



## **Knowledge Sharing Report-Milestone 2**



**RATCH-Australia**

## **Collinsville Solar Thermal Power Station**

[www.ratchaustralia.com](http://www.ratchaustralia.com)

## Introduction

RATCH-Australia Corporation Limited (RAC), in partnership Transfield Infrastructure Pty Limited, and The University of Queensland (UQ), is undertaking all the preparatory development work to assess the viability of converting an existing 180MW coal fired power station to a 30MW hybrid solar thermal / gas power station at the existing Collinsville Power Station (CPS) in Queensland (the Project).

As a part of the project, RAC will also examine the feasibility of using Novatec's Supernova Linear Fresnel Solar Thermal technology to generate superheated steam to be supplied to steam turbine/s to provide grid connected electricity. The dual-fuel boiler will also be designed to use natural gas to enhance grid reliability from the Project.

The Australian Government, through an Australian Renewable Energy Agency's (ARENA) Emerging Renewables Program Funding Agreement, is partly funding for the completion of the feasibility study.

This **Knowledge Sharing Report for Public Release** contains a summary of the learnings and knowledge gained to-date on the Project, including information from the public release versions of the Initial Plant Assessment Report and Modelling and Optimisation Report.

## Technical-Initial Plant Assessment Report

The initial technical assessment indicates there is the potential for repowering and life extension of a selected unit at CPS for operation as a solar thermal power plant for the next 25 years. In addition, there is the potential to use some of the existing equipment, supporting infrastructure and services at the CPS for the proposed Project to reduce the overall Project costs.

The technical, cost and risk comparison of the installation of a new steam turbine, compared to the reuse of the existing steam turbine, indicates that the use of a new power-block provides a technically superior, more reliable and lower risk option. In addition, the use of a new a new power-block provides various other benefits, including:

- increased solar generation yields
- reduced fossil fuel cost due the higher efficiency of the new plant; and
- the ability to use traditional lower risk project delivery mechanisms supported by warranties, such as a traditional engineer procure and construct (EPC) wrap contract, and the expected associated improved funding conditions.

### Learnings and Knowledge gained

Learnings and knowledge gained through the initial technical assessment are summarised below.

#### Re-use of existing equipment and power block

The ability and value of using the existing equipment and specifically the power block is dependent on the station and individual unit's specific installation, maintenance and operating regime history

#### Benefits of a new power block

The use of a new power-block has the potential to provide a technically superior, more reliable and lower risk option, along with the added benefits of increased solar generation yields and reduced fossil fuel cost due the higher efficiency of the new plant.

The advanced design incorporated in the current fleet of steam turbine generator and integrated equipment has the potential to provide various benefits. In the case of CPS these include:

- significantly improved levels of overall cycle efficiency through the use of a two cylinder reheat turbine with a moisture separator reheater specifically designed and engineered for solar applications
- fast start up capability and improved loading cycling performance which again improves the generation yield; and
- the solar to electrical conversion efficiency is very high with limited use of the fossil fuel.

The major value differential between the existing power block and a new power block for the Project relates to the cycle efficiency and corresponding generation yields. The substantial increase incycle efficiency of greater than 6% which represents nearly a 20% improvement on the refurbished plant equates to higher levels of solar generation yield (~14.4%) and reduced fossil fuel consumption (~21.4%).

Another major benefit of the installation of a new power-block is the ability to use traditional lower risk Project delivery mechanisms supported by warranties, such as a traditional engineer procure and construct (EPC) wrap contract, and the expected associated improved funding conditions.

In addition, new equipment will be compliant with the latest and more onerous standards and safety requirements thereby helping to reduce the risk to operational and maintenance personnel.

### **Thermal energy storage potential**

Thermal energy storage provides a mechanism to deliver electricity outside of daylight hours as well as an ability to ride through extended cloudy periods. For a given power block capacity, thermal energy storage requires a larger solar field and, depending on the hours of storage capacity required, solar multiples of between 2 and 3 would be expected.

In the case of the Project, the land constraints render thermal storage unviable.

In addition, feasible thermal energy storage systems have not been developed for direct steam generation systems and when or if they become available, they are likely to be high cost solutions.

### **Use of Hybrid**

The preliminary assessment of the use of a hybrid boiler to enhance grid reliability reduces the levelised cost of energy by 12%.

### **Solar layouts**

Minimising the distance between the steam turbine with its associated balance of plant and solar field has a significant impact on the overall solar power plant cost and operating efficiency.

## **Preliminary Environment Assessment Report**

The early assessment of environmental, heritage and stakeholder considerations is particularly important for utility scale solar thermal projects due to the quantity of land required to develop such a power station. The early assessment of these issues allows the issues to be managed in during the detailed design phase and project approvals process.

## **Modelling and Optimisation Report**

The preliminary financial model developed by RAC to compare the potential options for the Project indicates the New Power Block with Gas Boiler has the lowest projected levelised cost of electricity.