



## SOLAR POWER IN ALICE SPRINGS



## EXCURSION GUIDE FOR TEACHERS

Produced by the Education for Sustainability Central Australian Network (EFSCAN)



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## Sites / Locations

1. **Desert Knowledge Australia (DKA) Solar Centre**
2. **Uterne Solar Farm**

## Impacts and Issues

The excursions to solar power sites in Alice Springs are an opportunity to address the following learning areas:

**Environmental impacts of energy use:** Highlighting the interconnectivity between local energy use/electricity generation and global phenomena such as climate change and environmental sustainability.

**Renewable energy technologies:** An introduction to the concept of renewable energy technologies, their development throughout history and what is in store for the future. Look at the breakdown of local electricity generation to compare fossil fuel and renewable energy capacity in and around Alice Springs. Students will be encouraged to make the link between current environmental issues and the use of renewable energy sources as a way to confront these challenges.

**Large scale PV installations – topics for discussion:** Learn about the issues surrounding electricity generation from large scale solar PV installations, such as the importance of the panels' orientation, size and spacing, issues of electricity storage and discussion of grid capacity and peak consumption loads.



## Key Learning Areas / Strands

The excursion guides and associated activities can link to the following areas of the NT and national curricula:

### Northern Territory Curriculum Links

SUBJECT	Learning Areas		
Science	Energy & Change	Science as Inquiry (Understanding & Acting on Personal & Social Issues)	
SOSE	Environment	Environmental Awareness and Care	Natural Systems
Mathematics	Numbers	Algebra	
Essential Learning	Inner Learner		

### National Curriculum Links

SUBJECT	Learning Areas		
Science	Science Understanding	Science Inquiry Skills	Science as a Human Endeavour
Geography (Yr 9)	Environmental Characteristics: Landscapes & Resources	Human Characteristics: Livelihoods & Lifestyles	
Geography (Yr 10)	Environmental Characteristics: Environmental Sustainability	Human Characteristics: Human Wellbeing	
Mathematics	Numbers	Algebra	



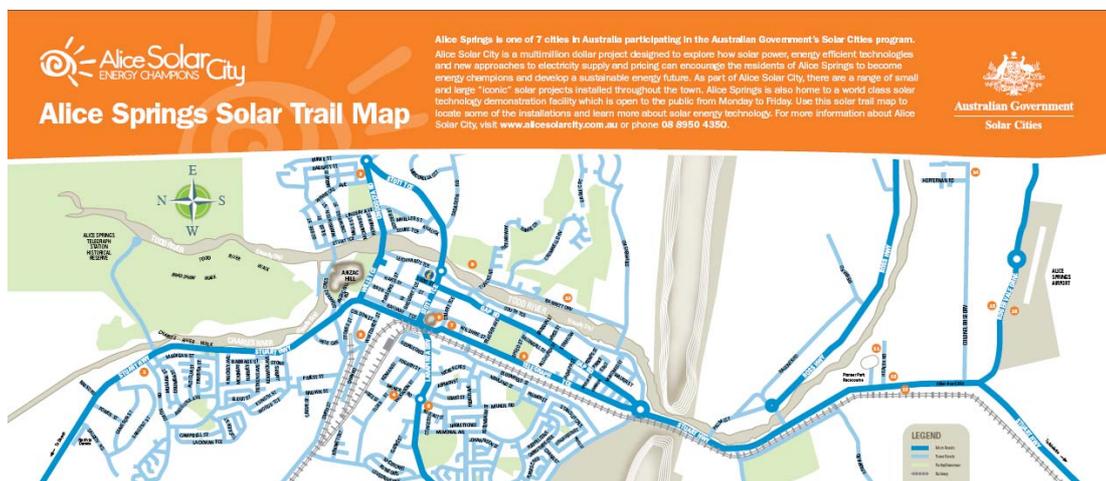
## Recommended Excursion Sequence

1) Visit the **Desert Knowledge Solar Centre** which introduces the students to the range of solar systems available (if you only have time for one, this is the most comprehensive). The main on-site activity & follow-up activities relate strongly to the Solar Centre.

