Lochinvar Ltd

LZC Solutions

Solar Thermal and its Integration with Domestic Hot Water systems
Presentation to CIBSE/ASHRAE Group 10TH December 2008

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Why solar thermal

Environmental factors

- Growing legislation
- Green lobby

Rising energy costs

People power

Why solar thermal

- A well constructed solar thermal domestic hot water package will provide a sustainable reliable source of domestic hot water for many years without the need for costly ongoing maintenance.
- **It will:**
- Reduce the Carbon footprint of the building
- Reduce the buildings reliance on fossil fuels
- Reduce the energy bills of the building

Basic System Design

- **System Components**
- **Sizing Solar Systems**
- **Integration With DHW Systems**

System Components

A Solar Thermal DHW system requires:

- A Solar collector
- Storage vessel or Heat Exchanger
- Pipework
- Control system
- Primary heat source

System Components

Solar collectors

There are 3 types

- Unglazed
- Flat plate
- Evacuated tube

Solar Collectors

- **Flat Panel v Evacuated Tube**

Flat Panel

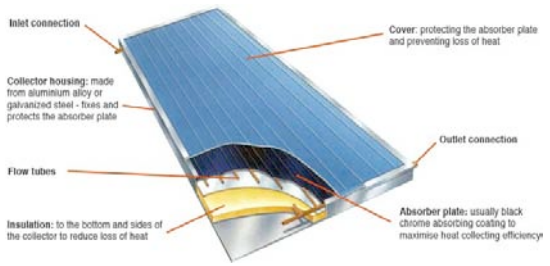
- Simple design
- Cheaper
- Can be roof integrated
- Heavier
- Larger surface area required
- Less efficient

Evacuated Tube

- High efficiency even on cloudy days
- Smaller surface area
- Lightweight
- Repairable
- Seen as delicate
- Can need higher maintenance

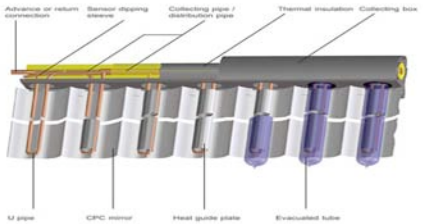
Solar Collectors

Typical flat plate collector



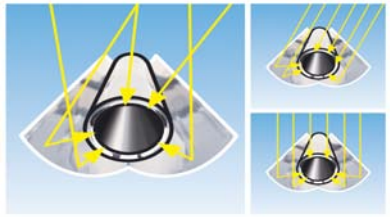
Solar Collectors

- Typical evacuated tube collector



Solar Collectors

- Evacuated tube collector principles



Solar Collectors

- All solar collectors must be certified to BSEN 12975
- Look for the solar key mark

Solar irradiation

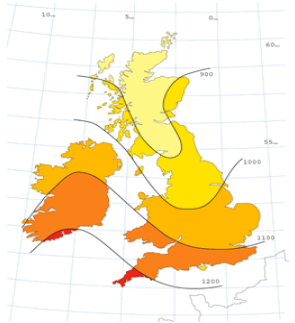


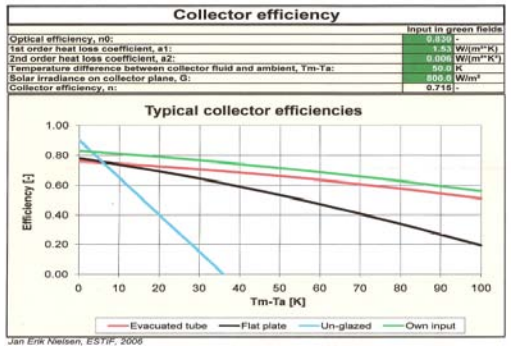
Chart showing solar irradiation in UK (W/ m2) on collector surface at 30^0 facing south

Collector Efficiency

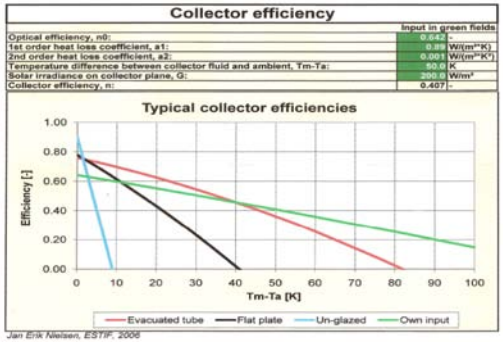
- Collector efficiency consists of
- Absorber efficiency average 85%
- Minus absorber emissions 2%-14% dependant upon insulation and selective coating

- **Collector efficiency will change according to dT between collector fluid temperature and outside air.**

Collector Efficiency



Collector Efficiency



Collector Efficiency

- Care should be taken to ensure the collectors are sited correctly.
- South facing @30-40 degrees
- Avoid shading

