The Irish Academy of Engineering

REVIEW OF IRELAND'S ENERGY POLICY

IN THE CONTEXT OF

THE CHANGING ECONOMY

Executive Summary

June 2009

This Report follows on from the *Report on Future Energy Policy in Ireland* published by the Irish Academy of Engineering in March 2006.

The selected topics contained in the Report relate to areas of more immediate priority in the context of the changing economy. The Academy plans to publish a series of follow-up, supplementary reports on energy matters over the next one to two years. This report and subsequent reports may be downloaded from the Academy's website at www.iae.ie.

This Report is based on the consensus view of the Irish Academy of Engineering's Steering Committee on Energy (see inside back cover for details of the Committee). They were assisted in addressing this highly complex subject by a number of other parties, whose contribution is acknowledged on the inside back cover. The Report does not necessarily reflect the personal views of all the Academy members.

Review of Energy Policy

Foreword

In March 2006 The Irish Academy of Engineering published a report on future Energy Policy in Ireland. This contained a list of recommendations covering the three main areas of energy use:

- Electricity production and distribution
- Transport
- Energy use in buildings

It also dealt with more general issues, including energy conservation.

The Report contained a list of quantified targets and associated strategies. A number of the recommendations are now reflected in national energy policy, but a number of key areas have yet to be addressed in a comprehensive manner. These include:

- Energy use in buildings
- Energy use related to the transport sector
- Energy price competitiveness particularly for electricity and gas
- Balancing economic, environmental and supply security objectives

While the long term aim of having a highly efficient and more eco-friendly energy sector remains a key consideration, much has changed in the global energy environment since the publication of the report in March 2006:

- Energy has moved right to the top of the international agenda based mainly on security of supply and cost concerns.
- The international economic crisis has transformed the situation in terms of reduced demand growth and capital availability. As a consequence, plans and policies have been thrown into disarray.

Academy Report 2009

In this 2009 report the Academy is recommending a very significant change in the direction of national energy policy in order to address the major economic challenges of the next four to five years. In addition measures to position Ireland so that it can make the necessary major changes in the energy sector that are necessary to secure its competitiveness in the longer term are suggested.

The Academy will be pleased to provide clarification, additional information or advice as required.

June 2009

Summary of recommendations

1. Freeze all regulated capital expenditure pending a robust techno-economic analysis incorporating up to date assumptions on demand growth and primary energy supply and prices.

2. Promote further efficiency improvement programmes in Ireland's building stock bearing in mind that such investment will provide significant stimulus to the economy and encourage job creation.
   Capital should be diverted from energy production/transmission projects to conservation programmes and used to fund a major new national energy efficiency programme. Proper standards, control measures and output targets should be established and professionally managed by a specialised coordinating agency to ensure programmes with predictably high rates of return are prioritised.

3. Re-examine Ireland's policy in relation to renewables penetration in the light of both greatly changed economic circumstances and the severe deterioration of Ireland's international competitive position. A properly resourced robust techno-economic analysis should be carried out by an experienced and reputable independent entity operating within a fairly wide terms of reference.
   Pending completion of this analysis Ireland's large scale renewable energy subsidies (REFIT) should be confined to the amount of renewable generation required to meet Ireland's EU obligations with priority given to projects which can be developed at relatively low overall cost, including any deep reinforcement costs.

4. The Commission for Energy Regulation should ensure that the european equivalent of the North American "Rate Impact Analysis" is formally carried out in respect of all policy and major investment decisions.
   Such studies should be performed by independent and experienced advisory entities and the results published for consultation prior to implementation of the relevant policy or investment decision.

5. Defer East–West electricity interconnection pending a full techno-economic study confirming its early requirement and economic viability.

6. Closely monitor the generation market to ensure that short term overcapacity costs are carried by investors and not by consumers.
   Wherever possible discourage the construction of generation overcapacity in the overall interest of economic efficiency.

7. Review and alter as necessary the planning, regulatory and legal framework for large scale infrastructure projects so as to ensure that major capital projects can be planned and completed in a predictable timescale and with more predictable economic returns.

8. Support the consideration of all feasible mainstream technology options with long term potential and remove inappropriate constraints such as the legislative barrier against nuclear generation.
   Government financial support should be confined to pilot projects and studies utilising Irish technical expertise wherever possible. Full scale deployment of new technologies should not impose financial risk on the Irish electricity consumer (or taxpayer). Evidence-based research, rather than ideology, should determine public energy policy.
   Government should adopt a position of "technology neutrality" in relation to new technologies.

9. Postpone any major commitment to smart metering investment (currently estimated at €1bn) until the results of national and international pilot schemes are available and a robust techno-economic investment case is made.

10. Structure incentives to generators, particularly renewable generators, to locate plant at optimum transmission locations and thus minimise the network investment necessary to connect such plant.

11. Consider options other than gas/wind for Ireland's long term primary energy mix and develop appropriate alternative scenarios for further study.
    Recognise the country's continuing vulnerability to major gas supply interruptions and expedite projects to mitigate this risk.
    In the context of future East-West interconnection, consider acquiring long term electricity supplies from the planned new wave of UK nuclear projects.

12. Ensure that the purchase of emission quotas is considered as a valid low risk policy option for Ireland on a par with low carbon technologies in order to meet our international carbon abatement obligations.
    Avoid imposing carbon abatement standards in Ireland which are more stringent or expensive than those imposed by our major European trading partners.

13. Consider the merits of using the current tax reform process to follow the example of countries like Denmark and Germany and rebalance the heavy cost of Ireland's carbon reduction policies away from the traded sector thus maintaining competitiveness in our export oriented industries and employment in Ireland's workforce.

14. Reassess the stated aim of having 200,000 electric vehicles operating in Ireland by 2020. The heavy cost of both infrastructure and vehicles, the minor environmental benefits and the tax implications, make it an unwise investment now without significant change in electricity supply sources and advances in the technology itself.

Contents

1.0 Executive Summary

There are certain inescapable realities which Ireland must confront as it develops and implements energy policy for the next two decades:

1. Adapting to global climate change
   This is one of this century's key challenges. The European Union (EU) has adopted a world leadership role in decarbonising energy supplies and its members, including Ireland, must now comply with those climate change obligations jointly agreed at EU level. These obligations are not optional.

2. Reducing energy (particularly electricity) prices
   Irish energy prices, particularly electricity prices are among the highest in Europe, indeed among the highest in the world. These prices are imposing heavy costs on Ireland's traded sector and contributing significantly to the country's general lack of competitiveness.

   This is a relatively recent development as Ireland's electricity prices were broadly competitive with other EU countries a decade ago. As a nation, which is heavily dependent on international exports for wealth generation the economic wellbeing of Irish society is critically dependent on a restoration of the country's international competitiveness.

3. Increasing primary energy security
   Ireland is highly dependent on natural gas for its primary energy, much of this is currently imported. Despite the imminent commissioning of the Corrib gas project, in the medium to long term Ireland will remain particularly vulnerable both in supply security and price terms to developments in the wider European gas market.

