

Renewable heat in industry

Industry specifics, trends, modelling results

Brussels, 14 April 2011

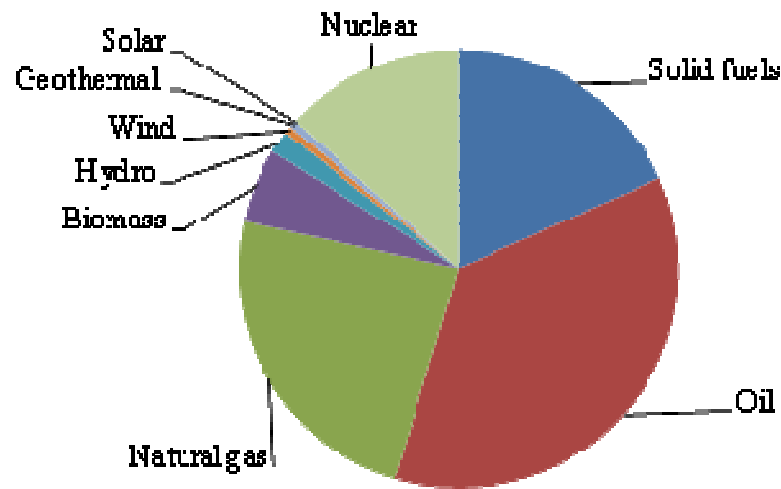
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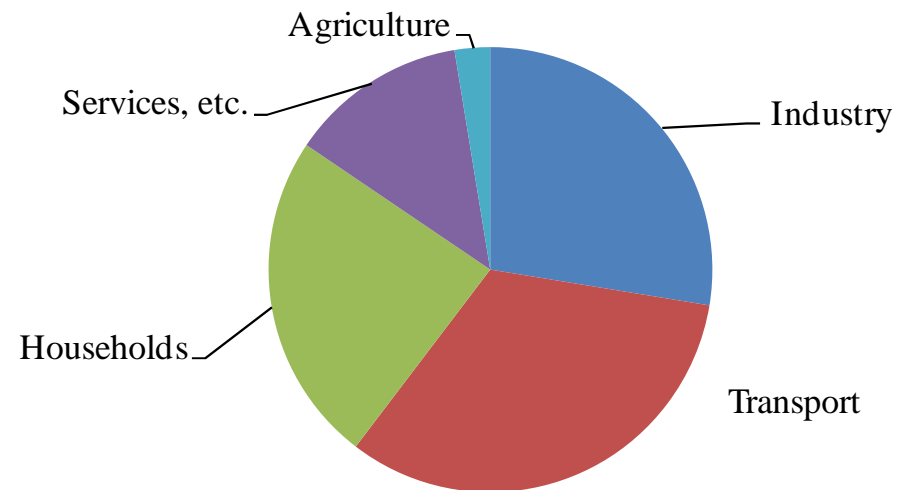
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Total energy use in 2007 (EU-27)



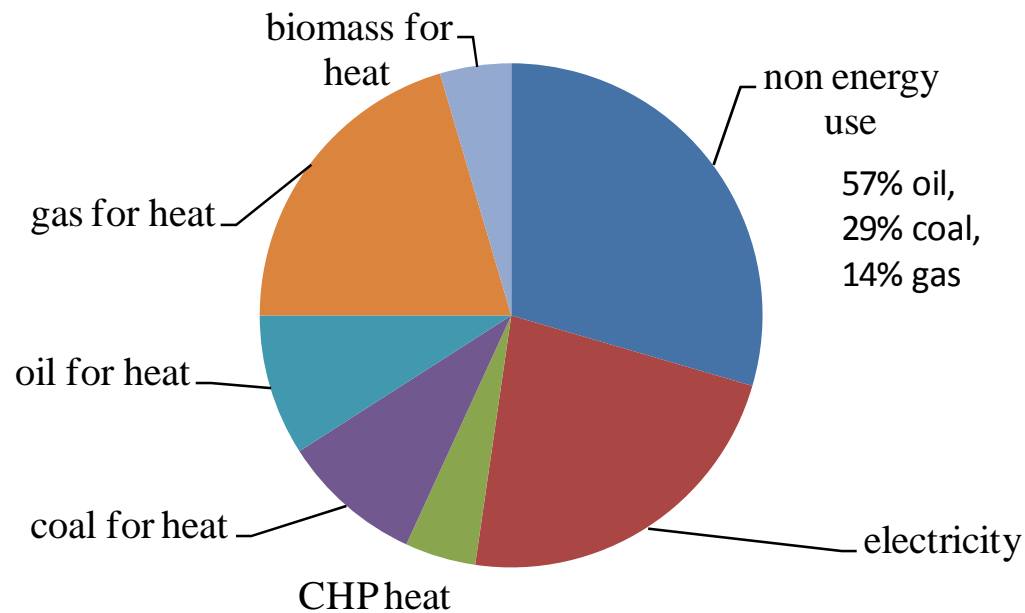
Gross Inland Consumption
1810 Mtoe



Final Energy Consumption
1160 Mtoe
(excl. conversion losses, non-energy and bunker fuels)

