Impact of the Emissions Trading Scheme for the CHP Industry.

1. Introduction

The proposed EU Emissions Trading Directive, which is part of the process being used by the EU to meet the Climate Change targets set under the Kyoto protocol, will have far reaching implications for Ireland. It has the potential if it is not implemented appropriately in Ireland to result in unfair treatment of and competitive disadvantages for CHP, thereby harming existing and new installations. Because CHP offers one of the biggest potentials for cost-efficient CO_2 reduction in Europe, this would run counter to the EU's ambition of averting climate change.

The Kyoto Protocol identified International Emissions Trading (IET) as one of the key market-based flexible instruments for compliance with Kyoto targets for global greenhouse gas emissions abatement. In addition to IET, overseas investment projects under Joint Implementation (JI) and the Clean Development Mechanism (CDM) are two further flexible mechanisms available to industry and Governments in meeting its compliance targets.

The Emissions Trading Scheme is expected to cover, in the first place, CO_2 emissions from specific large-scale industrial activities and combustion installations, including:

- Mineral oil refineries and coke ovens
- Ferrous metals, cement clinkers, glass, fibre, ceramics, pulp, paper and board industries with certain capacity.
- Combustion installations with a rated thermal input more than 20 MW.

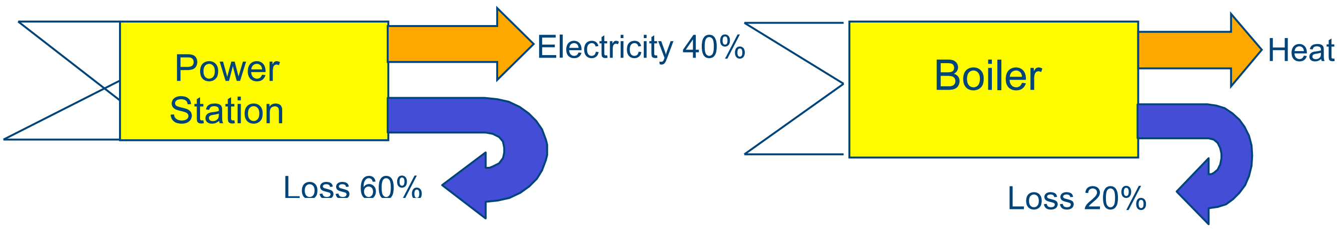
This means that a large number of both existing and potential future Combined Heat and Power (CHP) installations on sites with these activities will be subject to the Emissions Trading Scheme.
It is widely claimed that CHP because of its superior carbon efficiency should be a winner under the Emissions Trading Scheme. However there is concern that the roll out of the scheme in Ireland will punish CHP and block its development.

What is CHP

CHP is the simultaneous generation of electricity and useful heat in a single process. In other words it utilises the heat produced in electricity generation rather than releasing it wastefully to the atmosphere.

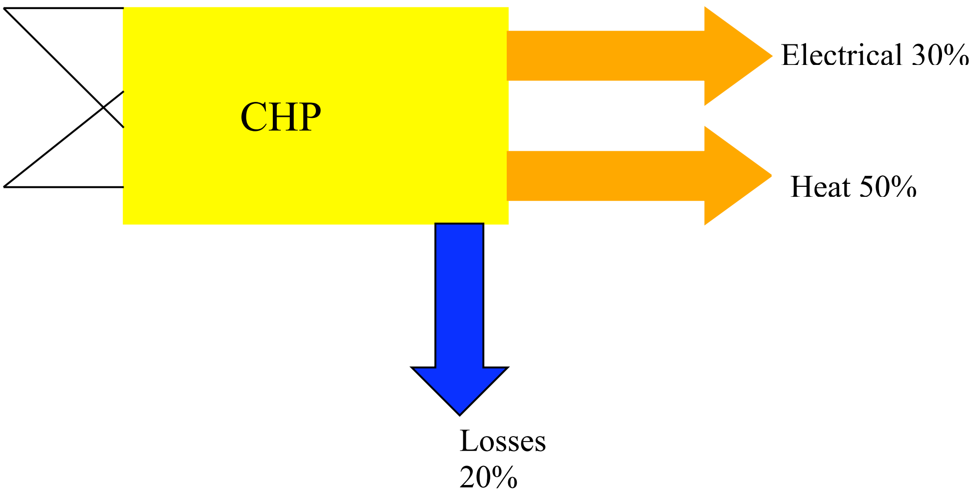
Applications that are generally suitable for CHP include hotels, hospitals, industrial processes and commercial buildings, where a continuous demand for heat and power exists.