2) Stop by the **Uterne Solar Farm**, which is a working solar farm providing power into the Alice Springs Grid. There is a short activity associated with the Solar Farm site.

3) If you have time, also drive by the large concentrated PV solar power station at the **Airport** and visit the **Crowne Plaza** to see the roof-top solar array.

If you want to see more solar PV installations around Alice Springs, you can download the Solar Trail Map (see below) from Alice Solar City's website and take a self-guided tour (details can be found in the Supporting Materials section at the end of this guide).



## General Safety Issues (Also see specific issues for each site)

**Duty of Care:** Teachers taking part in excursions have a responsibility to ensure that departmental policy (*DEET Policy Educational Excursions – General Guidelines*) is carried out, as well as a responsibility to exercise proper care and supervision throughout the duration of the excursion. The duty of care of a teacher requires the taking of reasonable steps to protect the student against risks of injury or harm that the teacher could reasonably foresee.

**Student Teacher Ratio:** Decisions regarding teacher-student ratio should take into account factors such as the age of the students, their maturity, the location of the excursion, specific needs of students, anticipated behaviour and the nature of the activities to be undertaken.

**Risk Management:** DEET Occupational and Safety policy requires a *Self Inspection Checklist – School Excursions* to be completed when any excursion is planned (template available [here](#)).

*Checklist – School Excursions* to be completed when any excursion is planned (relevant forms available [here](#)).

**Students will need to have sun protection, water, and sturdy shoes. Early morning visits are advised during summer months.**



## Pre-visit Alignment

### Terminology & Vocabulary

**Photovoltaic:** Meaning “Electricity from Light”, photovoltaic material is capable of creating an electrical current when exposed to light.

**Mono- & Poly- crystalline Silicon:** Referring to the two types of silicon crystal manufactured for solar panels, depending on the way in which the silicon has been processed, leading to different levels of purity in the end product.

**Amorphous silicon:** A thin-film solar technology. This type of solar cell can be applied as a film to low cost substrates such as glass or plastic in a variety of module sizes.

**Solar Cell:** A wafer of photovoltaic material that converts solar energy into electric energy.

**Solar Panel:** A collection of solar cells arranged across a surface, normally glass-topped, with electrical conductors connecting them to conduct the electricity produced.

**Solar Array:** A series of solar panel set out to collect solar energy over a large area.

### Teacher Resources: Intro to Solar Power & How Solar Cells Work

Overview of Solar PV from the Your Home Technical Manual:

<http://www.yourhome.gov.au/technical/fs67.html>

Overview of batteries and inverters from the Your Home Technical Manual:

<http://www.yourhome.gov.au/technical/fs69.html>

### Suggested Topics for Discussion: Pre-visit

**Why should/shouldn't we use solar power?** Discuss renewable & non-renewable energy. Discuss dirty and clean energy production. Discuss cost of maintenance & resource use, including embodied energy.

**What affects solar power availability?** Discuss what happens when the sun is not available (night/shade). Discuss issues of cloud cover, dust, smoke, etc.

**How can we deal with the times the sun is not available?** Discuss back up generators, battery systems and the associated costs. Highlight new developments such as Solar Thermal plants which are capable of storing solar energy for use at night.

**Why is/isn't Alice Springs a good place for solar power?** Discuss proportion of sunny days to cloudy days. Discuss humidity and haze and the effect of temperature on solar panels. Discuss dust & fire/smoke.



## Worksheet Activities: Pre-visit

### Activity: Where does your electricity come from?

This activity has the students explore the types of renewable and non-renewable resources used in power stations across Australia. Students use a computer and Google Earth to explore the different types of stations and where they are found. They then focus in on the stations around Alice Springs. *A computer with Internet access and Google Earth is required.*

### Activity: Energy Transfer and Transmission

This activity asks students to identify different types of energy and the mechanisms of energy transfer involved in solar power generation and electricity consumption.

