THE HOUSE OF LORDS ECONOMIC AFFAIRS COMMITTEE INQUIRY INTO THE ECONOMICS OF RENEWABLE ENERGY

Evidence from The Institution of Engineering and Technology (IET)

INTRODUCTION

1. The Institution of Engineering and Technology (IET) is pleased to make this contribution to the House of Lords Economic Affairs Committee's enquiry into the economics of renewable energy.

2. There are many shades of opinion, and many parties seeking to advance arguments supporting their own perspectives. We expect you to receive a diversity of responses reflecting many shades of opinion. The inherent complexity of energy technology and economics makes this very difficult to disentangle.

3. The IET's role is to provide an independent perspective on engineering issues. We attempt in this response, and in particular in Annex A, to explore the factors which affect the economics of renewable energy, to help the Committee understand and interpret the responses received from others.

KEY MESSAGES

4. The points the IET particularly wishes to emphasise are:

   - In developing renewable energy policy, understanding the "timescales" is as important as understanding "cost". This aspect is particularly lacking from public debate.

   - The cost data for renewable energy contain huge variable elements, particularly as we compete for manufacturing capability and expertise in a global marketplace. They can also change substantially over time due to factors that are not entirely rational or predictable.

   - Recent increases in oil price, if sustained, have the potential to be transformational to the economics of renewable energy, and also energy efficiency. Sustained high oil prices will impact consumer and business behaviour, and also perhaps make it easier to build a stronger public consensus over the need for renewable energy and its associated infrastructure.

RESPONSES TO QUESTIONS

Q1. How do and should renewables fit into Britain's overall energy policy?

5. Renewables currently meet a very small fraction of our total energy needs and it will take decades of sustained support before they begin have an appreciable impact. This is an enormous long term challenge that will require strong and sustained Government commitment, as a part of a long term multi-stranded energy policy.

6. A holistic energy policy is required, balancing costs, benefits and deliverability of a full range of options including demand reduction.

7. Many low carbon initiatives, particularly demand reduction strategies, have vast potential and are of little or even negative cost. However these tend to require behavioural change and can be politically and socially difficult to deliver on a large scale. A challenging but realistic view therefore needs to be formed of their potential, both now, but also in the future as social attitudes change. The change in social attitudes can be accelerated by appropriate marketing, a route that should be explored further by government.

8. Within this framework there will be a substantial role for renewable energy, and every opportunity should be taken to develop and deliver projects using today's technology, and to support the evolution of new technologies best suited to the UK's resources (e.g. deep water offshore wind, wave and tidal).

9. One issue of great importance is time to market. Large scale deployment of renewables and also other carbon saving measures requiring mass behavioural change will take many years - perhaps 20-30 years to become a core part of the market. In the meantime existing energy assets will require replacement. Whilst this should in no way slow down efforts to maximise renewables, it is necessary to take a realistic view of the ongoing needs for secure energy supplies in the short to medium term. New gas and coal fired generation will have to be an important part of this picture. Carbon capture and storage represents a possible route to decarbonise this at a later date, but the economics of this remain to be proved. Nuclear provides a low carbon option for the medium to longer term, i.e. after 2020.

How does the UK’s policy compare with the United States, Australia, Canada, and other EU countries?

10. The size of a country, its political ambitions, meteorological climate and existing electricity system will influence the way in which renewable policy is adopted.
11. Many European states have used generous support schemes to deliver multi GW scale deployments. A “feed-in tariff”, as adopted in many EU states, runs contrary to the concept of a free market in electricity. However, the clarity of these schemes has made it easier to get projects done. Germany, Spain and Denmark have the highest penetration of renewables in the world and have feed-in tariffs.
12. Tax credits in the USA have played a role in encouraging mass deployment there.
13. In countries such as China the political decision making process has facilitated rapid deployment. However all countries are different, and the UK's high population density and democratic tradition have acted as barriers here. Offshore wind offers a solution in the UK by placing the technology out of sight, but it is a high cost option.

Q2. What are the barriers to greater deployment of renewable energy?

14. A generalised answer could be misleading. In Table 1 we suggest the barriers for each technology together with actions that would be required to address them.

