

# Waterford Energy Bureau - Renewable Energy Fact Sheet No.9

## Solar Energy



### Brief Description

Solar (sun) water heater is an efficient and reliable technology that converts sunlight into heat to produce hot water. A solar water heater can reduce your hot water bill by between 40-70%. In Ireland a horizontal surface of 1m<sup>2</sup> receives an average of between 1,000kWh and 1,200kWh of solar energy per year (the equivalent of 120 litres of oil). Both direct sunlight (40%) and indirect sunlight (60%) provide this energy. So even when the sky is over cast and you can't see the sun, its radiation (sunlight) is available at ground level and can be converted into useful heat by solar water heater. On a bright day, any surface standing in the sun will receive about 1,000 watts or solar radiation (a power equivalent to that of 10 strong bulbs).

### Solar Thermal Technology

This type of system typically uses a transparent collector, consisting of a thin, black metal panel mounted on a south-facing wall to absorb the sunlight.

- A solar collector absorbs solar radiation (sunlight) and changes it into heat;
- A pump which transfers the heat from the collector to hot water in a storage tank;
- The storage tank accumulates hot water produced by solar energy so that it can be used when it is needed.
- A back up heater (gas/oil boiler, immersion, heater, heat pump, biomass), which will bring the hot water to temperature required when there is not enough sunlight to do so (mostly in Winter)

In Ireland, solar collectors alone cannot provide all the hot water for a household's needs throughout the year. They are normally installed in conjunction with a conventional heating system.



### Types of Solar Water heating

Two main types of solar collectors, both available on the Irish market include:

- Flat plate collectors, with a selective absorber, are well suited for hot water production and low temperature heating (Typical efficiency of 40%)
- Evacuated tube collectors that are more efficient with higher water temperature and provide solar water heating when solar radiation is less intense. (Typical efficiency of 60%).

### Uses of Solar Water Heating

Hot water from the solar water heating system can be used for

- Central heating/Pre Heating
- Swimming Pools
- Domestic Hot Water

### Installation Costs

The table below gives you an idea of the size and cost of an evacuated tube solar water heater for domestic hot water, according to the number of people in your household:

| <b>Evacuated Tube-Solar Water heating Installation for Domestic Hot Water</b> |   |   |   |
|---|---|---|---|
| <b>Number of People in the House</b>  | <b>Area of Solar Collectors (*evacuated tube)</b> | <b>Volume of the Solar Hot Water Tanks (Litres)</b> | <b>Indicative Initial Investment (**)</b> |
| 2-3   | 2-4m <sup>2</sup>                                 | 1/200   | €3500/€5500                               |
| 4-5   | 4-6m <sup>2</sup>                                 | 200/300   | €5500/€7000                               |
| 6-7   | 6-8m <sup>2</sup>                                 | 300/400   | €700/€9000                                |

(\* ) Area for flat plate collectors. The equivalent area for evacuated tube collectors will be smaller as they have a higher efficiency.

(\*\* ) Price of a complete solar package (collectors storage tank, controller, pump, hydraulic components etc.) excluding VAT and installation. Installation should require two or three days by a skilled installer.

The optimal inclination for your solar collectors is 20 degrees – 50 degrees. But they can be tilted from 30 degrees – 60 degrees without significant loss of performance. Some solar panel makes can be mounted vertically. Collector panels are most productive when facing south. However they can be oriented between southeast and southwest without significant loss off efficiency.

### Guide to installing Solar Water Heating

Adequate space should be left to install the solar storage cylinder (200-300 litres) in a hot press or boiler room. The optimum area of collector, which might be installed in a dwelling, depends on the hot water demand. It is generally held that 3-5m<sup>2</sup> of flat plate collectors might be right for a family of up to 4 persons; for 5-6 people, 4-6m<sup>2</sup> might be optimum. The corresponding evacuated tube collector absorber area may be reduced to two thirds of the equivalent flat plate collector.

It is generally expected that a well-designed system will provide the majority (40-60%) of a family's hot water requirements during the summer months and make a useful contribution during the rest of the year. Solar panels can be mounted in roof or on top of the slates/tiles.

### Solar Water Heating

A correctly sized solar water heating system will cover 40-60% of your hot water requirement with free solar energy. Solar water heaters comprise of a solar collector, pump controller and hot water storage.

The capital cost is largely offset by the economy on energy saved payback typically under 7 years. To conclude: the average solar panel receives 450kWh/yr per m<sup>2</sup> and one could assume that kerosene is displaced fuel corresponding to 115.6 kg CO<sup>2</sup> saving.

| Cost Analysis of installing a Solar panel in a house (4-5 persons 4-6m <sup>2</sup> of solar panel) |                                   |                              |                 |                     |
|---|-----------------------------------|------------------------------|-----------------|---------------------|
| Energy Source   | Typical Energy Consumed/Generated | Factor for Boiler Efficiency | Cost per kWh/hr | Typical annual Cost |
| Oil   | 1,800 kWh                         | 0.75                         | €0.08           | €192                |
| Elec.   | 1,800 kWh                         | 1                            | €0.17           | €288                |
| Solar (4m <sup>2</sup> )  | 1,800 kWh                         | N/A                          | €0              | €0                  |

### Solar Panels Grant

Considering environment and climate change concerns the Irish Government encourage renewable energy solar installations, through grant given by the Better Energy Homes Scheme. These installations contribute significantly to Climate Change Obligations and reduce Waterford Dependence on imported Oil.

### Cost Analysis of installing a Solar panel in a house (4-5 persons 4-6m<sup>2</sup> of solar panel)

| Typical Solar Panel cost (supply install, commission including) | S.E.A.I Grant | Typical Installation Cost |
|---|---------------|---------------------------|
| €3,500 to €5,000  | €1,200        | €2,300 to €3,700          |

### Photovoltaic PV

The photovoltaic (PV) process converts sunlight, directly into electricity. The equipment required for this process has no moving parts.

In addition, the electricity is generated with no emissions and no noise. A PV cell consists of two or more thin layers of semiconducting material, most commonly silicon. When the cell is exposed to light, electrical charges are generated and this can be conducted away by metal contacts as direct current (DC).

|                             |   |
|-----------------------------|---|
| <b>Solar-Flat Plate</b>     | €250/m <sup>2</sup> (to max. Of 6m <sup>2</sup> ) |
| <b>Solar-Evacuated Tube</b> | €350/m <sup>2</sup> (to max. Of 6m <sup>2</sup> ) |

The electrical output from a single cell is small; therefore multiple cells are connected together to provide a more useful output. Cells connected in this way are encapsulated (usually behind glass) to form a weatherproof module or panel. Multiple modules can likewise be connected together in order to provide sufficient power for common electrical appliances.

### Grants for solar Photovoltaic

There are no grants currently for Photovoltaic panels for home owners.

With regards to small business, community organisations, sports clubs and agricultural producers, a grant scheme will be expected in summer 2018, to financially support small scale solar energy generation for these groups,

Waterford Energy Bureau is a sub-section of Waterford City & County Council Environment Department.



**Waterford Energy Bureau**  
**The Mall, Co. Waterford**  
**Phone No: 0761 10 2429**  
[www.waterfordenergy.ie](http://www.waterfordenergy.ie)  
[info@waterfordenergy.ie](mailto:info@waterfordenergy.ie)

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