Combined Heat and Power in Ireland

Trends and Issues - 2003 Data Update

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SUSTAINABLE ENERGY IRELAND
Energy Policy Statistical Support Unit

Sustainable Energy Ireland

Sustainable Energy Ireland (SEI) is Ireland's national energy agency. Established on May 1st 2002 under the Sustainable Energy Act 2002, SEI has a mission to promote and assist the development of sustainable energy. This encompasses environmentally and economically sustainable production, supply and use of energy, in support of Government policy, across all sectors of the economy. Its remit relates mainly to improving energy efficiency, advancing the development and competitive deployment of renewable sources of energy and combined heat and power, and reducing the environmental impact of energy production and use, particularly in respect of greenhouse gas emissions.

SEI is charged with implementing significant aspects of the Green Paper on Sustainable Energy and the National Climate Change Strategy as provided for in the National Development Plan.

SEI manages programmes aimed at:

- assisting deployment of superior energy technologies in each sector as required;
- raising awareness and providing information, advice and publicity on best practice;
- stimulating research, development and demonstration;
- stimulating preparation of necessary standards and codes;
- publishing statistics and projections on sustainable energy and achievement of targets.

SEI is responsible for advising Government on policies and measures on sustainable energy; implementing programmes agreed by Government and stimulating sustainable energy policies and actions by public bodies, the business sector, local communities and individual consumers.

Energy Policy Statistical Support Unit

SEI has a lead role in developing and maintaining comprehensive national and sectoral statistics for energy production, transformation and end use. This data is a vital input to meeting international reporting obligations, for advising policy makers, meeting international reporting obligations and informing investment decisions. Based in Cork, the Energy Policy Statistical Support Unit is SEI's specialist statistics team. Its core functions are to:

- collect, process and publish energy statistics to support policy analysis and development in line with national needs and international obligations;
- conduct statistical and economic analyses of energy services sectors and sustainable energy options;
- contribute to the development and promulgation of appropriate sustainability indicators.

Introduction

Electricity generation produces heat as a by-product and in conventional electricity generation plant it is usually disguarded. Combined Heat and Power (CHP) systems channel this extra heat to useful purposes so usable heat and electricity[1] are generated in a single process. In the right circumstances, CHP can be an economic means of improving the efficiency of energy use and achieving environmental targets for emissions reduction. CHP usually involves the burning of fossil fuels, but heat and electricity are also produced from biomass (including biogas and waste).

This report examines the contribution made by CHP to Ireland's energy requirements from 1991 to 2003. This booklet is an update and should be read in conjunction with a report published in 2004 entitled, "*Combined Heat and Power in Ireland- Trends and issues 1991 – 2002*[2]. A survey for the year 2004 is currently underway and this data will be incorporated in a further iteration of this update and published in Summer 2005.

Installed Capacity and Number of Units 2003

The installed capacity[3] of CHP in Ireland at the end of 2003 was 136.5 MW_e (128 units[4]). This includes a number of units that are not operational (5.3MW_e 8 units) and the status of which is currently unknown (1 MW_e 4 units). The figure for 2002, published previously, of 131.5MW_e has been revised to 132.4 MW_e. The difference of 0.9 MW_e (5 units) is due to sites that were installed during 2002, rather than 2003 as expected. Growth in installed capacity in 2003 was 4.1 MW_e or 3.1%.

The total number of units for 2002, originally published as 105, has also been revised, firstly because of the 5 units that were installed during 2002, rather than 2003. Secondly, 5 sites had 2 units instead of 1, therefore adding 5 units to the total. The revised number of units in 2002 is 115. The total number of units installed in 2003 was 15 units giving a total of 128. Growth in the number of units in 2003 was 11.3%.

