Speech: After the trilemma – 4 principles for the power sector

It's a pleasure to be here and to reflect on Dieter's seminal report as ever with Dieter he brings experience authority and clarity of analysis to complex problem that always present themselves in the field of energy.

I want to start with 2 recent stories from the electricity market.

First, just 3 weeks ago, Amazon announced that it would install solar panels across its UK sites in order to fulfil its pledge to be 100% renewable. But – and this is what is remarkable to me in the story – this decision was not only about being green, It was the best business decision taken in those terms.

Second recent corporate example, is from DeepMind. DeepMind recently used AI to optimise Google's energy use. Before the AI geniuses got to work on it, a Google search required 0.3-watt hours of energy – 122 of those and you could boil a kettle to make a cup of tea. But DeepMind optimised the power used to cool the computers in Google's mammoth data centres, and now you can do almost 175 searches before you'd boil the water for your cuppa.

These are glimpses into the future of energy – green, cheap and technologically exciting.

Green energy is, increasingly, cheap energy. This is amazing news for many of us in this room that were veterans of the debate through the Climate Change Act 10 years ago and it is particularly exciting news because of the seriousness of the challenge that we have in climate change is underlined by the IPCC's latest report that humanity has to act to save the planet.

It also shows what successful Industrial Strategy can do.

We made a decision to decarbonise – a long-term decision – we built and designed the market mechanisms to deliver this efficiently, and today, the costs of technologies such as offshore wind are falling rapidly. What's more, we have built world-class industrial clusters in this important technology of today and the future.

Today, I want to focus specifically in making some observations inspired by Dieter's report on our approach to the power system. My colleague Claire Perry and I have already published our Clean Growth Strategy that covers a wide range of energy issues, such as our plans for decarbonising heat, for electrifying transport and delivering domestic energy efficiency improvements. Other critical energy industries, such as the oil and gas sector, form part of our broader Industrial Strategy and again, these are not my focus here today. I have also spoken and done a great deal on the retail market and what I have described as the loyalty penalty – I will not elaborate on that topic today there will be other occasions in which I can do

that.

I would like to pay tribute to the work of my colleague Claire Perry as the minister of state who has a huge enthusiasm for preparing this reform.

I have gone back as anyone with any responsibility for energy policy does and read the important speeches of my predecessors – Nigel Lawson's famous speech in 1982 and Amber Rudd's lecture in 2015 – and it has seemed to me that being in charge of energy policy for the country is sometime a bit like a game of pass the parcel – you know there's some great prize some great gift and will you actually get to unwrap it will it actually get into your hands when it comes to you?

Now Lord Lawson's speech is optimistic about what a more market-oriented approach could bring in terms of lower costs and greater efficiency. Amber's contribution was to be clear about the challenges and the opportunities that decarbonisation presents. Compared to them, I feel I have the good fortune of being able to say to you all here today: "Look! Here is the present we have all been hoping for. Cheap power is now green power. Thanks to all of our efforts of many people in this room it is no longer true that when it comes to electricity, you can only choose two of the three things that we really want: green, cheap and secure."

The policy conundrum known as "the trilemma" is I think coming to an end.

Before delving further, I wanted to thank Dieter for the care that he took with his "Cost of Energy Review" that had been commissioned. His review, and his contribution to energy policy over many years, has helped to shape my views. In opposition I remember countless conversations with Dieter focusing on how the world was going to be watching these policy mechanisms that could help optimise the achievements that were within grasp. Given the length and depth of the review I'm not going to respond to each of Dieter's recommendations specifically – if I was to do so we would be here for some time – but I want to respond to the major arguments and I want to share with you my views for discussion and debate during the weeks ahead on what the general principles that a complete power sector strategy should adopt. I am going to set out more details through a policy paper in the next few weeks, before publishing a detailed White Paper to follow in the new year.

The Past: Lessons we must learn

Let me very briefly place this moment in its proper historical context. We are just entering the fourth phase it seems to me a fourth phase in the evolution of our power system.