### Solar Schools Activity: Energy Quiz

This is a general quiz on the subject of energy, electricity production and consumption and links to climate change.

### Solar Schools Activity: Energy Crossword Puzzle

This is a quick crossword puzzle introducing renewable energy concepts.

### Solar Schools Activity: Debating the issues

A series of statements relating to climate change and renewable energy, designed to spark discussion and debate between students.

## Practical Activities: Pre-visit

### Build a Solar Cooker:

Have your students build their own solar cooker and cook up a snack to discover the power of solar energy. Here are some good methods:

Cook a hotdog using a Pringles can and the sun:  
<http://solardiyhq.com/pringles-can-hot-dog-cooke/>

Create a solar cooker from a Pizza Box:  
<http://www.csiro.au/helix/sciencemail/activities/solaroven.html>

Or have the students design their own cooker based on an assortment of ideas:  
<http://www.solarcooking.org/plans/>

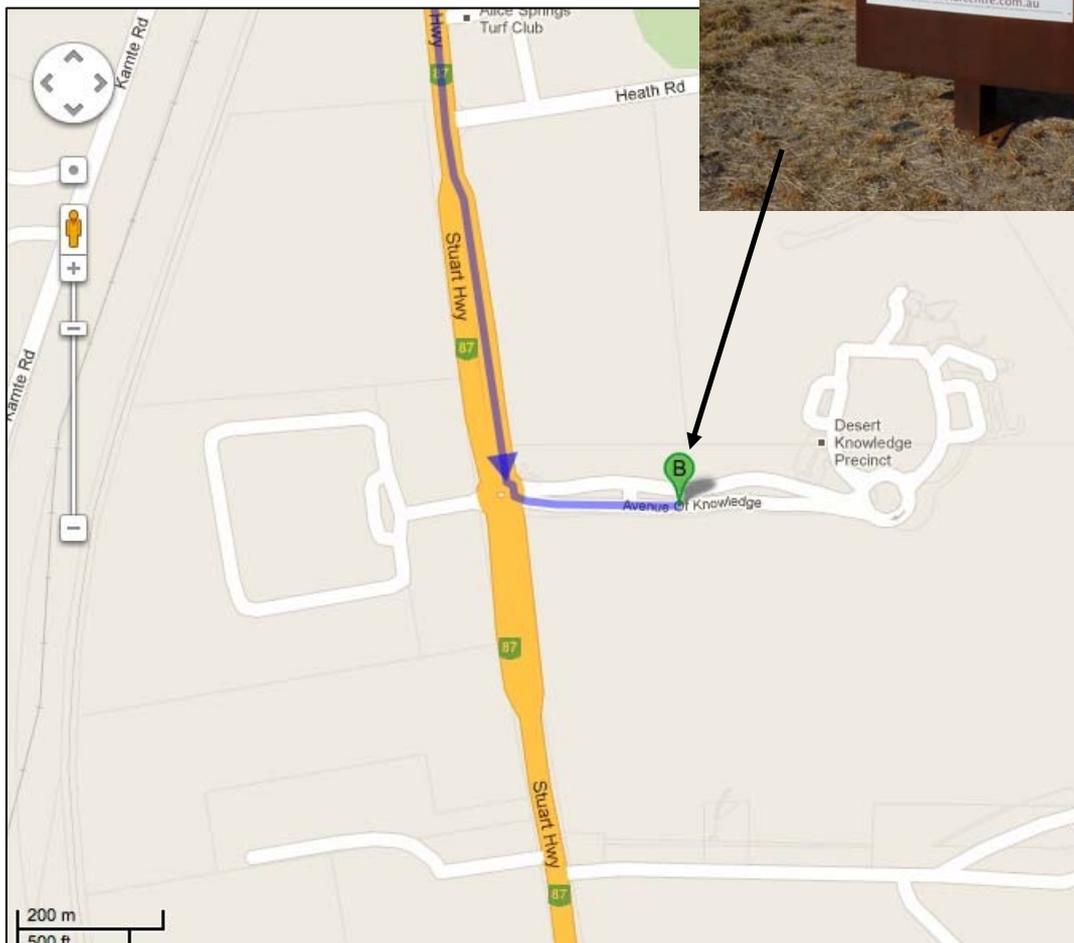


## Excursion 1: Desert Knowledge Australia Solar Centre

### Site / Location:

**Getting there:** (e.g.) Travel south along the Stuart Highway, through the Gap, and turn left into the Desert Knowledge Precinct (opposite Yirara