The Costs Associated with Generating Electricity from Peat and Biomass: A Case Study of Ireland

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Abstract

A key challenge at present internationally is the design of future electricity systems and the generation mix which will bring about emissions savings and fuel security at least cost. Peat is partially decomposed plant debris and is considered an early stage in the development of coal. Peat is used to generate electricity in several EU countries, mainly to take advantage of indigenous resources and diversify fuel mixes. Peat has the notable disadvantage of being highly carbon intensive – in fact it emits 1.23 times more CO_2 per tonne than coal. As a result of this, the Irish government has introduced a target to reduce emissions in Irish peat stations by co-firing with 30% biomass. The aim of this paper is to assess the viability of this target. This paper calculates the available indigenous biomass resource capable of being co-fired in peat stations and the cost of meeting the target. It is found that Ireland only has half the necessary resource to meet the 30% target and that the cost of meeting the target would be at least €20 million in excess of what is currently being paid for peat even without considering the additional capital costs required to handle biomass. Thus, it is concluded that while it may be technically possible to meet the governmental target this is not in fact the most efficient allocation of Irish biomass resources and the target may need to be reconsidered.

Keywords: Biomass, Peat, Renewable Generation, Climate Policy

1. Introduction

"Peat is a dead vegetable matter that is slowly accumulating in anaerobic water-saturated conditions" (Schilstra AJ, 2001). Peat has been a significant source of energy for electricity generation in Ireland since the 1950's, and was possibly the most important indigenous energy resource prior to natural gas coming on stream in 1979 (Bord na Mona, 2001). At its peak, peat provided just under 40% of all electricity generated in the State, though this figure has been falling steadily over the last 50 years. While not a significant source of energy in most countries, peat is also used for electricity generation in Sweden and Finland (Ericsson et al., 2004; Schilstra AJ, 2001). While peat is indigenous in all three countries, Finland and Sweden are part of the Nord Pool common electricity area alongside Denmark and Norway, rendering them far less dependent on peat for energy security than Ireland. In fact, of the 363.3TWh of electricity produced in the Nord Pool area in 2003, 24% came from nuclear energy, 46.3% from hydro stations and 1.7% came from wind (Laurikka H, Koljonen T, 2006). In contrast, peat is subsidised in Ireland in an attempt to alleviate import dependency as well as to preserve jobs in the industry (Styles D, Jones MB, 2007).

Biomass can be defined as all the earth's living matter; materials such as wood, plant and animal wastes, which – unlike fossil fuels – were living matter until relatively recently. Biomass is an appealing source of renewable energy for several reasons. The direct benefits associated with co-firing include a reduction in green house gas emissions, not only in terms of a reduction in carbon dioxide (CO_2) but also methane (CH_4) which also contributes to global warming (De S & Assadi M 2009; Sami et al 2001). As noted by Domac et al. (2005), "Millions depend upon bioenergy as their main source of fuel not only for cooking and heating but also more importantly, as a source of employment and incomes".

The substitution of imported conventional energy sources with renewable energy sources offers considerable potential for increasing the security of energy supply. The socio-economic benefits of utilising bioenergy, such as regional economic gain, security of supply and employment gains, can unmistakably be identified as a significant motivation for increasing its share in the total supply of energy (Domac J et al. 2005). Biomass, for its part, could significantly reinforce sustainable security of supply, considering that it is a widespread and versatile resource that can be used just as easily for heating, electricity production or as transport fuel. On a global scale, biomass ranks fourth as an energy resource, providing approximately 14% of the world's energy needs (Bain et al. 1998).

With particular reference to co-firing, using indigenously sourced materials will enable Ireland to maintain security of supply benefits. With regards to waste residues, such as wood wastes and Meat and Bone Meal, these residues, if used for co-firing, have the potential to reduce the amount of waste either being sent to landfill or exported, further reducing Ireland's global warming impact. However, biomass also poses several issues; for one it must be sourced responsibly, as transporting vast quantities over larger distances obliterates any CO_2 mitigation benefits from its combustion. Also with reference to energy crops, biodiversity must be maintained so as not to have lasting impacts on global natural habitats and food resources.

