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Energy efficiency in liberalised markets – implications for a low carbon future

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Abstract
Full liberalisation of retail gas and electricity markets in Great Britain was implemented in 1998. At the time, it was recognised that the new markets would provide a complex set of new risks, opportunities and incentives for energy efficiency. The most obvious effect - a reduction in prices driven by competitive pressures - would be damaging for energy efficiency; and there would be risks of existing regulatory-driven programmes being discontinued in a competitive market. On the other hand, transparent re-regulation of natural monopolies provided potential new policy levers. And liberalised markets themselves opened new opportunities for market actors to implement energy efficiency. A dozen years on, this paper reviews the actual outcomes. How important was each of these factors? How important has energy market structure and regulation been, compared to other factors, for energy efficiency? The paper seeks to draw some lessons for what might have been done differently. And, for a world in which policy makers might be prepared to be intervene more strongly to secure low carbon and energy security goals, it draws some conclusions for the role of energy markets and their regulation in reducing and transforming energy demand.

1. Introduction
Full liberalisation of retail gas and electricity markets in Great Britain was implemented in 1998. At the time, it was recognised that the new market would provide a complex set of new risks, opportunities and incentives for all market actors (MacKerron and Pearson 2000). In the field of energy efficiency, these included: reduced prices arising from greater competition, explicit regulation of the monopoly networks, discontinuing obligations on energy suppliers and market innovation in energy services (Eyre 1998).

A dozen years on from 'the 1998 process', this paper reviews the actual outcomes. How important was each of these factors? How important have energy market structure and regulation been, compared to other factors, for energy efficiency? It is worth recalling how radical the idea of full retail market liberalisation seemed at the time and how little was known about the implications of competition being extended to all consumers. Section 2 seeks to draw some lessons, with the wisdom of hindsight, for what might have been done better, or at least differently, to assist energy efficiency. And, recognising that we now may be in a world in which policy makers are prepared to be intervene more strongly to secure low carbon and energy security goals, Section 3 applies these lessons to changes in energy market regulation currently under discussion.

2. Energy efficiency and market liberalisation
Four potential changes to drivers of and barriers to energy efficiency were identified in advance of market liberalisation (Eyre 1998). There were: impacts on prices, opportunities

for new energy services, changes to regulated energy efficiency programmes and impacts of monopoly price regulation. Each is addressed separately below.

2.1 Energy Pricing

The explicit objective of retail energy market liberalisation was increased competition and therefore reduced prices. One obvious effect of such a change is a reduction in the incentive for energy efficiency. It seems very likely that such an effect has indeed occurred in GB retail energy markets. However, quantifying this with any accuracy is difficult, as it depends on two factors – the actual effect of liberalisation on prices and the price elasticity of energy efficiency – neither of which is straightforward.

The direct price impact of retail competition must have been relatively small, as the 'supply cost' is a small fraction (~10%) of the final retail price for both gas and electricity. There were undoubtedly some cost reductions through retail businesses focussing more ruthlessly on the core business of customer service and retention. (However, it is worth noting that this resulted in some of the more lamented effects of liberalisation, notably a huge reduction in energy end-use R&D). At the same time, there were some additional costs arising from the marketing (including doorstep sales) and ICT costs involved with establishing and maintaining a competitive market.

The indirect impacts of retail market competition on costs elsewhere in the energy supply chain were expected to be more significant, in particular via the increased pressure on suppliers to purchase as efficiently as possible in wholesale gas and electricity markets. Prices to UK consumers certainly fell in the early years of market liberalisation. However, in markets that are notoriously volatile, for a variety of reasons, such changes cannot be reliably estimated by inspection of price changes over the period of liberalisation. Moreover, the market has evolved into an oligopoly of six vertically integrated supply companies (HMT and DECC 2010), so that a distinction between the impacts of upstream and downstream competition is now less meaningful.

The impact of price changes on incentives for energy efficiency is also difficult to estimate. It is important to note that this is not the same as the price elasticity of demand, which is determined by the impact of price on both energy service demand and energy efficiency. At the time of liberalisation, the UK Government's own estimate of the long run price elasticity of energy demand was -0.19 (DTI 1997), i.e. quite inelastic. This necessarily implies an even smaller elasticity for energy efficiency.