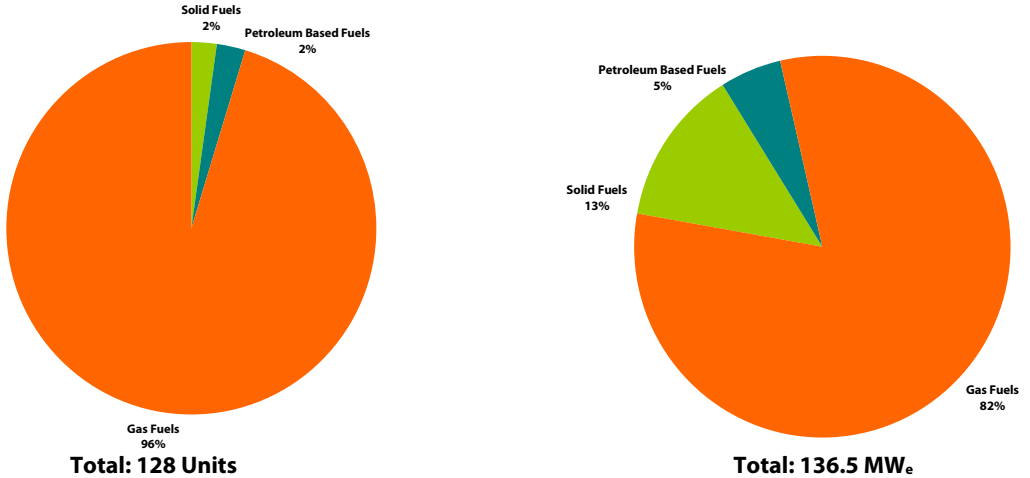
Regarding 2004 growth there was 0.6 (3 units) MW_e newly operational capacity in 2004 and a further 7.8 MW_e (7 units) due to be operational by the end of the year bringing the total to 145 MW_e. This data is provisional and will be validated when the 2004 survey is concluded in Summer 2005. A further significant development in 2004 was the closure of Irish Sugar in Carlow. This plant had a natural gas fuelled CHP unit with an installed capacity of 14.8 MW_e.

CHP by Fuel

It is useful to examine the fuel type associated with CHP plants from the perspectives of security of supply and emissions. CHP is promoted due to the improved efficiencies and reduced emissions that may be achieved relative to the alternatives. In this context, the choice of fuel has a direct impact on the levels of emissions reductions that may be achieved.

Figure 1 illustrates the installed capacity and number of units by fuel in 2003. Solid fuels are peat and coal, petroleum based fuels are LPG, heavy fuel oil and refinery gas while gas has natural gas and biogas as its constituent parts. Gas fuels were the fuel of choice with 111.1 MW_e. The vast majority of this was accounted for by natural gas. Solid fuels made up a significant share with 18.2 MW_e while petroleum based fuels accounted for the remainder with 7.2 MW_e.

Figure 1: Installed capacity and Number of Units by Fuel 2003



SOURCE: SEI

[1] In a small number of cases internationally, mechanical rather than electrical power is produced, in addition to heat.
[2] Available from http://www.sei.ie/uploads/documents/upload/publications/SEI_CHP_Report_Final.pdf
[3] Megawatt electrical or MW_e is the unit which represents the installed electricity generating capacity or size of a CHP plant.
[4] Note that units are distinct from CHP plants or schemes and that there may be more than one CHP unit at a site.

It is likely that gas will continue to be the fuel of choice for the majority of CHP Units in coming years even if the price of natural gas relative to electricity, which is key in the decision making process for developing CHP, has been increasing in recent years. In fact, some operators have found it uneconomical to run their units as a result of the high price of natural gas.

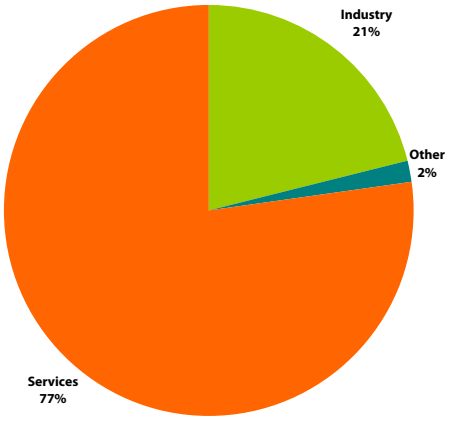
An interesting development in 2003 was the construction of Ireland's first solid biomass fuelled CHP plant. The CHP plant will use wood processing products such as sawdust, bark and woodchips together with forest thinings to generate heat for Granger Sawmills' timber drying operations. The plant also plans to export excess electricity to the national grid. The project is supported under Sustainable Energy Ireland's Research Development and Demonstration Programme.