College). The solar centre is located on the South side of the precinct road - note that there are two one way lanes divided by a median strip. It is well signposted. There are turning areas through the median leading into the Solar Centre Parking loop. You can use these, or continue down the track and drive around the round-about to come back to the Solar Centre.

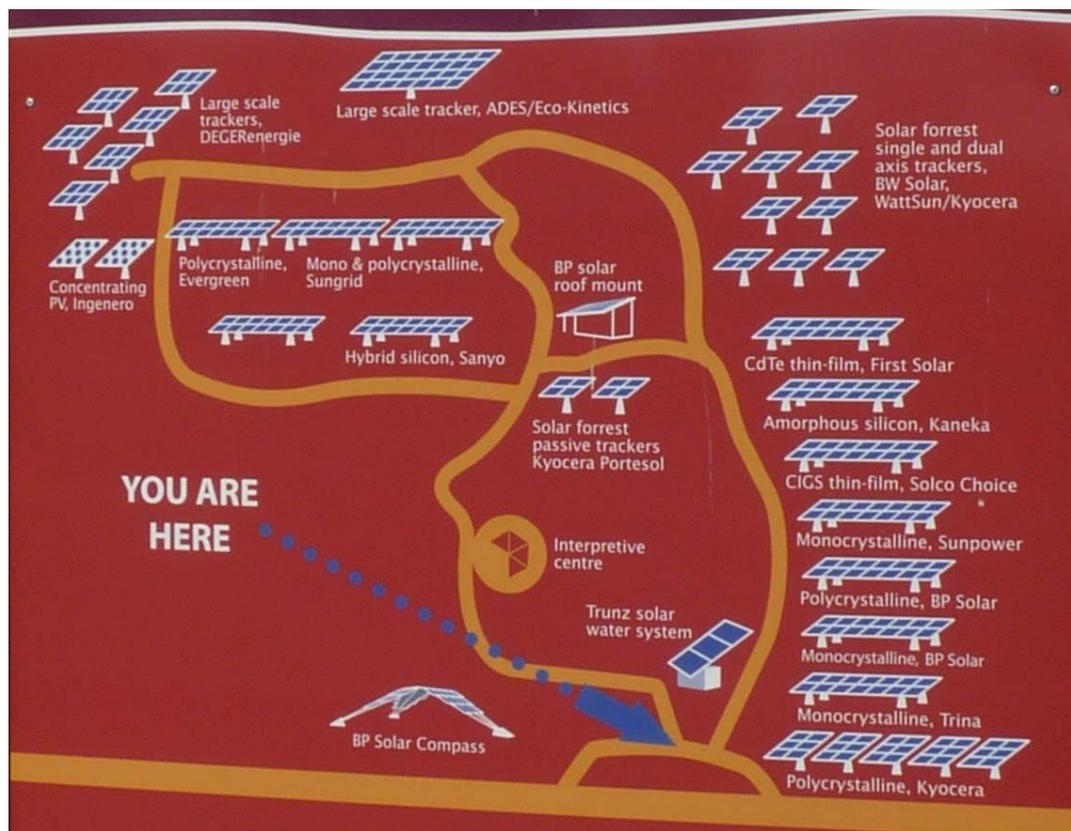
**Distance from CBD:** Approximately 10 km





## Site Description - Desert Knowledge Solar Centre

The Desert Knowledge Solar Centre has been built to compare the efficiency of many different solar technologies under Alice Springs conditions. A trail winds through the solar arrays and interpretive signs provide information about the technology behind each array, discussing the relative advantages of each. A set of touch screen panels in the central interpretive area give access to the Desert Knowledge Solar Centre website, which provides real time data on the efficiency of each of the arrays. Data output can be selected and manipulated to graphically view the output from one array over time or to compare the output of several systems simultaneously. Several different parallel set ups have been constructed to make for scientifically valid comparisons.



