Document Title:

2012 to 2020
INTEGRATED RESOURCE PLAN
(IRP)
For the Commonwealth of Dominica

Document Ref No: 2012/002/D

Independent Regulatory Commission
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INDEPENDENT REGULATORY COMMISSION

DECISION

Document Ref No: 2012/002/D

This Integrated Resource Plan for the Commonwealth of Dominica's electricity system for the period 2012 to 2020 is provided by the Dominica Electricity Services (DOMLEC) to the Independent Regulatory Commission as a response to Administrative Order#:2/2010, and has been amend and modified by the Commission.

The Commission now **ORDERS** that *Decision 2012/002/D* as an approved policy document, and the relevant content be incorporated by the necessary stakeholders, and became effective on the effective date given below.

Effective date: May 31, 2012

By Order

(Lancelot McCaskey)

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Lancelot McCaskey
Executive Director
On Behalf of the Commission

May 31, 2012

OBJECTIVE OF THE PLAN

This plan sets out to:

1. Project the load growth in Dominica from 2012 through 2016 based on the 2007 to 2011 data and expected large load additions.

2. Objectively determine when new capacity needs to be added to the generating system.

3. Suggest potentially viable options for generation expansion through 2020. There will be no discussion of cost for these options.

4. Review possible changes to the transmission and distribution system to accommodate generation changes.

5. Cover events that are statistically significant.

This is not intended to be a disaster preparedness plan. As a result, it does not consider events like, landslides covering the hydro plants or a fire destroying any of the generating stations.

SCOPE OF THE PLAN

This plan considers the **known** elements of the electrical system, and assumes a growth rate based on extrapolation of the last three years of growth in Dominica. It will consider the Dominican context and not include exportation of electrical power to neighbouring islands should any of the geothermal fields in Dominica be developed to the point where exportation of electricity produced from geothermal energy becomes viable.

DISTRIBUTED RENEWABLES AND THEIR IMPACT

There is the potential for distributed renewable energy that individual home owners may install and interconnect to the utility's network. Since 2010 to March 2012 there have been three installations - a 225kW wind turbine at Rosalie Bay Resort, a 9kW solar array at the home of Mr. Blaize Carroz in Castle Comfort and a 50kW solar array at the Brizee Mart facility in Canefield. In March of 2012 Rosalie Bay Resort applied for the permission to interconnect another 32kW to the system.

As the number and sizes of these potential systems are not known, they could not be included in this plan. These relatively small distributed renewable systems do not add firm capacity to the utility's network, but they could increase the peak demand of the utility's system, if they suddenly fall off, and generation from the utility is needed as a supplement.

ATTRIBUTES OF A WELL RUN ELECTRICAL SYSTEM

In order to provide a reliable supply of electricity, a system must have sufficient plant installed to allow for:

1. Scheduled outages for planned maintenance and

2. Forced outages (unscheduled or breakdown outages) on some units, and still have sufficient capacity to meet the demand for power from the customers at all times.

A well run electrical system must have sufficient available plant for it to meet all scheduled and a rational amount of forced outages without installing too much plant and so incurring unnecessary capital cost. Many islanded electrical systems use the N-2 Firm Capacity Criterion to help determine when to add new plant. The N-2 Firm Capacity Criterion is one in which new generating capacity is added to the system if the expected annual peak load cannot be supplied with the two largest units out of service.

DEFINITION OF FIRM CAPACITY FOR DOMINICA

Because of the run-of-the-river hydro plants that exist in Dominica, a conservative approach to the definition of firm capacity is taken, and is defined as the dry season capability of the hydro units in operation plus the available capacity of the diesel units minus the capacity of the two largest units of the utility. See Figures 1 and 2 below:

Figure 1

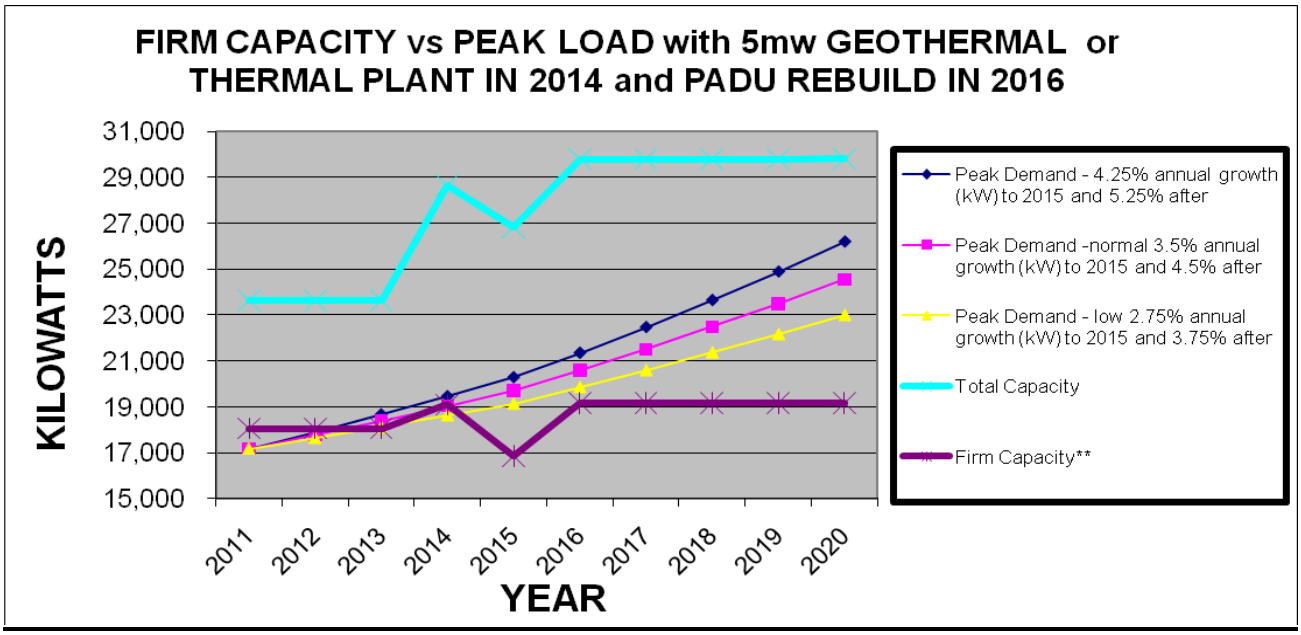
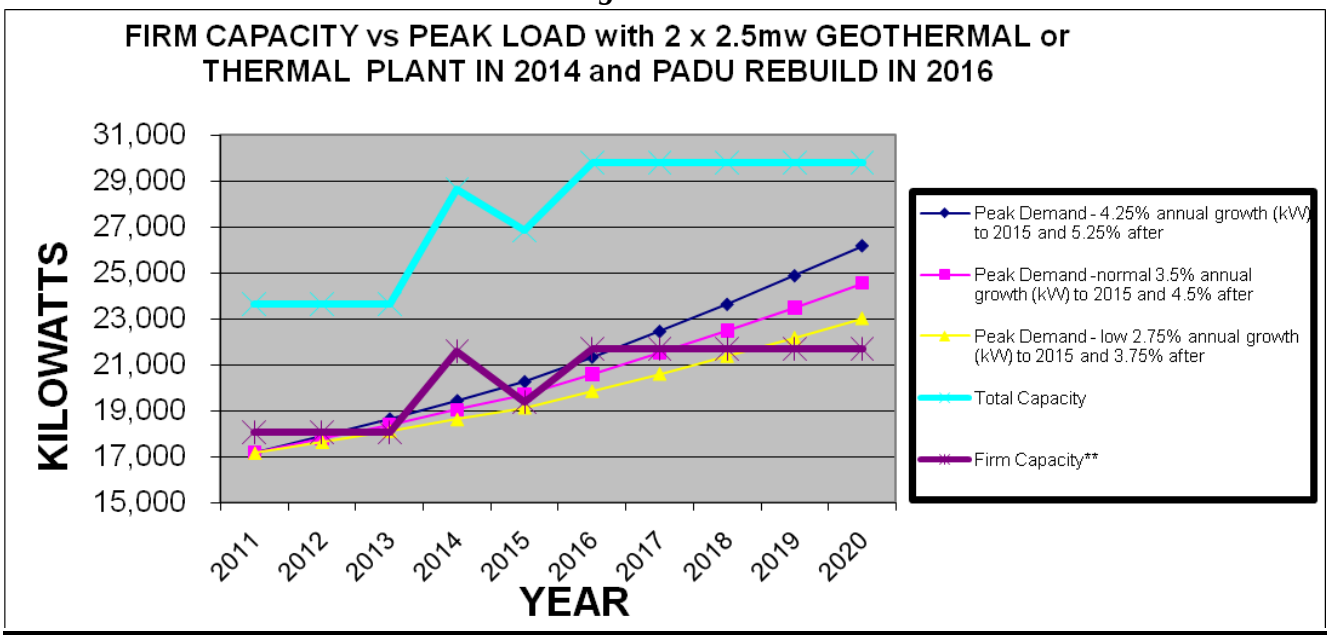


