# Unlocking Ireland's biomass potential –converting Moneypoint coal fired power station to sustainable biomass.

by

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**Executive summary:**

**Moneypoint coal fired power station is Ireland's largest single source of carbon emissions burning 2.5 million tonnes (mt) a year of American coal.**

**Converting Moneypoint to sustainable biomass:**

- **Delivers Ireland's 2020 renewable electricity targets more cheaply than doubling onshore wind power:**
  - Only limited modifications required to existing plant.
  - No change required to the Irish transmission system unlike doubling onshore wind that necessitates up to € 3.5 billion transmission upgrade.
  - No threat to rural heartland industries of bloodstock and tourism.

- **Unlocks Ireland's major potential to supply cost competitive sustainable biomass.**

- **Moneypoint's biomass needs could be totally met by converting 8% of Irish agricultural land to energy crops.**

- **Guarantees secure, long term demand for Irish biomass creating:**
  - More stable income for farmers and forestry. Long term, fixed price contracts for energy crops and forestry offer more stable income than more volatile, traditional sectors.
  - More positive investment in the Irish rural economy than more onshore wind which threatens bloodstock and tourism.
  - A credible, economically effective strategy for Irish agriculture to fight climate change.

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## 1) Moneypoint conversion to sustainable biomass: the best way to meet Ireland's EU 2020 renewable electricity target.

Ireland currently[1] produces 22.7% of its electricity from renewables with onshore wind generation providing 80% of the "green power" in 2014. The Irish government's current strategy is to meet the balance of the EU 2020 target of generating 40% of electricity from renewable sources by doubling onshore wind power generating capacity.

**Ireland's current 'all wind' strategy is misguided for two key reasons:**

- **The costs of doubling onshore wind capacity have been seriously underestimated. Additional 'system costs' will add over 40% to the direct REFIT tariff costs of Irish onshore wind generation.**
- **Sustainable biomass now offers a cheaper way to meet the rest of Ireland's EU 2020 renewable electricity target.**

a) Additional 'system costs' from doubling onshore wind:

Research by the Irish Academy of Engineers[2]and BW Energy[3] show that there will be large, additional 'system costs' caused by the addition of so much variable wind generation capacity to the Irish power transmission system.

These costs comprise EirGrid's up to €3.5 billion of capital costs for the Grid25 transmission upgrade programme, increased back up costs as combined cycle gas turbines (CCGT) are run inefficiently to provide back up for when the wind does not blow (estimated to rise by €175 million per annum according to the 2014 Single Electricity Market report) and curtailment fees for when the wind is blowing too hard for wind turbines to operate. Interestingly, other EU countries, such as the UK, have started to recognize that wind developers should bear the costs of the wider implications for power systems of adding variable wind generation.

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[1] *'Energy in Ireland – key statistics 2014': Sustainable Energy Authority of Ireland (SEAI).*
[2] *'Energy Policy and Economic Recovery, 2010-2015': Irish Academy of Engineering, February, 2011.*
[3] *'Review of the Irish Government's Strategy for Compliance with the European Directive 2009/28': BW Energy, March, 2014.*

These additional 'system costs' to accommodate 6 terrawatt hours (TWh) of variable wind generation would add over 40% to the direct cost of the onshore wind REFIT tariff.

This gives a total cost of around €100/megawatt hour (MWh) for the additional onshore wind power to meet the balance of the EU 2020 target.

b) Sustainable biomass now offers a cheaper way:

In 2007 Ireland committed to an 'all wind' strategy to meet 2020 EU renewable electricity targets. Over the last five years developments in sustainable biomass 'green power' generation mean it is now a cheaper way to meet the target than doubling onshore wind.

Since 2010, Drax power station in the UK (Western Europe's largest coal fired power station at 3,960 MW capacity) has already successfully converted capacity twice the size of Moneypoint (915 MW capacity) to sustainable biomass on schedule and to budget. This has reduced carbon emissions (audited on a full carbon life cycle basis) from the converted boilers by over 85% compared to coal fired generation using sustainable biomass pellets primarily sourced from North America.

BW Energy[4] (adjusting for lower transportation costs compared to Drax) that the total cost of renewable power generation from sustainable biomass at Moneypoint would be around €88/MWh – 12% cheaper for renewable power generation than more onshore wind.

