Britain's Energy Future:

Securing the 'Home Front'

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Preface by Stephen Twigg

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The views in this paper are not necessarily those of the Foreign Policy Centre.

Preface

In the past year, the UK government has made the case for a rapid shift to renewable energy sources from a number of different perspectives: national security, economic prosperity and protection of the global environment. On 14 September 2004, the Prime Minister made plain his view that the problem is urgent: 'I want to concentrate on what I believe to be the world's greatest environmental challenge: climate change. Our effect on the environment, and in particular on climate change, is large and growing … the issue is urgent. If there is one message I would leave with you and with the British people today it is one of urgency.'

On 28 October 2004, Foreign Secretary Jack Straw made a similar plea for urgency: 'By 2020, around a half of total oil demand will be met by countries with a high potential risk of internal instability…. By 2020, we will probably be importing three quarters of our primary energy needs – and we will need to adapt to that…. Urgent international action is required'.

In 2004 the International Energy Agency published an assessment that demonstrated the damaging impact of oil price increases on the long term benefits of the campaign by the Chancellor Gordon Brown to improve aid flows to poor developing countries and the Prime Minister's efforts to improve development in Africa. The IEA assessed that 'in the year following a $10 oil-price increase … the loss of GDP averages 0.8 per cent in Asia and 1.6 per cent in very poor highly indebted countries. The annual loss of GDP in the Sub-Saharan African countries would be more than three per cent.'

Key policy objectives, such as economic growth at home, in Africa and other highly indebted countries, are threatened by volatile swings in oil prices. Environmental security, and the role that renewables can play in that, are now among the highest priority issues on the international agenda.

Yet the UK Government target on its own use of renewables is among the lowest targets in Europe and the country is not on track

to meet the target. The UK cannot lead internationally on these issues without a dramatic change in its domestic policy settings, and without more visible linkages between its domestic settings and international partners.

We clearly need a shift in attitudes. For this reason, the Foreign Policy Centre is launching a new project to mobilise public opinion, government policy and private sector behaviour behind an accelerated drive for renewable energy sources, especially low carbon ones. The project has been given the rubric, 'Britain's Energy Future: Re-engineering the Home Front', to emphasise where the primary responsibility and locus of action must lie.

Yet the project is an international one. Its focus on the 'Home Front' draws attention to how progress within single countries, especially the UK and the rest of Europe, is the *sine qua non* of global environmental and energy security.

One output of the FPC project is an Action Agenda. By June 2006, after a projected 30 meetings of industry leaders, finance sector leaders (especially venture capital), community groups, media representatives and political leaders, supported by a raft of new, purpose written publications and associated media work, the FPC and its partners will produce a new action plan for a more rapid transition to renewable energy sources by 2010. A key focus of the Action Plan will be a shift to alternative fuel sources of transportation and the role that renewables can play in more responsible approaches to energy conservation, especially in building management.

The FPC is not undertaking this project in isolation. We bring to the table our capacities for bringing together domestic and international networks of business and government leaders with the NGO sector and community groups. The FPC will work to create new networks between domestic stakeholders and international actors that have so far not emerged as solidly as they need to if the urgency of the problems identified by Prime Minister Blair is to be taken seriously. A steering group comprising leading figures from all sectors will drive the project.

This pamphlet is designed to launch the FPC project. The pamphlet addresses several aspects of the transition to use of renewable energy sources. On the one hand, Dan Plesch sets the global scene by highlighting new global risks involved in continuing a 'business as usual', transition to use of renewable sources. He also looks at the new opportunities to speed up the transition. On the other hand, Greg Austin and Fiona Grant look more closely at how we on the 'domestic front' must respond to the new security risks. They argue for a civic education campaign, backed up by corresponding government policy, that will empower UK citizens, both individual and corporate, to take a new role as 'energy wardens', a present day home guard.

The title of the chapter by Austin and Grant draws an analogy with air raid wardens in the Second World War experience of the aerial bombing of Britain. The analogy is not intended to convey the idea that Britain faces a national security threat on that scale in the energy sector right now. Nor does it mean that energy wardens would marshal the general citizenry to turn off their lights more often. The analogy is meant to convey the idea that the stakes are as high and that the solution will be found only when UK citizens and corporate entities (government included) start acting as if the stakes are that high. The time frames and immediate outcomes of the energy security campaign are very different from those of the war years, but the mentality at community and householder level must be similar to that of the war years or Britain will have no energy future. The analogy is meant to convey the need for the communities and people of Britain to take upon themselves greater responsibility in securing the country's energy future by adopting resilience strategies for inevitable shock to energy supply in coming years.

The basic assumption of this project is that an increased share of renewable energies would diversify energy sources, increase energy autonomy and improve the security of the energy supply.

Our partnership with the Corporation of London for the launch event demonstrates our intent to engage the leading business interests in this country, including the legal and accountancy sectors. Notwithstanding the important role that communities, householders

and individuals will play, it will be the business interests, not just in Britain but globally, that will ultimately be the most significant shapers of Britain's energy future. The Corporation has been a national trend-setter in the move to renewable energy, both in its own internal corporate practices and in mobilising the business community behind renewables.

It has also been a leader on the international scene. An outstanding example of this has been the Corporation's framing of the 'London Principles' launched at the Johannesburg Earth Summit in 2002. Personally supported by the Prime Minister, this piece of research formed the UK financial services sector's response to the summit on behalf of the Government and has subsequently been developed in partnership with the UN Environment Programme.

The FPC is similarly delighted to partner with Oxfam in developing a broad project on renewable energy and international development. As noted above, the economic impact of oil price rises is felt acutely in the least developed countries. Our programme will endeavour to raise the profile of the much neglected but vital link between energy issues and the international development agenda.

It will only be by mobilising a broad range of partners that our common goals of environmental and energy security can be met.

Stephen Twigg
Director
Foreign Policy Centre

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New Energy for Global Security

Dan Plesch[1]

The reliance of the industrialised world on oil would not matter as much if oil were found all over the place as easily as coal or even trees. The fact that sixty per cent of world reserves are located in the Persian Gulf has resulted in intense and growing competition between states for access to it. In addition to dependence on oil imports, the UK, and Europe as a whole, is becoming dependent on the importation of natural gas to run electric power generation. As Britain's Institution of Civil Engineers (ICE) put it:

> This country has been self-sufficient in electricity generation for the past 100 years. This is about to change dramatically. The (domestic) generation shortfall (80 per cent of current capacity) will be taken up by gas, 90 per cent of which will be delivered to this country through a very small number of pipelines.

The mainstream view of the problem of energy security is summarised in *Strategic Trends*, a study by the UK Ministry of Defence think tank, the Joint Doctrine and Concepts Centre:

> Global demand for energy resources will increase significantly due primarily to development and industrialisation in South and East Asia. There is little prospect of revolutionary breakthroughs in alternative supplies. Renewable and nuclear energy sources will remain of moderate importance but fossil

[1] This chapter is based on Chapter 7 of Dan Plesch, *The Beauty Queen's Guide to World Peace,* Politicos, London, 2004.

> fuels, and particularly oil and gas, will remain dominant. These will stay the key strategic resources as the main areas of supply and demand are separate. Their location and transport routes will therefore be security drivers for the developed and developing nations alike.

Yet revolutionary breakthroughs in alternative supplies are both necessary and possible. A strategic shift in technology towards renewable sources for transport, business and home use should be made a national security priority in the UK, the European Union and in the world as a whole. The compelling economic-security argument for shifting to renewables complements the evidence for renewable energy as a means to limit global warming. I argue that it is not only essential to national and international security to make a rapid change, but that ending oil and gas dependency within twenty years is practical, financially and technically. If this seems over-ambitious it is worth remembering that twenty years ago coal was a dominant source of supply and has now been phased out, while the idea that sports cars would run on diesel engines would have been treated as laughable. To concentrate our attention, the focus should be on what can be achieved in the next five years.

Worst-case scenarios

Demand for oil is rising around the world. The EU as a whole used oil and gas to meet more than half of its total energy needs in 2000, importing seventy-five per cent of its oil and forty per cent of its gas. The EU predicts that these proportions will rise to ninety per cent for oil and seventy per cent for gas by 2020. Developing nations are generating steadily increasing demand for energy and this demand focuses on oil and gas. A British admiral told me once that it would not be many decades before we saw Chinese aircraft-carriers seeking to protect Chinese interests in the Gulf.

So how serious would the political and economic impact of major interruptions to supplies of oil and gas on the industrialised world

be? A study by the US Brookings Institution soon after the attacks of 9/11 illustrated the potential economic impact of several scenarios and provides a good example of some of the factors that need to be considered. The study's worst-case scenario, written in early 2002, describes an economic disaster for the world as a whole:

> Finally, as a worst case, assume extremists exert control over the entire 21.7 mbd production in Arab Muslim nations, and that they cut this production by 10 mbd. Iraq could be expected to join such an initiative. How plausible is this? Bin Laden and other extremists want most of all to overthrow the Saudi monarchy and the other dynastic rulers in the region. On the other hand, the United States would be expected to use military force to prevent it. Although a US military occupation of the region could maintain oil supplies, it would have imponderable consequences for our relations with the wider Muslim world and could prove unsustainable. Furthermore, apart from the particular scenario sketched above, 10 mbd of supply could conceivably be lost to some other combination of political takeover or coercion, destruction of facilities, and interruption of distribution. So its consequences are worth examining.

The study included analysis of the impact of the worst-case scenario and concluded:

> The worst case brings devastating economic problems. Oil prices rise to $161 per barrel driving gasoline price to $4.84 per gallon (without tax). The increase in the nation's bill for products of crude oil rises by about 10 percent of GDP, which adds perhaps 15 percent to the inflation rate in the first year. And the recession is the steepest and deepest of the post-war period, with GDP declining nearly 5 percent the first year.

Western governments do consider worst-case scenarios for the interruption of supplies of oil, but these assume that the disruptions will be short-lived. This assumption relies on the belief that (a) oil-

supplying nations will always want to sell their oil regardless of the ideology of the people in charge, and (b) if an extremist government does try to 'hold the West to ransom' then the West can invade and seize control of the oil supplies. It is easy to imagine a situation where the government of one or more major oil-producing nations wished to withhold supplies as a means of attacking the industrialised world. In such a situation even a massive invasion might not get the oil wells and pipelines flowing and the tankers sailing again.

The experience in Iraq shows that six months after the invasion in March 2003, oil production had fallen from the 2002 level of two million barrels per day to less than a quarter of that. At the time of writing, production had gradually been restored to pre-war levels mostly from the peaceful southern oilfields around Basra, but it was proving very hard to export oil safely from the northern oilfields. Even 150,000 troops in a country of twenty million people had proved unable to forcibly extract oil.

When I have discussed the problem of severe disruption of Gulf oil with government officials in London and Washington the usual reply is that since there is no option other than oil we must just make the best of things. When I questioned an expert on the US National Security Council about the lack of any 'Plan B' if the existing political strategy in the Gulf (Plan A) failed, he merely explained that America's Plan B was to make sure that Plan A worked.

It would be very misleading to think that governments have put no measures in place to respond to shortages of oil supplies. In response to the oil crisis of 1973 the governments of the industrialised world created the International Energy Agency (IEA). Members are bound by treaty to support its emergency mechanisms. These include storing several months' supply in strategic reserves, preparing to use these when supplies are interrupted, and procedures for cutting back on demand. These procedures were used both during the Iran–Iraq war in 1980 and after Saddam attacked Kuwait in 1991. After 9/11, some countries took further

steps and Japan led south-east Asian nations in creating regional emergency reserves.