2.2 Energy services

The prospect of commercially driven energy efficiency offerings to households and other small customers, and by implication of market based solutions to climate change, has been a repeated theme in the justification of the idea of retail energy market liberalisation. It was envisaged at the outset (HMG 1997) and has been the subject of periodic policy drives to instigate significant commercial activities, notably through a DTI initiative in 2000 (Macklon 2000), an Energy Services Working Group in 2003 (DTI 2003) and a Treasury driven 'energy services summit' in 2006. None of these delivered a great deal of commercial outcomes, although the rhetoric from both Government and major energy suppliers has remained consistently positive.

The underlying premise that bolsters the faith in energy service markets arising autonomously is that there are cost effective opportunities for energy efficiency which would be realised if

only market forces could be set to work. Of course, it is correct that there are cost effective opportunities and this is well documented (Defra 2005; Levine 2007; CCC 2008). But the idea that the market failures lie predominantly in energy markets is misguided. The 'barriers to energy efficiency' are equally well documented and lie predominantly in energy efficiency markets (Sanstad and Howarth 1994; Brown 2001), i.e. outside the scope of the historically regulated energy markets, and therefore they were not rectified by energy market liberalisation.

In contrast to the political rhetoric, even before the 1998 process, it was clear that neither energy suppliers nor their customers expected energy service markets to develop to any significant extent (Owen and King 1997). And they, rather than the proponents of market reform, were proved correct. Retail energy suppliers retreated to a core business model (sometimes characterised as efficient purchasing in wholesale markets plus a call centre) and competed primarily on price. Any product differentiation tended to be through offers consistent with this model (other utilities, insurance etc) rather than via extending the business model to investment on the other side of the meter.

Some barriers to energy services within the regulatory environment were identified as barriers to energy services, including by the energy suppliers. Most notably, it was argued that the 28-day rule introduced during liberalisation, both as a consumer protection measure and to facilitate consumer switching, provided a disincentive to the longer term contracts that might be required to finance energy efficiency investment. Following the report of the Energy Services Working Group (DTI 2003), Ofgem removed the 28-day rule, but this still did not generate any significant energy services activity for small energy users.

It would be unfair to characterise these outcomes simply as lack of interest or inaction by the major energy suppliers. Each of them has piloted energy services offers, with various levels of success (UKERC 2005; EST 2008). But all reached essentially the same conclusion that, for the mass market and under current market conditions, the benefits of cost effective investments are more than offset by the transaction costs of finding appropriate customers, persuading them to sign contracts and delivering the necessary investment and customer support.

It is arguable that the significant innovation implied by energy services markets is more likely to arise from outside the market incumbents. However, the barriers to entry in existing energy supply retail markets are very large. Tight margins require the ability to spread fixed costs over a large customer base. Most importantly, the need to operate in volatile wholesale markets incentivises risk reduction by vertical integration. So, even for large retail companies with high brand values, energy retailing is not an attractive proposition. Moreover, the business of providing an energy efficiency service necessarily involves on-site, building specific, technical services that are very different in character from the virtual retailing of energy supply as now practised. New actors interested in energy efficiency delivery are likely to choose to do this directly rather than with the additional complexity of integration with energy supply in an 'energy services model'.

2.3 Regulated energy efficiency programmes

The initial energy efficiency obligations on energy suppliers in 1994 were on the Public Electricity Suppliers (PES) in the retail franchise market that preceded full retail liberalisation. These were the Energy Efficiency Standards of Performance (EESoP) that formed the precursors to today's Carbon Emissions Reduction Target (CERT). By this time,

the franchises were confined to households and small businesses and this history partly explains the situation, unique to the UK, of such obligations now being restricted to the household market. Similar programmes were commenced in the gas sector, but discontinued by the second regulator, and only recommenced when the new Government indicated an intention to require them by legislation in the 2000 Utilities Act. This moved the power to set such obligations to the relevant Secretary of State (then Defra, now DECC) who then set obligations in both gas and electricity. As importantly, it established the principle of placing such obligations on energy suppliers operating in a fully competitive retail market. GB was the first energy market in the world to go down this route and, in doing so, moved in the opposite direction to the prevailing trend at the time in the USA, where regulatory-driven programmes were discontinued as competitive markets developed. The new GB obligations went initially under the name of the Energy Efficiency Commitment, EEC (2002-2008) to reflect the move away from a regulatory 'standard of performance' and then CERT (2008-current) as the metric changed from energy saved to carbon.

