GLOBAL ENERGY SYSTEMS CONFERENCE

KEYNOTE ADDRESS

"VIEWED FROM THE LOCAL: The Policy & Economics of Energy Systems"

Michael Jefferson

Biography

Prof. Michael Jefferson studied at University College, Oxford and then the London School of Economics, before going into an economics consultancy, an industrial policy body, and then becoming Chief Economist of The Royal Dutch / Shell Group. He spent nearly 20 years in Shell in various roles, from Head of Planning in Europe to a Director of Oil Supply and Trading.

He then spent ten years as Deputy Secretary-General of the World Energy Council, where he began working with the Intergovernmental Panel on Climate Change as Contributing Author, Lead Author, Editorial Reviewer and Expert Reviewer, culminating in his receipt of the IPCC's certificate for his contributions to their award of the Nobel Peace Prize in December 2007. He has also written extensively on energy policy, including contributions to various UN bodies, and was for many years involved with the World Renewable Energy Network and Congresses.

He is a Visiting Professor in the School of Humanities at the University of Buckingham, and a member of the Technical Advisory Group of the Renewable Energy Foundation. He is a member of the Sustainable Development Committee of the UN Economic Commission for Europe.

Alongside his work in business, he has written several books in the fields of energy and economics; contributed to books on economic and social history; and written or co-authored many peer-reviewed papers in the energy and environmental field. He is a Visiting Professor at London Metropolitan University, and Professor of International Business and Sustainability in the Centre for International Business and Sustainability at London Metropolitan Business School.

Introduction

Some while ago there was talk of working “from the local to the global” in energy matters, linking optimisation of local supply opportunities, efficiency in use, and efforts to minimise environmental impacts. That sort of talk seems to have faded except for a few voices, like Ted Trainer’s, who campaign for “The Simpler Way”.

My observation point this morning lies in rural England, four miles from the nearest main road. There are some challenges to rural living, both on the energy supply side and because of remoteness. But I have some relevant background, and we have done what we can to anticipate uncertainty of energy supplies and improve energy efficiency. We are relatively well protected from the various intrusions that many rural dwellers suffer from – close proximity to wind turbines, for example. From this vantage point I can observe a rather shambolic state of affairs.

The Global

Let me begin by looking at the global position.

We are over 40 years on from the Stockholm Conference, which admittedly did do something to reduce trans-boundary air pollution, but failed to notice the risks to oil supply and prices which some of us had been discussing for upwards of two years before.

It is 30 years since the UN General Assembly called for the Brundtland Commission Report. The report concluded that it did not believe the dilemmas of sufficient energy supplies, energy efficiency and conservation measures, or environmental concerns, were being addressed by the international community with a sufficient sense of urgency and in a global perspective. That remains true.

Then came the Rio Earth Summit over 20 years ago, where sustainable energy issues were only discussed in Chapter 9: “The Protection of the Atmosphere”, and then scarcely in a concrete fashion. The UN Framework Convention on Climate Change did, of course, receive some 155 signatures in Rio, but that initiative had its

origins two years earlier. Perhaps it is not entirely surprising, therefore, that it was only in Rio+5, at the 19th Special Session of the UN General Assembly, that delegates seemed to stumble on the notion of sustainable energy development for the first time and a possible role for inter-governmental intervention. Better late than never, one might have thought, and yet the year 2000 Millennium Declaration made no mention of the word energy in any of its 32 clauses.

It was only in the following year, at the Ninth Session of the UN Commission on Sustainable Development, that there was any intimation that energy might be central to achieving the goals of sustainable development. Even then it was rather vague. The UN Deputy Secretary-General admitted: “Overall, the record card is very poor.”

At first sight it looked as if things might have begun to pick up with the appearance of a UN-sponsored report: “Energy Services for the Millennium Development Goals” in 2005, with its talk of achieving wider and greater access to energy services being critical to the achievement of the Millennium Development Goals. Little has happened on that since 2005, except the creation in 2009 of the UN Advisory Group on Energy and Climate Change which focussed on widening access to energy services and on energy efficiency. Various aspirations were set out in a report published in 2010, but little of real consequence has happened since.

The Rio+20 Earth Summit showcased the UN initiative “Sustainable Energy for All”, with its three goals to be achieved by 2030: to ensure universal access to modern energy services; to double the rate of improvement in energy efficiency; and to double the share of renewable energy in the global energy mix. The year 2012, you may recall, was designated by UN as “The International Year of Sustainable Energy for All”. The effect was rather spoiled by parallel admissions that 3 billion people still rely on traditional biomass, and a further 1.4 billion people do not have access to modern energy services.