Figure 2



OTHER CAPACITY

In addition to the above the IRC has on record 15MW of electricity held by self-generators across the country. This figure is expected to be greater when the capacity not yet captured on IRC's registers is included.

GROWTH

The historical growth of the peak demand and sales for 2007 to 2011 is shown in the table below:

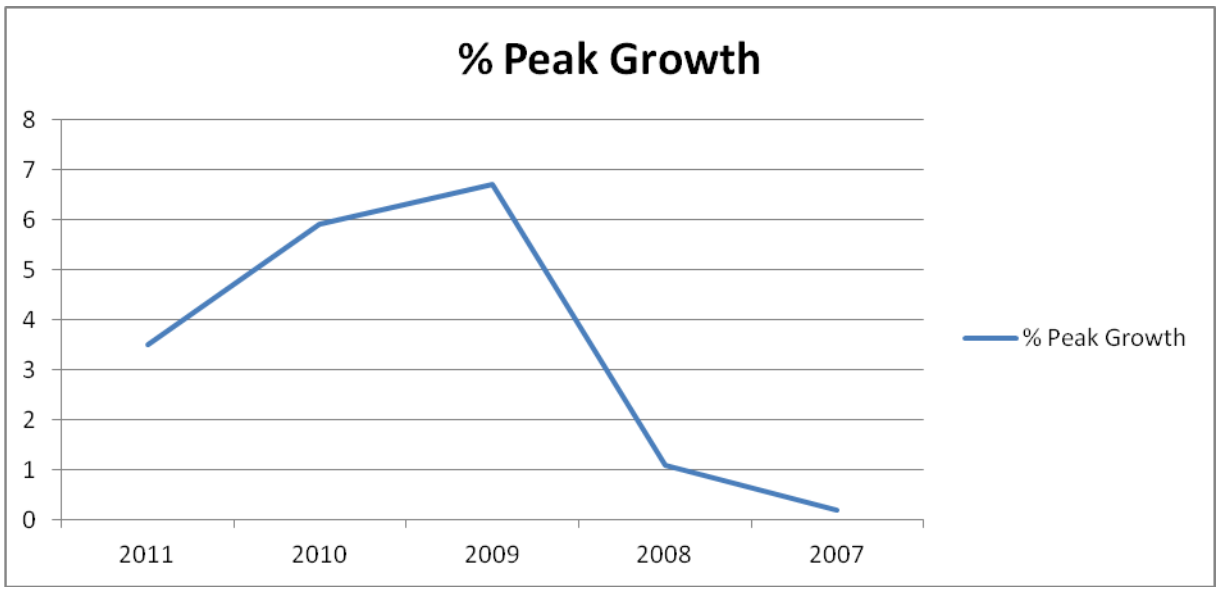
Figure 3

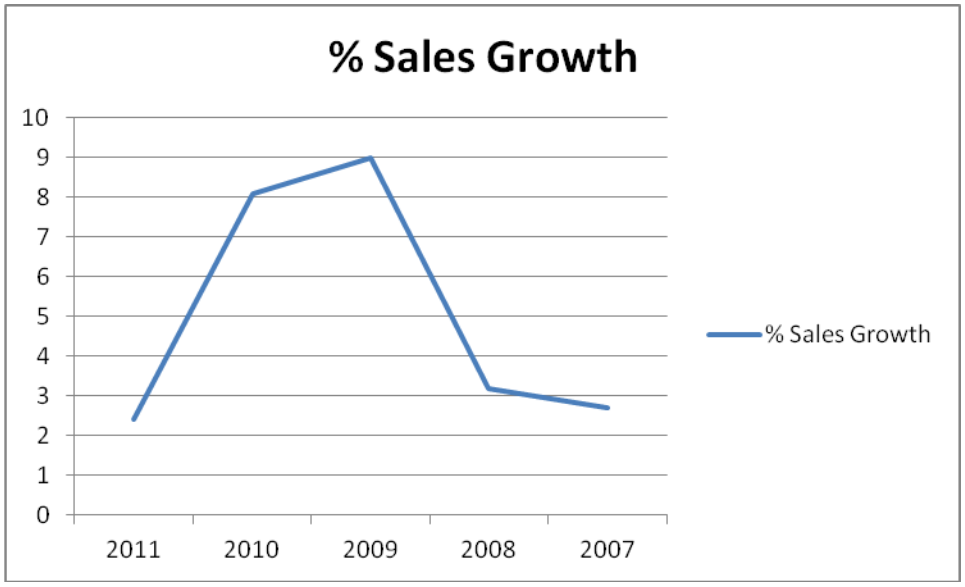
	2011	2010	2009	2008	2007
Peak Load	17.17	16.58	15.65	14.66	14.5
Percentage Growth	3.5	5.9	6.7	1.1	0.2

Figure 4

	2011	2010	2009	2008	2007
Sales Growth(kWh)	88,842	86,775	80,308	73,686	71,421
Percentage Growth	2.4	8.1	9.0	3.2	2.7

There is some correlation between the growth in sales and that of DOMLEC's peak load as shown in the graph below.





It can be seen that Dominica's growth is not linear. The annual peak demand in Dominica shows years of tremendous growth followed by years of almost stagnancy. The low growth in 2007 may be attributed to Hurricane Dean, while the 6.7% growth in peak recorded from 2008 to 2009 is considered unsustainable over any prolonged period. Factors such as tourism, the demand for Dominica's agricultural products and the in-flow of cash for major infrastructural improvements all contribute to the growth rate. The levelized growth for the period 2007 to 2011 amounted to 4.3% annually.

For planning the capacity needs for the period 2012 to 2016, a conservative 3.5% growth in peak demand annually was used. This is 0.8% lower than the levelized historical growth rate. There are two reasons for this.

- In the years prior to 2009 and 2010 the load growth in Dominica was stunted by the lack of adequate generating capacity and in 2008 there was a sharp spike in oil prices that caused the cost of electricity to rise steeply. This caused many customers to install generators and self generate.

- In 2009 the utility installed 4.2MW of new capacity in Fond Cole and the system's reliability improved and also the oil price fell as quickly as they had risen.

These two factors impacted the high growth rates seen in 2009 and 2010. As soon as oil prices began to rise again in 2011 a decrease in growth rate was experienced.

