

Solar Thermal Explained...
Barilla Solar

Presented by Karl Thorne



COURSE
OBJECTIVE

*to help you sell
solar thermal by...*

- *Understanding the technology*
- *Learning about some common applications and system layouts*
- *Knowing how to communicate the financial benefits and energy savings*

COURSE TOPICS

- *Introduction to Solar Thermal Technology*
- *Applications of Solar Thermal*
- *Renewable Heat Incentive*
- *Calculating Energy Savings & Financial Rewards*

SOLAR THERMAL TECHNOLOGY

how it works...

- *Uses free, endless, abundant fuel supply*
 - *For at least 5 million years*
 - *Earth receives a nearly constant 1.4 kW/m²*
- *Converts solar radiation into heat energy using a collector*
 - *We will look at the different types shortly*
- *Energy collected is stored in a hot water cylinder and used as required*
- *Customer benefits from fuel savings due to the energy input by solar thermal. Planet benefits from reduction of CO₂ emissions from unburned fossil fuel*

SOLAR THERMAL TECHNOLOGY

typical system...



SOLAR THERMAL TECHNOLOGY

*key components in
a system ...*

- *Solar Collector & Roof Mounting Kit*
- *Pump Station, includes*
 - *Circulation pump*
 - *Pressure Relief Valve & Air Bleed*
 - *Digital controller*
- *Storage Vessel*
 - *E.g. Twin-Coil Cylinder*
 - *Could be a swimming pool!*
- *Expansion Vessel*
- *Pipework & Fittings*
- *Fluid*
 - *Antifreeze & Inhibitor*

SOLAR THERMAL TECHNOLOGY

*what affects
performance...*

- *Geographic location*
 - *latitude or distance from the equator*
- *Orientation*
 - *Direction relative to south*
- *Pitch*
 - *Installed angle of the collector*
- *Shading*
- *Collector Type*
 - *Efficiency & heat loss characteristics*
 - *Optical properties*
- *Size of Collector Array*
 - *Installed aperture area*

SOLAR THERMAL TECHNOLOGY

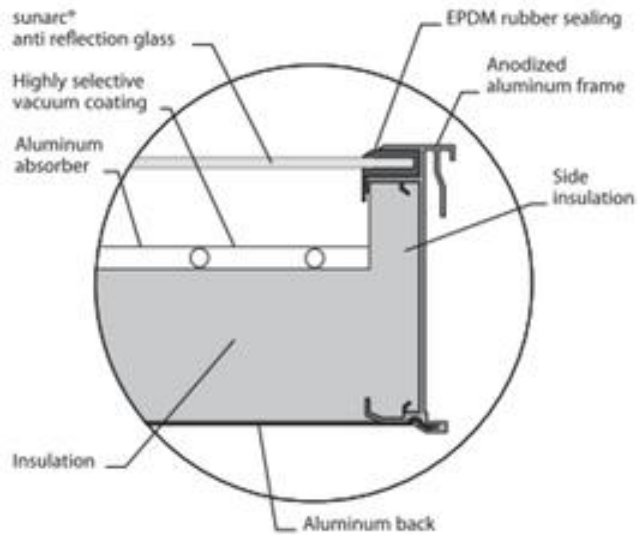
*different types of
solar thermal
collector...*

- *Flat-Plate Collectors*
 - *Can be roof integrated*
 - *High power in small area*
 - *Higher efficiency at lower operating temperatures*
 - *Ideal for pools and when space is tight*

