Kangaroo Island Solar Project
$500,000 Project sponsored by Renewables SA to deliver a “Visible Solar Icon” at the Kangaroo Island Airport

- 50 KW 2-axis tracking solar solution
- Grid connected with intent to provide visible demonstration of leading solar generation technology
- Announced by then-Premier Rann during Community Cabinet visit in July 2011
- Funded through RDA Adelaide Hills, Fleurieu & Kangaroo Island; Kangaroo Island Council providing Project Management
- Completed/operational late 2013
Opportunities / Challenges

- Belief that we could do more with the money
- Wanted to have a Point of Difference
- 50KW Tracking Solar declared a “must have” by Renewables SA

Possible Solutions

- Trackers + Combined Energy Storage – potential to run airport on 100% renewable energy
- Trackers + Electric vehicles – potential to lease vehicles to KI Transfers – existing airport car hire provider.
Other than Novelty Value - why an Electric Vehicle (EV)?

- Airport Electricity costs circa $0.27 / kWh
- Wholesale price for surplus power sold to grid $0.09 / kWh
- Power sold as EV “fuel” equivalent $0.66 / kWh

Barrier to EV uptake

- Available public infrastructure; type of infrastructure
- Limited ability to experience EV’s
- Cost of vehicles
- Perception / reality of Range Limitation – Range Anxiety
Timeline

- Solar Photovoltaics installed: Sept 2013
- EV’s delivered: Dec 2013
- Chargers installed: Dec 2013
- EV’s for Hire: Jan 2014
# 2014 Results

## 2013 Power Consumption & Costs for both sites – base use

<table>
<thead>
<tr>
<th></th>
<th>01-Jan-13</th>
<th>31-Dec-13</th>
<th>2013</th>
<th>$</th>
<th>kWh</th>
<th>$/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dauncey Street</td>
<td>$ 28,174</td>
<td>91,285</td>
<td>$ 0.31</td>
<td>$ 22,564</td>
<td>69,315</td>
<td>$ 0.33</td>
</tr>
<tr>
<td>generation credit</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-$ 1,167</td>
<td>-5,267</td>
<td>-$ 0.22</td>
</tr>
<tr>
<td>Airport</td>
<td>$ 18,282</td>
<td>68,006</td>
<td>$ 0.27</td>
<td>$ 18,410</td>
<td>69,072</td>
<td>$ 0.27</td>
</tr>
<tr>
<td>generation credit</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-$ 15,968</td>
<td>-65,129</td>
<td>-$ 0.25</td>
</tr>
<tr>
<td>Vehicle Leases</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-$ 1,257</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vehicle Power</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-$ 1,459</td>
<td>3,000</td>
<td>-$ 0.49</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>$ 46,456</td>
<td>159,291</td>
<td>$ 0.29</td>
<td><strong>$ 23,839</strong></td>
<td><strong>67,991</strong></td>
<td><strong>$ 0.35</strong></td>
</tr>
</tbody>
</table>

## 2014 Power Consumption & Costs

<table>
<thead>
<tr>
<th></th>
<th>01-Jan-14</th>
<th>31-Dec-14</th>
<th>2014</th>
<th>$</th>
<th>kWh</th>
<th>$/kWh</th>
<th>% drop in use from 2013</th>
<th>$</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dauncey Street</td>
<td>$ 22,564</td>
<td>69,315</td>
<td>$ 0.33</td>
<td>$ 22,617</td>
<td>69,315</td>
<td>$ 0.33</td>
<td>24%</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>generation credit</td>
<td>-$ 1,167</td>
<td>-5,267</td>
<td>-$ 0.22</td>
<td>-$ 91,300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airport</td>
<td>$ 18,410</td>
<td>69,072</td>
<td>$ 0.27</td>
<td>$ 18,629</td>
<td>69,072</td>
<td>$ 0.27</td>
<td>87%</td>
<td>94%</td>
<td></td>
</tr>
<tr>
<td>generation credit</td>
<td>-$ 15,968</td>
<td>-65,129</td>
<td>-$ 0.25</td>
<td>-$ 91,300</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>$ 23,839</td>
<td>67,991</td>
<td>$ 0.35</td>
<td>$ 22,617</td>
<td>69,315</td>
<td>$ 0.33</td>
<td>49%</td>
<td>57%</td>
<td></td>
</tr>
<tr>
<td>Vehicle Leases</td>
<td>-$ 1,257</td>
<td>-</td>
<td>-</td>
<td>-$ 1,257</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle Power Sales</td>
<td>-$ 1,459</td>
<td>3,000</td>
<td>-$ 0.49</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Savings**: $ 22,617
- **Earnings**: $ 2,716
- **Year 1**: $ 25,333

