ENVIRONMENT, SOCIAL, GOVERNANCE

QUESTION

Background:

Alasia is a small but wealthy island nation. It has good relations with its neighbour, the very large country of Capland.

In Alasia, electricity is supplied from four sources:

On-island generation:

1. Hydro-electricity. Most of Alasia's power is generated by large hydro-electric dams. Electricity is produced when water is released from the dams. Water enters the dams from river systems fed by rain.

2. Gas generator. Alasia has a small gas powered generator. The generator is expensive to run and used for emergencies only. In the past, consideration has been given to decommissioning the gas generator, because of the very high cost of gas in Alasia. (Gas is imported into Alasia on ships from Capland).

3. Private solar and wind installations. Many households in Alasia have solar panels on their roofs. These generate power which is fed into the Alasian electricity grid. However, recently some households have been going "off grid" – i.e. installing batteries in their houses and disconnecting from the electricity network. There are also a growing number of privately owned wind farms that feed into the Alasian electricity supply.

Off-island generation:

4. Capala Connector. A large cable, called the Capala Connector, runs under the ocean between Alasia and Capland. Depending on its electricity needs, Alasia can either sell electricity to Capland (if it has an excess supply) or buy electricity from Capland (if it has excess demand for electricity). It is very expensive to buy electricity from Capland, however.

Attachment 1 shows the contribution of each of these electricity sources to Alasia's energy use (and to its sale of electricity to Capland) over the last 10 years.

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The Situation:

A year ago, Alasia had an energy crisis, when it experienced rolling brown-outs for several months. A rolling brown out occurs when the government is forced to limit electricity availability during certain periods, due to a shortage of available electricity supply. This crisis occurred because of two events happening together:

- The Capala Connector failed. For a six month period, from 1 October 2015 to 31 March 2016, the Connector between Alasia and Capala was broken. Because the Connector runs underwater, and does not show fault locations, it was extremely difficult (and slow) to find the location of the fault.
- The hydro-electric dam levels were critically low. This was due to a combination of high levels of water released during winter of 2015 (to sell electricity to Capland) followed by record low levels of spring rainfall from September to December 2015.

During the crisis, the hydro-electric dams did not have enough water to generate sufficient electricity for Alasia. Alasia could not purchase electricity from Capland. The gas generator had to be fired up after being decommissioned for many years. The generation of electricity from gas was very expensive and not enough to cover the shortfall. Major industries were required to reduce production during the crisis.

The Minister of Energy in Alasia, Minister H. E. Dinsand has been severely criticised for allowing the energy crisis to occur, although the high 2016 rainfalls have solved the short term problem. The Minister's critics say that the risks should have been predictable. Minister Dinsand says that it was a 1 in a million combination of events, and that it could not have been predicted or prevented.

Following the crisis, the Alasian Government has set aside $1 billion to pay for any new initiatives in the energy area. Some of the ideas being suggested include building a second underwater connector to Capland, increasing incentives for household solar or private wind installations, building new hydro-electric dams and expanding the size of the gas generation plant.

The generation and sale of hydro-electricity in Alasia is managed by a semi-autonomous government department called Alhyrdra Inc. Alhydra has a dual Charter which requires it to:

1. Maximise profits to its shareholder (which is the Alasian Government) through the sale of electricity to Capland; and
2. Provide electricity to meet the bulk of Alasia's energy needs.

The CEO of Alhydra, who was appointed in 2013 and is a friend of Minister Dinsand's, receives a performance bonus based on the sale of electricity to Capland.

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Your Task:

You are a consulting actuary with AAA Ltd (Alasia Actuarial Associates Ltd). You are specialists in energy policy, pricing and strategy.

Minister Dinsand has requested that you prepare a report for him answering two main questions:

1. What monitoring schemes (such as the PSL described below) or other regulations should be placed on Alhydra to avoid a situation where it is incapable of providing electricity to Alasia, in a similar situation? This should be based on monthly modelling of Alhydra's electricity generation capacity (i.e. dam storage levels) based on different rainfall, usage and other scenarios.

2. What are the future risks Alasia is facing and what other strategic changes or investments should Alasia make to help avoid a future energy crisis?

Further Information:

A little more about Alhydra:

- Alhydra has 2,500 total GWh storage capacity in its dams. It has historically maintained the actual storage in the dams at about 25% capacity (i.e. about 600 GWh storage). However, since the appointment of the new CEO, actual dam storage has been allowed to run down below 20%. During the crisis the dams hit a historic low of 15% (the minimum level required for the turbines to operate) but now, as at 31 March 2017, the dams are back up to 25%.
- To forecast how much water can be released, Alhydra uses a model which assumes that monthly rainfall will be at average levels experienced over the previous 100 years. Attachment 2 shows average rainfall in Alasia over the last 100 years (used by Alhydra in its modelling). Attachment 2 also shows actual rainfall in 2015 which resulted in the energy crisis.
- Each millimeter (mm) of rain that falls in Alasia leads to an additional energy capacity of 0.8GWh in the dams. Climate change modelling shows that total rainfall is expected to gradually reduce in Alasia over time, particularly in the spring and summer months from September to March. Heavier rain (than the historic average winter levels) is expected in winter, however.
- Alhydra has always prided itself on its independence from the Alasian Government. It has lobbied against the type of monitoring schemes used by governments in other countries to manage their hydro-electric water storage. These monitoring schemes generally involve the setting of monthly Prudent Storage Level (PSL) profiles. If water levels are above the PSL, then the hydro manager is free to operate commercially. If water levels are below the PSL, then non-essential water release (such as sales to Capland) should be avoided and must be approved by government. The PSL can also vary by other parameters.

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The governments of both Alasia and Capland are signatories to global climate change agreements which are attempting to limit global warming to 2 degrees. Hydro electricity is classified as a renewable energy and this has driven Capland's very strong demand to purchase energy from Alasia. However the Alasian voters are very opposed to any more dams being built.

The original Capala Connector cost $1 billion to build. It was a very simple Connector without in-built monitoring points (to show where a fault may have arisen). A new Connector, with monitoring points, is expected to cost $1.5 billion.

Assumptions:

You should feel free to make any assumptions you wish in this question, but you should state these in your report. The assumptions should be reasonable overall but do not need to reflect any actual country.

SEE ATTACHMENTS 1 AND 2 ON NEXT PAGES

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ATTACHMENT 1

Energy Consumption and sales in Alasia

	Energy Consumed - GWh					Energy Sold - GWh
	Hydro-electricity	Gas generator	Solar and Wind	Purchases from Capland	Total	Sales to Capland
FY to 30 June:						
2007	812	0	15	80	907	35
2008	803	0	18	75	896	51
2009	850	0	35	2	887	20
2010	754	0	43	55	852	120
2011	745	0	49	35	829	80
2012	721	0	65	40	826	130
2013	713	0	75	30	818	150
2014	690	0	86	22	798	180
2015	681	0	94	21	796	200
2016*	560	48	108	0	716	140

*Includes the 6 month period when the Connector failed

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ATTACHMENT 2

Rainfall in Alasia

	Historic 100 Year Average Rainfall: Alasia (mm per month)		Actual Rainfall: 2015 Alasia (mm per month)
Jan	63		60
Feb	42		38
Mar	62		30
Apr	79		62
May	85		102
Jun	141		177
Jul	137		154
Aug	142		138
Sep	98		42
Oct	91		25
Nov	73		13
Dec	60		10
Total	1073		851

END OF QUESTION

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