

## Water Management Report

Alex Gareau and Kitti Hsiang

Focus: Summary of central design ideas for water heating and rainwater collection.

---

### Water Heating

Implementing an evacuated tube collector (ETC) system to fulfill water heating needs based 100% on solar radiant heat. Paradigma/Ritte Gruppe makes such a Solar Heating System which uses CPC-reflectors (Compound Parabolic Concentrator), allowing for maximum efficiency in collecting radiant heat. (See Figure 1). One concern is whether or not this system can remain efficient at low temperatures ( $< -20^{\circ}\text{C}$ ), but according to the manufacturer it remains fairly efficient for high temperature differences between collector tubes and ambient air. (Figure 2.) However this should be further investigated. If needed, alternate sources of heat could complement the ETC (heat pump, electric heating from PV panels, etc.) Conversely, during summer time when heat collection may exceed water heating needs, excess can be used for desiccant regeneration, if such a system is adopted to help air conditioning. Other issues to investigate: some research (in a previous report by Svetlana) indicates that PV-generated electricity may be more efficient than an evacuated tube system. However keeping that electricity for other usages may help reach net-zero. Then arises the question of roof space allocation for ETC vs PV arrays. ETC units may also be integrated in windows (Figure 5 at very end of document). To be discussed.



Figure 1. Basic components of an ETC unit.

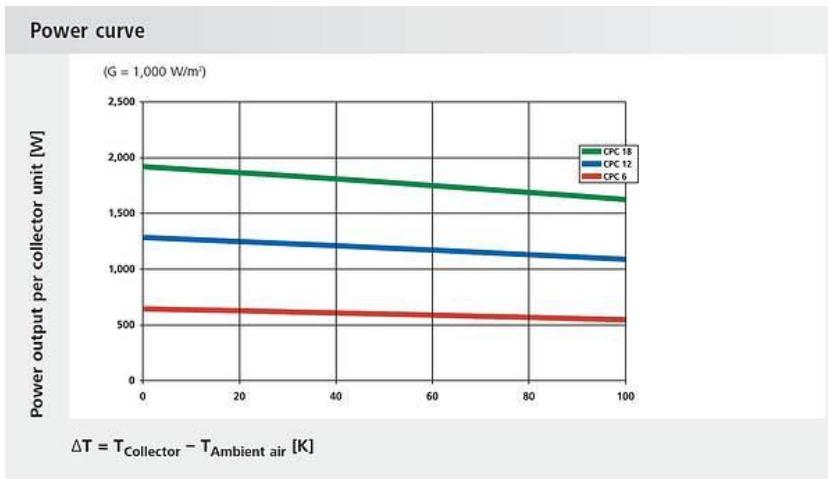


Figure 2. Power output VS  $\Delta T$  (Ritte-Gruppe).

To further optimize water heating, efficient water circulation in the house is important. Some key elements include a central manifold, to individually control each fixture, used in combination with cross-link polyethylene (PEX) piping network, which offers better insulation than copper and is corrosion resistant.

### Water Collection

A cistern used to collect rainwater for all water consuming activities, excluding consumption. Here a 1500L tank is suggested (by the same report by Svetlana) to fulfill an average daily consumption of 80 liters/day for a two person home. This is based on an average Montreal rainfall of 104cm/year and accounts for accumulating reserves during heavy rainfall to make up for drier period of year (e.g. winter). The tank and pipes must be properly insulated to deal with winters. The system must be further designed to deal with cold climate: round shape to minimize heat loss, stirring water in tank to prevent freezing, PEX pipes which remain ductile at low temperatures, insulate valves and other fragile components, etc.

### Reuse of Greywater

Greywater from the shower (second floor) would be gravity fed to the ground floor toilet. As for the second floor toilet, greywater from the bathroom sink could be used. When either of these greywater supplies wouldn't suffice, rainwater may be pumped from the tank.

