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Why the UK's Proposed Reform of Electricity Markets Needs More Rational Analysis, and Less Wishful Thinking

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Energy Regulation Insights

From the Editor

The UK government will have surprised many foreign observers by issuing a consultation document proposing an "electricity market reform" which largely abandons markets in favour of centrally-planned investment.

The proposal is a turnaround for the UK, which has been telling other EU states to liberalise their energy markets for 20 years. The only way to understand these proposals is as a sign of the government's well-publicised determination to meet environmental goals—whatever the cost to the planet. Anyone interested in the reasons for the turnaround will be disappointed by the supporting "Impact Assessment"; the arguments set out in it are unusually poor—selective, inconsistent, and theoretically unsound.

In this ERI, Sean Gammons and I, both members of NERA's Energy, Environment, and Networks practice in London, examine the analysis behind the proposals and identify weaknesses in it. We explain where additional analysis would be useful to make sure that the policy does not impose excessive costs, and also suggest some alternative solutions that are more likely to achieve the government's own objectives for the electricity sector.

Graham Shuttleworth, Editor

Electricity Market Reform in the UK: Wishful Thinking?

In December 2010, the UK government issued a consultation on Electricity Market Reform (EMR). By now, the government's main proposals have been widely reported. The key elements are:

- Long-term price guarantees (Feed-In Tariffs or FITs) for investment in new "low carbon" generation (renewable and nuclear generation, as well as coal-fired generation with carbon capture and storage);
- "Carbon price support" (i.e., a floor price for emissions of CO2 specific to the UK electricity sector);
- Emissions performance standards (designed to prevent construction of new coal-fired generation without carbon capture and storage); and
- Limited centralised procurement of new "flexible" generation (sufficient to ensure security of supply).

International observers may be surprised to see that the UK government, after advocating energy market liberalisation in Europe for 20 years, has now moved so far away from reliance on market mechanisms. Anyone looking for a reasoned argument for this policy shift, however, will be sadly disappointed. Close inspection of the suite of documents issued under the EMR consultation reveals that the government's new policy is based on weak foundations that other regimes may find less attractive.

Below, we consider the analysis behind these policy choices and identify areas which require less wishful thinking, and more careful attention to the economics and experience of electricity markets.

Assuming desirable outcomes, rather than analysing economic impacts, does not produce a rational policy

Key Features of the Impact Assessment

The most striking feature of the UK's new policy is the idea that full "decarbonisation" of the electricity sector by 2050 is an imperative, regardless of the cost to the UK economy. Other governments (and UK electricity consumers) may want to strike a different balance between environmental targets and their economic cost.

The second most striking feature of the new policy is its reliance on a set of selective, untested, and inconsistent assumptions about electricity markets and the effects of government intervention, which more or less guarantee the choice of the proposed forms of intervention. The so-called "Impact Assessment" sets out these assumptions (on pages 21-22) and they form the basis of the annex on modelling. The assumptions are controversial—indeed, some represent little more than wishful thinking—and the consultation invites questions as to their validity. The entire policy therefore rests on assumptions that even the UK government does not regard as robust.

Another striking feature of the new policy is a more general indicator of UK government views on markets. For whatever reason, the Impact Assessment assumes at several points that markets will behave irrationally and that government interventions will always "do the right thing". For example:

- The IA (just like the associated modelling) assumes that private sector investors make decisions based on a short-sighted, inaccurate view of the future—but that politicians and governments do not;
- The IA assumes that fluctuations in market prices are due to irrational investment cycles[1] and that governments will not indulge in similarly irrational behaviour;[2] and
- The IA assumes that the private sector's apparent reluctance to invest in high-cost, technologically risky forms of capacity with a relatively high upfront cost is obstructive and undesirable, rather than a rational way to maximise society's welfare.

The EMR therefore represents the UK government's attempt to reassert centralised (and hence political) control over the electricity market, even though the costs of doing so are likely to be large and the reasons for doing so would not survive close scrutiny. Many of the proposed solutions will either have little effect or increase costs and worsen security of supply. The EMR documents assume away undesirable effects of the proposed interventions—for instance, they assume that intervening in *part* of a market is not as bad as intervening in the *whole* market (whereas, of course, any government intervention affects the whole market).[3] Assuming desirable outcomes, rather than analysing economic impacts, does not produce a rational policy.