Furthermore, using the internationally accepted metric – 'cost of carbon abatement' – converting coal fired Moneypoint to sustainable biomass is much better value for saving Irish carbon emissions than doubling onshore wind (Moneypoint biomass cost of carbon abatement €60 tonne/$CO_2$ compared to €114 tonne/$CO_2$ for more onshore wind).[5]

Not only is the 'green power' generated from Moneypoint with biomass cheaper than more onshore wind but also because it displaces coal which is twice as carbon intensive as the gas generation displaced by more wind power.

Finally, this analysis conservatively does not factor in the negative economic impacts on the Irish bloodstock and tourism industries of doubling onshore wind.

[4] *'Review of the Irish Government's Strategy for Compliance with the European Directive 2009/28' BW Energy, March 2014.*

[5] *B W Energy ibid informed by Liberium Capital 2013 financial analysis 'Drax Group' by Atherton.*

## 2) How Moneypoint conversion can unlock major potential in Irish biomass supply for renewable power:

**The conversion of Moneypoint to sustainable biomass can unlock the major potential in Irish biomass supply for 3 key reasons:**

**a) Conversion to sustainable biomass creates stable, long term demand for Irish biomass.**

**b) Ireland has the potential to meet this demand at competitive prices compared to imports.**

**c) Long term fixed price contracts for biomass (based on Moneypoint's demand) can overcome traditional reluctance to supply more sustainable biomass.**

**a) Conversion to sustainable biomass creates stable, long term demand for Irish biomass:**

Moneypoint coal fired power station currently burns up to 2.5 million tonnes a year of American coal split between three boilers. Full conversion to sustainable biomass would create secure, long term demand for up to 3.7 million tonnes of biomass pellets each year. The higher tonnage reflects the fact that biomass pellets have less energy per tonne than coal (17 GJ/t compared to 25 GJ/t).[6]

If the plant was fully converted at outset, initially Moneypoint could operate on N. American feedstocks switching to Irish sources as domestic supplies develop.

Alternatively, the conversion process could be staggered and introduced boiler by boiler mirroring the development of a domestic sustainable biomass supply chain. Each boiler would require up to 1.23 mt of biomass pellets a year.

**b) Ireland has the potential to meet this demand at competitive prices compared to imports:**

Ireland has potential to produce three main types of biomass particularly suitable for use in 'green power' generation:

- Forestry based materials such as forestry thinnings.
- Agricultural residue materials such as straw and grain husks.
- Energy crops especially miscanthus (elephant grass).

There are 4 key reasons why there is significant potential in Irish biomass supplies for 'green power' generation:

