# Irish Academy of Engineering

**Irish Academy of Engineering's Response to**

**DCENR's Consultation Document on**

**Ireland's Renewable Electricity Support Scheme**

## 1. Introduction

Ireland's electricity prices were at or below the EU average for industrial and domestic consumers up to 2000. Since then prices in Ireland increased substantially and are now amongst the highest in the EU. In the past the electricity industry and the Department attributed this to rising imported fuel costs, but there has been no corresponding fall in Irish electricity costs as fossil fuel costs collapsed.

The reality is that electricity costs in Ireland are far more influenced by the very high level of capital investment in the sector since 2000 and the remarkable fact that this sharply increased level of capital investment was maintained since 2008, when electricity demand peaked. In 2014 demand in Ireland was only 73% of the level projected for that year in Eirgrid's Generation Adequacy Statement 2008-2014, see table in Appendix 1.

Given that fuel costs now account for less than one quarter of electricity costs it can be concluded that electricity prices would now be approximately 20% lower than at present had demand reached expected levels, or had capital investment been frozen to a level appropriate to present demand levels.

**It is thus remarkable that DCENR's consultation paper of July 2015 devotes just one line to the need to minimise costs for consumers (Section 2.2) and makes no reference to either the historic or projected cost of renewable support schemes or their impact on Ireland's competitiveness.**

This is in marked contrast to the UK's consultation document on a Review of Feed-in Tariff Schemes Aug 2015, which placed a very considerable emphasis on the costs of Renewable Supports and their potentially adverse impact on the UK's competitiveness.

https://www.gov.uk/government/consultations/consultation-on-a-review-of-the-feed-in-tariff-scheme

In these circumstances the Academy believe that a modified support scheme must be absolutely focused on minimising capital expenditure and costs to electricity customers and ensuring that profitability in the renewable sector is in line with both the low risks involved and the very low returns now available in the market for low risk investments.

## 2. Development of Ireland's REFIT Schemes and Renewable Energy Commitments

The REFIT 1 scheme was introduced, inter alia, to comply with Directive 2001/77/EC which required Ireland to raise the proportion of electricity generated from renewable sources from 3.6% in 1997 to 13.2% in 2010. This was estimated to require that installed renewable generation capacity be increased to 1450MW by 2010, predominantly by increasing wind generation capacity.

The EU, in developing the 2001 Directive had a number of stated objectives including:

- To reduce fossil fuel-fired generation and its associated $CO_2$ emissions, thus aiding compliance with the Kyoto Protocol, adopted in 1997
- To improve security of supply, by reducing dependence on energy imports to the EU

- To create local employment and have a positive impact on social cohesion

The target set for Ireland under the Directive, in terms of increasing the penetration of renewable electricity, was slightly above the average for the 15 Member States, at that time, but was not unreasonably so. In the event, renewable electricity generation capacity was increased to 1697 MW, by Dec 2010, thus exceeding the Government's target.

Subsequently, the EU as part of its 20/20/20 strategy introduced Directive 2009/28/EC which required countries to increase the share of energy from renewable sources in Gross Final Consumption of Energy by 2020. Ireland agreed to one of the most demanding targets, in terms of the increase required, as the renewable share was to be increased from 3.1% in 2005 to 16% by 2020.

Under this Directive each country had to prepare a National Renewable Energy Action Plan (NREAP) setting out the National 2020 Targets and estimated trajectories of energy from renewable sources in Heating & Cooling, Electricity and Transport. The national targets for electricity from each country's action plan, as submitted, are summarised in Appendix 2. This shows that Ireland committed to increasing the proportion of electricity generated from renewable sources in the period 2005-2020 <u>by more than any other country in the EU</u>, despite the fact that the acute economic downturn was clearly visible at that stage.

This was agreed to even though Ireland is a small isolated synchronous grid, with very limited hydro generation capacity and even less hydro storage capacity. Thus committing Ireland to operating a system with a very high proportion of non-synchronous generation and very limited rapid response plant was extremely challenging and had not been done elsewhere.