Even if UK politicians have forgotten the lessons of state control that led to the creation of an electricity market in 1990, they can learn those lessons again when discussing and designing new institutions. The following sections identify four problems with the UK government's current proposals and where additional analysis would put them on a more rational footing.

1. Unjustified Distrust of Markets

The IA and the modelling annex assume that investors are short-sighted and invest inefficiently.[4] But is this really true? Is it a sound basis for government policy? To support its case, the IA refers to outdated theories which are now discredited. (See Box 1.) Investors might appear to be short-sighted when in fact they are far-sighted but distrust the sustainability of government policies. That distrust will not diminish if government policies impose a large increase in costs to which consumers (and voters) will object. Will expanding political control over the electricity market (via centralised agencies) lead to more efficient or lower cost outcomes? Will such policies be more sustainable and therefore inspire greater trust in long-term investment signals? That seems unlikely. For a number of reasons, the current proposals seem bound to raise costs unnecessarily and to make environmental policy less credible in the long run.

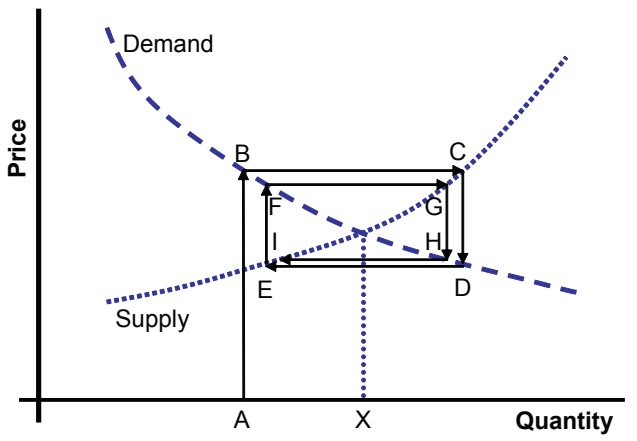
Box 1: The "Cobweb": A Discredited Theory of the Market

The UK government assumes that investors are myopic and will not invest for the future on a a rational and efficient basis. This assumption is not consistent with most modern theories about markets. The IA refers to the "cobweb" theory to support its accusation that markets perform inefficiently. The IA ascribes this theory to a paper written in 1938, but economic theory has moved on since then. The cobweb theory is incomplete and outdated, as described below.

Figure 1 shows a cobweb model, in which supply supposedly oscillates between surpluses and shortages due to the short-sightedness of investors. The dashed blue line shows how customers demand a larger quantity (horizontal axis) if the price is *lower* (vertical axis). The dotted blue line shows how investors or producers will supply a larger quantity if the price is *higher*. At the quantity marked X, the price would settle at a level where producers supply X and customers demand X. This is the "equilibrium" outcome, where supply equals demand.

However, some economists have always distrusted the ability of markets to find the equilibrium outcome. Figure 1 shows one of the theories developed to explain that distrust. Assume that the level of supply is currently "A". To ration demand to this level, prices must rise to the level indicated by "B". The theory says that producers will then rush to produce the quantity consistent with this price, at the point C. However, this decision results in over-supply; to encourage sufficient demand to absorb it, the price crashes to the level defined by point D. At this price, suppliers cut back their production to point E, and so on around the cobweb via F, G, H, I, etc. Some of these cobwebs eventually arrive at the equilibrium and some don't.

Figure 1: The Cobweb Theory



Does this mean that markets are a flawed way to organise production? No, because this is a flawed model of the market.

Implicit in this model is an assumption about investors that is hard to sustain in practice. The model assumes that investors use the *current* price of a commodity to plan their *future* production, but never take into account how their decisions affect *future* prices. This assumption is implausible, but also raises a more fundamental problem: if investors familiar with the market cannot anticipate the effect of expanding production, why should we expect central planners or governments to understand markets any better? Economists debating this issue in the 1970s and 1980s rejected the cobweb and similar market models in favour of a different view.

First, investors aren't as short-sighted as the cobweb assumes. There is plenty of evidence of markets moving swiftly towards point X. Unfortunately, the world is uncertain so point X shifts randomly all the time, leading to unpredictable periods of over- and under-supply. Booms and busts are not evidence of "cycles", just the effect of repeated random "shocks". Second, no individual can forecast random shocks, or the location of point X, better than investors acting together in a market. This result leaves no reason why government intervention should improve upon the market's ability to reach the equilibrium output, and there is precious little evidence that it does. Even if the government can collect superior information, the best policy is just to publish it, so that players in the market can act upon it.