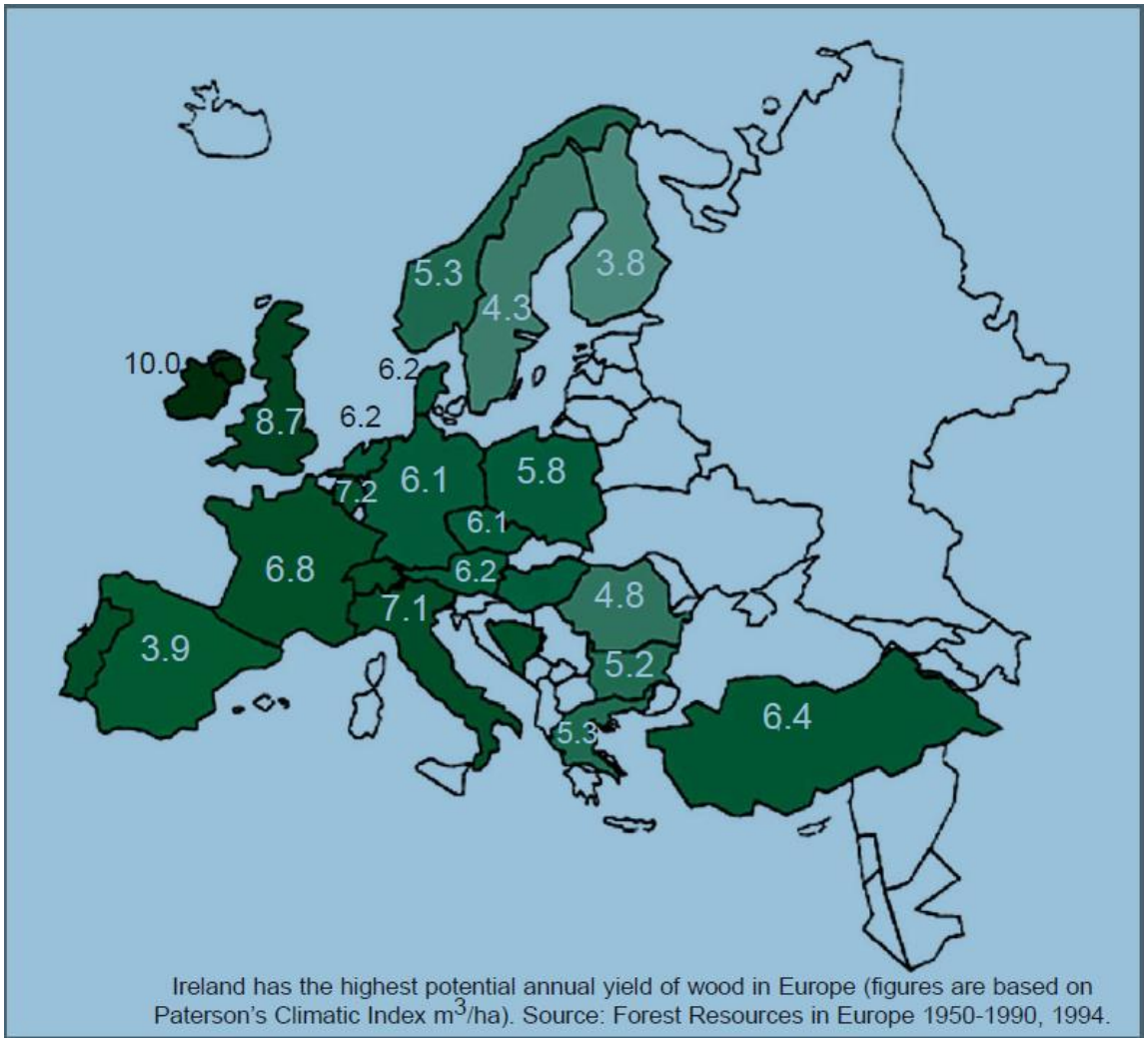
1) Ireland has the best growing climate for forestry in Europe with substantial scope to expand due to low forest cover.
2) Large amounts of grassland are suitable for energy crops, underutilised and could be converted with minimal impact on food or feed production.
3) Irish sustainable biomass could be supplied at competitive prices.
4) Energy crops can offer farmers better, more stable returns than traditional sectors such as beef farming.

[6] *UK Biomass Energy Centre December 2015.*

1) Ireland has the best growing climate for forestry in Europe with substantial scope to expand due to low forest cover:

With around 730,000 hectares under forest, Ireland is one of the least forested countries in the European Union (11% cover compared to an average of 18%) despite its climatic conditions being the best for biomass production. Indeed, according to the Paterson Climatic Index[7] Ireland scores 10 ha/$m^3$ annual biomass production potential whilst Finland, where 18% of energy is produced by biomass[8], rates only 3.8ha/$m^3$. Ireland currently produces about 3.5 million tonnes of timber a year with only a small proportion currently used to generate energy (primarily sawmill residues). According to the SEAI[9] in 2011, 0.5 million m3 of forestry thinnings – a key potential source of sustainable biomass - was left uncollected on the Irish forest floor.

Annual Biomass Production Potential
Paterson Climate Index $m^3$/ha



Ireland has the highest potential annual yield of wood in Europe (figures are based on Paterson's Climatic Index $m^3$/ha). Source: Forest Resources in Europe 1950-1990, 1994.

[7] *Forest Resources in Europe 1950-1990 published in 1994.*
[8] *See REIO Biomass factsheet, Sustainable Energy Ireland, p8*
[9] *SEAI 'BioEnergy Supply Curves for Ireland 2010 – 2030' October 2012.*

2) Large amounts of Irish grassland are suitable for energy crops, underutilised and could be converted with minimal impact on food or feed production:

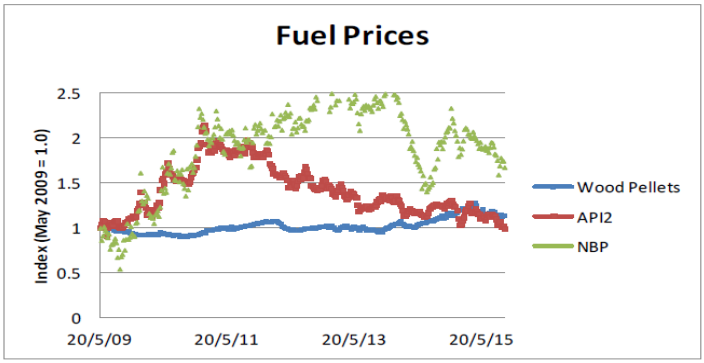
According to the Sustainable Energy Authority of Ireland (SEAI) 2 million hectares (ha) of Irish agricultural land (out of a total of 4.2 million ha) are suitable for energy crops such as miscanthus or short rotation crop (SRC) willow.[10]