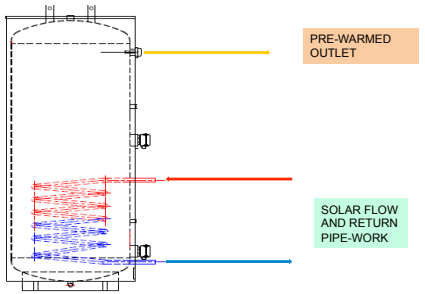
System Components

Storage vessel or Heat Exchanger

- Must be sized accurately for collectors
- Usually fitted next to the primary heat source
- Heat exchangers used for specialized applications

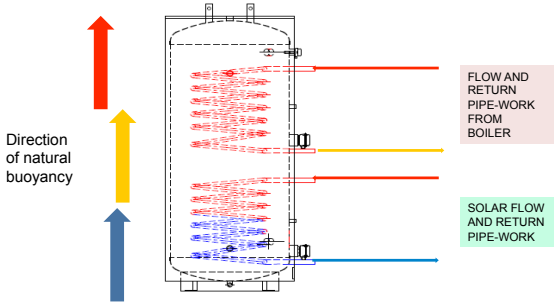
Solar store

- **Pre-heat store**



Solar store

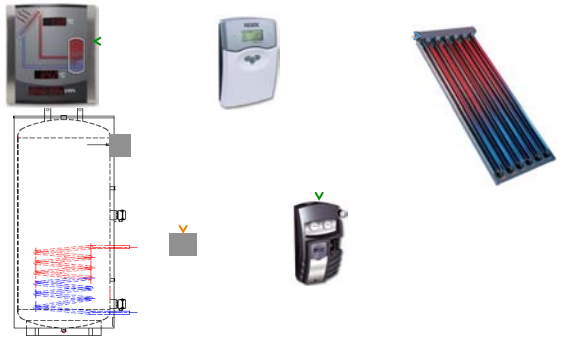
- **Twin coil calorifier**



Pipe-work

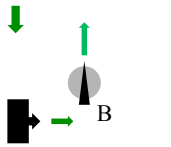
- Must be sized to suit the individual project
- Must be constructed from materials capable of withstanding high temperatures (160c) and pressures (6bar) pressfit !
- Should incorporate appropriate safety valves and expansion vessel.

Controls



Controls By-pass arrangement

3 port valve closed until temp B exceeds demand temp



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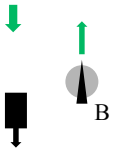
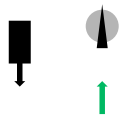


Controls Heat-dump arrangement

Fan convector

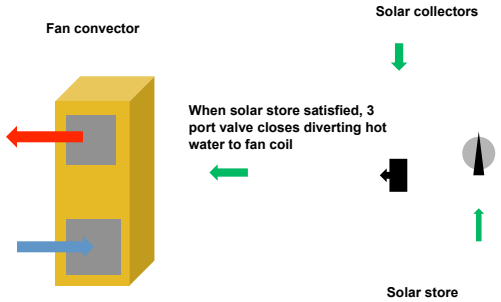
Solar collectors

3 port valve closed until solar store satisfied



Solar store

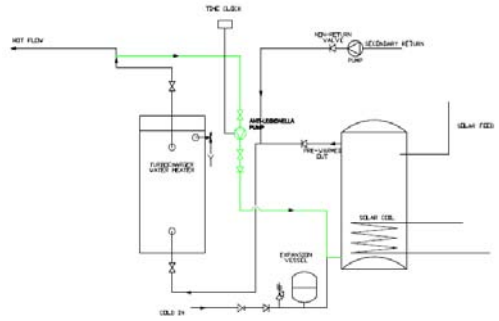
Controls Heat-dump arrangement



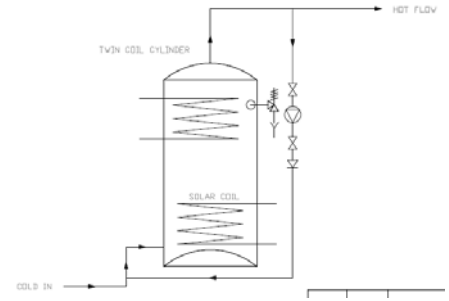
Controls legionella control

- Legionella colonisation can be a risk within the solar vessel, especially during spring/autumn when temperatures within the vessel will be lower.
- Temperature control
- Mechanical control

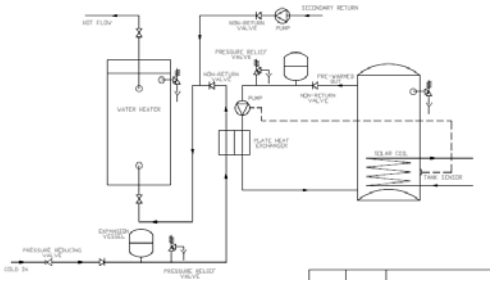
Legionella control-temperature



Legionella control-temperature



Legionella control-mechanical



Primary heat source

- Will still do a large percentage of the D.H.W demand
- Efficiency of appliance important
- Consider condensing

