

COMMISSIONER: Good morning. We will reconvene on the subject of financing and investment in nuclear infrastructure and from the UK, we welcome Mr Darryl Murphy. Counsel.

5 MR JACOBI: Dr Darryl Murphy joined KPMG in 2009 and is a partner at KPMG's power and utility fuel advisory. In this role he currently advises the UK Department of Energy and Climate Change on the development of the electricity market reform, including negotiation on the contracts for different CFD Hinkley Point C Nuclear Power Plant. Dr Murphy has 20 years of
10 experience in infrastructure financing. Throughout his career, he has advised public and private sector clients on financing and the delivery of infrastructure projects worldwide, including nuclear programmes in Saudi Arabia and Poland, nuclear expansion plans in Romania and case studies for nuclear development for the South African government. Dr Murphy holds both an
15 honours degree and a PhD in Maths and a postgraduate diploma in business and administration and the Commission calls Dr Darryl Murphy.

COMMISSIONER: Dr Murphy, thank you very much for joining us this morning or this evening your time. As a banker, why do you see a nuclear
20 power plant as a different investment proposition?

DR MURPHY: Well indeed, I am assuming you can see the slide in front of you which sort of portrays this as a nuclear like many projects is shown as a sort of jigsaw puzzle with different aspects. I think though what is important is
25 stressing as an ex-banker, if you really focus on the – some very distinct risks there are two principle issues that spring to mind. One is it is a very particular one around nuclear, which is the fact that here you are talking about extremely large-scale investments and in the context of extremely complex construction. And so on that basis, what one sees is I guess, the history of projects which I
30 guess unfortunately show that in evidence through cost overruns and delays, demonstrating the complexity. And I think for any financier undertaking infrastructure projects, assuring the fact that you can actually build what you say you are going to build is a high prerequisite. The problem is that if one compares to other asset classes, the simple fact is the size and complexity
35 means that if I use the sort of jargon that you are unable to find anyone that typically can kind of wrap, i.e., take all of that construction risk on to its own balance sheet as it were.

So if for example you were financing a gas power plant, you may well find that
40 an EPC provider who can provide that wrap. In nuclear that typically is not possible given the size. So that construction risk is a very big concern to financiers. The other element is the long payback period. Obviously there are very large amounts of capital. The operating costs are relatively low for nuclear but of course you have to payback that initial investment. And what
45 that means is you tend to need a very long period of revenue certainty as it

were, to ensure that you get sufficient return on an initial investment. And again, as a financier that would be, I guess, very heightened in the context of nuclear given the magnitude of that investment.

5 MR JACOBI: If I could pick up your answer with respect to the ability for firms to fund them off their – to fund such projects off their balance sheets, has there been a shift in the capability of utilities and other organisations to be able to, I guess, either pool their resources to finance such projects off their balance sheets, I guess in the last decade?

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DR MURPHY: I would say – and I apologise, I guess the perspective I'm giving perhaps as a – this very nature, a very European tinge to it, as it were, given my location and probably my primary experience is of course in Europe, and of course the problem we face in Europe is European utilities financially are certainly not in the same financial position as they were say – if you went back pre the global financial crisis for example. So in fact what we have seen is large European utilities probably even less able to manage the risks around developing nuclear, and what that's led to, I guess, is a distinct shift, to some degree, that we've moved away from utilities looking to develop nuclear plants to nuclear really being led a lot of instances by the vendors themselves, ie, the principal suppliers of the equipment. So therefore, that leads to further, I guess, challenges given that really those organisations themselves are not necessarily all capitalised to a level that they can actually take the full delivery risk.

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MR JACOBI: You expressed a view with respect to offering revenue certainty, which I assume is the funding part of the equation.

DR MURPHY: Yes.

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MR JACOBI: I'm interested to pick up the relationship between the funding and the financing, and I think we've got a slide that might pick it up at slide 4.

