Retrofitting your home - an overview

cifal seminar~20/11/09
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Home Renewables Advisor
Energy Saving Scotland advice centre NE
Energy Saving Trust

- The **Energy Saving Trust** is an independent UK organisation, set up in response to the Earth Rio Summit of 1992. Their aim is to promote the sustainable and efficient use of energy.

- The **Energy Saving Scotland advice centre network**, was set up in April 2008, it is funded by the **Scottish Government** and managed by the **Energy Saving Trust**. A one-stop shop for sustainable energy advice, with the objective of encouraging a low carbon lifestyle. This network shall help achieve the 80% CO$_2$ emissions reduction by 2050, as set out in the Scottish Climate Change Bill.

- A range of advice services are available to help deliver such carbon savings: **Home Renewables; Sustainable Transport; Small Business; Community Outreach & Customer Advisors.**
Energy Saving Scotland advice centres

- Advice available by phone, email, post and in person (home visits, talks, events etc.)
Every household in the UK creates around six tonnes of carbon dioxide every year - enough to fill one hot air balloon.
If everyone in the UK installed loft insulation up to 270mm thickness, the equivalent financial saving would pay the heating bills of around 860,000 families for a year.

We would also save about 3.8 million tonnes of CO2 per year, the equivalent saving of taking 1.3 million UK cars off the road.
The average household wastes £32 each year by leaving appliances on standby. Across the UK this is equivalent to the annual output of more than 2 700MW power stations.
If every UK household installed just one extra energy saving light bulb in their house, the CO2 saved would be equivalent to taking 120,000 cars off the roads.
Energy Inefficient Homes

- 40% of Scotland’s carbon emissions come from heating and lighting our homes.
Energy Efficiency Measures

“Energy use in the home”

- 5%
- 25%
- 60%
- 10%
Heat loss from an un-insulated house

- Walls: 35%
- Roof: 25%
- Floor: 15%
- Windows and doors: 25%
Energy Efficient behaviour

- Turn off radiators in rooms that are not used
- Turn down room thermostat by 1°C - saving 10% of fuel bill
- Turn down boiler thermostat when weather is warmer
- Don’t cover radiators with furniture
- Close doors, draw curtains at dusk.
- Set Hot Water thermostat to 60-65°C
- Switch lights off when leaving the room
- Do not leave electric appliances on standby
Low cost measures

- Fit a hot water tank jacket
- Use energy efficient light bulbs
- Fit shelves above and reflective panels behind your radiators
- Install a real time electric monitor
- Draught proofing (doors/floors/chimney balloon/vents?)
- Loft insulation top up
- Underfloor insulation
- Cavity wall insulation
- Any other ideas?
Buy energy efficient appliances

- Energy ratings:
  - White goods: European A-G rating (up to A++ for cold appliances)
    - an A++ rated fridge freezer will save £42 a year in running costs compared to one purchased new in 1995
  - Boilers: SEDBUK A-E rating
- Home Energy Performance certificates (from Jan 2009)
Renewable Heat & Electricity Technologies
Home Renewables Advisor (HRA)

- A free, impartial & site specific advice service. To help support the awareness and need for increased energy efficiency measures and renewable energy installations within the domestic sector (owner-occupier).

- This service provides support by: telephone advice; a home visit, followed by a personalised report and a post installation visit.

- The HRA service does not provide: heat loss calculations; system sizing or a full cost analysis.
Renewable Energy Installations
(Micro - up to 50kW)

- Heat Producing Technologies
  1) **Solar Thermal** (water & air)
  2) **Biomass** (pellets, chips & logs)
  3) **Heat Pumps** (ground/ air & water)

- Electric Producing Technologies
  4) **Micro Wind** (stand alone & roof top)
  5) **Solar Electric** (PV)
  6) **Micro Hydro** (low-medium-high head)
1) Solar Thermal (water & air)

“Captures heat from the Sun”
Solar Collector
“Flat Plate”
4m² SolarTwin flat plate collectors (installed by Solar Energy Systems)
Solar Collector - “Evacuated Tubes”
Solar water- Key factors

Can provide 100% of household hot water needs in the Summer & 50% over the year.