The full advantage of natural gas-fired technology is achieved when the production of power and heat is combined. For this to be technically and economically feasible, it generally requires a simultaneous demand for heat and electricity on the site for a minimum of fourteen hours per day or 5,000 hours per annum. By using the heat produced in generating electricity by engine or turbine mover, the Combined Heat and Power plant becomes much more energy efficient than conventional forms of power generation. By changing from separate systems producing heat and power for industrial processes to CHP, considerable amounts of energy are saved. Typically, up to 85% of the primary energy is used in industrial CHP.



Overall Efficiency 58%

Figure 1 Separate Production of electricity and heat



Overall Efficiency 80%

Figure 2 Combined Heat & Power

CHP applications in Ireland

Large-scale CHP systems are suitable for use in large industrial and commercial processes such as dairies, breweries, pharmaceutical plants, airports, universities and food processing plants.
The prime mover in large scale CHP can be a gas turbine or gas engine. This drives a generator, which produces the electricity, the exhaust gases then pass through a recovery unit that provides the heat in the form required by the site (e.g. steam or hot water).

Additional steam or hot water can be produced using a technique called supplementary firing; this involves burning more gas in the oxygen rich gases prior to the waste heat boiler. This increases the heat output and thus provides the user with the facility to modulate heat production without affecting electricity generation. Electricity can be imported from or exported to the grid as the site demand varies.

Figure 3 below indicates the sectors where the most activity has taken place, by showing the amount of CHP units installed per sector(as of end 1999):

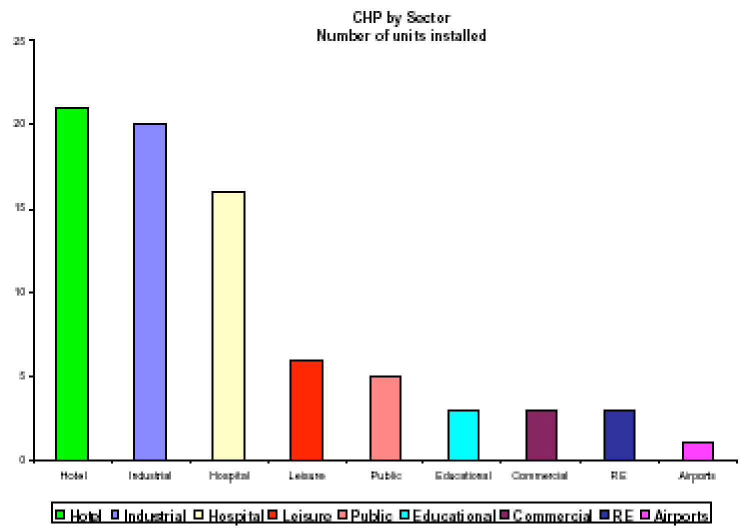


Figure 3 CHP by sector. Number of units installed.

The pie chart below indicates where the largest amount of electrical capacity is installed. This also gives an indication of where we can expect our target to be met.

