

# Solar Schools for British Columbia

A collection of  
lessons to assist  
teachers and students  
with their exploration  
of solar energy



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## Picture this

### Showing how solar energy systems work

#### What will happen

Students develop a fun and interesting presentation to explain the concepts of solar photovoltaic and solar thermal systems.

#### Students will

- Differentiate between solar photovoltaic and solar thermal systems;
- Develop an understanding of how each of these systems works;
- Research a variety of sources;
- Assess the pros and cons of each type of system;
- Set criteria they will use to evaluate their work;
- Create an interactive teaching methodology;
- Teach others in a memorable way;
- Conduct self-evaluation and refine their work.

Total Time 3 - 5 hours	Establish what students know	Activity - Part A	Activity - Part B	Debrief what students learned
	30-40 minutes	20 minutes	120-240 minutes	40-60 minutes

#### What you need to know

There are two main areas in solar energy system development. They are solar thermal and solar photovoltaic systems.

- **Solar Thermal (Solar Hot Water) - Using sunlight for heating.** Water heating is one of the most cost-effective uses of solar energy. To date, over 42 million solar thermal systems have been installed worldwide. Solar hot water systems are most often used for heating swimming pools or for domestic hot water use such as showers, dishwashers and household laundry. Solar thermal is also used for space heating.

Most solar water heating systems consist of three main components:

- A solar collector to convert solar radiation into useable heat.
- A heat exchange/pump module to transfer heat from the solar collector to the water.
- A storage tank to store the solar heated water. Some systems also contain an alternate energy source such as gas or electricity to boost the water temperature if there is not sufficient sunlight to heat it.

- **Solar Photovoltaic – converting sunlight into electricity.** Photovoltaic power generation uses panels made of semiconductors that allow sunlight to be converted directly into electricity. The panels consist of solar cells that are typically combined into modules that hold about 40 cells, and about 10 of these modules are mounted in photovoltaic arrays. These arrays can be mounted at a fixed angle facing south, or on a tracking device that follows the sun, allowing them to capture the most sunlight over the course of a day. About 10 to



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20 arrays can provide enough power for a household. For large electrical utility or industrial applications, hundreds of arrays can be interconnected to form a single, large photovoltaic system. Photovoltaic systems are used to run satellites and space stations.

#### What might surprise you

In Canada, provinces that use natural gas for power production could prevent the production of more than 700 kilograms of the greenhouse gas carbon dioxide per house per year for each house producing power from a roof-mounted 3 kW solar PV system. In provinces that use coal for power, that number would be much higher.

#### Establish what students know

- Inform students that they will be exploring and describing solar energy technology in such a way that they will be able to then explain it to others. For example, to teach their parents how a solar technology system works to provide heat or electricity.
- Have students discuss what the words 'photovoltaic' and 'solar thermal' mean. Provide them with the meanings of the root words. i.e. 'photo' means light and 'voltaic' means electric, 'solar' refers to the sun and 'thermal' means related to or associated with heat, and in this case, water.
- Have students form teams of three or four. Assign half the teams to illustrate how a photovoltaic system works and the other half to illustrate how a solar thermal system works.
- Each team will have 3-5 minutes to sketch how they think their system works.
- The teams then each join up with another team that worked on the other type of system. Each team presents their sketch and explains how their system works to the other.

### In Advance

- You may wish to complete the lessons How Solar Cells Work and Magic of Solar Thermal in advance of this lesson to provide students with a grounding in solar technology.
- Review production of electricity, parallel vs. series wiring, and definitions of power, energy, volts, amps, and watts.

#### What you need

- Chart paper
- Markers
- Backgrounder
- Access to video and Internet

## Main Activity Part A

### Exploring Solar Technology

#### What you do

In this part of the lesson the students add to and confirm their knowledge of the two types of solar energy systems.

1. Divide the class into two groups based on which solar energy system they diagrammed. Have each group a video that explains how that solar energy system works. If your school does not have video resources available on this subject, there are a great many short videos on YouTube. Be sure to preview these videos before assigning students to watch them.
2. After viewing the video, students break back into their original teams and rework their sketches to reflect what they have learned. The teams then present to their larger group to ensure that all components of the system have been covered.
3. If necessary, provide students with further opportunity to research and add to their knowledge and understanding of solar technology. Some starting places for information include:
  - Solar BC – See a list of the solar domestic hot water systems that are currently registered for the SolarBC program through registered installers.  
<http://www.solarbc.ca/learn/systems>
  - Natural Resources Canada (NRCAN)  
<http://nrcan.gc.ca/eneene/renren/index-eng.php#solar>

## Main Activity Part B

### Learn One - Teach One

In this part of the lesson the students create a fun and interesting way to teach others how the two types of solar energy systems work.

1. Assign an audience to each team or allow students to choose which type of audience they would like to present to. Audiences could include: another class at the school, the school staff, an elementary school group, a group of seniors, their parents, etc.
2. As a class, brainstorm a variety of methods for presenting the material such as a true-false card game, a working model, a board or other type of game, a skit, a metaphorical representation using everyday objects, a song, a video, etc.
3. Work with the students to determine the criteria for measuring the success of their teaching technique. How will they know if they have demonstrated all of the information and if their audience has understood what they are teaching.
4. In their original teams, students then decide on a method of presentation for their solar energy system and an audience to present to.
5. Students use their previous research and sketches in creating their presentations. You may also wish to provide them with further background information such as the SOLAR BC website <http://www.solarbc.ca/learn/systems>. Provide students with one to two class periods in which to develop and rehearse their presentations.

6. While developing their presentations, the teams should make a list of vocabulary that could be new their audience.
7. When the presentations are complete, have each team conduct their presentation to the rest of the class.

#### Debrief what students learned

- Instruct the teams to analyze their learning using questions like:
  - What content was new to you?
  - What was the most interesting information you discovered?
  - What did people seem to enjoy the most about your presentation?
  - How well did the learners grasp the information?
  - What did learners appear to understand easily? Struggle with?
  - What did learners want to know more about?
  - How would you change it to make it better?
- Have the teams write 3-5 recommendations that would improve the effectiveness of their presentation.
- Provide students with an opportunity to share their conclusions and to identify how to make their work available for use by future students and teachers, other schools, and by other groups with interest in expanding their awareness and understanding of solar technology.

#### Assessment

- Did each team adequately explain how either solar photovoltaic or solar thermal systems work?
- Have students list the pros and cons of each type of technology.

#### Extensions

- **Show What You Know.** Provide the teams with an opportunity to conduct their presentation to their target audience.
- **Sharing Solar Discoveries.** Post, document or catalogue the presentations and results to assist others who are planning to teach about solar energy systems. To post teaching ideas, submit them by email to [info@solarbc.ca](mailto:info@solarbc.ca)

## Check Out

#### Links

- Clean energy ideas <http://www.clean-energy-ideas.com/articles/>
- California Solar Centre <http://www.californiasolarcenter.org>
- National Energy Education Development Project (NEED) <http://www.need.org>

#### Videos

- A slideshow from the Rarus Institute showing how a silicon solar cell works [http://www.solarschoolhouse.org/hascw/solar\\_cell.swf](http://www.solarschoolhouse.org/hascw/solar_cell.swf)
- From Space to Earth – the history of solar electricity [www.californiasolarcenter.org/fste/fste.html](http://www.californiasolarcenter.org/fste/fste.html)