The policies which Ireland is currently implementing in an effort to tackle the foregoing issues were developed at a time of very positive economic growth. A central thesis of this report[1] is that these policies must now be changed and changed radically and quickly to accommodate to the new economic reality in Ireland.

Meeting the foregoing objectives, of necessity, implies policy conflicts. It is perfectly possible, for example, to achieve a high level of primary energy security but at an unaffordable cost. The challenge therefore is to select our policies based on sound, evidence-based research and provide a balanced implementation aimed at optimising overall national welfare.

This report provides specific recommendations aimed at achieving this objective.

[11] This report does not set out to be an exhaustive analysis of all energy policies for Ireland. It seeks to focus on particular urgent and important issues. High on this list is Ireland's electricity industry on which much of this report is focussed.

1.1 Policy background

Since the publication of the Academy's previous report (2006) on Future Energy Policy in Ireland the economic environment in the country has changed radically for the worse. Two issues deserve special mention in this context: energy demand growth and electricity prices.

1.1.1 Energy demand

Energy demand in Ireland is falling reflecting the contraction of economic activity in the country. This is particularly so in the case of electricity. Demand for electricity has dropped, worldwide, for the first time since World War 2 (see fig. 2.1 [Main report]).

It is estimated that Irish electricity demand will decline by 10% over the two year period 2008-2009.

Despite this decline in demand, it would appear that most national energy policies remain based on a presumption of significant economic and energy demand growth. Current policy in relation to the electricity industry for example is likely to lead to significant short term over-investment in capital projects, coupled with an unnecessary cost imposition on the electricity consumer.

1.1.2 Competitiveness and Electricity prices

Fig. 1.1 shows the divergence between Irish and European average industrial electricity prices since 2000. The trend shows no sign of abating. The impact of this divergence on Ireland's relative competitiveness can be clearly seen from fig 1.2.

The corresponding trend for domestic prices is shown in fig. 2.3 in the main report. A decade ago Ireland had some of the lowest domestic electricity prices in the EU, now it is at the highest end of the comparison scale when taxes are excluded.

It is most important to bear in mind that absolute energy prices are not the issue in this discussion. While electricity prices have recently fallen in Ireland, they have also fallen throughout Europe: Ireland's poor competitive position remains unaltered.

It is doubtful that such general fossil fuel price reductions will do anything to rectify the poor competitive position of Irish industrial electricity.

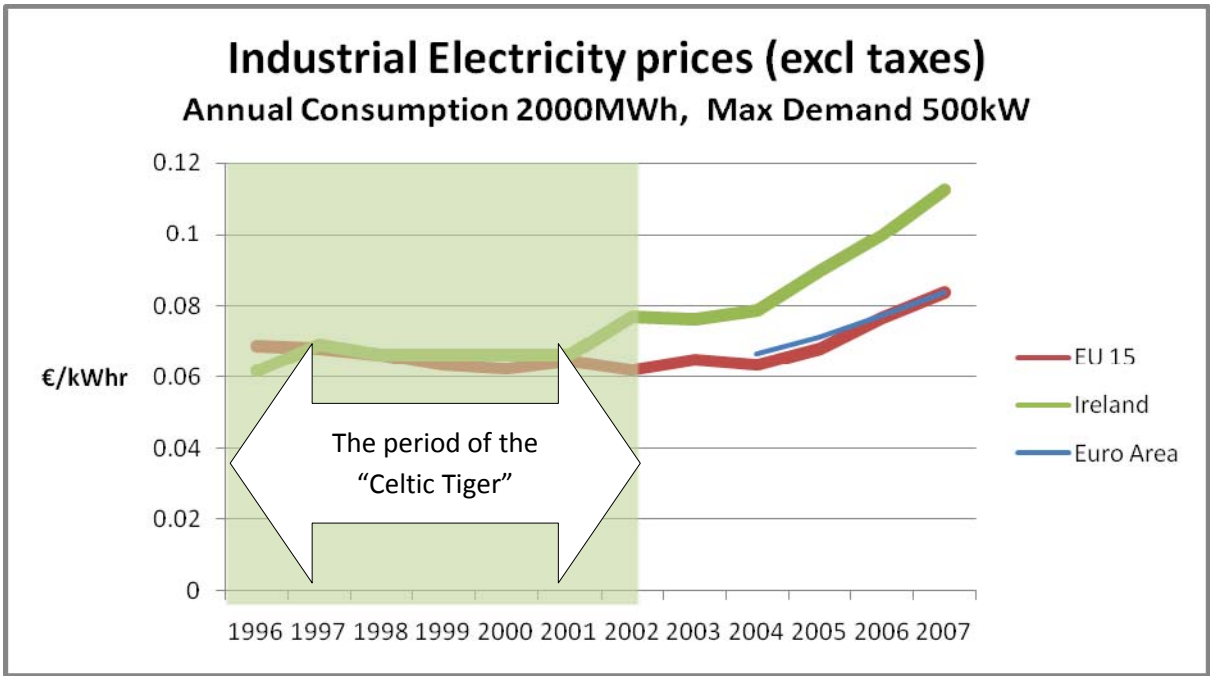


Fig. 1.1 – Industrial Price Competitiveness *Source: Eurostat*

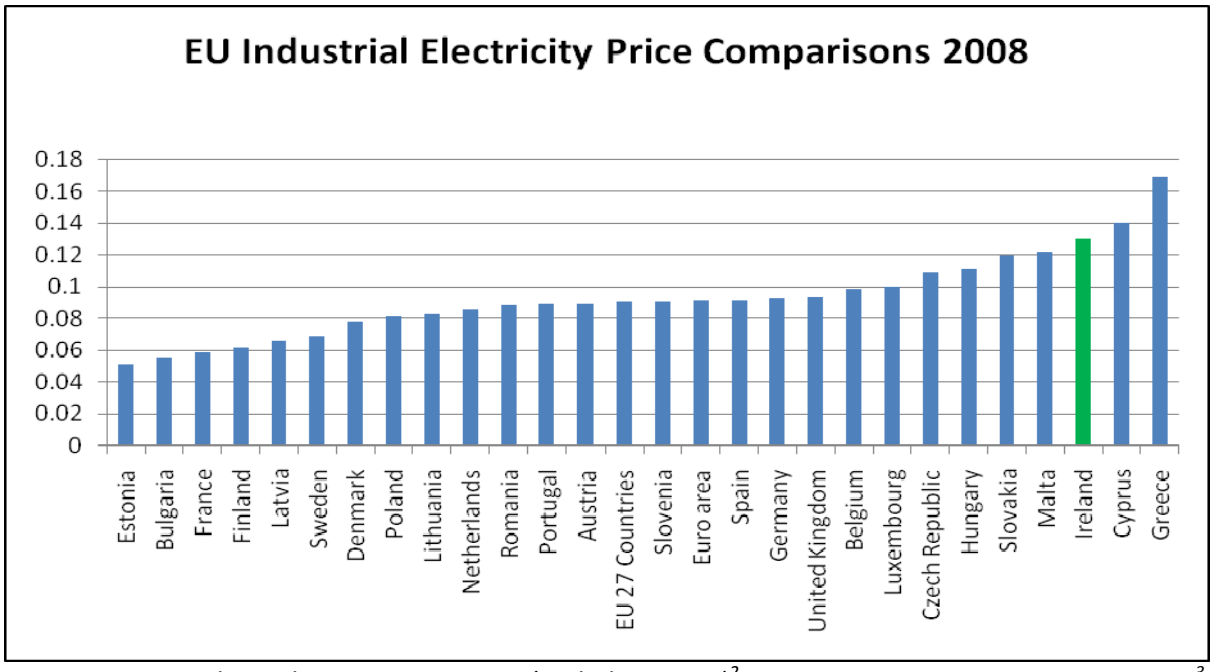


Fig. 1.2 - 2008 Industrial Price Comparisons (excluding taxes)[2] *Source: Eurostat*[3]

[2] Average national price in euro per kWh without taxes applicable for the first semester of each year for medium size industrial consumers (Consumption Band Ic with annual consumption between 500 and 2000 MWh).