The SEAI's suitability mapping tool was then used to estimate that up to 250,000 ha of grassland could be converted to energy crops without a significant impact on food or feed production. To put this in perspective, assuming an annual yield of between 10 oven dried tonnes per hectare per annum (odt/ha/y) such an energy crop acreage could produce around 2.5 million tonnes a year of dried energy crop biomass. For an energy crop such as miscanthus this is equivalent on an energy basis to around 2.65 million tonnes of biomass pellets.[11]

Under the Common Agricultural Policy currently, not more than 10% of grassland can be converted to tillage by 2020. Therefore, up to 10% of Irish grassland – currently equivalent to 380,000 ha - could convert to energy crops. 380,000 ha of Irish energy crops could deliver around 3.8 m tonnes of dried energy crop biomass each year. Conversion policies have not yet been published for the post 2020 period by the EU.

3) Irish sustainable biomass could be supplied at competitive prices:

Since 2009, an international sustainable biomass market has developed as carbon neutral renewable power generation from sustainable biomass became possible at large scale. This has replaced carbon intensive coal fired generation at existing EU power stations. It has been characterised by stable biomass pellet prices especially compared to coal (API2) and European gas prices.




*Source: Argus & BW Energy*

[10] *SEAI 'BioEnergy Supply Curves for Ireland 2010 – 2030' October 2012.*

[11] *Assumes ongoing miscanthus annual yield of 10 oven dried tonnes (odt) per hectare from SEAI 'BioEnergy Supply Curves for Ireland 2010 – 2030' October 2012, energy value of 18 GJ/t for 1 odt of miscanthus from UK Biomass Energy Centre December 2015 and total annual energy demand at Moneypoint equivalent to 62.9 million GJ (3.7 mt of biomass pellets with an energy content of 17GJ/t).*

Based upon analysis of Drax pellet costs adjusted for the shorter transportation distances for Moneypoint, BW Energy estimate that imported biomass at Moneypoint would cost around € 7.7 per gigajoule (GJ).[12]

If the Irish sustainable biomass market is to develop at scale, it needs to be price competitive with potential pellet imports that would cost around € 7.70 GJ for delivery at Moneypoint.

A detailed 2010 study by University College Dublin (UCD) and Teagasc, responsible for research and development in the Irish agri-food sector [13]estimated that energy crop biomass pellets (primarily miscanthus) could be produced and delivered in Ireland for € 7 GJ.

The analysis (based upon a relatively small scale pellet plant producing 45,440 t a year) highlighted that significant scale economies would be available for larger pellet plants. In the current international biomass market, Moneypoint's annual pellet requirement would typically be met by much larger plants (processing around 450,000 t a year).

Other sources of Irish sustainable biomass such as forestry thinnings and other forestry residues could, according to the SEAI, cost as little as € 5.00 GJ based upon Teagasc and COFORD trials[14]. This would require Irish foresters to adopt established Nordic whole tree harvesting techniques to utilize a larger proportion of the felled timber. This represents a 45% cost reduction compared to the current shortwood harvesting approach used in Ireland.

Essentially, if forestry thinnings as a source of sustainable biomass become an increasingly important revenue stream for forestry operators (currently they are left to rot on the forest floor), there is scope for cost reductions and economies of scale as demand increases.

4) Energy crops could offer farmers better, more stable returns than traditional sectors such as beef farming:

In order to motivate Irish farmers to switch to producing perennial energy crops, the economic benefits need to be clear to capitalise upon the large areas of agricultural land that are physically suitable to grow energy crops.

Teagasc[15] has recently compared the profitability of different traditional farming sectors with growing perennial energy crops. The conclusion was that growing energy crops would be economically attractive compared to less profitable beef production. This view has also been supported by the official Tillage Sectoral Energy Crop Development Group in their March 2014 report 'Achieving the Potential for Growing Energy Crops on Irish Farms'. Furthermore, Teagasc's 2011 National Farm Survey has shown that most beef farms in Ireland are loss making.

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[12] *'Review of the Irish Government's Strategy for Compliance with the European Directive 2009/28' BW Energy, March 2014.*

[13] 'Economic Analysis of Manufacturing Costs of Pellet Production in the Republic of I Ireland Using Non Woody Biomass' 2010 Open Renewable Energy Journal by Nolan, McDonnell, Devlin from UCD and Carroll and Finnan from Teagasc.

