The Royal Academy of Engineering

Renewable Energy Strategy

Response from The Royal Academy of Engineering to the Department for Business Enterprise & Regulatory Reform

September 2008

Q1: How might we design policies to meet the 2020 renewable energy target that give enough certainty to business but allow flexibility to change the level of ambition for a sector or the level of financial incentive as new information emerges?

Reaching the target of 15% of the UK's total energy supply to come from renewable sources by 2020 will be extremely challenging. The Academy agrees that a wide range of policy instruments and technological solutions will be needed to tackle climate change and security of energy supplies. Renewable energy clearly has a central role to play. There is, however, some concern that setting such a difficult target for renewable energy will detract attention from other low-carbon technologies, such as nuclear power and carbon capture and storage, which have an equally important role in mitigating climate change.

Effective policy must have clear and realistic goals. In terms of climate change, the goal must be to reduce emissions of greenhouse gases in order to limit predicted rises in global temperature. The Climate Change Bill will enshrine in law the necessary emissions reductions and this must be the main target for UK energy policy.

Most of the relevant technologies and infrastructure have a lifespan of several decades. Policies must therefore be similarly long-term in nature. There is a danger that focussing on a single target in 2020 will result in short-term solutions that will not be sustainable. The case of biofuels has shown that care needs to be taken before committing to a particular technology.

Q2: To what extent should we be open to the idea of meeting some of our renewable energy target through deployment in other countries?

The Academy agrees with the consultation's stated intention to allow only a limited proportion of the UK target to be tradable. The vast bulk of the target needs to be delivered nationally as the overriding objective must be to genuinely decarbonise our own economy and any significant deployment outside the UK would deflect from this goal.

It must also be recognised that if the option for the UK to meet its target through deployment in other countries is allowed, it might also be the case that other countries could meet their targets through projects in the UK, thus negating some potential gains.

Q3: In the light of the EU renewable energy target, where should we focus further action on energy efficiency and what, if any, additional policies or measures would deliver the most cost-effective savings?

As the consultation document points out, there are already many schemes either in operation or about to come into place that are designed to reduce the amount of energy used across all sectors of the energy market.

The heavy industrial and power generation companies have been amongst the first to be subjected to carbon reduction legislation and regulation. The fact that in this sector relatively few players are responsible for a significant proportion of carbon emissions and these are already heavily regulated means that progress here has been comparatively easy to date. Indeed, figures from Defra show that emissions from business have fallen since 1990 although there is evidence to suggest that the transfer of manufacturing to emerging economies such as China and India has displaced the associated emissions away from the UK. Recent figures also show that

this reduction has levelled off recently so continued effort here is required.

The domestic and transport sectors have proved more challenging for a number of reasons. One of the most significant of these is the large number of individual sources of emissions which must be affected. Reducing emissions in both sectors requires a change in behaviour of almost every person in the country. The recent increases in fuel and electricity prices have show that change is possible and that price signals are effective, however, energy prices are volatile and cannot be relied upon to effect permanent change.

In the transport sector the lack of any obvious low-carbon technology to replace fossil fuels means that it is crucial to increase the efficiency of vehicles and reduce the number and average length of journeys.

In the domestic sector, well established technologies such as better insulation, double glazing and more efficient appliances are still the most cost effective measures and the Academy welcomes the recent announcement by the Government to increase expenditure in this area through their home energy saving programme.

The more information people have regarding their energy usage the better able they will be to make the right decisions. Smart meters should help with this and the results of the Government's current trials of such meters are eagerly awaited. If these prove successful it is hoped that the energy utilities will be strongly encouraged to widely adopt the technology.

Retro-fitting properties with energy efficiency measures is of central importance. Building new homes to high standard in terms of carbon emissions should not be neglected but housing stock has a long life span and by 2020 the majority of properties that exist today will still be in use. Thus, if results are expected from improved energy efficiency, efforts must be focussed on upgrading the current housing stock.

Q4: Are our assessments of the potential of different renewable electricity technologies correct?

Generating a third or more of our electricity from renewable sources by 2020 would be an enormous challenge. While it would be difficult to claim that the assessments of the various renewable technologies in the consultation document are incorrect, they do seem to represent an extremely optimistic forecast at the limit of what might be possible.