If we think of the first extending from 1926 to 1982. Electricity in the 1920s was the hot new thing for industry and households and I dare say clubs like this would have replaced the chandeliers with electric lighting. The system grew piecemeal, and governments of the day soon understood that this new form of usable power would be economically transformative. It Stanley Baldwin's 1926 Electricity Act that envisaged the connection across the country of the biggest and most efficient power stations. The Act regulated

the system both in terms of technical connection in terms of the standards and the pricing. The system was privately or municipally owned but it was essentially increasingly controlled nationally. The system became ever-more integrated – a good example of this, as I was surprised to discover, is that Britain first connected itself to the European back grid in 1961. In this age of debates around Brexit, it is worth remembering that the untrammelled flow of power down wires made so much economic sense on all sides that it predated our EU entry by 12 years.

By the 1980s, the system had too much capacity – in 1979, the reserve margin was 27%. This was largely due to overly-optimistic forecasts of demand that were knocked sideways by the oil shocks, a point that exercised very much Nigel Lawson in 1982 when he said that "forecasting errors are the rule rather than the exception".

Professor Stephen Littlechild who, with Professor Michael Beesley, wrote some of the defining papers on how to bring competition to bear in electricity systems, and as an economics graduate at Cambridge studying Beesley and Littlechild was my formative instruction in regulatory economics and the economics of energy. That brilliant transformative approach which became internationally famous resulted quite rightly in Professor Littlechild being given responsibility, as the privatised sector's first regulator, of developing and implementing the new system. The model for regulation was to unbundle – that is, to separate potentially competitive functions like generation, from transmission and distribution – and then to regulate what could not be left to competition. The big lesson he taught us is that wherever possible we must embed market mechanisms to deliver innovation as well as efficiency.

Unbundling and privatisation rapidly reduced labour and engineering costs to the great benefit of consumers both in domestic settings and industrial. To define and to clarify the government's role, of course the invention of what became the world famous RPI-X formula for those natural monopolies was a huge innovation. As conceived, a regulator with good knowledge of the companies could set an annual target for efficiency – the "X" – which would determine their permissible prices for the year.

Of course many aspects of the system are with us today, but the system evolved as it needed to do from RPI-X. It has moved to allow natural monopolies to invest and recover costs; to innovate without worrying that they will not keep any of the benefits; or to be rewarded for improved outcomes. Ofgem is actively making improvement to this system. However, I agree with Dieter that now is the time to look at increasing the scope of competition in networks.

The growing understanding of the threat of climate change soon brought back difficult national choices. Phase 3 of our power system was the age of the trilemma. You could date that moment in policy terms to April 1993 when the then Chancellor Norman Lamont introduced the first ever tax said to be aimed at ensuring that we honour international climate commitments to greenhouse gas abatement and reduction. We had promised at the Rio Earth Summit to stabilise emissions by 2000, and the Chancellor imposed VAT on domestic

energy.

Were it not for climate change, I firmly believe that we would still be essentially refining the Lawson/Littlechild model. But decarbonisation, especially with new technologies that have high capital costs and low marginal costs, has made the problems of electricity policy intrinsically more complex than they were in the 1980s. And think a moment – without all of our efforts, I don't think we would be contemplating today the prospect that is ahead of us of cheaper, cleaner electricity.

The era of the trilemma required an overhaul in our generation technology, and there were real worries that the market would not deliver the required investment. My predecessors therefore introduced a market in 2013 for firm capacity alongside a suite of instruments to support low carbon generation.

So what lessons should we extract from this necessarily brief history?

An integrated system – paid for by the many – delivered huge benefits but required an active state to provide a strategic context and create markets. Overly-centralised decision-making eventually led to inefficiencies. The market reforms dealt with many inefficiencies, but could not be counted upon reliably to deliver the investment that decarbonisation requires.