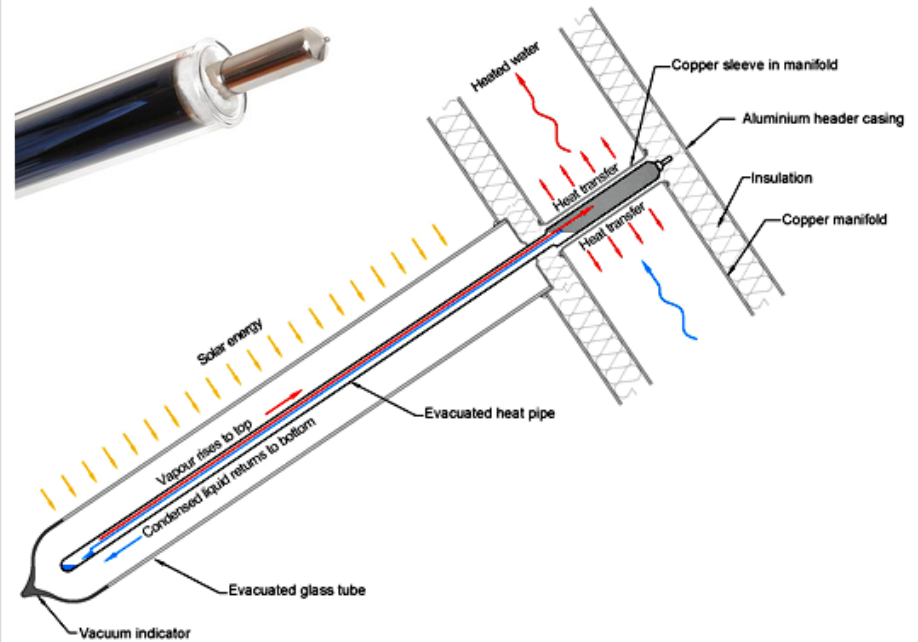


- *Evacuated Tube Collectors*
 - *Optical properties improve efficiency over flat plate when off-south*
 - *Higher efficiency over flat-plates at higher operating temperatures*