Are there technical limits to the amount of renewable energy that the UK can absorb?

15. There are no fundamental limits to the amount of renewable energy the UK could absorb in the long term. Technical challenges increase with increased levels of renewable generation but these are soluble given the will to do so.

16. However in the short term intermittent renewables are probably limited to around 20% of total capacity. The large scale deployment of intermittent renewables has the potential to challenge grid stability. However if we gradually re-engineer our networks, loads and systems to deal with higher levels of renewables, the penetration level can increase. This process would take several decades of concerted effort.

17. The technologies of demand management, for example by smart metering and smart networks, have the potential to make this more manageable. The problem will also emerge only slowly as the deployment of intermittent renewables will take time, and it will be possible to adjust the approach as the evolution of technology and social behaviours takes place over time.

18. The issues that will set an upper limit to the level of renewables that are eventually deployed are economic rather than technical. The cost of electricity in a 100% renewables system would most likely be very high. However given the outlook for fuel prices, equipment capital costs and the value of carbon it is hard to see any scenario where energy costs do not increase substantially from today in real terms. It may be argued that this would then incentivise energy saving properly.

Q3. Are there likely to be Technological Advances that would make renewable energy cheaper and viable without Government support in the future?

19. Research into the currently unproven renewable technologies such as carbon sequestration, ocean thermal gradients, wave energy and nuclear fusion requires sustained effort and is very costly. At the current rate of progress these technologies will not be available to contribute to any significant scale to meeting the carbon reduction targets for 2020, and their ability to contribute materially to the 2050 target must be regarded as uncertain at the moment, though it is very much hoped that this will become more certain over the next few years.

20. Good news about research breakthroughs is beneficial in that it could encourage young people to consider a career in engineering research. However, policy makers may gain the impression that all the hurdles are close to being overcome, which is far from the case. Policy makers need to be aware of an inherent optimism bias in the academic community which results from the nature of the research grant awarding process, and also in the very different challenges of cost-effective engineering deployment at scale, once technologies have been demonstrated to work under ideal conditions

21. Government policy should adopt a better integrated strategy covering the *whole innovation chain*, to maximise the chances that successful R&D will deliver successful products. Piecemeal policies have delivered mixed results, mainly limited to the deployment of mature lower-cost technologies at the expense of larger-scale and emerging technologies.

22. We recommend that Government policy should:

- Be more selective in setting priorities and allocating funding for early stage research;
- Be more successful at leveraging support for costly demonstration and commercialisation;
- Take advantage of the potential for international partnerships;
- Pre-emptively identify and address barriers to deployment, including the supply of technical skills, cost, robustness and maintainability.

Q4. Arguments for and against "feed in tariffs"

23. Funding support for renewables exists to:

- Provide a proxy for carbon pricing where this does not yet exist, and
- To encourage development of technologies and deployment capacity

24. The market mechanism used in the UK (the Renewable Obligation) provides a relatively sophisticated means to provide incentives to develop utility scale renewable energy sources; however it is too complex to send appropriate messages to those considering small scale renewables. These also have a part to play in meeting climate change targets and improving security of energy supply, but householders and small businesses are not equipped to handle cumbersome incentive mechanisms, which are therefore a barrier to deployment. Simple incentive mechanisms, for example feed-in tariffs or capital grants, are more likely to lead to wider deployment.

25. However, care needs to be taken to avoid perverse incentives in this area. Whilst certain small scale renewables can be cost and carbon-efficient, other small-scale renewables are of considerably less benefit. Public or consumer funding support would better be directed towards demand reduction, energy efficiency or larger scale low carbon projects rather than funding what can, in effect, be totemic installations rather than real benefits.

26. There are arguments to say that some of these totemic technologies will become more cost effective over time and should therefore be supported. Solar PV is an example of this.

27. On a global level there are other considerations: the effect of generous feed in tariffs in Germany and Denmark has led to the situation where there is a high level of solar photovoltaic deployment in countries with relatively low solar radiation, compared with low levels of adoption in southern European countries with the most sun. In technologies where resources are in short supply this may not be the most efficient global policy.