The cobweb model is therefore discredited (1) as a market model, because it assumes that investors never consider the future, which is implausible, and (2) as a reason for government intervention, because it assumes that governments know more than investors, which is not borne out by experience. Other attempts to show that markets perform poorly face similar criticisms.

Markets may not be perfect—but they don't have to be. Markets just have to be better than central planning—and the evidence shows that they usually are.

In the preferred policy "package", the UK government provides price guarantees based on the costs of each technology. The danger in this method is that the government policy will provide support to unnecessarily expensive (or risky) technologies.[5] This policy shuts out the market's ability to find the cheapest way of reducing CO2 emissions.[6]

What kind of financial or economic discipline will be placed on the policy to ensure that costs do not spiral out of control? The IA mentions auctions, but does not explain how they would help. The government might call for bids from potential developers, or for bids from projects with the necessary permits. Auctions for putative renewable and nuclear projects will not improve security of supply if they attract offers from potential developers who then cannot overcome barriers within the planning system. On the other hand, investors are unlikely to develop nuclear projects to the point where they have all the necessary permits just so that they can compete in an auction that they might lose. More likely, the award of contracts will embroil the UK government in protracted negotiations. In such negotiations, project developers will hold the whip hand if government negotiators have to achieve defined targets. The result is likely to be (as in all central planning systems) a steady escalation in cost–or capacity shortages as projects promised by developers are delayed or cancelled.[7] The IA does not take account of these risks and potential inefficiencies despite the empirical evidence of their existence.[8] In today's economic conditions, consumers will not accept lightly any increase in the cost of their electricity.

The supposed benefit of the preferred package depends largely on a reduction in the cost of capital (hurdle rate) required by investors. The government treats this reduction as a benefit to society. However, the analysis supporting this conclusion is entirely subjective and theoretically indefensible. The modellers impose an arbitrary premium on the cost of capital for each type of plant, based on its "investment beta". However, increased gearing does not change the underlying cost of capital. Its sole effect is to reduce a firm's tax payments. This reduction in tax is not a gain to society, since the government and/or other taxpayers lose whatever the firm gains. Even the reduction in investor risk is only achieved by transferring risk to consumers. A supposed reduction in the cost of capital from these sources should not be counted as a benefit to society.[9]

Thus, the IA does not explain how costs will be reduced or managed. It does not consider whether UK electricity consumers (and voters) will tolerate the additional costs of the UK-specific targets for CO2 in conditions of slow economic growth. Investors will ask themselves how credible the new policies will be if increasing resistance to rising costs is likely to emerge in the future.

2: Inconsistent Views on Electricity Market Signals

The EMR says that energy-only electricity markets will not provide adequate investment signals, because prices are highly volatile and because reliance on high prices at peak times is subject to the risk of political intervention (see paragraphs 7 to 9 on pages 27-28 of the IA).[10] However, the lessons drawn from this observation are partial and inconsistent.

With regard to low carbon and flexible generation, the IA just assumes (p.22) that providing price guarantees will encourage more investment, and will also lower the cost of capital and hence total costs to consumers.[11] The EMR therefore proposes to offer low carbon and flexible generation a price guarantee (i.e., the difference between a fixed price and the fluctuating market price), rather than a price premium (i.e., a fixed amount on top of the fluctuating market price).

At the same time, the government rejects the option of adopting a market-wide capacity mechanism, leaving some forms of investment to rely on peak prices. Instead, the government proposes a capacity mechanism targeting "flexible" generation. However, paragraph 34 of the IA says that this option "relies on effective functioning of the electricity market", brought about by "moderate reforms", to encourage investors to keep existing capacity open and to build new flexible capacity. This line of argument exposes inconsistencies at the heart of the government's policy:

- Assuming an "effectively functioning" market removes the need for a *targeted* capacity mechanism;
- If the criticism of peak prices in paragraphs 7 to 9 is correct, no energy-only market can ever "function effectively". Instead, a *market-wide* capacity mechanism would be required to protect investment signals from political intervention.
- And if capacity mechanisms reduce risks and lower costs, as *assumed* on page 22 of the IA, why does the government not extend these benefits to conventional generation, through a market-wide capacity mechanism?[12]

The government simply adopts a different view of market investment signals at different points in the same document. Such inconsistencies provide no sound basis for any new policy.