Here in the UK there are a growing number of people who fear they may join one or other of those groups as the EU’s Large Combustion Directive cuts a swathe

through coal-fired electricity generation; gas storage capacity remains very modest; further nuclear plant closures remain in the pipeline; and the contributions of renewable energy –especially wind power - continue to be exaggerated.

Whether the review of progress towards the Millennium Development Goals, to take place in 2015, will advance matters must be a matter of some doubt. The UN system has already warned that a further 1.4 billion people risk being without modern energy services by 2030, largely as a result of population expansion.

Then there is the role of UN agencies and other inter-governmental bodies in climatic change matters. Now climatic change is a very complex subject as we all know, and the subject of some controversy. Last week the UK Meteorological Office held a meeting to discuss what they termed "the disappointing summers of recent years", out of which I hope will come greater prudence about how well we can foresee future climatic change and closer focus on doing more sensible things about it.

Suffice it for me to say that with so-called 'greenhouse' gas emissions being pumped out in increasing volumes at the global level, their atmospheric concentration is likely to increase and thus raise the risk of enhanced near-surface global warming. I said so-called 'greenhouse' gases because, of course, the Earth's atmosphere is very different from a greenhouse.

But there are also natural variations and shifts in the capacity of the Earth's system – the oceans and forests in particular – to absorb some of these gases. Solar variation has recently been cited in some quarters as an important factor. Given the complexities and uncertainties, it is surely foolish not to take ***sound*** precautionary measures. I emphasise the word 'sound' because, as I shall explain later, many things being done in the name of mitigating climatic change are ***not*** sound.

This is not the place for me to explore closely the data on these so-called 'greenhouse' gas emissions, but I do want to expand on one aspect of them. The initial Kyoto Protocol targets were whittled down. Some Annex I countries show large increases (up to almost 60%); others claim large decreases (such as the UK down 23.2% since 1990 by 2010 according to the UNFCCC database). Germany is down nearly as much, and Norway claims an even greater reduction.

What do these figures really mean? They are production-based, and do not reflect the national consumption basis of these Annex I countries. There is no reflection of the emissions 'embedded' in imports of goods from China or India, for example, largely manufactured using coal-fired electricity generation. If these emissions 'embedded' in UK imports were taken into account, for instance, almost all of the reduction of 23% since 1990 would be wiped out. This is not a secret. The chief scientific advisors to the UK Departments of Energy & Climate Change, and of the Environment – Professor David MacKay and Sir Robert Watson – have pointed out, respectively, that the official figures are "an illusion", and "We've got to be more open about this." In September, 2010, Sir Robert even concluded that if you took carbon emissions "embedded" in UK imports into account a net increase of 12% had occurred since 1990. The UK Committee on Climate Change, reporting in April this year, referred to the increase it the UK's carbon footprint in recent years "because of the growth of our imports". The fact that some of these imports are the result of closure of UK manufacturing facilities is irrelevant to the argument that the official figures, and the basis for the Kyoto Protocol, are a false prospectus. Indeed, the whole UN climate negotiation process has been severely flawed. Many questions have arisen over the past twenty years about the UNFCCC process.

Why, for example, on the last morning of the Kyoto conference did Chairman Estrada suddenly gavel out the original Article 10 (which had become 9) of the draft Protocol, covering voluntary commitments by developing countries to curb or reduce emissions? He had previously warned that the whole Protocol was in peril because of disagreement on this Article, acceptance of which was crucial for US support of the Protocol in the wake of the Byrd-Hagel Senate Resolution of the

previous July insisting that developing countries take on some commitment. By that final morning, apart from a bit of temporary grandstanding, some form of agreement had been reached. The Chairman's action caused US Ambassador Stuart Eizenstat and Head of US Delegation Melinda Kimble to rush to him to expostulate, but to no avail. How did this happen? Why has so little been made of it?

