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ENERGY POLICY: SECURITY OF SUPPLY, SUSTAINABILITY AND COMPETITION

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1. Introduction

Energy policy is suddenly back in fashion. The events in California, where one of the most advanced economies in the world witnessed power cuts and its two main utilities got into financial difficulties, the failure to liberalise European energy markets, and the growing European and British gas import dependency, have all contributed to a sense of unease with reliance solely on market forces and conventional regulation. The tripling of oil prices in 1999 reinforced this nervousness.

These events would, in themselves, give any government pause for thought. But they occur in a context of climate change, and the requirement to cut greenhouse gas emissions. While easy gains were made on the environmental front as a result of the rapid contraction of the coal industry in the 1990s, the Royal Commission on Environmental Pollution's suggestions that cuts of the order of 50% in CO_2 emissions might be needed by the middle of the century is made in the context in which, other than more nuclear power, there are no obvious solutions (RCEP 2000).

In the circumstances, it is timely that the government has launched a review of energy policy (PIU 2001). This paper does not seek to offer a 'solution' since energy policy is both multi-faceted and context-dependent. Rather the aim of the paper is to provide a framework to consider the design of policy, some comments on the context for that policy, as well as a consideration of the appropriate instruments and institutions. The task of marrying the privatised and quasi-competitive energy industry to the wider public interests is altogether more difficult than either the planning approach of the 1940s, 1950s, 1960s, and 1970s, or the promotion of competition in the energy-abundant years of the 1980s and 1990s.

The structure of the paper is as follows:

- section 2 examines the design of policy. It considers the objectives of policy and focuses on three main problems: security of supply in terms of longer-term contracts, network security, and environmental constraints;
- section 3 looks at policy instruments, and argues that, following privatisation and competition, there is a strong presumption in favour of market-based instruments;

- section 4 considers the new policy context, particularly gas dependency and climate change;
- section 5 considers the institutional aspects of energy policy and, in particular, the relationship between government and OFGEM, as well as the plethora of other bodies that have been created in recent years. It argues that an energy agency or commission may be required;
- section 6 concludes with a set of recommendations which the energy review might consider.

2. The Design of Policy

According to the 1998 White Paper on Energy Sources (DTI 1998), the government's energy policy is:

> 'to ensure secure, diverse and sustainable supplies of energy at competitive prices'.

It is hard to disagree, although even this confuses means and ends. But as a guide to policy design, it lacks content, and it is incomplete. In fact, governments intervene in energy markets for a whole host of reasons well beyond these objectives, and the forms of intervention are numerous. The objectives are multiple, as are the instruments. The result is inevitably complexity and inconsistency.

First, governments extract considerable tax revenues from the sector. As the Chancellor pointed out in his pre-Budget speech in November 2000 following the petrol crisis in the autumn, lowering petrol taxation would reduce general government expenditure.[1]

There are, or have been, taxes on energy generally, and specifically on particular fuels: VAT; the Climate Change Levy (CCL); petroleum revenue tax on North Sea oil; duties on petrol; and gas levies.

Second, governments intervene to achieve broad industrial and social objectives. Coal has been supported as part of industrial policy (clean coal), regional policy, and social policy. Electricity tariffs have been distorted to benefit the fuel poor, and rural over urban customers, and diesel to agriculture is treated differently from that for road haulage.

Third, governments intervene on environmental grounds. The Fossil Fuel Levy provided a nuclear tax of over 10% of electricity bills in the early 1980s; customers will now pay a renewables levy; industry pays a CCL; and all customers pay to promote energy efficiency through their electricity bills.

[1] As Brown stated, 'Mr Speaker, those who would spend…money on tax-cutting should now tell us which hospitals, which schools, which public services they would cut.'

Fourth, governments have always intervened for security-of-supply reasons, although their enthusiasm depends on the supply–demand balance. Governments set rules for stocking and for emergencies; they grant licences, and protect military interests.

To these multiple objectives, confusion is added by the plethora of departments and institutions which promote different particular concerns. The Treasury is concerned with the fiscal aspects, and productivity and competitiveness. This overlaps with the DTI, which is the sponsoring ministry for the energy industries. DEFRA is concerned with environmental policy (but the international aspects of climate change are the concern of the Cabinet Office), and the MoD has considerable nuclear interests. The trade-offs between the different objectives are therefore not only ill-defined, but very much the substance of day-to-day interdepartmental negotiations and territorial disputes. It is therefore hardly surprising that energy policy is complex, and that governments find it very difficult to confront the hard questions of energy policy design.

It is also apparent that any attempt to describe the energy market as a competitive one, just like any other industry, is mistaken. The government is a major player in the energy market—indeed, in many respects, it is the dominant one, influencing price, outputs and capital structure. Privatisation did not change this feature; it changed the form of interventions, and the mechanisms of influence shifted from the boardrooms of nationalised industries to more explicit policy instruments and regulatory control. But the idea that governments could simply retreat from the scene and leave it to competitive markets is an illusion—energy is just too important to the economy and society, and, as we shall see, it suffers from multiple market failures. Governments throughout Europe and now in the USA have realised this after the cheap and abundant energy decades of the 1980s and 1990s.

Faced with multiple objectives, the economic approach starts by narrowing these down to efficiency considerations, and analyses the energy market against a competitive benchmark. How far do the inherent characteristics fail to meet the conditions of a competitive market? Market failures are identified, their magnitude established, and the policy tool kit of instruments is then evaluated—correcting prices through taxes and subsidies, regulation, and direct government intervention. The costs of these measures are

then brought into play (the government failures), and, if the costs are less than the benefits, the type of intervention is recommended.

Until the end of the 1970s, it was widely assumed that energy markets were characterised by pervasive market failures which were so great as to necessitate regulated monopolies for at least the onshore gas and electricity industries, and significant government intervention in the conduct of offshore oil companies. Competition, far from being desirable, was made illegal. In the UK and Europe, these monopolies were typically nationalised, or with government (local and national) stakes. In the USA, rate-of-return-regulated monopoly franchises operated. In the UK, we had the Gas Council, which controlled all North Sea gas supplies (the offshore developers had to land gas in the UK and sell to the Gas Council); the Central Electricity Generating Board (CEGB) linked to the Area Boards through the bulk supply tariff; the two Scottish Electricity Boards; and British National Oil Company (BNOC), which negotiated options on North Sea oil, as well as directly participating in fields, and acted as a price fixer. The National Coal Board (NCB) had the coal monopoly. The nuclear industry was in state hands, and, indeed, BP was majority publicly owned until Denis Healey started to privatise it, although it acted largely as a private company.