However, there are worrying inadequacies in the IEA emergency procedures, which themselves only deal with short-term problems. The European Commission has stated that the mechanisms were created in response to the circumstances of 1973 and are little changed today. In particular, any of the major industrial nations in the agreement can block implementation of the procedures. Some countries do not even keep their allocated reserves; and there are no procedures at all for gas. Perhaps most worryingly, a review of some key questions has revealed that although the world has acknowledged the problem of oil dependency since the 1970s there has been no change in the level of that dependency over the last thirty years. The world got thirty-five per cent of its energy from oil in 2000, about the same level as the thirty-seven per cent of 1990, but gas increased from eighteen to twenty-two per cent in the same period.

Officials in Western governments assume that any major disruptions to supply will be short-lived. If they prove to be wrong in this assumption, the economic and political consequences would be severe and could be catastrophic. I argue that a shift from oil and gas would be a strategic move that tackles one of the worst-case scenarios that may be inflicted upon the country and the industrialised world in general. Getting out of oil and gas and into renewable energy is an elegant side-step compared to the bull-in-a-china-shop approach preferred by Washington at present, and indeed for some time past. In the jargon of strategic studies, it is asymmetric grand strategy. The result of the shift would be to remove a major strategic weakness, a major cause of conflict, and to create a stronger strategic position. The nuclear option carries unnecessary costs, vulnerability to terrorism and no long-term disposal plan.

The cost of dependency

On present plans, Britain will have to import more and more, and maintaining these supplies has already a large cost in shaping our policies towards supplier nations. These costs include the impact of fluctuating oil prices and the military and foreign policies of trying to secure the supply.

One unquantifiable cost is the way in which Western states forget their commitment to human rights when it comes to getting their hands on the oil needed to keep their economies going. For example, two major oil producers, Nigeria and Russia, appear to escape criticism for their internal human-rights abuses, because of the imperative of ensuring oil supplies. In both countries, the government engages in widespread abuses of human rights, according to organisations such as Amnesty International. These values are often given by Western leaders as key ones to be supported in foreign policy. Unfortunately, the desire to obtain access to the oil mutes attention to reform of human rights.

The large cost of securing oil supplies to the industrialised world is rarely included when traditional energy strategies are evaluated or when an assessment is made of the benefits of shifting to renewables. The security cost of oil – and in the future of gas – is counted in the cash required to support military forces, and in putting the concern to secure oil ahead of other priorities such as democracy and human rights in some of the countries concerned. These costs form what we can call a human-rights and military subsidy required to secure oil and gas. In addition, the crises threatening to interrupt supplies from the Middle East cause the oil price to go up and down with a consequent huge negative impact on the international economy amounting to hundreds of billions of dollars every year.

It may seem odd to include these costs, because it is not normal to find them included in analysis in the media, although the potential extra costs of developing renewables are often dismissed because it is said that they will need a 'green subsidy' or 'green tax'. As Shimon

Awerbuch of Sussex University has observed, 'the mystery about all this is why policymakers have not exploited the obvious connection between the enormous costs imposed by fossil [fuel] volatility and the potential for mitigating these costs offered by renewables'.[2] Once the costs of price volatility and security are considered the economics of a shift to renewables are even more attractive.

The economic impact of oil price rises is felt most acutely in the least developed countries. The International Energy Agency estimates a 3 per cent GDP hit to non-oil producers in sub-Saharan Africa from a $10 rise in the oil price. This illustrates the vital importance of energy issues to the international development agenda.

The military subsidy of oil prices

The highly political nature of judgements on cost was well illustrated in a discussion some years ago in the US Senate. In a decidedly tetchy exchange, Senator Jesse Helms, then chairman of the Foreign Relations Committee, questioned Jeff Gotbaum, a senior official of the Clinton administration, about the costs of securing Gulf oil during the 1991 war.[3]

> Mr Gotbaum: First let me say a couple of things just so that there is no miscommunication between us. Desert Storm (the reconquest of Kuwait in 1991) in addition to costing many lives, had a total estimated incremental cost of about $57 billion. Of that $57 billion, our estimate, almost $54 billion, over 90 per cent, was reimbursed to the United States either by cash contributions or in kind contributions. So, when I at least asked the question of my staff, well, what does this mean on a per barrel basis, the view we took is that we ought to look at the total cost of Desert Storm, say round figures,

[2] S. Awerbuch, 'Determining the Real Cost: Why Renewable Power Is More Cost-competitive Than Previously Believed', *Renewable Energy World*, March–April 2003, vol. 6, no. 2.

[3] 'United States Dependence on Foreign Oil', Hearing before the Committee on Foreign Relations, United States Senate, 104th Congress, 1st Session, 27 March 1995 (US Government Printing Office, Washington, 1995).

> $60 billion. But since that was really there to protect world oil demand, we ought to look at it divided by something like the world oil supply over a period of years. If you take your $60 billion and you take demand, if you will, which is about 24 billion barrels a year, say, over a 10-year period, that works out to be about 25 cents a barrel.
>
> Now, what I personally came away with was not that that meant that it was only worth 25 cents a barrel to us to have security in the Middle East. That is like saying that because a seat belt only costs $3 a human life is only worth $3. But it seemed to us that it said to us it is worth somewhat north of that, sir.

A reasonable estimate of the military cost of attempting to secure Gulf oil is far higher than the extra cost of the 1991 Gulf War. America's annual spending on the military and intelligence was around $400 billion and $40 billion respectively in 2004-5. About a quarter of this – or $120 billion – is focused on securing Middle East oil supplies. In addition to the US's annual costs associated with Gulf oil, there are other military costs closely related to securing the region's oil. These include a proportion of the military spending of US allies in NATO such as Britain and France, each of which spend more than $40 billion on the military each year.

Last, but by no means least, are the costs of the wars in the region in which oil played a strong if not determining factor. These include the decade-long war between Iraq and Iran, the Iraqi invasion of Kuwait in 1990 and its subsequent expulsion in 1991, and the recent 2003 invasion of Iraq. Precise figures for all these factors are not available, but US figures for its military costs in these wars are more than $200 billion and rising. A somewhat conservative estimate would average this out at perhaps $10 billion a year. The larger cost of the lives lost is not calculable, while the proportion of the costs to the regional economy of the various wars is a complicated calculation, but the sums involved cannot be small.

Consequently, an estimate of the non-US annual oil-related military costs to both US allies and adversaries in the region of some $30 billion seems quite conservative. This sum includes an annual security cost attributable to Gulf oil of $120 billion for the US, $10 billion for the contribution of Britain, France and other Western states, $10 billion for the annualised costs of the various actual wars and $10 billion of the military spending of the Gulf states themselves; adding up to the sum of $150 billion a year.

What of the amount of oil that this spending is supposed to secure? If we include the oil produced by states under US protection, namely Bahrain, Kuwait, Oman, Saudi Arabia, Qatar and the United Arab Emirates, this amounts to some six billion barrels of oil per year. It is reasonable to conclude that the $150 billion is spent trying to secure some six billion barrels a year. That is more than $20 a barrel. Even half this figure, $75 billion, is still a large subsidy.

The global economic impact of fluctuating oil prices

In addition to the military subsidy to the price of oil, another and much larger cost of oil to the world economy is the cost of price fluctuations. These are sudden spikes and subsequent falls in the oil price caused by instability.

The price of oil has varied between $4 and $40 a barrel since 1970. It is reasonable to expect that the economic impact of oil price fluctuations is great, but how great? Some $14 thousand billion (trillion) over a thirty-year period to the world as a whole; $7 trillion to the US economy alone according to the US Department of Energy Oak Ridge National Laboratory, in a study published in 2000:

> Estimates of the costs to the US economy of the oil market upheavals of the last 30 years are in the vicinity of $7 trillion, present value 1998 dollars, about as large as the sum total of payments on the national debt over the same period. ... The costs of oil dependence have been large under almost any plausible set of assumptions. These cost estimates do not

> include military, strategic or political costs associated with US and world dependence on oil imports.[4]

Shimon Awerbuch of Sussex University has analysed the problem of the relative costs of oil and of renewable energy and concludes that the cost of oil is normally calculated using obsolete methods based upon what is called the 'engineering economics' approach. Awerbuch argues that other industries use a well-established 'capital asset pricing' model for capital budgeting and project valuation. When applied to oil and gas, he claims, they produce far higher estimates of the past and future costs of these products than those used by the IEA.

Awerbuch also provides a convincing summary of other studies that show the negative impact of oil price fluctuations in causing the main global recessions since 1945 and stock market slumps. For example, the rise in oil prices after the Arab–Israeli war of 1973 produced a global economic recession, and a similar recession was triggered after the Iranian revolution in the early 1980s. These rises in the cost of imported oil were an important factor in creating the debts now still burdening many third-world nations.

Getting out of oil and gas: asymmetric geopolitics

Since 9/11 there has been much discussion amongst strategists and in the media of 'asymmetric war and strategy', by which is meant unusual ways of fighting and of organising power. However, imagine for a moment that a shift from oil and gas could be made in the same way that the Victorians shifted from horse and sail to steam ships and trains. Were such a change made to decentralised and plentiful energy sources, then the prospects for peace would be much improved. A decision to shift transport away from oil would remove the possibility of extremist regimes in the Gulf crippling the industrialised world and that any further conflicts in the region would

[4] D. Greene and N. Tishchishyna, 'Costs of Oil Dependence: A 2000 Update', Oak Ridge National Laboratory (US Department of Energy, Washington, 2000).

risk blowing up the world's petrol station. Supporters of the EU can also use a fast track out of oil for transport as the quickest and most cost-effective means of both reducing reliance on the US military to secure Europe's oil and providing greater freedom of action to disagree with Washington.

Political initiatives for renewable energy

The major drive for renewable energy has come from the environmental movement, concerned to reduce damage to humans and the world as a whole caused by man-made change in the weather. Climate change has become a major centre of action for governments and pressure groups around the world. This effort created the UN agreement known as the Kyoto protocol that sets targets for governments to limit the amount of CO_2 released into the atmosphere. Some governments, including the US, have refused to agree to this measure and have not implemented comparable unilateral actions themselves. Amongst the states that have agreed to reduce CO_2 emissions, there has been an upsurge of investment in renewable energy technologies, particularly in wind power. For the first time major government incentives and industrial investment are being applied to renewable technology. It is this political process that provides the background for the current progress on renewable energy.

Since the oil price rise of 1973 there have been isolated voices in and out of Western governments calling for an end to dependency on Middle Eastern oil and for a new energy strategy. Now, at least in the United States, there is the growth of a broader strategy, and President Bush has spoken of the need to develop new technologies. A US group involving both the legal adviser to President George Bush Snr and the White House Chief of Staff to President Clinton along with Senator Tim Wirth is leading a new and integrated approach through the Energy Futures Coalition.[5] They defined the coalition's strategy this way:

[5] T. Wirth, C. Gray and J. Podesta, 'The Future of Energy Policy', Foreign Affairs, July/August 2003, vol. 82, no. 4.

> A strategic energy policy will unite diverse political constituencies and forge common cause among stakeholders that are often at odds ... Most of all, a collaborative strategic approach holds out hope for ending dependence on oil, eliminating excess carbon dioxide emissions, and providing clean and reliable energy services and agricultural opportunity to the world's poor. The result would be to 'hurry the future' by unleashing a torrent of innovation that will stimulate economic growth, create new jobs, improve productivity, and increase prosperity and security for the United States and the world.

The case for a rapid transition to renewable energy for power and transport

The 'hydrogen economy' is a phrase used to describe an almost complete transition to a fuel cell-driven economy by the middle of the twenty-first century. Jeremy Rifkin's *The Hydrogen Economy* provides a route map to a mid-century transition. The key technological idea is to dispense with the internal-combustion engine and replace it with a chemical system that transfers hydrogen into electricity. This system needs no moving parts comparable to the cylinders filled with exploding petrol or diesel that power the internal-combustion engine. Different or interim approaches are to replace oil and diesel with fuel from plants and produce hybrid vehicles using both internal-combustion and electric engines.

