

Levelised Unit Cost – A Calculation and Reporting methodology

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To ensure there is no confusion, contradiction and a fair and meaningful comparison within the geothermal and investment community in relation to the use of unit generation costs, the adoption of a standardised methodology for cost calculations and reporting among different electricity generators is a prerequisite. The Australian Geothermal Energy Association, "AGEA", proposes to use Levelised Cost as the unit cost measure to be quoted when companies report average unit generation costs. Levelised Cost is the methodology used by the electricity generation industry and its use enables the comparison of the generation cost of different forms of electricity generation (such a coal, gas, wind, wave and geothermal) and of different projects using the same form of generation. The methodology to be adopted by AGEA for calculating and reporting average unit electricity generation costs when developing and/or operating geothermal power generators has not been finalised. This paper describes one method for calculating and reporting Levelised Costs. It has been prepared to facilitate discussion and consideration as AGEA moves to agreement on a desired methodology.

Keywords: Unit generation costs, Levelised Cost, calculating unit electricity generation costs, geothermal.

Introduction

Unit production costs are used for many purposes, ranging from internal management costing through to project evaluation. The methodology used in calculating the unit cost will depend upon its use. The Australian Geothermal Energy Association ("AGEA") is seeking the adoption of a standardised methodology for the calculation and reporting of unit electricity generation costs to ensure there is no confusion, contradiction and a fair and meaningful comparison can be made between alternative investments by the geothermal and investment community.

AGEA proposes the establishment Levelised Cost as the unit cost measure to be quoted when companies report average unit generation costs.

Levelised Cost is the methodology used by the electricity generation industry and its use enables the comparison of the generation cost of different forms of electricity generation (such a coal, gas, wind, wave and geothermal) and of different projects using the same form of generation.

This paper describes a methodology for calculating and reporting average unit electricity generation costs by companies developing and/or operating geothermal power generators. The methodology is currently open for comment before finalisation by AGEA.

Calculation of Levelised Cost

There are a number of ways of approaching the calculation of unit production costs. The electricity industry uses Levelised Cost which incorporates the investment in the plant and the fact that not one, but many units of electricity are produced during the life of the project.

The Levelised Cost is the time series of the capital and operating expenditures divided by the net power supplied, discounted to their present values.

The following sets out the main components of the Levelised Cost calculation methodology:

- Expenditures include all those required to deliver the net power supplied to the station busbar, where electricity is fed to the grid or end user. It does not however include the potential additional costs to the electricity network to cater for the impact of the power plant on the existing network;
- The time series covers the life of the power plant from evaluation through to decommissioning;
- Capital expenditures include all costs required for the development, commissioning and decommissioning of the geothermal power generator including the site preparation, evaluation, production and reinjection wells, the plant and machinery, administration and personnel buildings/accommodation and power lines and associated costs to connect to the grid or end user.
- Operating expenditures include all operation and maintenance costs on the wells, power plants and power lines including make-over or additional drilling costs to extend the project life, plus permit and licence fees, administration, insurances and any royalties payable for the extraction of geothermal energy;
- Capital and operating expenditures are to exclude income taxes, the benefits associated with the generation of renewable energy,

including Renewable Energy Certificates but are to include any costs associated with the generation of greenhouse gases. The costs are to be in constant monetary terms;

- Net electricity generated and supplied to the grid, or end user, takes into account the plant availability and variability due to the plant operating efficiency factors such as ambient temperatures, the parasitic power required for operating the well pumps and plant and machinery and the impact of thermal drawdown, if applicable, over the project life;
- The discount rate is the rate of return that could be earned on similar investments on a pre-tax basis.

The formulae to calculate the Levelised electricity generation Cost (LC), for each power plant, is the following:

$$LC = \sum_t [(I_t + M_t) (1 + r)^{-t}] / \sum_t [E_t (1 + r)^{-t}]$$

Where:

LC	=	Average lifetime Levelised electricity cost per MWh
I_t	=	Capital expenditures in year t
M_t	=	Operating and maintenance expenditures in year t
E_t	=	Net electricity generation in year t
r	=	Discount rate
\sum_t	=	The summation over the life of the power generator including evaluation, construction, operation during the economic lifetime and decommissioning of the plant.

Reporting of Levelised Cost

When reporting of average unit generation costs a company should clearly state that the unit cost is a Levelised Cost and either \$/MWh or c/kWh.

The company reporting should be prepared to disclose, as a minimum, the following information used in the calculation of the Levelised Cost:

- Total capital expenditure
- Average annual total operating and maintenance expenditure
- Average annual net electricity generation
- Life of the power generator
- Discount rate

Conclusion

This paper describes a methodology for calculating and reporting average unit electricity generation costs by companies developing and/or operating geothermal power generators. The methodology is currently open for comment before finalisation by AGEA.

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