Q5. Are the current transmission and distribution systems capable of managing a large share of intermittent renewable electricity generation and, if not, how should they be changed?

28. The existing transmission network connects demand centres and coal fields (coal being the fuel of choice when the existing transmission network was constructed in the 1960s) The significant sources of renewable energy tend to be remote from load centres and grid access points, thus requiring heavy investment in network extensions and consequential delays to connection. Note that the long lead times for installing major transmission lines

result from the need to consult affected land owners and residents through the planning process.

29. Where renewables are closer to load centres, new technology and adaptation will be required for multi-directional flows of power in electrical distribution systems to make effective use of microgeneration, although there is currently adequate capacity in the existing networks to mean this will not be a major barrier for several years.

30. Generally the costs of new overhead transmission lines and substations are not a major barrier to new projects – this is much more driven by planning consents. However this position will change if planning consent requires the use of buried or sub-sea cables. At major transmission voltages, underground cables cost around 10-20 times overhead lines, though this gap narrows substantially at lower voltages. The cost of major transmission lines in the UK is quite uncertain as there is little recent experience of building them in any substantial way. An estimate of £1m per km is a reasonable all-in figure to use for major overhead transmission lines for approximate calculations. Additional costs are incurred for substations; these are often included within a power station budget for new generation. For example, the cost of a new substation for a recent 1000 MW class generator was around £25-£30m. These costs have all increased substantially in the last few years, mainly as a function of global commodity and equipment prices.

31. However even though overhead lines are usually of modest cost in comparison to power stations, it is important that the regulated environment in which the transmission and distribution companies operate provides adequately for strategic investment in new lines when needed.

32. The UK also needs to consider the impact of expected climate change on the power infrastructure and adaptation strategies that will be necessary. This is likely to affect the design and location of substations and lines, and to require modifications to existing infrastructure. It may also affect the design, location and economics of generating plant.

Q6. External costs – environmental impacts

Not addressed in the interests of brevity.

Q7. How do the costs of generating electricity from renewables compare to fossil fuel and nuclear generation?

33. This is likely to be a key question for the Committee. However, the inherent complexity of the subject makes this very difficult to disentangle. This is because:

    - Cost estimates change substantially over time owing to volatility in world equipment and services markets
    - Actual costs of existing renewables cannot be compared on a like for like basis with projected costs of unproven technologies. While hydro-power, on-shore wind and other established technologies have been critically appraised by commercial concerns in order to make significant investment decisions, the energy technologies that are still in the R&D phase have not been appraised in this way. It is not possible to give reliable estimates of unproven technology costs because the timescales for their deployment are some way in the future.
    - Forecasts of economies of scale and can easily be over- or under estimated and require detailed engineering input.

- The factors affecting cost changes are not entirely rational or predictable.

34. Data affecting costs contain huge variable elements that require sophisticated analysis. It is impossible to assess the validity of any cost estimate or comparative cost estimate without knowing the many assumptions that have been fed into the calculations.

35. We address this issue in more detail in Annex A.

Q9. If the UK is to meet the EU target that by 2020 15% of energy consumed will come from renewables, will most of this come from greater use of renewable sources in electricity generation? If so, why? Should British support for renewables in other countries be allowed to contribute towards meeting the target for the UK?

36. IET members and their employers are working worldwide on energy projects. It is often true that energy is used much more carbon-intensively in other countries, particularly in the developing world. Also there is a high rate of build of carbon intensive infrastructure such as coal fired power stations, which will have lives of 30-50 years and potentially lock in emissions for this time. Measures to reduce these emissions can yield carbon reduction benefits many times those that the same investment could yield in the UK. These measures include renewable energy projects but equally improvements in end use of energy. However there are challenges in auditing these benefits that are only partially addressed in the current Kyoto mechanisms.

37. There is also a question of whether “follower” countries in this area would give less regard to the UK as a leader if it was seen to be not putting its own house in order.