As the UNFCCC sessions have rolled on year after dismal year, so it has become almost obligatory for the '*Earth Negotiations Bulletin*' to report: "the session left many with the lingering feeling that much work needs to be done in a very limited amount of time." Given the amount of bracketed text that usually has to be fought over, this is not surprising. The one time there was a last minute attempt to introduce a short, clear, alternative text in Copenhagen proved a disaster. The fact is that, although alternatives may be difficult to propose, the UNFCCC system is deeply flawed. This, of course, has at least as much to do with the differing objectives of national governments as with aspects of the UN itself. The EU, and some of its Member States, have taken a leading role in many of the UNFCCC proposals and debates buoyed by the appearance of having made progress in curbing emissions. The UNFCCC records the EU-15 as having reduced its emissions between 1990 and 2010 by 11.3% and the EU-27 by 16.8%.

In the first case, the failure to express emissions on a consumption basis, in order to reflect 'embedded' emissions means the EU-15 figure is grossly misleading. On a consumption basis the EU-15's carbon emissions between 1990 and 2010 may have risen close to 20%, not fallen 11% (the estimates are very difficult to calculate). Widening the assessment to the EU-27, which reflects the many changes since the break-up of the Former Soviet Union, results in a significant decline for these countries even when adjusted to a consumption basis. This represented a fall of about 50% in the contribution of the 12 additional countries to the EU total in 2010. Nevertheless, this drop was insufficient to offset the increase in the EU-15's carbon emissions on a consumption basis. It did moderate

the EU-27 increase to about 10% between 1990 and 2010, but this is a far cry from the claimed 16.8% decline.

The policy relevance of these figures becomes immediately apparent when we consider the EU's emissions' targets for 2020 and beyond. Although it may be politically convenient to play along with the production-based declaration of carbon (and other 'greenhouse') gas emissions, it is arguably intellectually dishonest. The EU target of reducing its emissions to 20% below 1990 levels by 2020 is seen to be 30 percentage points off course (I am coming to the UK's position later). Thus in my view it is incorrect to claim, as the EU does, that: "the EU has put in place legislation to reduce its emissions to 20% below 1990 levels by 2020, and data show it is well on track to reach this target." [their emphasis].

Then there is the EU "Roadmap" for moving to a low-carbon economy by 2050. This, it is suggested, should cut the EU's emissions to 80% below 1990 levels "through domestic reductions alone", with targets of a 40% reduction by 2030, and 60% by 2040. I am reminded of my former colleague, Professor John Jewkes's view expressed almost 50 years ago:

> "Those who have set out to make a man master of his economic destiny have left behind them a trail of economic wreckage, all the more melancholy because it was the outcome often of noble hopes and scientific pretensions." [in his Lindsay Memorial Lecture]

Intriguingly, too, the EU claims that the Roadmap: "shows how the main sectors responsible for Europe's emissions – power generation, industry, transport, buildings and construction, as well as agriculture – can make the transition to a low-carbon economy most cost-effectively."

No mention, you may note, of households - of us, many already struggling to cope financially. I don't see how most people will be able to cut back as these targets suggest they will have to. I doubt very much that the next two generations will be prepared to. Under the UK's Climate Change Act, a reduction in household

electricity use of 27% by 2020, and of 40% by 2040, is indicated. There is no hope of my household cutting electricity use by about 30% through improved insulation, we've gone through all that at considerable cost. And I do not believe that our future energy supply prospects are anywhere near as rosy as such target-setting suggests.

From the Supply Side

I do not need to remind you that over 80% of the world's energy supplies still come from the fossil fuels. Nor, probably, that the level of subsidies to fossil fuels worldwide has been increasing in recent years – by nearly 30% since 2010 - and are likely to exceed US$ 600 billion this year. Although in North America and Western Europe oil consumption declined through 2012, overall world oil use rose nearly 1%. Although gas consumption fell in many European countries last year, it rose over 2% last year worldwide, including an increase of over 4% in the USA. Coal use too rose worldwide, by 2.5%, with China accounting for just over 50% of world consumption with a further rise of just over 6%. China has increased its coal use by over 2.5 times since the year 2000. India only uses about 15% of China's coal by volume, but it has doubled its consumption since the year 2000.

These figures put the quadrupling of world new renewable energy use (excluding hydropower) since the year 2000 in perspective. The total is still equivalent to less than India's coal use in 2012; and about 12.5% of China's. It is less than the oil used in The Philippines, or Qatar, or Norway, or Switzerland in 2012. Indeed, total non-hydro new renewables use in 2012 represented less than the one-third increase in hydropower's contribution since 2000.

