

Teacher Professional Development Workshop, “Bring Renewable Energy and Electronics into Your Class” October 23rd, 2015

Thank you to all the teachers who came to our 2015 Pro-D workshop. We hope the sessions inspired you to take renewable energy and electronics into your classrooms. We have assembled a list of resources below, including session summaries, Lend an Experiment (LEx) Box contents, and places to buy supplies.

For any questions, comments, or suggestions, please contact us at outreach@phas.ubc.ca.

Session Summaries

Note: We have made the powerpoint presentations available on the website:

<http://outreach.phas.ubc.ca/resources/teacher-workshops/>

Session #1 – Teaching Energy and Climate in Schools, Chris Waltham

This session discussed the problems that come up in teaching climate issues at an undergraduate level, and how this translates to underlying issues that educators can address at all grades and ages. A background in energy and climate, as well as ideas for activities to address said issues were also given.

Useful references: c21.phas.ubc.ca, wihouthotair.com

Session #2 – Simple Electronics for Energy Measurements, Andrzej Kotlicki

The second session provided an introduction on voltage, current, resistance, power, and building simple circuits. Tips and advices were given on using multimeters, infrared thermometers, LEDs, and more.

Session #3 – Hands-on Activities in Energy and Climate, Chris Waltham

This final session comprised a discussion on activities to teach various concepts in energy and climate as well as some of the background science. These activities can be done using the equipment from our borrowable Lend an Experiment (LEx) Boxes. The activities include:

- Hand Crank Exercise
 - Tactile! Students can feel what a newton is like, what 100 mW of output is like
 - Connect geared generator to lightbulb, find the electrical power. Estimate the mechanical power with the portable scale.
 - Use different lightbulbs (e.g. LED and incandescent). Find the electrical power needed to generate the same amount of light.
 - Connect geared generator to supercapacitor – the handle will keep on turning after you have stopped cranking it (electromagnetic induction)
- Attaching wind turbine blades to geared generator – a paper pinwheel out of poster paper can turn the generator at the low to medium gear ratio
 - Measure electrical output, optimize blade configuration, optimize gear configuration or load (higher grades)
 - Can try with a water wheel as well
- Playing with infrared thermometers – measure the intensity of emitted thermal infrared coming from the surrounding environment

- Note: the IR thermometer does NOT measure the temperature of the location of the laser beam; rather, it measures the incoming IR in a *cone* – see specifications on thermometer
- Measuring passive solar heating using probe thermometers
 - Observe the temperature of small cubes of various colours and transparency exposed to direct sunlight. Experiment with plastic cups attached to various colours to explore the greenhouse effect

Lend an Experiment (LEx) Box Contents

LEx Box: Renewable Energies and Electricity

- ✓ Digital Multimeters (20)
<http://www.dx.com/p/1-8-lcd-portable-digital-multimeter-black-1-x-6f22-9v-137151>
- ✓ Incandescent light bulbs, 1.4 V (10)
<https://www.digikey.ca/product-detail/en/1728/289-1230-ND/1552785>
- ✓ White LED light bulbs, 3.2 V (10)
<http://www.digikey.com/product-detail/en/C513A-WSN-CV0Y0151/C513A-WSN-CV0Y0151-ND/1922948>
- ✓ Breadboards (10)
- ✓ Gearbox/ hand crank generators (10)
<https://www.pololu.com/product/67>
- ✓ Portable electronic scale (10)
<http://www.amazon.ca/COLEMETER-Digital-Hanging-Luggage-Fishing/dp/B00D864GBW/>
- ✓ Supercapacitors, 1.5 F (10)
<http://www.digikey.ca/product-detail/en/JUWT1155MPD/493-4331-ND/2538685>
- ✓ Wind turbine hubs (5)
<http://www.vernier.com/products/kidwind/wind-energy/parts/kw-wth3/>, then drilled to fit shaft of gearbox generator
- ✓ Solar panels (5)
<http://www.dx.com/p/diy-6v-2-5w-solar-powered-panel-black-375248>
- ✓ Alligator clip jump cables (20)
<http://www.digikey.com/product-detail/en/12-1650/GC396-ND/258503>
- ✓ 50 kOhm potentiometers/ variable resistors (5)
<http://www.digikey.ca/product-detail/en/3352T-1-503LF/3352T-503LF-ND/1088352>
- ✓ Set of prepared jump wires

LEx Box: Climate and the Environment

- ✓ Probe thermometers (15)
<http://www.dx.com/p/digital-compact-lcd-thermometer-with-outdoors-remote-sensor-15553>
- ✓ Infrared thermometers (5)
<http://www.dx.com/p/1-2-lcd-non-contact-digital-infrared-thermometer-with-laser-sight-50-c-380-c-35754>

LEx Box: Environmental Sustainability and Energy Use at Home

- ✓ 120 V incandescent light bulb, 60 W (1)
- ✓ 120 V compact fluorescent light bulb, 60 W equivalent (1)
- ✓ 120 V LED light bulb, 60 W equivalent (1)
- ✓ Light bulb holders (3)
- ✓ Kill-a-watt meters (3)

If you have ideas for other types of LEx boxes you would be interested in, or recommendations for our existing boxes, please send us your suggestions! We would love to hear from you.

List of places to buy supplies

Online:

Deal Extreme* <http://www.dx.com/>

Ali Express* <http://www.aliexpress.com/>

Digikey <http://www.digikey.com/>

*cheap, ships from China directly, takes 1-2 months (make sure to check delivery)

In person:

Lee's Electronics <http://leeselectronic.com/>

Main Electronics <http://www.mainelectronics.com/>

Urban Source (craft supplies) <http://www.urbansource.bc.ca/>

Thank You

We would like to thank Pacific Institute for Climate Solutions and other donors for their generous support for the development of LEx kits and relevant educational materials.



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