Flat-Plate Collector

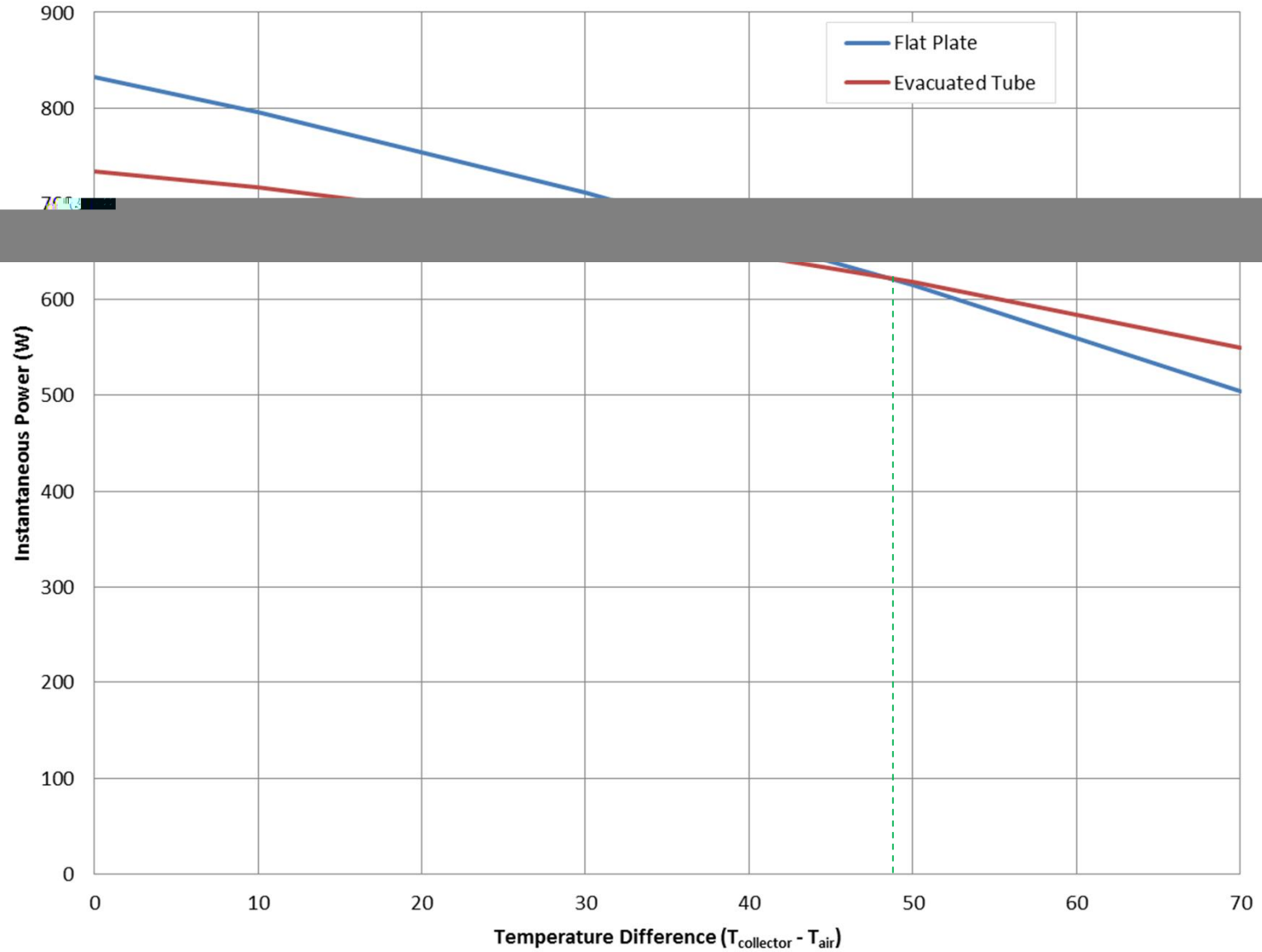


Heat Pipe Evacuated Tube Collector



Comparison of Collector Types

Power vs Operating Temperature



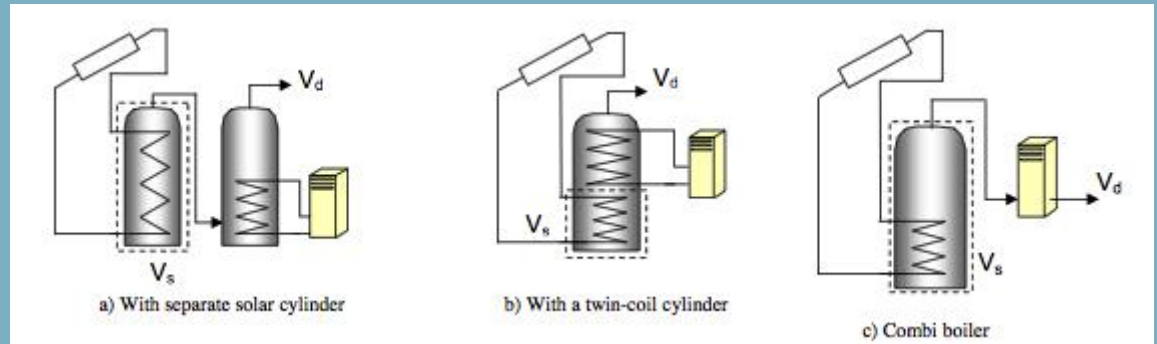
SOLAR THERMAL TECHNOLOGY

*mounting
options...*

Type	Laid Flat	On Roof	In Roof	A-Frame	Façade
Flat-Plate	No	Landscape /Portrait	Portrait	Landscape /Portrait	No
Heat Pipe EVT	No	Portrait	No	Portrait	No
Direct Flow EVT	Yes	Landscape /Portrait	No	Portrait	Yes