Thus, in the 1970s, Michael Posner could, in his 1973 classic *Fuel Policy*, provide a planning approach to the design of policy, using the principles of marginal cost to evaluate the prices that should be set, and the outputs implied by these prices (Posner 1973). Furthermore, since the state-owned energy sector was so large a part of the total economy, it was natural to include a chapter on the balance of payments. The 1967 White Paper on nationalised industries (HM Treasury 1967) , with its focus on long-run marginal cost, lent itself naturally to the energy sector, and the Plan for Coal fitted into the planned response to the OPEC shock of the early 1970s. Posner took market failure for granted: the job of policy was to use the tools of economics to plan how supply might be made equal to demand in the national interest.

By the end of the 1970s, the planned approach had revealed the scale of government failure, and the pendulum swung in the other direction. The pursuit of the national interest had been exposed as having more to do with the National Union of Mineworkers' (NUM) interests and those of the nuclear lobby. Losses provided a drain on the public purse, and

the low gas price charged by the Gas Council was stimulating demand beyond what supplies might satisfy.

The new market philosophy, with its belief that competition was the most effective way to allocate resources, motivated the twin pillars of policy in the 1980s and 1990s: privatisation and the promotion of competition. Nigel Lawson's speech on energy policy in 1982 (Lawson 1982) provided a clear break with the traditions upon which the Department of Energy was built, and a series of steps began timidly with the Oil and Gas (Enterprise) Act 1982 and the Energy Act 1983, and eventually gave the Gas Act 1986 and the Electricity Act 1989. As Lawson put it:

> I do *not* see the government's task as being to try to plan the future shape of energy production and consumption. It is not even primarily to try to balance UK demand and supply for energy. Our task is rather to set a framework which will ensure that the market operates in the energy sector with a minimum of distortion and energy is produced and consumed efficiently.

This new approach led—eventually—to some of its architects believing their own rhetoric. Market failure was no longer merely less serious than government failure; the most committed advocates of the new approach got close to denying market failures at all. When electricity was privatised, its opponents argued that the lights would go out, and that the CEGB should retain the duty to supply, but market advocates rejected these claims, arguing that markets could be relied upon to deliver security of supply. Failures in supply could only be caused by failures of regulation, and by not going far enough in deregulation.[2] Governments in the 1990s never quite went this far, although they got very close to it, and clearly acted as if they believed it. For example, by 1995, the White Paper on 'The Prospects for Nuclear Power in the UK' could assert boldly that:

> the government cannot identify *any* reasons why the electricity should not of its own accord provide an appropriate level of diversity (DTI 1995, para 2.8, p. 4, my italics).

[2] Interestingly, this has been one of the cruder explanations of the Californian crisis.

Careful analysis supports neither of these two polar positions—pure planning or pure competitive markets—and, inevitably, the economic borders of the state in energy markets cannot be easily or exactly defined. Designing energy policy is a more pragmatic matter, where the boundaries move, both in the light of experience and because the underlying questions which it is supposed to answer shift over time. Neither the pure nationalised monopoly model nor the full market model is convincing. Nationalised industries did deliver investment—in the UK, France and other European countries—but they have also proved peculiarly vulnerable to union power, vested interests, capture and poor management. The NUM, acting within the framework of the NCB and an electricity industry largely dependent on NCB coal, has proved the most serious threat to security of supply in the post-war period. On the other hand, however, the energy market is at best an oligopoly, with a pervasive government presence. As discussed above, it owns the resources, and it taxes, regulates and subsidises. Market solutions will therefore always be constrained by the actions of governments and regulators. Governments control the *framework* within which markets operate, whether or not they choose to recognise this explicitly and provide a strategic framework.

In this oligopoly within government constraints, what then are the market failures upon which energy policy should concentrate? The first and overarching problem is typically regarded as *security of supply*. This is one of the most overused and misunderstood concepts in the energy debate. Supply can *almost* always be made equal to demand, *provided* the price is allowed to adjust. Only in extreme circumstances, such as embargoes, strikes or wars, is energy physically unobtainable.

The recent experience in California illustrates this problem. *If* retail prices had been unregulated, as many commentators have suggested they should have been, then there was a price at which demand would fall sufficiently to match supply, since consumers would no longer be able to pay for supplies. However, a moment's reflection shows that this is not a credible solution, neither politically nor economically. The complementarity of energy with the rest of the economy means that customers will typically want stable and predictable prices, in line with their investments in durables, housing and capital stock at any point in time.

It follows that the way to think about security of supply is to start with some idea of the level of fairly stable prices that customers might be willing and able to pay, and to see whether, given this demand, there are 'secure' supplies available. Over time, this price will have to adjust to reflect economic fundamentals, and demand may be reduced for environmental and other reasons. But the key term here is 'over time'. Rapid adjustments to energy shocks are typically difficult to achieve and very costly (as in California). However, broadly, this approach is consistent with both customer expectations and the political reality that ministers setting policy face. (Fuel protests may otherwise result.) It is part of the public interest.

Reflecting this desire for relatively stable prices over time, the security-of-supply problem then splits into three:

- are there sufficient incentives in place for a portfolio of contracts—for fuel supplies to emerge, with sufficient power stations, refineries and associated plant constructed?;
- will the gas, electricity and oil networks be built to a sufficient capacity margin?; and
- will there be sufficient diversity in fuel sources?

Market optimists answer 'yes' to the first and third questions, and 'yes, subject to a supporting regulatory framework' to the second. Market pessimists answer 'no' to all three. Pragmatists answer 'not necessarily' to all three, dependent on the circumstances.