### 3.1 Ireland's support for wind generation.

The REFIT 1 scheme was introduced as the earlier Alternative Energy Requirement scheme had failed to increase renewable capacity in line with expectations. This was attributed to the fact that the scheme was a tender process with contracts being awarded to developers offering the lowest electricity price, in line with most recent UK Contract for Difference (CfD) proposals. Many of the selected developments did not proceed, in the IWEA's view because the prices tendered were uneconomic. But, it was also a factor that the financial community was unfamiliar with the risk profile of the wind industry, at that stage, thus financing was difficult.

The Initial REFIT prices were set for 2004 as follows from new facilities

- Large Wind, i.e. ≥ 5 MW, €57.0/MWh
- Small Wind, i.e. ≤ 5 MW, €59.0/MWh
- Biomass, land fill gas, €70/MWh
- Hydro & Biomass other, €72/MWh

These prices were to be adjusted in line with movements in the Consumer Price Index, despite the fact that generation costs were, for most technologies, predominantly fixed. In addition suppliers of renewable generated electricity were entitled to an additional 15% of the REFIT prices.

In response to the 2009 Directive the REFIT 2 Scheme was introduced in 2012 to encourage the development of an additional 4000MW of new renewable generation by 2020. The REFIT 2 reference prices were essentially the same as the REFIT 1 scheme, with full indexation in line with movements in the CPI being applied from the 2004 base prices, despite the fact that wind turbine technology had advanced significantly in the period 2004-2012 and installed wind generation in Ireland had increased from 371 MW in 2004 to 1725 MW in 2012, thus the financial community was much more familiar with pricing the risks involved.

The 2015 REFIT reference prices are as follows

- Large Wind, i.e. ≥ 5 MW, €69.720/MWh
- Small Wind, i.e. ≤ 5 MW, €72.167/MWh
- Biomass, land fill gas, €85.622/MWh
- Hydro & Biomass other, €88.068/MWh

In addition suppliers of renewable generated electricity were entitled to a balancing payment of €9.90/MWh, in addition to the REFIT reference price and to the SEM market price, should the latter exceed the sum of the REFIT reference price and balancing payment. Thus generation from renewable sources in Ireland provides electricity customers with no protection in the event of price spikes at fossil fuel plants, thus negating one of the key potential benefits claimed for renewable generation.

This combination of guaranteed index linked minimum prices and upside potential, together with payment in the event that wind generation was

- Constrained, due to network constraints, provided the wind farm had contractually 'firm access' to the network
- Curtailed because aggregate non synchronous inputs exceeded what could be absorbed by the system in Ireland, while maintaining system security standards

made the development of wind generation in Ireland extremely risk-free and thus commercially very attractive.

In addition wind farm developers have no liability for

- Network reinforcement investment necessitated by their developments. Given stagnant electricity demand, these requirements are now the major driver of Eirgrid's network investment programme.
- The increased cost of conventional thermal generation arising from increasing wind generation. This arises from the fact that
  : Conventional generation, particularly gas-fired combined cycle generation, is now being operated at significantly lower capacity levels, with a consequent fall in efficiency
  : The reduced requirement for natural gas for power generation, by far the largest demand on the gas network in Ireland, results in increased gas network charges for all gas customers, as the network has to be configured to meet gas demand when the wind is not blowing.
- The rapidly increasing costs of 'Ancillary Services', as Eirgrid seeks to accommodate

ever increasing levels of wind output on the system and plans to raise the allowable 'System Non-Synchronous Penetration' (SNSP) level from 50% to 75%, under the so called DS3 Programme

This combination of guaranteed revenues, protection from associated costs and Ireland's very good wind regime has proved to be extremely attractive and profitable for developers. Thus network connection access sought substantially exceeds requirements and developers sought 4000MW of transmission connection under Gate 3 by Oct 2013.

Furthermore the profitability of new wind farms in Ireland has significantly improved since 2012 as the downturn in the Chinese economy has caused

- Iron ore prices to fall by 75%, from 2012 levels, thus reducing wind turbine tower costs
- Copper prices to fall by 50% thus reducing electrical system costs.