[14] *SEAI 'BioEnergy Supply Curves for Ireland 2010 – 2030' October 2012.*

[15] *'A Discounted Cash Flow Analysis of Financial Returns from Biomass Crops in Ireland' 2009 Journal of Farm Management by Clancy, Breen, Butler and Thorne.*

As the 2014 Teagasc Tillage Sector Development Plan stated 'A thriving energy crop sector would sustain and diversify rural farm income'.

Additional advantages of energy crop production over and above higher profitability (compared to beef rearing) were also identified by the Tillage Sectoral Energy Crop Development Group. These included:

- Offsetting national greenhouse gas emissions (GHG) from agriculture.
- Increased rural employment in the biomass supply chain with a multiplier effect of keeping revenue in the local economy.
- Reduced dependence on fossil fuels especially for heating and power in off gas grid farmsteads.
- Significant environmental benefits including increased biodiversity of farmland, reduced flood impact, improved water quality and better sludge management

The Irish Farmers Association has also highlighted the savings to grain farmers of using energy crops to fuel biomass driers for green grain. This could save up to 22.5 million litres of carbon intensive diesel a year.[16]

**c) Long term fixed price contracts for biomass based on Moneypoint demand can overcome traditional reluctance to supply more sustainable biomass:**

According to Eurostat, the EU's official statistical service, Ireland in 2013 had the 4th lowest energy output from solid biomass out of 28 EU countries despite her favourable climate and farming and forestry expertise.[17]

In 2014 according to the SEAI, only 1.2% of Irish electricity supplies were met from solid biomass 'green power' generation compared to onshore wind power that contributed 18.2% of Irish electricity supplies.[18] The small amounts of solid biomass that are used in Irish renewable power generation primarily are from agricultural and forestry waste and not from energy crops.

**Ireland to date has not capitalised upon her major opportunity to produce cost competitive sustainable biomass. Growing domestic energy crops could help deliver 2020 EU 'green power' targets more cost effectively than doubling onshore wind and provide beef farmers with higher, more secure income.**

Why is this the case?

**According to the SEAI, the most important constraints are:**

**'the absence of a secure long term market for perennial energy crops and the reluctance of farmers to move away from established enterprises to unfamiliar crops'.[19]**

[16] *Irish Independent 7th October 2015 Fintan Conway of Irish Farmers Association.*
[17] *2015 Eurostat data, official data service of the European Union.*
[18] *SEAI '2014 Energy in Ireland – Key Statistics', December 2014.*
[19] *SEAI 'BioEnergy Supply Curves for Ireland 2010 – 2030' October 2012.*

**Converting Moneypoint to sustainable biomass with an annual demand of 3.7 million tonnes of biomass pellets would deliver that vital, secure long term market for Irish biomass.**

Experience at Drax power station in the UK has shown that 'green power' biomass generators are willing to offer secure, ten year fixed price contracts to biomass suppliers.

This 'demand pull' from Moneypoint can stimulate the development of supply chains in the Irish agricultural sector to encourage switching from grassland to energy crops. This is particularly important when farming perennial energy crops requires different planting cycles/management than traditional pasture.

**To put the scale of the Irish energy crop opportunity in perspective, Moneypoint's annual biomass fuel requirement could be totally satisfied by converting only 8% of Irish agricultural land to energy crops such as miscanthus.**

**This equates to 350,000 ha of energy crops which would deliver approximately 3.5 million tonnes a year of dried sustainable miscanthus biomass (equivalent on a total annual GJ basis to 3.7 million tonnes a year of imported wood pellets).[20]**

In fact, under the current EU Common Agricultural Policy (CAP) cap on the 2020 conversion of grassland to tillage (10%), Ireland could convert approximately 380,000 ha of pasture to energy crops – more than enough to meet the sustainable biomass needs at Moneypoint.

Furthermore, this conservative analysis does not take into account the additional sources of forestry based biomass that could be stimulated by Moneypoint's 'demand pull' effect on Irish biomass supplies.

Clearly the bulk of Irish forestry supplies are dedicated to higher value uses (saw logs processed into planks and panel boards) than energy generation.

However, unlike in other countries where forestry thinnings and residues are used for sustainable biomass generation, Ireland currently leaves this resource on the forest floor. The SEAI estimated that 0.5 million m3 a year of forestry thinnings and residues were left uncollected in 2011. This resource equated in energy terms to 89,000 tonnes of oil equivalent (toe) or around 200,000 tonnes a year of dried energy crops.

