LATROBE VALLEY GEOTHERMAL ECONOMIC MODELLING

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Laby Research Project

LABY FOUNDATION PTY LTD

Introduction

The Latrobe valley region is about a two hours drive from metropolitan Melbourne and encompasses an area of high geothermal activity. This project seeks to explore sustainable methods for generating electricity and its commercial viability. Solar, wind, geothermal, and thermal storage generating systems were considered and their Net Present Value (NPV), Internal Rate of Return (IRR), and Levelized Cost of Electricity (LCOE) were calculated.

Assumptions

The assumptions made in the economic calculations are as below. A cost of capital of 3% stems from historically low borrowing rates in recent years [1]. An inflation figure of 2.5% is conventionally used by taking the midpoint of RBA's long-term inflation target [2]. An electricity price of $0.10 per kWh represents an approximation of current wholesale electricity prices.

Cost of Capital	% pa	3.00%
Inflation	% pa	2.50%
Contingency	%	10.00%
Project Life	years	30
Electricity Price	$/kWh	$ 0.10
Social Benefits Multiplier	x Energy Revenue	1
Carbon Credit Rebate	$/kWh	$ -
Leftover Heat Value	$/kWh	$ -

Fig. 1: Assumptions for Economic Calculations

Methodology

The NPV, IRR, and LCOE for each proposal are presented in the next column. The methodology used here is standard financial capital budgeting. In each period, the expected cash inflows and outflows are netted to arrive at a net cash flow figure. This is then discounted at the cost of capital rate to arrive at a NPV. The IRR percentage is the hypothetical cost of capital for the project's NPV to be zero. LCOE is calculated by dividing the discounted net cash outflows by the net power output.

Net Cash Flows

Net Cash Flows				
Study	**Description**	**NPV ($)**	**IRR (%)**	**LCOE ($/kWh)**
Proposal 1	Eavor Closed loop (Profile 1)	$ (67,190,329)	-2.27%	$ 0.3069
Proposal 2a	High Temperature Geothermal Aquifer – river water cooled	$ 5,863,124	5.35%	$ 0.1122
Proposal 2b	High Temperature Geothermal Aquifer – air cooled (Not adiabatic)	$ (3,951,094)	0.79%	$ 0.1867
Proposal 3a	No Reinjection Aquifer (Winton Style) sea water cooling	$ (5,514,937)	-2.92%	$ 0.3353
Proposal 3b	No Reinjection Aquifer (Winton Style) cooling with spent production water	$ (7,851,324)	-6.83%	$ 0.7381
Proposal 4a1	Hybrid generation using Solar, Wind, Geothermal and thermal storage using water	$ (2,344,899)	0.38%	$ 0.1975
Proposal 4a2	Hybrid generation using Solar, Wind, Geothermal and thermal storage using water (Higher flow rate pump)	$ 855,995	3.81%	$ 0.1302
Proposal 4b	Hybrid generation using Solar, Wind, Geothermal and thermal storage using a PCM	$ 11,919,714	7.47%	$ 0.0947

Fig. 2: Net Cash Flows of Several Proposals

It can be seen that given the assumptions, Proposal 2a and 4b are most likely to generate the highest returns and yield the lowest LCOE.

What-If Analysis

A what-if analysis is preformed to determine a project's sensitivity to changes in its assumptions. The following range of assumptions were made regarding key parameters:

Assumptions		Low	Base	High
Cost of Capital	% pa	0.00%	3.00%	10.00%
Inflation	% pa	0.00%	2.50%	5.00%
Contingency	%	0.00%	10.00%	20.00%
Project Life	years	10	30	50
Electricity Price	$/kWh	$ 0.05	$ 0.10	$ 0.30
Capital Investment	% Base Case	50%	100%	200%
Drilling and Well Establishment	% Base Case	50%	100%	150%
Operating and Maintenance Costs	% Base Case	50%	100%	200%
Social Benefits Multiplier	x Energy Revenue	1	1	5
Carbon Credit Rebate	$/kWh	$ -	$ -	$ 0.10

Fig. 3: What-If Analysis Range of Assumptions

The full range of figures and their sensitivities can be viewed in the What-If section of the spreadsheet. From the spreadsheet, the most influential factor on project viability seems to be electricity price. Its sensitivity is plotted in Figure 4. Project life and cost of capital also greatly impact a project's outcome. Although it might be hard to physically quantify, a project's social benefits multiplier also contributes highly to a project's viability. The rest of the parameters affect but does not significantly alter a project's outcome.

What-If Analysis

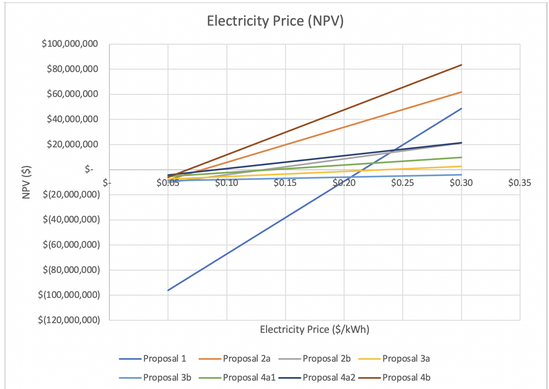

Fig. 4: Electricity Price Sensitivity Analysis

Availability

Please email us for a copy of the spreadsheet.

Acknowledgements

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References

[1] Independent Pricing and Regulatory Tribunal. "Local government discount rate". Available at https://www.ipart.nsw.gov.au/Home/Industries/Local-Government/Local-Infrastructure-Contributions-Plans/Local-Government-discount-rate. Aug. 2021.

[2] Reserve Bank of Australia. "Inflation Target". Available at https://www.rba.gov.au/inflation/inflation-target.html.