The Wind Turbine Price Index, published every six months by Bloomberg has fallen by approximately 30% over the past six years (from €1.21 million/MW for first half 2009 to €0.82 million/MW for first half 2015). In addition and even more importantly the cost of finance is at an all-time low.

Thus it is now appropriate to substantially amend the existing renewable support schemes to reflect the new cost structures and take account of the fact that when the original REFIT scheme was introduced the accepted view was that wind farms would necessarily have to be located in areas of Ireland with high wind speeds to be economic i.e. predominantly close to the western seaboard, where the electricity network was generally weak.

Now however advances in wind turbine design have made development feasible in all areas and indeed the more recent export orientated proposals are concentrated in the East Midlands, where there is existing grid capacity.

## 4. Irish Academy of Engineering Recommendations in Relation to Renewable Generation Supports

The impact on electricity prices of renewable electricity support schemes and large capital investments in renewable energy developments needs to be properly assessed. As pointed out earlier in this submission, the very high level of capital investment in power generation in Ireland at a time when electricity demand was not increasing, has resulted in significant increases in Ireland's electricity prices and a loss of competitiveness relative to other EU countries. For this reason, capital investment in renewable electricity generation should be considered against projected increases in electricity demand and alternative methods of reducing Ireland's GHG emissions.

### 4.1 Wind Generation

The Academy of Engineering recommends that the new renewable support scheme for wind generation should

- Reset REFIT reference prices for new developments, undertaken post 2015, to the levels originally set for 2004, to reflect the fall in materials and financing costs
- Remove CPI indexation from those technologies which are essentially fixed cost, in the case of new developments
- Remove the Balancing Price paid to suppliers of renewable generation, as there is now no justification for such a payment, particularly following the completion of the East-West Interconnector
- Remove access to system marginal prices, when those are higher than REFIT provisions, in the case of both existing and new developments, as payments in this case are both unjustified and are likely to increase significantly, as wind penetration increases. It is inappropriate that wind generators benefit from the system problems caused by increasing wind farm penetration.
- Require that new renewable electricity developments contribute to the full cost of associated network reinforcements, in proportion to the share of additional capacity required for their development. This will help concentrate development in areas with existing network capacity and thus minimise the requirement for highly controversial new overhead lines.
- Given that Ireland has substantially more onshore wind generation potential than can ever be exploited there is in Ireland's case no justification for introducing a separate and higher pricing regime for offshore wind. Thus the Academy supports the present position of not differentiating between onshore and offshore wind.

**4.2 Solar PV**

The continuing rapid advances in solar PV technology and manufacturing capacity in the past ten years and the considerable scope for further technological breakthroughs in the area, coupled with the advances in battery technology, primarily driven by the auto industry, means that this technological combination has the greatest potential to displace fossil fuel fired generation across the world. Indeed in areas dependent on diesel generation or remote from electricity grids this technological combination offers a potentially life changing solution to electricity supply and cost problems.

But in Ireland, with its electricity demand peak in winter evenings solar PV will be less beneficial and thus there is no justification for offering a REFIT pricing structure more advantageous than that proposed for wind. Furthermore distributed PV generation will not reduce investment requirements in the Distribution Network for the same reasons. Thus there is no justification for introducing reverse metering.

Indeed given that locations fitted with solar PV will make a significantly lower contribution to necessary network costs there is an argument for introducing a higher rate of fixed electricity charges for sites so equipped, if fairness is to be maintained in the electricity billing regime.

However, as solar PV costs are expected to continue to fall, PV electricity may well be competitive with wind generated electricity in Ireland in the next ten years, as the latter technology is relatively more mature and has less potential for future cost reduction. Thus solar

PV may well play a significant role in providing a seasonal complement to wind generation by 2030.

But the lesson from Germany needs to be borne in mind for this and indeed any other renewable electricity technology. That is that very large scale early investment is no guarantee that manufacturing jobs will follow, even in a country with a very strong engineering manufacturing sector.