Condensing Technology

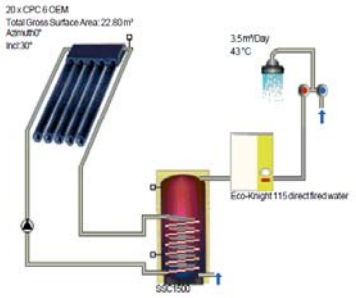
- Gross efficiencies – up to 98%
- Hot water recovery rates from 700 to 10,000 l/hr

Sizing of solar systems

Project Criteria

- In order to provide an accurate sizing the following information is required:
  - Daily hot water demand
  - **SOLAR FRACTION** required
  - Post code of the building
  - Type of building
  - Number of occupants per day
  - Roof space available and orientation/ pitch of roof

T-SOL sizing calculation

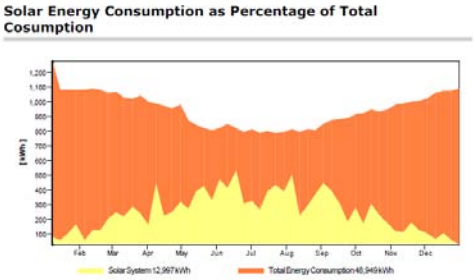


Results of Annual Simulation

Installed Collector Power:	15.96 kW	
Collector Surface Area (Irradiation):	22.47 MWh	1,123.71 kWh/m²
Energy Produced by Collectors:	13.35 MWh	667.26 kWh/m²
Energy Produced by Collector Loop:	13.00 MWh	649.83 kWh/m²
DHW Heating Energy Supply:	49.08 MWh	
Solar Contribution to DHW:	13 MWh	
Energy from Auxiliary Heating:	35.95 MWh	
Natural Gas (H) Savings:		1,930.7 m³
CO2 Emissions Avoided:		3,279.23 kg
DHW Solar Fraction:		26.6 %
Fractional Energy Savings (EN 12976):		20.8 %
System Efficiency:		57.8 %

- Typical results, Bristol

T-SOL sizing calculation



System efficiency

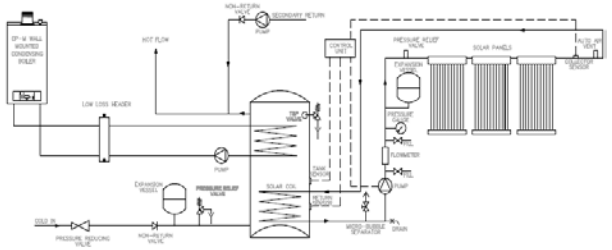
- **System efficiency is dependant upon:**
- Type of collectors used
- Temperature of the DHW system
- Installation of collectors
- Solar fraction
- Correct sizing of solar storage vessel
- Typically around 50%-60%

Integration

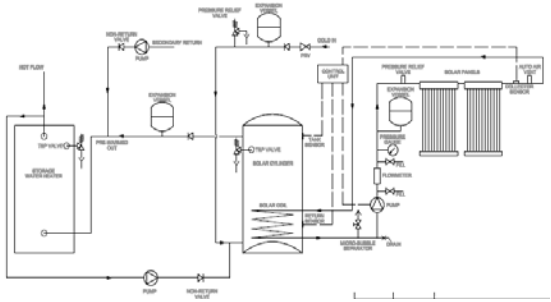
The main methods of integration are:

- **Domestic hot water systems**
  - Twin coil calorifier
  - Pre-heat store
- **Swimming pools**
  - Heat exchanger

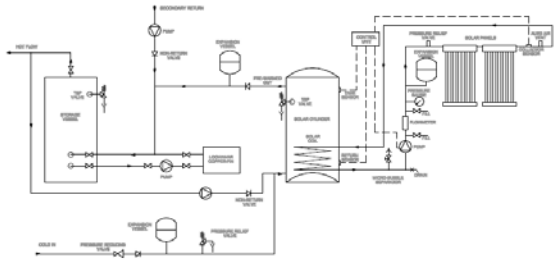
Integration using a twin-coil calorifier



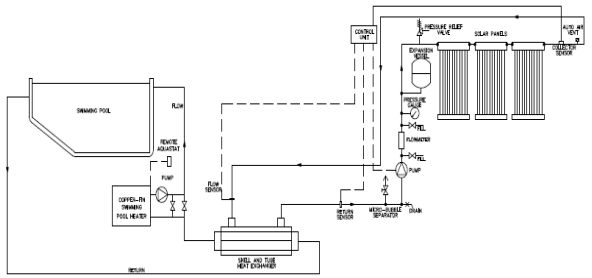
Integration using a pre-heat store



Integration using a pre-heat store



Integration with swimming pools



Maintenance

- Panels are generally self cleaning due to angle sited
- Pressure within the system checked annually
- Circulation pump checked annually
- Visual inspection of panels every 3-5 years

Thank you for listening

Have you any questions?

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