FEEDBACK ON 'TOWARDS A SUSTAINABLE ENERGY FUTURE FOR IRELAND' - GREEN PAPER

01/12/06

PREFACE

We welcome very much the publication of 'Towards a Sustainable Energy Future for Ireland'. It sets out the issues, challenges and tradeoffs we face in a coherent and comprehensible fashion, and identifies the key issues on which decisions must be made. We also welcome the invitation and opportunity to provide feedback and suggestions, and we do so below.

Comhar Sustainable Development Council's 25 members are drawn from five pillars: the State sector, economic sectors, environmental NGOs, social/community NGOs and the professional/academic sector and therefore is in a unique position to provide recommendations on energy across a wide range of issues and perspectives.

We address the issues on which specific feedback was requested below. But first we note some general recommendations in regard to the priorities, which we believe should prevail.

General Recommendations

Identify priorities

While all issues are interrelated and therefore difficult to separate; given that government time and other resources are scarce, it is important to identify priorities, using payoff in terms of competitiveness, security of supply and sustainability relative to cost as the way of establishing these, recognizing that in most instances it is not possible to advance all these objectives simultaneously. This will help ensure that those at the top of the list get the necessary attention. We recognize that precision in this area is difficult without the application of considerable evidence-based analytical resources (and we have recommendations in this regard). But with existing evidence and access to international experience, it is possible to make qualitative judgments.

Our priorities in this regard are identified in the following Table.

Recommended Priorities for Energy White Paper, Comhar Sustainable Development Council

Priority	Competitiveness	Security of Supply	Sustainability
1. Target Gains in energy efficiency Reducing consumption in energy supply and generation, farming and natural resources, households, industry and commerce, transport as a result of improved energy efficiency requires giving consumers right price signals, making the right institutional arrangements and investments.	All the evidence shows that the payoff per Euro spent in reducing energy consumption is larger than comparable payoffs per TOE, in investment in increased supply. We can design energy conservation to cut peak demand for electricity, thereby reducing potential for black or brownouts and reduce demand for capital. There will be competitive advantage in developing new technologies in energy efficiency and the potential for technological transfer to the developing world	Because we import most of our energy, reducing demand results in automatic reduced vulnerability to price spikes and supply interruption.	There is an automatic dividend in reduced greenhouse gas emissions, reduced need for new capital investment in supply and distribution with associated disruptive potential for environment and social cohesion, and reduced air pollution (NOx, particulates, VOC etc)
2. Support Grid Enhancement including distributed generation Increasing wind power to 30 per cent of supply as envisaged can only happen if the grid is designed and managed to allow this to happen. Likewise, facilitating the use of micro energy, partially dispatchable, non-dispatchable and embedded generation requires investment in both infrastructure and management systems.	There may be a trade-off here between improving security of supply and sustainability and increasing delivery costs to consumers. The key is to keep such additional costs to the absolute minimum feasible. Because this investment is designed in part to secure wider EU objectives of increased renewables, and reduced greenhouse gas emissions, there may be a case for subventing some of the public interest gain and related investment from general tax sources.	The key point of this investment is to reduce transmission losses and increase the capacity to increase indigenous renewables supply in general, and in particular as regards wind. There will be a substantial dividend in security of supply. It also opens up the possibility to increase small-scale distributed generation.	Same gains as energy efficiency - see above.
3. Support Grid Interconnection A decision on a 500 MW electricity interconnector between Ireland and UK has been made.	This will act as the natural gas interconnector has done, by giving third parties access to supply, engendering welcome competition and thereby enhancing competitiveness.	This will be enhanced, as more supply options for electricity will be available to consumers. It will also potentially enhance the potential to export renewable electricity, thereby enhancing the viability of investment in same.	The outcome here will be ambiguous, depending on the carbon efficiency of the inward supply, and whether it is supplied from nuclear power.

Priority	Competitiveness	Security of Supply	Sustainability
4. Use Public Sector as model Public expenditure is about 34 % of GDP. Government in its purchase of services and investment decisions has huge potential leverage on overall energy performance.	If government investment in housing, commercial buildings, transport infrastructure and transport services, all exemplify best practice in both energy efficiency (including operation) and mobilization of renewables, this will yield large net gains over time, and act as a powerful demonstration effect.	Government will reduce its demands on imported energy by enhanced conservation and use of renewables.	There is an automatic dividend in reduced greenhouse gas emissions, reduced need for new capital investment in supply and distribution with associated disruptive potential for environment and social cohesion, and reduced air pollution (NOx, particulates, VOC etc)
5. Carbon-proof all Policy Carbon emissions and fossil fuel use are synonymous. If we reduce the former, we will automatically reduce the latter. All major policy initiatives – including tax concessions - should as a matter of course be subjected to *ex ante* (and *ex post*) analysis, to assess what they will cost, how and by whom will they be delivered, and what they will yield in terms of economic, social and environmental gains to society.	Our world is becoming increasingly energy and carbon constrained. It is common sense to understand what are the implications in these regards before we make major policy decisions. Because we are overshooting our Kyoto commitments we have to pay others to reduce on our behalf. Carbon proofing will allow us to reduce this bill and its associated drag effect on the economy and competitiveness. It will also mean that we don't need to regulate reductions in those areas where it would be extremely expensive to do so.	Depending in the scale and nature of the opportunities to reduce carbon emissions that such analyses yield, there will be a commensurate reduction in imports and in vulnerability to price and supply shocks.	See above.
6. Support expanded Indigenous renewables development We have clear comparative advantage in regard to wind with available technologies, some potential advantage as regards biomass for heat, and (lower) for diesel and petrol, and potential technologies in development in regard to wave.	It is clear that CAP reform is going to result in substantial areas of land 'unused' for conventional agriculture, and that biomass may have potential. The 'Greener Homes' package has demonstrated the consumer appetite for wood pellets. Viable economy-enhancing businesses seem likely, with benefits especially in rural areas.	This will result in lower reduced dependence on fossil fuel imports, and lower exposure to price and supply interruption shocks.	See above.