Hydrogen would be best produced using renewable electricity, and though this is a huge task, it is achievable over a decade or two. Distribution is often cited as an almost insurmountable obstacle although, based on some evidence from industry, these costs are lower than might be imagined. It is also clear that industrial leaders appear to believe that vehicles can be made that have sufficient performance to appeal to the public.

At an IEA conference in 2003,[6] Dr Gert Eisenbeiss derided the political desire to see a rapid transition to hydrogen on the grounds that it was too difficult to make and introduce soon. In particular, he expressed a concern common amongst environmental groups that moving to hydrogen may simply mean using oil and gas to make the hydrogen or using crops to create bio-fuels when the moral choice is to produce more food for the world's starving people.

There are a number of potential solutions to this problem. For example, the Borax company is looking at means of producing hydrogen by means of non-toxic, non-CO_2-emitting chemical reactions. A second part of the solution is to massively expand the production of solar and wind-generated electric power to produce the needed electricity; and finally, where oil- and gas-produced electricity is used, the problem of controlling CO_2 emissions will have been transferred from millions of exhaust pipes to hundreds of factories. Where the task has been concentrated it may be easier to tackle, both technically and financially.

An additional option, under development by Shell, is to use photovoltaic cells to break up water into hydrogen and oxygen. At present the costs involved are considered to be too great; however, were the technology considered as important to the nation's defence as the need to maintain a high-tech military industry, then the cost would be regarded as much more manageable. One remaining technical obstacle is to find a cost-effective electrolyser.

In addition to hydrogen, there are two other solutions to the problem of alternatives to oil for transport fuels. The first is to produce vehicles with combined electric and internal-combustion engines. Major car manufacturers are now producing and developing these hybrid vehicles – Ford, GMC, Chevrolet, Toyota and Honda have cars in production – although in Europe manufacturers such as Volkswagen are concentrating on getting diesels to achieve more than 100 mpg. The first models looked, and were, cramped and

[6] Dr Gert Eisenbeiss, International Energy Agency, Paris, March 2003.

heavy. Newer models, such as the Toyota Prius, look and perform more like mainstream cars. They cut demand through fuel efficiency as they are able to produce a combined fuel consumption of around seventy miles per gallon.

The second solution is to find other fuels for the traditional internal-combustion engine. One type of fuel used is liquefied gas. However, although these vehicles minimise the production of CO_2, the use of gas merely transfers the problem of fuel importation from the oil problem to the gas problem. Another major type of fuel is derived from plants. These bio-fuels include recycled vegetable oil or chip fat, and there was a lot of publicity about people converting their cars to run on this fuel. Some diesel vehicles are reported to run well without technical modification on a combination of ninety per cent diesel and ten per cent vegetable oil.

UK bio-diesel advocates explain an example of what can be achieved[7]:

> The environmental benefits of bio-fuels are well proven. UK agriculture could produce over 5 per cent of fuel needs in fairly short order from existing crops and technology. In a 10-year time span this could rise to 10 per cent if new crop technology were brought into use and sufficient land was available after the core function of food production had been met.

Many environmentalists are sceptical over the effectiveness of subsidising bio-fuels compared to wind and solar power. Nevertheless, bio-fuels offer a quite quick if partial solution to oil dependency.

The introduction of hybrid electric/internal-combustion cars may well offer an important bridge out of oil dependency, but the real prize

[7] Memorandum submitted by the British Association for Biofuels and Oils (BABFO), Select Committee on Environment, Food and Rural Affairs, 2003.

would be to begin an accelerated shift out of dependence on oil and gas altogether.

The competitive price of wind and solar power

Potential stumbling blocks in the proposed transition from oil to renewable hydrogen include the cost of producing the hydrogen and, as we have discussed, the problem of not adding to greenhouse gases. So, how cheap does the hydrogen need to be?

In a presentation at the Royal Institute for International Affairs[8], Professor Bragi Arbason of the University of Iceland explained that production of renewable hydrogen by passing electricity through water – electrolysis – which releases the H_2 from the O, costs around two US cents per kilowatt hour (kWh) for the electricity, using Iceland's abundant supplies of hydro-electric power. This electricity price is between two and three times the price of imported petrol. However, since fuel cell engines are between two and three times more efficient than internal-combustion engines the prospect of commercial viability is in sight.

Assuming that a target cost of electricity is in the range of two to three cents/kWh, can such a price be obtained from the renewable sector? A study by the European Wind Energy Association in 2003 stated that wind power production costs were already down to below three cents/kWh. This is a fall from around 15 cents in the 1980s, around six to eight cents in the 1990s and four to five cents at the turn of the century. Some studies are recording that economies of scale produced by much larger turbines are already bringing the price below two cents. An additional factor with dispersed energy supplies is that less is lost by being transported along powerlines.

An assessment made at Imperial College London indicated that, particularly for wind energy, prices would fall considerably further by

[8] 'Delivering Climate Technology Programmes, Policies and Politics', Royal Institute for International Affairs/Carbon Trust, London, November 2003.

around 2020. The study concluded that by 2020 the following cost ranges were likely:

- Onshore wind: 1.5–2.5p/kWh
- Offshore wind: 2.0–3.0p/kWh
- Photovoltaic: not competitive until between 2020 and 2025
- Wave and tidal stream: 4.5–6.0p/kWh is likely in the short term (3–4 years)
- Energy crops: 2.5–4.0p/kWh.

An important part of this study was including estimates of the decrease in price resulting from economies of scale. It did not, however, include any additional financial or regulatory input from governments on grounds of national security.

It should also be noted that the use of solar power simply to generate heat and use it as a source for hydrogen is a far shorter route to solar derived-hydrogen than photovoltaics, especially along the coastlines of hot countries. For example, Volker Quaschning and Franz Trieb found that 'prices in the range of five to eight cents/kWh of generated electricity can be expected in the medium term for solar-only operated thermal power plants'.[9]

Towards a hydrogen economy

It is in Japan that the greatest effort is being made towards a shift to hybrid engines and hydrogen. This is not surprising given Japan's disastrous dependency on oil in the Second World War and its present reliance on oil from the Persian Gulf, an unstable area of the world over which it can exert little direct influence.

The Japanese government and associated agencies are investing around ¥100 billion a year (£500 million) in the shift to hydrogen. It

[9] V. Quaschning F. Trieb, 'Solar Thermal Power Plants for Hydrogen Production', Hypothesis IV symposium, Stralsund, Germany, 9–14 September 2001.

projects that by 2020 some five million vehicles will be driven by hydrogen. The Japanese programme envisages a development phase ending in 2005 with proven technologies and new industry standards for the new fuels. In the period 2005–10 Japanese planning envisages the gradual introduction of the infrastructure to install hydrogen alongside diesel and petrol in filling stations. The Japanese see government-owned vehicle fleets leading industry and the public towards the widespread use of hydrogen-powered vehicles. Government-owned vehicles include as a matter of course large numbers of cars, light vans, buses and trucks. A government-led purchasing policy would entail announcing to industry that as of a certain date the government will only purchase vehicles meeting the new specifications. Government power as the largest consumer in society would provide a major competitive impetus to industry, all in the spirit of the old saying 'the customer is always right'.

In the EU the Commission President, Romano Prodi, created an advisory 'High Level Group on Hydrogen and Fuel Cells' in 2002 to look at the transition to hydrogen. The EU already has a target of meeting twenty per cent of vehicle fuel needs from alternative sources by 2020, including hydrogen. In September 2003 the EU announced a four-year research programme totalling €300 million. This is barely a tenth of the level of Japanese central support and, even allowing for national research efforts within the EU, the Union is far behind the Japanese in this area of research.

The most recent EU policy on security of supply has been heavily criticised by some leaders of the renewable energy community[10] for failing to take the opportunities offered by renewable technology and not meeting the real security challenges.

In the United States, President Bush launched a new Hydrogen Initiative that aims to assist the transition to a hydrogen economy.

[10] Statement of Dr Hermann Scheer, President of EUROSOLAR, on the European Commission draft 'Proposal for a directive of the European Parliament and of the Council concerning measures to safeguard security of electricity supply and infrastructure investment', Berlin, 4 December 2003.

President Bush's multi-year commitment of $1.7 billion to research into the hydrogen economy is insignificant compared both to the current expenditures on oil-related defence costs and to a serious transition to hydrogen. A key problem in the Bush proposals is that it seeks to use gas to produce the hydrogen, which would not reduce greenhouse gas emissions and would increase the pressure on global gas supplies, especially as the gas comes partly from oil and coal production.

In the UK the government has launched an ambitious and practical plan to reduce greenhouse gas emissions through the development of wind power for electricity, and is also sponsoring an international effort to assist renewable technology in the developing world. However, in the area of transport it is merely participating in the EU pilot city study on hydrogen fuel cell buses.

The industrial effort

Research and development into hydrogen-powered fuel cells is also being carried out by industrial corporations in several sectors. These include vehicle manufacturers such as DaimlerChrysler, General Motors, Honda, Renault and Toyota, fuel companies including BP and Shell, and specialist fuel cell-builders including Ballard, Rolls-Royce and Siemens. Total industry investment in fuel cells totals around $4 billion.

California has long been a leader in environmental technologies and it is there that some of the first prototype fuel cell vehicles can be found on the roads. Toyota has a fuel cell sports utility vehicle and GM a light van.

The biggest single factor holding back the introduction of hydrogen is lack of investment, although some major oil companies have limited objectives for hydrogen. BP estimates that the total global

investment in the hydrogen economy is around $1.5 billion a year:[11] a huge amount but barely one per cent of the military-industrial research budget of the EU and the US, which totals some $150 billion per annum.

Renewable hydrogen for vehicles

The IEA claims that $16,000,000,000,000 – 16 trillion – of investment will be required up until 2030 to provide for the world's energy needs. According to the IEA projections, just nine per cent of this investment will be towards renewable sources of energy. The assumption is that larger investments in renewables are too complex, lack political will and would be too costly. But is this the case?

As we have demonstrated already, renewable electric power and renewable electricity/hydrogen for fuel cells are rapidly becoming cost comparable to the existing cash cost of petrol, diesel and natural gas for electricity. So what estimate can be made for the total cost of installation of the new technologies? If such costs are already included in the IEA's $16 trillion estimate of global energy investment – only directed to oil and gas production – the main point may be the introduction of national and international steering mechanisms to move the market away from oil and gas and towards renewables. These can include tax incentives and other short-term subsidies, regulations, and removal of support for old technologies.

Wind Force 12, a study by the European Wind Energy Association, estimates a global cost of $628 billion to achieve a world wind energy output of twelve per cent of the electricity needs estimated by the IEA for 2020, some 3,000 terawatt hours (TWh). World wind resources are far larger, though not evenly distributed around the globe. Nevertheless, the following data indicates a massive potential for the use of wind energy. The total world wind resource potential is 53,000TWh in comparison to a world electricity demand of

[11] Dr M. D. Jones, Manager, Hydrogen Technology, BP, presentation to the IEA Renewables Energy Working Party Seminar, Paris, 3 March 2003.

14,000TWh in 1998, rising to an estimated 27,000TWh in 2020. Just for the sake of argument, suppose the target was ten times as great; not twelve per cent, but 120 per cent of electricity needs, over 30,000 TWh. The cost would be huge, some $6 trillion ($6,000,000,000,000) over the next fifteen years, or $400 billion a year: comparable to around eighty per cent of currently planned investment, but with great additional benefits. A comparable effort should be considered for the use of solar electricity. In combination there would be enough electricity to support hydrogen for transport as well as dramatically reducing the requirement for natural gas imports.