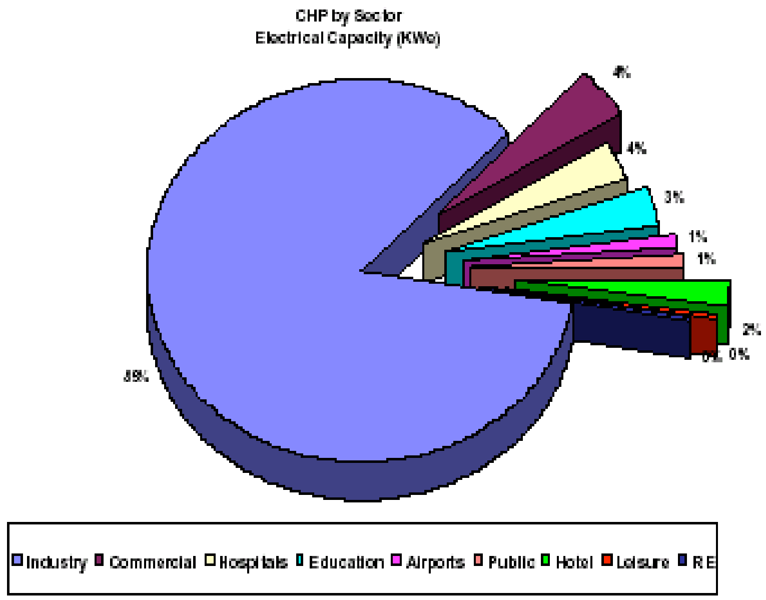


Figure 4 Electrical capacity by Sector.

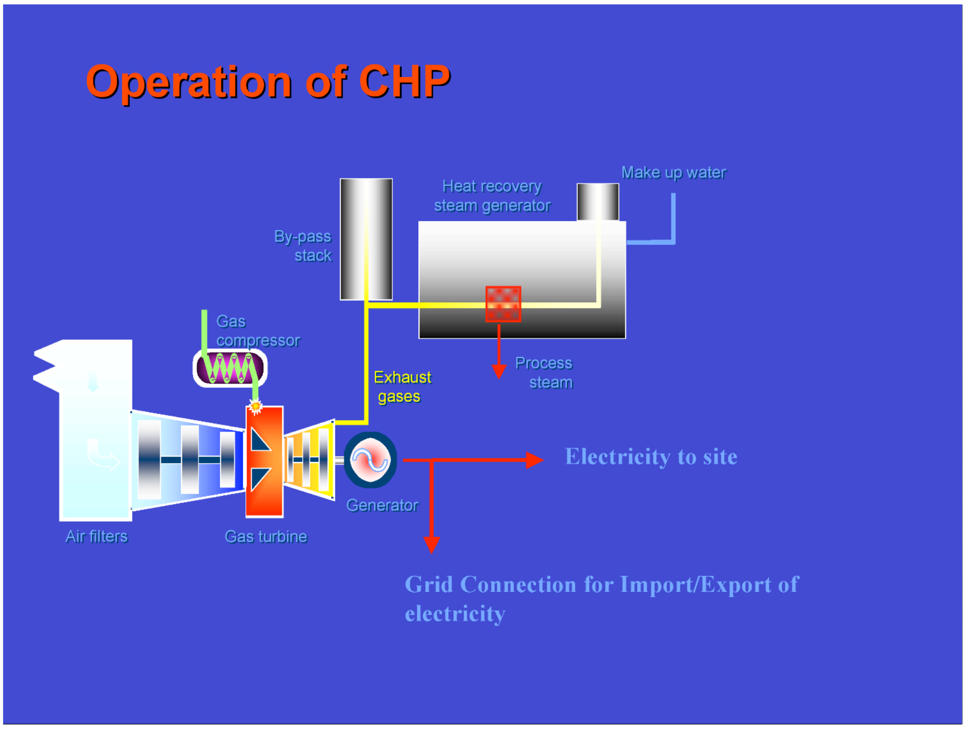


Figure 5 Typical CHP configuration

CHP Association

The Irish CHP Association was set up in April 2003 to promote the cause of CHP on an all island basis. Other countries have very consciously espoused energy policies designed to promote its uptake. As a result 50% of all electricity in Denmark and about 40%

in the Netherlands is produced from CHP. The EU average is about 10%.In Ireland represents less than 3% of all electricity generated . The Climate Change strategy recognised the positive contribution that CHP could make to meet Ireland's Kyoto commitments. Sustainable Energy Ireland produced a report in December 2001, which examined the reasons for comparatively low uptake of CHP in Ireland. *"An examination of the Future Potential of CHP in Ireland"* concluded that the market potential for CHP was 1000MW against a total installed capacity of 122 MW. However there are several barriers to CHP at the moment in Ireland and its treatment under the pending National Allocation Plan will be crucial if these targets are to be achieved.

