



HYBRID POWER SYSTEMS

SUMMARY

A brief description of Hybrid Power Systems and the factors affecting their design and feasibility

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For more information or for a preliminary discussion on your project, please see our website circularsolutions.com.au or contact info@circularsolutions.com.au.

CIRCULAR SOLUTIONS

Circular Solutions is a specialised renewable energy consultant and contractor. Our services include:

- Concept development including feasibility, design, strategic planning, and regulatory advice;
- Project delivery as a turnkey or EPC contractor, as in house project and contract management for the owner, or as a fully financed (BOO) solution.

Our team are specialists in:

- Concept design and specification of micro-grid and island power systems;
- Detailed design and project delivery of renewable energy projects with significant experience in remote locations; and
- Systems integration and commissioning including thermal power and batteries.

Because we are a consultant and a contractor, we are uniquely placed to provide practical advice to our clients and partners based on current costs and on-site experience.

For more information about Circular Solutions, our team, capability and experience please visit our website www.circularsolutions.com.au.

To contact us to discuss your renewable power projects please email the team at info@circularsolutions.com.au.

DEFINITIONS

Different groups within the power and energy industry have varying definitions and uses of the term Hybrid Power System. In this document we have used the term to describe any power generation system that includes both thermal and renewable power generators.

Project owners will usually choose to install a hybrid system to achieve the benefits of thermal power (reliability, dispatchability and stability) with the additional benefits provided by renewable power sources (low generation cost and/or environmental incentives from the government or their clients, including corporate social responsibility).

GENERATION SOURCES

For small to medium power generation the most common thermal generators used include reciprocating and turbine technology generators burning diesel, LPG or Natural Gas.

The most common renewable generation options are wind turbines and solar photovoltaic. Less common renewable options are wave power, tidal power, waste to energy (including biogas from landfill, biomass,

conversion of rubbish, etc), algae, biodiesel, mini-hydro and hydrogen. The last two can also be used for energy storage.



SELECTION OF HYBRID MIX

Selection of the generation mix for a power station is dependent on some or all of the following:

- Project duration (investment time line, lease duration, power off take contract duration)
- Power quality, stability, reliability, dispatchability (usually defined by the power purchaser)
- Land area available and its cost (generation capacity of solar is very dependent on available space)
- Resource availability including long term predictions (renewable resource availability changes depending on location but can usually be forecast reasonably accurately over the long term, hydrocarbon prices are much more difficult to predict accurately over the long term)
- Availability of capital (renewable generation options are usually more capital intensive than their hydrocarbon alternatives)

A concept level options analysis at the beginning of a project can quickly reduce the options to a few most feasible alternatives and provide reasonably accurate options pricing, sensitivity analysis and identify the key risk areas.

FEASIBILITY

The feasibility of any power generation process and hybrid projects in particular are dependent on a number of items:

- Location of power purchaser -power generated on site will always be more valuable than power that need to be transmitted over a network (network fees, government charges and retail fees are between 1/2 and 2/3 of the price that power consumers connected to a network pay)
- Duration of the project or power purchase agreement – this duration affects the payback period the project needs to achieve (or the risk that the developer needs to take on for uncontracted power)
- Location of the project – this will affect the cost of construction, the cost of fuels, the availability of renewable resources and the approvals required
- Site conditions – clearing and grubbing required, flatness of the land, the soil type, proximity to power networks will all affect the project cost

These items all need to be considered by the project developer. Adequate consideration of these items in conjunction with the concept design will reduce the risk of time or money wasted pursuing options that are not feasible.