Helm Review

In his review, I believe Dieter points the way to how we can evolve our system, taking the best from these past phases. I will explain this now by considering Dieter's 3 major recommendations, for:

- first: a Firm Power Auction
- second: Independent System Operators
- and third: dealing with a system that is dominated by fixed costs

The Firm Power Auction

Dieter's Review recommends many domains in which we can expand the use of market mechanisms, and I generally agree with the thrust of his analysis and recommendations. This is very much in keeping with the Lawson/Littlechild philosophy, which one might characterise as being: "where a good market mechanism can be designed to deliver an outcome, then use it!".

Let me focus now on Dieter's recommendation for a Firm Power Auction which seeks to have businesses decide how to deliver low-carbon capacity rather than ask government to make technology choices. Dieter argues this will increase efficiency and lower bills by having a single market to procure all capacity.

I find his reasoning extremely cogent. Ministers set the overall goal, businesses make offers and the government asks its designated experts to procure efficiently on behalf of consumers. This is a simple and sensible division of responsibilities, and one I endorse.

But the system must still address all of the necessary requirements of this. As Dieter points out, there are questions of pace and of wider strategy.

First, there is a question of industrial strategy – our current support system for offshore wind for example has produced great benefits. The costs of offshore wind projects are falling and will fall further. We are now the leading country not just in Europe but in the world for deploying offshore wind energy. The cost has fallen by half since 2015, and factories and jobs are springing up all around our coasts, from Belfast to Hull, from Machrihanish to the Isle of Wight. We have major global clusters of expertise which deliver real economic benefits to the country and to the places in which they're located. It would be unwise to disturb this ecosystem right now with a major reorganisation. We will shortly announce the parameters for the next Contracts for Difference (CfD) auction round that will be held by May next year, and, led by Claire Perry we also hope to move to the next stage with our ambitious Sector Deal in the coming weeks for offshore wind. Over the coming years, we will look to reforms of our CfD mechanism to make generators more responsive to market signals.

But I agree we should be transitioning to a system in which businesses decide what technologies to deploy in meeting twin security and decarbonisation targets.

In terms of mechanisms to deliver this, let me pause for a moment to say something about this morning's Tempus decision.

The judgement was as everyone knows that's read it is on a procedural matter – the Commission's process for granting State Aid approval – rather than on the policy on Capacity Markets per se.

The Commission and the government are already working together to consider the judgement and the best means to respond swiftly and appropriately. And National Grid has confirmed today that the decision will not cause any risk to supply this winter.

Some people may be disappointed that the simplification in market mechanisms that I have in mind will be progressive and not instant. It's worth touching on one of the major reasons for why I think this is the case – and that is the question of carbon pricing.

Carbon pricing has an important role to play in helping us meet our climate goals, and it has already been a significant driver in reducing the amount of coal we use. Dieter proposes we tax carbon to its full social cost to stop unabated fossil-fuel technologies from dominating any auction. As he says, doing this in just one country would require border-adjustment taxes to avoid decimating our important industries because of environmental dumping. However, delivering it would be a major diplomatic move if we were to address that challenge. It would require a transformation in the way that the world thinks about climate change policy.

So in the absence of that being immediately available, I think we need a gradual transition from current mechanisms to a more integrated market. Other

policies whose logic lies in the absence of full carbon pricing are also therefore still needed. A good example of this approach is our £315 million Industrial Energy Transformation Fund that was announced in the recent Budget as part of our Industrial Strategy, something that would help companies invest in money-saving and decarbonising technologies.

But I want to stress that I very much accept Dieter's vision that we should move to mechanisms that give businesses more decisions and governments fewer. So this is my first candidate for a principle for future power sector policy after the trilemma:

- the market principle – that we must wherever possible use market mechanisms that take full advantage of innovation and competition

But the market principle, in my view, does not mean that the only intervention that my successors or I will need to make in generation markets will be to set the decarbonisation level and the security margin – energy and environmental policy are shaped by complex externalities and there is intrinsic uncertainty about the future. These are what really drive the requirement for a government approach to the power sector strategy.

Let me elaborate.