Priority	Competitiveness	Security of Supply	Sustainability
7. Support commercial indigenous fossil fuel discovery and development. We have potential to discover and develop oil and gas fields offshore - become a new 'Norway'. The terms and conditions that apply to prospecting and discovering need to be sufficient to maintain exploration, but not so generous that the benefits of the latter are unnecessarily diminished.	Being in the Euro zone, we are buffered from the malign effects of currency appreciation and resulting damage to competitiveness that large-scale commercial oil or gas discovery can yield (the 'Dutch disease'). Nevertheless, cost inflation is a continuing risk. There is much to be learnt from Norway in regard to how to foster local community gain, and how to invest off-shore to secure pension and other benefits for future generations.	One major discovery would ensure our 'independence' from supply interruption, but not from high prices, as Irish output would be sold at world prices.	Sustainability impacts would depend on the pace of field development and exploitation, and on the terms and conditions relating thereto. There would be a potential carbon gain from not having to ship oil or gas long distances. Transfers to significantly impacted communities should be an automatic entitlement. This would ensure equity and fairness, and inhibit unnecessary delays.
8. Ensure that fuel poverty does not prevail. Ideally, poverty would be addressed as part of a wider social and economic agreement. In practise, because poor people devote a much larger share of disposable income to energy than do rich people, it needs to be addressed.	There will be a short term negative effect on competitiveness, as the resources needed to proof against poverty will come in part from other parts of the economy. In the longer term, the better acceptability of energy policies that encourage efficiency may result in a net competitiveness gain.	The impact will be neutral or negative. However, if fuel-poor households are encouraged and facilitated to invest in energy saving technologies as part of the programme, this effect will be mitigated.	Community cohesion will be enhanced.
9. Identify the key delivery agents, and resource them to do the job	Most policy failure in Ireland (and elsewhere) occurs because there is ambiguity as to who is in charge of delivery – where the Euro stops – and/or they are not sufficiently equipped managerially, financially or technically to do the job to best international peer-reviewed practice. Many aspects of energy policy are in the quintessential 'fall between the cracks' territory and this needs to be corrected if we are to maintain competitiveness. Accountability is crucial.	Not applicable	Not applicable
10. Focus on incentives and on R&D If the signals given to consumers and producers do not automatically encourage them in the 'right' direction, all other policies – information, regulation, voluntary agreements, etc. will struggle. R&D gives us choices we didn't have before. If we can keep generating new approaches that yield more competitive and more environmentally and socially benign outcomes, we gain.	The right price signals and the right level and application of research and development will give us an economy that responds quickly to price signals, and that keeps lowering costs and/or improving quality.		

RESPONSES TO QUESTIONS POSED IN ENERGY GREEN PAPER 'TOWARDS A SUSTAINABLE ENERGY FUTURE FOR IRELAND'.

I. SECURITY OF SUPPLY

3.2.1 Diversification of supply (in addition to renewables)?

One key objective is to foster speedy, socially responsible and environmentally and economically viable indigenous supplies of oil and gas.

We recommend that an Options Paper be developed outlining:

(a) Best practise internationally for countries at Ireland's state of development, i.e. good infrastructure, robust economy, stable politics and reasonable access to markets, very low discovery rate[1], difficult offshore geology and climate.
(b) Options addressing tax and royalty rates, development protocols, environmental and social assessment

Use the Options paper to generate informed debate and discussion, followed by government decision which will apply to new exploration.

3.2.2 Improve generation and transmission adequacy

(a) Top priority should be energy conservation, especially directed at flattening out the peak (see 3.2.11).

(b) Provide sites with planning permission for new development.

(c) Facilitate and foster distributed generation.

3.2.3 Strategic gas storage

Support Shannon Development or other State agency to partner with the private sector. There is a tendency for publicly held 'strategic' oil and gas stocks never to be used; if prices are falling, there is reluctance to sell as the stock is being sold at a loss. If prices are rising, it seems to make sense to hold on, because they may continue to rise. Identifying the conditions under which there will be some draw down of stock is a key strategic and policy issue. A private public partnership (PPP) may provide a way forward.

[1] Many companies have invested many millions in exploration that yielded zero return.

3.2.4 Challenges to participation by new players in development and operation of new power generation plant.

A key problem inhibiting such development is the perception that the Electricity Supply Board (ESB), as the dominant player, will use its position in the market place to the disadvantage of new entrants.

The Commission for Energy Regulation (CER) and the Competition Authority need to come together a produce a joint and enforceable Protocol that specifies the nature and character of what will comprise international best practise as regards the electricity supply sector, and then enforce these provisions.

See 3.2.1 above for other suggestions

3.2.5 Greater Electricity Interconnection with Europe?

Making sure that the UK interconnector happens on time is a key priority. Designing and permitting it such that capacity could be increased relatively quickly is important. In addition to enhancing security of supply, this will also open up the potential to export renewable-generated electricity and make investment in the latter in Ireland more attractive.

The costs and benefits of a direct link to mainland Europe need to be identified and kept up to date on an ongoing basis. It seems very unlikely that such would be viable before the new UK interconnector is in place, but relative costs and benefits change over time and they need to be monitored. If the UK decision were to for some reason to change, then this option would need to be re-visited.

3.2.6 Exploration and production of indigenous resources

See 3.2.1 above.

3.2.7 Enhance contingency measures re imports of oil and gas.

There is a balance to be struck between investing in action to prevent something that may never happen, and accepting the risk.[2]

Maximising the efficiency of current production and consumption, fostering development of indigenous renewable and fossil fuel resources, and the provision of storage for oil and gas will all help mitigate or inhibit the effects of supply interruption or price spike.

See 3.2.3 above for more on this theme.

[2] The investment in Martello towers around the Irish coast, and the star fort in Kinsale, were major strategic investments to help protect against invasions that never happened.

3.2.8 Green Paper generally on policy directions for security of supply?

Good, but more focus on energy conservation, promoting indigenous fossil fuel development, and the modalities of delivery of electricity interconnection with the UK.

II. PROMOTING SUSTAINABILITY OF ENERGY SUPPLY

3.2.9 Improve the pace and range of renewable resources for electricity generation.

Estimate the value to society of reducing emissions of CO_2, air pollutants etc. and added security of supply. If we apply these values to the electricity generated by renewables then we can measure the 'social gain' yielded. This will provide a systematic and robust means of putting a value on the environmental and security of supply gains, which in turn will demonstrate the social values yielded by renewables.

Key to ensuring that one of these costs – carbon dioxide – is reflected in the costs of fossil fuels generation is **the indefinite maintenance of the European Union Emissions Trading Scheme (EU ETS).** This has produced the first price signal that tells participants that if they increase carbon emissions, it will cost, and if they reduce, it will save them money. Preliminary indications are that the first year of operation of the pilot scheme produced a reduction in CO_2 emissions below business as usual of about 5 per cent.[3] However, the sharp fall in price since April 2006 - which is likely to persist into 2007 – may diminish progress over the rest of the pilot period. However, this will be reversed in the Kyoto phase (2008-2012). On Wednesday, 29 November 2006, the European Commission announced its decision on the National Allocation Plans (NAPs) for 10 Member States for this latter phase.

