Europe should aim to cut losses in power generation

European efforts to increase energy efficiency are too focused on measures to improve end-use efficiency, and largely ignore the potential to reduce huge losses incurred in the electricity supply system, writes COGEN Europe's Fiona Riddoch. The challenge is to stimulate the much wider use of cogeneration across the continent.

Eurostat keeps the books for Europe's energy community. Member States are required to submit annual statistics to Eurostat giving a range of energy use, consumption and transformation figures to be published for the EU 27 Member States. This is a valuable activity for the energy community and these numbers are often the first and last stop in trying to understand how Europe uses energy.

As with all statistics achieving clarity depends on the questions that are asked and the way the results are represented. Issues can be highlighted or sidelined by their relative visibility or their final presentation.

Europe views the energy world the way Eurostat represents the energy world. Gross inland energy consumption and final energy use are a good example of how focus can be shifted by the way the statistics are summarized.

Europe's gross inland energy consumption (GIC), measuring the quantity of energy consumed within the EU's borders and covering all fuels and purposes, as quoted in the Energy Efficiency Action Plan (EEAP) 2006, was 1750 million tonnes of oil equivalent (Mtoe) while final energy consumption (FEC) was 1106 Mtoe. Final energy consumption is the energy finally consumed in the transport, industrial, commercial, agricultural, public and household sectors. It excludes deliveries to the energy transformation sector and to the energy industries themselves.

Europe's energy efficiency policy focuses on final energy consumption numbers and so loses sight of the total inland energy consumption, with one third of the total inland consumption dropping from view and scrutiny as a result.

TAKING ELECTRICITY GENERATION INTO ACCOUNT

The EEAP 2006 carefully highlighted the opportunities for end use savings to 2020, identifying potential savings of 249 Mtoe in areas outside the transport sector. This focus on end-use automatically means that there is no need to mention the electricity sector and potential savings there.

However, it is possible to estimate how much primary energy goes into combustion for electricity and hence what the thermal losses from the sector are by using the final energy consumption figure for electricity and allowing for non-combustion based electricity generation. The result indicates that around 300 Mtoe of primary energy was wasted by European utilities in generating electricity in condensing power stations in the base year of the EEAP.

Expansion of the electricity sector to 2020 is forecast and, while renewables will take an increasing share, the rest must be met by fossil fuel-powered plants, a sector where no major steps in conversion efficiency are expected, apart from marginal incremental improvements. Hence, between input to the

Sector	Energy consumption (Mtoe) 2005	Energy consumption (Mtoe) 2020 (business as ususal)	Energy saving potential 2020 (Mtoe)	Full energy saving potential 2020 (%)
Households (residential)	280	338	91	27
Commercial buildings (tertiary)	157	211	63	30
Transport	332	405	105	26
Manufacturing industry	297	382	95	25

Table 1. Energy savings potential in final energy use, EU EEAP 2006

system in GIC and FEC use, roughly a third of Europe's energy imports drop out of statistical sight. The lion's share of this energy goes into the electricity generating sector but only the output of this sector – the end-use aspect – is included in DG Energy's energy efficiency legislative action.

Given that that the electricity generation sector uses roughly one third of Europe's primary energy and that it operates at around 35% overall efficiency, the electricity generation sector using traditional condensing power stations is responsible for wasting 20% of the total primary energy consumed in Europe.

Europe's energy efficiency efforts keep our eyes focused on final energy consumption. For every kWh of electricity which arrives at the end-user two have been thrown away. The end-user then puts this energy to use and a further fraction of that kWh delivered can be saved through higher product or end-use efficiency. However, in this supply chain, particularly where there is a condensing power station involved, the major savings potential occurs before the energy reaches the final use application.

In its 2006 Energy Efficiency Action Plan, the European Commission highlighted exactly the extent of the challenge presented by the losses of the traditional electricity generation sector, clearly stating that 'there is a large potential for improving energy efficiency in energy production and distribution due to the significant size of current transformation losses'. The document went on to highlight that 'losses in the transmission and distribution of electricity – often as high as 10% – can also be reduced.'

DG Energy acknowledged the role intended for the EU Emissions Trading System (ETS) in tackling inefficiency and added that 'nonetheless, the Commission considers that a number of new measures are called for.'