**4.3 Biomass & Biogas Generation**

Biomass and biogas powered generation offer significant advantages over many other renewable electricity technologies, in particular in the case of large scale installation as

- They are synchronous and dispatchable
- Provide essential system inertia and primary response capability
- Do not adversely impact on the operational efficiency of other thermal plant

**4.3.1 Biomass Generation**

Ireland, unlike other countries does not have significant unused biomass waste streams and the capital cost/MW of new biomass fired power plant is very high and extremely difficult to justify, when Ireland already has a considerable surplus of conventional thermal generation.

But the existing peat-fired plants were designed by the Finn’s for biomass firing and Bord na Mona have operated the Edenderry plant at up to 80% of rated output exclusively on biomass and have advised that its output could be raised to 100% of rated output with a capital expenditure of less than €20 million.

Given that the PSO’s in relation to peat-firing expire at Edenderry in 2016 and at the ESB-owned plants in 2019 and the fact that these plants have substantially longer useful life and the continued need for essential synchronous generation, to maintain system stability, it is essential that the capacity to operate these plants on biomass is fully supported and that a an appropriate REFIT structure is provided.

Ideally these plants should be fired by Short Rotation Forestry (SRF) produced in the Midland Region given

- Their location and poor quality road connections
- The loss of employment in the Midlands arising from the cessation of milled peat production and the ability of SRF development, harvesting and transport to provide comparable alternative employment

Thus the challenge is to create a support scheme which encourages the development of an adequate indigenous biomass supply to fuel these plants. Given that the essential operational benefits that these plants can provide are delivered when the plants are operating at minimum output, approximately 30% of rated output and the difficulties of sourcing an adequate indigenous biomass supply it is proposed that the REFIT support structure for biomass fired electricity be designed on that basis.

To date there has been some reluctance to dedicate biomass supplies to this purpose but it must be recognised that

- Reliable system operation requires the continuing use of synchronous plant. Carbon capture and storage (CCS) development has proved very slow and the one post combustion plant completed to date, at Boundary Dam power plant in Canada, has been astronomically expensive, €1.0bn for a 110MW coal fired unit.
- The development of an indigenous biomass supply chain requires that buyers are in a position to offer 15 year contracts, to match the normal lifespan of SRF plantations. In reality only the electricity sector is in a position to offer such contracts.

But the development of an appropriate REFIT scheme will on its own not suffice. A suitably attractive biomass establishment grant scheme to promote SRF is essential.

But while there are excellent arguments for introducing a REFIT scheme for biomass-fired generation, at substantially above the level proposed for wind generation, there is no justification for paying a premium on that level, for electricity generated from biomass CHP plants, as the electricity produced from such plants is of no higher intrinsic value. Thus if a premium is to be paid to those plants for their heat output it should be funded under the renewable heat scheme.

The recently introduced REFIT 3 scheme should thus be immediately adjusted to remove reference to CHP, to avoid a serious misallocation of scarce capital resources.

#### 4.3.2 **Biogas Generation**

Anaerobic Digestion has potentially a significant role to play in providing biogas for injection into the gas network and possibly even more significantly in the future as a source of renewable transport fuel.
But it is in these areas that supports should be channelled and there is no argument for paying a premium for AD-powered generation above that paid for biomass fired generation. Indeed a lower price would be appropriate if AD plants do not provide the same range of system supports that large biomass powered plants can offer.

#### 4.3.3 Conversion of Moneypoint to Biomass Firing

The conversion of Moneypoint to partial or total biomass firing, on the lines being undertaken at Drax power station in the UK has been extensively promoted. But unlike the peat stations, Moneypoint is unsuitable for firing with wood chips and unlike Drax the existing coal mills in Moneypoint have, because of their design, proved unsuitable for milling wood pellets. Thus while Moneypoint could potentially be converted to wood pellet firing there would be a considerable capital cost involved to provide suitable wood pellet storage and milling facilities.
However, Moneypoint does have the very significant advantage of having excellent bulk discharge facilities, which facilitates the importation of wood pellets from North America or indeed elsewhere. Thus given the very slow pace of development and high cost of CCS and the slowdown in the pace of development of Small Modular Nuclear Reactors, which could possibly be deployed on the Moneypoint site at some future date, the potential conversion of

Moneypoint to biomass firing, using imported wood pellets justifies significant study. But it appears too early to consider the development of a REFIT pricing structure designed to facilitate such a development.