Every country except the UK, Lithuania and Slovakia had their allocation cut, both in regard to what they sought, and what they received in the pilot phase.

Overall, a reduction of 5.3 per cent for these 10 countries is made from the Pilot Phase, representing a reduction of almost 50 million tonnes annually in the supply. Considering that there will be considerable economic growth over the 2006-12 period, which other things being equal would produce rising emissions and associated demand for allowances, the cut is non-trivial, and is likely to be more than replicated as decisions are made on the allocations of the remaining 15 Member States. This in turn will result in a rise in the price of allowances over the 5-year period, which will stimulate further abatement.

If economic growth were to continue in Ireland at an annual average of about 5 per cent per annum in real terms, the economy will grow by over 40 per cent between 2006 and 2012, with rising use of electricity and cement, and

[3] Ellerman, D and Buchner, B., 2006. 'Over-Allocation or Abatement? A Preliminary analysis of the EUETS based on the 2005 Emissions Data', Working Paper, MIT, Boston

associated need to buy allowances to cover emissions. This will provide a considerable incentive to firms to invest in abatement. While there is uncertainty concerning the post 2012 situation, there is considerable political support to sustain the scheme, not only in the EU but also in Australia,[4] and there are Commission proposals to extend it to include aviation[5].

The **quality of the grid and its management** are crucial in this regard. The main complaint of new developers of **wind power** is that connection costs are uncertain and expensive and this generates uncertainty in regard to raising finance and the delays are expensive.[6] There are two issues involved: meeting the technical challenges faced in making the grid amenable to large volume connection of wind power capacity; and secondly, ensuring transparency, predictability and fairness in the assessment of costs of interconnection.

As regards **biomass**, a very important market in supplying heat is emerging from the demonstration effect of the 'Greener Homes' grant scheme[7]. This is likely to be the most financially and environmentally efficient outlet for most biomass supply. However, the opportunity to combine biomass with peat in the production of electricity is a potentially viable competitor, and should be examined.

3.2.10 In addition to electricity generation, what actions should be taken to develop renewable energy usage in the transport and heat sectors?

It is important to prioritise actions which will not involve 'permanent' long-term subsidy if the market is to be sustained. **The greatest potential in this regard, and the top priority, is the use of biomass for heat.** (See 3.2.9 above). The 'Greener Homes' programme has shown that there is considerable potential for greater use of biomass in domestic and commercial heating, notably outside urban areas. There are issues at present with the supply of wood pellets and prices, but this will correct itself as domestic suppliers gear up to meet the market. As the market captures economies of scale and scope, it is plausible to infer that the degree of subsidy needed at the installation phase will diminish, and little or no on-going subsidy will be

[4] On November 13 2006 the Australian Prime Minister John Howard announced that the Government would establish a joint government-business taskforce to examine the best options for establishing emissions trading in Australia. It is also his intention to propose the idea of an international emissions trading scheme across the Asia-Pacific climate pact. Also on November 13 Australia's finance minister Peter Costello stated that if the world starts moving towards a global carbon trading market that Australia cannot afford not to be part of such a system. (See November 13 and 14 articles '*Australian finance minister embraces carbon trade*' and *Howard turns around on emissions trading*' at www.PointCarbon.com).

[5] The leak to Reuters was reported in both the November 15th 2006 editions of the *International Herald Tribune* (pp. 1, 15), and the 'Daily News' section on the Point Carbon website (www.PointCarbon.com)

[6] O'Reilly, G. (2005) *Wind Power in Ireland – a Developers' Perspective*, Masters Thesis in Environmental Policy, UCD Dublin, 2005.

[7] Information on the scheme available from SEI at http://193.178.1.196/index.asp?locID=756&docID=-1

needed to generate the supply of wood for this market. In the case of transport, the challenge is much more daunting; with currently available technologies and costs, the degree of subsidy required – for example in the form of excise duties foregone – to market alternative transport fuels that are competitive in price and quality with petrol and diesel is very large.[8] The priority therefore should be on gearing up to meet the potential of the heat market; this can have considerable benefits for the rural economy. The focus in regard to transport fuels should be on achieving whatever is decided upon as the target at minimum cost.[9]

3.2.11 New Initiatives to increase energy efficiency in households, businesses, the public sector, transport and the built environment?

In terms of cost effective delivery of economic, environmental and social advantage, this is the most important area for policy and action. If we don't get this right, we will face policy failure. We support the development of an Energy Saving Action Plan, but only if it is developed quickly, in parallel with the White Paper, so that there is not undue delay in making progress in this crucial area. We already know from the pilot work of SEI[10] and other country experience what can be done and how it can be delivered. The focus should be on getting on with it.

The following actions are priorities:

- **Electricity Generation:** Provide meters to domestic households to allow for time-related monitoring and charging for electricity consumption; this will allow for big price differentials at peak and off-peak for the autumn winter season 2007-08.[11] The experience with the plastic bags levy shows that where (a) there are alternatives, and (b) the differential is sufficiently large to be a talking point, action is immediate.[12] We face a serious and immediate problem with electricity supply capacity and the key is to flatten out peak consumption; the latter stretches the supply capacity to its limits in the winter early evening as householders come home and turn on the heat, hot water, cookers, washing machines, dryers etc. We need to be strongly incentivised to change behaviour and this can only be achieved quickly and comprehensively if, say, we pay five times as much for electricity

[8] Ryan et al, (2006) show that if subsidy of transport fuels are seen primarily as a means of abating CO_2, the costs per tonne are of the order of € 200-400, very expensive relative to alternatives. (Ryan, L., F. Convery and S. Ferreira (2006) 'Stimulating the use of biofuels in the European Union: Implications for climate change policy', *Energy Policy* 34 (17), p. 3184-3194.)

[9] The EU has set indicative (i.e. non binding) targets of 2% in 2005 and 5.75% in 2010.

[10] SEI assists small and medium sized companies to develop energy-management action plans with the website http://www.sei.ie/energymap/index.asp?locID=827&docID=-1

[11] Their installation in all new houses should be required. Grant aided retrofitting should be mandatory over the next 12 months.

[12] McDonnell, Simon, and Convery, Frank, 2003. 'Applying Environmental Product Taxes and Levies – lessons from the experience with the Irish Plastic Bags Levy', Working Paper 03-01, School of Geography Planning and Environmental Policy, UCD Dublin.

use during the peaks as during off-peak periods. Because utilities bring on their most inefficient (and expensive) plant at the peak use, flattening the peak will also improve environmental and financial performance.

