Shire of Ravensthorpe

LGEEP Hot Water System Replacement

ENIGIN
WESTERN AUSTRALIA

Prepared by |

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1 Background and Context

The Shire of Ravensthorpe is eligible to apply for a Local Government Energy Efficiency Program (LGEEP) grant to replace electric and gas hot water systems (HWS) with a solar or heat pump HWS. The purpose of this is to encourage smarter energy use in local government buildings and community facilities. LGEEP is a non-competitive, capped allocation program.

In order to be eligible for this grant, local governing authorities are required to:

- Install systems on owned or long term lease buildings (5 or more years remaining)
- Install systems which attract 10 or more Small-scale Technology Certificates (STCs) at the time of installation
- Co-fund the projects (30% for the Shire of Ravensthorpe)
- Obtain and provide three or more quotes from different installers and manufactures
- Install systems within 12 months of signing a funding agreement.

The Shire of Ravensthorpe is classified as a Medium-sized regional governing authority, which is outside of the lowest half of the SEIFA 2006 – Index of Relative Socio-economic Disadvantage.

The Shire must contribute a minimum of 30% of the total cost of the project after the deduction of the STC value. The minimum and maximum grant is $20,000 and $30,000 respectively with a total project maximum value of $42,857.

Local governing authorities are required to identify and justify their preferred quote to ensure their proposed project is:

- Fit for purpose
- Represents value for money
- Results in energy efficiency gains (including an estimate of energy savings)
- Engages local suppliers and defines the extent of local procurement.

The following report provides a prioritisation analysis for the Shire of Ravensthorpe enabling the Shire to determine which, if any, of its current hot water systems should be replaced. The report also provides the content outlined above which is required to complete its LGEEP application.

2 Assumptions

The assumptions made in order to prepare this report are as follows:

- The current system capacity is adequate for the demand.
- Average shower time is approximately 6 minutes based on Water Corporation statistics.[1]
- As the Water Corp provides free 3 star shower heads that provide a flow rate of 9 lit/sec this has been used to estimate a consumption of 54 litres of water per shower.
- In calculating the thermal load of the hot water system it has been assumed that the fresh water temperature is 15°C, which is required to increase to 65°C.
- At a ratio of 1:1 hot water to cold water supply, each shower equates to 27L of hot water at 65°C. This assumes mixing 15°C cold with 65°C hot for a resultant 40°C water temperature.
- The residual monetary value attributed to an existing system has been based on a combination of its age and determination of its condition (remaining useful life).
- A maintenance cost of $400 every 5 years has been used where a HWS requires it.
- 10yr NPV calculations use a 12% discount rate and 5% annual increase in tariffs.
- The following tariffs have been used to calculate the financial benefit from solar HWS energy savings:

Table 1: Tariff information

Site	Tariff / unit	Comment
Recreation Centre	10.50c	Gas Tariff
Swimming Pool	31.94c	Synergy L3 Tariff

[1] http://www.watercorporation.com.au/W/water_use_at_home.cfm

3 Weighted Average Ranking Methodology

The Shire of Ravensthorpe has requested a review of the Recreation Centre and the Swimming Pool sites for consideration in replacing existing hot water systems. The following methodology has been used for prioritisation:

Table 2: Prioritisation Table

	Type of Existing System		
Hot Water Usage Patterns	**Elec. Storage**	**Gas Storage**	**Gas Instant**
Constant high use: Where a large amount of hot water is needed regularly most days of the week (e.g. Aquatic Centres)	Very High Priority	High Priority	Medium Priority
Intermittent high use: Where large amount of hot water is needed infrequently (e.g. on weekends for a sports pavilion)			
Constant low use: Where a small amount of hot water is needed regularly most days of the week (e.g. library)	High Priority	Medium Priority	Low Priority
Intermittent low use: Where a small amount of hot water is needed infrequently (e.g. only once to 5 times daily most days of the week or only on weekends, such as community hall)			

Other considerations used to prioritise systems were:

- Eligibility criteria for LGEEP funding;
- Insufficient storage tank size; if hot water needs are exceeding storage tank capacities, the system will be drawing a lot of energy to reheat them - usually during peak tariff hours. This can be expensive and an inefficient use of energy;
- Age of the system**:** If making a choice between replacing two systems of the same type (e.g. two electric storage systems) prioritise replacement of the older system.
- 10yr financial metrics (return on investment and Net Present Value)
- If there adequate efficiency opportunities that can be achieved by installing a timer or lowering the hot water temperature and keeping the existing system. For example, at some sites with intermittent or low hot water needs, it may be possible to install a clock timer or push button timer so the existing system is only turned on when it is needed. Hot water systems are often set too high. The maximum temperature only needs to be 60-65°C

4 Prioritisation

All sites in the scope of this report can upgrade their hot water systems to solar within the LGEEP budget. We have prioritised the sites based on the methodology described above.

Table 3: Facility Prioritisation

Rank	Site/HWS	Estimated Residual Value ($)	Estimated Energy Savings ($/yr) from Solar Upgrade	Estimated Annual Energy Savings (kWh) from Solar Upgrade.	Shire of Ravensthorpe Investment ($ ex GST)	% of LGEEP grant	10yr NPV Benefit	% benefit	Benefit to Investment Ratio	ROI (yrs)■
1	Recreation Centre +	600	7,720	20,423ˣ	8,611	69%	46,456	46.2%	0.67	1.1
2	Swimming Pool Showers *	0	7,099	22,226	3,922	31%	54,195	53.8%	1.72	0.6
	TOTALS	**600**	**14,819**	**42,649**	**12,533**	**100%**	**100,651**	**100%**	**100%**	**0.8**

+ Currently uses five Rheem instantaneous gas systems in average condition

ˣ Gas saving which is equal to 73,523 MJ/yr

* There are no heating systems for the showers at this site. There is no gas infrastructure at this site. As such, the calculations of energy savings are based on the assumption that the Shire of Ravensthorpe will use electrical hot water storage systems. The comparative analysis is based on the replacement of these electrical hot water storage systems with heat pump systems.

■ Energy tariff increases as specified in the WA Budget Paper No. 3' 2012 have been used to determine the ROI.

5 Investment Summary

Table 4: Solar Hot Water System Investment Summary

Site/HWS	Installed Cost After STC Deduction ($ ex GST)	Estimated STC Value ($33 ex GST per STC)	No. of STCs	LGEEP grant ($ ex GST)	Shire of Ravensthorpe Investment ($ ex GST)
Recreation Centre	$28,705	$5,841	177	$20,093	$8,611
Swimming Pool Showers	$13,073	$3,564	108	$9,151	$3,922
TOTALS	**$41,777**	**$9,405**	**285**	**$29,244**	**$12,533**

6 Recommended Solar Hot Water Systems

The solar collector systems for the Rec Centre, as recommended in this report, are to be mounted on the best available roof for energy efficiency and all will have tempering installed. The roof which houses the Swimming Pool showers is poorly suited to solar panel installation due to its contours and curvature. Alternatively a high efficient heat pump system has been designed. Three options basically based on the solar offset quantities have been analysed and the best option considering the energy savings and value for the money have been selected.

A review of reputable manufacturers products, who provide industry leading warranties, have been compared to determine the best value for money option at each site. Products have been assessed from **Rheem**; **Rinnai**; and **Solarhart**. Rinnai products were selected as representing the best value for money for the Shire of Ravensthorpe. All installers will be local small businesses. The following table provides details required to complete the LGEEP application form in relation to the recommended systems.

Table 5: Recommended Solar Hot Water System (HWS) Details

Site	Current System	Recommended System	Annual Energy Savings (% reduction)	Requirements
Rec Centre	Five Rheem 15 lit/min gas instantaneous systems in average condition	Rinnai Manifold Pack 3 including preheat solar of 3x 315L stainless steel tanks and 9 Collectors	73,523 MJ 20,423 kWh (44%)	- Solar system to act as the preheat - Sized to meet demand - Nine solar collectors installed on the North West facing roof.
Swimming Pool Showers	No water heating system	4x Rinnai 250L Heat Pumps	22,226 kWh (75%)	- Improve the current condition without any hot water system. - Sized to meet demand - High efficient heat pump system.