Peat is one of the most polluting fuels in use for electricity generation in Ireland, as can be seen in Figure 1. It does however offer benefits in terms of security supply to an economy otherwise highly dependent on fuel imports, the only proven exception being Ireland's abundant wind resources. Ireland has three power stations fuelled with peat. As all are relatively new (the oldest of which is Edenderry, with was officially opened in 2000), it makes sense to continue to use these stations after the capital costs have been spent while at the same time minimising the effect on the environment.

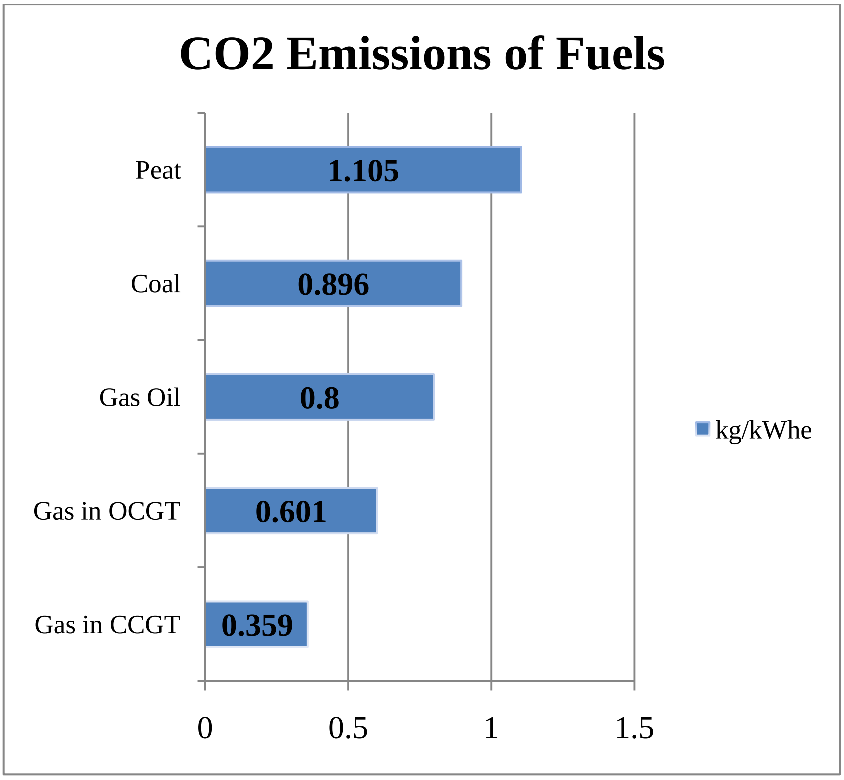

Figure 1: CO_2 emissions of fuels

The 2007 Irish Government White Paper has set targets for 30% co-firing with biomass in each of these three peat stations with a view to reducing Ireland's CO_2 emissions and meeting various EU and international goals. This means that in the region of one million tonnes of peat will have to be replaced on an annual basis from 2015 if these stations are to remain in operation after this point, as the Public Service Obligation (PSO) which guarantees the amount of peat purchased annually from Bord na Mona expires at this time. The PSO is a levy charged to all electricity customers and is designed to recoup the additional costs incurred by purchasing electricity from specified sources, including sustainable, renewable and indigenous sources.

The potential of this target in emissions terms is significant, especially as all forms of biomass are considered by the EU to be carbon neutral, due to the fact that all carbon emitted during combustion has been taken from the atmosphere during their relatively short lifetime.

So for example if this target is met then the emissions from the three peat stations will officially be 30% less than their current average – resulting in a savings of about 836,000 tonnes of carbon dioxide per annum. According to Philip Farrelly & Partners (2008), this equates to the equivalent of the elimination of emissions of 225,000 family cars.

Experience in Germany (Hartmann & Kaltschmitt, 1999) found that overall the co-firing of biomass provided benefits both in terms of emissions mitigation and also economic benefits in comparison with other renewable energy sources, meaning that in the future biomass could make a substantial contribution to a more environmentally friendly energy supply system. In Holland, Verbong & Geels (2007) found that while the co-firing of biomass in existing coal stations had positive benefits in terms of emissions and other environmental factors, it was still met by widespread opposition from local groups in relation to the types of biomass being used and as a result many co-firing plants encountered problems in permit procedures. This has already been an issue in Ireland, with many residents groups wanting clarification of what types of biomass will be used and the general public being opposed to incineration for waste disposal.