DR MURPHY: Yes, indeed. If you go to slide 4, this is, I think, very important, and it may seem, in truth to be very simple, but it is very important to separate the two terms. Often it's quite usual perhaps for - not usual, rather for people to interchange these terms. I think, strictly speaking, funding is principally, with any large scale infrastructure, who actually is paying for that asset, and basically in nuclear one would expect that in many cases there are decisions to be made, which is there tends to be a leaning upon the consumer, so the principal idea around electricity generation is the consumer pays for its electricity which, in itself, should ultimately recompense the investment therein.

45 There is a choice though, and it's a choice generally for governments, which is

they can choose to pay for infrastructure through general taxation revenue, as it were, and they can pay for the assets themselves, or they can basically look for payback from the consumer. What that does mean of course is in any particular nation, it is the individuals themselves who ultimately pay for the asset; it's just a matter of whether that's indirect through taxation to the government or directly through their consumer bills. That is a very active debate, particularly in Europe, given concerns around affordability to the consumer.

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10 Financing is rather simpler, in that sense, and clearly financing cannot occur without a level of funding available. What you're typically seeing is you've got a large amount of capital investment and, being rather simplistic, financing is a way in which you smooth those cash flows over time, and so from a financing point of view, the challenge for nuclear is there's a very large upfront investment in the order of billions of dollars in that context and therefore, it emphasises this fact that actually you need someone to be able to provide that financing upfront and, as I noted, previously often in the case of the developers, utilities, their balance sheets may not be necessarily able to withstand that level of investment.

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20 And I think as a general rule, it's fair to argue that nuclear tends to need a very strong balance sheet either of the developer or, alternatively, from government in some shape or form, and that support from government can come in different ways, which we may get into a little bit later. So basically funding is the key point, but you have to remember that someone is paying for this asset, but financing is, in effect, how you can amortise to some degree those upfront costs over time.

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30 MR JACOBI: To what extent does finance follow the funding, or is there something additional that's also required in order to ensure that you, I guess, achieve the financing required for the project to commence?

35 DR MURPHY: Well, I think you are correct, in that financing, I would always argue, follows the funding, because the funding creates the cash flows (indistinct) kind of makes them a rather sort of basic financing lesson, but it is an important principle when you start to understand how you layer risk, because financing follows the funding and therefore, what one has to look at is fundamentally what are the underlying risks that underpin that funding flows, and that is fundamentally come back to the key point we started on, which is the key risk in nuclear and in any others, the key risk being the large capital investment, and simply, can you actually complete the asset to generate revenue, meaning that actually energy tends to flow from the asset and therefore, what is the stability of that revenue over time which fundamentally is underpinned by the funding stream if that's occurred.

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MR JACOBI: You talked about there being some different models, and I think, dealing with particularly with the UK model, which the Commission has heard about earlier in the week, and I think we're picking up slide 5, is the contract for difference model, and I'm interested to understand what you think the key upshot is from the need for a contract for difference for nuclear construction in the UK.

DR MURPHY: Yes, indeed. I think this is a very critical point in any - whatever jurisdiction in this, one has to sort of modify it to your one-zone energy market. From a UK point of view, the key point that, I think, is a difficult one perhaps for consumers to understand is in reality there is a need for subsidy, and I think when you look at - clearly you'll be aware of the Hinkley Point transaction. A lot of the press has focused on the price agreed on the strike price, and fundamentally that price is significantly above where the wholesale market risk is.

That is not to say that nuclear is an extreme form of generation. The reality is that many forms, in fact all forms of energy generation, certainly in the UK market, do require subsidy, and that's the same in terms of renewable technology, and arguably would even apply to gas technologies if one was to build those. So fundamentally, nuclear does need a subsidy and they're extremely - and I can't think of an example where nuclear has been able to be put into generation without some form of subsidy requirement.