SOLAR THERMAL TECHNOLOGY

*hot water storage
arrangements...*



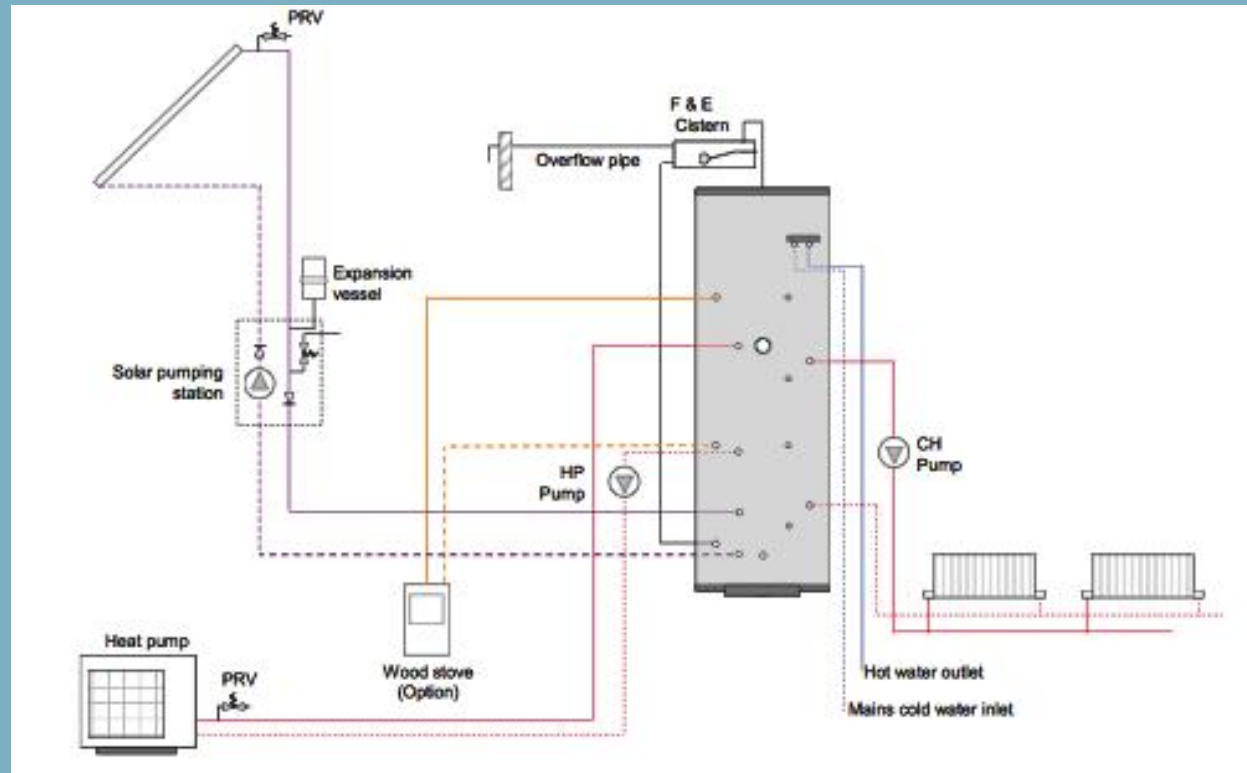
(a) Found on commercial applications

(b) Typical domestic arrangement

*(c) domestic combi boiler pre-feed &
commercial water heater pre-feed*

SOLAR THERMAL TECHNOLOGY

*integrating with
other renewable
technologies...*



Heat Pump Thermal Store

Integrating solar, heat pump and wood burner

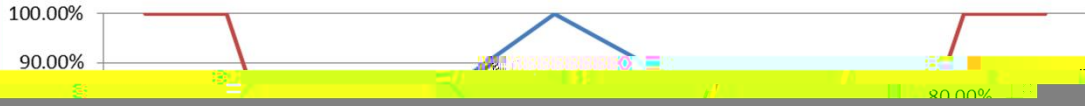
To provide space and hot water heating

APPLICATIONS OF SOLAR THERMAL

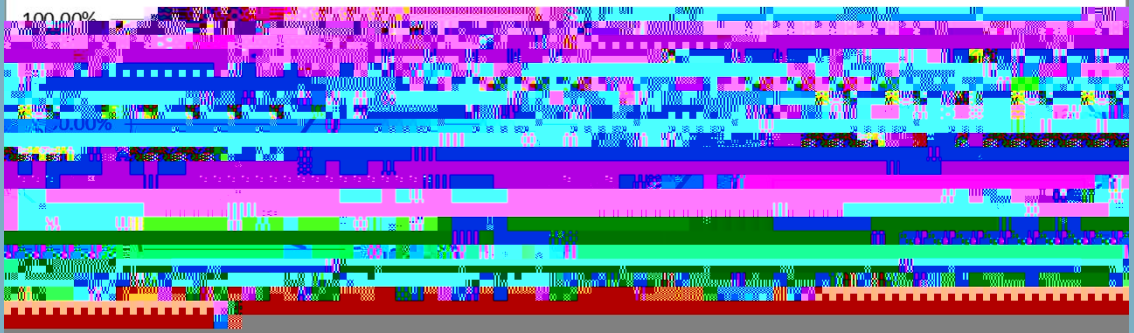
Solar thermal is best suited to:

- *Heating large volumes of water*
- *High demand between April – October*
- *Low draw-off during the day*

Annual Solar Energy Supply & Domestic Energy Demand



Annual Energy Supply & Swimming Pool Demand



APPLICATIONS OF SOLAR THERMAL

domestic...