First, my view is that energy is special. The economic and social consequences of anything going seriously wrong with our energy infrastructure has impacts that go a long way beyond what is captured in everyday bilateral contracts between parties – it involves complex externalities. For example, imagine the country that developed a reputation for being a place where you can't rely on the power supply. This was a reputation that Britain once has: many of us here remember the three-day weeks of the winter of the 1970s. The world's big manufacturers, service companies and finance houses would think twice about establishing themselves in any country that could not be confident that its capacity was secure. The whole economy builds on the foundations of secure, low cost energy – that is just what talking about "infrastructure" means. The government needs to represent the wide, dispersed interests of the whole economy.

Second, and this is especially true at moments of great global transformation like today, energy decision-making must take account of intrinsic uncertainty about the future. Let me give some examples.

Will we have an economic means of mass energy storage in 2035? It is not just that this is uncertain – we can't say that if we have a 95% chance or a 50% chance. We simply can't put a probability to it. Will we decarbonise heat with hydrogen, or with electricity, or with some as yet undiscovered means of inter-seasonal heat storage? We can't put probabilities to scenarios like this. Will transport be electrified such that total energy demand grows, or will energy efficiency rise to such an extent that demand actually falls? Will car charging happen on the street and in the driveway, or in out-of-town charging stations that autonomous vehicles navigate their way in the dead of night? Will our support for the careful exploration for domestic shale gas make the option commercially viable, adding a secure, domestic source of

supply, or will we depend instead on alternative sources of imported gas?

In the face of these difficulties of externality and intrinsic uncertainty about the future, the role of government should be three-fold:

- first: to coordinate and reduce uncertainty by making commitments to future outcomes (as our Climate Change Act does for 2050);
- second: to maintain diversity for insurance purposes; and
- third: To invest to maintain future flexibility

What does this in mean practice?

Take, for example, the case of Carbon Capture, Use and Storage (CCUS). The technology has economy-wide qualities that could turn out to be very valuable to indeed to delivering clean industrial growth. It could be that the deployment of low-carbon hydrogen for industrial heat, or even negative emission technologies might play a role. That might turn out to be necessary; we wouldn't want to rule it out at this stage but rather we should consider further into the future whether or not these approached will be useful or perhaps even essential. That is why I am today confirming that at the upcoming Summit in Edinburgh we will publish a CCUS Action Plan setting out our approach to deploying CCUS at scale in the 2030s, subject to costs coming down sufficiently. I am currently considering new missions under the Clean Growth Grand Challenge of the Industrial Strategy, looking at areas where we face the most acute decarbonisation challenges such as reducing our industrial emissions in particular industrial clusters. And beyond CCUS, this is also why I am keen to continue our support for R&D and that the Energy Innovation Board, which advises the government on clean technology innovation, strengthen the voice of business on its board.

So option value and insurance benefits need to be layered on top of any least-cost auction mechanism we devise. And this is not because we want to meddle, but because the future is intrinsically uncertain; there are genuine system-wide benefits to keeping potential low carbon options available.

It is the role of the government to know when it should invest in a certain type of system insurance, we should recognise that it is just as much our role to decide when the benefits of buying more insurance is not worthwhile. One such example of this is our approach to gas storage. Here, we rely on the market following a constant and detailed consideration to deliver the necessary capacity based on price signals, rather than intervening to require a specific source of storage to be given and taking in the cost of that.

The UK has consistently enjoyed a high level of gas security over the last decade. This is the upbeat lesson that I take from last winter's Beast from the East. This has been confirmed repeatedly through my own department's analysis, as well as reports done by external bodies. Our security margin in a winter that is as cold as one in every 20 is around 22%. We enjoy a diverse range of gas supplies, with no source contributing more than a quarter of total supply. The development of Liquified Natural Gas as a global market has hugely increased our resilience since the days when our system was first designed, in that we can now source supplies from many producers and

shippers. The market has been allowed to choose a range of options for meeting the nation's gas demand and has procured them in an efficient way.

The market has delivered what competition does so well: lower prices than would have otherwise been the case. We have the second lowest industrial and household gas prices in Western Europe. If Ministers were to intervene to require for a particular source of supply, such as storage, the cost of doing so would fall to consumers through higher energy bills. The Beast from the East showed us this: those countries that directly intervene to support gas storage were not actually protected from price spikes during this period, and some with more storage capacity than we have saw spikes far larger than ours.