These comparisons are disappointing after over twenty years of inter-governmental and much national promotion of new renewable energy schemes. We have now reached the point where renewable energy sources account for just over 13% of global primary energy supply. But traditional biomass still accounts for just over ten percentage points of this, and hydropower for 2.5 percentage points. All other forms of new renewable energy – modern biomass, wind power, direct

solar, geothermal, and ocean/wave – have risen to about 0.5%. Not exactly a giddy height. And among that 0.5% there have been some very strange goings on as I will be explaining shortly. In terms of electricity generation new renewables account for under 3% of the world total.

However, as we all know, much has been going on in the oil and gas world, as we read daily in reports on shale gas and now shale oil.

The story has been going around over the past couple of years that the notion of 'peak oil' is either a myth or an irrelevance. The former view is based on what appear to be increasing proved recoverable oil reserves, as presented in the Oil & Gas Journal, the annual BP Statistical Review, the International Energy Agency, and the US Energy Information Administration. There are three main reasons for this increase.

First, the five major Middle East OPEC Member oil exporters have shifted their definition of 'proved' conventional oil reserves from an earlier standard 90% probability to a 50% probability [P50] over the past twenty years, to take advantage of OPEC production quota arrangements. This alone has resulted in what is essentially an artificial increase in proved oil reserves of some 435 billion barrels. Then Venezuelan heavy oil has been added to what was a conventional oil data series. This accounts for a further rise of 298 billion barrels. The third reason is that Canadian tar sands have been added to the series as well, making up a further 174 billion barrels. Thus of the world total of proved oil reserves claimed as being 1.67 trillion barrels in 2012, 471.5 billion – the Venezuelan and Canadian bits – are not conventional oil. To which needs to be added the further 435 billion barrels 'massaged' upwards by the five major Middle East OPEC Member States. There has been a little upward 'manipulation' by a few other OPEC Members of their conventional proved oil reserves figures, but this does not amount to much.

There also appears to have been little or no reflection by the five major Middle East OPEC Member States of their conventional oil production over the past three decades or so. Between January 31st, 1984, and December 31st, 2012, this

production figure totalled just over 280 billion barrels. What the standard published figures appear to tell us, therefore, is that at least half the claimed 1.67 trillion barrels proved oil reserves figure is probably spurious.

There have, of course, long been suggestions that the claimed oil reserves figures of Saudi Arabia, Kuwait, and the UAE are all overstated – by some 130 billion barrels, 50 billion, and 26 billion, respectively. There have also been questions over the suitability of some heavy Saudi crudes for current refinery configurations and final market requirements. As those of you who have supplied refineries and markets know, crude oil qualities may not always suit requirements. The recovery and refining of Venezuelan heavy oil and Canadian tar sands pose further challenges and costs – including environmental ones. The recovery of a claimed recoverable 350 billion barrels of shale oil also poses such challenges, including the implications of research findings that have appeared in "The Oil Drum" that the EROI of shale oil is a mere 5:1, less than half of the lowest EROI figure yet produced for conventional oil.

Interestingly, BP in publishing its 2013 "Statistical Review of World Energy", headed its Note on Oil reserve definitions with the disclaimer: "Nobody knows or can know how much oil exists under the earth's surface or how much it will be possible to produce in the future."

The conclusion I draw from this is that current mainstream published proved oil reserves figures are too high; and it is too early to write off the 'peak oil' hypothesis. We all need to recall also the warnings that have been given ever since 1975 that oil price rises can snuff out global economic recovery.

As I mentioned, there is also the view that the 'peak oil' hypothesis is an irrelevance in the wake of expanding US shale gas supplies and the prospect of 350 billion barrels recoverable from shale oil. Yet shale gas will not provide much comfort to the transportation sector unless there is mass conversion of transport fleets to either electric vehicles or gas-powered ones, with all the ancillary support required.

What has happened, of course, is that shale gas has already both caused a massive cut in US gas prices (with interesting wider implications for competitiveness, not least for European companies), but also coal prices. One consequence already clear in the energy statistics is increased shipments of coal from the US to Europe, with the counter-intuitive result - for those propounding the urgent need for mitigation of climatic change - that the burning of coal in European electricity generating has increased in many countries. Thus in 2012 the UK increased its coal consumption by 24% over 2011 (the highest volume since 2006); Spain by 19%; Italy by 16%; The Netherlands by 8%; Germany by 4%; and Ireland by 17%. Overall, the EU increased its coal consumption by 3.4% in 2012 over 2011, while the USA decreased its coal consumption by nearly 12% over the previous year.