Solar Thermal can be used to:

- *Assist heating domestic hot water*
- *Assist heating an indoor swimming pool*
- *Assist heating an outdoor pool, space and hot water heating*

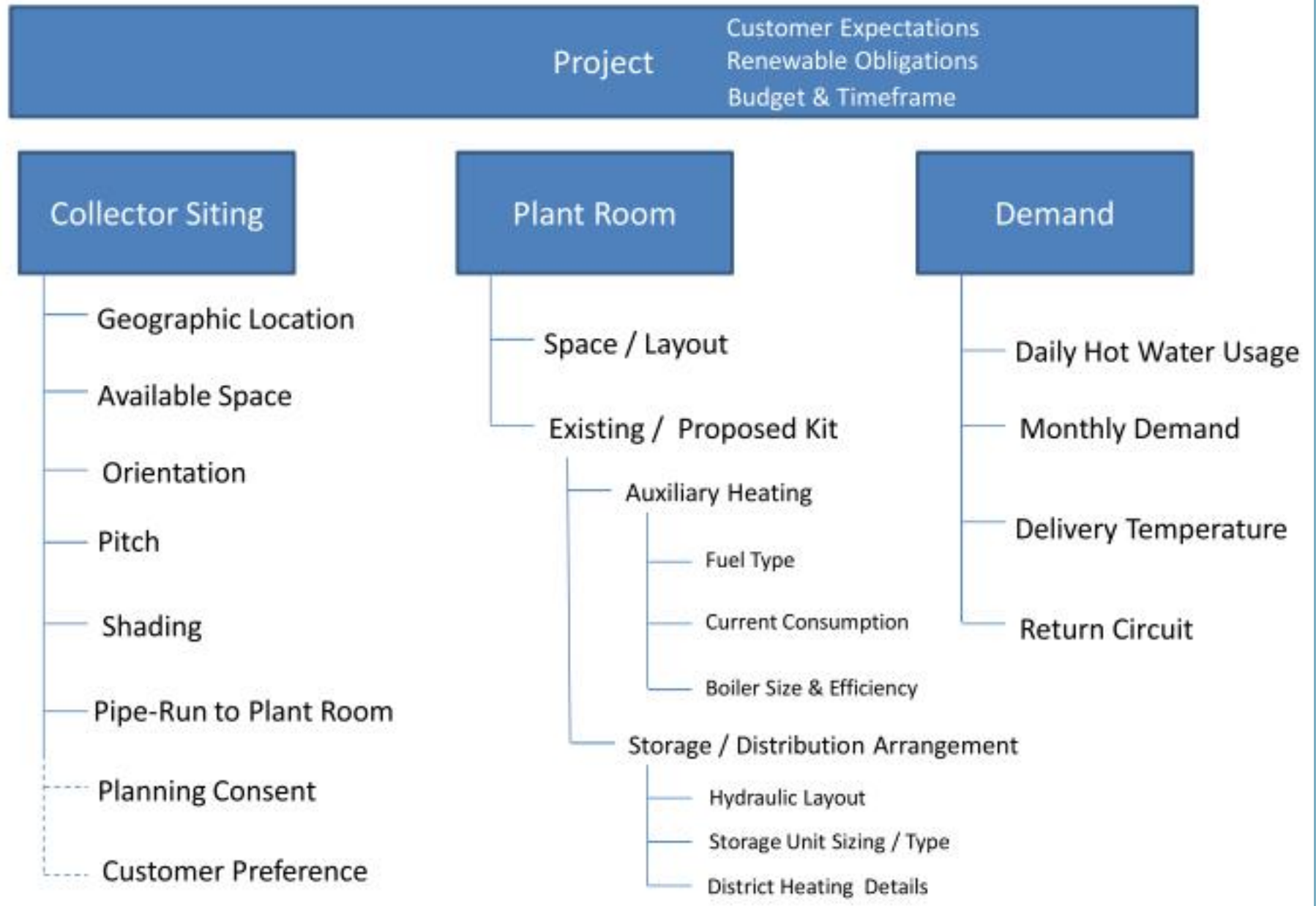
APPLICATIONS OF SOLAR THERMAL

non-domestic...