The most significant changes in energy efficiency programmes over this period have not been in nomenclature or metric, but in scale. The initial EESoP programmes were funded from an explicit levy on consumer electricity bills of £1 per customer per year. The latest estimates of programme costs (which in a competitive market are ultimately paid by consumers) are £61 per household annually, covering costs of CERT in both gas and electricity (DECC 2010). In other words, costs have increased by a factor of approximately 60. As energy efficiency costs have fallen over the same period, largely as a result of the economies of scale in larger programmes, the consumer energy saving benefits have increased by a factor even larger than 60. The key impacts of earlier phases have been assessed in evaluations of both EEC 1 (Lees 2006) and EEC2 (Lees 2008), showing that the benefits significantly exceed costs, which is consistent with the cost effectiveness of the majority of installed measures.

These programmes have been influential in other European countries, notably France and Italy (Bertoldi, Rezessy et al. 2009; Eyre, Pavan et al. 2009), as well as in the design of the EU's Energy End-use Efficiency and Energy Services Directive. However, the GB targets remain the largest in Europe – now saving about 2% of household energy use annually (DECC 2010). The international experience is that this type of policy has been successful in helping to transform product markets (insulation, heating, lights and appliances), but less successful in engaging and restructuring the work of the key trades in the energy efficiency business, in particular those involved in day-to-day building maintenance and improvement (Eyre, Pavan et al. 2009).

2.4 Monopoly regulation

In European markets that developed out of publically owned monopolies, liberalisation was accompanied by the introduction of a transparent regime of regulation for the natural monopoly businesses (pipes and wires). The role of these businesses was initially seen as important for energy efficiency. There was an underlying concern that, because the distribution networks provided major profit centres for the incumbent supply businesses (the PES and British Gas), these suppliers might wish to discourage customer energy efficiency. Such arguments were used by energy efficiency proponents to counteract the faith in free market solutions and to support the introduction of energy efficiency obligations on the PES.

Influenced by trends in US utility regulation, see e.g. (Moskovitz 1989), there was significant debate about the structure of the monopoly price control and the need for 'decoupling' of profits from sales volume. There was concern that price controls containing an allowed cost

element related to kWh sales, a 'volume driver', would provide a perverse incentive to supporting energy efficiency in the PES and British Gas.

In practice, the role of distribution regulation in energy efficiency seems to have been of little importance and is not even mentioned in the current Ofgem consultation on RPI-X regulation (Ofgem 2010a). Distribution activities have become increasingly separated from supply through a combination of regulatory and commercial changes. Networks are now owned by separate companies with no energy trading interests and the dominant suppliers (the 'Big Six') have declining regional identities and are more integrated with upstream generation than network businesses. Ironically, just as the concerns about the risks for energy efficiency of a distribution volume driver have faded, the Fifth Distribution Price Control (Ofgem 2009) has finally removed the volume driver.

However, it would be unwise to conclude that there should be no role for distribution companies in end use efficiency. The primary legislation that enables CERT, the 2000 Utilities Act, allows energy efficiency obligations be placed on either suppliers or distributors. The preference for using an obligation on suppliers arose from the view that their advantages (customer contacts, marketing and focus on service provision) outweigh those of the distribution businesses (high capitalisation, low cost of capital and an area focus). The opposite approach of a distribution obligation was taken Italy with the explicit, and successful, aim of incentivising distributors to tender for delivery and thereby create markets in energy efficiency services separate from energy markets.

As the scale and nature of the required end use investments moves towards higher cost energy efficiency and microgeneration, the balance of advantage arguably changes. Distribution companies could, in principle, finance investments on the customer side of the meter over long periods of time, unlike supply companies that almost certainly seek to recover CERT costs in the year they are incurred, thereby using revenue to fund capital investment. The role of energy distribution businesses in financing end user investment is potentially consistent with the emphasis on private sector financing in the last home energy efficiency strategy from the previous Government (HMG 2010) and its reincarnation from the new coalition, Green Deal (DECC 2010).