A shift to renewables for both electricity and transport would need to resolve a number of major logistical issues. The cost of installing hydrogen in petrol stations is one example of the changes that are needed. At first sight it may seem an insurmountable task. But not according to the evidence provided by BP to the US Congress.[12] They argue that in a transition phase to hydrogen before pipelines across country had been established, 'the cost to BP alone to add hydrogen to all our retail sites in the US would be $6.8 billion'. BP's market share of US petrol stations is around 14 per cent, thus a cost for all of the US could be $50 billion for changing an entire infrastructure around. Compare this to the $87 billion President Bush allocated to one year's security and reconstruction in Iraq. A global capital cost of even $150 or $200 billion to install hydrogen is a small price to pay for the benefits of the transition.

These are gigantic numbers to consider. However, before we let them panic us, ponder the following:

1. A move from oil dependency will result in a phasing out of the military 'khaki cost' of defending oil and gas supplies of around $150 billion a year;
2. It will also include a phasing out of an annual cost of price fluctuations that is in the region of $400 billion a year for the

[12] J. P. Uihlein, Fuels Project Manager, BP, evidence to US House of Representatives Subcommittee on Energy, 24 June 2002.

global economy;

3. In addition to the phasing out of the combined military cost and impact of oil price fluctuations of close to $1 trillion a year, the global economy would have the benefit both of these resources and of an environment in which it was possible to plan business on the basis of stable electricity and fuel transport prices.

CONCLUSION

Without wishing to scaremonger, this brief introduction to international energy stakes hopes to have demonstrated that rapidly decreasing our dependency on oil and gas imports is a national imperative on multiple and convergent fronts. A rapid shift to renewable energy sources presents one of the rare policy opportunities to unite the interests of security, economic, developmental and environmental domains. Even if one of the aforementioned 'worse case scenarios' never comes to fruition, the economic and geopolitical stability brought by energy independence is reason in itself to move swiftly ahead with a shift to new energy sources. Initial technical and financial obstacles appear to stand in our way, yet a true assessment of the real costs of the *status quo* should leave us in no doubt of what is to be done.

Energy Wardens Wanted

Greg Austin and Fiona Grant

After decades of pressure from environmental lobby groups, governments around the world have joined the global push for cleaner, low carbon energy. For its part, the UK has – at government level – accepted the need to diversify into renewable energy based on security, environmental and economic perspectives. However, it has been slow to take this up considering that the time frame is very short compared with the amount of time needed to change the energy use practices of a population and of a highly industrialised and consumer-led economy. Many of the energy consumption patterns are rooted in deeply entrenched social, economic and political attitudes and relationships. Governments have introduced stringent anti-pollution measures and have set ambitious targets for reducing greenhouse gases and increasing use of renewable energy sources.

But the policy environment does not stand still. The already 'challenging' task of the shift away from carbon-based fuels has been complicated in recent years by the emergence of new time pressures. The risk of serious political and economic shocks to energy supply has increased significantly in the past decade. The need to mitigate climate change processes linked to carbon dioxide emissions has become more urgent. There are also other environmental issues, which will have economic and social repercussions. No individual country can address such global issues by itself. As the UK Foreign Secretary has said, and as was noted in the preface, 'around a half of total oil demand will [by 2020] be met by countries with a high potential risk of internal instability'. Time is definitely against us.

This chapter addresses the question: in the global battles for energy security and for environmental security, what must Britain do to secure its 'home front'. The chapter concentrates on one area of

policy, the shift to renewable energy sources. It reviews government policy designed to bring about that shift. The Prime Minister, Tony Blair, has identified the need to move urgently and effectively to address climate change. There have been important achievements in UK policy, but key targets are unlikely to be met. There is little sense of urgency in the mainstream political debate, or indeed in the overall policy settings themselves. Less than four per cent of the UK's electricity supply comes from renewable sources, some of which are not 'low carbon'. The fairly modest target for 2010 is ten per cent. There is clearly much left for the government to do, and this chapter reviews some of the more prominent critiques.

But the chapter's review of UK government policy demonstrates what we all know and knew. Government policy and new laws can only have a low and slow impact on deeply entrenched patterns of social and economic consumption. In a liberal democracy with a market economy, it cannot be otherwise. A qualitatively new approach to energy consumption patterns is needed. This chapter takes a basic concept of governance – that of citizen stewardship of public goods – and maps out how it might be applied to the case for a more rapid transition to use of renewables in the UK.

Britain's Policy on Renewables

The UK government has shown support for the development of renewable energy since the mid-70s. The first major landmark in its commitment appeared in the form of the Non-Fossil Fuel Obligation (NFFO) of 1990, which operated for a decade providing a guaranteed market for electricity produced by renewables, which was subsidised by a levy on electricity consumers. This was replaced through the Utilities Act 2000, which ushered in a new legal framework for renewable energy in Britain. As mentioned, the UK Government has set a target that by 2010, ten per cent of electricity should come from renewable sources and 20 per cent by 2020. From one point of view, the 2010 target is one of the most ambitious for any industrialised country. If met, it would represent almost a six-fold increase in the share of electricity generation coming from renewable sources.

The government set the ten per cent target some five years ago, in January 2000. Its 2003 White Paper, *Our energy future – creating a low carbon economy,*[13] set the 2020 target of doubling renewables' share of electricity (to 20 per cent). The government committed itself to the twin goals of ensuring security of electricity supply at affordable prices and meeting targets for reducing greenhouse gas emission. Key to government policy is the wish to achieve these by market mechanisms.

The White Paper expressed these goals as follows:

- to put the United Kingdom on a path to cut emissions by some 60 per cent by about 2050 with real progress by 2020;
- to maintain the reliability of energy supplies;
- to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and
- to ensure that every home is adequately and affordably heated.

Clearly there is tension between these four goals. Electricity produced from renewable sources has generally been more

[13] Presented to Parliament in February 2003. Hereafter referred to as the White Paper. The 2003 Energy White Paper *Our energy future – creating a low carbon economy,* and subsequent progress reports on its implementation produced by the Sustainable Energy Policy Network (SEPN), established to help deliver the White Paper's objectives, are fundamental to the Government's renewables policy. The government states that the White Paper contains 'over 130 commitments that must be delivered.' Yet the vast majority of these are commitments to 'review' or 'consider' studies undertaken by other bodies. There is a distinct lack of national-level actions to be carried out, and the sum of funding available for renewables remains modest compared with the potential size of the market. Other significant contributions to the formulation of renewables policy include the Prime Minister's Strategy Unit's *The Energy Review* of 2002 and an inter-departmental report on *UK International Priorities: The Energy Strategy* (2004). In a major statement on environmental security published in 2005, *Securing the Future*, there was no significant change in policy settings for renewables targets, though there was a greater implicit appreciation of the scale of the mobilisation effort required to get there. See *Securing the Future*, March 2005, p. 18, http://www.sustainable-development.gov.uk/documents/publications/strategy/SecFut_complete.pdf.

expensive than fossil-fuel based alternatives and thus sits uneasily with the aim of making electricity as affordable as possible.

As many observers have noted, there are technical and practical limits on the cost-effective availability of renewable energy:

- geographical variations in the incidence of wind and solar power
- biomass production must compete with other land uses
- a limit to the number of rivers that can be used for hydroelectric power
- renewable sources need conventional energy sources as back-up
- wind and solar power are intermittent and unpredictable
- climatic factors can produce big variations in the availability of biomass and hydropower from one year to the next.[14]

Under current pricing regimes, the renewables energy sector remains for the most part a 'higher costs' venture. Particular sectors, especially hydropower, are now competitive. Wind power in some onshore locations with high average wind speeds is approaching real competitiveness.[15] Some renewables, such as biomass and biofuels, cost 'two or more times as much as their conventional alternatives'. Others, such as photo-voltaic power, are more expensive still.

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[14] European Commission, Communication from the Commission to the Council and the European Parliament, 'The share of renewable energy in the EU', COM(2004) 366 final, 26.5.2004, http://europa.eu.int/comm/energy/res/documents/country_profiles/com_2004_366_en.pdf.

[15] According to the Commission: 'The European wind industry has 90% of the world equipment market. Nine of the world's ten largest wind turbine manufacturers are based in Europe. The industry employs 72,000 people, up from 25,000 in 1998. Costs per kWh have fallen by 50% over the last 15 years. Installed capacity in the EU15 grew by 23% in 2003, to a total of more than 28 GW (Figure 2). In an average wind year this capacity can produce 60 TWh of electricity, approximately 2.4% of EU electricity consumption. This success story is not the result of a common European effort. As the chart shows, Germany, Spain and Denmark contribute 84% of total EU15 wind power capacity.'

Market mechanisms must be supplemented by subsidies or taxation of other sources to support the renewables market and incentives must be offered to persuade the private sector to finance renewable development. This does not simply mean securing a return on investment in renewables, but making this return as lucrative as other potential investments.

The main policy options available to government to improve the uptake of renewable energy include:

- feed-in tariffs;
- tradable green certificates (TGCs);
- fiscal and financial measures;
- investment support.[16]

Such measures have all played their part in the successful uptake of wind-generated power in several European countries. In particular, the successful expansion of wind power in several countries has been based on:

- an attractive long-term financial framework;

[16] See European Commission, 'Electricity from Renewable Energy Sources', 2004, http://bookshop.eu.int/eubookshop/FileCache/PUBPDF/KO5603635ENC/KO5603635ENC_002.pdf. Feed-in tariffs set a guaranteed premium price to the green electricity producer and put an obligation on the grid operators to purchase the output. The price is typically guaranteed for a long period in order to encourage investment in new renewable energy plant. Feed-in tariffs are supply-side measures that push green electricity onto the market. TGCs are issued when electricity from a renewable source is produced. Green electricity quotas can be imposed on utilities and large consumers, which they can fill either by using green electricity or by buying green certificates. TGCs are a demand-side measure driven by quota obligations that pull green electricity onto the market. Fiscal and Financial Measures: 'Supporting green electricity investments, production or consumption, these are simple examples of fiscal measures to stimulate supply or demand. Often this can take the form of exemption from 'ecotaxes' or 'carbon taxes' that are placed on fossil-fuel energy sources. Financial measures can also include reduced interest rates on loans, which lower the cost of investments and encourage new renewable generating capacity. Investment support involves direct financial subsidies for building renewable energy generating capacity. It is a measure that stimulates the supply side and can easily be tailored to encourage particular forms of renewable energy in line with national and regional policies.

- removal of administrative barriers through uniform planning procedures and licensing systems;
- guarantee of fair grid access and non-discriminatory tariffs;
- least-cost network planning.[17]

Rather than trying to decide the exact composition of the UK's future fuel mix, the government focuses on creating a market framework, with supporting policy measures. There have been five main elements to the government's strategy in support of renewable energy since 2000:

- a Renewables Obligation (RO)[18]
- Climate Change Levy (CCL) Exemption and other tax regimes
- Capital Grants (and Planting Grants for Energy Crops)
- Research and Development Programme
- Emissions trading

Renewables Obligation

The Renewables Obligation, which came into force in 2002 and will remain in force until 2027, requires licensed suppliers of electricity to purchase at least a specified proportion of renewable electricity from eligible sources. Compliance is demonstrated through Renewables Obligation Certificates; otherwise a supplier can pay Ofgem a 'buy-out' price.[19] Providing an element of security for RES industries, cost is ultimately born by the consumer. Set in 2001 at a proportion of three per cent of energy supplied, the Renewables Obligation has risen gradually, and the level of the Obligation is targeted to increase to 10.4 per cent by 2010 and to 15.4 per cent by 2015-16.