The graphs in Figures 1 and 2 above show that, without meaningful efforts by consumers to conserve electricity, there would be need for at least 1MW of new electrical capacity by 2014.

CONDITION OF EXISTING GENERATING UNITS

There is the question of the age and condition of the diesel fleet of DOMLEC.

For depreciation purposes DOMLEC, like most utilities, has a fixed retirement date associated with each generating unit. This date is a theoretical date, and if the unit can still be run efficiently and reliably then it will not be retired after it is fully depreciated.

Retirement is determined not by a fixed date but after analysis of the replacement cost, and the impact this would have on the rate base as opposed to the improvement in efficiency the new unit would bring. In most cases a well maintained unit will give reliable and efficient service well beyond its "book" retirement date.

A report on the condition of the units scheduled for retirement from the DOMLEC fleet done in March 2009 by an independent contractor (Mr. Elford Felix), states that, with proper maintenance practices these engines should run reliably until 2014.

At present the Commission is in possession of DOMLEC's most recent retirement schedule. It shows that all of DOMLEC's generating units are due to retire between 2012 and 2017 with most of them due between 2012 and 2015. Rehabilitation of them to extend their useful life will require the approval of the Commission. A copy of the schedule is attached.

PRESENT GENERATING SYSTEM

The present generation facilities on Dominica consist of:

1. Three cascading run-of-the-river hydro plants (Laudat, Trafalgar and Padu) on the Roseau River with an installed capacity of 6.6MW and an available capacity of 6.16MW.
2. The Fond Cole Power Station close to Roseau with a mix of medium and high speed units (nine in total) with an installed capacity 13.27MW and an available capacity of 12.35MW.
3. The Sugar Loaf Power Station in the Portsmouth area with five high speed units with an installed capacity of 6.83MW and an available capacity of 6.43MW.