2. Case study: Ireland

Ireland's energy mix for electricity is unique for a number of reasons; firstly as a result of being an island economy the level of interconnection between it and neighbouring countries is low – at present there is only one interconnector between the GB and Northern Ireland which operates at 400MW, with another of 500 MW capacity expected to be online by 2012 (Malaguzzi Valeri L, 2009). Ireland has very little in terms of indigenous energy resources; it does have some indigenous resources in the form of considerable peatlands; estimated to be 0.95 million hectares (Mha) or 13.8% of the national land area by Connolly et al. (2007) and some natural gas, production of which is ongoing at the Kinsale and satellite fields off the south coast, although this is expected to further decline over the next few years. Any future indigenous production will come from the Corrib gas field in the West of Ireland. These resources are by no means sufficient to meet Irish energy demand, and in 2007 Ireland imported 88.3% of its energy needs – one of the highest levels of energy imports in the EU, after only Luxembourg (97.5%), Malta (100%) and Cyprus (95.9%), according to Eurostat data (2010). As a result, Ireland is very susceptible to shocks to energy prices and needs to encourage as diverse a fuel mix as possible in order to protect its security of supply. Table 1 below shows the changes in the mix of fuels for electricity consumption between 1990 and 2008. The level of renewables has increased further since 2008, and is currently about 10% of all electricity generated.

Shares % Electricity Generation Fuel Mix		
	1990	**2008**
Fossil Fuels (Total)	**98.1**	**92.9**
Coal	40.3	20.4
Peat	19.5	11
Oil (Total)	11	6.8
Fuel oil	10.8	6.5
Gas oil	0.2	0.2
Gas	27.3	54.7
Renewables (Total)	**1.9**	**6.4**
Hydro	1.9	1.6
Wind	0	4
Combustible Fuels (Total)	98.1	93.6
Electricity Imports	**0**	**0.8**

Table 1: Electricity Generation Fuel Mix (SEAI 2009)

Looking at the share of fossil fuels, it is clear that the use of coal and peat is much lower than it was previously, due in large part to an increase in the share of natural gas. While this is clearly a positive outcome in terms of emissions reductions it poses problems in relation to maintaining the country's security of supply with over half of all electricity consumed coming from natural gas. With this in mind, finding a way to reduce emissions from said coal and peat stations provides the potential to reduce emissions while still maintaining security of supply benefits, and, in the case of peat, reducing dependency on energy imports.

While coal can be used to co-fire with biomass, as can be seen in Molcan P et al. (2009) and Baxter L (2005), this paper will focus on the co-firing of biomass with peat for several reasons; firstly because it is a higher emitter than coal, secondly because peat is a more expensive fuel than coal and therefore creates an added incentive to reduce its consumption, thirdly more types of biomass can be co-fired with peat than with coal as a result of the stations being better suited to dealing with variable moisture levels and thus higher quantities of biomass, and finally due to the fact that peat is an indigenous fuel unlike coal which also offers job creation benefits and prolongs the supply of this resource for future generations.

2.1 Peat stations

Ireland currently has three peat stations in operation; Edenderry Power Ltd was officially opened in 2000 with a capacity of 120 MW (which is approximately 3% of Ireland's installed capacity). The plant's efficiency is 38.4%, and uses a Bubbling Fluidised Bed Boiler. The plant consumes one million tonnes of peat each year to deliver its energy output, which results in approximately 32,000 tonnes of ash and CO_2 emissions of 846,000 tonnes per annum. Lough Ree and West Offaly Power Stations are ESB owned stations (previously the State monopoly). Both stations were commissioned in early 2002 using modern fluidised bed technology, and have a combined total output of 250 MW. These stations have a much higher efficiency than the previous peat plants which they replaced, producing 30% more electricity for the same amount of fuel inputs. Over 37% of the primary energy supplied from the fuel is converted to electricity and supplied to the National Grid.

"Fluidised-bed combustion evolved from efforts to find a combustion process able to control pollutant emissions without external emission controls such as scrubbers" (DOE, 2010). The technology is particularly attractive with respect to co-firing of fuels due to its fuel flexibility - almost any combustible material, from coal to municipal waste, can be burned - and the capability of meeting sulphur dioxide and nitrogen oxide emission standards without the need for expensive and inefficient add-on controls (DOE, 2010).