While governments should always be willing to respond to changing circumstances, the success of our liberalised, liquid and low-cost gas market should tell us that the government should only intervene to guarantee optionality where it is strictly necessary. This is a consideration that needs to be constantly reviewed.

Future technological development that is unknowable from where we stand today means that sometimes it is wise not to spend now but at the right time. We need to decide when it is best to commit to invest in certain technologies and when we should invest in the future.

Thinking about timing and options is extremely relevant to nuclear power, which last year contributed 20% of the nation's electricity. There has been some criticism of the prospective cost of the Hinkley project, but one aspect of the benefit that has not been emphasised often enough is that it restarts programme of civil nuclear power in this country and conversely the loss of much of the supply chain and the domestic skills in the civil nuclear sector was a set back which could have been avoided if we'd thought ahead. We need to have a supply chain that is active – engineers who understand the technology, PhDs and university departments specialised in it, welders, civil engineers, concrete pourers, and more… We've had to restart our civil nuclear industry more or less from scratch, and doing so has bought us an opportunity to meet our climate targets over the longer-term at lowest cost.

Now, everyone in finance knows this – but when you hold an option, the next decision you face is whether to exercise it. If nuclear is sufficiently competitive, then it is worth, in my view, turning that option into a commitment. And in our effort to bring down costs, we are exploring the right ways to finance new nuclear, including through the potential for Government investment in the Wylfa project, as well as a Regulated Asset Base model for future projects. It is also why we recently announced a nuclear industry sector deal with its emphasis on the need to reduce the costs by 30% through increasing modularisation and advanced manufacturing.

Because make no mistake – all technologies are in competition with each other. The better any one of them does, the more the others have to step up to stay in the running – and that is good for consumers, it's good for the country and climate. In the recent past, it seemed as if we faced decarbonisation with too few viable choices. We now have the greater luxury of being able to see real competition and still enjoy a diversity of sources

of clean power.

While I share Dieter's vision of a government setting the framework and investors making technological choices, we need to design an approach that is sufficiently flexible to allow the government to purchase the system benefits of insurance and optionality. In other words, a strategic layer needs to be added, and that is what I propose to move towards.

So I propose a second principle for power sector strategy after the trilemma:

- the insurance principle – given intrinsic uncertainty about the future, government must be prepared to intervene to provide insurance and preserve optionality

Independent System Operators and Network Regulation

I now want to talk about another big and radical idea in Dieter's review – the regulation of network infrastructure.

Digitisation is transforming the once staid business of power networks. The deployment of smart technologies throughout the grid is an essential contributor to the end of the trilemma. It adds to optionality and requires subtle market design.

The 1926 Act was all about creating a centralised grid that would deliver secure supplies more cheaply than did decentralisation. The Lawson/Littlechild model assumed there would be little fundamental technological change in the grid, and therefore not that many hard investment decisions.

Today, new technologies – such as embedded generation co-located with storage, demand-side management, energy efficiency and AI-enabled control – offer potential efficiency increases from diverse, non-traditional and potentially competing sources. I opened this talk with a story of DeepMind massively reducing the energy it takes to answer a Google search. When we get the supporting regulatory system right, it won't just be Google data warehouses that are optimised – it could be every home and business in the country.

The transformation of distribution and supply should deliver, amongst other things, the prize of domestic energy efficiency improvements. Reducing draughts and waste has a double virtue: it can cut bills significantly and it is also good for the environment. It is often those least able to afford it who live in the worst insulated homes, and many of our houses were built in an age of unimaginable coal profligacy. We need to ensure that innovative businesses of the present and future can capture the system and network benefits of persuading customers to reduce their energy demand. Sometimes that will mean consumers becoming producers. Smart meters, data access, smart networks and the right rules and incentives are necessary for this transformation. The distinction between supplier and distributor may no longer hold in this new world. I am therefore launching, with Ofgem, a review of supply licenses, to ensure we eliminate any unnecessary regulatory

barriers. This will sit alongside a joint review between Ofgem and my department into the future of the retail market.