38. These are perhaps more political than engineering questions and as such the IET does not comment further.

Table 1. Current status, future prospects and actions on renewable technologies in the UK

Where are we?	What can be achieved?	What is holding it back?	What needs to be done?
ON-SHORE WIND POWER Technology is mature and economical with current policies in utility scale application. Not really effective in small scale application. Very large projects will have significant visual impact in UK landscape	Gradual expansion of capacity (over 15GW of potential wind capacity has been applied for in Scotland alone).	Objections under planning regime. Transmission grid capacity. Increasing costs due to global competition for raw materials and equipment. Concerns about managing variability for increased wind capacity.	R, D&D into active grid management.
OFF-SHORE WIND POWER Fundamental technology is mature but uneconomic under current policies. Deployment offshore will continue to bring technological and operational challenges.	Potential for large scale development.	High capital cost - increasing due to global competition for raw materials and equipment. Transmission grid capacity. Transmission/distribution grid expansion. Concerns about managing variability for increased wind capacity.	May be favoured under reformed (banded) Renewables Obligation. R, D&D into active grid management.
HYDROELECTRIC POWER Mature technology.	Around 1000 MW of future potential in UK, vast remaining potential worldwide		
TIDAL POWER Several technologies exist in prototype, in need of full-scale demonstration and commercialisation. About 10-15 years from full commercialisation, and uncertainties over cost competitiveness.	Sizeable natural resource to be exploited in UK. Potential for technology export.	Risk/cost of demonstration. High initial costs and extended operating lifetimes.	Demonstration support. Development of standards.
WAVE POWER Several technologies exist in prototype – all inevitably large with high embedded energy and uncertain maintenance and operating costs. At least 15 years from large scale commercialisation.	Sizeable natural resource to be exploited in UK. Potential for technology export.	Risk/Cost of demonstration. No large companies pushing the technology. Size of devices (typically 100m per MW) and impact on shipping. Requires hundreds of machines, each the size of a tube train, packed with hydraulics, generators, etc Energy transmission from large numbers of floating structures. Limited supply chain.	Demonstration support. Development of standards. Deployment requires the commitment of large shipbuilders and power engineering companies – commitment that will take time to build.
TIDAL BARRAGE Technology is proven, but	Multi GW scale possibilities in UK (e.g.	Cost, environmental issues, investment risk, grid	Studies in progress. Substantial structural

Where are we?	What can be achieved?	What is holding it back?	What needs to be done?
capital costs tend to be very high	Severn Barrage), but power limited to certain (changing) times of day	connections	change to electricity market and/or government subsidies probably needed for large schemes.
SOLAR PHOTOVOLTAICS Mature but costly technology, currently used mainly in niche and 'showcase' applications.	Limited potential for improvement of current (first and second generation) technology but some scope to improve production costs through improved manufacturing processes. Higher efficiency and more flexible materials currently in development could result in lower-cost, higher-efficiency applications. Mass deployment has been achieved where government support has been substantial (e.g. Germany, Japan).	High capital cost. Competition for raw materials (silicon) resulting in high cost. Lack of skilled installers. Lack of information and accreditation schemes.	R&D into manufacturing. R&D into "second generation" thin film silicon PV, organic PV and high-efficiency "third generation" PV (e.g. quantum dots). Skills development. Technology and installation accreditation.
SOLAR THERMAL ENERGY Technology is mature and relatively cost-effective.	Large potential for domestic use, both retrofit and new build.	Lack of skilled installers. Lack of information and accreditation schemes. Integration with building stock.	Skills development. Technology and installation accreditation. Introduction of 'microgeneration-ready' standards for new homes.
CONCENTRATED SOLAR ELECTRICITY Mature but quite expensive	Very suitable for desert regions – requires plenty of sunshine and large land areas	Not suitable for UK; long term potential for mass application in North Africa and export to Europe	Support studies
ENERGY FROM WASTE A variety of mature or near-market technologies exist for recovering energy from waste. Electricity generation from landfill gas is the most widely used.	Significant potential, depending on local circumstances.	Potential for landfill gas limited by restrictions on landfill. Planning consent for thermal waste to energy plants.	Interaction with waste management policies.