3. Biomass

Given that one of the main basis for burning peat is for its security of supply benefits, any biomass used to co-fire at this point should ideally be indigenous so as to not to reduce these benefits. The main fuels available in Ireland which are suitable for co-firing with peat are therefore Willow, Miscanthus, Wood resources and Meat and Bone Meal (MBM).

3.1 Energy Crops – Willow & Miscanthus

Energy crops have gained much interest in recent years, with studies suggesting the most appropriate for Ireland to be Miscanthus and Willow (Styles D, Jones MB, 2007). These crops take relatively little time to grow (1-4 years) and the same plot of land can be planted on repeatedly for about 20-25 years. The growing of energy crops is particularly advantageous for farmers, as it can be done on land where little else can be commercially grown, and is an alternative source of income for farmers affected by changes to the Common Agricultural Policy (CAP) (EC 2010). As these crops are indigenous, they have the potential to reduce Ireland's dependence on energy imports if co-fired or at least maintain the current security of supply gained from peat.

3.2 Wood

The SEI Co-firing with Biomass (2003) report classifies wood fuel resources available to Ireland as saw dust, cutter chips, demolition wood, recycled wood, logging residues, and processed wood pellets. Thanks to Ireland's record afforestation programmes of the past twenty years, Ireland is in the fortunate position of having a significant source of indigenous wood available for energy (2007, Koffman, Kent). Taking into account the current market for wood and wood products the estimated surplus available to the Irish electricity and heat market was estimated by Coford in 2003 as having the potential to supply some 3.6PJ (1TWh).

Co-firing wood with coal is in operation in several countries – such as Poland (Berggren et al. 2008) – and thus could potentially be done in Moneypoint, the only Irish coal station at this time. These studies have shown maximum share of wood co-fired to be between 5-10%. With respect to co-firing with peat, Fortum (2002) shows that a trial at Edenderry Power Ltd proves that it can deal with a fuel mix of at least 30% wood. This means that in theory all three peat burning stations should be able to handle 30%, which would meet the government's target reductions in full for these plants.

In all but a few cases, the cost of wood technology and its supply costs are unable to compete with existing fuels, be it peat, coal, gas, or oil. Koffman, Kent (2007) show a break down in the costs associated with various methods of supplying wood for energy generation for conifers, broadleaved stands, and solid biomass and the Boora peatland site. Overall, it can be seen that while whole tree chipping is the least expensive option, costs vary significantly between types of wood source, as do the amount of energy they can provide, mainly due to the moisture content of the wood in question.

3.3 Meat and Bone Meal (MBM)

Due to changing regulations in the agri-sector for the use of MBM in recent years, its application as a fuel for energy generation has gained enormous interest internationally. This is of particular importance for Ireland, where 150,000 tonnes of MBM waste are produced each year according to Cummins EJ et al. (2006), costing in the region of €22 per tonne in terms of storage and not including disposal.

4. Challenges Faced in Biomass Co-firing Trials

Edenderry Power Ltd has undertaken numerous co-firing trials over the past number of years, and through personal communication the following concerns were raised.

4.1 Storage

At present, all three Irish peat stations have very little in the way of storage capacity – Edenderry, for example, has two days fuel requirement in storage available to it. This is an issue in terms of how many deliveries are needed on a day to day basis and in particular poses a challenge for crops which are seasonal such as Willow and Miscanthus. MBM, due to the fact that it is an animal residue, is also somewhat problematic in that needs specialised refrigerated storage to ensure it is kept at a suitable temperature to prevent it from decaying. Edenderry is located in a fairly rural area and thus has the potential to increase its storage capacity (at a cost), however Lough Ree and West Offaly stations are based along the river Shannon in somewhat built up areas and therefore their capacity to increase storage facilities is low. This will clearly have an impact on the types of biomass that the two ESB stations will be readily able to receive and also their ability to drive down costs through efficiencies of scale.

4.2 Handling

For the most part, Willow and all types of wood require no modification to the current handling process; in fact they can be processed alongside the milled peat and fed into the boiler at the same time and in varying quantities with no real difficulties or loss of efficiency. Miscanthus and MBM however have proven in trials at Edenderry to be rather more problematic.