For Germany, in the wake of its post-Fukishima panic, it looks particularly bad news given an earlier coal subsidy system in place until 2018, closure of nuclear power stations and opening of new coal-fired ones, and taxes and duties on electricity use increasing by 25% this year to nearly 32 billion Euros amidst increasingly vocal opposition. It is not surprising that, with elections looming, Mrs. Merkel has called for a reduction in government spending on wind and solar power. Germany's *Energiewende* no longer looks like an Energy Wonder. But then Germany's experience of placing wind turbines in inner Lande where there is little wind and capacity factors achieved are low, and offering vast subsidies for solar roof panels where levels of solar irradiation are modest has become a byword for sub-optimal decision-making.

But it is not, of course, just the German government that has been spending money on subsidising renewable energy schemes. The household energy customer has been contributing 35% of this – and now finds they are paying over 25% more for their electricity than the EU average. More problematic still, the EU Competition Commissioner has now stepped in to say he is unhappy about the anti-competitive implications of Germany offering its energy-intensive firms (and an increasing number of not so intensive ones) price concessions.

When it comes to renewable energy there are some even more fundamental questions which need to be asked, and satisfactory answers given.

First, according to Vaclav Smil – who has looked into these things more closely than anyone else I know – has pointed out that they all have far lower power densities than the fossil fuels, with biomass and wind at the bottom of the list. Secondly, with the exception of hydropower, they all have lower EROIs than the conventional fossil fuels, as Charlie Hall, Cutler Cleveland and others have pointed out. I must confess to thinking some of these findings too over-generalised. In terms of EROI, for example, to claim a single EROI ratio of 18:1 for wind turbines when so much depends upon the mean wind speeds of where turbines are located seems liable to be wide of the mark. Or to claim solar PV has an EROI ratio of 6.8:1 without considering solar irradiation levels in the locality. Of course, if there are no alternatives to solar PV, for example to provide light by which people can work and study in many poorer economies, the Social or Economic Return on Energy Invested may be more relevant than EROI. But underlying these concepts lie fundamental questions. As so often, the devil is in the detail.

Let's start with so-called modern biomass and biofuels, the exploitation of which five years ago Jean Ziegler – UN Special Rapporteur on the Right to Food – called "a crime against humanity". A World Bank study published the same year, in the wake of food price riots in 47 countries, concluded that the expansion of biofuels and their impact on low grain stocks, together with speculative activity and bans on exports, was responsible for 70-75 % of those food price rises. US National Academy of Science publications have concluded that if all US corn and soybean production were to be devoted to biofuels then this would only meet 12% of US motor gasoline demand, and 6% of its diesel demand. Also problematic are the findings published in *'Science'* and elsewhere that corn and cellulosic ethanol have been found to increase carbon emissions compared to gasoline by up to 93%, and 50%, respectively. Meanwhile, progress on second- and third-generation biofuel technologies appears to be very slow. Sources for this and many of the other examples I would cite if I had more time can be found in Chapter 10 of Roger

Fouquet's: "Handbook on Energy and Climate Change", published a couple of months ago.

Tidal energy where it involves estuarine barrages is another area for concern. Proponents of a Severn barrage, for example, who have been around since 1849, resolutely overlook the fact EdF admitted, that their La Rance barrage destroyed the local ecology. They ignore the facts that the Canadians have closed their Annapolis project because of environmental harm, and decided not to proceed with barrages at the Cumberland and Minas Basins. They exaggerate the electricity likely to be generated by a Severn estuarine barrage – more likely to equate to 2.5% of UK current annual needs, not 5%. And they do not begin to address the harm to migratory and over-wintering birds if such schemes were to be extended to other estuaries between the Conwy and the Solway Firth, where little electricity would be generated anyway.

Equally awkward questions can be raised about wind power. As Carlos de Castro and others have pointed out ['*Energy Policy',* 39, 2011], the global potential is more likely to be 1 TW than the figures of 70 TW and more that have been published. Yet it is estimated that transforming even 1 TW of wind energy into electricity would require 5% of the world's land dedicated to agriculture. Vaclav Smil has calculated this would take land representing 1W per square metre.