Where are we?	What can be achieved?	What is holding it back?	What needs to be done?
BIOMASS Technologies using 'first generation' biomass resources for heat, power generation and transport are fairly mature but relatively costly. Higher-yield 'second generation' biofuels are being researched but are at least 10-15 years from commercialisation.	Biomass for heat and power generation could be more widely used in parts of the country. Potential limited by other demands for land use, especially food crops. Currently biomass is imported from Europe, this is likely to reduce as EU states all turn to biomass to achieve their renewable energy targets.	Lack of supply chain coordination. Lack of skilled installers. Lack of information and accreditation schemes.	Establishment of sustainable supply chains. Skills development. Resource, technology and installation accreditation. R&D into 'second generation' biofuels.
GEOTHERMAL Mature but costly technology for UK. Applied on a large scale at lower costs in countries with good resource (e.g. Iceland, Philippines)		High cost of installation. Lack of skilled installers. Lack of information and accreditation schemes. Integration with building stock.	Skills development. Technology and installation accreditation. Introduction of 'microgeneration-ready' standards for new homes.
GROUND SOURCE HEAT PUMPS Mature technology that can be cost effective	Significant opportunities in space heating, easiest to apply in new buildings or major refurbishments	Getting people to apply the technology	Changes to building regulations
GREEN BUILDING DESIGN (USING NATURAL HEAT, LIGHT AND COOLING) Exemplar projects abound but not deployed universally	Huge opportunities for new construction and retrofit, more examples of best practice needed for retrofit	Lack of interest/knowledge amongst people commissioning buildings or retrofits; weak building regulations and enforcement	Aggressive approach to building regulations and their enforcement; better marketing of the benefits, higher energy prices.
HYDROGEN AND FUEL CELLS Hydrogen is not inherently renewable; in the near term, the most likely sources are fossil fuels, resulting in CO_2 emissions unless accompanied by abatement technology. This is an immature technology.	Trials in USA using fuel cells power by off peak electricity to provide hydrogen for motorcycles. Portable power sources (e.g. phones, laptops) in advanced development.	Finding cost effective applications and developing hydrogen production infrastructure. Also ensuring that power to make the hydrogen does not come from high carbon sources.	Basic R&D on hydrogen generation. R&D on hydrogen transport infrastructure requirements.

STORAGE TECHNOLOGIES

Where are we?	What can be achieved?	What is holding it back?	What needs to be done?
PUMPED STORAGE HYDRO Mature technology, often quite expensive	Allows storage of energy to balance intermittent renewables and/or demand peaks and troughs. Large scale possibilities exist in UK and have been studied in the past.	Not an attractive investment, also potential environmental issues.	Flagging of opportunities, and impact on market price of intermittency. Will not be commercially attractive until value of intermittency or gap between peak and base prices becomes high.
DEMAND CONTROL Technically possible but massive deployment challenge	Potentially allows non essential demand to be removed at times of peak demand or low outputs from intermittent generation	Market not yet ready to deploy it; attention needed to regulatory and legislative frameworks.	Deployment of smart meters is a first step and government is active through Energy Bill enabling provisions, changes to domestic appliance standards and wiring regulations may be needed. Deployment of ESCOs would help (as in Energy White Paper)
SMART WHITE GOODS Manufacturers are engaged with innovators; selective trials taking place.	Potentially allows interruptible demand to be 'intelligently disconnected' at times of power system stress. The value of this is could be significant because it may be a cost effective way of replacing expensive fast-response standby generation on the grid.	Constructing the 'value chain' so that those who bear the costs can receive the rewards. Also needs mass roll out. Needs consumer acceptance.	Proving the technology (in hand with some big white goods manufacturers); demonstrating it effectiveness and commercial value; constructing a route to market and the value chain for rewards.
ELECTROCHEMICAL STORAGE Significant R,D and D done in UK a few years ago but subsequently abandoned	Short term energy storage to manage demand peaks or low intermittent generation	Market not yet interested	More development work. Will not be commercially attractive until value of intermittency or gap between peak and base prices becomes high

For further details on renewable technologies, see the IET Factfiles: http://www.theiet.org/factfiles/index.cfm

ANNEX A

FACTORS INFLUENCING COMPARITIVE COSTS OF RENEWABLE ENERGY

A1. Quoted cost estimates for future renewable energy generation vary widely and comparisons can be meaningless unless the costs quoted are based on the same input assumptions. Particularly misleading results can be obtained by comparing the quoted costs of renewables already in commercial production with indicative costs of those still at the research stage.