Miscanthus requires added pre-processing as a result of being a grass-like material – in trials this has resulted in it being shredded rather than chipped which causes issues in its handling, with the fibres becoming blocked in the moving parts and causing outages. Miscanthus also has a low calorific value by volume, meaning that in order to be used effectively it would require the speeding up of conveyor belts, which in turn would increase handling costs if it is to be input separately from the peat. Per hectare, Miscanthus delivers 171 GJ - this in effect means that if Ireland were to attempt to meet the 30% target through Miscanthus alone, it would need to devote 416 square kilometres to growing it. Similarly, Willow delivers 160 GJ/ha, meaning that 431 square kilometres would need to be grown to meet the target solely through its use. This is the equivalent of just over 11% of all land currently devoted to agricultural crop production in Ireland.

MBM requires separate handling and storage facilities to peat, therefore making it a more expensive option for the peat stations. In terms of capital spending this is quite significant (with estimates ranging from €2-10 million) as in order to prevent it from decaying it must be kept in a specialised cool store. MBM also has an ash content of 25% which is extremely high when compared with 1.5-3% for peat and will therefore require extra maintenance and cleaning of the boiler than peat would on its own.

Wood pellets, while having a low moisture content and the added benefit of being able to be used within the current handling processes, could also be fed into the boiler separately in order to be used as efficiently as possible. This is because as they have a much lower moisture content than peat and the other biomass fuels being considered, they can be used to maintain the levels of moisture in the boiler when dealing with other forms of biomass or even just with peat, as its moisture content depends in part on drying in Irish weather conditions. Other fuels, such as energy crops and wood chippings can be combusted directly in with the milled peat requiring no separate storage costs.

As a result of these various issues, at present it is simpler for peat stations to concentrate on co-firing resources which require no immediate capital costs, and of these to then select the least expensive resources first. This will allow them to reduce their emission levels while minimising their cost base as much as is possible. Table 2 below shows the number of biomass deliveries and the net weighed tonnes of biomass delivered to Edenderry Power Ltd for the week ending the 19^{th} July 2009, showing that without regular deliveries the plant would not be able to use these resources as storage is currently low. It also gives an indication of the types of fuel which suppliers are currently delivering, as a result possible of ease of transport and sufficient profit levels for said suppliers.

	Wood Chips	Wood Pellets	Sawdust	Dried Chips
Tonnes	1644	535	543	31
Deliveries	66	19	21	2

Table 2: Biomass Delivered to Edenderry Ltd.

5. Results & Discussion

The various operational issues associated with each fuel, along with their underlying prices and availability, all have an impact on their suitability for use in co-firing with peat. Table 3 below has been created based on the literature, personal communications and analysis and summarises this information.

Taking into account of all these considerations, one can see that the wood resources are the preferred form of biomass for co-firing with peat, due to the fact that they have the lowest price per GJ delivered and have the fewest number of handling issues associated with them, and as a result they are the best available option for co-firing from the peat stations perspective.

Rank	Fuel	Calorific Value (GJ/tonne)	Price per GJ	Resource	GJ Potential
1	Wood Resource	6.5	€4.5-6.5	274,545 tonnes	2,110,000
2	Wood Pellets	17	€4.5-6.5	10,000 tonnes	170,000
3	Willow	12.13	€8-12	500 ha	77,000
4	MBM	15	€5-6	40,000 tonnes	600,000
5	Miscanthus	13.72	€8-12	2500 ha	427,500

Table 3: Fuel Ranking

Coford (2009) estimates the annual wood resource available to be 302,000 m^3, which would result in 2.1 million GJ of energy that could be delivered through the use of wood resources alone. In order to meet the 30% target in all three peat stations, 7.1 million GJ of biomass will be required on an annual basis demonstrating that wood alone is clearly not enough to meet current targets, and as a result a blend of biomass resources will be required in order to achieve this target.

Wood pellet resources are ranked second because of handling issues but are still relatively inexpensive and have a high calorific value. However, the above estimated wood pellet resource is not representative of the entire national resource but rather the amount that is estimated to be available to the peat stations at such a low price. This would be as a result of overstock from the heating sector at the end of the season, and it is unlikely that this would continue if domestic wood pellet boilers increase in their level of penetration over the next number of years.