## Safety Issues - Desert Knowledge Solar Centre

**These are active solar arrays and electrically charged. There is no barrier, but students must remain on the paths and should not touch anything on or associated with the solar arrays.**

This is an outdoor site so drinking water, sturdy footwear and adequate sun protection are essential. No amenities are available at the Solar Centre and very little shade is provided. However, there are toilets, drinking water, and a Cafe in the Desert Knowledge Precinct. Their location is well sign-posted if you continue east along the Desert Knowledge road.

The loop walk is approximately 500 m in length. All areas can be seen to some degree from the carpark, but there are buildings and trees which will block your view. It is recommended that younger students be closely supervised.



## Onsite Activities

### **Activity: Silicon Crystal Team**

This activity asks students to gather information about the various solar arrays and make comparisons between different photovoltaic materials.

### **Activity: Technology Team**

This activity asks students to gather information about the various solar arrays and make comparisons between different solar technologies.

### **Activity: Tracking Team**

This activity asks students to gather information about the various solar arrays and make comparisons between different solar tracking methods.

### **Activity: Embodied Energy**

This activity introduced the concept of embodied energy and asks students to think about the embodied energy content in different types of solar technology and the impact of different materials and manufacturing processes on embodied energy content.

**These activities can also be performed back in the classroom by accessing the DKA Solar Centre website.**



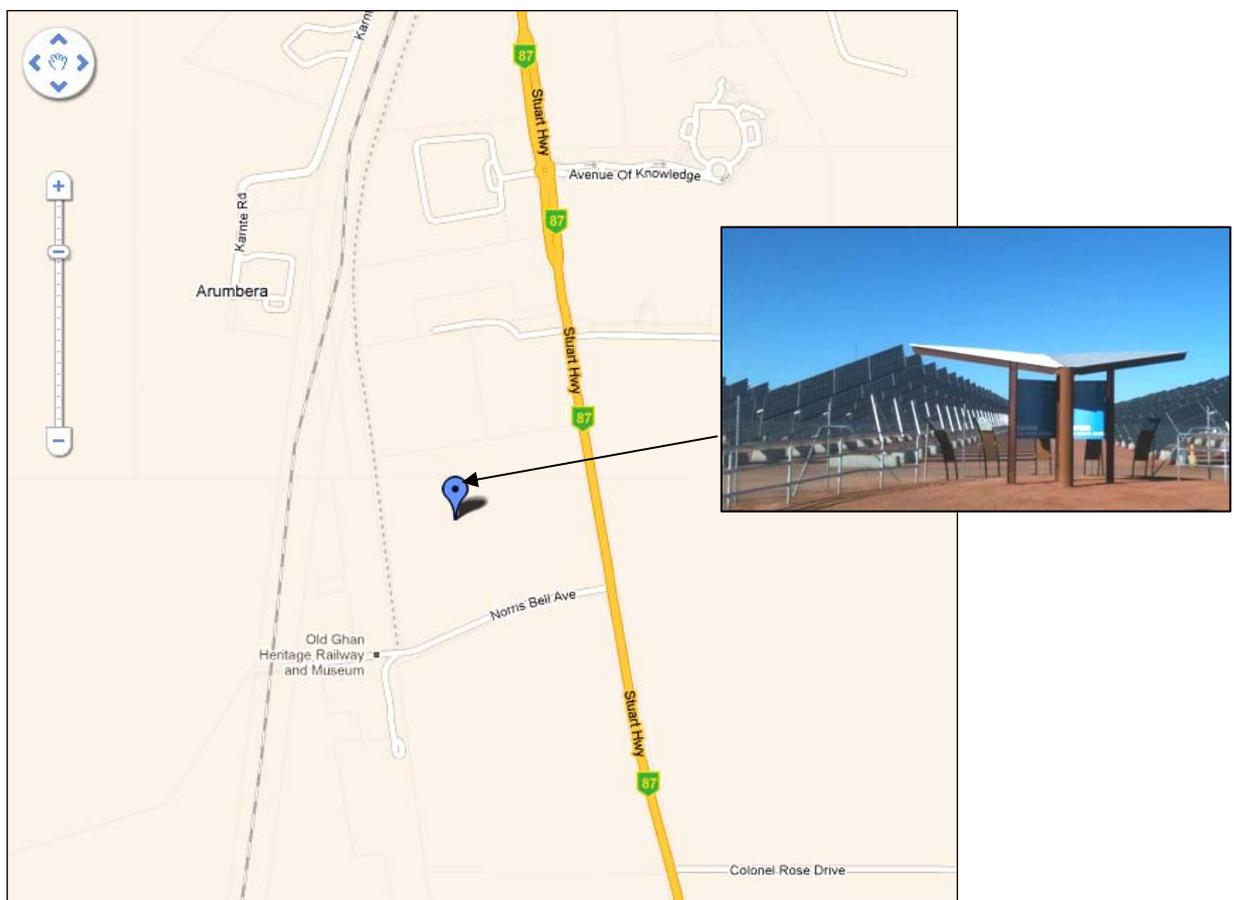
## Excursion 2: Uterne Solar Farm

### Site / Location:

#### Alice Solar City: Uterne Solar Farm

**Getting there:** (e.g.) Travel south along the Stuart Highway, through the Gap, and turn right on Norris Bell Avenue just after the 8HA radio station. A sign to the Transport Museum points the way. A dirt track leads off to the right after a couple of hundred metres, leading to the solar farm viewing point and interpretive display.

**Distance from CBD:** Approximately 10 km



Google Maps Link [here](#)