Gross Savings for Council for Year 1 in excess of $25,000
# 2015 Results

## Gross Savings for Council for Year 2

- In excess of $33,000

## Gross Savings for Council for Year 1 & 2

- In excess of $58,000

## Yearly Savings Table

<table>
<thead>
<tr>
<th></th>
<th>01-Jan-15</th>
<th>31-Dec-15</th>
<th>2015 cost</th>
<th>% drop in use from 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>kWh</td>
<td>$/kWh</td>
<td>$</td>
</tr>
<tr>
<td>Dauncey Street</td>
<td>$13,371</td>
<td>55,985</td>
<td>$0.24</td>
<td></td>
</tr>
<tr>
<td>generation credit</td>
<td>-$721</td>
<td>-$3,320</td>
<td>-$0.22</td>
<td>55%</td>
</tr>
<tr>
<td>Airport</td>
<td>$12,969</td>
<td>47,361</td>
<td>$0.27</td>
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<tr>
<td>generation credit</td>
<td>-$8,668</td>
<td>-$62,738</td>
<td>-$0.14</td>
<td>76%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$16,951</td>
<td>37,288</td>
<td>$0.45</td>
<td>64%</td>
</tr>
</tbody>
</table>

## Additional Savings:

- Savings over Mains: $29,505 in excess of $122,003
- Earnings: $3,757
- **Year 2 Total:** $33,263

- Savings over 2 years: $52,122 in excess of $281,294
- Earnings: $6,474
- **Year 1 & 2 Total:** $58,596

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KANGAROO ISLAND COUNCIL
## 2016 Results

**Gross Savings for Council for Year 3**
in excess of **$17,000**

<table>
<thead>
<tr>
<th></th>
<th>01-Jan-16</th>
<th>31-Dec-16</th>
<th>cost $/kWh</th>
<th>% drop in use from 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2016</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dauncey Street</td>
<td>$ 16,363</td>
<td>69,066</td>
<td>$ 0.24</td>
<td></td>
</tr>
<tr>
<td>generation credit</td>
<td>$ 594</td>
<td>-3,197</td>
<td>$ 0.19</td>
<td>40% 28%</td>
</tr>
<tr>
<td>Airport</td>
<td>$ 10,799</td>
<td>43,571</td>
<td>$ 0.25</td>
<td></td>
</tr>
<tr>
<td>generation credit</td>
<td>$ 4,234</td>
<td>-63,071</td>
<td>$ 0.07</td>
<td>18% 129%</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>$ 31,989</td>
<td>46,370</td>
<td>$ 0.69</td>
<td>31% 71%</td>
</tr>
<tr>
<td>Vehicle Leases</td>
<td>-$ 2,100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle Power Sales</td>
<td>-$ 1,215</td>
<td>2,699</td>
<td>-$ 0.45</td>
<td></td>
</tr>
</tbody>
</table>

**Savings over Mains** $ 14,467 -112,921
**Earnings** $ 3,315

**Year 3** $ 17,782

**Savings over 3 years** $ 66,589 -272,212
**Earnings** $ 9,788

**Year 1 - 3** $ 76,377

**Gross Savings for Council for Year 1,2 & 3**
in excess of **$76,000**
Accumulated results, Dec 2016

Kangaroo Island Airport
- Continued reduced costs/savings
- Almost cost neutral, close to 100%

Dollar cost

Power usage (kWh)

Note: $ rebate fell from feed-in (9c/kWh) to minimum (6.5c/kWh) in 2016.
Green Energy “Fuel” Sales

• 8.9MW power sold as EV “fuel” for 50% premium over cost to purchase and 222% premium over sale back into Grid
• 2014 revenue - $1,908
• 2015 revenue - $1,453
• 2016 revenue - $2,026
Income to Council
- Small lease revenue stream from KI Transfers

Positives
- Good exposure for KI (TV etc) and KI Transfers
- Education and awareness of benefits of green energy
- Good quality of Nissan product, albeit old product