[3] Data from Italy not supplied

It is worth noting that Irish industrial electricity prices (excluding taxes) are double those of France and approximately 60% higher than those of Poland.

1.2 Investment

Current capital expenditure plans for regulated investment particularly in the electricity sector, are based on economic growth projections which are far too optimistic. It is perfectly possible for example that Irish electricity demand will not recover to 2007 levels until as late as 2014.

Against this background capital expenditure within the control of policymakers and regulators[4] should be frozen immediately pending a full review of all investment projects based on robust techno-economic analysis. Continuing this expenditure and the creation of unnecessary network capacity in the short term, for example, will impact significantly on electricity prices as investors legitimately seek to recover their investment costs.

Keynesian[5] stimulus arguments are not applicable to this expenditure as the bulk of it is expended on imports. Most EU utilities are currently engaged in this exercise (freezing capital expenditure for example) as they are keenly aware of the potential commercial losses likely to arise from over investment against a declining demand.

> ***Academy Recommendation:***
> *Freeze all regulated capital expenditure pending a robust techno-economic analysis incorporating up to date assumptions on demand growth and primary energy supply and prices.*

[4] Regulated capital expenditure is mainly concerned with the monopoly elements of network businesses such as electricity and gas transmission and distribution where investment decisions are essentially approved by the regulator acting in the general interest of the consumer.

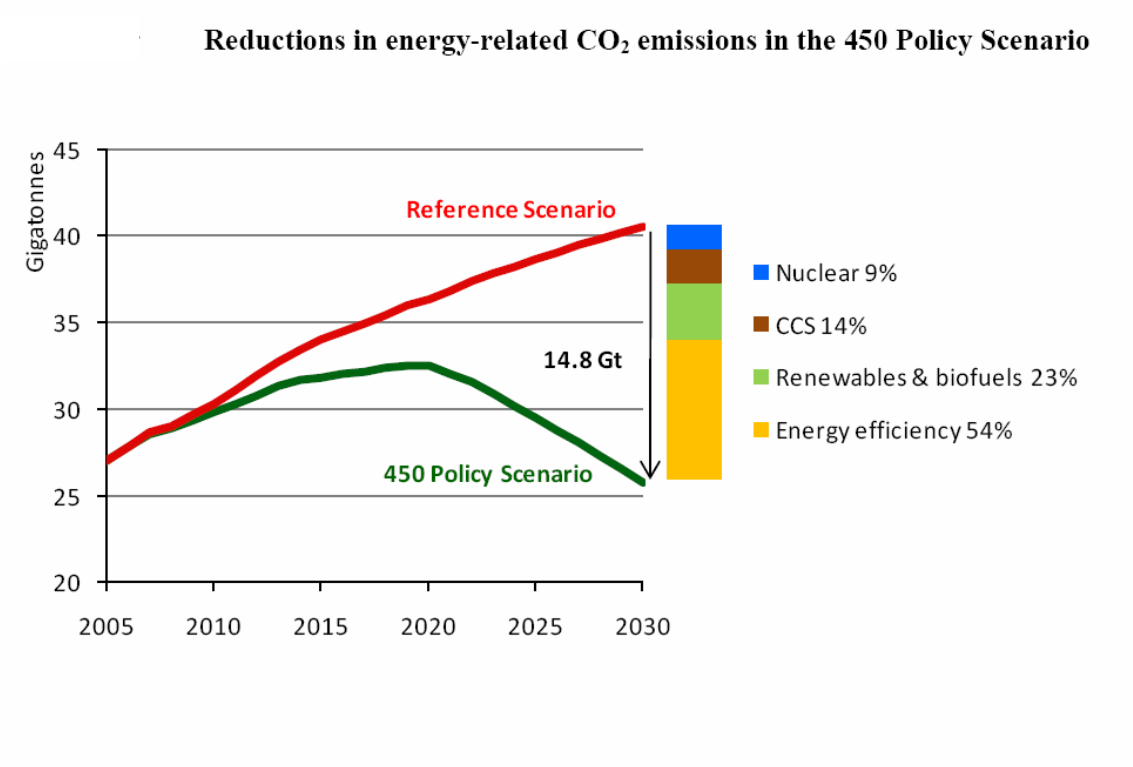
Since the generation of electricity is a competitive activity in Ireland investment decisions in this area, unless by a dominant undertaking, are unregulated and only require a licence from the regulator. These decisions are taken by investors and must be subject to normal market discipline. The generation market in Ireland is generally considered to be imperfect because of its small size and large incumbent (ESB) and is easily distorted by policy decisions such as feed-in tariffs for renewables which enhance the potential financial return and reduce the risk of a particular category of plant.

[5] Rather than seeing unbalanced government budgets as wrong, Keynes (John Maynard Keynes, 5 June 1883 – 21 April 1946) advocated what has been called countercyclical fiscal policies, that is policies which acted against the tide of the business cycle: deficit spending when a nation's economy suffers from recession or when recovery is long-delayed and unemployment is persistently high—and the suppression of inflation in boom times by either increasing taxes or cutting back on government outlays.
Keynes' policies are far from universally accepted by either economists or governments.

1.2.1 Energy Efficiency

In terms of carbon abatement, international authorities are unanimous that energy efficiency programmes are the most cost effective way to tackle the problem. In Ireland we have a history of poor energy efficiency standards in our built environment and the Academy welcomes both the revised standards and retrofitting programmes advocated by government in the recent past.

The IEA 2008 projections aimed at achieving the 450 Policy Scenario (450ppm CO_2 by 2030) are shown in fig. 1.3. It is notable that more than 50% of the proposed decarbonisation up to 2030 arises from efficiency improvements rather than technology change. Not only that, the McKinsey chart in fig. 3.1 [main report] shows clearly that these efficiency gains are by far the most cost effective approach to carbon reduction in the immediate future.



Source: IEA (2008).

Fig 1.3

It is the Academy view that, at a time of falling demand, more of Ireland's available large scale energy investment should be diverted from production and transmission facilities and applied to the many conservation and energy efficiency programmes and projects that provide positive economic returns when compared to alternatives such as purchasing CO_2 emission quotas. Immediate examples of such programmes are the improving of insulation standards in the existing building stock and the application of new lighting technologies.