How to evolve natural monopoly regulation that allows any credible supplier – be it Tesla, Nissan, Siemens, Rolls Royce, DeepMind or some brand new start-up – to help reduce system costs is one of the big challenges facing us. That is the challenge for today's regulators.

The current system that Ofgem operates allows for some flexibility in investment and incentivises companies to try better solutions. However, in a world of technological transformation, there are diverse other solutions that should be explored through competition. For example, at any location, a demand-side-management scheme might be better than a network reinforcement, or a big battery might be better still. During this period full of technical opportunity and uncertainty, open competition is our friend. This is an area that Ofgem are already looking to improve, and I endorse and applaud the work that Dermot Nolan and Martin Cave are doing in this area and for the work they have underway already. I will support them by legislating where necessary to open up new network requirements to competition.

Dieter offers another radical solution to network regulation. Independent system operators should determine very specific outcomes for the network – for example increased resilience to peak demand in a part of the grid. Delivering these outcomes ought to be put out to tender, allowing many technical solutions to compete. The cheapest option that delivers the required system benefit should be selected.

It is worth noting that we have already gone a long way towards this model when it comes to National Grid and high voltage transmission. National Grid has separated its transmission business from its system operator role. The system operator therefore does not have an incentive to prefer transmission assets when recommending investment on the system. While this is a welcome change, it is early days and as I have said before, we will consider full separation if it should prove necessary.

However, technical solutions may be even more disruptive at the distribution level. If we are charging electric cars on the street, using their batteries to boil our kettles at peak times, and foregoing the need for network reinforcement, who pays what to whom? Get the incentives right, and consumers will reap the benefits. Dieter proposes the creation of Distribution System Operators to define needs and run tenders.

The principle of making sure that there is no conflict of interest between the network equipment owner and the network operator is very important. Distribution companies are currently taking action to resolve their conflicts of interest, but we need to accelerate reform. Network companies need to satisfy the public that they are structured in such a way as to provide infrastructure at the lowest cost.

Data is central to delivering the smart power system of the future. That's the big pay-off from our smart meter programme. It's why we have set up a new Energy Data Taskforce to make sure data access, rights and controls are

appropriate.

Armed with data and new technologies, it may well turn out that there are new ways of operating and controlling the networks that are safe and efficient but that are not allowed under old regulations that now contain now defunct technology assumptions.

I will therefore initiate an Engineering Standards Review to ensure that the technical standards we have are right for this next phase of our system's development.

Regulation must be entrant- and innovation-friendly, whilst, of course, maintaining investor confidence. That means a reform of how rules are made. Observers – from the CMA to Dieter – have found that the system of industry code self-regulation has, over the long term, meant less innovation, less competition, and ultimately higher prices for consumers. Incumbents have often been able to put their interests ahead of those entrants or consumers. We need to find a solution that harnesses industry knowledge of the system without handing over the keys to insiders. So the government and Ofgem will launch a full review into industry codes and code governance, and of course will be prepared to act to reinforce with legislation any changes that may be necessary.

The concept of greater independence for network operators is the right long-term approach. As we aim in that direction, I suggest that the core principle we must follow, my third, is:

- the agility principle – energy regulation must be agile and responsive if it is to reap the great opportunities of the smart, digital econom

The No Free Riding Principle

The last of Dieter's big arguments revolves around that very hard question of "who should pay"?

Many of the technologies we're deploying have high fixed costs and low operating costs. As Dieter rightly points out, as the share of fixed costs grow, output prices matter less than they used to and fixed access charges matter more. Who pays shared costs becomes a broad question of economic policy, with complex distributional and incentive effects.

Ultimately, we are aiming for a fair distribution of costs, with good incentive properties, to ensure that we are actually minimising system costs and not just shifting them from one person to another.