As foresters see that a genuine market exists for roundwood downgrades and thinnings, a more dedicated supply chain for forestry biomass in 'green power' generation can develop at competitive prices (see page x). The SEAI has estimated that through applying established Swedish harvesting techniques, up to 1.25 million m3 of thinnings and residues could be harvested by 2030 at prices that are competitive with imports. This is equivalent in energy terms to 230,000 toe or around 510,00 tonnes a year of dried energy crop biomass.[21]

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[20] *Assumes ongoing miscanthus annual yield of 10 oven dried tonnes (odt) per hectare from SEAI 'BioEnergy Supply Curves for Ireland 2010 – 2030' October 2012, energy value of 18 GJ/t for 1 odt of miscanthus from UK Biomass Energy Centre December 2015 and total annual energy demand at Moneypoint equivalent to 62.9 million GJ (3.7 mt of biomass pellets with an energy content of 17GJ/t).*

[21] *SEAI 'BioEnergy Supply Curves for Ireland 2010 – 2030' October 2012.*

## 5) Substantial benefits to the Irish rural economy, all Irish electricity consumers and Irish government:

Converting Moneypoint to sustainable biomass sourced from Irish energy crops is not only a better way to reach EU 2020 'green power' targets from an energy perspective but also for broader economic and political reasons.

These reasons include:

a) Investment effect in the broader rural economy:

Building a domestic sustainable biomass supply chain in Ireland will create long term rural jobs and give greater stability to volatile farming revenues. Even using extremely conservative forecasts for the role of biomass in Irish heat and power (only 5% biomass generated electricity and 12% renewable heat by 2020), the SEAI estimates that up to 7,000 new net jobs would be created in agriculture and forestry.[22]

Doubling onshore wind power will not create the same economic stimulus to the Irish rural economy. Firstly, the bulk of the capital investment (70%) will be spent on turbines imported from China, Denmark or Germany and will not have a multiplier effect in the Irish rural economy. Secondly, any impact on farming revenues from wind farm site contracts will be more than outweighed by the negative impacts on the rural bloodstock and tourist industries that are important employers in rural communities.

b) Maintaining cost competitiveness in industry and for domestic consumers:

Irish electricity prices are already 40% above the EU average putting pressure on industrial competitiveness especially in power intensive industries and domestic consumers. Converting Moneypoint to sustainable biomass is cheaper than doubling onshore wind both on the basis of the direct cost of 'green power' production and the cost of carbon abatement.

c) Enhanced credibility for Ireland's climate change strategy:

A key challenge for Ireland in fighting climate change is reducing greenhouse gas emissions (GHG) in the agricultural sector. Methane (from livestock) is twice as dangerous as a greenhouse gas as carbon dioxide (from burning fossil fuels).

Post 2020 EU targets will focus more directly on overall GHG emissions as it has been recognised that the 2020 targets have not maximised the reduction in GHG emissions.

This is because the 2020 target is set according to the percentage of renewable energy supplied relative to overall energy demand. As a result, you can have the self - defeating strategy of continuing to burn as much carbon intensive coal as possible (as it is a cheap

[22] *Sustainable Energy Authority of Ireland (SEAI) 'A Macroeconomic Analysis of Bioenergy Use to 2020', June 2015 by Stanley, Clancy and Scheer.*

source of electricity) whilst paying subsidies to increase renewable power (to meet the renewable quota target).

This contradictory approach has been epitomised by the position of Moneypoint coal fired power station that is Ireland's largest single source of carbon emissions and supplies 25% of Irish power. In fact, despite the growth of renewable power generation – predominantly onshore wind – the actual amount of CO2 emissions in the Irish power sector per unit of power generated went up in 2012 compared to 2011[23]. This was due to more coal being burnt at Moneypoint at the expense of lower carbon gas. Continuing to burn coal at Moneypoint has meant that overall carbon emissions have not fallen anywhere near as quickly they could have done.

In essence, converting Moneypoint to sustainable biomass sourced from Irish energy crops:

- Maximises cost effective emissions reduction in the power sector.
- Enables Irish agriculture to make a positive contribution to the fight against climate change. This is particularly important given the economic significance and emissions footprint of Irish agriculture and the increasingly aggressive EU focus post 2020 on actual emissions reductions.
- Improves Irish energy security.

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**BW Energy March 2016.**

[23] Irish Government Green Paper on Energy Policy May 2014.