It should also be recognised that a realistic REFIT reference price will necessarily be substantially higher than that proposed for wind generation, though perhaps ultimately unavoidable if a carbon free electricity sector is the objective.

**5. Marine Energy**

It has long been recognised that Ireland has excellent marine energy resources. The annual mean wave energy off the North West Coast is 80kW/m wave front, which is amongst the highest in the world and Ireland also has significant tidal stream energy resources, particularly off the North East coast, though not on a par with the flow rates available in Canada, France or GB.

But while Ireland was one of the parties to the first International Energy Agency agreements on Wave Power Development in 1978 the reality is that despite an estimated R&D expenditure of in excess of €500m since then no wave energy device has been continuously producing electricity for longer than one year, because of the extreme hostility of the marine environment.

Thus, there is still considerable uncertainty as to whether wave power can be successfully harnessed and wave energy devices are at least five years from commercial operation and given that Ireland's wave energy resource is seasonally aligned with its wind resource, whether wave power will ever be competitive with wind power and thus justify a preferential REFIT regime.

The argument that a highly preferential regime is justified, by the employment potential that the development of wave power offers, should be assessed as part of Ireland's industrial support policy. The reality is that Ireland's marine engineering sector is much less developed than that in the adjoining island, or indeed in Continental Europe. Furthermore the German experience of supporting solar PV development must be borne in mind by those advocating such an approach.

Thus the appropriate response appears to be to provide a REFIT scheme for marine energy in line with that proposed for wind energy and provide the additional supports, if justified, from the Government's R&D and employment support funding schemes.

## Appendix 1

### Ireland Electricity Demand 2006-2014

| | 2006 | 2007 | 2008 | Outurn 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh |
| **Jan** | | | | | 2.60 | 2.55 | 2.37 | 2.43 | 2.42 |
| **Feb** | | | | | 2.32 | 2.22 | 2.38 | 2.27 | 2.19 |
| **Mar** | | | | | 2.41 | 2.33 | 2.21 | 2.39 | 2.37 |
| **April** | | | | | 2.11 | 2.05 | 2.07 | 2.14 | 2.06 |
| **May** | | | | | 2.08 | 2.05 | 2.09 | 2.08 | 2.08 |
| **June** | | | | | 1.97 | 1.97 | 1.94 | 1.93 | 1.96 |
| **July** | | | | | 2.02 | 1.99 | 1.98 | 2.03 | 2.02 |
| **Aug** | | | | 2.03 | 2.00 | 2.03 | 2.00 | 2.01 | 2.03 |
| **Sept** | | | | 2.06 | 2.04 | 2.00 | 1.99 | 2.02 | 2.05 |
| **Oct** | | | | 2.22 | 2.18 | 2.19 | 2.19 | 2.23 | 2.20 |
| **Nov** | | | | 2.3 | 2.36 | 2.25 | 2.28 | 2.26 | 2.26 |
| **Dec** | | | | 2.5 | 2.65 | 2.41 | 2.30 | 2.24 | 2.41 |
| | | | | | | | | | |
| **Total** | **27.97** | **28.43** | **28.83** | **27.24** | **26.74** | **26.04** | **25.80** | **26.03** | **26.05** |