We hear much of the view that, if the wind is not blowing strongly in one place it will be blowing elsewhere – if not in the English Channel then around Ireland or Germany – and so with appropriate grid linkage this could be overcome. But research by Jim Oswald and others [*'Energy Policy'*, 36, 2008] has questioned that, finding when in and around the UK wind speeds are very low (frequently when electricity demand is high, during anti-cyclonic periods) wind speeds in neighbouring countries can also be very low which "suggests that intercontinental transmission grids to neighbouring countries will be difficult to justify." And we know that weaknesses in national grid systems can cause difficulties, such as for Denmark where wind energy may produce the equivalent of 20% of Denmark's

electricity requirements, but as half of that usually has to be exported to Norway, Sweden or Germany for technical reasons, the true figure for the Danish electricity customer is around 10%.

The other great hope is solar power, and particularly the technical potential of Concentrating Solar Power for Europe (and indeed sub-Saharan Africa), using ultra high voltage direct current transmission. The Desertec concept has long been around, but whether socio-political conditions in North Africa make this attractive at the present time is an open question. The theoretical potential remains huge, but how long is it likely to be realised to a substantial degree? Let us recall that over a century has passed since Frank Shuman built the first CSP plant at Meadi.

Wider interest focuses on solar PV. But in relatively high solar irradiation countries, from Australia to Spain, cautionary remarks have come. Graham Palmer's recent paper in '*Sustainability*' concluded that economic and energy costs will erode much of the benefits of integrating a high penetration of solar PV in Australia. Pedro Prieto's work with Charlie Hall concluded that with a very low EROI (only 2.45:1, lower than some other estimates) solar PV has serious constraints. The rush into wind power and solar in Spain, in their view, contributed to its recent economic crisis. They concluded: "Certainly, there must be a much more comprehensive, objective, analysis undertaken if we are ever to understand well what energy choices are before us."

There are other renewable energy technologies which could make a modest contribution, but the big question is whether most of the modern renewable energy targets bandied around are realistic. These targets encompass the WWF belief that 100% of the world's energy needs can be met by modern renewable energy sources and technologies by 2050, and last week's announcement that Europe could become the first continent to achieve 100% renewable energy targets by 2050. It may be no surprise that the World Future Forum and World Wind Energy Association are behind this claim, but it may be embarrassing to the Frauenhofer Institute to be associated with it. The IPCC's Special Report on

Renewables claimed that almost 80% can be achieved within the same period. REN21 have sensibly been more cautious, recently pointing out in "How Much Renewables?" that a range of opinion exists, from what it characterises as the "conservative" view taken by oil companies, some industry groups, the IEA, and the US EIA that renewable energy will show a share of under 15% of total energy by 2040 or so (18% under the IEA's 'New Policies' scenario by 2035).

IIASA's massive "Global Energy Assessment" published last year ventured 75% in its high 'Efficiency' cases and a 55% median. In my view, with traditional biomass continuing to provide 5% to 10% of global primary energy needs, a total renewables contribution of around 25% by 2050 would seem closer to a realistic figure. Ted Trainer has examined needs and evidence and concluded that a renewable energy future is unaffordable without a mass exodus to "a Simpler Way" of living.

Whatever the realistic figure is, what most concerns me is the failure to look at the relevant issues from a more fundamental perspective.

Why is there so little discussion of the concept of 'useful energy' as propagated for some decades by Bob Ayres? Why is so little attention paid to power densities, as Vaclav Smil has so eloquently guided us on? Why is the concept of Energy Return on Energy Invested (EROI), on which Charlie Hall and Cutler Cleveland have written for over thirty years, been so comprehensively ignored – except by Dave Murphy? Why has the concept of EROI not been extended to the societal return on energy invested until now, with a paper in Press by Jessica Lambert, Charlie Hall, and three of their colleagues? These are all concepts and issues which a forthcoming Special Issue of the journal "*Energy Policy"* will turn its attention to. I am pleased to be able to report that the research for two of the papers to be published in this Special Issue was supported by the UK Department for International Development. You may consider by now that I am sparing in my praise for official initiatives.

But if a more fundamental perspective is to be undertaken it will immediately be confronted by the view of Ed Davey, Secretary of State at the UK Department of

Energy & Climate Change, that as renewable energy developers in the UK only get paid for the electricity they produce, these other matters are of no importance. How wrong he is. Do these developments not cost money, involve the use of rare materials – some of them with high Global Warming Potentials, and where placed in sub-optimal locations divert scarce resources from where they could be better used?

Let me now come back to my local vantage point and consider some of the absurdities going on around me. For I have observed in recent years a large-scale 'kleptocracy' at work – a rigged system taking money from electricity customers to fund frequently sub-optimal schemes for which often exaggerated, and sometimes false, claims have been made. Unfortunately, time does not allow me to do more than skim the surface of a few examples.