We would agree that the biggest growth is likely to come from wind – both onshore and offshore. Over the past few years onshore wind technology has matured faster than other renewables such as solar or marine and has now reached a point where it is a well established form of electricity generation. Continued growth in this sector is to be expected, but the rate of growth cannot be guaranteed. Constraints in the supply chain, planning consent and grid connections still exist and could easily affect the projected growth. The prime locations are quickly being used up and the failure of large projects such as the Lewis wind farm are indicative of the sort of setbacks that could result in targets being missed.

The projections for growth in offshore wind give even greater cause for concern, based as they are on a much lower base level and shorter history. It is likely that offshore wind projects will not be held back by planning constraints as much as onshore. But supply chain constraints and grid connections are even more of an

issue as there are extra technical difficulties to deal with when installing and connecting wind turbines at sea. It is also expected that offshore turbines will have a higher load factor than their onshore equivalents, but this remains to be proved, especially when maintenance issues are taken into account. It is likely that offshore turbines could suffer more prolonged periods of down-time owing to access restrictions.

So while the projections for wind energy may be met, even the slightest of technical setbacks or miscalculation in the models could easily result in a serious shortfall. Equally, bottlenecks in the supply chain or planning process – both of which are highly possible - could also result in the targets being missed by a significant margin.

It would be sensible, therefore, to have some margin of error built into the projections. One possible area where the potential is underestimated is in co-firing of biomass. This is a proven option and can be adopted at existing plants, thus eliminating problems from planning or grid connection.

The Severn Barrage also represents a significant potential source of renewable energy with the added advantage of being predictable. It would pose, however, an unprecedented engineering challenge in terms of skills, supply chain and project management with a corresponding large price tag. But if the renewable target is to be reached, serious consideration must be given to large projects such as the Severn Barrage. The Academy and the wider engineering community is actively supporting the feasibility study BERR is currently carrying out and looks forward with interest to its results. If the decision to go ahead is taken, the Government must be careful not to count too early on the potential of the barrage to help meet the renewable target. With a project of such complexity, completion to a tight schedule cannot be guaranteed.

An additional area of concern is the issue of intermittency. Research has shown that although many renewable sources of energy are intermittent in nature, the national grid is able to cope with a certain amount of intermittent generating capacity (about a fifth) without requiring a significant amount of back-up thermal generation and with only modest rises in costs. If the potentials laid out in the consultation document are fulfilled it is likely that this proportion will be exceeded and the UK will be moving into unknown territory. Indeed, even the models used to predict the performance of the grid generally only assume a maximum of 20% intermittent supply. Moving beyond this level will raise the potential risks in terms of costs and security of supply and may prove to be a serious barrier to achieving the target without additional expenditure.

Q5: What more could the Government or other parties do to enable the planning system to facilitate renewable deployment?

The Academy supports the measures set out in the current Planning Bill and it is hoped that, once this Bill receives Royal Assent, many of the constraints to the deployment of all low-carbon technologies, including renewables, will be removed. It is particularly important in the case of large projects as these will provide the greatest benefit in the shortest time.

It is also important that the public are fully engaged on these issues. While the changes to the planning system may speed up the process it will still be possible for objections to slow the process down. Objections could come from a variety of sources such as local pressure groups, NGOs and conservation groups. It must be made clear that difficult decisions will need to be made and potential risks to the environment, through action or inaction, will need to be measured against each other.

One possible approach to help resolve such difficulties is the model of volunteerism put forward by CoRWM for dealing with radioactive waste.

Overall, the more open and honest the debate between all parties, the less likely it is that a potentially damaging stalemate will occur. In this regard, the Academy is keen to provide a neutral and independent space for such conversations to take place.

Q6: What more could the Government or other parties do to ensure community support for new renewable generation?

No comment.

Q7: What more could the Government or other parties do to reduce the constraints on renewable wind power development arising from:

a. marine navigation;
b. environmental legislation;
c. aviation and radar;
d. any other aspects of regulation?

No comment.

Q8: Taking into account decisions already taken on the offshore transmission regime and the measures set out in the Transmission Access Review, what more could the Government or other parties do to reduce the constraints on renewable development arising from grid issues?

Grid connections represent a major barrier to the increase in renewable energy, particularly given that the best resources of wind or marine energy are often located away from the areas of greatest demand. Every effort must be made to make sure that all low-carbon energy is quickly and efficiently connected to the grid. The Academy welcomes the recommendations in the Transmission Access Review and the proposed changes to the planning system relating to grid access. Close attention is required to ensure that these measures are sufficient to bring about the considerable upgrades required in the GB grid system.