- 1m² of panel can produce 50 litres of hot water in the Summer.
- Require roof area size of 3-4m², facing W-S-E, un-shaded with a 30-45 degree tilt.
- Costs £3000-£4500
- Flat plate collectors are cheaper, more robust and less efficient(30%).
- Evacuated tube collectors are more: expensive; fragile; versatile and efficient(40%).
- Need a larger(dual coil) or additional hot water cylinder tank.
- Further information: www.solar-trade.org.uk
Solar Air System
Solar air- Key factors

- Solar air is captured from behind the sarking within the loft, used to pre-warm ventilation air.
- Roof area size required 3-4m\(^2\), W-S-E facing, 30 degree tilt.
- Costs £1500-£2000 installed
- A good solution for fuel poverty(cold,damp housing) and super-insulated new builds.
- Further information: [www.nuaire.co.uk](http://www.nuaire.co.uk)
2) Biomass (pellets/woodchip/logs)

“Burned to produce heat”
Logs
Some use in modern technology
Bulky and non-automated feed
Low technology conversion

Chips
Up to 3cm
Size and moisture content critical
Technology readily available

Pellets
Regular product (usually 6mm)
Very efficient, energy dense
Biomass stoves/boilers

Log burner stove

Pellet stove

Pellet boiler
Biomass - Key factors

- Biomass is considered carbon neutral, only if sustainable woodland management is in place.
- Used for room heating or whole house heating needs.
- Lit and fed automatically, timer and thermostat control.
- Automated systems can be 90%+ efficient
- Need to consider space to house boiler, fuel storage and delivery access. May need to manually fill hopper.
- Electricity needed for ignition, fan and feeder.
- Installed Costs: Wood stove (5-20kW) £1000+, Pellet stove (6-12kW) £2500+, Pellet stove/boiler (8-20kW) £3000-£7000), Pellet boiler (12kW+) £12000+
- Pellet cost averaging about £200/tonne (4.2p/kWh)
- Further information: www.usewoodfuel.co.uk
3) Heat pumps (ground/air/water)

“Extracts heat from the ground/air/water”

Air source
Design and sizing – boreholes

- Boreholes are generally 125mm in diameter wide enough to install two pipes 40mm in diameter with a U bend
Step 1
(From source collector – ground/air/water)

Step 2
HEAT PUMP

Expansion valve
(Decreased temp.)

Step 3
(To distribution network - rads/underfloor heating)

Condenser

Compressor
(Increased temp.)

Evaporator
Heat Pumps - Key factors

- Extracts heat from natural sources (ground/air/water)
- Coefficient of Performance (CoP) ranges 2.5 - 5
- Costs £1000 per thermal kW, domestic installation ranges from £8000 - £15,000.
- More efficient with underfloor heating due to lower flow temps 45-55 °C.
- Various specifications: variable compressor/high temp.
- Economy electric tariffs are available (E10, Eco2000 etc.)
- Run on green tariff, or electricity from PV/wind to reduce the carbon emissions created by compressor.
- ASHP good option for retrofit properties (well insulated)
- Heat pump can be docked into an existing boiler.
- Upgrading single to three phase supply is expensive.
- Further information: www.heatpumps.org.uk
4) Micro Wind

Stand alone turbine

“Converts energy from the wind into electricity”

Roof top turbine
Design and sizing

- Wind speed is extremely variable
- Wind speed can be different within a short 100m distance
- Variability means guestimating
- BRE MCS installers have to state:
  “The performance of wind turbine system is impossible to predict with any certainty due to the variability in the wind from location and from year to year. Our generation estimate is based upon the best available information but is given as guidance only and should not be considered as a guarantee. For a greater level of certainty, it is recommended that on-site wind speed monitoring is undertaken for at least a year”

- Cubic relationship between power and windspeed – if wind speed doubles, power in the wind increases by a factor of eight
Turbulence


Source: CE72 Installing small wind powered electricity generating systems

Source: www.bwea.com/you/siting.html
Key components of wind system (grid connected)

- 6kW Proven Energy wind turbine
- To dedicated MCB in fuse box
- AC Isolator
- kWh meter
- Rectifier
- Inverter

(Source: On Site Generation)
Micro Wind - Key Factors

- Converts the kinetic energy in wind into electricity.
- Sizes: small 100w, rooftop 1-3.5kW, stand alone 2-15kW
- Installed costs: 1kW (£2000), 2.5kW (£15,000), 6kW (£20,000)
- Good wind speed, greater than 7 m/s.
- Wind speed can vary greater within a 1km grid.
- Prevailing wind: South West.
- Siting is VERY important, avoid trees/buildings which create turbulence.
- Efficiencies of around 30%, capacity factor 30%.
- Systems can be grid connected or stand alone (batteries)
- Roof top turbines are in their infancy, field trail now available, [www.warwickwindtrails.org.uk](http://www.warwickwindtrails.org.uk)
- Further information: [www.bwea.com](http://www.bwea.com)
5) Solar Photo-Voltaic (PV)