Back to the Local

Can you believe, for instance, that a UK Planning Inspector can approve a scheme for the simple burning of palm oil in a small electricity generating plant when the evidence of associated carbon emissions, tropical deforestation, habitat and species loss have been pointed out to him? That a developer can claim that they never contemplate proposing to place turbines where, according to the official wind speed database, wind speeds at 45 metres above ground level are below 6.5 m/s, when a cursory glance shows that 50% of the turbines are in areas below that? That the Investigations Branch of the UK Advertising Standards Authority cannot distinguish between total revenues and subsidies? That the Advertising Standards Authority appear quite happy when a developer claims their proposed development, in one of England's lowest mean wind speed areas, would achieve the third highest capacity factor of all England's onshore developments in 2007, and fall back on the defence that they consulted an 'expert' whom they refuse to name? Or the Planning Inspector who has claimed in several 'Decisions' that various onshore wind energy developments in England could achieve 100% capacity factors?

The wind energy development which has been operating longest near where I live, since January, 2006, has claimed it would achieve a capacity factor of 25%. It even provides the basis – or did, you never know when 'inconvenient truths' will disappear – for the Wikipedia entry for "Capacity factor". There is the prime example of a development which demonstrates a capacity factor of "just under 25%". Well and good, you might think, until you examine the operator's data. They did achieve 24% in the windy year 2008, but the rolling average to end-2012 is only 20.6%, and the calendar year figure has been as low as 16.3% (2010). Fortunately, that development is not in a sensitive location visually or historically.

I could, of course, go on quoting individual cases. I could elaborate on the flawed claims (based on the very strange findings of a single case in Cornwall, right where Dr. Amanda Harry found many of her patients suffering from health effects up to 1.5 kms. from their nearby wind turbines) that wind energy developments have little or no effect on residential property values. I could expand on those – Dick Bowdler and Mike Stigwood, for example - who have severely criticised the "misleading" ETSU-R-97 standards on 'noise' levels (actually, of course, aerodynamic modulation and its effects are a bit more complicated than just decibels), and the defects of the re-writing of wind turbine 'noise' guidance by the Institute of Acoustics which were so clearly exposed by the Renewable Energy Foundation on May 20th of this year. I wonder why cumulative visual impact features so rarely as an influence on Planning Inspectors' decisions in a country where population density exceeds 400 per square kilometre. I could raise questions about the major feature in "The Sunday Telegraph" of June 16th, which challenged the claims of the wind energy industry that it is a major source of employment in this country. Instead, the report suggested, the industry employed 12,000 people last year at a subsidy of £100,000 per person employed – when the total subsidy to the industry was £1.2 billion, paid by the long-suffering electricity customer.

Instead, before I conclude, let me address the view that the UK is the windiest country in Europe and therefore ideally positioned for wind energy developments.

I will set aside consideration of offshore developments, where although mean wind speeds are relatively high so are installation and maintenance costs. I begin instead with the claim in the Companion Guide to PPS 22, introduced by Lord Prescott in 2004 as the Planning Guidance for Renewable Energy. On page 165, paragraph 34, it is stated that wind energy capacity factors generally fall "anywhere" between 20% and 50%, "with 30% being typical in the UK."

This claim was challenged in a short paper which appeared in the Spring, 2012, Bulletin of the International Association for Energy Economics. One may start by looking at wind speed atlases for Europe, which indeed show Scotland to be probably the windiest country in Europe. This is presumably the basis for claims that the UK is the windiest country in Europe. Yet a mere glance at the maps shows that onshore England has a relatively modest wind resource, and for most of inland England a very modest wind resource. For all of Central England the maps produced in Roskilde show mean wind speeds below 6.5 m/s at 50 metres above ground level.

The implications should be clear, and a look at capacity factors achieved at onshore wind energy developments bear them out.

In windy Scotland capacity factors around 30% have been achieved, with a rolling average of just over 29%, although the figure was only 23.75% in 2010. In case there are any aggrieved 'Munro bashers' among you I won't intrude further on Scottish strengths or sensitivities.

By contrast, the figure for onshore developments in England has achieved a rolling average of only 23.6%, with 26.2% being the highest calendar year figure ever achieved to date, and 18.7% the lowest (in 2010). Also, in 2010 nearly 60% of England's developments failed to achieve a capacity factor of 20%, and in the previous year one-third failed to do so. One might well consider that, given their low power densities and poor EROIs, policymakers would ensure no developments were even considered where mean wind speeds are too low to ensure satisfactory

capacity factors. For several years I have suggested a minimum 30% capacity factor, and a heavily reduced or nil subsidy for any performance below that.