A2. Below we set out the factors that need to be taken into account when estimating future costs of renewable energy technologies. We also discuss the factors influencing the cost of alternatives which are necessary for comparison in a holistic energy policy.

COSTS OF ELECTRICITY OR HEAT FROM RENEWABLE SOURCES

A3. Costs of electricity or heat from renewable sources are affected by

a) Capital costs of equipment

b) Other capitalised costs of producing complete working power or heat plant

c) Capital costs of necessary infrastructure to export the power or heat to where it can be used

d) Quality of the primary energy resource being converted into energy or heat

e) In some cases, the cost of providing primary energy resource at the point of use

f) Costs of operation and maintenance

g) Costs of finance and equity return expectations

h) In some cases, costs associated with intermittency of output

We explore each of these in turn below:

Capital costs of equipment and construction

A5. The capital cost of equipment for energy production depends on a wide and sometimes surprising range of factors. At one level there is variability from site to site (for example different wind farm layouts to suit different landscapes and ground conditions require different expenditures on cable lengths and foundation requirements; different biomass fuel types require different storage, handling, combustion and emission control solutions).

A6. However at least as significant is pricing pressure in global markets for all types of equipment depending on supply and demand balance, and raw materials costs, for example copper and steel prices. At the moment almost all power equipment is supply constrained globally, and we have seen price rises over the last two to three years of 50-100%. In turn this signals investment to increase supply capacity and potentially new entrants to the market, creating the possibility of downward price corrections in the future. It also may cause developers to defer projects in the hope of securing better pricing and availability later.

A7. You are therefore likely to be presented with data showing very wide ranges of equipment capital costs. Also the pricing prevalent today is unlikely to represent a long run average price.

Other capitalised costs

A8. Other costs associated with building new power plant include land acquisition, environmental and social assessments, permits, engineering costs, legal fees, costs of planning gain, and the internal costs to organisations of having staff devote effort to developing projects. In aggregate these tend to be in the range of 5-20% of the capital costs of equipment and construction, and are proportionally higher for smaller projects, 'first of a kind' projects, and projects with unusual characteristics.

Infrastructure capital costs

A9. For power plant these costs include the connection to the grid and any necessary reinforcement of the grid necessary to allow the plant's output to be exported to a point of consumption. This can include anything up to major new transmission lines and substations. Infrastructure investment is as complex as power station investment and is subject to many of the same constraints. In particular the costs of gaining planning consent for new transmission lines can be very substantial, and transmission infrastructure costs are highly influenced by global commodity prices (steel, copper, aluminium).

A10. Infrastructure costs also vary hugely depending on plant location. At one extreme a wind farm in southern England close to an existing major substation may have very low infrastructure costs, whereas a similar wind farm in northern Scotland may incur infrastructure costs of the same order as the costs of the wind farm itself.

A11. For renewable heat the same issues apply, but at a more local scale, as heat degrades in long distance transport. The costs of a district heating network can be substantial, especially if it is to be used to supply existing premises rather than a new development.

Quality of primary energy resource

A12. Many renewable technologies harvest a primary energy resource made available free of charge by nature. However the cost of a unit of energy production depends substantially on the extent to which the resource is available to be harvested. This can vary significantly from site to site. For example achieved capacity factors for onshore wind farms range from 10% to 35%.

A13. In assessing claimed costs it is important to understand the underlying assumptions used.

Costs of providing the primary energy resource at the point of use

A14. Further costs arise where the primary energy resource requires intervention to be made available in a form suitable for use at the power station location. This is a particularly important issue for biomass and waste.