“Converts energy from the Sunlight into electricity”

Solar PV array (1.5kWp)

Solar slates
Types of PV panel

• Monocrystalline
  – 17% efficient
  – Most expensive as cut from single silicon crystal

• Polycrystalline
  – Slices of silicon made into cells
  – 14% efficient
  – Cheaper to manufacture

• Amorphous thin film
  – Low efficiency 6%
  – Cheapest manufacture

• Other innovations
  – Compound parabolic concentrator

(Source: On Site Generation)
Solar PV laminated panels
Key Components of PV System (grid connected)

(Source: On Site Generation)
Solar PV - Key factors

- A typical 1.5kWp (12 panels) domestic array will meet 1/3rd annual household electricity requirement
- Will need a roof area of 12-15m² facing SE-S-SW, un-shaded.
- Roof integrated PV systems will offset cost of building fabric.
- Cost: £9000 for 1.5kWp
- Virtually no running costs
- Can be grid connected or stand alone (batteries)
6) Micro Hydro (low / medium head)

“Converts energy from the flow of water into electricity”
Low head - cross flow turbine
Medium-High head - impulse turbine

Source: www.british-hydro.org
Micro Hydro - Key factors

- Converts potential energy of water into mechanical and electrical energy.
- High efficiency 50-70%
- Key factors for the site are head and flow.
- Low head (<10m) Medium head (10-50m) High head (>50m)
- Lower head sites tend to be more expensive due to larger turbine and civil costs.
- Costs: £3000-4000 /kW for a low head, £2500/kW for medium scheme.
- Planning and water abstraction licence will be required.
- Further information: www.british-hydro.co.uk
CASE STUDIES

1) ACC GSHP in farm houses affordable warmth
2) Moray ASHP Rothes affordable warmth
3) Renewable Heating Pilot study
   (P5 map, P7 Key findings)
   www.scotland.gov.uk/socialresearch
Home & Community Renewables Grants

- Home Renewables
  Managed by Energy Saving Trust
- Community (CARES)
  Managed by Community Energy Scotland
- Advice & information
- Project support & guidance
- Capital Grants
  (30% up to £4000)
- Technical Grants
  (up to £10,000)
- Capital Grants
  (up to £150,000)

Funded by Scottish Government
Home Renewables Grant

- Only for owner occupiers
- 30% up to £4000
- 2 grants per property allowed
- Up to 8 grants for builder/developers (on behalf of future homeowners)

Not Eligible!

- DIY installation
- Retrospective claims
- Installations with unaccredited products or installers
Pilot Home Loans (interest free)

- Only for owner occupiers
- 30% up to £4000
- 2 loans per property allowed

**Not Eligible!**

- New Builds
- DIY installation
- Retrospective claims
- Installations with unaccredited products or installers

Tel: 0131 5557900 (select option 1)
Email: homeloans@est.org.uk
Communities and Renewable Energy Scheme (CARES)

- Open to non-profit community organisations

- Funding available for technical support, relevant training and the installation of renewable energy equipment.

- Technical grant up to £10,000. Maximum capital grant of £150,000

[Website link: www.communityenergyscotland.org.uk/]
Small Business Loan

- Open to small businesses and not for profit organisations (up to 250 employees), with an annual energy bill of less than £50,000.

- Free interest loan available for Energy Efficiency measures (pay back 4 years) and Renewable Energy technology installations (pay back 8 years). Loan from £1000 to £100,000.

- Free impartial site visits and/or energy audits to identify recommended EE & RE measures.

Louisa Coursey, Business Advisor
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Energy Assistance Package

• Scottish Government’s new support for those vulnerable to fuel poverty. Previously known as the ‘Central Heating Program’.

• Gives advice and support to help maximise your income, cut your fuel bills and make your home more warmer and comfortable.

• The package has four stages. Each stage offers different levels of advice and support depending on your circumstances.

Freephone : 0800 512 012
www.energyassistancepackage.com
“The significant problems we face cannot be solved at the same level of thinking we were at when we created them”

(Einstein)

Today we are faced with the challenge of ‘climate change’ and ‘resource depletion’. The mindset that has created our carbon based economy (consumption lifestyle), cannot provide us with our low carbon needs.

We have to re-evaluate our lifestyle choices, increase our energy efficiency and where possible, install renewable energy technology.
For further advice please contact:

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www.energysavingtrust.org.uk/homerenewables