- **New Housing:** Bring the **housing energy performance regulations for new housing** up to the standard now being achieved by the Sustainable Energy Ireland managed 'House of Tomorrow' programme. This demonstrates that better than 30-40 per cent improvements in the energy performance of housing and commercial buildings is achievable with existing proven techniques and technologies.[13] Some local authorities – notably Fingal – are already mandating these and higher standards in their local area development plans. The building regulations should as a matter of priority be upgraded to meet these new standards. There will be very substantial payoffs in terms of energy saving and associated reduction in vulnerability to supply interruption, reduction in greenhouse gas emissions, and creating of a growing and export oriented green building sector.
- **Existing Housing: Incentivise the retrofitting of energy efficiency standards in existing housing.** The easiest way to do this is to provide a discount in stamp duty for all sales that meet the highest standard of efficiency, as verified via the labelling of buildings using the labelling mandated in the *Energy Performance in Buildings Directive*, which comes into effect in 2007. This retrofit business will provide a buffer for the industry when demand for new housing flattens out and then declines.
- **Commercial Buildings:** Until recently, this rapidly growing sector has been given little attention vis a vis energy and sustainability performance. Similar regulatory and incentive mechanisms should be applied as in the case of new and existing housing.
- **Public Sector:** The public sector accounts for about 34 per cent of all national expenditure. In its construction and leasing decisions, in its ability to drive performance with its purchase of goods and services, government can have great influence on behaviour. Sustainable Energy Ireland's Public Sector programme[14] has shown what is possible in this regard. All public investment should be 'carbon and energy efficiency proofed' as a matter of priority; decisions on buildings and housing involving direct public investment or significant subvention should meet the high standards achieved in the SEI programme.
- **Transport:** The key here is to provide strong market signals that energy and carbon efficiency are important. Unless the trajectory of emissions associated with transport can be changed, it will be very difficult to make substantive progress in regard to flattening out and then reducing greenhouse gas emissions. While VRT reductions are currently given to hybrid and alternative fuelled vehicles, vehicle tax reductions should not be made dependent on type of vehicle

[13] Information on the programme available from SEI at http://www.sei.ie/index.asp?locID=315&docID=-1

[14] Information available from SEI at http://www.sei.ie/index.asp?locID=351&docID=-1

technology but rather on the efficiency of the vehicle. In our Budget 07 submission, we propose a re-calibration of the Vehicle Registration Tax (VRT) and annual road tax that could change the trajectory, and have significant impacts, reducing CO_2 emissions in the order of 0.5 million tonnes over the Kyoto period. In support of CO_2 differentiated vehicle taxes an overhaul of the car-labelling scheme is needed so that vehicle purchasers can easily understand the range of CO_2 emissions and fuel consumption values available in each vehicle market segment.[15] We strongly support the ongoing and proposed public transport investment in Transport 21. In parallel, we advocate *prioritising demand side management*. It makes no sense to invest over 30 billion Euro in infrastructure without having at the same time a strong programme to manage this investment effectively. Unfortunately, this idea has become associated exclusively with the use of tolls for the use of motorways. The most effective means of achieving cost and environment efficient public transport is to make it easy for buses to operate. The DTO Traffic Counts[16] show that the N11 Quality Bus Corridor in Dublin carries 50 per cent more passengers at morning peak than the Sandyford – City centre Luas line (5938 vs 4125). Managing infrastructure so that buses taxis and multiple occupancy vehicles can operate with high frequency and efficiency is key to this. Pricing to ensure free flow is an important but not exclusive part of this portfolio.

- **Businesses:** In the UK, a carbon levy has been charged, but most of this has been re-bated to firms who demonstrate that high-energy efficiency standards have been achieved. *Ex post* analysis shows that this has been a key driver of improved carbon and energy efficiency, making the UK an international leader in this field. The levy is not available as a policy instrument in Ireland. Sustainable Energy Ireland's Large Industry Energy Network (LIEN) has been a key source of mutual learning and support for energy-intensive industry in aiming to achieve high efficiency performance.[17] This has recently been complemented by a voluntary programme whereby firms commit to meet a demanding energy standard, and by the energy management action plan mentioned above directed at small and medium enterprises (SMEs). These initiatives need to be supported and incentivised by providing some tax concessions or grants to those companies that participate in energy management schemes that will trigger almost universal action so that Irish industry can be a world leader in energy efficiency.

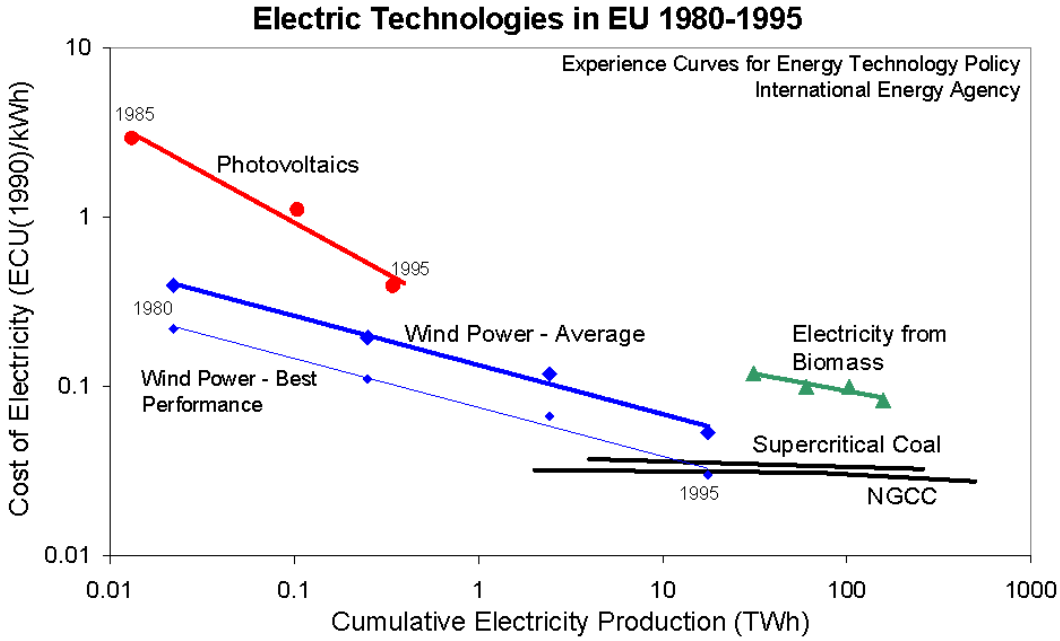
[15] Similar to the new label developed under the voluntary scheme introduced in the UK in September 2005. Information at http://www.vcacarfueldata.org.uk/green-label/index.asp

[16] DTO (2004) *QBC Monitoring Report*. Dublin Transportation Office, Dublin, and DTO (2005) *QBC Monitoring Report*. Dublin Transportation Office, Dublin.

