Domestic PV system (1.44 kW PV) with grid connected inverter

Jonathon Thwaites
Rebate conditions for residential dwellings

- must be new or a new extension to an existing system
- must be installed on principle place of residence
- only one rebate per residence
- no other funding from the AGO
- PV designer, installer (SEIA) accredited, or competent
- meet relevant electrical and safety standards, regulations
- must have Western Power (in WA) approval if grid connected
- Supplier to provide 12 month warranty on system and installation
- minimum 2 year maintenance contract should be offered
- must operate on building for a minimum of five years
- must be available for inspection by State regulator and AGO
AGO PV rebate scheme in 2000

- Commonwealth funding of 31 million dollars over 4 years
- 1/1/2000 AGO introduced residential PV rebate scheme
- rate of $5.50 per Watt of new PV, capped at 1.5 kW, $8,250
- 1/7/2000 extended for community, capped at 5 kW, $27,500
- 1/7/2000 GST applied to renewables (adds $2,000 to cost)
- 1/10/2000 rebate reduced $5.00 per Watt of new PV

  domestic capped 1.5 kW, $7,500
  community capped 2 kW of PV, $10,000, special 5 kW

- typical 1.5 kW PV system, with inverter, installation etc
  date total cost from purchaser
  1/6/2000 $16,750 $8,500
  1/7/2000 $20,000 $11,750
  1/6/2001 $24,000 $15,750 rebate used up!
Residential photovoltaic rebate program in 2005

- funding to assist purchase of (PV) systems for households.
- is available for grid connected and stand-alone systems.
- rebates of $4.00 per rated Watt of new installed PV
- maximum of $4,000 for a 1,000W system.

- addition of PV to existing systems
- rebate of $2.50 per rated Watt,
- maximum of $2,500 for a 1,000W addition.

- PV Rebate is for photovoltaic panels only.
- no rebate for batteries, inverters regulators etc
Other information

- 1/6/1999 Net metering introduced for small grid energy producers
  10 % GST on export
  grid access and transmission charges waived
  monitors import and export energy only

- Smart power
  tariff changes with time, day and season
  favours PV energy producers - energy produce at peak tariff and used on shoulder or off peak

- 1/12/99 Green power scheme
  3c premium payable to ensure ‘green’ energy source that is approx. 30%
  not passed on to small energy producers
Western Power tariffs

Western Power Renewable Energy Buyback - Smartpower Tariff

<table>
<thead>
<tr>
<th>Time of day (h)</th>
<th>Price (c/kW.h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>11.93</td>
</tr>
<tr>
<td>4 - 7</td>
<td>8.94</td>
</tr>
<tr>
<td>8 - 11</td>
<td>5.96</td>
</tr>
<tr>
<td>12 - 17</td>
<td>18.38</td>
</tr>
<tr>
<td>18 - 21</td>
<td>11.93</td>
</tr>
<tr>
<td>22 - 24</td>
<td>8.94</td>
</tr>
</tbody>
</table>

Tariff c/kW.h  
high shoulder  11.93  
low shoulder   8.94  
off peak       5.96  
on peak        18.38
Major components of the system

- PV panels
- Grid interactive inverter
- Metering
- Switch gear and wiring
PV Panels

- 90 Watt Photowatt PW 90 polycrystaline
- one string of 16 panels (series)
- panels configured as 16.8 volts (12 volt)
- peak power at 25 °C
- 255 volts DC, 6 amps
- mounted as 4 groups of 4 panels
- weight 10.5 kg
Inverter and metering
Inverter

- Fronius Midi
- 1500 Watts, working range is 1200 to 2000 Watts
- Efficiency 93% varies with input power, optimized for 1500 W
- MPP voltage range 185 V to 360 V, configured for 250 V, 6.5 A
- Data logger (8 inverters)
- Modem box, software, extra large display
- DC isolation box, 450 V, 20/6 A (150/400V)
Output screens

sdi files:
• inverter input and output V and A
• inverter temperature
• date and time
• integrated power (energy)
• energy year, month, day, 15 min
Mounting of panels

Important issues:

- direction
- angle of mounting
- shadowing effects of nearby buildings and trees
- mechanical integrity
- natural connective cooling
- collection of dirt on panel surfaces and frames
- compatibility of roofing, panel, screws and framing materials
Mounting brackets

