interconnector	Delay of fuel import Severe weather event*
Low		Industrial action	Loss of one generating unit

* Recent years have seen an increase in extreme weather events, which is expected to increase further due to climate change. Occurrences such as low temperatures and heavy snow can lead to significant increase in fuel and electricity consumption, due to the increase in demand for heating.

Sources: IPA analysis, UK NRR and stakeholder consultation.

Although there are many possible risks to the energy sector in Jersey, this study focused on those which have both a medium to high relative likelihood of occurrence and also a medium to high potential impact should they occur.

Based on our understanding of current on-Island policies, international energy security standards and the relative infrastructure costs, we identified the definition options for energy security and resilience standards.

Electricity supply

"Sufficient sources of electricity capacity to meet annual peak demand, in any circumstances where [OPTION 1] such source(s) (the Channel Islands Electricity Grid (CIEG) cable link to France or on-Island generators) are unavailable at the same time."

Electricity supply standards

OPTION 1	Policy	Assessment
"one"	N-1	Allows for one redundancy in the system. Least-cost option, although leaves the island vulnerable in the event of a simultaneous loss of more than one power asset
"one of each type of"	N-1 'plus'	Allows redundancy of largest interconnector plus the largest diesel generator and the largest gas turbine, plus needing to meet 75% of peak winter load for 48 hours from on-Island generation. Aligned with Jersey Electricity Company's current standard.
"two"	N-2	Allows for two redundancies in the system. The current standard in Guernsey. More secure but more expensive

Source: IPA

Supply and storage of petroleum and gas-based fuels

"Sufficient fuel supply and storage to maintain the predicted demand for [OPTION 2] days for each petroleum and gas product."

Fuel storage standards

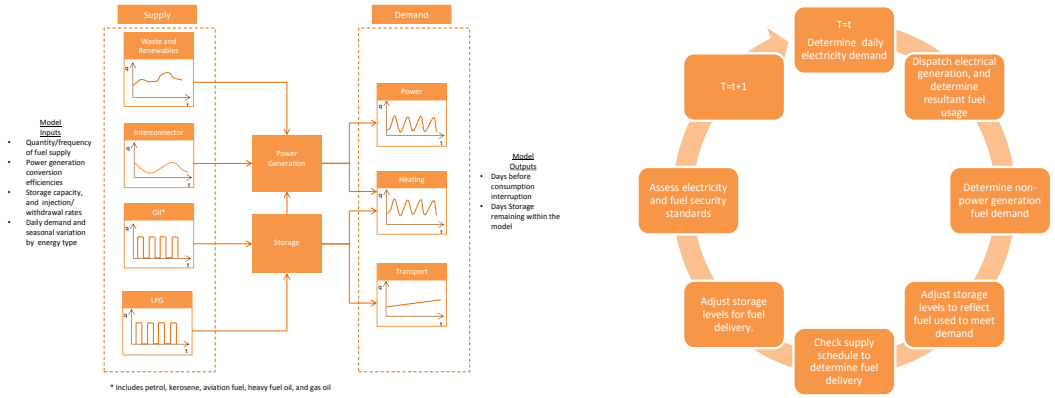
OPTION 1	Worst-case probability*	Assessment
"seven"	3.8% (once every 27 years)	Lower security standard and cheapest option.
"ten"	1.2% (once every 41 years)	Mid-security standard, for which there currently appears to be sufficient storage capacity.
"fourteen"	0.05% (once every 2175 years)	High security standard, which may require the construction of additional storage facilities

** Calculated using the International Energy Group's methodology for calculating worst-case fuel delivery delays for the Channel Islands*

Source: IPA

We modelled Jersey's energy demand and supply balance for the period between 2020 and 2050. The modelling methodology involved establishing an equilibrium baseline fuel stocking position across a 60 day modelling horizon (where system demand is met by fuel delivery). December and January were modelled as these months represent peak demand months for petroleum products and power, representing period of greatest system stress. Having established the baseline, we modelled a set of system shocks and solutions in order to determine system security with respect to the definitions set out in the previous section.