The successful implementation of such national energy efficiency programmes requires a combination of regulations and incentives. It will also require organisational changes at the

implementation level. Currently there are more than one hundred national organisations (varying from policy organisations like SEI to individual local authorities) engaged in different aspects of energy conservation programmes. Successful implementation requires a much less fragmented approach. A model similar to the National Roads Authority (NRA) should be considered in order to provide more focus at a national level.

Programmes to address energy efficiency deficiencies in Ireland's building stock have the advantage of providing an important economic stimulus and employment opportunities in the country at a time of significant recession and may well become self-financing at a national level.

> ***Academy Recommendation:***
>
> *Promote further efficiency improvement programmes in Ireland's building stock bearing in mind that such investment will provide significant stimulus to the economy and encourage job creation.*
>
> *Capital should be diverted from energy production/ transmission projects to conservation programmes and used to fund a major new national energy efficiency programme.*
>
> *Proper standards, control measures and output targets should be established and professionally managed by a specialised coordinating agency to ensure programmes with predictably high rates of return are prioritised.*

1.2.2 Networks

Ireland has proposed a very large electricity network (transmission and distribution) investment programme (possibly up to €10bn over the next decade and a half). A significant part of this investment is intended to facilitate the connection of renewables to the system.

In the current economic climate, and particularly with the downturn in electricity demand and the obvious lack of competitiveness of Irish electricity prices, the Academy has serious concerns about the justification for this level of investment in the short to medium term.

In the past, coordinated planning of generation and transmission led to considerable economies in the development of the overall power system. This is no longer possible under a market based system. It is possible, however, to incentivise the location of generation at optimum transmission locations by imposing significant transmission development costs on generators.

This is a particularly important issue for renewable generation. The Academy believes that a more economically optimum approach should be taken to incentivising the construction of generation,

particularly renewable generation, at desirable locations from a network point of view. This might well be achieved by "auctioning" network capacity at desirable locations.

> ***Academy Recommendation:***
>
> *Structure incentives to generators, particularly renewable generators, to locate plant at optimum transmission locations and thus minimise the network investment necessary to connect such plant.*

1.2.3 East-West Interconnection (EWIC)

In July 2006, the Irish Government decided to construct an interconnector from Ireland to Great Britain. It would appear that this decision was taken without the benefit of a robust techno-economic study or cost benefit analysis.

In February 2008 EirGrid submitted a "Business Case" to the CER supporting the investment[6]. The estimated cost is €596m and the EU has indicated support up to €100m resulting in a net investment of €496m. The following is a rough comparison of the cost of Irish interconnector with the BritNed[7] interconnector currently under construction between the UK and Netherlands:

Project	Length (km)	Nominal Transfer Capacity (MW)	Estimated Cost (€m)	Cost per MW of nominal Transfer Capacity (€m)
Eirgrid EWIC	256	500	596	1.19
BritNed	260	1000	600	0.60

Table 4.1

While this comparison is necessarily quite crude it does raise the question of the large price discrepancy per unit of transfer capacity and whether EWIC has been optimised for size. The Academy has not been able to locate a technical study dealing with this optimisation.

The study submitted by EirGrid in 2008 was based on growth assumptions which have now been invalidated by Ireland's economic crisis

[6] CER090731 Business Case – The development of an East-West interconnector (EirGrid)
[7] http://www.nationalgrid.com/NR/rdonlyres/88FF9856-8D4E-47F9-85DB-B8BDB3CCF24B/17288/BRITNED2.pdf

In addition it is not clear that the main benefit, the "capacity savings", amounting to some €40m annually out of a total annual benefit of €66m, would be attainable under current market rules as the benefit would appear to imply 100% usage of the interconnector. The Academy understands for example that during 2008 the usage factor on the Moyle interconnector was approximately 14%[8]. This would appear to indicate a much lower likely benefit from EWIC.

The coupling of electricity markets with significantly different structures and rules (Ireland and the UK have very different electricity markets) can often lead to unintended consequences. These should be investigated as part of the updated economic analysis.

There are different ways of looking at these economic benefits and the Academy is not in a position to produce detailed studies. However it would like to see the economic case made with considerably more rigour. In particular authorities need to allay concerns about:

- The reluctance of the Great Britain (GB) regulator to approve any financing for the project.
- The fact that realising the system security benefits would seem to require a formal commercial agreement with the UK industry and this does not appear to be completed.
- The fact that a proposed merchant interconnector does not appear to be financeable.
- The combining of two markets with grossly different trading arrangements and the possible unintended price consequences which might arise.

The Academy is strongly of the view that such large projects as EWIC should not proceed in the absence of robust economic analysis based on the latest data and strongly recommends that the project be deferred pending the establishment of a robust business case.

> ***Academy Recommendation:***
>
> *Defer East–West interconnection pending a full techno-economic study confirming its early requirement and economic viability.*

1.2.4 New Generation

Energy demand growth, particularly electricity demand growth, is falling across the globe at an unprecedented rate. Recent IEA figures show the first drop in world electricity consumption since the Second World War.

[8] SEM Market Monitoring Unit Public Report 2009, 14 April 2009, SEM/09/039.

Taking into account new plant under construction Ireland has sufficient generating plant for its needs for the foreseeable future and indeed is likely, for the first time in many years, to enter a period of plant surplus. In a normal market such a surplus would put downward pressure on electricity prices to the benefit of the customer and at the expense of investors.

However it is fair to say that to date Ireland's electricity market has been far from normal and is only recently showing signs of facilitating real competition. It will be important therefore to ensure that the current capacity payments mechanism does not impose any extra burden on consumers.

The potential extra costs arising from large scale renewables penetration are a significant concern and are dealt with in Section 1.3.1, Renewables.

The Academy recognises that the regulator may not intervene to prevent the construction of surplus plant but strongly recommends that this situation be monitored closely to prevent the imposition on customers of any costs resulting from over construction. It further recommends that any measures that can be taken to discourage overcapacity, particularly in the renewables sector, should be taken.

Academy Recommendation:

Closely monitor the generation market to ensure that short term overcapacity costs are carried by investors and not by consumers.

Wherever possible discourage the construction of generation overcapacity in the overall interest of economic efficiency.

1.2.5 Planning and legal framework for development

Despite some recent legislative changes included in the Strategic Infrastructure Bill (2006) it is difficult to have any confidence in the ability of Ireland's planning, regulatory and legal framework to facilitate the delivery of new major energy projects on time or on budget. Large infrastructural projects in Ireland cannot be planned and completed in a predictable economic timeframe. The risk return calculations for such projects are currently little better than a lottery.

Whether it is the experience with the Corrib project, construction of wind farms or delivery of new electricity transmission infrastructure (or indeed Ireland's road infrastructure), there is huge uncertainty about the likely final delivery date and overall cost which is not the case in other jurisdictions. Indeed following what can only be described as a debacle in relation to the Corrib field Ireland is viewed as a high risk location for such large scale international investment precisely because of the unpredictability of its permitting processes.