### Efficient fixtures/appliances

It goes without saying that installing low-flow fixtures and efficient appliances throughout the house is essential in minimizing water consumption. Choosing those is not a priority for now, but research for innovations is ongoing. One example of such an innovation is a showerhead

To complement the ETC water heating system, a heat recovery unit would be installed to collect water heat from shower drain and transfer it to the hot water tank (Figure 3). This could be even more efficient if the mechanical room is located almost directly under the (based on last plans).

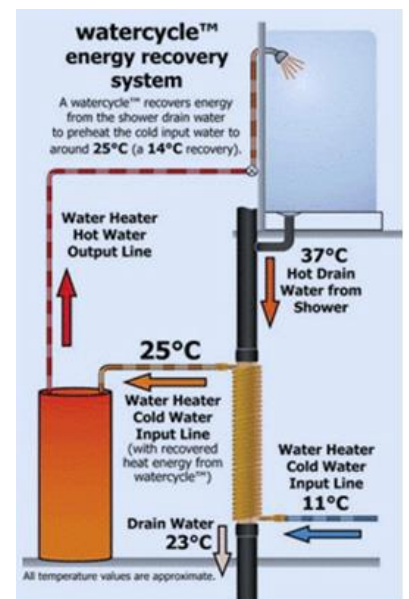


Figure 3. Diagram of Heat Recovery System, HX-3030 Residential and Commercial DWHR by Echometips.

which cuts down flow to a trickle once the desired water temperature is reached until the shower enthusiast enters the shower (Evolve Roadrunner II).

#### Other ideas being researched

- I. Solar, air, geo pump for the heating/cooling hot water system, e.g. SunPump
  - i. Combines characteristics of solar, air, and geo heaters
  - ii. Works at night
  - iii. Only one mechanical part (lowers chances of failure)
- II. Constructed indoors wetlands as a means of water filtration
  - i. Aesthetically pleasing
  - ii. Low cost and low energy
  - iii. Requires minimal maintenance and operation
  - iv. Filters out toxins in water; takes out pollutants as well as excess nutrients
  - v. One area of concern would be the harsh winters; is it possible to have it indoors?
- III. Moss green roof to slow water runoff
  - i. Moss can endure harsh winters (cold, lack of sun)
  - ii. A means of initial water filtration
  - iii. Low cost, low maintenance

To be updated..



Figure 4 and 5. ETC unit placed on roof and integrated in window.

External links:

- Natural Resources Canada.  
<http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&uris=qc&rn=2&page=4&CFID=32715245&CFTOKEN=cad51de7157882cb-DA317AB6-D1D2-E08A-F84A3B7D0ED592F4>
- Ritter Group / Paradigma (ETC).  
<http://www.ritter-group-usa.com/faq/>
- MANABLOC Central Manifold.  
<http://www.supplyhouse.com/Viega-NPTS-36144-14-Port-Compression-MANABLOC-Package-NPT-Supply>
- Ecohometips Heat Recovery System.  
<http://www.ecohometips.com/drain-water-heat-recovery.html>
- Evolve Shower Head  
[http://evolveshowerheads.com/roadrunner2\\_showerhead.html](http://evolveshowerheads.com/roadrunner2_showerhead.html)
- [http://www.solar-hot-water.ca/wp-content/uploads/SunPump-brochure\\_Feb15d.pdf](http://www.solar-hot-water.ca/wp-content/uploads/SunPump-brochure_Feb15d.pdf)
- [http://mossacres.com/info\\_5.asp](http://mossacres.com/info_5.asp)
- <http://www.totousa.com/>
- <http://www.globesolarenergy.com>
- [http://water.epa.gov/type/wetlands/outreach/facts\\_contents.cfm](http://water.epa.gov/type/wetlands/outreach/facts_contents.cfm)
- [http://water.epa.gov/type/wetlands/restore/upload/1998\\_04\\_02\\_wetlands\\_pdf\\_hand.pdf](http://water.epa.gov/type/wetlands/restore/upload/1998_04_02_wetlands_pdf_hand.pdf)
- <http://www.watersmartinnovations.com/posters-sessions/2008/PDFs/1630-%20ML%20Robinson-%20Constructed%20Wetlands.pdf>