[17] European Commission, Communication, 'The share of renewable energy in the EU'.
[18] Complemented by similar obligations for devolved administrations, such as the Renewables Obligation for Scotland.
[19] The buy-out price was orginally set at £30/MWh. The 2004-05 figure is £31.49/MWh.

Climate Change Levy Exemption and other Tax Regimes

Renewable energy generation is exempt from the climate change levy (CCL) imposed on all non-domestic energy customers since 2001. It gives these sectors an incentive to improve energy efficiency and is expected to provide the renewables industry with support worth around £1 billion by 2010. The government has introduced graduated Vehicle Excise Duty (VED) and Company Car Tax, both now linked to the car's CO_2 performance. VED now ranges from £60 to £160, with zero duty for electric vehicles.

Capital Grants R&D support

Following the Energy Act 2004, the Government is spending just over £500 million between 2002 and 2008 to help emerging renewable and low carbon technologies in the form of R&D spending and funding for capital grants. Other funding includes over £60m of grants for energy crops and biomass, and £42m to support the first wave and tidal farms. The Government has focussed on providing additional incentives and subsidies for offshore wind – the only technology that offers a realistic prospect of coming close to the target.[20] The government supports take-up of hybrid cars with £1,000 purchase grants under the Transport Energy programme, administered by the Energy Saving Trust.

According to the 2005 Review of the White Paper, Research Councils currently spend some £40m annually[21] on energy R&D through programmes including SuperGen, Towards a Sustainable Energy Economy (TSEC), Carbon Vision (with the Carbon Trust) and the Fusion programme. Through the Supergen Initiative, Research Councils will fund over the next four years:

[20] The Government's projections show that the bulk of new renewable generating capacity between now and 2010 is expected to be in the form of wind energy, both onshore and offshore. Indeed, the UK has a huge potential wind resource. Wave and tidal generation will not contribute significantly to meeting the Government's 2010 target. However, on current trends, those sources could become more prominent in progress towards the 2020 target.

[21] The House of Lords STC describes this level of funding have been described by the House of Lords STC as 'minimal'. In 2004-2005, the US is spending $250m on comparable research. See *Renewable Energy Practicalities*, p. 7.

- £2.9 million for work on biomass and energy crops;
- £1.9 million for work on fuel cell research;
- £3.1 million for work on photo-voltaics;
- £2.6 million for work on wave and tidal research.

Emissions trading

UK emissions trading involves organisations agreeing to meet emissions caps in return for a share of a financial incentive. Those firms that cut emissions below an allocated/auctioned amount can sell the remaining portion of their quota to other firms that require the additional portion of the cap to operate. At the end of 2002, the European Council reached agreement on a new European carbon emissions trading scheme, which was implemented in the UK earlier this year. In 2007, all 'direct participants' of the UK trading scheme will transfer their CO_2 emissions to the EU scheme.

Feed-In Tariffs

Although these schemes have proved particularly successful in Germany, which has the largest renewables sector in Europe in absolute terms, the UK government has decided not to go down this path. The reason for this is that it prefers more market-determined pricing than that needed for feed-in tariffs. The House of Lords, in its 2004 Renewable Energy report, recommended that the Government consider supporting the existing Renewables Obligation by guaranteeing a minimum price per unit of renewables-generated electricity. For some, the increased cost to the consumer is a small price to pay for added security and momentum to the renewables market. The 'market based' or 'fixed price' debate continues.[22]

UK Performance against the Target

The shift to renewable energy in the UK has not proceeded at the pace foreshadowed in 2000 when the ten per cent target was set.

[22] House of Lords Science and Technology Committee report, *Renewable Energy: Practicalities* (July 2004).

According to data released in March 2005 by the Department of Trade and Industry, Britain is off target as shown in Figure 1.[23] Figure 2 shows that if the annual increase in the renewables' share from 2004 to 2010 matches the annual average increase since the target was set, the UK will fall more than 40 per cent short of its target. Appendix 1 provides a 2004 assessment of Britain's progress toward meeting its renewables target. The assessment was prepared jointly by the government and the European Commission. The document, summarised in Table 1, shows the mixed score-card that the UK gets, both for its own government policy settings and for non-economic factors, some of which it can control and some which it cannot.

Table 1: UK Scorecard for Transition to Renewables
Scale 0-5

	Degree & Duration of Support	**Non-economic factors**
Wind onshore	5	4
Wind offshore	5	4
Photovoltaic	1	3
Biomass electricity	2	4
Hydro large	0	0
Hydro small	4	4
Geothermal electricity	3	3
Wave and tidal	3	4
Biomass heat	3	4
Solar thermal	4	3
Geothermal heat	0	0
Biofuels	0	0

***0**=No activity; **1**= Insufficient support or very strong barriers; **2**=Little support or significant constraints; **3**= Moderate support or acceptable market conditions; **4**=High support or good market conditions; **5**=Very high support or very good condition*

[23] HMG, Sustainable Development web-site, http://www.sustainable-development.gov.uk/performance/4.htm. The graphs have been provided by Angie Austin based on UK government data.

Figure 1: Trend required to meet 10% target

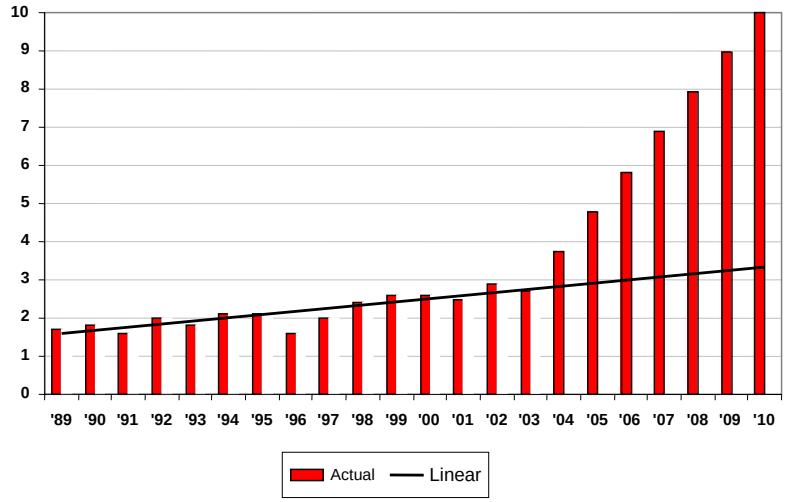
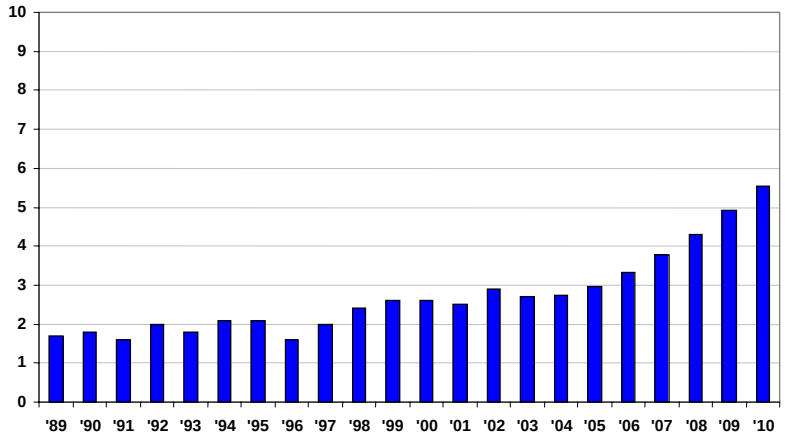


Figure 2: Trend based on average change from 2000 (yr when target was set)



In commenting on EU performance generally, but also true for the UK case, the assessment notes that the success of the wind sector has not been matched by the slow growth of biomass electricity.[24] The same sorts of support measures provided to wind had not been applied to that sector. Yet, as the report noted, if the EU and member states were to meet their collective target for renewable energy by 2010, there would need to be an expansion of biomass generation to the point where it was providing 40 per cent of all renewable energy.

The Commission's overall assessment of UK progress toward the renewables target was 'not that optimistic'. It said that apart from four Member States (Denmark, Germany, Spain, Finland), which 'have actively adopted measures', other Member States would have to 'act more quickly to introduce more ambitious policies in order to meet their targets'.[25]

In particular, the Commission found that Britain only had 'medium level' conditions on a scale of one to three for promoting grid access and removing administrative barriers.[26] Germany and Spain were assessed to be ahead of Britain on both counts. The Commission also reported that the UK had been unable to meet an important milestone date it had agreed in 2001. By March 2004, the UK had failed to complete its obligation under Article 5 of the Directive that requires Member States to implement a system for a 'guarantee of origin'[27] by 27 October 2003. It had completed the first two of the required three steps,[28] and the third was under way. While the

[24] 'Between 1997 and 2001, Finland, Denmark and the UK (mainly using biogas) were the only countries in which biomass electricity grew steadily. In some countries the biomass contribution grew comparably but intermittently, and in others it stayed small'

[25] European Commission, 'Electricity from Renewable Energy Sources'.

[26] European Commission, Communication, 'The share of renewable energy in the EU'.

[27] This is a certification for generating firms that acts as evidence that they have generated a given amount of electricity from renewables.

[28] According to the Commission, the most important steps are the 'implementing legislation, appointing the body for issuing the guarantees of origin and establishing an accurate and reliable system including the preparation of documents and registries'. See http://europa.eu.int/comm/energy/res/documents/country_profiles/com_2004_366_en.pdf.

delays in this implementation are understandable, the stringing out of already 'lenient' time frames puts the government's commitment under some doubt.

There are many reasons why the UK is off-track from its target for use of renewable energy sources. Some of these explanations can be found in the 'tactical settings' of government polices, others can be found at the 'strategic level'. The next section provides examples of critique of UK policy at the tactical level. The material in that section is not meant to be comprehensive. It is meant rather to give examples of how much more needs to be done in discrete areas of policy, at the same time as reminding readers of just how complex and difficult it has been even to make the progress achieved to date.

Assessing Government Policy: Tactical Settings

Positive evaluations of government policy can be found in numerous documents issued by it, or prepared with its support and in a variety of reviews by parliamentary committees and other bodies. By reference to a number of critical commentaries, this section seeks to illustrate the range and depth of tactical policy settings that remain to be addressed.

According to a study by the Institute for Public Policy Research in the UK, there was still a need for greater sophistication in setting policy for renewables.[29] The study concluded that the 'main delivery mechanism, the Renewables Obligation (RO), suffers from problems of design and scope, which have led to a rapid increase in wind power planning applications but neglected other, less developed technologies'. IPPR proposed a number of measures to redress this, including an additional, performance-based price for output, such as a 'feed-in' tariff to guarantee a market and price for new technologies or for small scale projects. This in effect would create higher values for the renewables certificates for emerging technologies, and thus

[29] Catherine Mitchell and Bridget Woodman, 'The Burning Question: Is the UK on Course for a Low Carbon Economy', November 2004, Institue for Public Policy Research, http://www.ippr.org.uk/ecomm/files/Exec%20Summary%20from%20The%20Burning%20Question.pdf.

encourage (or oblige) suppliers to buy a certain proportion of their power from such sources.

The House of Lords Science and Technology Committee (STC) also took issue with the RO, saying that it sets rising targets for the amount of renewable electricity to be generated each year, thus providing subtle market-driven incentives to generators. The incentive in any one year is high until around 70 per cent of the Government's target for renewables generation in that year has been attained, and then declines rapidly.[30] The Committee believes that this mechanism will in fact ensure that the Government's targets are not attained. The value of ROCs, and thus the subsidy received by renewable generators, is determined by the ratio of eligible renewable generation to the level of the RO at the time. Therefore, if the output from eligible renewables were actually to ever reach the RO level, the marginal value of ROCs would fall to zero. Seen in this way, the RO actually acts as a cap on renewables capacity, not as a target. The Government should set the RO at a significantly higher level if it wishes to avoid this effect and encourage more confidence in the investor community in renewables. The STC suggests looking to Germany and Spain for models of where 'feed-in' tariffs reduce risks to investors and developers, albeit at large cost to the consumer. It also suggests undertaking a set of rolling RO targets or guaranteeing a minimum price for the duration of the Obligation, in order to encourage sustained investor support.