[17] See http://www.sei.ie/index.asp?locID=198&docID=-1 for details.

3.2.12 Additional policy measures to expand research and development and priority areas for research?

Investment in Research Development and Demonstration (RD&D) combined with demand-pull policies that encourage adoption of new technologies, are the key to reducing the costs of new energy technologies to the point where they can compete with conventional fossil fuel and other alternatives.
The association between time, cost reductions and R&D are learning by doing is exemplified by the cost trend in selected renewable technologies, illustrated in the Figure below.



Source: IEA (2000) *Experience Curves for Energy technology Policy*, p. 21. Available at http://www.iea.org/textbase/nppdf/free/2000/curve2000.pdf

Because the developers of new innovations can't capture all of the benefits of their achievement, the market fails to provide the economically efficient quantum of investment; public sector support, focused in particular the public goods aspects of energy demand and supply, is warranted.

The creation of an R&D budget and associated Energy Research Council are therefore very welcome developments.

Our main message here is that it is crucial that we invest substantially in research, development and demonstration if we are to compete, reduce import dependency on strategically vulnerable oil and gas, and meet our environmental obligations, notably relating to greenhouse gas emissions. *But* we need to do it well: US and other experience shows that it is very easy to waste large sums of money in R&D, and there are important lessons to be learnt from our own and international experience as we design and implement this initiative. We identify some key lessons from international experience. The analyses from three sources of experience that are relevant – Resources

for the Future, the International Energy Agency, and the US National Academy of Sciences – are summarised in Annex II.

Lessons from Energy R&D Experience

There are many lessons in these experiences for the design and implementation of the Irish (and other) energy R&D programmes. These include the importance of:

- A long-term perspective: The gains come from consistent programmes applied over a long period. 'Stop-Start' R&D that is, for example, reduced when oil and gas prices fall for a period, will not deliver to its potential.
- International standard peer review of proposals.
- Portfolio of research that spans basic, applied and demonstration projects, and at scales from small-scale incubation to large-scale interdisciplinary and inter-institutional initiatives.
- Consistent assessment methodology, which addresses both economic and environmental (especially greenhouse gas emission) benefits and costs.
- Quality of organisation and management of the programmes; they make a significant difference to the results.
- Sustaining a demand for innovation is as important as creating a supply. R&D should be accompanied by incentives for technology adoption by the household, industrial and commercial sectors. Demand-pull is important.
- The buildings sector and energy conservation generally – avoided costs – yielded the largest net gains to R&D in the US, and should be a priority research area in Ireland. (See Annex II and below).

Priority Areas for Research

International experience shows that the greatest payoffs are in the 'public goods' area, where there are many relatively small firms and substantial potential gains for the public from innovations in energy savings and in renewables deployment. This situation applies with particular force in Ireland in the Buildings Sector.

- **Institutional, Legal, and Economic Analysis:** Technologies may be developed that allow for major reductions in energy use, or enhanced performance with a given quantum of energy. However, the ability to convert such developments into commercial reality may be inhibited by legal, financial, institutional or cultural constraints. Research should focus not just on technologies, but also on identifying key constraints inhibiting innovation and performance, and how to overcome them. Many of the benefits of energy research are environmental, including reduction of green house gasses; the evaluation framework should include estimates and values.

- **Demand Side Management (DSM):** Because there are well-organised and powerful stakeholders and easily identified sectors, supply side prescriptions tend to get most policy and media attention and associated funding. But managing demand is often many times more productive in terms of payoff to effort, and is an area where a country poor in natural resources but smart and nimble in regard to intellectual resources can make an impact. Demand side management in regard to transport is crucial if gridlock is not to be a permanent feature of life, but also in regard to electricity demand (see earlier), in regard to buildings (see below) and in industrial and commercial uses. This is a frontier where application of R&D combined with policies that encourage early adoption of DSM will yield dividends.

- **The Buildings Sector:** This should be a research and development priority (see Annex II for Lessons). New housing and commercial buildings have benefited from support for *demonstrations* of innovative technologies managed by Sustainable Energy Ireland. These programmes have been very valuable in diffusing best practise and creating the platform for mainstreaming – see recommendations in regard to building standards earlier. A new frontier of demonstration now needs to be opened up, complemented by *basic and applied R&D* that aims at transforming performance in regard to energy efficiency across a range of hard and soft technologies. Development of databases and models that allow alternative scenarios to be tested, and of policy instrument combinations that could drive innovation, should all be in the R&D mix.

- **Biomass:** As the forests of Ireland – and the associated sawmilling and other wood processing – mature, and as the implications of direct payments for conventional cattle based farming take hold, there is potential for large supplies of woody and other biomass. The potential for commercially viable production to supply the heat market is especially notable, but there are also other opportunities. The Greener Homes programme is creating a domestic market for same. But research and development is needed to convert this potential into a reality, across all stages of the fuel chain.

- **The Electricity Grid:** RD&D is needed to investigate how best to allow the grid to increase its absorption of intermittent and small-scale suppliers.

- **Energy and Climate Change:** These are two sides of the same coin. Increasingly, globally, at EU and national levels, energy policy and climate change policy will evolve simultaneously and in an integrated fashion. How best to achieve productive synergies in innovation in both simultaneously should be an R&D theme, perhaps in collaboration with the EPA.

- **Wave Power:** This is at a very early stage of development internationally. Funding to support indigenous research and also to support links with key players internationally seems to be the way to succeed.

- **Development of modelling capacity**: There is a paucity of models available to model the Irish energy and related sectors at national and local levels. Centres of excellence should be established to facilitate full-time energy (both demand and supply-side) modelling in this area so that we develop the expertise needed in Ireland. Models are only as good as the data that is input and therefore good data is a prerequisite to good modelling. Progress has been made with the establishment of the Energy Policy Statistical Support Unit as part of Sustainable Energy Ireland, however there remains a lack of centralised data collection in the energy efficiency and use of many related areas such as transport.