2.1 Supply security and contracting

Let us start with contracts and contracting incentives. Theory suggests that willing buyers and willing sellers, left to their own devices, will seek mutually supporting contracts, assigning risk according to the relative values they place on it and their relative costs in bearing it. In energy markets, spot trading brings the market into instantaneous balance, and the future profile of expected spot prices (the futures market) enables contracting to hedge the price risk. Complications arise where storage is possible, but electricity is essentially non-storable, and gas relies largely on interruptible contracts with industrial customers and load variance with North Sea gas fields.

A crucial fact for energy policy is that transparent, liquid futures markets do not exist for anything like the timeframe over which price risk may need to be hedged. Even oil markets one year ahead are thin, whereas new oil fields may take a decade to develop, and then another decade to deplete. In electricity and gas, futures markets are even weaker, while, at the extreme, nuclear stations and hydro dams have project lives of up to half a century (or sometimes more), and even gas CCGTs can be decade-long projects. Although some claim that such futures markets will develop, the fact is that, for *current* investment projects, and *current* long-term take-or-pay contracts, they do not remotely cover the time period.

Therefore, there is a core contracting problem in energy markets which policy needs to address. Before liberalisation, risk was assigned to customers through vertically integrated monopolies, and, in the 1980s and 1990s, as we shall see in section 4 below, this did not much matter because supplies were abundant. Long-term contracts were simply not needed. However, this merely means that policy could temporarily ignore the contracting problem, not that it went away. Indeed, its converse—stranded contracts and stranded assets—was a dominant issue (see Helm & Jenkinson 1997).

Why, then, are futures markets so underdeveloped? Are there any alternatives? How might contracts be engineered? In the old energy policy world, contracts did not matter because rate-of-return regulation of captured monopoly customers provided a guarantor that costs would be met—and, hence, not potentially or actually stranded. Full retail competition ended this cosy arrangement: customers are no longer committed to any particular supplier and, hence, any contracts *out of the market* are instantly exposed. This was what was so radical about the ending of the monopoly supply, as British Gas was to discover when its long-term take-or-pay contracts were exposed.

Upstream supply, however, is far from fully competitive. At best, there is an oligopoly of electricity generators and gas-field suppliers. Oil is notoriously dominated by large companies. Furthermore, these companies are often vertically integrated, with the resulting incentives to discriminate between their own customers and those of rival suppliers. In electricity, the Pool made such vertical discrimination difficult, since all electricity had to go through the spot market, and anyone could buy electricity within it. As the MMC found in 1996 when considering the vertically integrating bids by National

Power for Southern Electric, and PowerGen for Midlands Electricity, the Pool placed a structural barrier in the way of the abuse of vertical integration (see MMC 1996). No such inhibition applies to NETA, where bilateral trading outside the market is permitted (and sometimes even encouraged) (see Helm 1999).

In the absence of a fully competitive upstream market, a futures market will not flourish. The generation market, North Sea gas, and oil all have important competitive elements, but they are not *sufficiently* competitive to ensure an efficient futures market so that financial instruments can hedge long-term contract risk. Nor, indeed, are they likely to be: many parts of the energy market are showing increasing signs of further concentration, particularly in UK and European electricity, and government and the European Commission have been unwilling or unable to stem the merger wave of the past few years.

Some argue that this re-emerging market power is part of the solution. If companies can create quasi-monopolies, but reduce the scope for customer switching, then they may have more incentive to invest and sign longer-term contracts. For example, if electricity and gas supplies in England and Wales become dominated by Centrica, Innogy and Powergen, then each can predict its future contractual base with some accuracy. Furthermore, if they *all* pursue the *same* strategy in the contracts market, then none is exposed to customer switching as a result of going 'long'.[3]

But market power swaps one set of problems for another—the abuse of that market power and its inefficiencies resulting from 'the quiet life' of monopolists insulated from rivalry. The inefficiencies of the NCB, CEGB, and British Gas have been exposed by privatisation and competition. If market power is acquiesced to, regulation will inevitably focus on the abuse of dominance. Furthermore, market power may not actually *solve* the security-of-supply problem, because one way of abusing market power is to keep the

market short, as in California. The implication of these considerations is that there *is* a contracts security-of-supply problem in the *absence* of a full futures market and there are competition policy issues in relation to concentration. Both are likely to be enduring features of the energy market. Since a fully competitive market upstream is unlikely and since *some* competitive elements will remain—oligopoly appears to be the 'normal' market form—energy policy will continue to be concerned with the supply–demand balance over time.

2.2 Network security

The second aspect of security-of-supply concerns *networks.* Network infrastructure is essential to deliver energy supplies to customers, and comprises electricity wires and gas and oil pipelines. Will network companies invest and interconnect to create an optimal network, such that supply can meet demand without bottlenecks? Historically, the answer has typically been 'no', and most energy infrastructures have been built with some form of government involvement. Notably, the natural gas network was built by the Gas Council and then British Gas in the 1970s and the electricity grid by the CEB before the war and developed by the CEGB thereafter.[4] In each case, a statutory monopoly, under public ownership, planned and developed the infrastructure. In the private sector, monopoly licences have been granted, supported by a regulatory duty to ensure that the function of these companies can be financed, typically implying some guarantee to the regulatory asset base. It is notable, too, that electricity network capacity and interconnection problems have arisen in the European and Californian markets.

The reasons for this government intervention are threefold.

[3] There is, however, no evidence that they are going long; on the contrary, trading positions appear to have been adopted. This might also explain the behaviour of the two main Californian companies in their acquiescence to the limit on longer-term contracting.

[4] Note, too, the impressive recent public-sector rebuilding of the French electricity grid after the great storm.

- First, as natural monopolies, optimal networks based on marginal cost pricing will result in losses. Marginal costs are below average costs in the relevant range of output. Since monopolists cannot be left to set prices, investment in sunk network assets will always be at the mercy of regulators and governments. Government therefore has to *commit* to investors that the investment costs will be recovered (or do it themselves through public ownership).

- Second, where networks are owned within vertically integrated structures, regional incumbents have little incentive to invite competitors into their markets, nor to provide capacity sufficient to facilitate access for upstream rivals.

- Third, in the absence of storage at the point of consumption, networks need excess capacity to absorb demand shocks. This aspect is a *system* property. Where the public interest is represented as risk aversion to interruptions (because of complementarity), the capacity margin will need to be supported by regulation recovering its costs.