Willow in tests has been shown to handle very well and has a relatively high energy density, however it is simply too expensive at present to be a major contributor to co-firing initiatives and thus only has the potential to deliver very little of the target at this point.

MBM is relatively inexpensive per GJ delivered and has a high calorific value, and so at face value one would expect it to be higher up in the ranking, but it causes major operational issues for the power stations due to the fact that it requires separate storing and handling than peat and also creates issues in the boiler as a result of its high ash content.

Miscanthus has a low energy density per tonne delivered and at present requires extra handling to avoid it blocking moving parts of the delivery system. Presently Miscanthus is the least desirable indigenous option available to Irish peat stations.

If one were to assume that all of the above resources were to be used to co-fire in Irish peat stations, Table 4 below is an indication of the total potential resource in GJ, the percentage of the target that would be met, and the related emissions savings from using up the entire stock of biomass resources on an annual basis.

Current Potential	
Total Resource in GJ	3,384,042
% co-fired	14.4
CO_2 displaced (tonnes)	376,200

Table 4: Current Resource Potential

One can see from Table 4 that even if all available indigenous resources were consumed it would only be possible to achieve just under half of the co-firing target. This poses a serious threat to the viability of the 30% co-firing target set by the Government in 2007. As a result of this, Ireland will have to either increase production of energy crops (which at present does not seem feasible), import biomass resources from abroad (which will reduce the level of emissions benefits it currently offers along with impacting on security of supply), or purchase carbon credits if the target is to be kept in its present form.

This is a major roadblock to overcome before one begins to look at the costs of implementing the target. As it stands, even achieving half of the target through indigenous resources will cost significantly more than peat currently does – at €3.70 per GJ (the current cost of peat), the equivalent amount of peat could be delivered at a cost of approximately €12.52 million - roughly €4.8 million less than the least cost scenario shown in Table 5 below.

Fuel	Low Cost (€)	Mid Cost (€)	High Cost (€)
Wood Resources	10,257,939	12,537,481	14,817,023
Willow	616,000	770,000	924,000
MBM	3,000,000	3,300,000	3,600,000
Miscanthus	3,420,000	4,275,000	5,130,000
Total	**17,293,939**	**20,882,481**	**24,471,023**

Table 5: Cost Scenarios Current Resources

These costs scenarios were developed using data from Bord na Mona from current contracts in place with biomass suppliers and offers which they received from prospective suppliers in the case of some fuels, however in reality the cost of the total resource could prove much higher under all scenarios as some of these resources would have to be transported from all across the country.

Figure 2 below shows the total costs associated with meeting the entire 30% target. In this case, the costs include the total cost of using all existing biomass at the mid-cost price estimate, and then meeting the rest through either importing biomass from abroad or increasing the stock of indigenous bio-energy crops (willow or miscanthus). The cost of energy crops is assumed to be the same as current Bord na Mona estimates, and imports are assumed to cost between €6-8/GJ delivered to Edenderry Power Ltd. Energy crops are clearly a much more expensive option relative to importing biomass from abroad (by €11.1 million) while at the same time only delivering the exact same amount of energy. It is important to note however that while this is a less expensive option; importing biomass results in higher emissions due to the fact that the biomass fuels must be transported great distance, which consumes energy in itself.