Moreover, RO discriminates strongly in favour of generation technologies that can be brought to the market rapidly, notably wind power. This situation disadvantages the diversification of the national renewable portfolio and should be addressed.

IPPR has called for efforts to value electricity that was generated from domestic systems but not sold to suppliers so that there would be greater incentives to install such systems. IPPR also noted that 'heat derived from renewables or from liquids, such as biofuels, is not covered by the electricity obligation'. The effect of this, according

[30] House of Lords Science and Technology Committee report, *Renewable Energy: Practicalities* (July 2004).

to the study, was to 'neglect the contribution that renewables can make to total carbon dioxide reductions or to the wider energy system'. IPPR called on the UK to 'establish a renewable heat obligation' in addition to the electricity obligation. The study called on the Government to extend its Community Energy programme[31] with higher levels of funding and a requirement for developers to justify the rejection of CHP as an option.

The government is reviewing the feasibility of transport renewables obligation similar to the RO for electricity.

A recent assessment by the Environment Audit Committee was more strident in its critique of what remained to be done in exploiting tactical options.[32] The Committee cited the conclusion of a study by the National Audit Office that the renewables obligation 'provides an incentive only for wind and does little or nothing to bring to market other renewable technologies which are more costly, partly because the Obligation was not banded in order to provide effective incentives for these other technologies'. The Committee felt that the obligation did not offer the 'flexibility and certainty of feed-in tariffs which have been applied successfully in Spain and Germany'.

In 2001 the Cabinet Office Performance and Innovation Unit commissioned OXERA to carry out a study of a number of possible scenarios for the future of renewables in Britain. OXERA's work suggests that for the UK's 2010 renewable target of ten per cent to be achieved, the build rate for all renewable technologies would need to increase by about two orders of magnitude. Government

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[31] Community energy schemes set up in 2001 provide heat and/or power from one central source to multiple buildings (such as homes, schools, universities, hospitals or offices). Schemes can range in size from one tower block with a central heat source for all the flats to citywide schemes connecting many public and commercial buildings. The benefits include Low cost heating and power, improved energy efficiency, significantly reducing carbon dioxide emissions and fuel costs, reduced management costs and increased reliability, and enhanced energy security through fuel flexibility. See http://www.est.org.uk/housingbuildings/communityenergy//.

[32] Environmental Audit Committee, Seventh Report, Pre-Budget 2004 and Budget 2005: Tax, Appraisal, and the Environment, 13 April 2005, http://www.publications.parliament.uk/pa/cm200405/cmselect/cmenvaud/261/26110.htm#a15.

funding levels do not appear to have reacted wholly to this prediction.

Government procurement policy for cars, buses and trucks in Britain may have been setting a bad example by failing to move to fleets that use renewables. For example, the government has announced a very modest target that by 2012, ten per cent of its vehicles will be 'low carbon'.[33] By contrast, the government has set itself a more ambitious target than the national level by committing itself to a target that by 2008, rather than 2010, its estate will source ten per cent of its power form renewable sources.[34] (As noted by the Environment Audit Committee, the 'combined annual procurement budget of central and local government in the UK is in the region of £125bn a year'.)[35]

According to a review of Europe wide practices at the European Conference for Renewable Energy in 2004, progress was still needed in the field of intelligent grid management.[36] The Conference also concluded that while feed-in schemes provide for the most stable investment conditions, there needed to be some differentiation made for regional conditions, varying on-grid technologies and smaller scale technologies. More attention had to be paid to the regulatory framework and financial incentives for addressing the heating and cooling sector well beyond current regulation at the European level through the Directive on the energy performance of buildings. The heating and cooling sector was not yet adequately covered by promotion mechanisms such as feed-in systems.

At a time of its Presidency of the EU and Chairmanship of the G8, the UK targets for use of renewable energy put it fourth last in the

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[33] *Securing the Future*, p. 85.
[34] *Securing the Future*, p. 90.
[35] Environment Audit Committee, Sixth Report, 'Sustainable Public Procurement', 13 April 2005, http://www.publications.parliament.uk/pa/cm200405/cmselect/cmenvaud/266/26603.htm.
[36] European Conference for Renewable Energy 'Intelligent Policy Options', Berlin, 19-21 January 2004, Conclusions Session 2: Implementation of Renewable Energy Sources Policies in Europe, http://europa.eu.int/comm/energy/res/berlin_2004/doc/2004_berlin_session2_conclusions_en.pdf.

EU-15 and last among the European members of the G8, as shown in Table 2.[37] It is very difficult to believe that the UK can continue to 'lead from behind' on renewables policy.

Table 2: National Targets for Share Electric Power produced by Renewable Sources by 2010

Austria	78.1
Sweden	60.0
Portugal	39.0
Finland	31.5
Spain	29.4
Demark	29.0
Italy	25.0
France	21.0
Greece	20.1
Ireland	13.2
Germany	12.5
UK	***10.0***
Netherlands	9.0
Belgium	6.0
Luxembourg	5.7

Assessing Government Policy: Strategic Approaches

Improvements in many of the technical and tactical aspects of promoting a shift to renewables will continue to be made but there is reason to believe that they cannot have the strategic impact that new circumstances now demand. There is little in current UK policy on renewables that reflects the sense of urgency now recognised by the government. A target set in 2000 does not have the same political and security relevance today given the changing security threats, both conventional and environmental, and trends in global energy markets. There is a need for new strategic approaches.

There is no doubt that the UK government has the political will at the highest levels. But it may be time for the government to admit that it can't achieve its objectives in a timely manner through traditional

[37] The EU targets were set in 2001.

governmental mechanisms. The remainder of this chapter looks at possible elements of a new strategic approach.

A Need for 'Carbon Costing'

The current pricing of energy production from renewable sources does not reflect its true cost to the environment, social welfare or industrial productivity. According to evidence given to the House of Commons Environmental Audit Select Committee in 2002, and as is widely appreciated: 'there has not been carbon costing in the market-place... there is a lot of science that needs to go behind that'.[38]

A variety of measures that place a value on the costs associated with climate change and that link it to the price of energy sourced from carbon intensive fuel sources will in no doubt close the margin between the price of renewable energy and carbon intensive energy. The growing decline in this margin and the growing consumer awareness of the benefits from sourcing energy from renewable sources will increasingly shape energy consumption patterns away from traditional 'dirty' fuels.

One such policy measure is the introduction of an emissions cap on industry by government. This cap provides a financial incentive to firms that are able to reduce emissions below an auctioned/allocated amount as they are able resell the quota/cap on to other firms in the market. This type of regime tends to be favoured over taxes as the target set for emission reduction can be set directly as opposed as indirectly with a tax. It also provides the additional benefit where firms can allocate over a set period when and how they can meet the new regulatory requirements.

A carbon emissions trading scheme was introduced in the UK at the start of the year and will later become part of a wider EU carbon emissions trading market. The other measure used by the UK government to attempt to internalize the costs associated with

[38] Dr Brian Count, 6 February 2002, http://www.publications.parliament.uk/pa/cm200102/cmselect/cmenvaud/582/2020603.htm.

climate change in the production of energy from carbon intensive fuel sources is the Climate Change Levy (CCL). The levy, by the Government's own admission, only reflects 50 per cent of its cost estimated on the economy as a result of carbon intensive energy production.[39]

Carbon costing has not yet penetrated government policy except at macro levels (carbon emissions, carbon trading, climate change levies). But, with few exceptions,[40] the relative carbon cost of consumer items (cotton versus synthetics) is not as a matter of course revealed to consumers as a component of the pricing or labeling. Nor is the carbon cost of home building and home management choices as widely publicised as it needs to be, notwithstanding an impressive array of programmes for home energy audits or best practice in building design that is sensitive to issues of renewable energy and carbon-sourced energy. The growing demand for more energy efficient housing and commercial property is the first step in a shift in consumption patterns that takes into account the cost of energy.

As noted above, the move to value the costs of climate change and internalise these costs in the production of energy sourced from fuels that contribute to global warming, is in its infancy. Closing the gap in the relative cost of renewables versus non-renewable production needs to be addressed if the renewable energy target of 10 per cent is to be met by 2010. In its assessment in 2004, the Commission (EC) concluded that more rapid progress toward use of renewables depended on the creation of a 'level playing field' by 'including external societal benefit/costs' in national energy policy frameworks. The same conclusion was reached by the European Conference for renewable energy: 'As long as the energy prices do

[39] Catherine Mitchell and Bridget Woodman , 'The Burning Question: Is the UK on Course for a Low Carbon Economy', November 2004, Institute for Public Policy Research, http://www.ippr.org.uk/ecomm/files/Exec%20Summary%20from%20The%20Burning%20Question.pdf.

[40] 'There is a voluntary colour-coded energy efficiency label for new cars – similar to those now used for white goods (large domestic appliances) – to provide consumers with clear, simple information about the climate change impacts of different vehicle makes and models. The Government launched this label in February 2005.' See Securing the Future', p. 85.

not reflect the full socio-economic costs there will be no level-playing field for renewables'. The Conference urged the EU to include the 'polluter-pays' principle in all its policies, and take into account the long-term benefits of renewables should be taken into any decision on new power capacity building in all member states.[41]

Public Engagement as One Missing Link

Despite the breadth of work been undertaken to research and develop different types of renewable technologies, the case for renewables has still not won the battle for widespread public support. According to a study commissioned by DEFRA, a large majority of the public are familiar with the term 'renewable energy', 'although their understanding of the term appears to be variable, and they seldom use it in their own speech'.[42] It simply does not register with most people.

Much media coverage continues to focus on contentious issues such as the aesthetic appeal of onshore wind farms. Debate fails to join up the environmental case for renewables with the economic arguments and the issue of overall national energy security.

Only a tiny fraction of the limited funds dedicated to renewables targets are for changing public opinion. Some of this is spent through schemes by the Countryside Agency's Community Renewables Scheme and the New Opportunities Fund Green Spaces and Sustainable Communities Scheme (in England only). In 2001, PIU committed up to £10m to a programme over three years,

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[41] European Conference for Renewable Energy 'Intelligent Policy Options', Berlin, 19-21 January 2004, Conclusions Session 2: Implementation of Renewable Energy Sources Policies in Europe, http://europa.eu.int/comm/energy/res/berlin_2004/doc/2004_berlin_session2_conclusions_en.pdf.