(Source: EU Energy in Figures, 2010)

Industrial energy use EU27 in 2007



450 Mtoe
(Source: Eurostat)

Industry specifics for renewables

Negative aspects:

- Large energy contracts at low purchase costs and relatively low distribution costs
- Relatively low taxes
- Aversion to high investment sums
- High demands for return on investment
- Focus is on industrial products (core business) and not on energy

Positive aspects:

- Use of biomass is cheaper and cleaner in large installations
- Enough demand for large deep geothermal or solar heat projects
- Sometimes waste streams with wood or for biogas production
- High energy consumption results in relatively low transaction costs per MJ
- Roof surface is available for solar thermal (likewise for PV and also wind)
- Avoiding costs for CO₂ Emission Trading Scheme (ETS)

CO₂ Emission Trading Scheme (ETS)

All large industries and electricity producers have to join

EU target: in 2020 20% reduction CO₂ compared to 1990

Target -21% compared to 2005: in Europe -17%, buy outside EU 4%

Current CO₂ prices 15-20 euro/ton CO₂ with peak to 30 euro/ton CO₂

ETS and renewable heat

Because the amount of allowances in the period 2013-2020 is fixed renewable heat at an ETS location does not result in CO₂-reduction in the third trading period (but it does count towards the RES target).

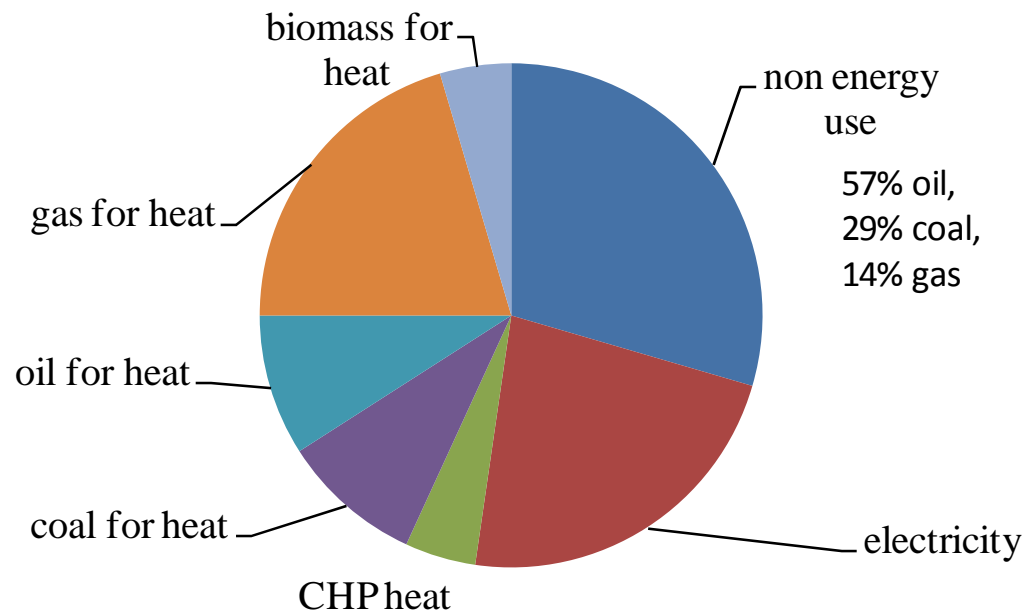
But renewable heat, if not based on buying biomass, helps with ETS-risk management for industrial companies.

Current CO₂-prices (translated to 1-2 euro/GJ fuel) are too low for a substantial stimulation of renewable heat.

For substantial stimulation CO₂-prices should be in the range of 200 euro/ton CO₂. But this is not expected.

If CO₂-prices are high (and stay high) scarcity of biomass can be expected through demand from the industry and electricity sector, resulting in higher biomass prices.

Industrial energy use EU27 in 2007



450 Mtoe
(Source: Eurostat)

Renewables for fossil non-energy use (feedstock)

Technical options:

Coal/cokes for steel production can be replaced by charcoal or H₂

Oil for plastic (polyethylene) can be replaced by bio-ethanol

Natural gas for fertilisers can be replaced by H₂ made with green electricity

But:

- Some options do not work in ETS (no local CO₂ non-energy use emissions)
- Non-energy use does not count for the renewable energy target

This could be improved by allowing renewable feedstock to be accounted for in some way in the Renewables Directive (for example by handing out CO₂-credits for biomass-based products).