2.5 Overall impact of liberalisation

A rigorous assessment of the overall impact of retail market competition on energy efficiency would require a quantitative assessment of each of the four factors set out above, in particular the trade-off between downward pressure on prices and explicit energy efficiency obligations. An easier assessment can be made from changes in the size of markets for energy efficiency measures. For all the basic measures except double glazing, installation rates have increased significantly (Utley and Shorrock 2008) and, except for condensing boilers, where the market has been driven recently by Building Regulations, CERT and its predecessors have been the main driving force.

The overall outcome of policy since retail market liberalisation in GB for energy efficiency of retail customers has therefore been positive. However, it is worth emphasising that the manner in which this has been achieved has been rather different from what might have been expected, certainly by the main proponents of energy market reform. The major direct impact of liberalisation has been price reduction, and therefore a reduced incentive for energy efficiency. There has been no flourishing of free market energy efficiency activity – such initiatives have been small. Instead, major activity in energy efficiency has resulted only

indirectly from liberalisation, through the accompanying regulated programmes. These have reached levels that are historically unprecedented and comparable with or larger than similar programmes anywhere in the world. The main note of caution is that the future applicability of the same approach to more expensive and complex measures may be limited.

3. Lessons for the future

3.1 The broad context

The new context for UK energy policy is an increased emphasis on energy security due to the decline in indigenous oil and gas production, as well as more stringent, and legally binding, targets for carbon emissions reduction (HMG 2009). At the time energy market reforms were designed, neither the threat of climate change nor the depletion of UKCS reserves had the salience that they have now within the policymaking community.

The objective of reducing UK greenhouse gas emissions by 80% by 2050 implies more radical changes to the energy system than were ever contemplated by the proponents of energy market reform. Most policy attention has focussed on the need for 'close to zero carbon' electricity. However, this alone will be insufficient; significant decarbonisation of heat and transport, most likely by electrification, will also be required. The analysis underpinning these conclusions has been reported extensively elsewhere, see e.g. (CCC 2008; Ekins and Skea 2009; HMG 2009) and is not repeated here.

The implications for energy demand policy are very significant. Marginal improvements in energy efficiency through low cost measures will be insufficient. More substantial investments will be needed, for example through 'deep retrofits' of buildings. Moreover, the predominant end use fuels (oil products in transport, gas in buildings and industry) will need to change. Some analyses point to wholesale electrification of transport and heating systems. Although these are certainly technically feasible, they pose problems - social, organisational and political - that are not necessarily captured in a broad techno-economic assessment. It therefore cannot simply be assumed they will happen because they appear to give the least cost solution. To the extent that full electrification is not achieved, the pressure to reduce energy demand will be further increased.

3.2 Current proposals for home energy investment

The extent of the challenge to deliver a secure low carbon energy system is becoming more apparent to policy makers. The types of change canvassed earlier in the last decade (RCEP 2000; PIU 2002), but then dropped as too challenging, are now viewed with apparent equanimity and more ambitious changes are projected even within the current decade. The targets for renewable energy in 2020 are probably the best known case. But the plans for energy in the home are equally challenging. According to the previous Government's home energy strategy (HMG 2010), market penetration of low cost insulation measures will be largely complete by mid-decade, all new homes will be net zero carbon from 2016 and, by 2020, smart meter roll out and 4-7 million 'eco-upgrades' will have been completed. The last of these envisages a 'whole house' treatment at a cost of £8,000 to £12,000 per dwelling to include at least one 'new' technology, such as solid wall insulation or a heat pump, that are currently deployed in the UK at rates of only a few thousand annually.

It is envisaged that 'eco-upgrades' will be delivered primarily via the private sector financing 'pay as you save (PAYS)' investment and that the main policy change required will be facilitation of financing by enabling investment debt to be attached to the property, coupled

with improved consumer information, via home energy displays and Energy Performance Certificates (DECC 2010; HMG 2010). The implication is that market forces can deliver massively increased demand side investment provided a couple of market imperfections (access to finance and good information) can be fixed. Energy retailers are again envisaged to have a key role. However, the lessons of the last decade are that assuming such large scale delivery via a private energy services model is unwise and that stronger regulatory mechanisms will be needed.