It has also been suggested that network maintenance may not be optimally provided without regulatory intervention. This problem may arise under price-cap regulation, where output failures can only be observed with a lag or where shareholders are risk-neutral to shocks (such as severe weather), whereas customers are risk-averse. Again, this is a regulatory problem which may be exacerbated by management failure (as arguably in rail) or short-term ownership (as in the UK regional electricity companies, RECs).

2.3 Diversity

To these the problem of *diversity* of energy supplies is usually added. Strictly, it is a *dimension* of security of supply, but, analytically, it can be distinguished in that it typically concerns the risks associated with shocks, whereas the above questions might be described as relating to the expected supply and demand position.

Shocks can be split into several categories, notably *price*, *quantity* and *technology*. Price shocks are the most common—for example, the recent tripling of oil prices. Quantity shocks relate to physical constraints. Technology shocks relate to new concepts and ideas,

to failures (for example, the discovery of nuclear design faults), or to new constraints (for example, an unanticipated technical advantage of nuclear over coal with the discovery of the climate change problem).

Governments have traditionally argued that diversity is best achieved by a mix of fuel sources, and by a preference for domestic over imported energy supplies. These may conflict—for example, the UK relied overwhelmingly on coal-fired generation, and France on nuclear, so that both countries had a very limited fuel mix. In practice, all sorts of policies have been justified in the name of diversity—for example, maintaining nuclear; expanding gas; supporting coal; and renewables. In other words, all the main fuel sources have claimed priority on diversity grounds, and diversity has in practice proved a rationale for wider political objectives.

The natural way to think about diversity is as a portfolio effect. Risks are spread in financial markets by diversification, and so, too, the argument goes, by diversifying fuel sources. This type of analysis lends itself to empirical measurement and the development of indices. These techniques are, however, only as good as the data, and this in turn depends on a prior identification of the risks to be diversified.

Mrs Thatcher, for example, thought the major risk was a miners' strike, and her diversification strategy involved weakening labour power by a combination of legal reform, breaking up the electricity industry, and building more nuclear plant. The degree of unionisation might, on this argument, be a component of the diversity measurement. The French, by contrast, have appeared relaxed about union power, but not about depending on Middle Eastern oil, and hence the diversity for them was *increased* by an overwhelming focus on the domestic nuclear power programme. Mr Bush appears to share the latter concerns, too. As will be argued below, gas dependency appears to be the central concern in the medium term for the UK economy, although whether this is a concern about particular sources of gas supply (Russia) or the gas price will have a great effect on the policy response. These examples illustrate a general point: the amount of insurance worth purchasing through diversification depends upon the scale and probability of the threats. It is therefore *context-dependent*. Twenty years ago it was the miners, now it may be Russian gas.

There is no reason to believe that competition will necessarily *inhibit* securing diversity. In many cases, it might help: by allowing markets to experiment with new technologies, and by facilitating entry. The arguments above do not imply less competition. But neither do they justify the conclusion which dominated energy policy in the 1980s and 1990s—that competition is *sufficient*. There are, indeed, good reasons for fearing that it will not, and from time to time, this may turn out to be serious.

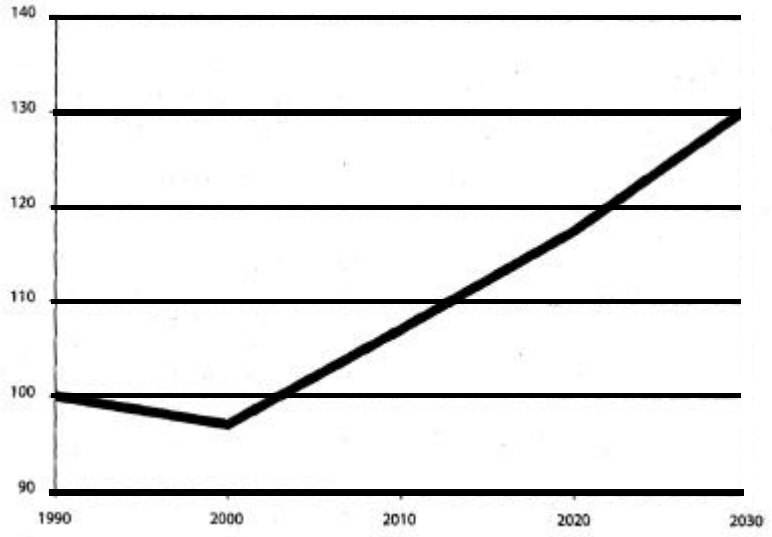
2.4 The environmental constraint

The debate between the marketers and the planners has been conducted around the above arguments for most of the second half of the twentieth century. But from the 1980s another factor began to influence the design of energy policy, namely the environment. First, acid rain, then global warming gradually moved up the agenda. Sulphur targets were imposed at the European level as a regional solution to a regional problem, and then governments began to adopt unilateral and multilateral targets for greenhouse gases. The Kyoto process led to national targets for greenhouse gases, and the UK also adopted an additional CO_2 target of reducing its emissions 20% below the 1990 level by 2010.

For both sulphur and CO_2, the early targets were achieved largely as a *consequence* of other policies and changes in the market unrelated to environmental concerns. In particular, the coal industry contracted sharply, with the dash for gas. Flue-gas desulphurisation (FGD) has helped the sulphur reduction, but from 1990 it was clear that CCGTs offered a cheaper solution, and their thermal efficiency helped the CO_2 targets as well. Looking forward, however, the prospects for stabilisation of CO_2 emissions, let alone the sorts of reductions proposed by the RCEP report, are not good (see RCEP 2000). Indeed, even in the short run there are causes for concern, as indicated by the substantial increase in coal burn (up 26%) in the early months of this year, as a result of the rise in gas prices.

In a more global context, the prospects are even worse. The US Energy Plan predicts that energy demand will grow by 32% by 2020, while the EU projections in the Green Paper for CO_2 emissions are as follows:

EU energy-related CO_2 emissions (1990 = 100)



European Commission (2000), 'Green Paper: Towards a European Strategy for the Security of Energy Supply', November 29th.