Additionally, Irish permitting procedures are perceived to be far slower and more bureaucratic than those of competing EU jurisdictions. The time taken to obtain foreshore licences in Ireland for example (usually several years) is looked on with amazement by international investors.

There is also a perception of weak and inconsistent political support for such projects. This encourages resistance from various vested interests and the ever increasing use of the courts leads to ever more delays and cost increases.

> ***Academy Recommendation:***
>
> *Review and alter as necessary the planning, regulatory and legal framework for large scale infrastructure projects so as to ensure that major capital projects can be planned and completed in a predictable timescale and with more predictable economic returns.*

1.3 Future (or alternative) technologies for power generation

A new generation of power production technologies will only begin to significantly impact in Ireland post 2020. This timescale is dictated by the extended time required to phase out the existing stock of generation assets.

These technologies include carbon capture and storage (CCS), advanced nuclear energy, advanced renewables, large scale electricity storage and ocean energy.

In the short term the government should not exclude consideration of any technology options and should remove any barriers to their deployment. In terms of financial support however the government should confine its policies to pilot projects, studies and facilitation arrangements where there is clear justification for the investment (such as at present contemplated for Ocean Energy).

1.3.1 Renewables

At oil prices below $100 per barrel no alternative technology is competitive with conventional generation technology (assuming CO_2 prices below €30 per tonne). Technologies that are currently a decade or so away from commercial viability include:

- Offshore wind
- Solar generation
- Wave and tidal generation
- Liquid bio-fuels

Countries that are investing heavily in these technologies are usually aiming to develop associated large manufacturing industries (Germany, Spain and Denmark for example). Because of its small indigenous market size and industrial structure, Ireland is not well positioned to create large manufacturing enterprises centred on these emerging technologies.

The very real opportunities for Ireland are likely to lie in the area of intellectual property based on R&D, licensing, patents, component manufacturing, systems integration and related software systems, specialised operational programmes and small niche markets.

1.3.2 Nuclear Energy

Nuclear energy is the only existing non-fossil fuel technology that can provide economic base load electricity all year round without greenhouse gas emissions. Western nuclear power technology has an excellent safety record going back 40 years.

A new plant in a country like Ireland would almost certainly take up to 15 years to plan and construct (that is post 2025). Consideration of the issue cannot even begin in a serious manner however while the existing legislation remains in place. This legislative barrier may well close off an opportunity that could be very important for Ireland in the post 2025 era.

1.3.3 Carbon Capture and Storage (CCS)

Despite significant investment from coal producing countries (such as Australia, USA and Germany) this technology is proving very difficult to develop in both economic and engineering terms. It is most unlikely to become commercial before 2020 and its widespread adoption depends critically on the market price for CO_2 emission quotas.

Converting the existing Moneypoint coal plant to minimal CO_2 emissions using this technology is not a realistic option for both economic efficiency and other engineering reasons. Ireland should keep abreast of the current pilot projects now in the pipeline as well as evaluate likely long term CO_2 storage locations, thus preparing for a time when the technology will be commercially applicable.

1.3.4 Energy Storage

As renewables penetration increases in the Irish electricity system, the problems of managing such an intermittent supply source as wind loom ever larger. In this context an expansion of our energy storage capability would be an enormous asset for a system operator.

There are a number of potential technologies that can be utilised in the energy sector. The following are the main contenders.

- Pumped storage
- Compressed air energy storage
- Flow battery storage
- Heat storage in district heating systems[9]

The specific capital cost (€/kW installed) of most of these technologies tends to be very high. The first two carry significant construction risk and the third significant technology risk. All should be allowed to compete on the Irish market.

However, the development of gas storage capability, coupled with an increased penetration of rapid response and flexible gas turbine powered generating plant, could also provide the load following capability required in the future.

A thorough study of the economic benefits of storage followed by revised market rules which permit investors to recover the full value of the services provided would be a good starting point from which to encourage this technology.

Academy Recommendation:

Support the consideration of all feasible mainstream technology options with long term potential and remove inappropriate constraints such as the legislative barrier against nuclear generation.

Government financial support should be confined to pilot projects and studies utilising Irish technical expertise wherever possible. Full scale deployment of new technologies should not impose financial risk on the Irish electricity consumer (or taxpayer). Evidence-based research, rather than ideology, should determine public energy policy.

Government should adopt a position of "technology neutrality" in relation to new technologies.

1.3.5 Smart Meters

Recent advances in information technology now permit much more sophisticated customer interfaces for utilities. In particular Time of Use (ToU) metering can now be much more sophisticated and menus of charging options can be provided to the customer. There is a requirement, of course, for considerable investment in both metering and communication capacity (estimated at €1bn for the Republic of Ireland).

[9] EcoGrid.dk Phase 1, Summary Report: www.energinet.dk/en/menu/R+and+D/EcoGrid/EcoGrid.dk.htm

The key question is not whether this technology can be deployed but rather whether there is an economic case for it. A few utilities (Enel in Italy, for example) have rolled out smart metering programmes to all their customers. A relatively high level of "non-technical losses" (electricity theft) encouraged this investment in Italy. This is a very costly investment and most utilities have confined their programmes to their larger customers where the benefits are more immediately obvious.

ESB and Bord Gáis, on behalf of SEI and CER, are currently carrying out pilot programmes for this technology. The Academy believes that a robust case has yet to be made for providing this technology on a universal basis in Ireland, particularly as Ireland has a more dispersed pattern of housing and lacks the industry scale of countries like Italy. The cost per capita of such a programme in Ireland is likely to be very high.

> ***Academy Recommendation:***
>
> *Postpone any major commitment to smart metering investment (currently estimated at €1bn) until the results of national and international pilot schemes are available and a robust techno-economic investment case is made.*

1.4 Primary energy

Ireland can change its primary energy mix only on a timescale commensurate with changing its generating plant stock. This is measured in decades rather than in years and thus points up the importance of getting such strategic investment decisions right.

In fig. 1.4 the relative "levelised" generation costs[10] from various technologies are shown with the carbon costs added. The CO_2 cost implicit in this diagram is €20 per tonne.

The cost advantage for countries using nuclear generation in a carbon constrained world is evident. Ireland's challenge is to compete with this over the next decade or so as more and more EU countries avail of the advantage of relatively cheap nuclear energy.

[10] Levelised energy cost (LEC, also called levelised cost of energy or LCOE) is a cost of generating energy (usually electricity) for a particular system. It is an economic assessment of the cost of the energy-generating system including all the costs over its lifetime: initial investment, operations and maintenance, cost of fuel, cost of capital. A net present value calculation is performed and solved in such a way that for the value of the LEC chosen, the project's net present value becomes zero.
This means that the LEC is the minimum price at which energy must be sold for an energy project to break even.

In the medium term Ireland has no choice but to rely on its current generating technologies and add more gas fired or renewable generation as required, with the decision between these alternatives made on security of supply and economic grounds (including carbon costs). The use of interconnectors for importing energy can also be factored into this analysis.

If Ireland is to make significant long term changes however it must begin the process now by reviewing all alternative primary energy scenarios. It is in this context that Ireland should set itself a target of becoming fully competitive with EU electricity prices by 2015.