CHP By Sector and Sub-Sector

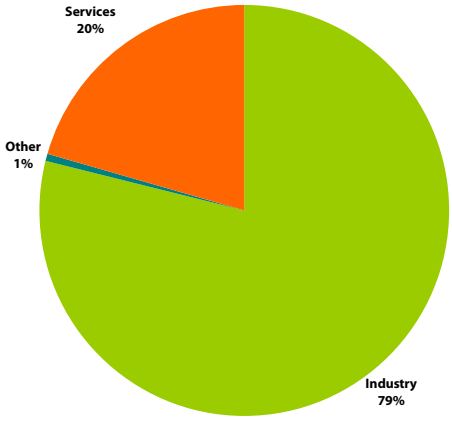
CHP is more suited to some sectors of the economy than others, depending on what it is used for, the amount of energy consumption and the split between electrical and heat requirements.

Figure 2 presents the number of units and installed capacity for CHP in Ireland in 2003. In 2003, the services sector, accounted for 99 (77%) of the 128 units and 27.8 MW_e of the 137 MW_e installed capacity (20%). It can be seen that the majority of units are in the services sector while the bulk of installed capacity is in Industry, indicating that there are a large number of relatively small units in the services sector. Traditionally, CHP was more suited to large industrial concerns but the availability of ready made, small scale, reliable, gas units in the 1990's meant that the services sector could avail of the technology whereas previously they would not have the heat and electricity demands to justify the outlay.