To provide a rational and consistent basis for the future electricity market, the UK government will have to address the following conundrum: are prices in an energy-only electricity market able to provide efficient signals for investment? If

the answer is "no", there is a case for special arrangements (capacity mechanisms) covering all of the market, including conventional generation. If the answer is "yes", there are no flaws in the current market that justify the proposed form of support to low carbon and flexible generation. But the government cannot justify the currently proposed policy by answering "no *and* yes".

3. Market Interventions Are Never "Partial"

At various points, the IA suggests that certain proposals are preferable (i.e., less harmful to efficiency, less "distortionary", less costly to administer) because they affect only *part* of the electricity market and not the *whole* market. This view seems to be based on a misunderstanding of markets. No government can avoid the accusation that it is intervening in a market by claiming that it is only intervening in *part* of the market.[13]

The main concern here is the proposal to institute a targeted auction of contracts for "flexible" capacity, which is needed to offset increasing variability of output from renewable energy sources, and to maintain security of supply. The IA says that only 3 GW of additional investment would be required to maintain capacity margins (IA p. 55, paragraph 155). The IA does not say how the government will ensure that the proposed scheme creates additional capacity, rather than just replacing existing capacity with (unnecessary and costly) new capacity.[14] The problem here—which the IA ignores—is "crowding out".[15]

The IA recognises (p.33, paragraph 31) that offering special arrangements to some types of capacity may lead to a "slippery slope" in which all capacity seeks to have such contracts, because they are more attractive. The IA does not recognise, however, that government-sponsored contracts for peaking capacity, intended to increase the capacity margin above market levels, will simply depress electricity market prices and discourage investment in other types of capacity. A partial scheme will therefore replace existing capacity with new capacity, without little or no improvement in security of supply.[16] The centralised purchaser will then have to go down the "slippery slope" of awarding contracts to more and more capacity in an attempt to increase the capacity margin, which will only succeed when *all* plant receives such payments. In the meantime, low-cost existing capacity will have been replaced prematurely with high-cost new capacity. Consumers may wonder why.

A more efficient solution would recognise the futility of partial interventions in markets, and would take a market-wide view from the start. When considering market-wide capacity mechanisms, the IA and modelling annex only examine a flawed type, i.e. a fixed price which encourages excess capacity. It would be possible to cure the most obvious flaw in this capacity mechanism by adding some kind of price response (as found in most actual mechanisms). Such a market-wide capacity mechanism would provide the desired security of supply, without relying on price signals in which neither investors nor the UK government have much confidence.

4. The Rationale for Carbon Price Support Has Largely Disappeared

When first discussed in the UK, the "carbon price floor" appeared to be a flagship policy, correcting a flaw in the EU Emissions Trading System (ETS) and sufficient to motivate the investment in low-carbon generation required by government policy. "Carbon price support" (CPS) remains as a component of *all* the packages considered in the EMR consultation. However, the purpose of the CPS is no longer clear now that the UK government has decided to offer all low-carbon generation a direct price guarantee in the form of a contract for differences (i.e., a contract that tops up revenues from the market to bring them up to the level implied by a price guarantee).

The CPS would have limited application—it would only affect electricity generators within the UK (or possibly Britain) that earn market prices and are not covered by centrally allocated contracts. Such contracts would cover renewable plants, (new) nuclear plants, and fossil fuel-fired generation with CCS; "flexible" generation (peaking plants or fast-response capacity) would also receive support through contracts for capacity payments. Only gas-fired plants, "unabated" (non-CCS) coal-fired plants and existing nuclear plants would remain in the market. Given that electricity market prices would (mostly) pass through the increase in costs at gas-fired plants, the main effect of CPS would be to increase revenues to existing nuclear stations and to discourage the use of "unabated" (non-CCS) coal-fired generation. However, a lot of coal-fired plants already have to close by the mid-2020s, due to the increasing demands of EU environmental directives. Those closures are one of the causes of concern about security of supply that is motivating the EMR process. It seems perverse within that process to impose an additional charge that brings forward the closure of coal-fired plants, worsens security of supply, and raises total costs to consumers.[17]

Curiously, the IA does not consider the CPS in isolation, or study any "policy packages" which exclude the CPS, so it gives no estimate of the effects of this policy by itself. Given the adverse effects on the UK economy of any unnecessary increase in electricity prices, it would seem necessary to remedy this omission.[18] The CPS by itself might even prove adequate to encourage low-carbon generation without suffering the inefficiencies likely to arise from the use of FITs.[19]