Trends and examples

Use of biogas from organic waste or waste water treatment

- *Potential depends of amount of waste*
- *Already in use*
- *Can be cost effective*

Biogas from food waste
the Netherlands



Use of wood for electricity and heat production

- *Demand for wood will increase*
- *Already in use*
- *Large installations can be clean*
- *High investments but cost-effective in case wood is cheap*

Hasslacher Sawmill
Austria
5 MW_e/10 MW_{th}



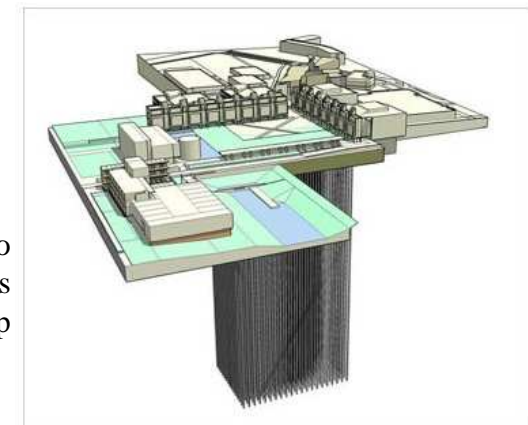
Trends and examples

Aquifer Thermal Energy Storage (ATES) for heating and cooling of industrial halls (equal to office heating)

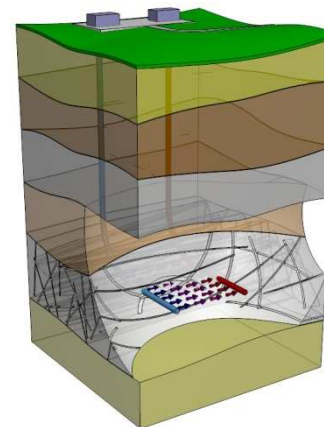
- *Potential depends on underground*
- *Only moderate temperature heating and cooling*
- *Already in use*
- *Can be cost-effective*

Deep geothermal energy

- *Depends on underground*
- *Already in use*
- *But also still under development*
- *Can be cost-effective*



Seasonal storage Ontario
384 boreholes
213 m deep



60 MW geothermal power plant
To be developed in Cornwall (UK)

Trends and examples

Solar system for hot air and hot water in the food industry

- *Already in use*
- *Further cost reduction needed*
- *With storage >20% demand*
- *Still expensive*

Food industry (1997)
2 MW_{th}, 20% hot
water demand



Concentrated solar power

- *Fast growing sector for electricity production*
- *Higher temperatures (Example 1200 °C H₂-production)*
- *Research on night storage*
- *Still expensive*

Extresol (Spain) (2009)
50 MW_e + 7.5 h storage



Matching technologies and temperatures

Level	Temperature range	Biomass	Deep geothermal	Heat pumps	Solar thermal	Underground heat/cold storage
H5	Above 600°C	x				
H4	Between 200 and 600°C	x				
H3	Between 100 and 200°C	x	x		x	
H2	Between 65 and 100°C	x	x		x	
H1	Below 65°C	x	x	x	x	x
C3	Between +10 and +15°C			x	x	x
C2	Between -30 and +10°C			x		
C1	Below -30°C					

Observations from modelling results

- For all countries: fuel price is a decisive modelling input: at low conventional energy prices (almost) no penetration of renewable heat options in industry sector.
- Financial support measures improve the cost-benefit ratio: more support results in more renewables
- Cheapest options penetrate first: biomass heat-only (especially if based on waste streams) good competitive strength but generally limited in potential.
- Most expensive options (solar thermal, geothermal) generally do not penetrate at low conventional energy prices.
- In some countries the potential for solar thermal energy in industry has been found to be very limited (Lithuania: 0 PJ in 2030, Poland 0.5 PJ in 2030, Netherlands: 0.8 PJ in 2030). Deep geothermal is slightly better positioned.
- Sensitivity analyses: impact of level of conventional fuel prices is very high. High uncertainty in modelling output through biomass price scenario choices

Recommendations for renewables in industry

- Several opportunities exist for renewables in industry: high local energy density and a high (and constant) heat demand, for which large-scale renewable heat is suitable. For local emission prevention (particulate matter) it is easier to control for one large industrial installation instead of numerous small-scale household installations. Large areas of roof surface provide large space for solar thermal.
- High energy supply per installation makes impact of support measures potentially large, and support measure transaction costs per GJ are relatively low.
- Industry is a very important energy consuming sector in Europe, which thus deserves considerable policy attention. However, apart from the CO₂ Emission Trading Scheme (ETS) not much policies are in place. Long-term sustainable and renewable energy supply for industry is needed.
- Governments could play a facilitating role in bringing parties together (residual heat, geothermal hot spots, concentrated solar thermal reserved zones).
- For all renewable heat options demonstration projects or commercial projects are in operation. Member States are recommended to scale up demonstration plants by targeted research and development to overcome technical, financial and non-financial barriers.

Questions?

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