Figure 2: CHP Number of Units and Installed Capacity by Sector 2002



Total: 128 Units

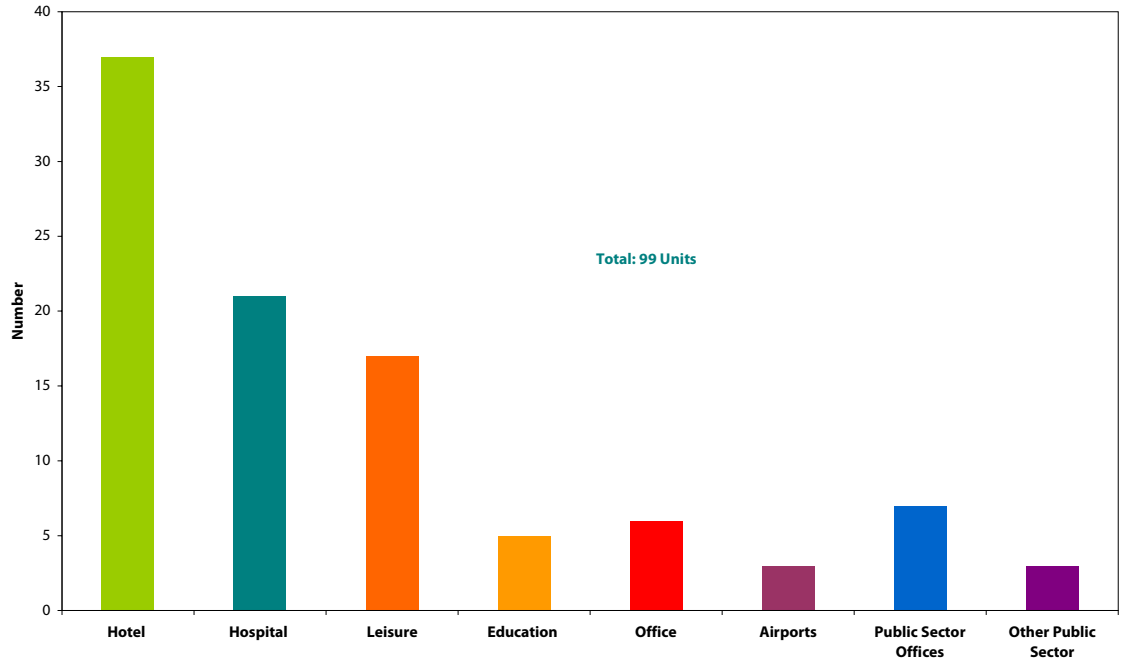


Total: 136.5 MW_e

SOURCE: SEI

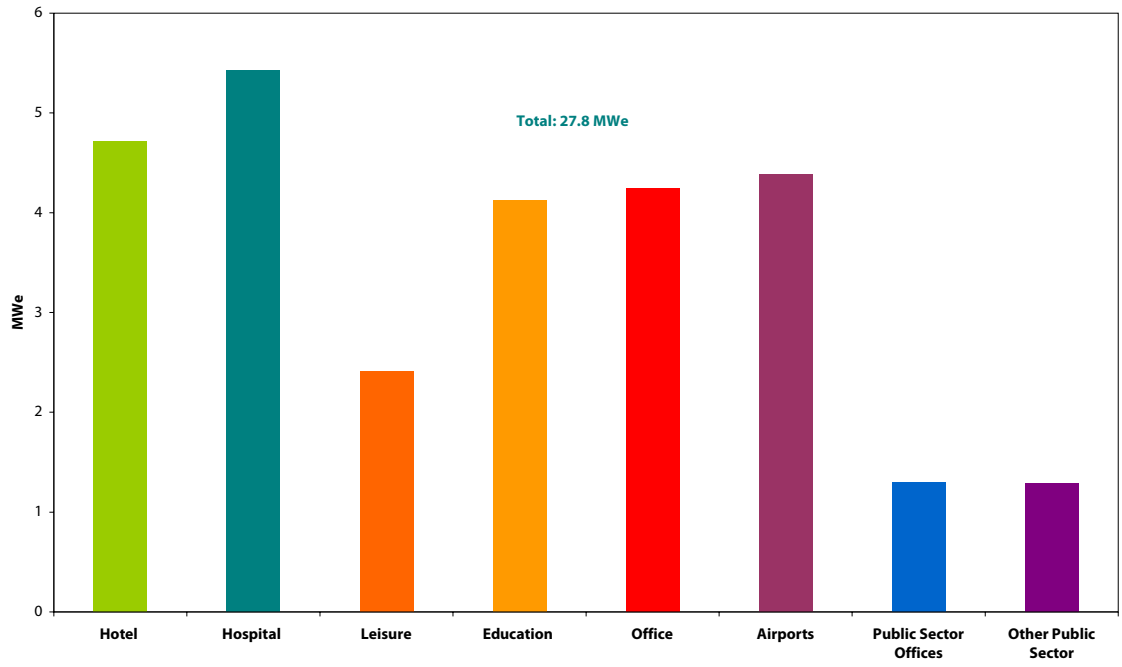
If we can examine the breakdown of services further, figures 3 and 4 it can be seen that *hotels* and *hospitals* account for the majority (59%, 58 units) of units while the *leisure* sub-sector accounts for another 17% (17units). These sub-sectors, in particular, benefit from having a more or less constant demand for heat and electricity but the technology may also be suited to any site that has a simultaneous demand for both heat and electricity.

Figure 3: Number of Units by Services Sub-Sectors 2003



SOURCE: SEI

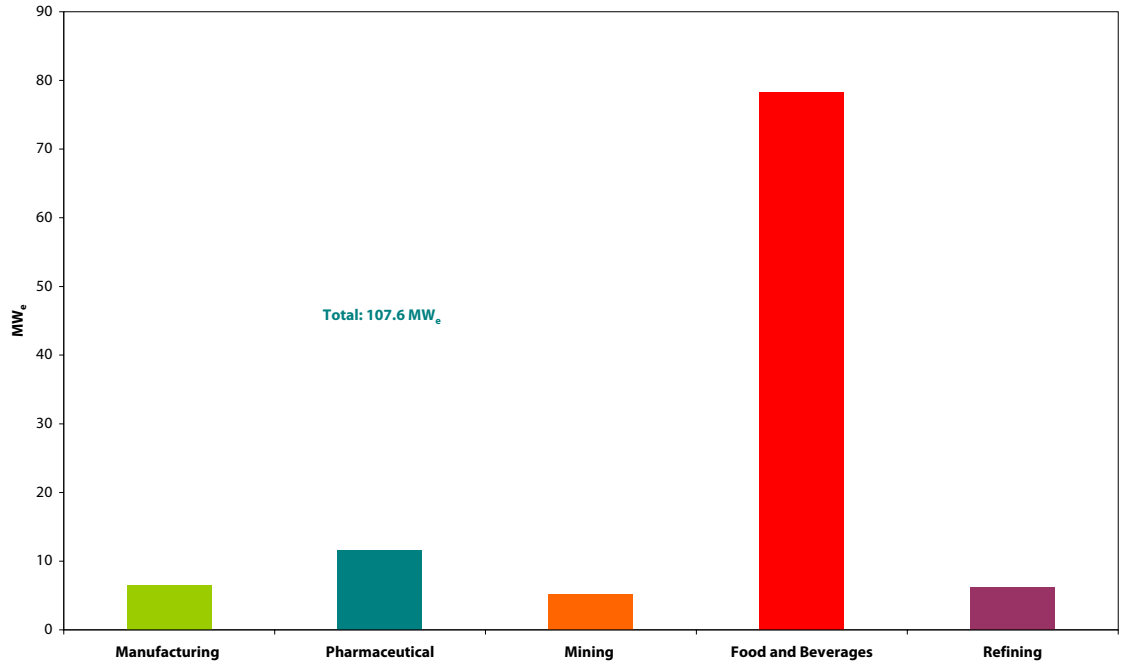
Figure 4: Installed Capacity by Services Sub-Sectors 2003