[42] The study went on: 'It does not appear to be a common sense term, in so far as those who do not know what it means struggle to explain it accurately ('energy that is reusable' is the most common interpretation). Nonetheless, a study that tried to find more impactful terms for this range of technologies ended up concluding there was no better term available. Interestingly, the term does not seem to engage the majority of the public; only a small proportion of the public who are not already well-versed in the concept say they would like to know more about it'. http://www.defra.gov.uk/environment/climatechange/pdf/ccc-app1.pdf

administered by the DTI, to be used on community and household projects, and up to £2.5m to be allocated to the administration of a series of regional road-shows. In addition, £4m were given to facilitate the demonstration of technologies to encourage more interactive use. In 2005, the government launched the Climate Change Communications Initiative with funding of at least £12 million over the period 2005-08, to 'tackle public attitudes to, and understanding of, climate change, and what we can each do to help reduce our personal contribution to climate change'.[43] The government has also supported broader initiatives, such as Environmental Stewardship, to 'incentivise farmers to deliver environmental benefits'.[44]

The government commissioned several consultancy reports to propose a strategy for climate change communications which were completed in February 2005.[45] These provide a solid foundation for advancing the broader climate change agenda. The authors of the strategy felt that it would contribute by 'generating a sense of urgency on climate change'.[46]

The objective of the strategy was, however, quite limited. It is 'to encourage attitude change and acceptance of policy change for climate change in the UK'.[47] There is a specific recommendation that 'certain energy audiences critical to the fulfillment of the energy white paper goals should also be targeted'. The study identifies key target groups as constriction industry, product design, public sector, investors, insurers, transport, business, and the media.[48] The strategy identifies both national and local strategies. At the local level, the strategy suggested the core activity should be to 'motivate,

[43] See http://www.sustainable-development.gov.uk/documents/publications/strategy/Exec%20Sum.pdf.
[44] See http://www.sustainable-development.gov.uk/documents/publications/strategy/Exec%20Sum.pdf
[45] These were produced by FUTERRA Sustainability Communications Ltd, and can be found at the web-site http://www.defra.gov.uk/environment/climatechange/02.htm#ccc.
[46] FUTERRA, 'UK Communications Strategy on Climate Change', February 2005, p. 8.
[47] 'UK Communications Strategy on Climate Change', p. 12.
[48] 'UK Communications Strategy on Climate Change', p. 18.

support and ensure the skills of local communicators for climate change'. It recommended the establishment of a fund for local communications planning. At the national level, the study proposed a series of large-scale activities

The strategy correctly noted at several points that additional research on basic attitudes was necessary. It recommended that base-line surveys be carried out at the start of implementation of the communications strategy, so that the results of new communications messages and campaigns could be measured.[49] It suggested using an existing DEFRA survey (Public Attitudes to Quality of Life) as the foundation of this rather than create a new survey.

Public opinion on the environment is inevitably shaped through both social and formal learning. Throughout the UK education system, either at school or tertiary level, there is little education on renewables. The Environmental Audit Committee has observed stridently: there is a 'fundamental lack of commitment to the basic principle on the part of those with responsibility for promoting it and educating us about it'.[50] 'The Prime Minister's vision of the threat of climate change, and in particular the urgency he expressed about taking positive action to deal with this threat, must be reflected in those Departments' actions [DfES and DEFRA] and not just their rhetoric'.

There certainly appears to be a disparity between the volume of studies and strategy reports produced and the speed of change in terms of renewable energy industry growth and public opinion about the need for a low-carbon future.

In its major strategy document released in March 2005, the government noted that one of its international commitments was to 'urgently and substantially increase global use of renewable

[49] 'UK Communications Strategy on Climate Change', pp. 59-60.
[50] Environment Audit Committee, Fifth Report, 'Environmental Education: Follow-up to Learning the Sustainability Lesson', 5 April 2005, http://www.publications.parliament.uk/pa/cm200405/cmselect/cmenvaud/84/8403.htm.

energy'.[51] On the previous page, the report said that the UK's 'international commitments must be followed up and implemented as a matter of urgency'. The report said that this must be done through 'addressing the international impacts of our domestic policies' and by 'working … to spread good practice and maintain political pressure for change'. The next section of this chapter looks at what might constitute a good campaign of this sort, and how domestic and international aspects might fit together.

What Makes a Successful Take-Up Campaign

Campaigns and environmental issues, like renewable energy, are no strangers to each other. The FUTERRA communications strategy for climate change has been referred to above and it will certainly provide a solid basis for forward work. There is, though, some more focused European experience of promoting take-up of renewable energy sources that is also quite relevant. This experience demonstrates quite effectively that the 'communications campaign' of the sort designed by FUTERRA should not be confused with a comprehensive campaign to foster the uptake of renewables. A communications campaign must sit alongside many other concrete activities, whether they be drafting of sub-sector targets, the training of officials, the funding of lighthouse and demonstration projects, or the identification of new leadership posts in energy development and administration.

The 'Campaign for Take-Off' between 1999 and 2003, which was designed to act as a catalyst for the development of renewable energy sources, was evaluated at European conference in 2004.[52] The meeting concluded that the campaign was successful because it provided clear benchmarks for progress and clear signals for decision makers at all levels to take up ambitious targets at sub-

[51] *Securing the Future*, March 2005, p. 18, http://www.sustainable-development.gov.uk/documents/publications/strategy/SecFut_complete.pdf.

[52] European Conference for Renewable Energy, 'Intelligent Policy Options, Berlin, 19-21 January 2004, Conclusions Session 1: 'The Campaign for Take-Off 1999–2003: Sharing Skills and Achievements to foster Renewable Energy Development in Europe', http://europa.eu.int/comm/energy/res/berlin_2004/doc/ 2004_berlin_ session1_conclusions.pdf.

sector levels (such as wind and photovoltaic). The meeting noted the success of 'pioneer regions, cities and municipalities' in Europe because they had reliable, coherent and ambitious energy plans' that set out the main parameters for energy-related decision making. Their plans addressed both demand side issues and supply side (renewable energy sources). The plans included legal, regulatory, financial, communication and training measures. The best plans were those that had a highly integrated approach that addressed conservation (the demand side) and the supply side equally.

Most importantly, the conference concluded that a Europe-wide campaign was particularly useful, no doubt because it stimulated a competitive instinct as well as show-casing best practice.[53] Since urban areas represent the largest group of energy consumers in Europe, the conference noted the huge success of several large cities, where the renewable issue was linked to improving living conditions, or the regeneration of dying industrial areas.

The conference agreed that decision makers needed to plan sustainable energy strategies at short, medium and long term perspective 'in order to provide clear signals to the private sector and those facilitating investment'.

Other key conclusions about the experience to 2003 included:

- Clearly identified leadership frameworks at all levels are essential
- The closeness of energy decisions to the citizens is an important catalysts for greater uptake at local level
- Lack of awareness and information among officials and the public is still one of the most important barriers against the uptake of renewable energy sources

[53] 'The transfer of know how between the regions, with specifically developed technology, will contribute to a balanced EU and Member States energy mix. The creation of Partnerships between the different actors and the European Commission has importantly contributed to stimulating the implementation of RES at local and regional levels'.

- The decentralised nature of uptake is a precondition of success;
- Renewables uptake helps to create new local markets, expertise and employment;
- Local policy can have a considerable impact in reducing CO_2 emissions, if the objectives, the targets and the top down message are precisely formulated
- Islands and remote rural communities are 'privileged laboratories' for renewables and should turn themselves into demonstration centres
- A special innovator campaign allowed the application of new approaches and technologies within a range of emerging sectors (construction, transport, tourism, services, and water production)
- Under the 'Renewable Energy Partnership' scheme, regions, cities, municipalities, industries and their associations were called upon to join the network by signing up to strong commitments and tangible targets.

The Conference proposed a successor campaign for 2004-2007 and made the following recommendations for it:[54]

- Integrate renewable sources and energy efficiency in a single approach for any public awareness activity
- Assess and set tangible targets for renewables supply in end-use sectors

[54] European Conference for Renewable Energy, 'Intelligent Policy Options, Berlin, 19-21 January 2004, Conclusions Session 1: 'The Campaign for Take-Off 1999–2003: Sharing Skills and Achievements to foster Renewable Energy Development in Europe', http://europa.eu.int/comm/energy/res/berlin_2004/doc/ 2004_berlin_ session1_conclusions.pdf.

- Involve market actors and decision makers at all levels in a direct way
- Publicise the benefits and success stories specifically designed to 'overcome resistance of local politicians and planners, who currently lack awareness and information'
- Identify and use lighthouse initiatives and showcase projects.

Accountability: Who Is Responsible?

In addressing the renewable energy problem and indeed the entire question of energy security, one cannot help being struck by the lack of strong linkage made in public statements by officials, community leaders and other commentators between desired outcomes and who is responsible for getting there. The UK government has adopted, quite appropriately, a policy principle that the market should decide, at the same time as it has been willing to provide a wide range of 'non-market' support measures. There is room to believe that this relative silence on the issue of responsibility is overlooking one of the main sets of issues that must be addressed in making a faster transition to renewables, at the same time as ensuring energy security in the face of sustained interruptions of energy supply, either localised or nation-wide (or across Europe for that matter).

In 2004, the House of Lords Science and Technology Committee made this point rather robustly, saying that they 'could not avoid the conclusion that the Government are not taking energy problems sufficiently seriously' because they 'could find no one at the executive level whose responsibility it was to ensure continuity of supply'.[55] They went on to say that 'we were told simply that market forces would solve the problem. We are not convinced and urge the Government to give these matters further consideration'.

[55] House of Lords Science and Technology Committee Report, *Renewable Energy: Practicalities* (2004).

While that comment about energy security may seem at first glance to be somewhat removed from the issue of uptake of renewable energy sources, it is in fact closely related. To meet a serious energy shock, any government must have a national energy security plan that answers the question 'who is in charge' and 'what is his/her legal authority'. This plan must be a layered one that addresses the regional and local decision-making chain. This is clearly the case in the UK for natural disasters and emergency response

In respect of promoting renewable energy, the government has clearly taken steps to foster both regional and local ownership of the new energy agenda. For example, in its 2005 policy paper, it announced that it would strengthen the Sustainable Development Commission and ask it to report on the Government's progress on sustainable development.[56] It also said that it would work with the Audit Commission to strengthen the Comprehensive Performance Assessment of local authorities to take more account of sustainable development and the local environment. It committed itself to ensuring that 'all central Government departments and their executive agencies will produce focused sustainable development action plans based on this strategy by December 2005'. There are numerous other examples of government awareness of the need to set clear chains of authority and leadership for energy-related decision-making in certain policy areas. But this effort is still not as comprehensive as it needs to be.

In the community at large, and in a variety of businesses, universities, schools and prisons, there are people who have taken the lead and can be identified as the 'energy decision-makers'. One of the best examples of this is the Corporation of London which has an integrated energy and water plan, and a system of energy wardens to oversee it.

Such strategic energy planning across many layers of administration and activity is the exception rather than the rule. One indicator of this

[56] *Securing the Future: UK Government Sustainable Development Strategy*, March 2005, http://www.sustainable-development.gov.uk/documents/publications/strategy/Exec%20Sum.pdf.

is that an internet search for 'energy warden/s' on UK web-sites returns only 156 hits, suggesting that the existence of such a concept, or staff in that role, figures in the communications strategy of only a small number of the millions of organisations in Britain where it might be expected to exist. Organisations where such concepts can be quickly identified from web-site searches included the Ministry of Defence, Canterbury University, the Scottish Energy Efficiency Office, the Welsh Local Government Association, and the councils of Shropshire, North Devon, North Lincolnshire and Bexley. A search on UK websites for 'energy audit/s' returns 1,000 hits, suggesting a higher penetration of the idea of energy surveys as being part of a cost management system, but even that information suggests that energy auditing is not a widely accepted concept throughout Britain.

CONCLUSION

The UK Government has shown impressive leadership on mitigating climate change and the transition to renewable energy. There is still much it can do better. Important innovations introduced in 2005, especially the introduction of a climate change communication strategy, show that it continues to refine its strategies. One thing is clear. The country's weak performance on the transition to renewable energy sources (in terms of the target of ten per cent by 2010) puts it in the unenviable position of 'leading from behind'. A range of other considerations in security, economic and social policy – both at home and internationally – dictate a more rapid transition to use of renewable energy sources.

On a 'tactical' level, much can still be done in terms of promoting grid access and removing administrative barriers. On a more 'strategic' level, the government will have to accept a comprehensive move to 'carbon costing' reflective of the hidden costs of non-renewables use.

