GREENPEACE

SECURING POWER

Securing Power, a new report by world leading energy experts Pöyry Energy Consulting, provides a compelling piece of the answer to the energy security and CO_2 emissions challenges that the UK faces today. Pöyry's ground breaking analysis shows an unprecedented opportunity for very large scale combined heat and power (CHP) plants sited at Britain's industrial hotspots.

Securing Power demonstrates how, by seizing the opportunity to provide both heat and electricity from the same fuel, we can cut emissions, reduce fuel use, cut costs and provide up to 16GW of new electricity generating capacity to meet UK demand over the coming years. This can be achieved by using highly efficient CHP plants located on existing industrial sites.

THE UK NEEDS NEW CAPACITY TO REPLACE ITS EXISTING POWER STATIONS

Within the next two decades, a number of UK power stations will close. By 2025 all nuclear power stations except Sizewell B in Suffolk will have closed down, whilst the EU's Large Combustion Plant Directive means that a number of the oldest and most polluting coal power stations are being withdrawn from service.

Guaranteeing that the UK will always have enough electricity to meet demand depends on replacing these power stations. But the government's concern for energy security is overshadowing its concern over climate change and it is calling for new investment in more of the same nuclear power stations and inefficient, coal fired power stations as if there is no other option.

ANY POTENTIAL SOLUTION MUST PROVIDE HEAT AS WELL AS ELECTRICITY

Heat accounts for 49% of the UK's energy needs but has been the continuous missing element of the UK energy policy. Almost all of the focus has been on electricity provision which accounts for just 17% of our final energy demand. But heat is crucial in terms of fuel dependency. Whether for domestic central heating or in industrial applications, heat accounts for around 70%[1] of all UK natural gas consumption, imported or otherwise. Discussing energy security, in particular the security of gas supplies, without discussing heat completely misses the heart of the issue.

Despite this, there is currently no heat strategy in the UK. While focusing enormous resources on nuclear power, which does little to relieve gas consumption and provide heat, the government's 2007 Energy White Paper had only 4 out of 342 pages on heat.

'Decarbonising heat... is important, as heat accounts for around 47% of the UK's total carbon emissions.'
John Hutton, Secretary of State for Business

CHP USES THE HEAT FROM POWER GENERATION INSTEAD OF WASTING IT

In the UK today, power stations waste on average almost two thirds[2] of the energy they generate and therefore two thirds of the fuel they consume. In fact, 20% of all the UK's CO_2 emissions come from the fuel burnt in creating this wasted heat, which means a fifth of our national CO_2 emissions come from something that serves no useful purpose to us at all.

'[In the UK] power stations discard almost the same amount of energy into the atmosphere and waters as householders use to keep warm.'
John Hutton, Secretary of State for Business

CHP offers the most efficient use of fuel for combustion, making use of the unused heat from thermal electricity generation. If power stations are built and located close to industries so that this heat can be captured rather than dumped into cooling towers or nearby waterways, it can be piped as high pressure steam or hot water into industrial processes or buildings. By using more of the energy in the fuel, CHP can more than double the useful output from the power station. In this way, CHP deals simultaneously with the challenge of providing heat, lowering emissions and increasing efficiency whilst decreasing our dependence on fossil fuels.

Cutting out waste by using CHP starts to tackle the core of our energy challenges – reducing fuel use, especially natural gas, insulating us against fuel price rises and cutting CO_2 emissions. In Scandinavia and the Netherlands, CHP is widely used and is achieving all of these goals. In fact Denmark and the Netherlands now get over 40% of their power from CHP. However, in the UK CHP has not, to date, received much attention in policy terms, especially compared with nuclear power and new coal fired power plants.

WHILE THE AVERAGE EFFICIENCY OF UK POWER STATIONS IS JUST 38%, CHP PLANTS SUCH AS THOSE IN USE IN SCANDINAVIA CAN ACHIEVE OVER 90% EFFICIENCY.

FOR BRITAIN TO GUARANTEE OUR ENERGY SECURITY AND REDUCE EMISSIONS, UP-SCALING THE USE OF CHP IS ESSENTIAL

The greater and denser the heat demand, the more practical and economic it is to supply heat from CHP. In the UK, the densest and most consistent heat demand is in the industrial sector. In a few heavily industrialised sites nationwide there is enormous localised heat usage but, to date, only limited use of CHP. An industrial setting makes it relatively easy to develop the infrastructure for CHP. It is easier, cheaper and quicker to deliver because heat is transported over shorter distances and there are fewer users. Rethinking where and how to site power stations is crucial to delivering a more secure and low carbon energy system.