SOURCE: SEI

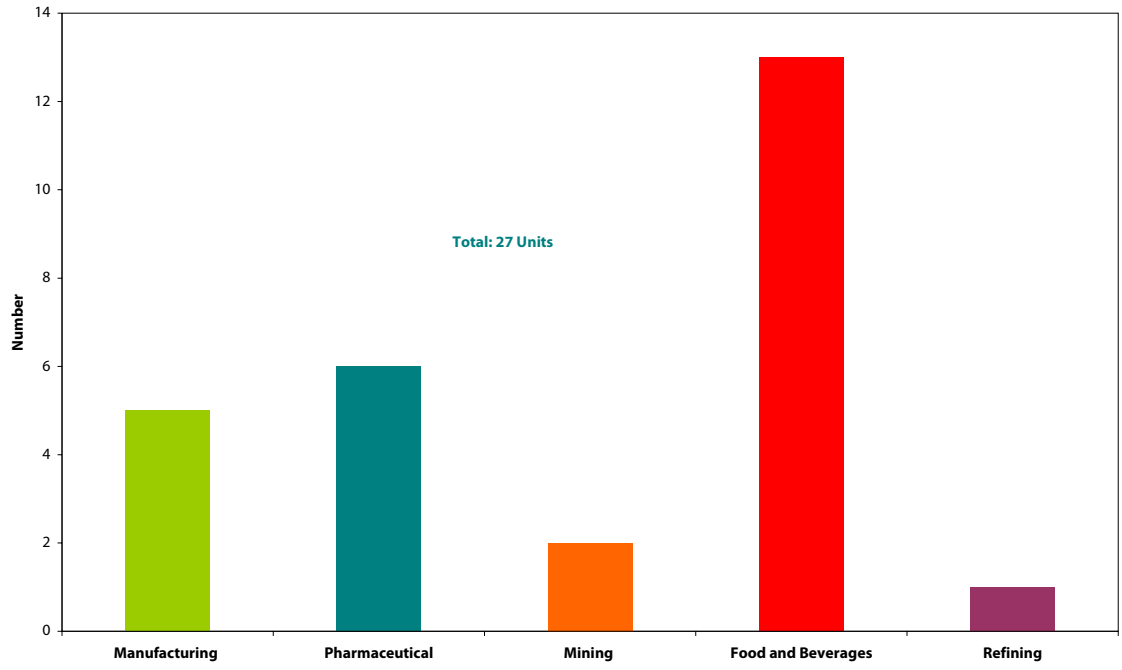
It is also possible to examine the sub-sectoral breakdown of installed capacity and number of units in industry, 5 and 6. It can be seen that *the food and beverages* sub-sector dominates with 48% (13 units) of the number of units and 73% (78 MW_e) of industrial installed capacity in 2003.