Conclusion

The UK government's proposals for EMR abandon any reliance on markets to encourage investment. However, the analysis behind these proposals relies on faulty assumptions about how markets work. The EMR contains some useful ideas for improving the operation of the British electricity market, such as (1) reform of cash-out prices to sharpen investment signals, (2) capacity mechanisms to reduce the risk of government intervention in peak energy market prices, and (3) long-term government guarantees of the future carbon price. However, consideration of these and other policy packages is undermined by analysis that is selective, inconsistent, and therefore uninformative. In some cases, the "analysis" is little more than a set of assumptions about particular outcomes – i.e. wishful thinking. Designing an efficient replacement for the current market will require a more rational approach. Electricity market reform needs proper economic analysis of market behaviour. Consumers might also welcome some consideration of the trade-off between self-imposed environmental targets and total costs to the UK economy.

EndNotes

1. The IA even refers on page 28 to the outdated and discredited "cobweb" theory of markets, dating from 1938. Modern economic theories assume that investors do the best they can, but occasionally get caught out by random shocks. Even efficient markets do not promise perfect foresight.
2. Most modern economic theories assume governments are no better at seeing into the future than private investors. The UK government may feel sceptical about the rationality of markets after the recent banking crisis. However, evidence from the same crisis (from Iceland, from peripheral states of the Eurozone, and from the UK) suggests that before 2008 national governments were just as likely as the banks to make optimistic forecasts, leading to painful adjustments in public sector funding when growth slackened in 2009 and 2010.
3. The government's IA actually finds that the net benefits of all the reform packages considered are negative compared to the baseline over the period to 2030, which is the limit of the modelling undertaken thus far (paragraph 6 of the consultation document). However, the government assumes away this inconvenient result by arguing that the net benefit would turn positive if calculated over a long enough period, if CO2 targets were stricter, and if innovation benefits were quantified (paragraph 6, p. 41 of the consultation document).
4. See page 24 of the Redpoint report: "In forming expectations of future returns, we assume that investors take a ten year forward view of the expected supply/demand balance, but use prevailing fuel and carbon prices in their projections of future electricity prices. Hence, the model assumes that investors do not anticipate future increases in carbon prices, a key factor in determining the generation mix produced by the model."
5. Indeed, much of the EMR process seems to be intended to encourage more expensive and riskier investments, on the grounds that markets are "biased" against such projects.
6. There is much criticism of the EU ETS for setting a price on CO2 emissions that is "too low". However, the government has not explained why the low cost of achieving its policy (in this case the price of reducing CO2 emissions) is a problem rather than a cause for rejoicing. In practice, the government has set targets for CO2 emissions reduction that apply solely within the UK, even though (1) it is more expensive to reduce CO2 emissions in the UK than in other EU member states, and (2) reducing CO2 emissions in the UK electricity sector will—at least until 2020—merely allow other EU member states to increase their CO2 emissions within the overall cap for Europe. See G. Shuttleworth (2010), "The Case for Markets", New Power, Issue 15, 28 April 2010, pp 6-8.
7. The UK's old scheme for promoting renewables, known as the Non-Fossil Fuel Obligation (NFFO), was cancelled and replaced with the current RO to try to resolve such problems. Similarly, the energy crisis in California in 2000-01 was brought about in part by a policy of awarding long-term contracts to favoured forms of generation, which subsequently ended in litigation and a failure to build adequate capacity to meet demand.
8. The IA compares a market-wide capacity mechanism with a "targeted" mechanism aimed at encouraging particular types of investment. It actually states in paragraph 87 that "A targeted tendering for capacity is expected to lead to a more stable de-rated peak capacity margin and reduced risk of [load shedding]", before adding the crucial phrase "assuming [system operator] forecasts are sufficiently accurate". In other words, the IA favours one scheme because it is assumed to operate better than the others, without actually analysing its likely impact.
9. The IA only calculates this reduction in cost as a benefit. The lower cost of capital would not cause an increase in investment, since the associated FIT would fall by the same amount as costs, leaving investors just able to cover the costs, as before.
10. The method used by Redpoint, advisors to the government on this topic, to model current market arrangements and the reform proposals, and to assess their impact on security of supply, raises a number of technical questions. The consultation document (paragraph 33, p. 30) says that the trade-off between the cost of peaking capacity and the cost of unserved energy implies an optimal de-rated capacity margin of 10-12% and expected energy unserved (EEU) of 0.5-4.0 GWh per annum. In other words, the efficient long-run equilibrium would entail a small amount of load shedding. The consultation document says that the modelling of the current market arrangements under the baseline scenario yields long-run de-rated capacity margins of 5-11% and EEU of 8 GWh per annum, implying the current market arrangements will provide insufficient security of supply. It is unclear from the explanation

given in Redpoint's accompanying report whether this inefficiency is due to problems with the current market, or problems with the modelling (e.g., the assumption about investors being myopic, or problems with the logic that prevent it converging on efficient equilibrium outcomes.)