In the context of future interconnection to the UK proceeding in the medium term (2015 - 2020), Ireland should consider participating in the new UK nuclear programme, either by taking minority stakes in particular nuclear plants or contracting at an early stage for a percentage of the plant output. This alternative should be factored into the analysis of the East-West interconnector economics.

The issue of primary energy mix cannot be separated from fuel security. As a percentage of total generation fuel needs, Ireland is more dependent on natural gas than most other EU countries. This situation cannot be significantly altered for approximately the next decade, no matter what policies are pursued. Yet the primary energy security at gas fired generating plants in Ireland is currently measured in hours in the event of a major gas pipeline failure.

While dual fuelling alleviates this problem to some extent, it is not an adequate response to the risk involved. Ireland needs to be much more proactive in progressing the completion of the Corrib gas project, the construction of LNG import facilities and the development of gas storage options.

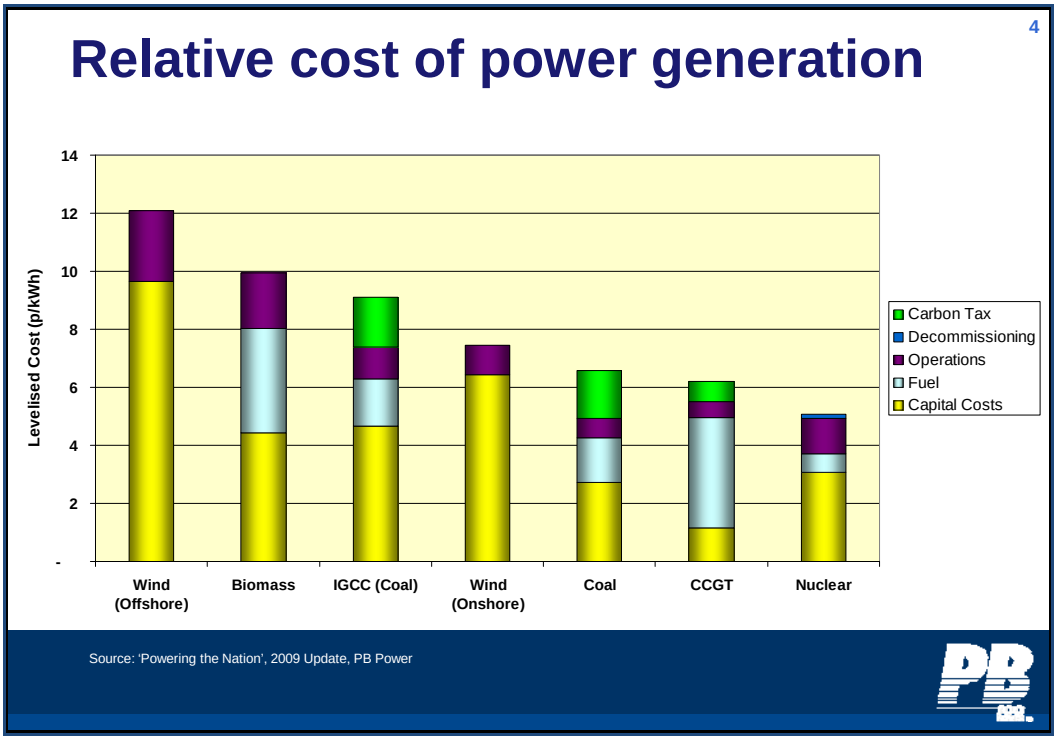


Fig. 1.4 - Source PB Power, 2009 update. Based on CO_2 costs of €20 per tonne

Academy Recommendation:

Consider options other than gas/wind for Ireland's long term primary energy mix and develop appropriate alternative scenarios for further study.

Recognise the country's continuing vulnerability to major gas supply interruptions and expedite projects to mitigate this risk.

In the context of future East-West interconnection, consider acquiring long term electricity supplies from the planned new wave of UK nuclear projects.

1.4.1 Carbon abatement

For the foreseeable future Ireland will have to purchase carbon emission quotas on the international market in order to meet its carbon abatement obligations. Such purchases currently take place under the EU cap and trade arrangements. There is some optimism that such a system may be expanded post 2012 as new arrangements are introduced "Post Kyoto".

Trading of emission quotas must be an integral part of Ireland's carbon abatement strategy and is no better or worse than introducing low emissions technologies. The decision on which course to follow should be based on economic pragmatism as this is precisely what Ireland's competitors will do.

European leaders signed up in March 2007 to a binding EU-wide target to source 20% of their energy needs from renewables such as biomass, hydro, wind and solar power by 2020. At the time the EU also put forward a proposal for a higher target of 30% but crucially this was subject to other OECD countries setting similar targets. This conditionality resulted entirely from a realisation that if the EU did this on its own, energy costs would quickly make EU industries uncompetitive in a global market.

It is notable that other OECD countries did not rise to the EU challenge and that the target remains at 20%.[11]

This lesson should not be lost on Ireland. The Academy supports the Government's policy efforts to meet Ireland's obligation of obtaining 16% of its energy from renewables by 2020, but cautions that targets such as 40% of Ireland's electricity generation from wind by 2020 will only be achieved at an unacceptably high economic cost for our industries in competitiveness terms. This is particularly so following the recent drop in electricity demand and the decrease in fossil fuel prices, further considered elsewhere in the report.

Given the fall in energy demand worldwide at present it is likely that, at least in the short term, carbon emission quota prices will remain depressed and this will be an economically attractive and low risk option for Ireland to follow.

Academy Recommendation:
Ensure that the purchase of emission quotas is considered as a valid low risk policy option for Ireland on a par with low carbon technologies in order to meet our international carbon abatement obligations.

Avoid imposing carbon abatement standards in Ireland which are more stringent or expensive than those imposed by our major European trading partners.

[11] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

1.4.2 Renewables – wind power

On the 23rd April 2009 the European Commission (EC) adopted a new directive[12] on renewable energy. This requires all EU countries to meet specific targets for all renewables as a percentage of final energy consumption in 2020 with two year intermediate targets set proportionally. In Ireland's case the requirement is to increase the country's renewable share of final energy consumption from 4% in 2008 to 16% in 2020.

Much of this renewables expansion will come from wind energy. As a matter of urgency, Ireland needs to carry out a "Rate Impact Analysis" on this proposed programme (including the cost of transmission expansion) and review the level and application of its REFIT programme in the light of such analysis.

The above analysis should establish the level of wind energy penetration required to meet the new EU target. Unless it can be clearly demonstrated that exceeding this target reduces electricity prices the target should not be exceeded.

In the absence of the above analysis current government policy has set a target of producing 40% of Irish electricity from renewables by 2020 and EirGrid has produced a plan for grid investment (Grid 25[13]) costing more than €4bn to accommodate total transmission demand. A significant portion of this cost arises from the requirement to connect very large quantities of renewable generation (wind).