Figure 5: Installed Capacity by Industry Sub-Sectors 2003



SOURCE: SEI

Figure 6: Number of Units by Industry Sub-Sectors 2003



SOURCE: SEI

Policy

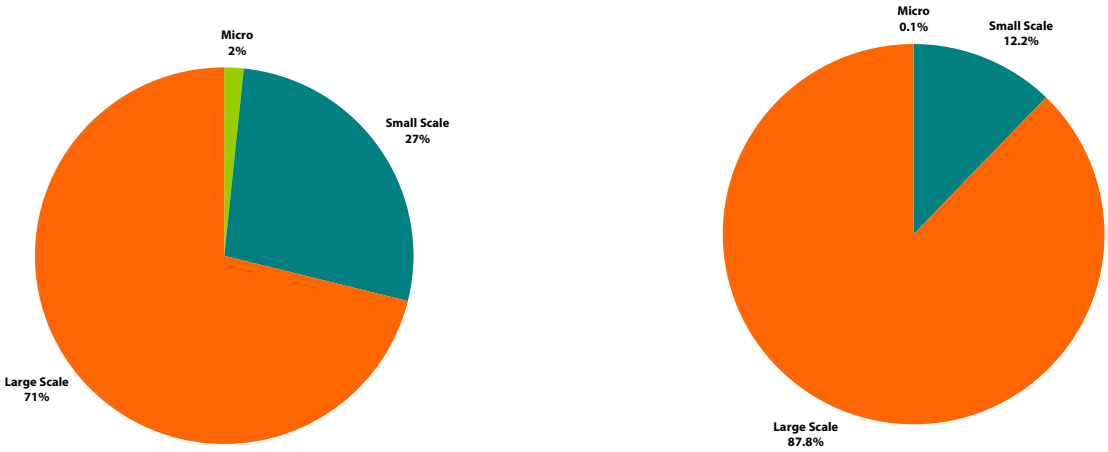
The European Commission published a strategy document on CHP in 1997 which has as its aim the doubling of 1994 CHP penetration by 2010[5] (from 9% to 18%). This target refers to the EU–15 and in 2002 (the latest year data is available) the proportion of total electrical output that was generated from CHP was 12%.

[5] Commission of the European Communities (1997) A Community Strategy to Promote Combined Heat and Power and to Dismantle Barriers to its Development.

The European Union CHP Directive[6], approved in February 2004, seeks to create a favourable environment for CHP installations. Transposition of the Directive into national law is required by 21st February 2006. The Directive requires all Member States to analyse national potentials for CHP identifying the potential for heating and cooling demands. It contained a number of provisions designed to promote the use of CHP in liberalised electricity markets across the EU.

The Directive also contained new definitions for micro, small and large scale CHP. Figure 7 and table 1 illustrate the new definitions and how Ireland installed capacity fitted into those classifications in 2003. It can be clearly seen that the majority are in the over 1 MW_e category.

Figure 7: Units by Capacity Size Range 2003



Total: 128 Units **Total: 136.5 MW_e**

SOURCE: SEI

Table 1: Units by Capacity Size Range 2003

Electrical Capacity Size Range 2003	Number of Units	Share of Total (%)	Electrical Capacity kWe	Share of Total (%)
Micro <50 kWe	2	1.6	76	0.1
Small Scale 50 kWe - 1mWe	35	27.3	16646	12.2
Large Scale >1 MWe	91	71.1	119809	87.8
Total	128	100	136531	100

SOURCE: SEI

The Department of Communications, Marine and Natural Resources established a CHP Strategy Group to analyse and make recommendations on possible options for future national CHP policy. This group is due to publish a draft report in Spring 2005.