Despite all this, the enormous scope for industrial CHP in Britain has been almost completely overlooked. Pöyry's *Securing Power* report indicates that there is untapped potential sufficient to generate up to 16GW, with a best estimate of 14GW of electrical power using ultra efficient CHP plants. 14GW is enough to provide dependable electricity capacity, equivalent to the annual needs of two thirds of all UK households.

Using new methodology developed from discussions with industry, Pöyry go beyond previous government assessments that have not reflected the full scope for industrial CHP. *Securing Power* delivers a new analysis of primary data from the European Union Emissions Trading Scheme (EU ETS) and reveals previously hidden potential for massive CHP power generation on the UK's industrial sites.

Pöyry has identified nine specific industrial sites (see map) around the country where CHP could be installed to meet local industry's heat and power demand and also supply additional electricity to the National Grid. Installing CHP at these nine industrial sites could provide over 13GW of the 14GW potential electricity generation capacity.

Above: In addition to meeting heat needs, CHP can supply electricity to the grid. ©Reynaers/Greenpeace

Top left: Construction of Finland's nuclear power plant has been plagued by cost overruns and delays. ©Greenpeace/Cobbing

Bottom left: Greenpeace documents CHP technologies across Europe. ©Reynaers/Greenpeace

Overleaf: The existing CHP plant at Immingham has potential for large scale expansion. ©ConocoPhillips/David Lee Photography Ltd

Front cover: CHP is already widely developed in Scandinavia, including Copenhagen. ©Reynaers/Greenpeace

Table 1 – Clusters with greatest potential for new or additional CCGT CHP technology

	Thermal (MWth)	Electrical (MWe)
Coryton	960	1,440
Ellesmere Port	905	1,358
Fawley	876	1,315
Grangemouth	1,375	2,064
Immingham	1,701	2,552
Pembroke	1,406	2,110
St Fergus	537	805
Teesside (Seal Sands)	432	627
Teesside (Wilton)	611	916
Total Capacity		13,187

Source: Pöyry Energy Consulting

UNDISCOVERED POTENTIAL: IF DEPLOYED IN THESE LOCATIONS, CHP WOULD PROVIDE ELECTRICITY TO THE GRID AS A BY-PRODUCT OF MEETING THE DEMAND FOR HEAT

CHP TACKLES CLIMATE CHANGE AND ENERGY SECURITY, REDUCES OUR DEPENDENCE ON COAL AND RULES OUT THE NEED FOR NUCLEAR POWER

SECURING SUPPLIES

The 14GW of electricity generating capacity from CHP identified in *Securing Power* far outstrips the 10GW that the government's nuclear new build programme aspires to install by around 2030. Whilst CHP plants would provide heat at the same time, nuclear power plants rely on cooling systems to dump the heat they generate and so provide only electricity as a useful output.

THE INCREASED EFFICIENCY OF USING FUEL FOR BOTH HEAT AND POWER PROVISION WOULD SAVE THE UK THE EQUIVALENT TO ALMOST HALF OF ITS 2006 GAS IMPORTS.

The new coal plant proposed at Kingsnorth in Kent is 1.6GW in capacity. Industry reports suggest that another seven[3] of the same type of coal plants could follow if the government decides to continue to support new coal. These plants could total 10.6GW of capacity and would, at best, achieve around 45% efficiency. So, like nuclear plants, new coal plants would contribute only a fraction of the total energy[4] that could be provided by the CHP plants described in this report[5] and CHP could even produce more electricity.

LOWERING COSTS

Based on the ConocoPhillips CHP development at Immingham, industrial CHP is quicker and cheaper to build than nuclear power stations. The Immingham plant supplies two refineries in Humberside with heat, steam and power. It is currently being expanded (although the report shows potential for even greater expansion) and when this expansion is complete it will reach the same electricity generating capacity as the UK's flagship nuclear power station, Sizewell B. Reports suggest that the total cost of the Immingham development has been around £560 million.

According to energy company ConocoPhillips, the benefits to the UK economy of installing 5GW of CHP would be in the region of £7bn[6]. This could free up greater investment into the renewable energy technologies that are essential to both energy security and tackling climate change.

Current estimates put the cost of a single new nuclear power plant significantly higher than CHP capital, between £2.8[7] and £6[8] billion, not including the cost of managing and storing waste. The Nuclear Decommissioning Authority (NDA) recently increased its estimated cost of dealing with the nuclear waste in the UK from £73 billion[9], predicting that the total will be billions more[10] up to double the previous estimate.

There are only two nuclear power stations under construction in Western Europe. The first, Flamanville 3 in France, funded by the French government, was recently suspended by the French nuclear safety authority over poor quality of construction which would render the plant unsafe. The second, Olkiluoto 3 in Finland, was contracted from the French state nuclear company Areva under a subsidised turnkey agreement of €3 billion, but is thought to already be nearly €2 billion over budget due to serious safety problems and construction delays[11]. Both are the European Pressurised Reactor (EPR) design most likely to be chosen for the UK.