Lessons learnt
- Range issues with Nissan Leafs
- Charge time (7 hours) issues associated with limited range (130km)
- Chargepoint price too high, minimum charge amended
- Not viable for KI Transfers – except due to subsidised trial terms – would need 65-75% usage to be viable, whereas only used about 20% of time
- Usage – Airport/Kingscote; local businesses; professional visitors; not tourists
- More marketing information required to target tourists and provide assurances around usability

End 2016 - Nissan Leaf lease period expired
- Cars returned
- Mitsubishi PHEV technology more appropriate to our Island situation and driving ranges required
- Costs of technology still high enough to present commercial challenges to adoption
- Mitsubishi PHEV vehicles available through Budget KI
Plug-in Hybrid

Early adopters….45,000+km / vehicle

Actual Fuel Costs (fuel costs/log book mileage)

- Outlander – Island 9.9 cents/km
  ~7.6lts/100km
- Outlander – Adelaide 3.5 cents/km
  ~ 2.7lts/100km
- Nissan Navara – Island 11-15 cents/km
  ~ 8.5-11.5lts/100km

- Need to run Outlander more often in “Electric Mode” to pickup additional benefits.

- Noted that Island use means higher than usual average speeds when compared to city driving – over 80kph the petrol engine automatically cuts in – would explain higher than anticipated fuel costs.

- No range anxiety – good reliability

- Needs Australian-ising for regional uptake – 16” wheels / tyres for ride; spare tyre option; steel roo bar
What has happened since?

• 2015 United Nations Association of Australia World Environment Day - Best Specific Environmental Initiative (Local Gov. Category)
• 2014 KESAB Award - Environmental Sustainability
• 3 x Mitsubishi i-Miev vehicles purchased by Community members
• EV tourists bring vehicles from mainland
• 2 x Outlander PHEV leased by Council
• Uptake of Nissan Leaf hire vehicles plateaued - regular customers being Government, Health providers, business operators - range anxiety
• Go Electric! - Outlander PHEV hire vehicles with Budget KI – 5 available
• Electric Highway created linking Adelaide with Southern Fleurieu / Adelaide Hills
• Eco-Fly / Drive / Stay promotion
Photovoltaic Efficiency

![Graph showing monthly kWh and Wh/m² for energy and irradiance from January to December, with a summary table below.

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Annual values</th>
<th>Unit</th>
<th>Total values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of global radiation</td>
<td>2,105.11</td>
<td>kWh/m²</td>
<td>8,115.24</td>
<td>kWh/m²</td>
</tr>
<tr>
<td>Energy (Measurement technique)</td>
<td>91,993.34</td>
<td>kWh</td>
<td>343,340.62</td>
<td>kWh</td>
</tr>
<tr>
<td>Energy (Meter reading)</td>
<td>91,993.34</td>
<td>kWh</td>
<td>343,340.62</td>
<td>kWh</td>
</tr>
<tr>
<td>Specific energy</td>
<td>1,839.13</td>
<td>kWh/kWp</td>
<td>6,864.07</td>
<td>kWh/kWp</td>
</tr>
<tr>
<td>Nominal output</td>
<td>50.02</td>
<td>kWp</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It is interesting to note the average uplift in efficiency of the tracking panels v fixed roof panels is around 21% per annum – this is lower than the claimed 28-30% for dual-axis tracking solar in this location.

Whilst averaging 21% there is a large monthly variance – as low as 1% and as high as 44%
Energy Savings bolstered by reduced emissions over life of project to date:
GHG avoided 265,422kg  97 Four-person household equivalents

EV savings compared to petrol equivalent
Electric Vehicles are relevant in Australia today and should become more so as:

- “Black” energy costs increase
- “Green” energy costs fall
- Storage / traction / charging technology develops
- Government & Councils play their part in creating Policy for sustainable energy solutions for buildings / fleet – driving cost savings with alternate technologies
- Public / private infrastructure is developed
- Low risk entry points for adopters are developed
- Usage-linked incentives for adoption are developed

South Australia is ideally placed to capitalize on this:

- Vehicle-manufacturing heritage
- Hi-tech R&D / low volume manufacturing / assembly skills
- Motivated State / Local Government sectors
For further information please contact

Andrew C Boardman
Chief Executive Officer
Ph 0448 868088
andrew.boardman@kicouncil.sa.gov.au