SEIA accredited

DIY
Panel temperature and cooling

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>3.0</td>
</tr>
<tr>
<td>65</td>
<td>2.8</td>
</tr>
<tr>
<td>70</td>
<td>2.6</td>
</tr>
<tr>
<td>75</td>
<td>2.4</td>
</tr>
</tbody>
</table>

*Graph showing temperature variation with current.*
Efficiency as a function of temperature at 2.5% per 5 °C

Panel and air temperature

Temperature °C vs. Time

Efficiency as a function of temperature at 2.5% per 5 °C

Panel temperature variation with air temperature

Panel temperature °C vs. Air temperature °C

Fitted line: Panel temp = 4.48 x Air temp - 60.0, R² = 0.787
Energy production per day

Energy produced (daily data points, 30 day moving average)
Energy production, use, export and import

Energy production and usage

- imported
- exported
- produced
- nett used

[kW·h]

30/12/00 01/07/01 31/12/01 02/07/02 01/01/03 03/07/03 02/01/04 03/07/04 02/01/05 04/07/05 03/01/06
Office of the Renewable Energy Regulator (ORER)

Statutory authority established to oversee the implementation of the Australian Government's mandatory renewable energy target


- Application for Accreditation - Accredited Power Station
- Application for Registration - Person Intending to Accredit a Power Station
- Application for Registration - Owner of Deemed Output Systems
- Recs worth about $35 now but only tradeable in Australia
Accredited PV power stations in Perth

<table>
<thead>
<tr>
<th>Accreditation Code</th>
<th>Registered Name</th>
<th>Station</th>
<th>Fuel Source</th>
<th>State</th>
<th>Accreditation Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRPVWA01</td>
<td>Jonathon Thwaites</td>
<td>Rooftop PV</td>
<td>Photovoltaic</td>
<td>WA</td>
<td>27/04/2001</td>
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<tr>
<td>SRPVWA02</td>
<td>Angus King</td>
<td>Rooftop PV</td>
<td>Photovoltaic</td>
<td>WA</td>
<td>01/04/2001</td>
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<td>SRPVWA03</td>
<td>Noranda Primary School</td>
<td>Noranda Primary School</td>
<td>Photovoltaic</td>
<td>WA</td>
<td>24/09/2001</td>
</tr>
</tbody>
</table>

Note: Can be deemed units or power stations
Power stations – must log energy collected for annual return
Deemed systems – calculated on latitude and size of system
Deemed systems – 5 year allocations
<table>
<thead>
<tr>
<th>Station Registration</th>
<th>Fuel Source</th>
<th>State</th>
<th>Status</th>
<th>Created</th>
<th>Electricity Generation</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRAWXYS1</td>
<td>Photovoltaic</td>
<td>WA</td>
<td>Invidia audit</td>
<td>2002-02-02</td>
<td>12/2001</td>
<td>2</td>
</tr>
<tr>
<td>SRAWXYS2</td>
<td>Photovoltaic</td>
<td>WA</td>
<td>Registered</td>
<td>12/2001</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>SRAWXYS3</td>
<td>Photovoltaic</td>
<td>WA</td>
<td>Registered</td>
<td>05/02/2002</td>
<td>12/2002</td>
<td>2</td>
</tr>
<tr>
<td>SRAWXYS4</td>
<td>Photovoltaic</td>
<td>WA</td>
<td>Registered</td>
<td>06/01/2004</td>
<td>12/2003</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: 1 certificate is equivalent to 1MWh of generation.

Download Results
Renewable Energy Certificates (RECs)

The REC-registry [http://www.rec-registry.com](http://www.rec-registry.com) is a web site that is:

- required by the *Renewable Energy Electricity Act 2000*
- dedicated to the:
  - creation
  - registration
  - transfer
  - surrender

of Renewable Energy Certificates.
Trading or Surrendering RECs

Persons (company or individual) wishing to register to transfer and/or surrender RECs in the REC-registry need to become a registered person under the Act and a system user of the REC-registry.

In order to access the REC-registry to transfer and/or surrender RECs, the company or individual will need to complete the online application form found on the web site to become a system user.

Worth about $35 each, 1 MW.hour per REC
Where to start

Sustainable Energy Development Office
Office of Energy
Level 9
197 St Georges Terrace
PERTH WA 6000
Phone: (08) 9420 5600
Fax: (08) 9420 5700
Email: sedo@energy.wa.gov.au
Web: http://energy.wa.gov.au