What is at stake?

The potential for CHP is substantial. Yet market liberalisation in the electricity and gas sectors has resulted in a very difficult transition period for CHP. In fact it has come to a standstill.
A new CHP plant will considerably increase the direct CO_2 emissions from the site requiring it to buy additional allowances to cover the Emissions in excess of its allocation by the National Allocation Board (NAB).
The same problem applies if the plant operator has switched in the past from heat only production to CHP after the baseline year for Emissions Trading. For its early action the organisation runs the risk of only being allocated the amount of allowances to cover the direct emissions of its plant.
When CHP electricity replaces power that previously had been purchased from a central power plant, there is a net reduction nationally of CO_2. If credit for this action is not allocated to the CHP promoter, it falls by default to the Central Power plant.
Large central power plants should be encouraged to support the development of CHP through joint ventures/contracting on sites.
Large centralised power plants should not be allocated or grand fathered sufficient credits that allow it to continue inefficient stations at the expense of CHP.

What is the Problem?

Figure 5 and 6 below shows two examples of what could happen to an industrial site after conversion to CHP. After conversion, the site will consume more fuel than before to generate the additional electricity on top of its existing heat production. Therefore it will naturally emit more CO_2 than it did previous to conversion.
In scenario 1if the allowances allocated to the installation are based on the lower pre-CHP emission levels, the operator will have to buy additional allowances on the market.

Yet the conversion to CHP will greatly reduce overall CO_2 emissions because the CHP electricity will replace electricity that previously has been produced in CO_2 intensive power plants.

However it would be the operator of the Centralised Power plant whose CO_2 emissions have been replaced, who is likely to benefit from the windfall and sell his leftover allowances on the market, or even to the CHP operator. Unless due consideration is given to this in the NAP, Emissions Trading will penalise CHP.

In scenario 2 the centralised Power operator must give up its allocation and this is transferred to the CHP operator, providing it with a surplus to sell. This would be an incentive to develop CHP and reduce our dependency on old inefficient centralised coal fired plants.