I do not know whether the Director of RenewableUK still believes, as she did five years ago, that quotation of “capacity factors” derived from the data officially supplied by wind energy operators to Ofgem is “bizarre pseudo-science”, “absolute nonsense”, and “ill-informed and disingenuous”. But for reasons of both policy and economics I know of no better way of examining the efficacy of onshore wind energy developments.

Many would throw in the problems which can arise with the intermittency of wind. Six years ago, in a paper published in ‘*Energy Policy*’, Graham Sinden found that low wind speeds had a very limited impact on the UK, and supported the view that “a 30% capacity factor is generally representative of the current level of wind power in the UK.” In this paper and in earlier ones published under the aegis of the Environmental Change Institute at Oxford, Dr. Sinden concluded that low wind speed conditions (sufficient to prevent wind turbine operations through lack of wind) only extended “across 90% or more of the UK during winter around one hour every five years”. Because low wind speed (or ‘calm’) conditions were “far more likely in summer”: “On average there is around one hour per year when over 90% or more of the UK experiences low wind speed conditions.” In a paper published in ‘*Energy Policy*’ the following year, it was pointed out that as a result of Dr. Sinden’s claims a close study had been made of Met Office data for October, 2007. There it had been found that there were eleven days in that month alone when, at 19.00 hrs., there had been low wind speed conditions recorded by the 64 Met Office stations. The author of the second paper did not feel the need to pursue the issue further back in time, the result seemed clear-cut both before and after he had discussed his findings with Dr. Sinden. Since then David MacKay has looked at intermittency from a slightly different angle, and between October, 2006, and February, 2007, there were 17 days when the output from the UK’s wind turbines was less than 10% of their capacity; five days when it was less than 5%; and one day when it was only 2%. As he remarked: “Clearly, wind *is* intermittent”

["Sustainable Energy", 2009, p. 187]. The amounts of money paid to operators to shut down their turbines in periods of windy conditions, or when back-up to traditional systems is not required, is not negligible. On April 29th this year it was some £1.15 million paid to 13 developments, at £106 per MWh (the record so far is £447 per MWh).

Meanwhile, concerns about nuclear and coal-fired plant closures have also been growing – not least in the UK.

For rural dwellers in England, in particular, hopes rose on June 6th when it was announced that "local communities would be given the power to block wind farms" under new planning rules. The Secretary of State for Local Government said he wished "to give local communities a greater say on planning, to give greater weight to the protection of landscape, heritage and local amenity."

But concurrently the Secretary of State for Energy & Climate Change, suggested a new system of incentives could lead to an increase of turbines. These incentives, according to the Department of Energy & Climate Change, centred on giving a local community agreeing to a wind energy development proposal a reduction in power bills of an average of £400 per year. In some quarters this was criticised as a 'bribe'; in others as an insult to people whose house values, visual outlook, and – in some cases – health, have been adversely affected. The Secretary of State for Energy & Climate Change did not help matters by stating: "We remain committed to the deployment of appropriately sited onshore wind … This is an important sector supporting thousands of new jobs and providing a significant share of our electricity." Did he mean to imply the siting of onshore wind to date has been appropriate? That 12,000 jobs is significant? That 3.2% is all that significant? [UK electricity supply in 2012 375,000 TWh; onshore wind provided 11,915 TWh]

Conclusions

On that note I think it is time to stop. Do I think that new renewable energy resources will be providing 15% of the UK's primary energy by 2020? No, I don't.

So far (with just six years to go) we have got up to 4%. Do I think new renewable energy resources will be providing 30% of the UK's electricity by 2020? No, I don't. The best quarterly figure we have achieved so far is 11.2%. I don't know, and won't claim I know, what the final figure will be. My conclusions are that at the global, regional, national, and local levels energy policy shows evidence of being in a shambolic state. The economics of many energy systems appear sub-optimal, not least when promoted through subsidies. Insufficient attention is paid to some fundamental concepts – such as useful energy, power densities, EROIs, and even where best to locate wind and solar systems. To use currently fashionable US parlance, there is evidence of "a rigged kleptocracy" which bodes ill for us all. We need sound policies, sound measures, and sound investments. All too often we are not getting them.

21st June, 2013.