7 Swimming Pool Water Heating System

Currently there are two swimming pools at the site, neither of which are undercover or indoors. Figure below shows the swimming pools at the site.

Fig. 1: Ravensthorpe Swimming Pools

Maximum temperature setpoint of the pools is 27.5°C and they are operating with a solar system. Based on our analysis the existing system is of sufficient efficiency. Based on the interviews with the pool staffs, the automatic control system bypasses the solar system on sunny days. This indicates a correctly operating and efficient system.

Due to atmospheric conditions the pools are at a usable temperature for approximately 7-8 months annually. To allow usage all year round, additional heating units are required. For this it is recommended that high-efficiency heat-pumps are used as the heating source. While not decreasing the energy usage at the site, it will increase the usage of the community-based facilities in an energy efficient manner.

Two main parameters affect the heat load of the swimming pools:

- Heat loss from the water surface to the atmosphere
- Heat loss caused by the users

Normally specific water amount sticks to the body of the swimmers when they are leaving the swimming pool. This has a minor effect in increasing the swimming pool heating load,

however the major heat loss in swimming pools happens from their surfaces. Graph below displays the monthly heat load of both Ravensthorpe swimming pools.

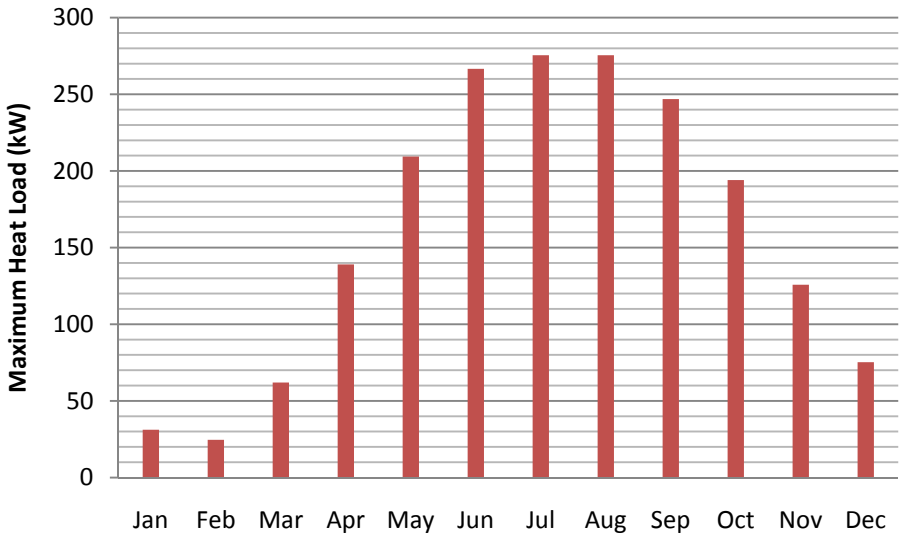

Fig. 2: Monthly Heat Load of the Ravensthorpe Swimming Pools

The table below outlines details of the recommended system for this facility.

Table 6: Heat Pump Details for the Swimming Pool

No.	Parameter	Quantity
1	Nominal Capacity*	240-280 kW
2	Power Input	52.2 - 56.0 kW
3	COP	4.6 - 5
4	Western Power Costs to add extra capacity to the power board	$18,000
5	System Cost + Installation	$140,300
Total Cost (Inc GST)		**$158,300**

* Additional information is attached

Due to the restrictions placed on the maximum grant amount for an LGEEP application and the proposed investment cost for the swimming pool heating solution, we recommend that the Shire of Ravensthorpe only apply for the replacement of the hot water systems at the Recreation Centre and Swimming Pool showers.

The proposed heating solution for the two swimming pools may be considered at a future date; however it is not possible to include this system in an LGEEP grant application.