

## Hut Solar Lighting

It seems that the UBC Sustainability Movement may be interested in funding solar lighting at our huts, we are talking of lighting two huts for \$400. So here's what we might do if they want to fund it. Keep in mind that a serious hydro plant at Phelix, instead of solar, would do way more to making the hut warm and liveable as well as providing lighting.

Here, all in one place, goes details about the successful solar lighting at Brew, and proposed lighting for Phelix and Harrison. The hope is that we don't need Coleman lamps with their frequent repair cycles, bad smells, hauling of fuel. If you want to feel good about not consuming petroleum, that's OK too.

### 1. Brew

- It has now been running for about a year and appears to work as designed. To completely charge the battery takes  $0.1A \times 20$  hours of direct sunlight, or a little more to deal with inefficiencies. To completely discharge the battery takes  $2.0Ah / 0.25A = 8$  hours.
- The location for Brew is ideal as there is nothing in the way of the sunlight, except clouds and snow buildup on the solar panel.
- The panel is 5 watts and is mounted vertically facing south to get maximum sunlight while avoiding (mostly) snow buildup. Some ice feathers do accumulate.
- Plastic conduit pipe protects the wires until they enter the hut through the floor.
- Cheap doorbell-quality wiring runs to the battery.
- Battery is 9 x Panasonic Eneloop NiMH AA penlight cells, holding 2 Ah when fully charged. Battery holder is a piece of plastic conduit pipe.
- There is no charge controller to limit battery overcharge. Resistors limit charge current to  $C/20$ , ie 0.1A, to protect the battery from damage from over-charge. 0.1A is easily achieved in full-on sunlight.
- A power switch, consisting of a timer and various integrated circuit components, allows turning on the light, and it turns off automatically after about an hour. It may be turned on again, of course.
- The light is a 3W (12V x 0.25A) led (from China). It is mounted below a plastic mirror, increasing the apparent light output.

Here's a list of parts and costs, more or less, as built.

5 W PV panel Eco-Worthy China eBay	\$23.54
9 ea Panasonic Eneloop batteries from NCIX	\$44.78
Light bulb, 3 watt, Banggood, China	\$4.46
Wire from Kerrisdale Lumber	\$10
Conduit pipe do	\$10
Mirror from Robertson Plastics	\$10
Parts for light switch, pushbuttons, pcb, ic's	\$15

Total around \$118

## 2. Harrison

- The location for Harrison, like Brew, is ideal as there is nothing in the way of the sunlight, except clouds and snow buildup on the solar panel.
- As this hut is relatively inaccessible, and relatively small, the lighting provided at Brew should be duplicated.
- If we could find a suitable charge controller we might charge the battery at a higher rate and then it would deal with multi-day winter trips, not that multi-day winter trips are likely.

### ***Harrison Lighting, Parts, Request for Reimbursement***

22.45	2016/10/25	Lee's Elec parts, ic's, pcb, switches
17.14	2016/10/28	Lee's Elec parts, resistors, box, battery case
1.89	2016/10/29	Dunbar Lumber 1m wire
25.53		Amazon 8 ea AA Eneloops
31.16		eBay 5W photovoltaic panel
6.71	2016/11/09	IKEA mirror behind light
15.99	2016/11/22	Dunbar Lumber wire, staples, connectors
<b>120.87</b>		<b>Total</b>

Request for payment submitted 2016 Nov 25

My original estimate of \$200 for the project will include the cost of installation, which we won't have spent until June 2017.

## 3. Phelix

- The Phelix (Brian Waddington) Hut is more challenging because it gets less sunlight in the winter (there is a mountain in the way). However, morning sunlight is available on the SE side of the Hut.
- The Hut is bigger than Brew, so two lights should be provided. Two mirrors are needed. Perhaps aluminized Mylar film would suffice.
- The simplest estimate has us duplicating the setup at Brew, again without charge controllers and using the Panasonic batteries (two sets of 9 cells). So, over \$200 total cost.
- Probably the batteries will be completely discharged over the New Years Holidays as the Hut gets a lot of use during these times. Should we use a lead-acid battery with higher capacity? No, because these get destroyed if discharged completely and then frozen. Can we connect several Panasonic batteries in parallel? They may not like being connected in parallel, and the batteries are the most expensive ingredient, but maybe.
- Note that there has been talk of putting in a micro-hydro plant at Phelix, which, if successful, would make the hut more livable and would provide lighting, but would be much more expensive.