IPA Energy Resilience Model: Overview and Operation



Source: IPA

Key findings

For each of the risks shortlisted we modelled their impact on the energy resilience of Jersey. Interventions were also modelled in conjunction with each of the risks in order to assess their ability to mitigate these risks.

For electricity, the most effective mitigating interventions to all shocks to the energy system are summarised below:

Summary of sensitivity results for electricity standards to 2050

Intervention	N-1	N-1 plus	N-2
Development of renewables	✓		✓
Development of new deepwater terminal			
Commissioning of hydrocarbon pipeline			
Commissioning of additional electricity interconnector*	✓	(✓)	✓
Replacement of retired power generation facilities	✓	✓	✓
Maximising existing fuel storage capacity	✓		
Reduced energy demand through energy efficiency measures		(✓)	

Notes: * This additional interconnector will be in addition to any replacements to existing interconnectors, so that there are 4 in total.

✓ represents significant mitigation of risks; and (✓) represents limited mitigation of risks.

Source: IPA

Commissioning of an additional electricity interconnector or the development of renewables improves Jersey's ability to meet N-1 and N-2 electricity security standards under most risk sensitivities where generating or interconnectors units are lost. Across all sensitivities and electricity standards, replacement of retired power generation facilities offers the best improvement to Jersey's electricity security. This shows that it is important for Jersey to retain a diversified generation mix, especially given the expected growth in electricity demand.

For fuel, the most effective mitigating interventions to all shocks to the energy system are summarised below:

Summary of sensitivity results for fuel standards to 2050

Intervention	7-day	10-day	14-day
Development of renewables			
Development of new deepwater terminal	(✓)	(✓)	(✓)
Commissioning of hydrocarbon pipeline	✓	✓	✓
Commissioning of additional electricity interconnector*			
Replacement of retired power generation facilities			
Maximising existing fuel storage capacity	✓	✓	✓
Reduced energy demand through energy efficiency measures	✓	✓	✓

Notes: * This additional interconnector will be in addition to any replacements to existing interconnectors, so that there are 4 in total.

✓ represents significant mitigation of risks; and (✓) represents limited mitigation of risks. The results shown above do not account for the improvement over the baseline observed for interconnector losses sensitivities, where improvements were observed over the base case for all interventions with the exception of the deepwater harbour.

Source: IPA

Maximisation of fuel storage capacity, improvement of on-island energy efficiency or the development of the hydrocarbon pipeline all demonstrated significant improvement to Jersey's ability to meet the seven, ten or fourteen day security standard under sensitivities, where damage or delay to the fuel storage/import infrastructure occurred. The exceptions to this were the sensitivities involving the loss of a generating unit, where no additional improvement was observed over the baseline for the seven and ten day standard. This is because under sensitivities involving the loss of on-island generation, the reduction in capacity was not significant enough to deplete on-island fuel reserves of heavy fuel oil and gas oil. On the other hand all interventions exhibited some improvement over the baseline in meeting the significantly increased demand for heavy fuel oil and ultra-low sulphur diesel resulting from the loss of one or more of the interconnectors

Next steps

IPA recommends that the following sequential approach should be taken to formulate a coherent and fit-for purpose energy resilience strategy for Jersey which will balance the competing demands of emissions reductions (sustainability), energy costs and achieving security of supply:

1) **Security** – assess the dynamics between the identified interventions and conduct further sensitivity analysis in order to determine a full range of possibilities which will also meet the energy security of supply criteria;

2) **Sustainability** – refine the interventions to ones which will help Jersey to meet low-carbon targets as outlined in the Energy Plan Pathway 2050;

3) **Affordability** – conduct a detailed feasibility assessment, including cost-benefit analysis, of the shortlisted interventions to determine least-cost solutions; and

4) **Drafting of energy resilience strategy** – selection of interventions and security standards.