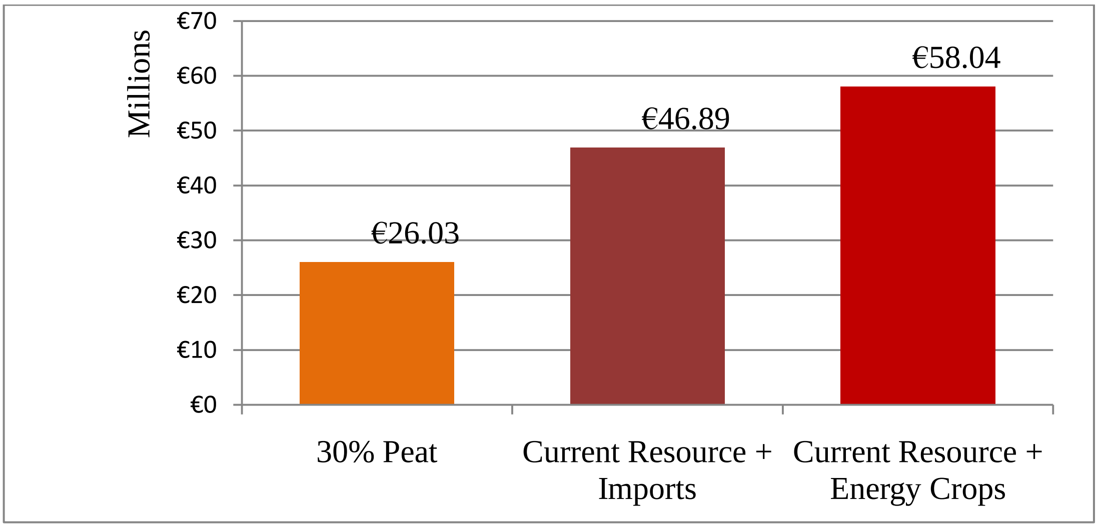

Figure 2: Costs of meeting target

In practical terms, meeting the additional 3,715,958 GJ through energy crops requires vast amounts of land – approximately 11% of all agricultural land currently used for growing crops, which realistically may not be the best use of this land or method of meeting a reduction of emissions. In real terms, if the difference was to be met through increases in the amount of Miscanthus grown, 21,730 hectares would need to be needed; if instead the difference was met through Willow 24,130 hectares would be needed. This is then further exacerbated by the fact that Willow takes 4 years before it can be harvested, and therefore four times the area would be required. The mid cost estimate of the energy crops (€58 million) is just over double the cost of peat for the same amount of energy output (€26 million). This does not mean that co-firing is necessarily unfeasible, but more that 30% is not necessarily the optimal level at which to co-fire in the Irish context. In order to determine at what point it makes sense for the peat stations to co-fire from a cost perspective, one must first take into account the cost of carbon alongside the cost of peat. Figure 3 shows the combined cost of both peat and carbon that the peat stations would have to pay if they do not co-fire.