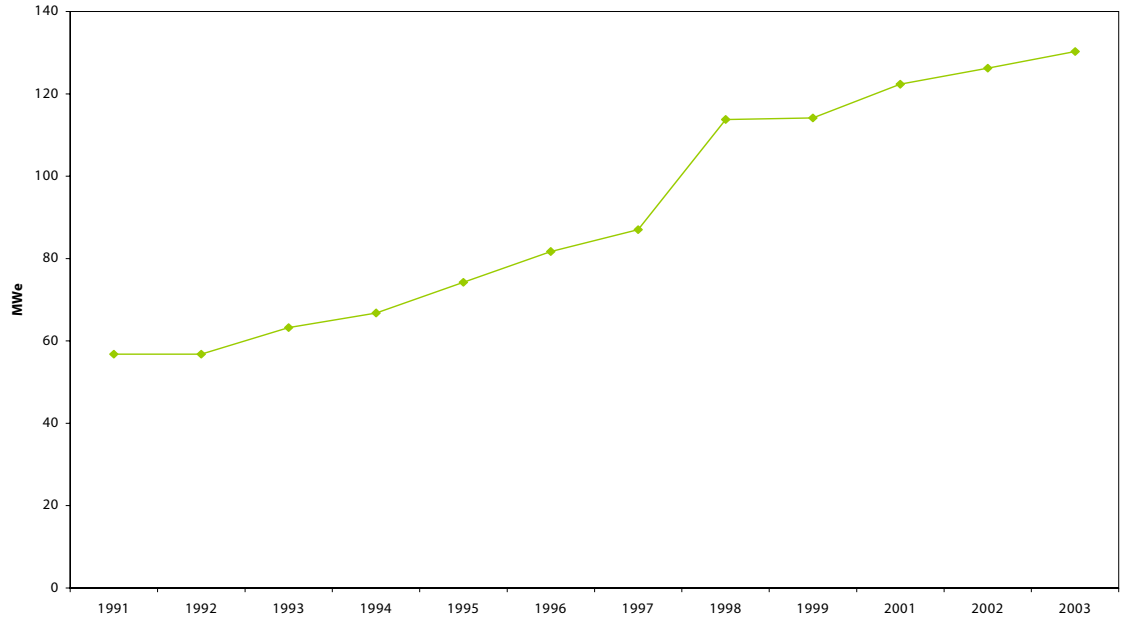
CHP 1991 to 2003

Figure 8 presents installed capacity[7] of operational units in Ireland over the period 1990 to 2003. Growth over the period was 129% or 7.2% per annum. Growth in operational installed capacity in 2003 was 3.2%.

[6] European Union, 2004. *Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market.* Available from: http://europa.eu.int/eur-lex/pri/en/oj/dat/2004/l_052/l_05220040221en00500060.pdf

[7] This data originates from surveys conducted by SEI in 1996 to1998, 2000 and 2002 that were part funded by EUROSTAT. SEI conducted similar surveys for 1999, 2001 and 2002. The ESB undertook the surveys in 1994 and 1996. There was no CHP survey carried out for 1995.Only operational units are included in the Eurostat funded surveys and thus only operational units are considered in the comparisons made in this section. Therefore installed capacity in 2003 was 130.3 MW_e and in 1991 it was 56.8 MW_e.

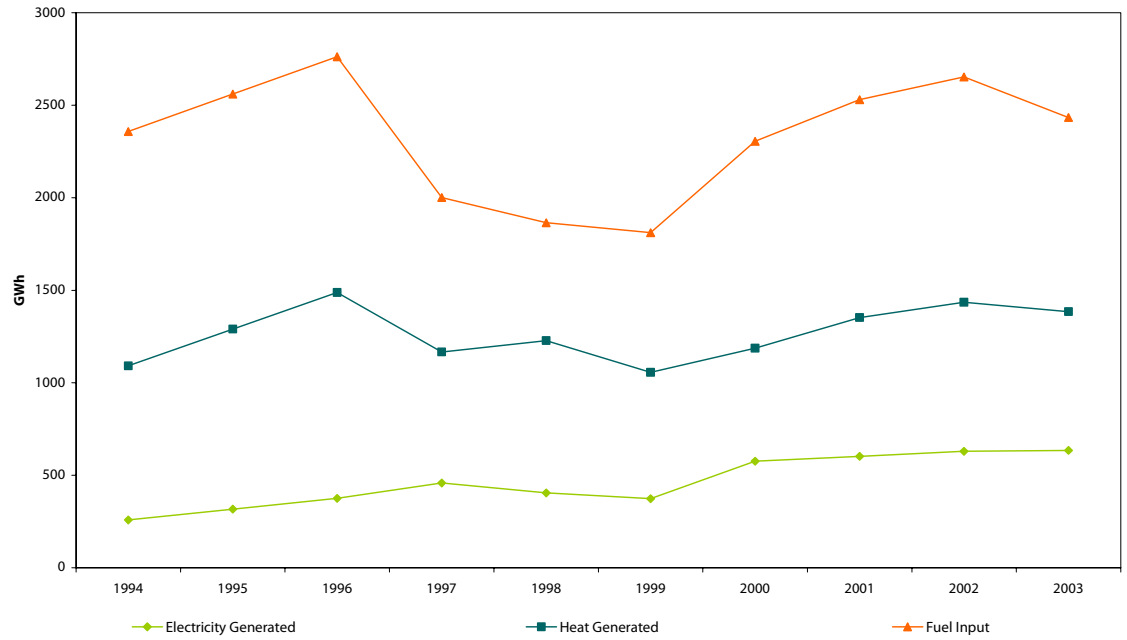
Figure 8: Installed Capacity1991 – 2003



SOURCE: SEI AND EUROSTAT

The trend in fuel input, electricity and thermal outputs over the period 1994-2003 is presented in figure 9. Fuel input has increased by 3% while the thermal and electrical outputs have increase by 45% and 145 % respectively over the period. This suggests that the overall stock of CHP installations has become more efficient over the period. In 2003 fuel input decreased by 8.3%, thermal output decreased by 3.5% while electricity increased by 0.8%.