Q9: What more could the Government or other parties do to reduce supply chain constraints on new renewables deployment?

No comment.

Q10: Do you agree with our analysis on the importance of retaining the Renewables Obligation as our prime support mechanism for centralised renewable electricity?

The main concern for companies seeking to build and operate centralised renewable electricity is the financial risk. Renewable electricity is, in general, more expensive to produce than traditional thermal forms of generation. Volatile primary fuel prices and a rising price of carbon will make renewables increasingly attractive, but financial incentives to mitigate the long-term financial risks will still be required to stimulate investment in the renewables market.

Countries such as Germany and Denmark have shown that feed-in tariffs are very effective in this regard. However, it seems clear that the UK Government is insistent on maintaining the Renewable Obligation (RO) as its main support mechanism. If this is the case, the Academy supports the proposed review of the RO and the proposed

banding of certificates for different technologies. Some renewable technologies, wind in particular, have clearly benefited more than other less mature technologies and it is important that this imbalance is addressed. This will require constant reappraisal as markets develop and technologies, both old and new, mature at different rates. Also, there should be less reticence to over compensate first movers in new technologies.

Q11: What changes (if any) should we make to the Renewables Obligation in the light of the EU 2020 renewable energy target?

No comment.

Q12: What (if any) changes are needed to the current electricity market regime to ensure that the proposed increase in renewables generation does not undermine security of electricity supplies, and how can greater flexibility and responsiveness be encouraged in the demand side?

No comment.

Q13: Assuming financial support measures are in place, what more could the Government do to realise the full potential of renewable Combined Heat and Power?

Good quality CHP, particularly medium scale community, public sector and business projects have been shown to be very effective at reducing emissions from buildings and should be encouraged as much as possible. Improvements to the planning process, building regulations and the RO mechanism are to be encouraged but more needs to be done in order to help establish the CHP industry in this country. The Government has the opportunity through its own procurement chain and building programme to promote CHP in schools, hospitals and other public buildings. In so doing, it would inject a considerable amount of investment into the technology and help establish it within the building trade as a viable option.

Q14: Are our assessments of the potential of renewable heat deployment correct?

Certain aspects of the potential renewable heat deployment in the consultation document are highly optimistic such as sustaining a 40% increase in solar thermal heating for any sustained period of time. In general a great deal more research is needed to fully understand the most productive way to introduce renewable energy into the domestic heat market.

Q15: Have we captured the key features of a Renewable Heat Incentive and a Renewable Heat Obligation as they would apply to the heat sector correctly? Would both of these schemes be workable and are there alternative ways of structuring the schemes to ensure they can operate effectively?

No comment.

Q16: Do you agree with our assessment that a Renewable Heat Incentive would work better in the heat market?

No comment.

Q17: What more could the Government or other parties do to encourage renewable heat deployment with regard to:

a. awareness raising;
b. air quality;
c. building regulations;
d. planning;
e. anything else?

One sector where attention is needed is the rental sector. Increased fuel prices will encourage home owners to reduce their costs by improving the thermal efficiency of the building or by installing renewable heat sources. However, tenants in the rental market, who are liable to the increases in the bills, generally have no control over the fabric of the building and are unable to make the necessary changes to the property. The landlord, on the other hand, does not in general incur the higher costs and therefore has no financial incentive to make any improvements. Energy performance certificates may help in this regard but their effectiveness will need to be reviewed regularly.

Q18: How far should the Government go in focusing on areas off the gas grid as offering the most potential for renewable heat technologies?

As the consultation document states, only 18% of domestic properties are off gas grid. Given that renewable heat technologies should be more competitive in these areas establishing a market for renewable heat in the whole of the UK should be more than sufficient to encourage the uptake of these technologies in off gas grid regions without the need for any added incentives.

Q19: Do you agree with our analysis of the mechanisms for support of small-scale renewable electricity?

The Academy would, in general, support the introduction of a feed-in tariff or nett metering as the most effective mechanism to support microgeneration. The full potential of microgeneration in reducing carbon emissions is difficult to gauge and a careful life-cycle analysis of each of the possible technologies would be strongly encouraged. In the majority of cases, microgeneration will look like demand reduction from a distribution network operator's point of view as generation will rarely exceed the specific site's demand. In these cases, feed-in tariffs would be of little value.