The structure of charging is becoming an urgent question because some households and businesses can install "behind-the-meter" generation or demand management systems thus avoiding historic grid and decarbonisation costs. We do not want these investment decisions to be driven by charging rules that reflect old realities. We want a level playing-field, in which "off-grid" or "low-grid" solutions are rewarded if they actually contribute to reducing system costs. That is why I fully support Ofgem's work to consider the future

of network charging, and why the government will do the same for the way its policy costs are recovered.

Dieter once again has a far-reaching proposal here. He suggests that the "legacy" costs of decarbonisation be cordoned-off, that industry should be exempt from them but not from carbon pricing and that the historic costs should be shifted to general taxation. The economic logic of Dieter's case is clear: why burden our exporting wealth-creating industries with a cost that serves no incentive purpose? If we compare our household and business electricity prices to Germany's, we see that German households face prices that are 68% higher than ours, and very large German businesses 15% lower. Should we therefore follow their example?

When it comes to the allocation of fixed costs, narrowly economic principles allow for so many options that the basis for decision-making must be strategic.

I have examined closely whether we have the right balance of fixed decarbonisation costs right. Already today, our energy intensive manufacturers are exempt from almost all decarbonisation levies. A decision to exempt industry from all historical policy costs would add £1.5 billion to either household bills or to the Exchequer by 2020 and since bills are our only plausible mechanism for cost recovery that is something I am simply do not think we should do.

But that does not mean to say I am comfortable with the situation we are currently in where industrial consumers higher electricity prices than elsewhere in the EU.

Industrial competitiveness is very much on my mind. I return again to Lord Lawson, who foresaw that energy "conservation" was the best starting point for competitiveness. Firms do not face the full incentive to increase efficiency because of our carbon pricing regime. Hence the importance of our announcement that we are offering new funding to support industrial energy efficiency and decarbonisation projects. The Budget, just a few weeks ago, also included a commitment to a Small and Medium Enterprise energy efficiency scheme, on which I will publish a call for evidence. I am also confirming today that we are working with Ofgem to determine whether new protections are necessary for SMEs and microbusinesses many of which pay too much for their energy.

We clearly need a high-level principle to guide the large number of charging decisions on the system of the future. My suggestion for my fourth and final principle for energy development policy after the trilemma:

- the "no free-riding principle": all consumers should pay their fair share of system costs

The Four Principles

To summarise. Dieter's review is a compelling vision for the future. From it, I have extracted four principles which I would like to discuss during the

weeks ahead that I think can be good guides to strategy in these transformative times for the power sector:

- the market principle –we must wherever possible use market mechanisms that take full advantage of innovation and competition
- the insurance principle – given intrinsic uncertainty about the future, government must be prepared to intervene to provide insurance and preserve optionality
- the agility principle – energy regulation must be agile and responsive if it is to reap the great opportunities of the smart, digital economy, and finally
- the "no free-riding principle": consumers of all types should pay a fair share of system costs

The Future: Zero subsidy

So where would these four principles leave us? I believe they will allow us to create a system that relies more than today on a competitive set of market mechanisms to drive down costs, would give to government a strategic role in dealing with externalities as well as dealing with intrinsic uncertainty. It would require an explicit agility in the support for innovation by regulators, and ensure a structure of charging that does not invite free riding.

As I said at the outset, I think the right approach in response to such a comprehensive and thoughtful report that Dieter has set out is to begin a discussion, a conversation which I do today. I'll set out some more details through a policy paper in the weeks ahead, before publishing a White Paper early next year.

But let me conclude with what I think 10 years ago would have considered to be an amazing prospect: it is looking now possible ,indeed likely, that by the mid 2020s, green power will be the cheapest power. It can be zero subsidy.

Cheapest full stop. Trilemma well and truly over. Shout it from the rooftops. You, the industry, together with government and science, together people who have been engaged in this most exciting and fundamental of industries will have created a possibility in which low carbon power actually can subtract from consumer bills. Moving beyond subsidy does not mean to say we are reverting to the dirty, polluting world of the past, it is one where green energy can be cheap energy – a present that my predecessors could barely have dreamed of.

Humanity should say three cheers to that.

Thank you for listening.