MR JACOBI: We picked up, I guess, on some of the construction risks. The Commission has heard, in the course of evidence, about a different class of reactor concept, the small modular reactor, and I'm interested to understand whether you have a view about whether that might resolve some of the concerns about construction risk, given some of the statements that have been made about those technologies.

DR MURPHY: Indeed, and I think you're right to note that SMRs provide an interesting alternative model with fundamentally the benefit being the investment upfront is a lot smaller for individual units, as the name would suggest. In theory you could develop nuclear power through SMRs, which have a much smaller capital need for the burden from a funding point of view, and the availability of financing from a finance point of view should be less. However, I think the context I would say is that the reality is that the technology, as at today, is rather unproven and so we come back to if there is one thing that concerns, in my view, funders more than complex construction risk it's probably unproven technology risk, and that, I think, is a very difficult investment proposition until such technology has actually been proven to work at an operational level.

So I think the problem with SMRs is probably how you actually probably kick

start that program and demonstrate to investors and funders that even though it's relatively low cost, the asset can actually be delivered. As at today, certainly on some of the work that I've been involved in on SMRs, the level of certainty about cost, and even the viability of technology, hasn't necessarily
5 been proven at a whole scale level. Now, that's not to say that may not - that obviously will improve, and I guess that's the desire and hope of many nations, but certainly we're not in a position today to say just because you do small nuclear projects for SMRs that some of these issues disappear.

10 MR JACOBI: I'm interested to pick up the extent to which the CFD arrangements are thought to be enough on their own. I guess they solve the funding aspect of the parcel for the UK to instil the investor confidence that's needed to obtain the finance that's required in the UK.

15 DR MURPHY: Yes. In a way, I think it's always instructive to - perhaps I always think of nuclear particularly in its - like most assets - in the form of its life cycle. You may wish to refer to slide 6 which seeks to break down - you could take this as any complex project that has been scaled in the context of nuclear, and in terms of the breakdown in that case, the five stages, the key to
20 this point is that, you know, the operations and maintenance period in stage 4, the CFD basically enables - of the two comments I made at the outset, it basically addresses and mitigates the revenue stability and it does that very well and it does that to a level which is represented in this slide that actually in theory you should be able to source a greater amount of financing from
25 different sources once you have actually an asset that is operational.

However, the CFD does not address in any way and certainly not in the construct of the UK model currently, does not address construction risk, therefore through and generally through financing availability, and so of the
30 two risks that I set out at the forefront of the presentation, the long-term revenue stability is addressed, but not the construction risk. So the CFD only becomes applicable, as it were, it comes into being once the plant is operational. So therefore one could argue it only goes part the way there and therefore still requires a developer who is capable of financing a large amount
35 of capital through a complex construction period.

MR JACOBI: I am just interested, the particular chart expresses the view that a strong equity basis is required in order to attract the debt. Could you just
40 unpack that a little for us?

DR MURPHY: Yes, indeed. I think I tend to, and I have a background more in debt financing, so I look at this very much from that perspective which is the debt fundamentally looks to that solid equity base to develop. So if you start
45 from the concept of development of a nuclear project, and whether that's in the very early stages of site preparation, or even possibly acquisition of a site,

through to development of the technical solution, sort of design and price firming sort of exercise, that is that period of a project is typically one that only in effect equity from a developer can finance and a debt financier, that typically would not finance at that basis.

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The next stage is in order to bring that debt in, it will look very clearly to a level of equity which is underpinning that particular project but as we've explained, whilst the construction is a very challenging one for many classes of debt providers and so it's only once one has a demonstrable sort of operational project that you are able to bring that debt into flow alongside the equity. It may well be at that time, of course, the providers of that equity may actually recycle so, for example, a utility developer may, once the plant is operational, seek to bring a financial investor into a plant given if it has a sort of proven track record, but we come back to the feature that in order to finance something through construction, one most definitely needs equity, and if there is going to be some debt they will need some very strong mitigation to ensure that they are confident that the project not only can be delivered but actually the debt is somehow covered in the event of cost overruns or delays.