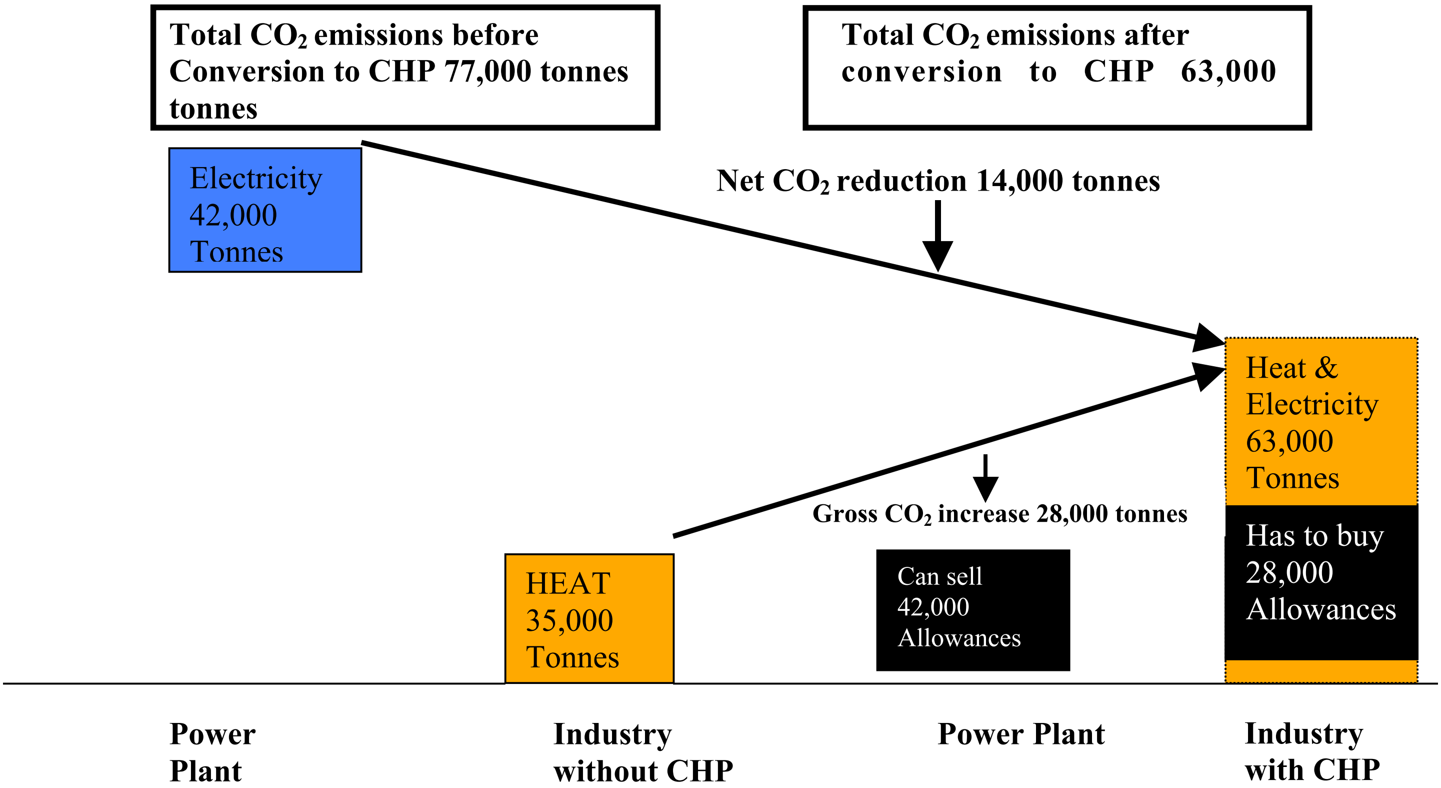


Figure 6 Scenario one Allocation method. Penalising CHP Development

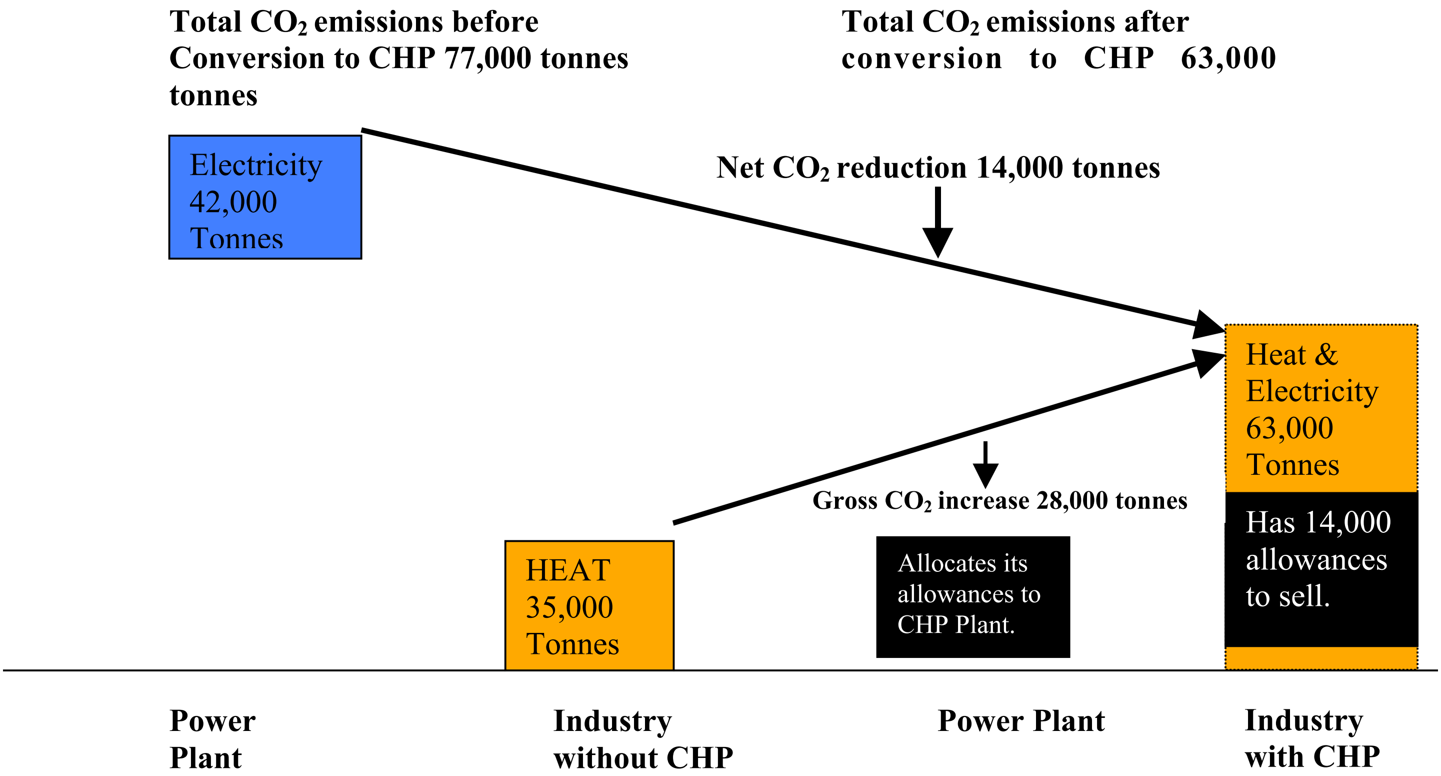


Figure 7 Scenario 2 Allocation method – Rewarding CHP Development

Recommendations

1. Emissions Trading should be designed to take into account the net CO_2 reductions from CHP. Credit should be given to the operator.
One option would be to allocate allowances equivalent to the equivalent to the separate heat and power production, which it replaces.

Another option would be to offer a discount to allowances that the CHP operator had to surrender, reflecting the carbon savings from CHP.

2. Like industrial CHP, public district heating also requires incentives to encourage a shift from separate production of electricity (included in Emissions Trading) and domestic heating systems (not included) towards new CHP.

It is vital that Ireland's National Allocation Plan include provisions for this.
3. Allocations to the Power sector.

Assigning grandfathered allowances to the power sector enables the monopoly supplier to retain old inefficient plants, which contributes to climate change and discourages new entrants. Taking the opposite approach forces efficiency by adding to the cost of poor efficient generators and the cost is passed on to the consumer, enabling new entrants to enter the market and create a niche for themselves.