Q20: Given the analysis on the benefits, costs and potential, in what way and to what extent should we direct support to microgeneration electricity?

No comment.

Q21: If you agree that better information will aid the development of distributed energy, where should attention be focused?

Information should be directed at medium sized community schemes such as educational institutions, businesses and public buildings. In these cases, the information provided should produce better results than for individual domestic installations because of their larger size.

Q22: Do you agree with the Government's current position that it should not introduce statutory targets for microgeneration at this stage in its development?

No comment.

Q23: What more could the Government do to incentivise retrofit of distributed energy technologies?

The Government could do two things to help incentivise retrofit of distributed energy technologies.

Firstly, it could streamline its procedures for approving new technologies and materials for use in the building trade. At present this can take a considerable length of time – up to 10 years – and is a major barrier to the uptake of potentially beneficial developments.

Secondly, it could ensure that its own procurement chain adopts distributed energy technologies as much as possible. This will give a necessary boost to the market and help renewable technologies reach maturity in a shorter time.

Q24: How can we best incentivise renewable and low-carbon transport in a sustainable and cost-effective way?

Biofuels will clearly play a part in reducing emissions in the transport sector but, as the consultation document points out, this must done in a sustainable way. We would commend the recent *Gallagher Review of the Indirect Effects of Biofuels* for a comprehensive review of these issues.

Also, as the *King Review of Low-carbon Cars* points out, emissions reductions can be achieved not only by a change in fuel, but also by changes vehicle efficiency and by behavioural changes. Efforts to increase the average efficiency of the road stock have met with varying success. Thus far, the car industry has agreed to voluntary targets for average vehicle emissions but has been lagging behind in meeting even these modest targets. If this continues to be the case then enforcing such targets would appear to be the only option.

Recent rises in petrol and diesel prices have naturally forced people to consider buying more efficient vehicles, but there is no guarantee that an upturn in the economy or a reduction in fuel prices would not reverse this trend. For this reason, it would be dangerous to rely on the current economic situation to provide the required emissions reduction. In engineering terms it is certainly possible to design cars with lower emissions. However, this will normally result in compromising on other aspects of the design such as safety and performance. Incentives are needed to make emissions the primary design consideration.

Behavioural changes are equally important and recent rises in fuel prices have again forced people to be more economical in their transport decisions. However, as with vehicle efficiencies, the economic situation cannot be relied upon to produce permanent changes in behaviour. Many options exist such as encouraging the use of public transport or bicycles and reducing the distances people travel either for work or leisure. All these options must be fully explored.

Q25: What potential is there for the introduction of vehicles powered through the electricity grid in the UK? What impact would the widespread introduction of these kinds of vehicles have on:

a. energy demand and carbon emissions;
b. providing distributed storage capacity;
c. smoothing levels of electricity demand on the grid?

What factors would affect the scale and timing of these impacts?

It is difficult to predict the potential of electric powered vehicles or their impact. At present, the performance of electric cars lags some way behind traditional counterparts but technological advances, particularly in batteries, could close this gap relatively quickly.

In terms of carbon emissions, any move to electric vehicles must be accompanied by a significant increase in low-carbon electricity supply otherwise the emissions will simply be displaced. The uptake of electric vehicles does not, however, necessarily require a corresponding rise in electricity generation capacity. It would be expected that most electric vehicles would be charged overnight when demand is low. It would therefore result in an increase in the base load demand level rather than an overall rise in maximum capacity.

It is possible that electrification offers the best chance to decarbonise the transport system. This is, however, purely theoretical at present and other options such as hydrogen powered vehicles may also be possibilities. More research is needed and nothing can be ruled out at this stage. Ultimately an alternative to liquid hydrocarbons will be needed but better efficiency and behavioural change currently offer the most effective means of reducing emissions from transport, certainly by 2020.

One initiative the Academy does strongly support is the electrification of the GB rail network. Currently 64% of passenger miles are by electric trains and it is hoped that by the end of a 10 year programme this figure will have risen to 91%.

Q26: Over what timescales do you think electric vehicles could plausibly contribute to our renewable energy and carbon reduction targets and what could the Government most effectively do to accelerate the introduction of such vehicles in the UK?

The road stock turns over relatively quickly in comparison to housing stock or heavy industrial infrastructure. Even so, it is difficult to see electric vehicles making much of a contribution before 2020.

Q27: How can we best ensure that our use of biomass is sustainable?