3.2.13 Expand National Energy R&D capacity?

Consistent R&D funding over a decade or more, supporting research from incubation - e.g. one PhD with a supervisor – to inter-institutional clusters linked to international groups – will over time create a solid supply base at the universities. This can be fast tracked somewhat by providing resources to 'import' outstanding individuals or teams, along the Science Foundation Ireland (SFI) model. There is an urgent need for ex-post analysis of energy policies implemented so that we learn from our successes and failures in order to improve future policy-making and minimise wasteful use of revenues. Demand will need to be created domestically by providing tax and grant support for soft and hard innovations, related to performance. Partnering with Sustainable Energy Ireland, the Environmental Protection Agency, the Marine Institute, Teagasc etc should be a resource-expanding priority that will also yield productive synergies.

3.2.14 Supply and Demand Questions related to National Bioenergy strategy?

The key is first to create the demand – the supply will follow. The 'Greener Homes' package has already created a demand for wood pellets, which can only be met at high cost by importing. But domestic suppliers are gearing up to meet this market; after a 12-month period, the supply will be on stream and will grow over time as more customers come on line. The same is true of biofuels for use in larger scale heat facilities, and in regard to the use of wood for electricity generation – in combination with peat – and for transport. The Green Paper devotes more space to describing the situation with regard to transport biofuels than to other biomass uses. More consideration and study should be given to the question to which purpose our burgeoning biomass industry should most efficiently be put? Internationally, there is evidence that unless transport fuel prices rise significantly biomass will be more cost-effectively used for heating than for transport.[18] The demand must be created first, using a mix of tax and subsidy measures. Information should be made available on the full life-cycle carbon intensity of any type of bioenergy sold,

[18] Grahn, M., C. Azar, K. Lindgren, G. Berndes, and D. Gielen (2006). "Biomass for heat or as transportation fuel? –a comparison between two model based studies". Forthcoming in Biomass and Bioenergy.

particularly in the case of transport biofuels and any fiscal supports be linked accordingly. R&D should be invested in at the same time – see above – so that cost reducing innovations can come on stream over time. It is important that we do not create a sector that depends on permanent subsidies. This will not be sustainable over the long haul.

3.2.15 Mandatory Targets and Incentives for renewables and energy conservation – one or both?

We need to set targets that are meaningful for a firm, household or sector. Overall national targets are useful as an overall policy target, but individual firms, government departments and agencies will only respond to the incentives or targets they face individually. The government overall should be set a target for energy efficiency and these should be broken down and monitored by department and agency. Households and private firms should be encouraged and strongly incentivised to meet ambitious targets for energy efficiency. As regards wind energy and electricity, the constraint at present seems mainly to be the costs, uncertainties and delays associated with grid connection – the supply of finance and entrepreneurial energies seem able to deliver electricity to the grid at a cost comparable to the best new entrant price if these grid related constraints can be addressed. More generally for other potential suppliers to the grid, the terms of interconnection and the price received for deliveries are the key variables determining viability.

3.2.16 Does the Green Paper generally set the right policy directions for energy sustainability?

Yes, but enhancing energy efficiency should be given much more attention and priority. It should be at the beginning of the White Paper, and be the key fulcrum for improving energy security, competitiveness and climate change and related environmental performance.

III. ENHANCING THE COMPETITIVENESS OF ENERGY SUPPLY

3.2.17 In context of liberalisation of the Irish energy market, what further actions should be taken to develop more competitive electricity and gas markets?

The fundamental challenges are scale and contestability. As regards scale, in the Irish market, both ESB and Bord Gais are dominant, but in global terms, they are tiny companies, suffering from diseconomies of scale and scope relative to their competitors in European and wider markets. The keys to enhancing competitiveness are to:

- Make it as easy as possible for new entrants to ‘set up shop’ – the proposed availability of sites with planning permission would be a big

step forward in reducing uncertainties and transactions costs in getting to market.

- Provide a guarantee of contestability by creating an enforceable Protocol between the CER and the Competition Authority that would provide enforceable provisions in regard to fairness of treatment of new entrants.

- Move forward as quickly as possible with the interconnector to the UK. Any delay beyond 2012 in getting this in place could be very expensive for consumers.

- Develop the grid and associated pricing policy to allow a diversity of small and large-scale intermittent suppliers to compete on an equal footing with large-scale incumbents.

3.2.18 What policy measures should be introduced to reform institutional arrangements and market structure?

See 3.2.1 and 3.2.4 above.

3.2.19 What actions should be taken to reduce costs of electricity and gas to consumers?

Competition, transparency, and research and development.

3.2.20 Role of State Owned Enterprises.

The key area where monopoly power is still necessary is in regard to transmission systems for gas and electricity; once the infrastructure is in place, the marginal costs of additional increments tend to be low. These should continue in State ownership. However, monopoly power inevitably provides opportunities to allow costs to rise beyond what a competitive market would yield, and controlling these costs by benchmarking to best international practise, and by regulation, may be necessary if consumers are not to suffer. Both the ESB and Bord na Mona have in the past demonstrated considerable facility in engaging with community development. This skill and propensity can be built upon, and they can also partner universities in regard to RD&D.

3.2.21 Alleviation of Fuel Poverty

Substantial expansion of the current programme administered by SEI is one key. Where fuel subsidies are provided, these should always be complemented by investment in energy conservation measures. For example, the provision of low energy light bulbs should be a routine part of the subsidy package.