From an economic perspective, it is important to appreciate that the optimal quantity of pollution is the *outcome* of the claims that individuals and firms make in response to the 'correct' marginal costs. These are only vaguely known, and therefore the quantity targets that the UK government has unilaterally adopted and the Kyoto ones are imperfect estimates of the optimal carbon emission levels. Price-based instruments—like carbon taxes—give an element of cost certainty, and enable markets to adjust, whereas quantity constraints allow the price to be revealed.

In the UK, we have a host of measures addressing the environmental consequences of energy production and consumption. These include price mechanisms (CCL, petrol tax, VAT), quantity mechanisms (tradeable points and emission limits under IPPC regulation), subsidies (energy efficiency), technology subsidies (renewables, CHP), and incentives for energy efficiency. There are numerous supporting bodies—including the Energy Saving Trust, the Carbon Trust, DEFRA's sponsoring role, OFGEM (under guidance), and the Emissions Trading Group. There is no overarching strategy (other than the ill-defined objective of sustainable development), and no evaluation of the combined effects of the measures or the interdependencies between them. And, most importantly, there is no

evidence to suggest that these existing policies will produce an outcome remotely near that demanded by the RCEP.

The implication is that, far from there being a surplus of capacity in electricity generation (as one might be led to expect if the National Grid Company (NGC) 'Seven Year Statement' were relied upon), there is a severe shortage of low-carbon plant. Most generation capacity is carbon-intensive. To meet the RCEP target—if this were to be an objective of policy—requires a replacement of *most* of the existing generation capacity.

3. Policy Instruments

For most of the post-war period, the traditional policy instruments for energy policy have been through nationalised industries. Under the Morrisonian model, the public interest was guaranteed through public ownership, and represented on the boards of the nationalised industries through non-executive directors. Competition was made illegal, in order to prevent short-termism, and to allow the industries to plan long term in the knowledge that captured customers would bear the costs.

In the USA and much of Europe, private ownership was combined with monopoly, and forms of rate-of-return regulation were used to prevent excess profits. Cost pass-through was typically subject to some element of efficiency or prudence reviews, but the monopoly generated a revenue base. As a result, utilities were more like bonds than equity, with low costs of capital.

With rate-of-return regulatory regimes, the companies needed to agree CAPEX plans with regulators, in order that they might enter the rate base. In the nationalised industries, these plans were agreed with the sponsoring department and the Treasury. Much of energy policy was therefore the outcome of negotiations with the institutions of government—whether delegated to regulatory authorities or direct.

To ensure these ‘negotiations’ met the security-of-supply requirements, the obligation was placed on the companies. Notably, the CEGB had the duty to ensure that there were sufficient power stations and grid capacity, the Electricity Area Boards similarly were required to buy sufficient power to supply customers, and to maintain adequate local distribution networks. British Gas had similar obligations.

In an important sense, these policy instruments ‘worked’, in that the lights stayed on, and the natural gas network got built. In the USA, the companies had the incentive to invest, provided the rate of return exceeded the cost of capital, and the duty to supply ensured that management planned their networks. The carrot and stick approach resulted throughout the developed world in matching the phenomenal economic growth of the post-war period with the energy it needed.

These policy instruments were not, however, without cost, and economic theory suggested that the results would be 'gold-plating' and OPEX inefficiency. Supplies would be 'too secure', with a resulting cost burden on industry and domestic customers. In response, other policy instruments were deployed—notably competition in generation and in supply, and price-cap regulation for network monopolies.

Strictly speaking, neither qualifies as energy policy. Rather they are regulatory tools to achieve efficiency, where the role of energy policy is limited to promoting market structures. In the 1980s and 1990s, governments began to pride themselves on not having an energy policy at all, in the traditional sense. 'Independent' regulatory bodies were set up with powers vested in Directors General, whose statutory duty was to promote competition. Importantly, government had virtually no role in agreeing the capital programmes, and licensing policy was delegated to the regulators. The network companies were required to show that capacity could meet demand, and NGC had to prepare a seven-year statement on generation capacity. Keeping government out of energy markets and limiting their discretion were seen as desirable features of the regulatory framework.

Under this new regime, government did not, however, give up all policy ambitions, despite the fact that there seemed to be no prospect of interruptions in supply, as surpluses in capacity and supplies arose in most industrialised countries, including the USA (especially California) and the UK. In particular, governments of both parties tried to protect the coal industry and to address the problems of acid rain and global warming, and, after 1997, fuel poverty took a greater role.

The new utility regulatory regime made such governmental interventions more complex and difficult to engineer. Generators could only be persuaded to buy more coal if they could pass on the costs to the RECs. This proved possible while an element of supply monopoly remained, as in 1993–98, but was more difficult in 1998, when a moratorium

on new gas entry, together with a more relaxed view on vertical integration, proved sufficient inducements for new contracts to be signed.[5]

In the utility regulatory regime, investment in networks became the outcome of a game between the utilities and regulators, rather than the result of a governmental top-down view of required network capacity. RPI – X provides a fixed-price, fixed-period form of contract to the utilities, and the periodic reviews which set the contract are the outcome of a process in which the utility sets out its 'bid' for CAPEX and OPEX. The regulator then analyses and, typically, cuts the numbers through efficiency studies, comparators and unit cost studies. This 'game' has an institutional context: economic regulators see success largely in terms of the level of price reductions.

Once the contract is set, the utility then profit-maximises by cost-minimising—by doing as little CAPEX and OPEX as possible, consistent with the required outputs. In other words, the utility sweats the assets, and the regulator aims to have the minimum set of assets consistent with the required outputs.

A further feature of RPI – X regulation is that regulators have striven to reduce the burden on current customers of future investment, by encouraging utilities to use their balance sheets to finance the CAPEX. These balance sheets have provided what I have elsewhere described as a 'private-sector borrowing requirement'. Thus, NGC and the RECs (which initially owned NGC) were privatised with zero gearing, and the debt on British Gas's balance sheets was modest and rapidly repaid.