### Generation Capacity Statements Median Forecast

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh | TWh |
| **GAR 2007-2013** | 27.83 | 29.11 | 30.41 | 31.71 | 32.14 | 34.47 | 35.74 | 36.94 | | | | | | | | | | |
| **GAR 2008-2014** | 27.97 | 28.94 | 29.89 | 30.82 | 31.77 | 32.75 | 33.75 | 34.77 | 35.82 | | | | | | | | | |
| **GAR 2009-2015** | | 28.43 | 29.02 | 29.64 | 30.26 | 31.10 | 31.98 | 32.89 | 33.83 | 34.75 | | | | | | | | |
| **GAR 2010-2016** | | | 28.83 | 27.24 | 27.21 | 27.79 | 28.57 | 29.18 | 29.80 | 30.43 | 31.08 | | | | | | | |
| **GCS 2011-2020** | | | | | 27.25 | 27.35 | 28.90 | 28.59 | 29.30 | 29.95 | 30.49 | 30.94 | 31.41 | 31.88 | 32.29 | | | |
| **GCS 2012-2021** | | | | | | 27.10 | 27.34 | 27.85 | 28.36 | 28.82 | 29.22 | 29.54 | 29.86 | 30.19 | 30.67 | 31.22 | | |
| **GCS 2013-2022** | | | | | | | 26.32 | 26.50 | 26.86 | 27.25 | 27.67 | 28.15 | 28.68 | 29.23 | 29.81 | 30.25 | 30.65 | |
| **GCS 2014-2023** | | | | | | | | | 26.60 | 26.91 | 27.28 | 27.67 | 28.08 | 28.47 | 28.95 | 29.34 | 29.73 | 30.13 |

## Appendix 2. Renewable Electricity Targets in EU Countries (%)

| | Directive 2001/77/EC | | | Directive 2009/28/EC | | | | Comparison of 2010 Targets |
|---|---|---|---|---|---|---|---|---|
| | | | | National Plans | | | | |
| | 1997 | 2010 | Increase | 2005 | 2010 | 2020 | Increase | Increase/Decrease |
| Austria | 70 | 78 | 8 | 61 | 69 | 71 | 10 | -9 |
| Belgium | 1 | 6 | 5 | 3 | 5 | 21 | 18 | -1 |
| Bulgaria | | | | 11 | 11 | 21 | 10 | |
| Croatia | | | | 33 | 33 | 39 | 6 | |
| Cyprus | | | | 0 | 4 | 16 | 16 | |
| Czech Republic | | | | 5 | 7 | 14 | 10 | |
| Denmark | 9 | 29 | 20 | 27 | 34 | 52 | 25 | 5 |
| Estonia | | | | 0 | 2 | 5 | 5 | |
| Finland | 25 | 32 | 7 | 27 | 26 | 33 | 6 | -6 |
| France | 15 | 21 | 6 | 14 | 14 | 27 | 14 | -7 |
| Germany | 5 | 13 | 8 | 10 | 17 | 39 | 28 | 5 |
| Greece | 9 | 20 | 12 | 8 | 13 | 40 | 32 | -7 |
| Hungary | | | | 4 | 7 | 11 | 7 | |
| Ireland | 4 | 13 | 10 | 7 | 20 | 43 | 36 | 7 |
| Italy | 16 | 25 | 9 | 16 | 19 | 26 | 10 | -6 |
| Latvia | | | | 45 | 45 | 60 | 15 | |
| Lithuania | | | | 4 | 8 | 21 | 17 | |
| Luxembourg | 2 | 6 | 4 | 3 | 4 | 12 | 9 | -2 |
| Malta | | | | 1 | 1 | 14 | 13 | |
| Netherlands | 4 | 9 | 6 | 6 | 9 | 37 | 31 | 0 |
| Poland | | | | 8 | 9 | 19 | 12 | |
| Portugal | 39 | 39 | 1 | 29 | 41 | 55 | 26 | 2 |
| Romania | | | | 30 | 28 | 43 | 13 | |
| Slovakia | | | | 17 | 19 | 24 | 7 | |
| Slovenia | | | | 29 | 32 | 39 | 11 | |
| Spain | 20 | 29 | 10 | 18 | 29 | 40 | 22 | -1 |
| Sweden | 49 | 60 | 11 | 51 | 55 | 63 | 12 | -5 |
| United Kingdom | 2 | 10 | 8 | 5 | 9 | 31 | 26 | -1 |