The target of 40% renewables appears to arise from the *All Island Grid Study*[14]. The study is based on a number of very critical assumptions which the study itself points out need further examination. In particular:

- In its "*Key Conclusions"* section the authors[15] recognise the significant limitations of the study:
  "*The limitations of the study may overstate the technical feasibility of the portfolios analysed and could impact the costs and benefits resulting. Further work is required to understand the extent of such impact*."

- The study is based on typical "pre-crisis" economic scenarios which are entirely unrealistic in relation to current projected electricity demand growth.

[12] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF
[13] http://www.eirgrid.com/EirgridPortal/uploads/Announcements/EirGrid%20GRID25.pdf
[14] http://www.dcenr.gov.ie/NR/rdonlyres/1B7ED484-456E-4718-A728-97B82D15A92F/0/AllIslandGridStudyStudyOverviewJan08.pdf
[15] Dept. Communications, Energy and Natural Resources (ROI); Dept Enterprise, Trade and Investment (NI)

- Under "*further work required*", the study authors further acknowledge that the study has been under resourced to begin with and that the resulting limitations probably invalidate the conclusions reached for high renewables penetration.

The *All Island Grid Study* is not a sufficiently robust exercise on which to base Ireland's future energy policy.

> ***Academy Recommendation:***
>
> *Re-examine Ireland's policy in relation to renewables development in the light of both greatly changed economic circumstances and the severe deterioration of Ireland's international competitive position. A properly resourced robust techno-economic analysis should be carried out by an experienced and reputable independent entity operating within a fairly wide terms of reference.*
>
> *Pending completion of this analysis Ireland's large scale renewable energy subsidies (REFIT) should be confined to the amount of renewable generation required to meet Ireland's EU obligations with priority given to projects which can be developed at relatively low overall cost, including any deep reinforcement costs.*

1.5 Paying for energy policies

Energy policies aimed at improving primary fuel security or decarbonising electricity production often incur a cost premium which must usually be borne by the electricity customer (or the taxpayer). Social policies aimed at employment creation in the electricity industry may have similar consequences.

It is important that such policies are carefully evaluated and that the cost imposition on the consumer is clearly quantified and explained prior to implementing such policies. This is the task of the regulator.

In North America which has a much longer history of successful energy regulation than most EU countries, regulators demand that a "Rate[16] Impact Analysis" be carried out and published in relation to all policies and major investment proposals. This approach has much merit in promoting

[16] North American authorities use the term electricity *rates* rather than electricity *tariffs* as is common in Europe.

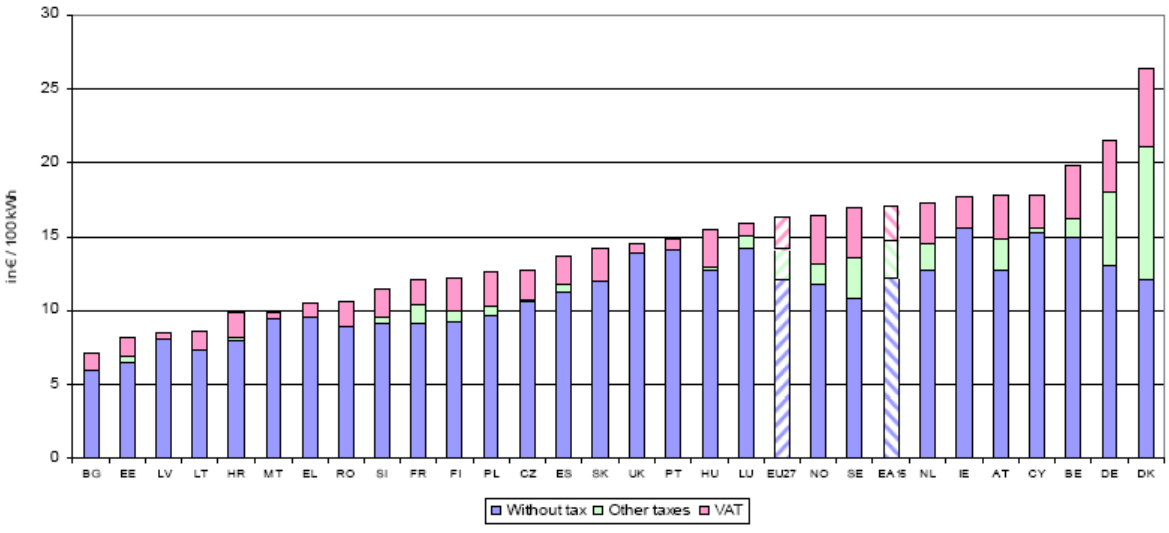
transparency in energy policy matters and the Academy commends this to Ireland's energy regulatory authorities.

Academy Recommendation:
The Commission for Energy Regulation should ensure that the European equivalent of the North American "Rate Impact Analysis" is formally carried out in respect of all policy and major investment decisions.
Such studies should be performed by independent and experienced advisory entities and the results published for consultation prior to implementation of the relevant policy or investment decision.

1.5.1 Electricity taxation

It is evident from fig. 1.5 and fig. 1.6 that EU countries such as Denmark and Germany in promoting policies of high renewables penetration have understood that imposing the costs of these programmes on the internationally traded sector through high industrial electricity prices is not acceptable. Accordingly the costs of such policies have been imposed through taxes on the domestic consumer.

Electricity prices for household consumers -1st Semester 2008[17]

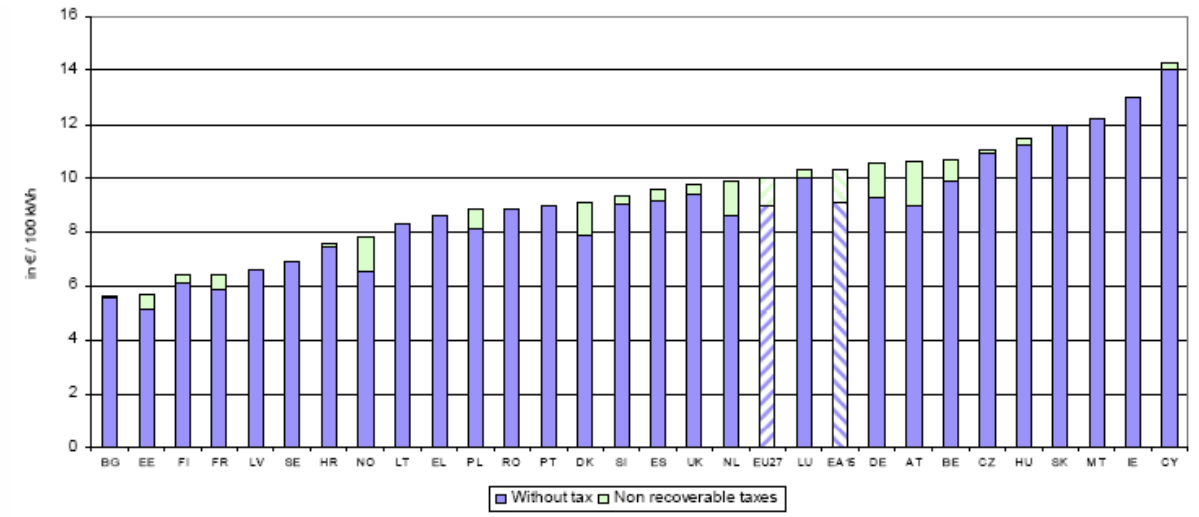


* 'Household consumers' refer to consumer band Dc (annual consumption between 2500 and 5000 kWh)

Fig 1.5

[17] Eurostat 45/2008 :Goerten & Ganea

Electricity prices for industrial consumers – 1st Semester 2008[18]



** 'Industrial consumers' refer to consumer band Ic (annual consumption between 500 and 2000 MWh)

Fig 1.6

Denmark, for example, which is mid way in the league table for domestic electricity prices (excluding taxes) jumps to the top of the league once taxes are included.