20 MR JACOBI: So am I right in understanding that at least during that period that what might be referred to as non-recourse finance is not going to be available?

25 DR MURPHY: Yes. I think that is fair to say, that the classic, as you say, non-recourse project finance is very difficult to achieve in nuclear. So therefore lenders would typically, and I guess you can look at case studies around the world and show either they will look to corporate support in extremis or in many cases government supports.

30 MR JACOBI: Just coming back to the previous graph, and I just want to pick up on a concept, I noticed that the CFD for nuclear operates for a period of about 35 years and I am just interested to understand is there any particular magic in 35 years in view of the fact that we understand these plants are capable of operating for a licensed period of 60 years and potentially being extended beyond that time?

40 DR MURPHY: No, I think one has to bear in mind a little bit of the UK context in this, but I think it carries over on an international basis, which is of course the CFD itself has to achieve state aid approval so you will be no doubt aware that the European commission looks very carefully at individual nation's approaches to anything where the state is providing, in effect, subsidy, as they are here, so therefore there was a - it's really a commercial balance between the fact that you are locking into power prices at the strike price for a long period of time.

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5 You know, why can't that be shorter? Well, of course, the shorter the area (indistinct) to focus one's mind on from an investor's point of view and from a potential long-term lender's point of view, it would typically only focus on the period within the CFD, and so if it was shorter you're likely to have to probably demonstrate that, for example, any debts would probably only be sized off the revenue in that period.

10 You have to counterbalance the fact that, of course, if you made that longer, ie beyond the 35 years, then you are obviously increasing the amount of fixed - obviously guaranteeing a level of energy into the future, so it is a delicate balancing act between how long you have to basically guarantee that strike price for, as against the sort of financial efficiency of, back to my point about over what period of time do you realistically need to see an adequate return on your initial capital.

15 MR JACOBI: I'm just hoping to pick up, I think what's implied by the charts at the bottom, I gather that what we'll likely to be looking at is a rolling class of investors as the project moves along. I am just interested to understand who the class of investors are and I think that might be picked up by what's in
20 slide 7.

25 DR MURPHY: Correct. Yes, slide 7 is obviously quite busy, but what it seeks to do is to differentiate the fact that there are many different sources of capital, particularly in this case we're looking at the equity base, as it were, and what we tried to seek to do in this sort of evidence here is that - what we tried to set out here is the areas of characteristics for certain investors, and if you can follow the detail along the top you'll see there that, for example, one could look at that in terms of operators, utilities, maybe investors who are more strategic in the sector, vendors themselves, ie actually the main nuclear technology
30 providers, civil providers, and then the latter three columns are jointly what I call more financial investors and going as far as differentiating sovereign wealth funds from infrastructure funds, from pension funds.

35 Those entities broadly act fairly similar, but what it tries to represent is the characteristics are very different both in terms of risk appetite and most importantly the horizon for their investment. So in many cases you may see certain investors who are willing to perhaps provide equity investments through construction but they may well seek to recycle, that will be often the case in terms of shorter term - if there is capital available from say vendors or
40 possibly contracted developers, you will see there is probably shorter term capital available but not necessarily long term.

45 So there's always exceptions to the rule, but as a general trend the more strategic investors, maybe more technical providers, tend to be more interested in probably a shorter term with some exit strategy, whereas there's obviously

relatively lower risk long-term investors which are more of a financial nature who may come in post construction but have a longer term view in terms of return on the asset. So the key - what I'm trying to do here is say if one is looking at how one pulls together an investor base for a project, he needs to
5 recognise there are different stages of project and those stages may appeal to different classes of investor.

MR JACOBI: I am just interested in picking up on the question of the competition for capital, and I think the particular UK challenge is dealt with on
10 slide 8, but I am interested more generally in the challenges faced in there being a competition for capital, particularly for nuclear projects as opposed to other energy and indeed other asset classes.