The utilities' response to this form of regulatory control has been to gradually exit the equity, by gearing up the balance sheets ahead of any investment requirements. In effect, utilities mortgaged their assets through a major exercise in financial engineering, sometimes through acquisitions, and sometimes through special dividends and share buyback. The result is that there is very little left of the private-sector borrowing

[5] See Geoffrey Robinson's autobiography (Robinson 2000), for some insight into how this bargaining took place.

requirement created at privatisation—and little by way of new and improved infrastructure assets to show for this financial engineering.

Where investment was not a priority—as it was not in the 1980s and 1990s—this financial engineering did not much matter. Indeed, if the cost of debt was lower than that of equity (because, under a debt-based regime, customers may face more of the risks which equity owners had previously borne), it may have had a positive effect. But, if more network investment is now needed, the utilities have little incentive to provide it, and the equity-driven management capability will have largely gone. Combined with high cost of capital with which RPI – X regulation has been associated, and the asset-sweating incentives, this approach may be ill-suited to an investment period in the energy sector.

Governments tried to rein in the regulators, by providing 'guidance' on social and environmental matters, through the Utilities Act 2000. Regulators were to be told of the government's priorities, and were given the duty to have regard to such guidance. In reality, it turned out to be a listing of the various government policy objectives—notably sustainable development and fuel poverty. On the former, since the government defined sustainable development to include not only environmental matters, but also economic growth and social concerns. However, since it did not define the trade-offs, compliance is impossible to measure. On the latter, the ambition to eliminate fuel poverty requires substantial cross-subsidies, which sit uneasily with full retail competition.

The ineffectiveness of these policy levers has been most noticeable in the environmental area, and led to a gradual recognition that liberalised markets require economic instruments. Private companies' incentives can be manipulated through taxes, quotas and subsidies. The main policy instruments have been levies, as noted above, on customers to finance energy efficiency, obligations on *all* suppliers to buy a proportion of their power from renewables, and the CCL, which, despite its name, is an energy tax. There is also the emissions trading initiative, which provides a subsidy for reduction in emissions targets.

In economic theory, there is no presumption that setting prices on externalities is better or worse than setting quantities. It depends on circumstances—the informational asymmetries between regulators and companies, the degree of uncertainty, risk aversion, and the shape of the damage functions. Where the priority is to be certain of quantities—such as toxic pollutants or conformity to international agreements—quotas may be better,

and then prices can adjust. Where, however, cost control is a priority, a tax may be preferable—say in the case of CO_2.[6]

It is important to recognise that such instruments are typically imposed in second-best circumstances, where prices are already distorted by taxes and inappropriately valued assets. In the energy sector, the price of oil has little to do with its marginal cost, being 'taxed' by OPEC and then by governments. Prices of electricity through the Pool and now NETA do not equal marginal costs, and only some externalities are subject to price adjustments. Setting an appropriate economic instrument on a piecemeal basis (as, for example, the CCL) may therefore fail to induce the required adjustments if second-best effects are ignored.

[6] Weitzman (1974) provides the classic theoretical framework.

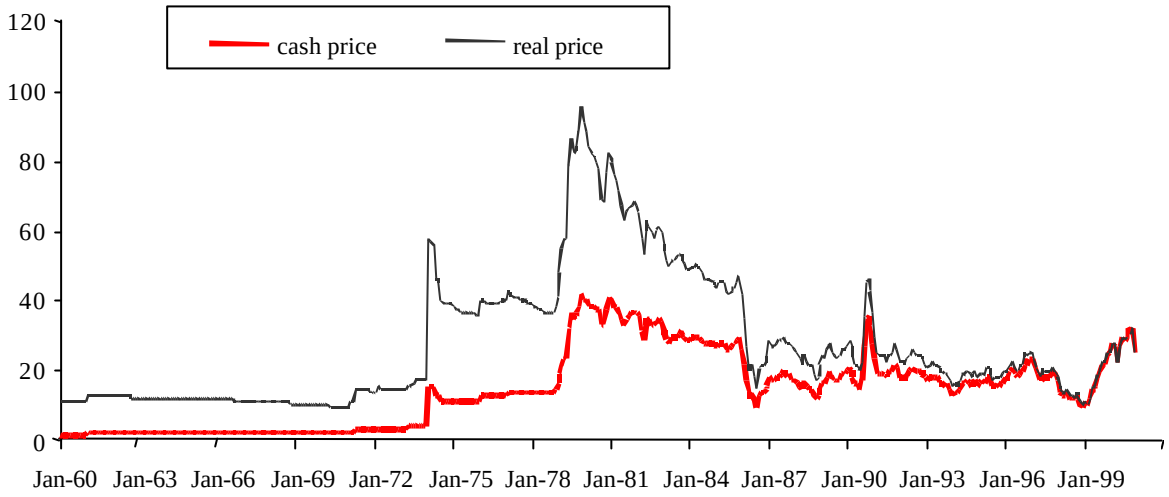
4. The Context of Policy: The Energy Policy Agenda

Energy policy has tended to follow the major shifts in the underlying fundamentals of the market place, and often it has been quite well designed to solve yesterday's problems. For the purposes of this paper, we can identify three stylised episodes—the 1970s; the 1980 and 1990s; and the early 21st century.

The 1970s were dominated by energy in one way or another. The OPEC oil shocks, the miners' strike, and the Plan for Coal were the main events, and were associated with inflation and recession (stagflation), union-driven threats to security of supply, and greater emphasis on indigenous energy sources. Energy policy responded, with the creation of the Department of Energy, with renewed interest in nuclear power (though not on the French scale), significant political support (and expenditure) for coal, and an active North Sea policy driven by BNOC. Almost all of the current power stations (except gas) were planned and built in this period, and the gas network planned on the assumption that it would service domestic and *interruptible* industrial customers.

The 1970s assumptions were: high and rising oil prices (perhaps to $60 a barrel); continued economic growth; and continued increases in the demand for electricity. The reality turned out almost the exact opposite. First, the 1980–82 recession led to a sharp fall in industrial demand, and left the UK with a 40% capacity margin. Peak demand for electricity would not increase for the next 20 years. Whereas the CEGB predicted in 1970 that around 100 GW would be needed by 1995, in fact only about half that capacity turned out to be required. And, despite the second oil shock in 1978/79, oil prices collapsed by the mid-1980s, and remained low until 1999, with the exception of the brief Gulf War peak in the 1990s.