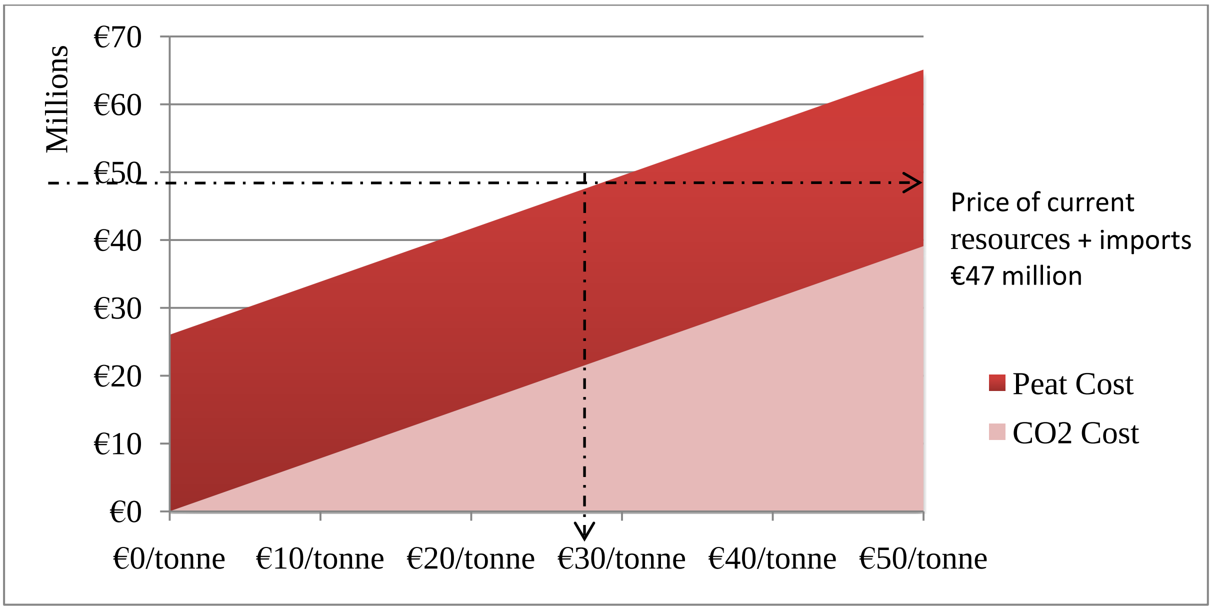

Figure 3: Carbon and peat costs

Comparing the combined peat and carbon costs to the price of biomass, it can be seen that at a carbon cost of about €28/tonne it is more or less as cost effective for the peat stations to co-fire as to simply continue to burn peat exclusively. All of the above calculations take only the fuel costs into consideration, so it is important to note that once all of the capital costs and the price of rectifying handling issues are included, a higher carbon cost will potentially be required before it makes sense financially to co-fire if indigenous resources are to be utilised. In 2009, the Irish Department of Finance (2009) updated the treatment of CO_2 emissions in all Cost Benefit Analyses (CBA) undertaken in the State. The below Table is the results of their advised market prices for use in monetising CO_2 emissions. From this we can see that at present on the basis of costs alone the incentive to co-fire is simply not sufficient at this point if increasing the supply of energy crops is considered, but would be in the case of imports.

Year Price	**€/tonne**
2009	13.24
2010	13.91
2011	14.61
2012	15.59
2013	16.76
2014	17.93
2015 & onwards	39

Table 6: CO_2 Pricing

6. Recommendations

In reality it is difficult to determine whether or not the 30% target is likely to be met by 2015. It does seem very unlikely that it will be possible to do so through indigenous resources, which means that biomass imports would be necessary, with subsequent impacts on Ireland's already precarious security of supply. Edenderry Power Ltd consumed an estimated 9791 net weighed tonnes of woody biomass in July 2009. This station is being used as the sample case before co-firing is rolled out at the other two peat stations, and by looking at their experience it is evident that while only wood is being co-fired; it is being done so quite successfully. In fact Bord na Mona are very confident that Edenderry will meet their 30% co-firing target by 2015 – which will require an estimated 2.31 million GJ of energy from biomass and thus could in theory be met by the current levels of wood alone which is the cheapest and easiest biomass fuel available in terms of handling.

The other two peat stations in Ireland have yet to co-fire any biomass resources at this point and are unlikely to do so in the near future. This is as a result of both stations being scheduled to close for long periods in 2010 and 2011 for health and safety reasons arising from corrosion, and therefore once the necessary upgraded and maintenance have been carried out the likelihood that either will attempt to experiment with their fuel mix would seem dubious.

As a result of these difficulties, the lack of available indigenous resources and the technical issues involving the resources that actually are available, it is unlikely that the target will be met at the given (or even notably higher) price of carbon. Therefore it is the recommendation of this paper that the national target be amended to a somewhat less ambitious target.

If the main aim of the Government White Paper (2007) is to enable Ireland to meet its emission targets, then it would appear that the electricity market is likely to be able to meet its very ambitious renewable energy targets primarily through wind power alone thanks to heavy investment – 1264MW installed wind capacity was connected as of February 2010 (Eirgrid, 2010), which is approximately 17% of total generation capacity. In effect, Ireland's indigenous biomass resources may be better utilised in attempting to reduce the emissions from our thermal sector, which accounts for 34% of all Irelands primary energy consumption (electricity accounts for 32%). This RES-H target is for 12% renewable energy for the heating sector by 2020; and present the renewable proportion was at 3.6% in 2008 (SEI 2009).

That being said, biomass does offer distinct benefits to the reduction of CO_2 from electricity generation however the level proposed in the target does not seem to make economic sense at the proposed level at this point.

7. Conclusion

This paper calculated the available indigenous biomass resource available for Irish peat stations in order to attempt to co-fire at a level of 30% as per governmental targets. It was found that at present only half of the level needed is available and therefore meeting the target will require either importing biomass from abroad or dramatically increasing Ireland's current supply of biomass crops. Importing is a less expensive option than increased biomass resources, but even so would cost over €20 million more than peat does in terms of fuel alone. While co-firing biomass with peat at the suggested level would reduce CO_2 emission by 836,000 tonnes per annum, the cost at present is prohibitive and not necessarily the best use of biomass resources, given their potential in the heating market.

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