11. Neither the IA nor the modelling report attached to it provide any evidence for the assumed reduction in the cost of capital. In any case, to the extent the rates do fall due to the price guarantees, it is only because risk is being transferred to consumers by government mandate, so it is not clear that there is any overall gain in social welfare.

12. The modelling of capacity payments examines only a flawed scheme, which offers a fixed capacity price to all comers (and which inevitably leads to over-capacity). However, real capacity payment mechanisms do not operate in this fashion—for example, the scheme operating in Ireland allows capacity payments to fall when capacity margins rise to prevent excess capacity being built. This part of the modelling is therefore flawed and uninformative, and undermines the rationale for the government's rejection of a market-wide capacity payment scheme.

13. Such a claim would be reminiscent of the apocryphal curate's egg. A vicar asks his curate—a junior priest—if the egg he is eating has gone bad. To avoid offending his boss, the curate replies that his egg is "only bad in parts". The point—in case there is any doubt—is that the whole thing is spoilt by badness in any part, whether one is discussing eggs or electricity markets.

14. The IA just assumes away this problem. The consultation document states in paragraph 56 that both schemes have been "modelled on achieving a 10% margin". Paragraph 56 also concludes that a targeted capacity scheme gives greater flexibility in the type of resource supported but only because that result is hard-coded into the modelling ("in the targeted capacity mechanism, the central body would choose the mix and so there was some new build OCGT, (simulated in the modelling by forcing certain technological outcomes)."). In practice, specific technological outcomes could equally well be forced into a market-wide scheme (though we would not recommend such an approach).

15. The IA refers to Swedish experience, but seems not to have noticed concerns about the effect of the Swedish scheme on the Nordic electricity market, which were raised by both the Nordic regulators and Nordpool. A similar scheme in New Zealand raised the same concerns and seems not to have improved security of supply in the long run; the IA does not mention this experience.

16. The market will find a new equilibrium, with roughly the same, lower level of capacity margin. This capacity margin is defined by the point where capacity shortages and peak prices occur frequently enough to cover the cost of investing in new conventional capacity or of maintaining existing conventional capacity.

17. In any case, in the period up to 2020, there will be a price for CO2 emissions due to the EU ETS. The price emerging from the EU ETS represents the opportunity cost of reducing CO2 emissions within these sectors. However, the EU ETS sets a limit on total CO2 emissions for a number of sectors, including electricity generation, for the EU as a whole. Any reduction in CO2 emissions caused by the rise in prices will (a) represent an inefficient choice and (b) be offset entirely by increases in CO2 emissions in other EU member states.

18. When the CPS was first proposed, it was presented as sufficient to encourage the choice of low-carbon generation. The aim of the "carbon price floor" was to remove uncertainty over future CO2 market prices; the demands for higher and more stable electricity prices were added later. However, the original aim of stabilising (or raising) CO2 prices can be achieved by offering a CFD for C02 emissions allowances ("EUAs") within the EU ETS, rather than a CFD on electricity prices (as in the current packages). Under this approach, the volume of EUAs in the CFD would be tied to the capacity or output of the low-carbon plants (like a FIT), multiplied by the average CO2 emissions factor for marginal generators over a year. This approach would impose some consistency on the degree of support to different forms of low-carbon generation (or make transparent any inconsistencies).

19. The government states (paragraph 23, p. 48) that "carbon price support on its own is unlikely to provide enough certainty on the government's policy direction to allow sufficient investment in low carbon technologies", but presents no evidence to support this view. The assertion is not credible—there must be some level of carbon price support that will encourage the necessary investment, even if it is extremely high. However, the discussion of alternative policies does not provide a complete analysis of costs, since it assumes that FITs will lower the cost of capital without inducing any offsetting loss of efficiency in the choice of plant and technology.

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