Solar Thermal can be used in a wide range of applications:

- *Commercial swimming pools*
- *Camp sites & holiday parks*
- *Care homes / sheltered housing*
- *Student accommodation blocks*
- *Bed & Breakfasts / Hotels*

Checklist - Surveying a Commercial Site



Checklist - Surveying a Swimming Pool

Project	Customer Expectations Budget & Timeframe
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RENEWABLE HEAT INCENTIVE

Overview...

- *Analogous to the Feed in Tariff for PV*
- *Applies to various renewable technologies including solar thermal, biomass and ground-source heat pumps*
- *Two categories*
 - *Non-domestic (started 28/11/11)*
 - *Domestic*
 - *Pilot Scheme (RHPP)*
 - *Proposed full scheme Oct '12*
- *Applies in England, Scotland & Wales*

RENEWABLE HEAT INCENTIVE (non-domestic)

details of scheme...

- *Applies to eligible heat use*
 - *Heating a space*
 - *Heating water*
 - *For carrying out a process*
 - *Needs to be within enclosed building*
- *Maximum installation 200kW for solar thermal (approx. 225m² aperture)*
- *Uses heat metering to record quarterly readings*
- *Requires MCS accredited installation & products on installations up to 45 kW (approx. 50 m² aperture)*
- *Applies to accredited installations installed and commissioned on or after 15 July 2009*
- *Lasts 20 Years; tariff increases annually with CPI*
- *Rate will be subject to depression; i.e. tariff decreased for new entrants as take-up hits certain trigger points (sound familiar?)*

RENEWABLE
HEAT INCENTIVE
(non-domestic)

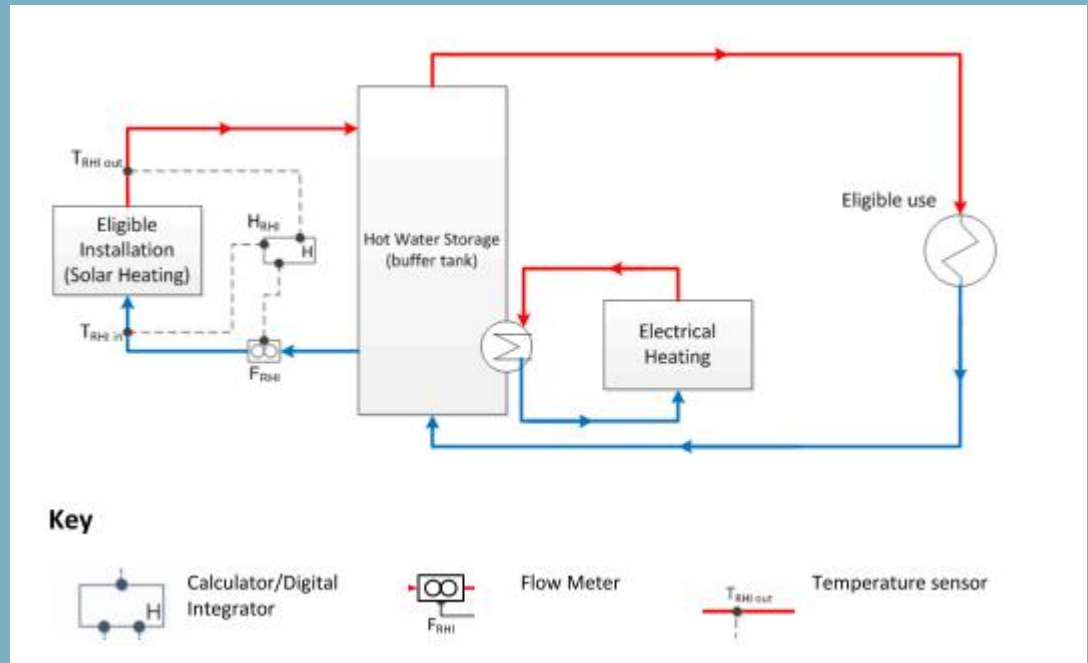
*application process &
getting paid...*

- *RHI for non-domestic is administered by Ofgem*
- *Payments are made by Ofgem*



RENEWABLE HEAT INCENTIVE (non-domestic)

heat metering...



RENEWABLE
HEAT
INCENTIVE
(non-domestic)

further reading...