Current policy envisages supplier obligations continuing after 2012 out to 2020, but the details remain unclear. Earlier ideas of a 'supplier cap and trade' (Defra 2007) have been recognised as unworkable (Eyre 2008), and quietly dropped. The likely inadequacies of a supplier obligation for the new challenges are increasingly understood (CCC 2008), but no viable substitute has been proposed.

3.3 Current proposals for energy market reform

The recognition that energy supply systems must change is being accompanied by some reflection on the adequacy of the institutional and market structures. Analysis indicates that existing electricity market and transmission access arrangements are not well suited to delivering the required levels of investment, connection and use of low/zero carbon power generation technologies, in particular remotely sited intermittent renewables (Baker 2009). These insights seem to be gaining some acceptance within policy making. In particular, Ofgem has undertaken a remarkable *volte face* – accepting that competitive wholesale markets alone may be unable to deliver the necessary investment and actively canvassing more interventionist approaches (Ofgem 2010b). Similar changes can be seen in the attitude of the last Government in its final months in the Energy Market Assessment undertaken by HM Treasury and DECC (HMT and DECC 2010).

In contrast, there has been little attention to the role of retail market structure in delivery of energy security and climate change goals. Presumably it has assumed that such problems are best addressed from above and that retail markets can have little impact upon them. If so, given the major changes required in energy use, this seems likely to be a serious misconception. Both Project Discovery and the Energy Market Assessment focus on potential changes to the wholesale market. The barriers to entry in the retail market and their links to vertical integration are noted and considered problematic for competition, but not for broader goals.

Most of the proposals from the Energy Market Assessment will have limited impact on energy efficiency markets. None foresees anything but the continuation of a competitive retail model. With the exception of demand side participation in wholesale markets (discussed below), most of the options canvassed (a minimum carbon price, further incentives for low carbon generation and regulation of carbon in power generation) leave retail markets largely unaffected, except for possible price changes. Only the 'single agency buyer model' seems to offer a significantly different environment for retailers, by creating what would be essentially a wholesale monopsony. This would re-establish a transparent wholesale market price for electricity, which might address some of the barriers to entry in the retail market by removing the competitive advantage of vertically integration. Whatever the upstream implications (which lie outside the scope of this paper), it seems the option most likely to promote innovation in retail electricity markets. Interestingly, in this context, it is the only reform option excluded from further consideration by the Energy Markets Assessment (HMT and DECC 2010).

The recognition that electricity markets face new challenges from high levels of inflexible and intermittent generation has led to increased interest in smart grids and demand side participation (DSP) in wholesale markets. New electricity loads can potentially exacerbate and/or mitigate the problem, depending on their temporal characteristics and associated storage capacity. In general, it is expected that electrification of transport may form part of the solution, because of the high storage capacity and low load factors of electric vehicles. On the other hand, electrification of buildings is likely to exacerbate problems, as it is strongly correlated with existing peak power loads and buildings typically have passive heat storage of only a few hours.

DSP is currently effectively limited to large energy users who can participate directly in wholesale markets or for whom (more often in gas) interruptible contracts are commercially attractive. Greater engagement of the mass market of electricity users will require more sophisticated arrangements and more substantial changes in retail markets. Current market reform options assume that the improved prospects for time of day pricing, via smart metering, point the way forward. They are certainly likely to offer some new options, but the lessons from energy efficiency in existing retail markets are that an uncritical assumption of 'rational' consumer behaviour is unwise.

Conceptualising the role of energy demand in energy market reform as being restricted to temporal load switching is deeply flawed. Much of energy demand will remain, in wholesale power market discourse, 'non-dispatchable'. But that does not mean it is fixed and immutable on longer timescales. So load shifting is only a minor part of the change required; investment to reduce demand and shift away from fossil fuels is far more important. Whilst much of the investment activity to secure these may need to be undertaken outside energy markets (as usually defined) that does not mean energy markets do not influence or interact with these decisions.