DR MURPHY: Indeed. Slide 8 is reproduced actually from the UK
15 government documents which we set out, I think to show the market what the – what I call here, particularly the more sort of structured project finance opportunities. Often a lot of our infrastructure in the UK could be provided by government and funded directly. In many cases they do rely on private capital and what this graph seeks to show is that where over the next five years it was
20 the government's plan as of the – about a year ago, to set out where it thinks the investment is up to 2020 or so. You will see it is very heavily energy focussed which reflects the strategy of the UK government. Obviously the very large element of that is nuclear and represents the fact that it's a very large investment. But therefore, if one is an investor or a financier in the market,
25 there are many other forms of opportunity out there. There is a lot of capital but equally that capital tends to flow more in the direction of relatively lower risk projects.

The only interesting perhaps observation to make is it perhaps wasn't so long
30 ago that offshore wind was seen as, again, a relatively risky complex construction proposition. Although, you know a space of a few years, we have started to see quite a large amount of financial investment in to nuclear – sorry, in to offshore wind both in terms of financial investors and debt and you will see obviously offshore wind is probably the next largest element that is
35 required from a UK perspective but still dwarfed by the level of investment required in nuclear.

MR JACOBI: Has that investment in offshore wind been driven by, I guess, a
40 growing familiarity with the process of and the delivery of those projects?

DR MURPHY: Yes, absolutely so. It's very important I think, and goes back
to my comments about SMRs that what you saw on offshore and it may seem odd to say but even if you went far enough back in time, onshore wind, it
45 proves the point that on new technology as it were, is always something that investors and financiers are very cautious about and therefore what we see in

an offshore is that certainly in the UK, which has been very much one of the largest investment areas for the asset class, we have seen offshore wind farms been built by utilities over a number of years. It has been only relatively recently, as I say, that financiers – external financial investors have come in to that asset. And one of the principle reasons is that some of them typically probably invest in operational plants first and so – excuse me. We do see that – what we see is a lot of investors come in to operational plants and then as they gain familiarity they may seek to invest in Greenfield, i.e. new construction projects. Often because of course, frankly, it may give them greater return or opportunity but it is fundamentally about getting a greater understanding of how that asset class and how it can perform over time and seeing empirical evidence that the assets can be delivered to time and budget in construction.

15 COMMISSIONER: Dr Murphy can I stick on the issue of risk for the moment?

DR MURPHY: Pardon?

20 COMMISSIONER: Does nuclear provide greater political risk than other means of power generation?

DR MURPHY: I think it is absolutely true to say it does. It is a – the problem is that nuclear is slightly different, I would argue, from other generation assets for two particular reasons. Obviously the hopefully heightened safety concerns around nuclear and of course the way it is regulated means it is very different to other asset classes first and foremost. And secondly, again, empirical evidence would suggest that if you looked in Europe for example, and see that governments have had genuine wholesale changes in their policy and attitude towards nuclear. So as a developer who is taking a long term investment risk, if one looked at the situation in Germany as an example, where the government then basically changed its policy towards nuclear. It offers a level of, I guess political uncertainty which can be quite difficult for investors to necessarily take when they are investing in something as demonstrated it has a very long life in order to achieve its kind of return aspirations. So I think there is no doubt that political and regulatory environment does heighten the context around nuclear.

MR JACOBI: I am just interested if we could pick up – I think we have spoken a lot about risk and I am just interested in picking up how those risks might be managed in any new build programme? Do you have any views about what the key aspects of that would be?