- *Department of Energy & Climate Change website*
 - *<http://www.decc.gov.uk/rhi>*
- *Ofgem website*
 - *<http://www.ofgem.gov.uk/e-serve/RHI/Pages/RHI.aspx>*

RENEWABLE
HEAT
INCENTIVE
(domestic)

*RHPP
premium payment...*

- *One-off £300 payment for solar thermal*
- *Administered by Energy Saving Trust (EST)*
- *£15 million scheme for domestic properties*
- *Other renewable technologies are eligible*
- *Must have 250mm loft insulation and cavity wall insulation*
- *Needs MCS accredited installation and products*
- *Required to submit 2 customer surveys*
- *May be chosen at random for heat metering*

RENEWABLE
HEAT
INCENTIVE
(domestic)

full scheme...

- *Proposed to come into effect with Green Deal in October 2012*
- *Details are very sparse at the moment, and are based on a consultation document released a couple of years ago*
- *May be based on deemed energy input using SAP*
- *20 Year Scheme; increased with inflation; initial rate of 18.5p/kWh*
- *Recommend you keep an eye on the DECC website (www.decc.gov.uk)*

ENERGY SAVINGS & FINANCIAL REWARDS

calculation method...

- *For any given installation you need to make an estimate of the energy yield from the solar thermal system and how much energy has been saved*
 - *Via simulation software e.g. T*sol*
 - *Using SAP 2005 (MCS method)*
 - *Using Barilla online tools*
- *You will need to know the customer's annual energy consumption and price*
- *You'll need to make an assumption about the efficiency of their current heating unit*
- *To give estimates of payback you will need to forecast the following:*
 - *Energy price inflation*
 - *Consumer Price Index (CPI)*
 - *Interest Rates*
 - *Annual maintenance costs*

ENERGY SAVINGS & FINANCIAL REWARDS

calculation method...

New Project | New from Wizard | Open Existing | Save Project | Report | Build Quote | Full System | Help

Solar Thermal Design Assistant

- Project Settings
- Energy Prices
- Survey & Design
 - Proposed Collector Site
 - Domestic Hot Water
- Solar Circuit
 - Solar Collectors**
 - Pipework
 - Fluid
 - Expansion & Cooling
 - Pump Station
- Reports
 - SAP 2005 Appendix H
 - Economic Viability
 - System Performance
 - Bill of Materials

Solar Collectors

Mounting: Roof Integrated * determines collector types

Type: Flat-Plate * determines collector models

Orientation: Portrait * landscape = sideways

Model: F22 AR (2.01 m2) *

No; Collectors: 2 *

No; Parallel Arrays: 1 * affects head loss

Flow Rate (l/hr/m²): 35 * specific flow rate

Calculate Save

OUTPUT BACK TO TOP

Item	Calculated Result	Units
Collector Array	2 x F22 AR	
Total Aperture Area	4.01	m ²
Recommended Aperture Area (to achieve 50% solar fraction)	5.6	m ²
Solar Collector Yield	2645	kWh/year
Total Absorber Area	4	m ²
Max Absorber Area (according to Part L Building Regs)	4.71	m ²

ENERGY SAVINGS & FINANCIAL REWARDS

example...

- *A solar thermal installation on a non-domestic property generates 5,000 kWh per annum. The existing boiler is LPG and has an estimated efficiency of 80%. The customer currently pays 49p/litre of LPG (7p/kWh)*
- *Annual Energy Saved = $5000 / 80\% = 6250$ kWh*
- *Savings from unburned LPG = $6250 \times 0.07 = \text{£}437.50$*
- *RHI reward = $5000 \times 0.085 = \text{£}425$*
- *Total annual savings & reward = $437.50 + 425 = \text{£}862.50$*
- *Assume installed cost $\text{£}8000$, CPI = 5%;*
- *energy price rise = 5%*

ENERGY SAVINGS & FINANCIAL REWARDS

calculating payback...

- *Assume installed cost £8000, CPI = 5%; maintenance cost = £100*
- *Energy inflation=5%; interest rate 0.5%*
- *Based on our example of 5000 kWh solar input, 6250 kWh energy saved and fuel cost of 7p/kWh*
- *Using Barilla calculator payback = under 7 years*
- *Net Present Value over 20 year lifespan = £44,770*
- *Unit cost of solar energy produced = -1.6p/kWh*