Oil prices, 1960–2001 ($ per barrel)



Source: Datastream.

The contribution of much lower electricity demand than expected and lower than expected oil prices undermined much of the 1970s' energy policy. The Plan for Coal was predicated on there being a growing demand for electricity (as coal accounted already for a market share of around 75%), and nuclear's claims were underpinned by high fossil-fuel prices. The rationale for the fast breeder reactor, supported by the THORP reprocessing plant at Sellafield, was to collapse (leaving THORP effectively stranded). Finally, the Howell plan in 1980/81 for a family of ten pressurised-water reactors (PWRs)—one a year for the next decade—ended in the hopeless economics of Sizewell B.

Gradually, a new energy policy emerged, tailored to the (radically) different world of the 1980s. The financial cost of the nationalised industries—in particular the NCB—provoked policies designed to improve efficiency rather than promote investment. Indeed, investment was not needed, once the gas network was completed. Reducing costs, sweating the assets, and thereby driving down prices, gradually began to take over from energy plans, and demand forecasts. The chosen instruments were ones that fitted the wider political climate—union reform, competition and privatisation. Of these, the first dominated the early 1980s as Thatcher prepared for the (arguably inevitable) showdown with the NUM, while competition was a key part of Lawson's two Acts—the Oil and Gas (Enterprise) Act 1982, and the Energy Act 1983. Privatisation of British Gas followed in 1986, and electricity in 1990 (the relevant legislation was the Gas Act 1986 and the Electricity Act 1989).

By the 1990s, another recession reinforced the 'excess supply' energy environment. Britain was awash with oil and gas, it had too much coal, and all the networks were well able to cope in the absence of strong demand growth. Once RPI – X had been introduced, operating costs were sharply reduced, and employment fell. In the power stations, manning levels were reduced (although after NETA's introduction they were to rise again). The surplus of capacity in electricity was further increased through the dash for gas, encouraged by a regulator who put more emphasis on increasing the number of competitors, and the gas bubble undermined the take-or-pay contracts of British Gas and triggered its break-up.

These surpluses meant that supply competition could be introduced without risk to supply security and the cross-subsidies could be unwound without customers facing real increases in prices. The final link in the vertically integrated structures of the post-war period was broken: customers could switch suppliers at will, so that there was no commitment to underwrite (and hence meet the costs of) long-term contracts and the associated assets, should these become 'out-of-the-market'. At the time, this did not matter, as there was no need for anyone to sign such contracts for the two related reasons that no more assets were needed, and, in any event, it was widely assumed that energy prices would be lower tomorrow. Spot trading was all that was required.

These trends went far wider than electricity and gas, and far wider than the UK. Focus on the efficiency of network delivery rather than network capacity ran down the US oil refinery and pipeline systems. Stranded assets and stranded contracts cropped up in most developed countries. Oil E&P activity declined with the oil price, and just-in-time techniques which the new information technology made possible led to substantial destocking, boosting company profits as stocks were sold, while reducing resilience to short-term supply shocks (as demonstrated in the petrol crisis in autumn 2000).

By the end of the 1990s, many of the conditions were in place for a major energy crisis. Stocks were low, infrastructure assets stretched, long-term take-or-pay contracts rare, and E&P was low. Meanwhile, the economic boom of the 1990s continued apace, pushing up world demand for oil and gas. There was no one cause of the tripling of oil prices in 1999, against the expectation of prices continuing at $10 or less per barrel; however, once the shock occurred, the fragility of the energy networks was exposed. In one of the most

advanced economies in the world—California—the lights went out and utilities filed for bankruptcy.

The 2000s already look very different from the 1990s in the scale of the energy problems that developed countries face. High oil and gas prices have raised the spectre of rising inflation and recession. The paucity of domestic energy resources has been exposed in the USA (for oil) and in Europe (for gas). The great North Sea years (the 1980s and 1990s) in which the UK economy—unlike France and Germany—was relieved of the post-war balance-of-payments effect of energy as an exporter, are beginning to recede, as gas imports begin to grow. Furthermore, the new environmental agenda—reducing CO_2 without the option of reducing coal (which has now contracted)—is beginning to bite. But, unlike in the 1970s, vertical integration through to captured customers no longer provides the comfort of cost pass-through. The energy sector faces the 2000s without a contractual base, and, in such circumstances, its security-of-supply problems are rather different. In addition, the new environmental constraints may require very large adjustments to be made.

5. Institutions

Historically, there have been two main types of institutions associated with energy policy: government departments and regulatory offices. For much of the post-war period, there was a Ministry of Fuel and Power. In the crisis years of 1945–48, its function was to maximise coal output to meet domestic demand, while earning precious foreign exchange. In 1947, stocks reached dangerously low levels—probably the closest Britain has ever come to a physical failure of supply outside wartime.

In the 1950s and 1960s, policy relaxed as oil took a greater share of the industrial market from coal, and was abundant in supply, and cheap. The need for a government department receded—as it did in the 1990s. By the early 1970s, the OPEC shock created a governmental policy requirement again, and the Department of Energy was created, to last for two decades before being closed in 1992. The functions and expertise of the department were then dissipated, with a residual capability at the DTI, occasionally sparked into life by coal crises (1992/93 and 1997/98).

While energy policy languished at the government level in the 1980s and 1990s, the focus became maximising the efficiency of the existing assets, and the dominant role came to be played by the economic regulators and the new institutions, OFFER and OFGAS. These were ‘independent’ of government, in the sense that they carried out their duties and functions of promoting competition and regulating monopolies without much regard to political and governmental concerns. Thus, in the 1992/93 coal crisis, the electricity regulator could tell the DTI Select Committee that he had not met the President of the Board of Trade. In so far as energy policy now comprised a liberalised and competitive approach to markets, OFFER and OFGAS in effect acted as the institutions promoting competition. There was no other policy to formulate.

As the UK (and the developed world) emerges from the years of excess and cheap supplies, it is apparent that there is no institution capable of developing policy. The energy review team at the Cabinet office does not have a well-resourced team, models, market expertise, or the associated support within government upon which to draw—precisely because their skills and resources were not needed in the 1990s.