THE EU ETS AND CHP – A MISSED OPPORTUNITY

The EU ETS has often been described in Brussels as the policy instrument that would in one fell swoop help the EU meet its international climate commitments while improving the efficiency of its industry, in the most cost-effective way.

Commission experts have long stressed that the EU ETS, and especially moving forwards with the introduction of auctioning, would be a driver for the development of CHP. Unfortunately the concerns of the sector have so far proven well founded, as industrial CHP has barely witnessed any growth since the start of the emissions trading system in 2005.

The revised Directive 2009/29/EC, which laid down the rules for the period post-2012 does not provide any incentives for high efficiency CHP. On the contrary, while in the period 2005–2012 Member States were encouraged to allocate more credits to CHP plants than standard boilers in order to promote efficiency, under the new rules, boilers will get a slightly better allocation of credits than CHP for a similar amount of heat. This is sending all the wrong signals to industry, which already has a natural tendency to aim for cheaper, more short-term efficiency measures.

Compounding the detrimental effect of the new EU-wide rules for allocation, the decision to allocate credits to the consumers of heat also puts some installations in a difficult spot as operators will have to bear the burden of acquiring all the required credits on the market or through auctions while the heat consumers will receive a given amount for free.

As has often been the case in the past few years with climate policy, CHP (but also other activities) fell victim to the Commission's greater goals of establishing a healthy carbon market. The laudable aim to create a simple unified framework misses the intricacies of the dynamics of energy supply and consumption. As a result, CHP which should come out as one of the most cost-effective solutions is hampered by poor policy design.

The Commission in 2011 is finally about to publish its long-awaited follow-up Energy Efficiency Plan and appears to be leaning towards maintaining and building on the full supply chain approach, this time including the utilities and industry covered by the ETS. A full supply chain approach is necessary if the major losses in the utility sector are to be addressed, while industry – already under pressure to improve energy performance – will come under some further scrutiny.

Using a sectoral approach to analyzing the energy efficiency of the European economy, good examples stand out in each sector. There are electricity supply networks which operate at a significantly higher efficiency than the average. Denmark's system, for example, has an average efficiency of 65% compared to the UK's average of around 54%, with cogeneration playing a significant role in this higher efficiency performance.

There are industrial sectors, notably paper,

chemicals and oil refining, which consistently combine their substantial demand for high temperature heat with the opportunity to generate electricity, thus raising the overall efficiency of primary energy use and saving well above 10% energy compared to just generating the heat and importing the electricity from a central location.

THE CHALLENGE FOR A WIDER ADOPTION OF CHP

To capture the energy efficiency benefits of using CHP, instead of traditional condensing power approaches combined with separate heat production, requires the EU to move to a more integrated approach to energy thinking. The traditional thinking, which planned to provide each form of energy separately, must be challenged. Where heat is needed there is also a need for electricity and vice versa. However, in more integrated thinking, the sequencing of demand of these two forms of energy becomes an important factor in improving the efficiency of delivery.

There are immediate energy efficiency benefits in generating the heat and the electricity close to the point of use and large heat demands centres rather than greenfield, coastal or remote sites, as is too often the case with new electricity generation installations.

The total heat demand across Europe in 2007 was 554 Mtoe. Europe could greatly improve its efficiency of use of primary energy and hence cut expensive imports by viewing this demand for heat as an opportunity to generate electricity and to avoid a need for separate supply of heat and electricity.

The approach can be further refined by considering that the total heat demand covers a wide range of temperatures, starting with high temperatures in industry and dropping to the low temperatures of space heating and sanitary hot water in buildings. To get the most out of original primary energy, the heat should be used as often as possible over its inevitable drop to lower temperatures. Hence, CHP in industry can produce high grade heat which, after having been used in the process and has lost a share of its energy content, can be fed into a heat network and used for space heating in buildings.

COGENERATION – AT THE CORE OF EFFICIENCY

Cogeneration is a foundation principle for a modern energy economy. Europe is entering a time where competition for resources is as fierce as ever while, at the same time, power within the global economy is shifting. It is no longer acceptable that Europe should continue to treat energy efficiency as virtuous but not essential. Europe can and should invest in energy systems which are secure for the future and develop new paths for renewable supplies.

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