The sustainability and carbon life cycle of biomass and liquid biofuels in particular has been well researched. For example, the Royal Society's report *Sustainable biofuels: prospects and challenges* and the *Gallagher Review of The Indirect Effects of Biofuels* both give a comprehensive review of these issues.

In general, all forms of electricity generation, be they renewable, nuclear or fossil fuel, will incur external costs to society and the environment. Accurately assessing the full life cycle in terms of greenhouse gases as well as their overall sustainability and social impact is notoriously difficult. The Government must continue to support research in this field and take account of international best practice when developing its energy strategy.

Q28: How do you see the market for biomass developing to 2020? What are the implications for:

a. imports;
b. longer-term prices and costs?

The RTFO and EU Directive will encourage growth in this market. Despite calls for a moratorium, the Government appears reluctant to cancel its targets or subsidies, and given the support these give the fledging industry in the UK, the Academy would support that position, subject to strict sustainability requirements.

Second generation biofuels are needed in order to increase yields and enhance the emissions savings but there is a danger that the industry will be tied into technologies used to process first generation biofuels. There will therefore need to be incentives to move to second generation fuels. It is hoped that the increased yields will provide sufficient profit increases for this to happen naturally but it will be important to monitor the situation to ensure that this is the case.

Q29: Should the Government take further regulatory measures to discourage biomass waste, including food waste, from going to landfill? If so, which types? What, if any, other measures should be taken to encourage its use to generate bioenergy?

In terms of sustainability and efficiency, utilising biomass waste is to be encouraged. A comprehensive reassessment of the classification of waste materials is needed in order to ensure that all materials that could be used to generate energy can be used.

Q30: What more could the Government or other parties do to help to ensure the provision of sufficient Waste Incineration Directive-compliant combustion capacity to burn available waste wood alongside other biomass, and what else might constrain the development of this capacity?

No comment.

Q31: What further actions will improve supply chain efficiency, consumer confidence and sustainable growth of the biomass supply chain?

No comment.

Q32: What barriers exist to the cost-effective deployment of anaerobic digestion, biogas and the use of biomethane injected directly into the gas grid, and what are the options to address them?

No comment.

Q33: What action could we take to make biomass communications more effective to both improve public awareness and help to address acceptability issues, and how should this be delivered?

No comment.

Q34: Are there issues constraining biomass supply and use other than sustainability, supply chain and information issues? How should these be tackled?

No comment.

Q35: How can we adapt the Renewables Obligation to ensure that it effectively supports emerging as well as existing renewable technologies? Are there more effective ways of achieving this?

If the RO mechanism is to be retained then the proposals to band the certificates in favour of less mature technologies are to be supported. This will, however, need to be regularly reviewed in order to keep pace with market developments. Ultimately, each technology should reach full maturity and be capable of competing freely in the market without the need for subsidies.

Q36: Is there evidence that specific emerging renewable and associated technologies are not receiving an appropriate form of support?

No comment.

Q37: Are there barriers to the development of renewable and associated technologies that are not addressed by current or proposed support mechanisms?

No comment.

Q38: What more could the Government or other parties do to ensure that the UK secures the maximum business and employment benefits from the EU renewable energy target?

No comment.

Q39: Do you agree with our analysis of the likely impacts of the proposed increase in renewable deployment on:

a. carbon dioxide emissions;
b. the local environment;
c. security of supply;
d. energy prices;
e. fuel poverty;
f. the energy market;
g. the economy;
h. any other wider issues that we should be considering?

No comment.

Q40: What more could the Government or other parties do to ensure the UK meets the EU renewable energy target?

No comment.

Q41: Do you agree with our overall approach to developing a UK Renewable Energy Strategy?

The target of generating 15% of UK energy from renewable sources is extremely challenging. It is the opinion of the Academy that, even if the policies laid out in the renewable energy strategy were to be generally successful, it is unlikely that the target will be reached. This is due to the fact that the policies are designed to just reach the target leaving no margin of error or contingencies.

We also have some concern that the RES target may interfere with other targets such as those to be set by the Climate Change Bill. It is important that the ultimate goal is as clear a possible. The main goal should be to reduce levels of greenhouse gases in the atmosphere and hence avoid the dangerous levels of global warming.

Submitted by:
Mr P Greenish CBE
Chief Executive
The Royal Academy of Engineering
3 Charlton House Terrace
London SW1Y 5DG

Prepared by:
Dr Alan Walker
Policy Advisor