A table showing the date of installation, the capacity and operational hours of the diesel units is attached.

These units supply the island via eight 11,000 volt (11kilovolts) distribution feeders.

The two diesel generation centers are tied together by the Portsmouth Feeder (PMF), but can also be tied together through two alternate routes utilizing the East Coast Feeder (ECF) and the Sugar Loaf West Feeder (SWF).

The hydro generating plants are linked to each other and the Fond Cole diesel station as follows:

Laudat to Trafalgar by a dedicated interconnector line called the LTI.

Trafalgar is also connected to Padu through a dedicated interconnector line called the TPI, and Trafalgar is also linked to the Fond Cole diesel station by a dedicated interconnector called the TFI.

Padu is also linked to the Fond Cole diesel station by a dedicated interconnector called the PFI.

In addition, another 15MW of installed capacity (known at this time) exist through self generators.

RECAP OF THE CAPACITY ADDITION OPTIONS PRESENTED IN THE LAST INTEGRATED RESOURCE PLAN

In the last Integrated Resource Plan the following were put forward as possible options for capacity addition:

1. Thermal plant in the Jimmit Valley
2. Thermal plant in the North
3. 10MW Geothermal in Wotten Waven or Soufriere
4. 10MW Geothermal in Portsmouth area
5. Thermal Plant Rental Option.

Since then there has been little movement on the proposed Thermal Plant in the Jimmit Valley.

DOMLEC has not been able to acquire land suitable for the sitting of a thermal plant in the north of the island. A parcel of land has been identified as suitable but the ownership of the land is in question.

There has been no known progress in developing the suspected geothermal resource in the Soufriere area

DOMLEC has also been unable to secure a licence for geothermal development in the north, and has abandoned its efforts in that direction in the light of the progress the government is making in the Wotten Waven area with the development of the geothermal field in that location, as there is not sufficient market, even with the possibility of sales to the French islands of Martinique and Guadeloupe to support two geothermal developments in Dominica.

Of the five options put forward in the last Integrated Resources Plan, therefore, only two remain viable at this time:

- A 5-15MW geothermal plant in Wotten Waven
- The rental of thermal units (diesel engines).

PRESENT OPTIONS

Recently the Government of the Commonwealth of Dominica has been working towards introducing policies for Energy and Energy Independence in the proposed National Energy Policy and the Sustainable Energy Plan. These initiatives are based on maximizing the use

natural resources of the island (in particular geothermal and water) to supply energy for the island, with the possibility of exporting electrical energy as a revenue earner for the government.

To this end much effort has been put into developing the geothermal resources at Wotten Waven. Two test wells have already been drilled and a third is in the process of completion.

At present, the Government is pursuing a plan to have the small geothermal plant located in Wotten Waven operational by mid 2014. The Commission is planning on this coming on stream as expected. While this is no contingency, plans must be put in place to counteract any such failure.

DOMLEC in an effort to increase the amount of renewable energy in its generation mix initiated a study to determine the possibility of increasing the capacity of the output from the Roseau River. That study shows that the capacity of the Padu power station could be increased from its present 1.4MW to approximately 3MW if the pipeline from Trafalgar to Padu is replaced by one with sufficient size to deliver all the water from the Trafalgar plant's tailrace to the plant at Padu. An additional turbine and generator would have to be added to the Padu station to achieve this.

At the time of the preparation of this plan the engineering, approval and procurement processes for this have not yet been initiated. These would require at least a year to complete.

While such a project seem feasible and attractive, the implementation of would require that the Padu station be taken out of service for at least six months. With the firm capacity of DOMLEC's system being so close to the peak, the company cannot take Padu out of service for any extended period without an unacceptably high possibility of prolonged loss of service to customers. There is, therefore, little chance that this project could be made operational before June 2014. The second drawback to this plan is the increasing dependence on one river and one catchment area for the island's hydro resources.

Additional viable options to meet the 2014 peak if the small geothermal plant is not on stream by then would be:

- A focused educational programme on energy efficiency and conservation in the usage of electricity.
- Requesting the larger consumers of electricity with their own generating capability to use their own resources at peak times.