The existing retail market is certainly not unproblematic, nor is it particularly popular. Gains from customer switching are now largely played out with 'non-switchers' left on the higher incumbent tariffs now arguably bearing all of the costs and gaining none of the benefits of competition. The market structure is largely driven by the needs of retailers to hedge risk, and this acts as a barrier to market entry. The result is a retail market oligopoly of multi-national, vertically integrated energy companies offering little diversity. And, as shown above, retail competition itself has delivered relatively little energy efficiency. The emphasis on price competition delivered by a strong focus on cost reduction is not conducive to innovation in service delivery, certainly not in the services required to secure a sustainable energy transition. Indeed, it is difficult to see how past systemic changes (e.g. natural gas conversion) would have been delivered within this market structure, and therefore there must be concerns about its appropriateness for future systemic change.

Of course, identifying retail market structure as a problem is somewhat easier than proposing sensible ways forward. The recognition that "I wouldn't start from here" is not helpful to policymakers. This paper does not seek to set out a blueprint for future market reform. However, it is worth noting that the challenges of very substantial changes to the downstream physical infrastructure (in distribution, metering and end-use technologies) are investment challenges. It is difficult to believe that they are best addressed via policies targeting energy suppliers, given that these are high turnover, largely virtual businesses with limited capacity to engage with physical investment. This tends to point to greater emphasis on the role of

distribution companies and energy users themselves in delivery of end use energy policy. Policy post liberalisation has tended to downplay an active role for distribution companies, but this needs to change. The case is most obvious for 'smart grids', but, in the context of radical energy efficiency improvement and electrification of heat and transport, the role of distribution companies in financing investment on the customer side of the meter is also in need of re-examination.

4. Conclusions

The outcomes of retail energy market reform for energy efficiency have not been as expected, certainly by the more vociferous proponents of energy market reform. Some of the big debates, e.g. the role of prices and volume drivers, have proved to be relatively unimportant. Some of the great hopes, notably for competition in provision of energy services, have been largely unrealised. One of the great fears, that market reform would lead inevitably to the death of regulatory driven programmes, has proven entirely unfounded.

Energy efficiency programmes have been a relative success story in the liberalised market. Programmes in Great Britain have become comparable in scale with the largest in world. However, it is difficult to argue that this is because of liberalisation, indeed one might argue it is more in spite of it. Political willingness to regulate for energy efficiency coincided with full retail liberalisation and has been the critical factor. Liberalisation has not meant deregulation; regulation has continued and increased.

This success needs to be caveated. Market based instruments in energy market regulation have delivered quite effectively on relatively low cost, cost effective measures. They have not delivered the type of demand side investment that will be needed to deliver new energy policy goals. These will include more substantial investments in energy efficiency, but also very large fuel switching. The implications of these requirements have not yet impacted on high level discussions about energy market reform.

UK Government policy for energy efficiency and electrification in the household sector has ambitious aims but is rather light on detail. The key lesson of the last decade is that regulation is likely to be essential. Yet the current policy proposals indicate a rather naive faith in market based solutions. The emphasis is on financing (via facilitating 'pay as you save') and information via smart meters. These are both important elements, but certainly not sufficient for the transformation of demand on the scale, and at the pace, that is envisaged.

The current agenda for energy market reform largely neglects the retail market and demand. There is a strong residual institutional commitment to retail competition despite limited evidence that it has very significant benefits or can help in addressing key future challenges. Only the reform option that has already been excluded from detailed consideration (the single buyer model) offers much prospect for innovation in retail supply markets by disrupting the oligopoly of vertically integrated suppliers. Retail market reform is not yet 'on the agenda', but it needs to be.

The current focus on the role of the demand side in energy market reform is on DSP in wholesale electricity markets. This is too limited, as it neglects the role that energy markets might play in affecting the two key problems facing the demand side – the overall scale of demand and the challenge of electrification of heat and transport.

The future challenges of very substantial changes to infrastructure point to greater emphasis on the role of distribution companies, as opposed to the energy suppliers, in delivery of policy. The case for 'smart grids' is established, but there may also be a role of distribution companies in financing investment on the customer side of the meter.

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