REDUCING EMISSIONS

According to Pöyry, the CO_2 saving from fully developing 14GW of CHP, compared to the current system of delivering heat and power separately, is between 10 and 26 million tonnes of CO_2 annually, depending on whether you assume that the electricity is replacing solely gas fired power stations or a mixture of coal and gas. At 26 million tonnes of CO_2, the saving would be 4.6% of UK CO_2 emissions.

ESSENTIAL STEPS TOWARDS AN EFFICIENT, DECENTRALISED, RENEWABLE ENERGY SYSTEM

Around Britain, industrial sites are using vast quantities of fuel to generate heat for processes such as oil refining and chemical manufacture. This produces high levels of CO_2. As we ultimately decarbonise our transport system and finally move away from oil, facilities such as oil refineries will become redundant. However, we urgently need to tackle climate change and these sites currently present an economical opportunity to quickly provide new bulk electricity generation whilst cutting fuel use and CO_2 emissions.

For as long as the UK continues to use fossil fuels, we should be using them as efficiently as possible to minimise CO_2 emissions. Matching industrial heat users with large scale gas fired CHP achieves that goal on a grand scale and could play a major role in replacing our current electricity system. It would reduce UK fuel consumption and help insulate against fuel price increases and supply concerns. Utilising already heavily industrial sites is a clear first step towards developing clean energy solutions for Britain. Systemic change requires a recognition of the importance of heat in the energy system, power systems that can effectively handle embedded generation and a market that rewards low-carbon power and heat.

Most crucially of all, industrial CHP will reduce CO_2 emissions while providing a solid stepping stone towards a more decentralised and increasingly renewable energy system. Developing skills, expertise and the supply chains for large scale CHP will enable community scale development and the widespread decentralisation of the system. This is necessary to ensure the best possible use of biomass and biogas for CHP plants. Combined with large and community scale renewables, this puts CHP in a central role delivering low-carbon heat and power provision for the UK as part of a transition to a fully renewable energy system.

GREENPEACE IS CALLING ON GOVERNMENT POLICY MAKERS TO:

- Ensure that adequate incentives are in place to send clear positive long term investment signals to developers. The Climate Change Levy Exemption for good quality CHP must be extended until at least 2017.
- Ensure that the Emissions Trading Scheme post 2012 does not unintentionally penalise CHP.
- Use public financial arrangements to support the construction of heat networks for major district heating locations, including the major industrial sites identified in Pöyry's report. Once a district heating system is constructed and operating, it can be sold to private sector.
- Oblige companies at each of the nine sites to connect to the heat network.
- Introduce a mechanism to remove revenue risk such as a low-carbon heat obligation for good quality CHP or a feed-in tariff.
- Introduce an emissions performance standard for all power stations outlawing the most polluting. Set at the right standard, this would drive investment toward low-carbon technology such as industrial CHP.

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ENDNOTES

1 http://stats.berr.gov.uk/energystats/dukes4_2.xls
2 On average 61.5% of energy is lost as heat from the power station cooling system and around 3.5% more is lost as heat in the power lines of the national grid.
3 Blyth, Tilbury, Ferrybridge, Longannet, Cockenzie, High Marnham and Fiddler's Ferry.
4 For new coal stations, 10.6GW x 7884 hours of generation per year, assuming 90% operational = 83.57TWH/y.
5 13.9GWe CHP would deliver 73TWh electrical energy and 48TWh thermal, a total of 121TWh. Pöyry's optimistic estimate is 16.3GWe CHP, which would produce 85.7TWh power at 60% load factor.
6 www.praseg.org.uk/downloads/2006/ConocoPhillips.pdf
7 BERR, *Future of Nuclear Power Consultation* (pg 68) www.berr.gov.uk/files/file39197.pdf
8 E.ON puts the cost at €6 billion (£4.8 billion). http://business.timesonline.co.uk/tol/business/industry_sectors/utilities/article3872870.ece Florida Power & Light said the cost could be up to $8,000 per kilowatt or $24 billion for two units. http://a4nr.org/library/economics/may.june-energybiz
9 *Cost of nuclear clean-up rises to £73bn,* Guardian, 11 October 2007 www.guardian.co.uk/business/2007/oct/11/nuclearindustry.environment
10 Jim Morse, NDA Director, 'I think it's a high probability that in the short term it will undoubtedly go up...I'm sure it'll be some billions, I really don't know.' http://news.bbc.co.uk/1/hi/sci/tech/7421879.stm
11 *European Nuclear Outlook*, Platts, 28 May 2008 www.platts.com/Nuclear/Resources/News%20Features/eurogrowth08/stuk.xml