A15. Some biomass and waste projects are located adjacent to a ready supply of waste material (e.g. woodchips from a wood processing plant). Others can be paid to take a feedstock (e.g. municipal solid waste which would otherwise attract landfill tax). However those which take feedstock from energy crops, or distributed sources of waste, will incur a transport cost (which can be substantial) and may have to compete for alternative uses for the feedstock such as food production, or alternative biomass power plants. There is already substantial import of biomass for power production. It should be noted that individual plants are designed for particular types of biomass – it should not be assumed that a plant designed for woodchips can burn chicken litter for example.

A16. Calculating the cost of the delivered feedstock is not only dependent on the particular circumstances of each plant but is also very vulnerable to future supply and demand balances, both locally and internationally. The UK's relatively small land mass means that a heavy dependence on biomass will imply substantial imports. Other countries in Europe and beyond are considering major roles for biomass. Hence in the future costs of feedstock are likely to rise, perhaps substantially. Transport costs are also likely to increase with increasing oil prices, and the transport has its own emissions implications.

Costs of operation and maintenance

A17. These costs include staff salaries, overhauls and repairs, rates, insurance and use of grid charges. They vary with technology (e.g. onshore wind requires almost no staff and limited maintenance, whereas biomass is relatively labour and maintenance intensive). However for a given technology they are generally reasonably predictable. An exception to this are the offshore technologies, where there is as yet limited experience of long term maintenance and hence less certainty.

Cost of finance and equity return expectations

A18. Unit electricity costs vary depending on financing costs, and the return expectations of developers. Both of these depend on the perceived risk of the investment. The risks involved include engineering performance but also perceptions of risk of change in regulatory environment or other uncertainties. For the established technologies these are well established, but less so for new technologies.

Costs associated with intermittency

A19. Intermittent technologies such as wind and wave power impose costs on power system operations around the provision of replacement capacity. These costs are negligible when the amount of intermittent generation is small, but could be substantial at levels of intermittent renewables implied by the EU targets for 2020, especially if dedicated power plant has to be provided as back-up. Alternative options such as intelligent load management are developing, these in turn will incur infrastructure costs for control and metering systems. Concentrations of intermittent generation in particular geographic regions, e.g. Scotland, will also create a need for investment locally to ensure the stability of local and regional grids.

ALTERNATIVES TO RENEWABLE GENERATION

A20. When assessing renewable generation costs against other options it is important to understand the uncertainties in

- other generation options, and/or
- non-generation options such as demand reduction and energy efficiency.

Alternative Generation Options

A21. The alternative generation options are gas and coal fired power plant and, potentially, nuclear energy. All the same issues as for renewable plant affect the cost of providing the physical generation assets. Market pressures worldwide affect pricing in just the same way, over time this will increase supply capacity and may ease pricing. However barriers to entry are generally higher in the gas, coal and nuclear power plant equipment markets and their responses are likely to be more sluggish, meaning that higher prices may persist for longer. However a large unknown at present is the impact of low cost Chinese plant entering world markets, particular coal fired. This is something that is currently gathering momentum rapidly.

A22. The major issue governing cost of alternative generation options however is global fuel prices. Recent oil price increases have been well publicised, and the consensus is that we have entered a prolonged period of much higher oil prices. Gas prices are linked to oil prices through indexation clauses in long term gas supply agreements in Europe, and we can therefore expect a prolonged period of high gas prices. Coal prices are set more globally, and are currently high driven by demand in emerging economies and high oil and gas prices. A major global recession could soften this, but the general picture is of energy becoming much more expensive. However there seems little consensus over how much primary energy prices will increase over a 10, 20 or 50 year horizon.

A23. A further uncertainty is carbon price, especially over the long term. To date this has had limited impact; it seems certain this will change, but only limited progress has been made on the international commitments that will give this clarity.

A24. This backdrop increases substantially the attractiveness of non-generation options such as demand management and energy efficiency.

Demand Management and Energy Efficiency

A25. A whole spectrum of these is available, ranging from home insulation to the redesign of cities to minimise car usage. Many of these options are low cost (even negative cost), but have not proved popular owing to their transaction costs or lifestyle implications.

A26. Heavily rising energy prices are likely to change this and it is interesting to speculate on possible consequences. An early sign is the reduction in motoring that seems to have occurred between January 2007 and January 2008.