4. Future Growth

As can be seen in Figure 8 below, the CHP market has grown from an installed capacity of 55 MW in 1992 to 132 MW at the end of 2000. This growth appears to have occurred in two distinct phases; The periods 1993-1996 and 1996 to 1999.
These two periods have coincided with incentivisation of the market. The average growth per annum between 1996 and 1999 was 12.8 MW. However between 1999 and 2000 the market only grew by just over 10 MW.

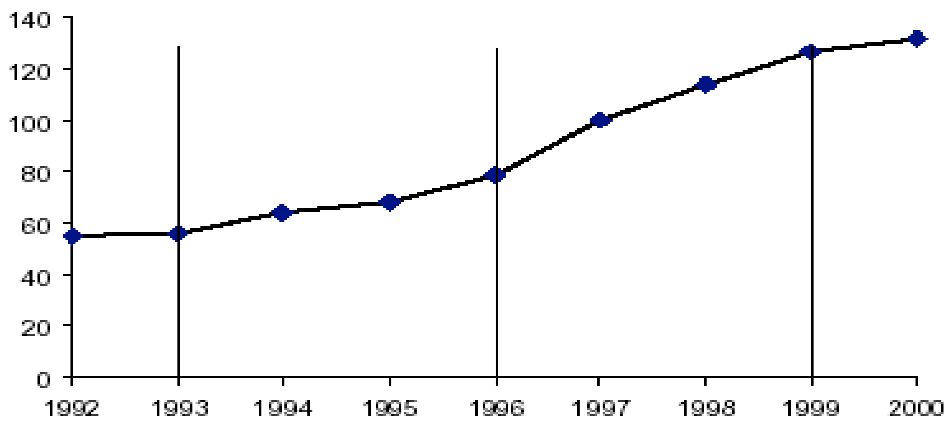


Figure 8 *Installed Capacity*

The National Climate Change Strategy sets a target of 0.25 Mt reduction of CO_2 attributable to CHP. However due to the many uncertainties and the barriers to CHP in the market, the CHP market is starting to constrict and predictions for 2004 onwards estimate that the market may shrink further. To achieve the target set out by the National Climate Change Strategy therefore requires a significant change in the growth rates of the industry.
Failure to recognise this in the NAP will prevent further conversion to CHP and it would also put the success of the European Cogeneration Directive into question in Ireland.