DR MURPHY: Yes. In terms of – in a way when we look at – you know, basically the way that nuclear is put together in a programme, I think one can

probably draw out a number of what I would call perhaps critical success factors. First and foremost, given the fact that these are very complex projects, they take a long time to develop as it were, even before they are constructed, I think that good up front strategic planning is very important and therefore there
5 needs to be a very clear framework that can encourage investment and in the UK context, that is where EMR and the CFD comes in to place, and so therefore it is very important for government to make transparent to developers what that support mechanism looks like. I think overall, the project risk environment, as I put it, is available and that is - what I mean by that probably
10 is that there is a clear understanding of what risk allocation is under a particular mechanism. And so it goes back to the playing field, if the asset needs a subsidy, which I state is very clearly the case in nuclear, then the way we adopted that in the UK was to have a contractual mechanism. And therefore, one has to make sure that the risk allocation under that contract, or any other
15 regulatory system, is clear to developers and fundamentally investable, if that is such a term.

I think the other thing to point out is the appropriate legal and regulatory environment, I think is extremely important. That is perhaps more relevant in
20 more developing countries. Certainly the need for nuclear regulation to be independent of government, as in any good regulator is extremely important and a lesson that is probably – as I say, probably very relevant for some developing countries looking towards nuclear. I think when one looks at the overall construct, we have talked a lot of about financing here, one has to be
25 realistic about having an appropriate source of investment and therefore it leads to an appropriate capital structure. So a realisation of the reality of certain investor asset classes and their appetite for nuclear becomes very important. I think you mentioned the point earlier; long-term political support is definitely, I think, interesting.

30 Obviously that can change but obviously at the outset, developers need that confidence and I think the other – one of the other points I draw out is the – I think it's the fact that nuclear in many cases is more successful when one sees it as a programme and not an individual project, and this is a well worn, I
35 guess, discussion and it is very relevant to SMRs which of course is ability to develop enth of a kind benefits. So the meaning being is that the first time you build any nuclear plant in a new jurisdiction, there is a lot of initial costs that have to be borne by that asset. In general terms, not just in nuclear, of course when you make the same investment again in the same technology, you would
40 expect there to be a number of savings in the fundamental cost and increasingly obviously there was a win win because of course investor confidence in theory should develop if those early projects are successful. And in some countries, such as Japan, I guess we have seen that where we were able to see a series of projects being developed with costs which declined. In the UK context, the
45 best example actually would be something like offshore wind, where offshore

wind prices, or even solar prices, as well as the technology, has fallen as the supply chain has managed.

5 So I think this comes at the outset from government perspective is to look at whether – what is the need for nuclear and whether there is an ability to drive out long term savings through a programme but not necessarily a series of discrete projects.

10 COMMISSIONER: I think in terms of Nth of a kind, I saw on your notes that you are thinking about seven or eight for large nuclear reactors in terms of the number required before you get the sort of stability that we are talking about?

15 DR MURPHY: Yes, it is. I think the problem you've seen though, it's been relatively few countries that really have been able to develop that in terms of technology. I guess the UK experience is interesting, because there is always tension between wanting to have competition against development of, by definition, nth-of-a-kind, at that level. It might be quite difficult to achieve a large number of technologies, and I think that's often a tension what has to sort of deal with. In other jurisdictions I guess you may see something like - within 20 France, for example, there tends to be only one typical level of technology.

The other problem we've had though, of course, in nuclear is those technologies do change or get modified quite quickly, and so in fact the danger tends to be that often the regulatory or even technology moves faster than the 25 ability to develop those projects. So I think in large scale nuclear, the ability to get up to that level is actually quite challenging and you do need to get to higher number level to really get those lessons learnt. I think that's the argument of how SMRs may be able to be utilised, because the ability to - again, you need a reasonable number of those schemes, but in theory, if you 30 could prove the first few successfully, then actually implementation of a greater number of SMRs should be relatively easier, not least of which because they're low in capital investment.

35 COMMISSIONER: Dr Murphy, thank you very much for your evidence this morning, and also the preparatory work that you put into this. We very much appreciate that.

DR MURPHY: My pleasure.

40 COMMISSIONER: Thank you. We'll adjourn until later this morning.

ADJOURNED

[8.22 am]