Figure 9: CHP Fuel Input and Thermal/Electricity Output 1994 – 2003



SOURCE: SEI AND EUROSTAT

Figure 10 focuses on CHP generated electricity in Ireland as a proportion of total electricity generation in the period 1994 to 2003. After growth in the mid 1990's and then again in 2000, the share of total generation from CHP has reduced slightly each year. In 2003 2.4% of total electricity generation was generated in CHP installations.

Some CHP sites export excess electricity to the national grid. In 2003 there were 12 sites (16 units) exporting electricity to the grid, unchanged from 2002. These 16 units exported 97 GWh of electricity in 2003, a decrease of 2.1% on 2002.

Figure 10: CHP Electricity % of Electricity Generation 1994 – 2003

SOURCE: SEI

Planned Growth and Targets

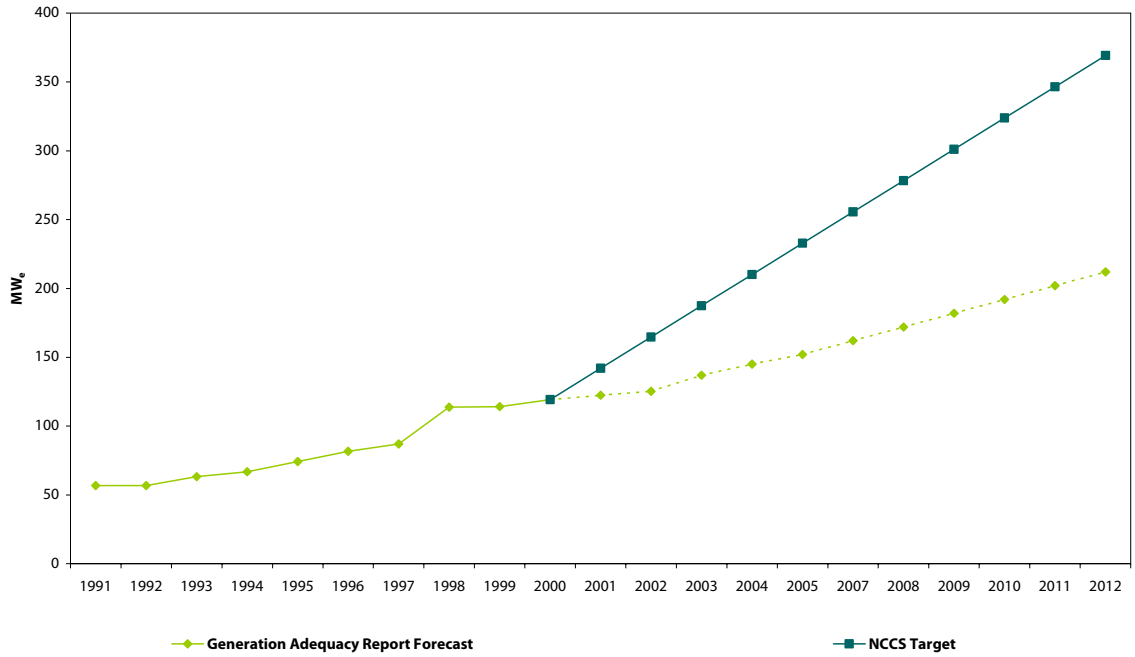
ESB National Grid, in its most recent Generation Adequacy Report 2005 to 2011 predicts that 67 MW_e of installed capacity will be added by 2012, from a base of 145 MW_e at the end of 2003[8]. Figure 11 illustrates the Generation Adequacy Report (GAR) forecast, which results in a total instated capacity of 212 MW_e in 2011.

As stated earlier, the National Climate Change Strategy sets a per annum target of 0.25 Mt reduction of CO_2 attributable to CHP, relative to business as usual, to be achieved by 2010. It has been estimated[9] that an additional 250 MW_e will need to be installed by the end of the decade, in order to achieve this target. The NCCS target is shown for comparison in figure 11.

If the GAR forecast is realised, it is clear that the target of an additional 250MW_e will not be realised.

[8] ESB National Grid, 2004, Generation Adequacy Report.
[9] Irish Energy Centre, 2001, An Examination of the Future Potential of CHP in Ireland- A Report for Public Consultation.

Figure 11 CHP Forecast Versus NCCS Target



SOURCE: ESB NATIONAL GRID / NCCS