But the issue of energy use is not something for the government alone. It is a matter of the most fundamental national importance. British citizens, both individual and corporate, must accept the need

to make a rapid transition to energy resilience, of which use of renewable sources and conservation are essential elements. The main recommendation for policy change flowing from this chapter is the need to mobilise the country behind a clearer understanding of energy use that will inform consumption patterns and choices for renewable sources. Encouragement to set up grass-roots community projects in energy conservation, especially in building management, is but one example. Dispelling the negative connotations associated with hybrid transport vehicles is another major challenge.

The government has identified a sense of urgency about various aspects of energy policy, but this sense of urgency is not shared by the community at large. In our view, an important tool in developing an awareness of the need is giving citizens a better capacity to act on it. While some may find the term ‘energy wardens’ a little off-putting, the idea behind the term is what counts.

The motif of a ‘home guard’ made up of ‘energy wardens’ is not meant to suggest that Britain is on the brink of large-scale military conflict. Rather, the image hopes to inspire a sense of community responsibility and common purpose. The emerging practice of key corporations and public institutions in Britain to appoint ‘energy wardens’, whether by that name or another, will inevitably become nationwide practice. The need for households and small firms to conduct an annual energy audit of their home or commercial sites will become a new part of our twenty-first century life.

Appendix 1: European Commission Assessment of UK Renewables Policy [57]

1. Summary of RES markets and policy

Background

In the United Kingdom renewable energy is strongly supported by a system with mandatory demand and several grants programs. Renewables are an important part of the climate change strategy. Renewable energy is therefore exempted from the Climate Change Levy (CCL). After one year of the new established certificate market, the CCL and the grants programs in full operation, the development of RES seems to be increasing apace.

RES targets

The RES-E target to be achieved by the UK in 2010 is 10 % of gross electricity consumption. An indicative target for RES-E of 20% for 2020 has been set. No formal targets exist for RES-H and biofuels.

Status of the renewable energy market

The buy-out revenues for non-compliances are recycled to the suppliers in proportion to the certificates they have used for complying with the obligation. This mechanism increased the certificate price above the buy-out price because the market is short. High prices in the first year gave the ROC (Renewable Obligation scheme) market a kick-start. Targets specified for 2010 and scheme duration specified until 2027 provide long-term security for renewable energy investors.

Main supporting policies

- Obligatory targets with tradable green certificate system. The non-compliance 'buy-out' price for 2003-2004 is set at £30.51/MWh (approx4.5 €ct/kWh). This buy-out price will be annually adjusted in line with the retail price index.

[57] http://europa.eu.int/comm/energy/res/documents/index_en.htm.

- Climate Change Levy: renewable electricity is exempted from the climate change levy on electricity of 0.43 p/kWh (approx. 0.63 € ct/kWh)
- Grants schemes: funds are reserved from the New Opportunities Fund for new capital grants for investments in energy crops/biomass power generation (at least £33m (€53m) over three years), for small scale biomass/CHP heating (£3m or €5m), and· planting grants for energy crops (£29m or €46m for a period of seven years).

Major issues

- The targets for the obligatory demand are set up to 2027, ensuring long-term demand.
- High targets and the redistribution of buy-out revenues make RES-E investments economically viable.
- A great differentiation of grant programmes with large budgets aimed at technologies and/or municipalities give a wide range of support to initiatives.
- Grid connection issues and severe competition on the electricity market could disadvantage RES in of the support programs.

Other issues

- Government has announced new plans on off-shore wind in 2003 and around 1.400 MW installed capacity has already been approved.

2. Current status and potentials of RES

2.1. Current penetration

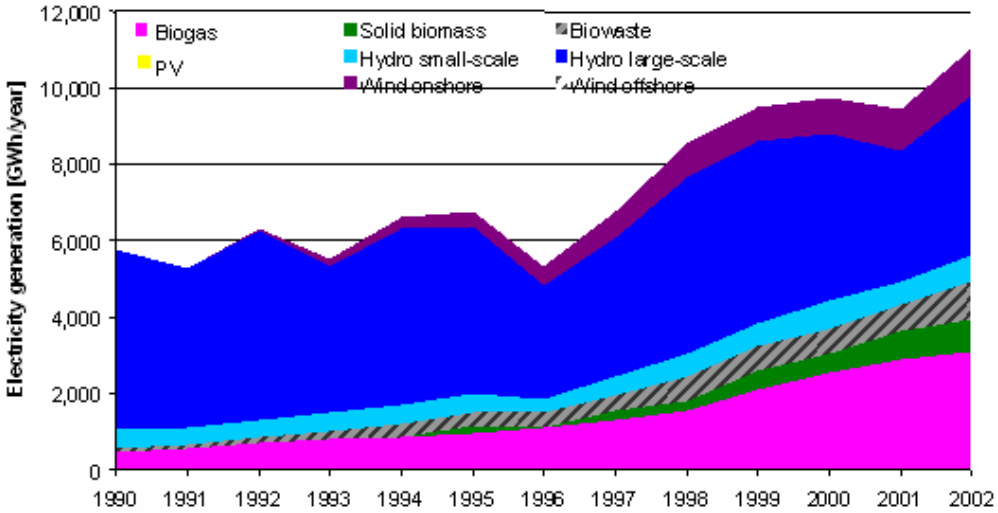
The **renewable electricity production** in the period 1990-2002 in the UK is shown in Figure 1. It can be seen that in this period annual RES-E production increased from 5.8 TWh in 1990 to around 11 TWh in 2002. **Hydro** generated electricity is the most important RES-E source, although its relative share in the RES-E production is decreasing. In 1990 hydro power was responsible for more than 90% of the annual RES-E production, whereas in 2002 its contribution was 42%. At present the second most important RES-E source is generation with **biogas**. Over the last decade the contribution of biogas to the RES-E production has increased from 8% in 1990 to

28% in 2002. Responsible for this increase is the production of **landfill gas**, which accounted for 90% of total biogas electricity production in 2002. Other technologies with an increasing contribution to the overall RES-E production in the UK are **on-shore wind** (11% in 2002), **solid biomass** (8% in 2002) and **biowaste** (8% in 2002). Installed wind power in the UK increased by 19% in 2002 to a total installed capacity of 534 MW.

Table 1: RES electricity production in 1997 and 2002 in GWh

RES-E Technology	1997 [GWh]	2002 [GWh]	Av. Annual growth [%]
Biogas	1,326	3,076	18%
Solid Biomass	199	870	34%
Biowaste	483	958	15%
Geothermal electricity	0	0	-
Hydro large-scale	4,005	4,584	3%
Hydro small-scale	164	204	4%
Photovoltaics	0	3	-
Wind onshore	665	1,251	13%
Wind off-shore	0	5	-
Total	**6,842**	**10,951**	**12%**
Share of total consumption [%]	1.70%	2.8%	-

Figure 1: RES-electricity production up until 2002[1]



[1] Based on EUROSTAT data, which are up-to-date only until 2001. For many RES, e.g. wind-onshore and PV more recent data from sector organisations and national statistics have been used.

Table 2 shows data indicating the penetration of **RES-heat** in the UK. **Biomass heat** production in 2002 reached 700 ktoe, which is significantly lower than the 917 ktoe reached in 1997. **Solar thermal heat** and **geothermal heat** production is still relatively small compared with biomass heat, but solar thermal heat has increased by average annual growth rates of 13% in the period 1997-2002.

As can be seen in Table 3, the production of **biofuel** corresponded to 3 ktoe in the year 2002, while in 1997 still virtually no biofuels were being produced.

Table 2: RES-heat production in 1997 and 2002 in ktoe

	Penetration 1997 [ktoe]	Penetration 2002 [ktoe]	Average growth rate since 1997 [%/year]
Biomass heat	917	700*	-5
Solar thermal heat	9	16	13
Geothermal heat	0.8	0.8	0

*Biomass heat only up until 2001

2.1 Mid-term Potentials

Figure 2: Mid-term potentials of RES electricity heat and transport in the UK

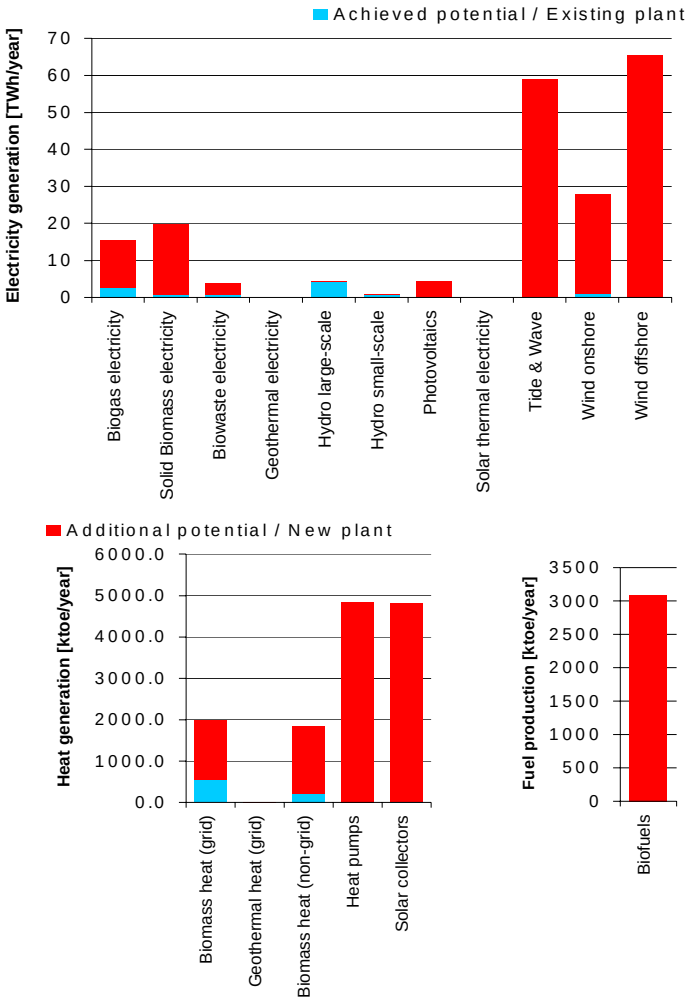


Table 3: Policy assessment for RES - United Kingdom
(continued on opposite page)

RES-type	**Wind onshore**	**Wind offshore**	**PV**	**Biomass electricity**
Dominant instrument	Climate change levy and renewable s obligation	As wind onshore plus capital grants	Govt promotion funds (plus see wind onshore)	As wind onshore plus govt funds for energy crops
Type of instrument	Tax incentive and green certificates	Investment compensation scheme plus see wind onshore	Rebates plus see wind onshore	Rebates plus see wind onshore
When implemented	2002	2002	2002	2002
Key factors	Only the currently cost-efficient technologies are stimulated; fluctuating prices Long-term certainty, high targets and prices For off-shore: possible locations already identified and secured; extra grants available		Programmes too small to result in lowering of production costs for PV. Political willingness assumed to be stable factor to stimulate success of programmes.	See hydro-small
Degree and duration of support	•••••	•••••	•	••
Non-economic factors	••••	••••	•••	••••

•	Insufficient support or very strong barriers
••	Little support or significant constraints
•••	Moderate support or acceptable market conditions

Hydro - small	**Geoth. electr.**	**Wave & Tidal**	**Biomass heat**	**Solar thermal**	**Biofuels**
As wind onshore	As wind onshore	As wind onshore	Govt funds for energy crops	Clear Skies Scheme	Tax exemption
As wind onshore	As wind onshore	As wind onshore		Investment compensation scheme	Tax incentive
2002	2002	2002		2002	2004
Only the currently cost-efficient technologies are stimulated. Long term certainty, high targets and prices		See hydro-small	High investment grants	Grants are less than 50% of installation costs for communities. Direct financial support for households and small-scale levels	
••••	•••	•••	•••	••••	
••••	•••	••••	••••	•••	

••••	High support or good market conditions

•••••	Very high support or very good conditions

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