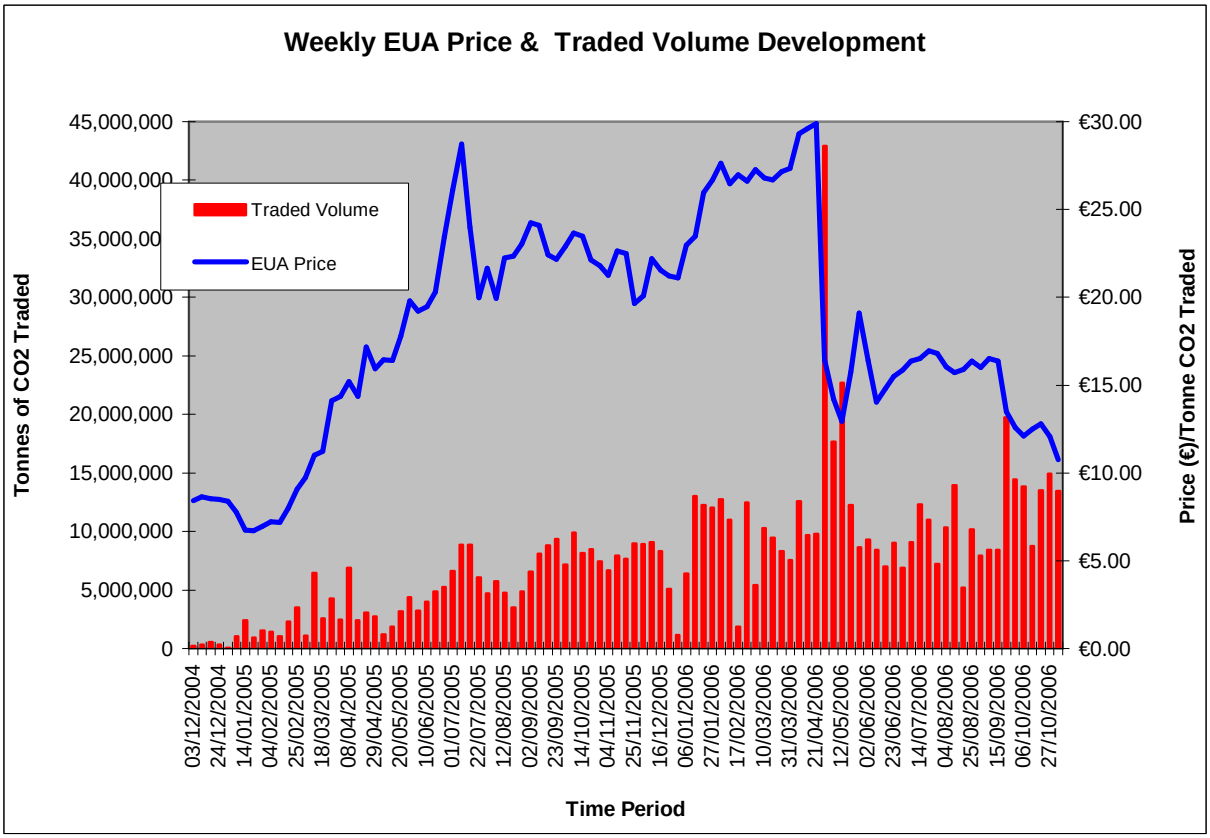
3.2.22 Direction Generally vis a vis Competitiveness?

Most key issues are touched on, but delivery mechanisms are not fully addressed. Also, investment and behavioural modification in regard to energy efficiency are crucial in delivering change that will enhance competitiveness. This issue is addressed in the ‘Sustainability’ section, but it should also be the lead instrument for enhancement of competitiveness.

ANNEX 1 – NOTE ON EUROPEAN UNION EMISSIONS TRADING SCHEME

Price per tonne of CO_2 peaked in April 2006, just before the data on actual emissions for 2005 were released. When it became clear that allocation of allowances in many countries exceeded emissions, there was an immediate and logical fall in price as the realities of supply and demand took the place of judgement and estimation.

Figure A1. EUA Price and Traded Volume Development



Current legislation provides only continuation to 2012, and this horizon is too short to encourage long term investments in low or zero carbon electricity generation. The EUETS yields a very important signal that the use of the atmosphere to dispose of greenhouse gases is expensive. There is evidence that the first year of the very limited pilot phase (2005-07) yielded a reduction in CO_2 emissions beyond 'business as usual' of about 5 per cent.[19] The effect would be much more profound if the planning horizon were indefinite. At present, the allowances are allocated free to the participants.

[19] Ellerman, D and Buchner, B., 2006. 'Over-Allocation or Abatement? A Preliminary analysis of the EUETS based on the 2005 Emissions Data', Working Paper, MIT, Boston

On Wednesday, 29 November 2006, the European Commission announced its decision on the National Allocation Plans (NAPs) for 10 Member States. The decisions were as follows (all volumes in millions of tonnes of CO_2 allowances

Table A1. Annual Allocation of Allowances in the Pilot and Kyoto (2008-12) phases of the European Union Emissions Trading Scheme for selected countries.

Country	Annual allocation Pilot Phase 2005-07	Proposed Annual allocation by MS for 2008-12	Decision by European Commission on an allocation for 2008-12 period.	Difference from pilot phase	% change from Pilot
Germany	499	482	453.1	-45.9	-9.2
Greece	74.4	75.5	69.1	-5.3	-7.1
Ireland	22.3	22.6	21.1	-1.2	-5.4
Latvia	4.6	7.7	3.3	-1.3	-28.3
Lithuania	3.4	16.6	8.8	+5.4	+158.8
Luxembourg	3.4	3.95	2.7	-0.7	-20.6
Malta	2.9	2.96	2.1	-0.8	-27.6
Slovakia	30.5	41.3	30.9	+0.4	+1.3
Sweden	22.9	25.2	22.8	-0.1	-0.4
UK	245.3	246.2	246.2	+0.9	+0.4
Total	908.7	924.01	860.1	-48.6	-5.3

Source: European Commission http://ec.europa.eu/index_en.htm

Every country except the UK, Lithuania and Slovakia had their allocation cut, both in regard to what they sought, and what they received in the pilot phase.

Overall, a reduction of 5.3 per cent for these 10 countries is made from the Pilot Phase, representing a reduction of almost 50 million tonnes in the supply. Considering that there will be considerable economic growth over the 2006-12 period, which other things being equal would produce rising emissions and associated demand for allowances, the cut is non-trivial, and is likely to be more than replicated as decisions are made on the allocations of the remaining 15 Member States. This in turn will result in a rise in the price of allowances over the 5-year period, which will stimulate further abatement.

If economic growth were to continue in Ireland at an annual average of about 5 per cent per annum in real terms, the economy will grow by over 40 per cent between 2006 and 2012, with rising use of electricity and cement, and associated need to buy allowances to cover emissions. This will provide a considerable incentive to firms to invest in abatement.

ANNEX II SOME INSIGHTS FOR EFFECTIVE MOBILISATION OF RESEARCH AND DEVELOPMENT AS A POLICY INSTRUMENT

Resources for the Future: At a forum organised by Resources for the Future in Washington DC in 2001 on energy and environment, there was a session on R&D.[20] John Wise, vice president for research (retired) of Mobil Research and Development Corporation said: 'the government serves the public best when it supports research into technologies that support environmental remediation; development of domestic sources; fragmented, low tech industries such as homebuilding, and technologies that generate high risks for the developer, but high potential rewards to society.' Gerry Taylor, director of natural resource studies at the Cato Institute, said that while there have been a handful of success stories, the US government's overall track record on supporting energy R&D has been terrible. There are two fundamental reasons for this: incompetent programming, in the form of narrowly focused research initiatives, and political rather than economic motives influencing the funding process.

The *International Energy Agency* has a unique overview of energy systems around the world. Their conclusions - see box – support the hypothesis the programme needs to be long term, comprising both supply and demand dimensions.