> ***Academy Recommendation:***
>
> *Consider the merits of using the current tax reform process to follow the example of countries like Denmark and Germany and rebalance the heavy cost of Ireland's carbon reduction policies away from the traded sector thus maintaining competitiveness in our export oriented industries and employment in Ireland's workforce.*

1.6 Transport policy and electric vehicles

The economic case for a major shift to battery electric vehicles (BEVs) is currently very weak. This is analysed in more detail later in the report. In present circumstances in Ireland, there is no short term economic case for subsidising (either by the taxpayer or electricity consumer) the purchase and use of BEVs. This is due to:

[18] Eurostat 45/2008 :Goerten & Ganea

- The high percentage of fossil fuels in Ireland's electricity primary energy mix.
- The relatively small reduction in CO_2 emissions from using BEVs, as opposed to equivalent diesel engine cars.
- The likely very high cost of the vehicles and limitations on their use when they are launched commercially on the market.

In cost benefit terms, from the State's or Taxpayer's perspective equivalent CO_2 emission quotas can be purchased in the market at a fraction of the cost of subsidising BEVs.

The current policy of using enhanced taxation instruments to reduce emissions and fuel consumption is effective and remains the best means of achieving these particular goals in the short term.

Academy Recommendation:

Reassess the stated aim of having 200,000 electric vehicles operating in Ireland by 2020. The heavy cost of both infrastructure and vehicles, the minor environmental benefits and the tax implications, make it an unwise investment now without significant change in electricity supply sources and advances in the technology itself.

1.7 Strategies

Energy policy and related plans should be considered in three phases:

- Short-term: 2010 – 2015 (Recovery)
- Medium term: 2015 – 2020 (Economic Growth)
- Long term: Post 2020 (The New Energy World)

1.7.1 Short term strategies: 2010 – 2015

The broader economic context involves halting the major economic downturn and aiming to restore GDP levels to mid-2008 levels by 2013. The primary focus must be to reverse the 25% loss of national industrial competitiveness in tandem with restructuring the banking system and stabilising the Government's finances.

Energy policy has a key role to play in the recovery phase and the following five general strategies should be adopted:

1. Reduce energy prices for industry to internationally competitive levels. This requires a minimum 20% drop from the mid-2009 position in addition to any price changes arising from primary fuel price variations. In the short term deferring large scale capital expenditure and adjusting energy taxes offer some early savings and are within Ireland's control.

2. Base future policy on evidence based research with an emphasis on short term actions that properly balance economic, environmental and supply security aspects of Ireland's energy sector.

3. Divert a portion of planned large scale capital expenditure from energy production to energy conservation, particularly in the built environment.

4. Remove the institutional barriers to efficient infrastructure development.

5. Incentivise future investment in the *full* portfolio of available energy technologies (including carbon capture and storage, advanced renewables, electricity storage and nuclear energy).

1.7.2 Medium term strategies: 2015 – 2020

This period is most unlikely to be a return to the "business as usual" or "Celtic Tiger" scenario. The worldwide economic collapse of 2008 is a historical breakpoint. For Ireland the future is likely to be radically different from the past. Energy policy will be a key component of this new direction and a considerably enhanced focus must be given to economic competitiveness.

In addition to managing growth in an optimum manner during this Phase, care must be taken at the policy level to position Ireland for the major technological changes that will almost certainly be a feature of the post 2020 period.

1.7.3 Long term: Post 2020

This is the era in which new technologies and systems should materialise. These include new renewable technologies, advanced nuclear generation, clean fossil fuel technologies, smart grids, new modes of transport and potentially many others.

To take full advantage of these new developments in a manner that complements Irish economic development it is essential to:

- Put in place mechanisms *now* to ensure that Ireland keeps fully abreast of these developments

- Ensure long term flexibility by not excluding any future technologies (nuclear power for example) from proper consideration.

- Avoid the temptation to categorise winners and losers on the basis of ideology. Long term energy policy must be evidence based and Governments almost universally have a poor track record of selecting successful commercial technologies.

Strategic lessons

Ireland's current Energy Policy:

- Is not properly grounded on sound techno-economic principles and analysis.
- Does not reflect the radical changes which have taken place in the Irish economy over the past 18 months.
- Has not given sufficient weight to national economic competitiveness.
- Should, as a matter of urgency, be reviewed and updated to reflect the new economic realities and the priorities of recovery and growth through competitiveness.

Academy Members of the Energy Standing Committee:

Chairman: Kieran O'Brien, Acting Director General of World Energy Council

Dr Anthony Barry, former Chief Executive of CRH plc, Past President of IBEC
Michael Hayden, President of The Academy
Brian Sweeney, former Chairman and Chief Executive, Siemens Ireland
Frank Turvey, former Deputy Chief Executive of the Radiological Protection Institute
Dr Edward Walsh, Founding President of the University of Limerick

The Academy is grateful to the following who provided information, insights and analysis of data to facilitate compilation of the Report: Their participation and cooperation does not imply their agreement with the findings and recommendations, which are the sole responsibility of the Academy Energy Standing Committee.

Eirgrid
ESB
EUROCASE
Royal Academy of Engineering
SEI – Kevin O'Rourke, FIEI
UCD Energy Research Centre – Professors D Timoney and Dr W Smith
Gerry Duggan, Chairman of the Energy & Environmental Division of Engineers Ireland
Colm McCarthy, Economics Lecturer, University College Dublin
Don Moore, C. Eng., Executive Consultant to The Academy of Engineering
D G Nolan, C. Eng., FIEI
Tom Reeves, Commissioner, Commission of Energy Regulation

The Irish Academy of Engineering

The Irish Academy of Engineers has a membership of just over 115 experienced Irish engineers drawn from a wide range of disciplines. Using the experiences and knowledge of its members, the Academy focuses on issues where the engineering profession can make a unique contribution to economic, social and technological development.

Its aim is to facilitate communication and dialogue on engineering related matters and with this in view it publishes reports, some of which are listed below:

- Engineering a Knowledge Island
- A Vision of Transport in 2050
- Ireland's Environment
- The Government's Technology Investment Fund
- Infrastructural Spatial Development for the Island of Ireland
- Creating Europe's most attractive environment for intellectual property

The Academy is an all Ireland body. Its membership includes Irish engineers of distinction, who are resident in other countries.

22 Clyde Road
Ballsbridge
Dublin 4

Tel: (01) 402 3653
Email: iae@dit.ie
Web: www.iae.ie