### Site Description - Uterne Solar Farm

The Uterne (pronounced you-turn-ay) Solar Farm is a 1 MW peak capacity solar power station. 3,048 ultra-efficient Sunpower mono-crystalline panels are hooked up to a tracking system to enable the panels to follow the path of the sun through the sky, maximising the power output throughout the day. Electricity generated at the Uterne Solar Farm is fed into the local power grid and can provide enough electricity to power the equivalent of 288 average Alice Springs homes.



## Safety Issues - Uterne Solar Farm

**This is an outdoor site so drinking water, sturdy footwear and adequate sun protection are essential. No amenities are available onsite. Very little shade is available.**

## Onsite Activities

No on-site activities have been developed for Uterne Solar Farm due to the lack of suitable shading and amenities. It is recommended to use the Uterne Solar Farm excursion to reinforce discussion of local power supplies and renewable energy themes.



## Post-visit Activities: Worksheets

The following activities can be done back in the classroom after visiting the excursion sites.

### **Activity: Concentrated Solar PV**

This activity encourages students to investigate efficiency and other aspects of a particular type of solar technology.

**Note: Any of the on-site activities for the DKA Solar Centre can be performed in the classroom using the DKA Solar Centre website. Students will need a computer connected to the internet.**

## Post-visit Activities: Practical

### **Conduct an energy audit of the school/classroom:**

Students try to find out how much energy the school uses to function every day and where it comes from (e.g. electricity, solar, fossil fuels).

Here's a good source: <http://www.enviroweek.org/media/Energy-Audit.pdf>

### **Solar Schools Activity: Meter Reading**

A related activity which will help students find out how much electricity is being used in their homes or at school.

### **Solar Schools Activity: Analysing Greenhouse Gas Data**

This activity asks students to graph global atmospheric CO<sub>2</sub> levels and temperatures over the last 240 years, look for data patterns and construct scientific arguments to back up their findings.

### **Solar Schools Activity: Effect of Amount of Light and Wavelength on Solar Cells**

This activity asks students to conduct a scientific investigation to measure the electrical output of a solar panel under different light conditions. This activity requires some specialist equipment.