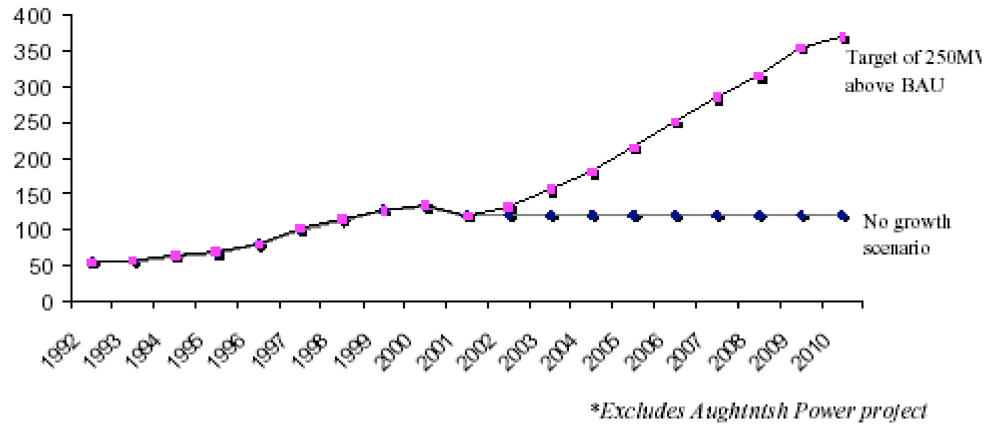


Figure 9 Installed CapacityFuture Scenarios

5. Allocation Versus Grandfathering

During the pilot phase allowances will be granfathered. However how will allowances be allocated after this period. Auctioning would be the preferred option of the CHP Association as it encourages efficient power generation. For example the state could allocate without charge all of its allowances during the pilot phase and thereafter, the share of the auctioned allowances would increase by 10 % per year. This in 2008 ten percent of allowances would be auctioned and in 2012 fifty percent would be auctioned.

Case Study of CO_2 Reductions from A CHP Plant.

Table 1 illustrates the grams of CO_2 emissions per G Joule for each fuel

EMISSIONS FACTORS for INDUSTRIAL COMBUSTION (g/GJ net)	
Fuel	**CO_2**
Natural Gas	54,940
H.F.O.	76,000
Electricity in Ireland	215,492

Using this table we have calculated the tonne of CO_2 emitted prior to the operation of CHP *(Table 2)* and post-CHP *(Table 3)* for a dairy processing facility at Glanbia, Ballyragget, Co. Kilkenny.

Table 2 Emissions from plant pre-CHP

Source	**CO_2 Tonnes/yr.**
Electricity	57,876
H.F.O	74,016
Total	131,982

Table 3 Emissions from plant post-CHP

Source	CO_2 Tonnes/yr.
Natural Gas	68,398
Total	**68,398**

Total net reduction of 63,584 tonnes of CO_2

Similarly, the emissions from another dairy processing facility at Dairygold, Mitchelstown, Co. Cork have been assessed. In this case a comparison is made between the current operations on site utilising CHP technology and the emissions from the current operations as they would be if CHP is not in place i.e. electricity purchased from the ESB and steam generated on-site using Natural Gas.

Table 4 Emissions from plant utilising CHP

Source	CO_2 Tonnes/yr.
Natural Gas	48,036

Table 5 Emissions assuming electricity bought from ESB

Source	CO_2 Tonnes/yr.
Natural Gas	29,181
Electricity (ESB)	46,391
Total	**75,572**

Total net reduction of 27,536 tonnes of CO_2

The above case studies clearly show the significant effect of CHP technology in reducing emissions.