If the government is to develop an energy strategy (to sit alongside its transport strategy), it will need some institutional focus to take the initiative forward. The evidence from companies cannot be relied upon without independent appraisal. In the rail industry, the Strategic Rail Authority (SRA) has the task of developing a detailed strategic plan. In air it is the Civil Aviation Authority (CAA), and, in water, it is the task of the Environment Agency (EA) to develop an environmental and flood-defence strategy. Finally, OFCOM will take on major policy functions from the Independent Television Commission (ITC), and other bodies it will subsume. All of these examples have their faults, many of which are well documented. But, in all cases, economic regulation is seen as *one* (necessary) component of policy, although by no means sufficient.

An institution focused on policy could take a variety of forms. These range from beefing up the DTI Energy Directorate, to the redesigning of OFGEM, through to the setting up of a new body. The first two options have the disadvantage that they will inevitably carry over the interests, culture and historical baggage of their original forms. The DTI's approach to energy policy grows out of a departmental concern for industry and industrial policy. It is the department of *trade* and *industry*, not the department of consumer affairs, for example. OFGEM's baggage includes a belief in auctions and the auctioning process, and that security of supply is a matter of creating competitive markets. This is not to criticise these institutions, but merely to point out the consequences of using either as a basis for a new energy policy.

The creation of a new institution might take a number of forms. It could be an agency, a commission, or a department. It could be restricted to energy, or incorporate energy and environment under a single heading. Although it is beyond the scope of this paper to provide a detailed assessment of the options, there are a number of points that need to be borne in mind. The first is that agencies and authorities tend to have much higher status that commissions within public institutions. The EA and SRA have proved of a more substantive form than, say, the Commission for Integrated Transport (CfIT), or the Sustainable Development Commission. An energy commission could easily become little more than a debating forum, perhaps an incremental upgrading of the current Energy Advisory Panel.

It is also important to establish the hierarchy between the economic regulator and an energy body. As the SRA, EA and CAA models have shown, the tension between the concerns of ORR and OFWAT, on the one hand, and the SRA and EA on the other, have not always been creative, whereas the CAA/Economic Regulation Group (ERG) relationship has been altogether more harmonious. (Elsewhere, I have argued that ORR ought to be merged with the SRA—Helm 2000). The important point here is to define the hierarchical relationship *ex ante*, rather than necessarily combine economic regulation with an agency immediately. However, perhaps after a period of time, OFGEM's functions could be split up between the OFT (for competition matters) and the energy agency for the rest, and then it could be wound up in due course.

Institutions need processes to give them focus. There need to be jobs to do, otherwise they tend to drift (as with CfIT), or pursue their own agendas. An energy agency would have a primary duty with respect to the security of contract and network supplies, diversity and sustainable development, and this could be organised around a medium-term rolling energy security statement. It would incorporate the NGC 'Seven Year Statement', and information from Transco and the Scottish companies, and provide an overall assessment to Ministers on an annual basis.

Given that the environmental constraint is likely to be a dominant force in the market, and that the existing capital stock is ill suited to a low-carbon economy, it would be odd not to incorporate the environmental considerations within a new agency's remit. Although it might be objected that this is the job of the EA, in fact water dominates that organisation and its budget, and most of its 10,000 employees are engaged in water and flood-defence-related activities. The definition of the boundary is, however, a pragmatic one, and the important point is to avoid a continuation of the conflicts of the past between the DTI and the environment departments (the DoE, then the DETR, and now DEFRA). A new agency would need to take a leading role with regard to carbon trading and energy efficiency, and both the Carbon Trust and the Energy Saving Trust might fall within its remit. There would then be an opportunity to prune back the plethora of bodies that have been created in the past few years.

A crucial role for an energy agency would be as a centre of expertise within government. It would be required for modelling and providing detailed policy advice to Ministers.

These functions are not currently well fulfilled within government, and a number of policy weaknesses can be linked to the scale of informational asymmetries between government and the private sector.

Finally, it is important to note what the energy agency should not do. It should not be a reinvention of a department of energy within Whitehall, and it would not be a planning body for the industry. As section 3 noted above, the instruments of energy policy are, in the private and liberalised structures now in place, rather different, with greater relevance on economic instruments. But to design, implement and then revise economic instruments requires the necessary expertise—which government lacks at present.

6. Conclusions

This paper has argued that:

- there are serious market failures in the provision of energy networks and in contract markets which require an overarching energy policy framework. Oligopolistic energy markets cannot be relied upon to ensure security of supply;

- the opening up of retail markets to full competition broke the link between long-term sunk investments and the guarantee of cost recovery from customers. Financial markets will not be in a position to hedge efficiently longer-term contract risks, especially as consolidation takes place;

- for much of the 1980s and 1990s, these security-of-supply problems did not matter, as markets were in excess supply, and oil and gas prices were weak. In these circumstances, asset-sweating, rather than investment, was the priority. These conditions should not be assumed to be permanent features of the market;

- the need to reduce CO_2 emissions renders much of the existing energy capacity inappropriate to the new constraints—both power stations and networks (through embedded generation);

- an energy policy is now needed to provide for a longer-term contractual basis—for gas in particular. Renewables policy is, in effect, a long-term contractual obligation, and any revival of nuclear would require long-term contracts too. If the findings of the RCEP report are to be taken seriously, then there is a considerable shortfall in low-carbon capacity;

- energy policy in the context of a privatised and liberalised market needs to place much more emphasis on economic instruments, since the old-style arm-twisting and ‘agreements’ of the nationalised industry system cannot be enforced if customers can switch. There is a strong economic case for using carbon and other taxes for environmental policy, rather than overtly picking technologies, so that

the relative environmentally adjusted costs of nuclear, wind and renewables, and new energy technologies can be tested by commercial companies;

- there is a strong case for creating an energy agency or similar body as a centre of energy expertise, to implement policy and advise Ministers, over and above the narrow economic regulatory functions of OFGEM;

- a rolling security-of-supply statement, prepared by an energy agency for Ministers, would assist in providing a framework for policy;

- an energy agency should include environmental aspects of energy policy, and incorporate some of the numerous bodies that have been created in recent years.

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