## Supporting Materials

A variety of further learning resources, including books, magazines and DVDs, is available from the Alice Solar City reference library at the Smart Living Centre – only a small selection are referenced here. These materials are available for loan on request.

### Books:

CSIRO (2009), *THE CSIRO HOME ENERGY SAVING HANDBOOK: How to save energy, save money and reduce your carbon footprint.*

Diesendorf, M. (2007), *GREENHOUSE SOLUTIONS WITH SUSTAINABLE ENERGY*, UNSW Press.

Gore, A. (2006) *AN INCONVENIENT TRUTH: The planetary emergency of global warming and what we can do about it*, Bloomsbury, London.

Komoto, K. et al. (2009), *ENERGY FROM THE DESERT Very Large Scale Photovoltaic Systems: Socio-economic, Financial, Technical and Environmental Aspects*, Earthscan, London.

Renewable Energy Centre Brisbane & North Point Institute of TAFE Queensland (2003), *RENEWABLE ENERGY: INTRODUCTION TO RENEWABLE ENERGY TECHNOLOGIES (NUER01) Resource Book*,

### DVDs:

*AN INCONVENIENT TRUTH: A Global Warning*, Paramount Pictures.

*CRUDE: the incredible journey of oil*, ABC DVD

*YOUR HOME: Your interactive step by step guide to comfortable, stylish and healthy living*, Australian Government & the Building and Design Industries

### Web Content:

Alice Solar City: [www.alicesolarcity.com.au](http://www.alicesolarcity.com.au)

Alice Solar City Uterne Solar Farm factsheet:

[http://www.alicesolarcity.com.au/sites/default/files/Uterne%20Fact%20Sheet\\_0.pdf](http://www.alicesolarcity.com.au/sites/default/files/Uterne%20Fact%20Sheet_0.pdf)

Alice Solar City Solar Trail Map:

[http://www.alicesolarcity.com.au/sites/default/files/428655%20ASC%20Solar%20trail%20map\\_FA\\_LR.pdf](http://www.alicesolarcity.com.au/sites/default/files/428655%20ASC%20Solar%20trail%20map_FA_LR.pdf)

(You can also pick up copies of the Solar Trail Map at the Alice Solar City Smart Living Centre)

Climate Commission report on the national outlook for renewable energy generation over the next decade:

[http://climatecommission.gov.au/wp-content/uploads/Renewables-report\\_lowres.pdf](http://climatecommission.gov.au/wp-content/uploads/Renewables-report_lowres.pdf)

CSIRO Report: Solar Intermittency: Australia's Clean Energy Challenge: <http://www.csiro.au/science/Solar-Intermittency-Report> (this is a useful resource to use as a basis for discussion on the issue of solar intermittency)

Desert Knowledge Australia Solar Centre: <http://dkasolarcentre.com.au/>

EnergyTrend: for current PV prices: <http://pv.energytrend.com/>

International Energy Agency Photovoltaic Power System Programme: <http://www.iea-pvps.org/>

(This website provides a number of reports relating to solar PV trends and other research)



## Supporting Materials, continued

Power & Water Student Resources: [http://www.powerwater.com.au/community/student\\_resources](http://www.powerwater.com.au/community/student_resources)

SolarBuzz: Market Research and Analysis (for current PV module prices): <http://www.solarbuzz.com/facts-and-figures/retail-price-environment/module-prices>

SolarSchools.net: get involved with a community of schools making a difference to their energy consumption - resource for further activities: <http://solarschools.net/>

'Your Home' Technical Manual: <http://www.yourhome.gov.au/>

## Who Can Help?

If you need further information on the excursion guides or any of the site locations, you are welcome to contact any of the following:

EFSCAN Co-ordinator  
Education for Sustainability Central Australian Network  
Email: [efscan@alec.org.au](mailto:efscan@alec.org.au)

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***(Please note, the Alice Solar City Project comes to an end in June 2013 and staff at the organisation may not be available to offer ongoing support after this date)***

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