The International Energy Agency and Energy R&D – a normative view.

Governments must ensure adequate long-term R&D, particularly in the light of industry's decreasing investment in it and the tendency for co-operation with industry to push the government R&D portfolio toward short-term, lower-risk projects. Measures to internalise the costs of environmental externalities would help stimulate industry to do more of its own long-term R&D.

Technological advances are needed not only in incremental improvements, which is the most usual in industry, but also 'great leaps forwards' are required. This will mean that governments must continue to play the role of the patient investor and wait to reap the rewards of this investment in later years.

Stimulation of private R&D requires both the push of public R&D and the pull of deployment programmes that can sustain the technologies until they are cost efficient on the market. (IEA, Energy Outlook 2000, p. 39)

National Academy of Science (US). In 2000, the House Interior Appropriations Subcommittee of the US directed 'an evaluation of the benefits' that have ensued as a result of the Department of Energy's (DOE) energy efficiency and fossil energy programmes. The report was requested by

[20] 'RFF Council Explores Balancing US Energy Needs and Environmental Protection,' *Resources* Issue 145, Fall 2001, Resources for the Future, Washington DC, p.22

Congress to identify general improvements that can be attributed to federal funding in these areas. In response to this the National Research Council published a report in 2001 that presented the results of this work.[21]

From 1978 until 1999 the US federal government spent $91.5 billion (2000 dollars) on R&D, mostly through DOE programmes. This represents approximately one third of total national public and private energy R&D funding. The two programme areas to be evaluated in this report – energy efficiency and fossil energy - have between them have received $22.3 billion or 26% of total DOE expenditure on energy R&D since 1978. In energy efficiency programmes, the transportation sector has always received the largest share of the budget- 42% in 2000, and 43% cumulatively between 1978-2000. Earlier on (i.e. in 1978), buildings and industry received 40% and 18% respectively. This had changed to 25% and 32% respectively in 2000. The fossil energy programme has historically focussed research on two Offices- the Office of Coal and Power Systems and the Office of Natural Gas and Petroleum Technology. Between 1978-1981 73% of the budget was invested in technologies to produce liquid and gas fuel options from U.S. energy resources- coal and oil shale. In 2000, however the coal conversion and utilisation portion of the budget represented only 30% of the fossil energy budget.

TABLE ES-1 Energy Efficiency Technology Case Studies Slotted in the Matrix Cells That Are Most Relevant Today

Type of Benefit	Realized Benefits	Options Benefits	Knowledge Benefits
Economic benefits (net life-cycle energy cost reductions)	**Low-e glass** **Electronic ballasts** **Advanced refrigerators** **Advanced turbine systems** **Oxygen-fueled glass furnace** **Lost foam casting** DOE-2 (applied to design) Forest products	**Forest products** Compact fluorescents	**DOE-2 (applied to standards)** **Compact fluorescents** Black liquor gasification Forest products Oxy-glass technology (applied to other areas) Lost foam **Free-piston Stirling heat pump (failure)**
Environmental benefits	**Indoor air quality, infiltration, and ventilation** Electronic ballasts Advanced refrigerators Low-e glass Oxy-glass	PNGV DOE-2 Indoor air quality (IAQI&V) Forest products	**Catalytic converters for diesels** **PEM fuel cell for transportation and distributed generation** **Black liquor gasification** **Advanced batteries for electric vehicles** Indoor air quality (sick buildings) **Stirling engine for automobiles (failure)**
Security benefits	Advanced turbine systems	**PNGV** DOE-2 (peak load analysis)	Advanced batteries for electric vehicles PEM fuel cells for transportation and distributed generation

NOTE: PEM, proton exchange membrane; PNGV, Partnership for a New Generation of Vehicles. The table does not indicate possible future position as a result of completing R&D. No significance should be attached to the ordering of the entries in the cells. When more than one type of benefit is relevant for a technology, the primary benefit is shown in bold.

The main task carried out by the assessors was to find a methodology to evaluate the benefits accrued by the programmes. One of the main challenges was to find a method that would represent both economic and non-economic benefits (and costs) of the programmes. This was important, as the nature of public funded research programmes is such that public benefits exist that are not lucrative for the private sector (for technologies not yet developed, for example). An evaluation framework was developed that considered the benefits and costs, both quantitative and qualitative, of the programmes. For each programme the committee selected a number of case

[21] NRC, 2001: 'Energy Research at DOE: Was It Worth It?' National Academy Press, Washington DC

studies that varied greatly in size but were representative of the programmes. These were then fitted in to the evaluation matrices.

The conclusions of the assessment were that in general the DOE programmes had 'yielded significant benefits (economic, environmental, and national security-related), important technological options for potential application in a different (but possible) economic, political, and/or environmental setting, and important additions to the stock of engineering and scientific knowledge in a number of fields'. The committee judged the net realised benefits of the programmes to be in excess of the DOE investment.
However the committee also found many limitations to the benefits and potentials for improvement. They determined that DOE did not employ a consistent methodology to assess the programmes and that too often only the economic benefits were quantified and regularly overstated. The committee also ascertained that the organisation and management of the programmes made a significant difference to the results of the programmes.

The energy efficiency programmes reviewed realised approximately $30 billion (1999 dollars) in benefits that mainly came from three modest building projects begun in the late 1970s and substantially exceeded the R&D investment of $7 billion (1999 dollars). The fossil energy programmes reviewed provided benefits in total of nearly $11 billion that exceeded overall the costs of $10.5 billion, however the period from 1978-1986 did not realise economic benefits.

The largest benefits were achieved by an order of magnitude in avoided energy costs in the buildings sector and avoided environmental costs from NOx reductions achieved by a single programme in fossil energy.

The committee recommended that DOE develop and utilise an evaluation framework similar to that used here to regularly assess the benefits and costs of their programmes. DOE also needs to consistently record budget and cost-sharing data for all projects to enable better assessment and evaluation. The committee also comment that project failures do not mean overall programme failure. In fact a balanced portfolio of R&D programmes will generally contain some project failures, indeed one that does not could be viewed as overly conservative. Programme areas that did not live up to expectations were ones in which DOE tried to introduce a new technology but without the necessary incentives for adoption by the private sector.

A significant recommendation of the committee was that for short-term R & D programmes that are meant for rapid deployment, DOE should consider using some of the funds to develop appropriate economic incentives to enable market penetration of the technologies. The committee found that industry participation in R&D programmes should be encouraged, however DOE must ensure that long-term as well as short-term goals are pursued.