- Encouraging the larger generators to self generate on a full time basis and to keep their excess generation for the grid, and

- The rental of a thermal unit to make up the shortfall in generation(s).

These could be considered separately or in combination.

Owners of renewable supplies who wish to supply themselves first and sell their excess to DOMLEC will continue to do so in accordance with DOMLEC's published interconnection policy as approved by the IRC.

PREPARATION FOR THE INTERCONNECTION WITH GEOTHERMALLY PRODUCED POWER IN THE WOTTEN WAVEN AREA

In order to best utilize the electrical energy generated by geothermal means a number of changes would have to be made to the transmission and distribution network to facilitate this. Firstly, how and where to interconnect the new geothermal plant to the present network must be determined. There are several options available.

Option 1 – Interconnect With the Present 11kv System in the Roseau Valley.

The simplest method of interconnecting power obtained from the geothermal plant in the Wotten Waven area to the existing network is by interconnecting to present 11kV system in the Roseau Valley that sends power from the hydro plants on the Roseau River to the Fond Cole power station for distribution.

One disadvantage of this is that there would still be a need to keep the high speed diesels at the Sugar Loaf station in service for the purpose of voltage control in the north of the island. This would reduce the effect of having geothermal produced power as the least efficient diesel engines on the system (the high speed engines at the Sugar Loaf station) would be kept operational.

Option 2 – Interconnect With the Present 11kv System in the Roseau Valley and Build a North-South Transmission Line.

There are factors which give merit to the construction of a North-South transmission line. These are:

- Reduction of losses during power transmission between Roseau and Portsmouth

- Giving an additional path of supply so maintenance can be done on the Portsmouth feeder (which runs along almost all of the west coast) without power interruption

- Providing additional security for power flow either north or south in the event of a disaster.

One way to avoid having to keep the Sugar Loaf station running for the purpose of voltage stiffening in the north is to have a North-South transmission line with a minimum voltage of 33kV so the voltage drop associated with transmitting power can be overcome and the voltage in the north would be adequate without the need of running the Sugar Loaf generating station in the north.

Option 3 – Build a Line to the North Capable of Carrying Two Transmission Circuits, One For Local Consumption, the Other For Export.

A third option is to build a two circuit transmission line from Wotten Waven to the Sugar Loaf station in the north.

The lower line would be for the transmission of power for the local market, and would have a take off in the vicinity of Fond Cole to feed the distribution system there.

The upper line would be at a voltage determined by the company exporting power to Guadeloupe.

The advantage of this is that it lessens the footprint of the electrical network on the island. Instead of two separate structures taking power south to north on the island there is now one structure. Right of way, easement issues, zoning problems, environmental impact and surveying costs associated with the construction of such a transmission line would be halved.

The disadvantage is that a single structure failure would affect both circuits.

FUTURE CONSIDERATIONS

Given the fairly high risk for natural disasters (earthquakes, hurricanes and volcanoes in Dominica) and for the purposes of disaster planning and security of supply the Commission is of the opinion that the island is best served by maintaining two generating centers, one in the north and one in the south. This adds operational and investment costs to the system but lends tremendous value to the disaster preparedness of the country.

At present, all additional generation units under consideration, including geothermal, are based in the Roseau Valley in the south of the island near to the capital city of Roseau which is the main load center.

This plan recommends that by 2020, after the installation of the geothermal generating units, the diesel units be relocated to a plant site in the north to help with:

1. Disaster recovery, as all the present plants, and those contemplated in the near future are being located in the south.

2. Providing power to the Portsmouth area if the North South transmission line fails for a significant length of time.

3. Providing an adequate and modern diesel plant for emergencies and load following and peak lopping as neither the hydro nor the geothermal plants are good at this.

4. Providing work and employment opportunities for persons in the north of the island.

All the units in this new facility do not have to be new. Some may be relocated from the present Fond Cole station. The Fond Cole station would be converted to a sub-station for the distribution feeders in the south, while Sugar Loaf would have a sub-station for the distribution feeders in the north.

In the future consideration can be given to a transmission line along the east coast to allow a transmission ring to be formed.

RETIREMENT OF DIESEL UNITS

The advent of geothermal energy will give rise to being able to retire the diesel engines that are under performing whether through loss of efficiency or poor reliability. However as the time table for any geothermal plant is still unsure no provision for this can be made.