HOUSE OF COMMONS

Energy Security and Net Zero Committee

Oral evidence: Tidal power and the Severn, HC 816

Wednesday 7 May 2025

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Watch the meeting

Members present: Bill Esterton (Chair); Sir Christopher Chope; Torcuil Crichton; Wera Hobhouse; Melanie Onn; Mike Reader; Claire Young.

Questions 1 – 71

Witnesses

I: Sarah Williams-Gardener, Chair, Western Gateway; Shaun Gaffey, Senior Planner, RSPB Cymru; Dr Athanasios Angeloudis, Reader in Environmental Fluid Mechanics, School of Engineering, University of Edinburgh.

II: Dr Andrew Garrad CBE, Chair, Severn Estuary Commission; Sue Bartlett-Reed, Commissioner, Severn Estuary Commission; Chris Mills, Commissioner, Severn Estuary Commission.

Examination of witnesses

Witnesses: Sarah Williams-Gardener, Shaun Gaffey and Dr Athanasios Angeloudis.

Q1 **Chair:** Welcome to today's Energy Security and Net Zero Select Committee hearing on the Severn estuary tidal power plans. We are here to discuss the commission's recommendations in detail regarding the feasibility and benefits of tidal range energy in the Severn estuary. This follows a report recommending its development in March.

I am delighted to welcome our first panel. I will ask you to introduce yourselves before we start with the questioning.

Sarah Williams-Gardener: Thank you very much for the invitation. My name is Sarah Williams-Gardener. I am the chair of the Western Gateway, which is the organisation that commissioned the report.

Shaun Gaffey: Thank you for the invite. My name is Shaun Gaffey. I am a chartered town planner working with RSPB Cymru. I oversee planning, policy and casework at RSPB Cymru. I have been feeding in on the final recommendations of the report. It is good to meet you.

Dr Angeloudis: Good afternoon, everyone. Thank you for inviting me. My name is Athanasios Angeloudis. I am a reader at the School of Engineering at the University of Edinburgh. I have more than 10 years of experience in tidal energy. Pertinent to this project, I have been funded by the Natural Environment Research Council for a large part of this period to look into optimising tidal range schemes in terms of their environmental impacts, their performance and their feasibility as a whole.

Q2 **Chair:** Thank you all very much. You are extremely welcome. I will start the questioning with some questions about the viability of tidal range in the Severn estuary. Previously, there have been numerous attempts to develop tidal range technology in the estuary. Why is it different this time?

Dr Angeloudis: I am guessing this is directed to me. That is a very good question. I can confirm that the technology is perfectly viable. It is proven. There are projects around the world that can demonstrate this at a large scale, not just at a pilot scale. I believe a number of recommendations have been made in the past. These are recorded by the Severn Estuary Commission. One of the challenges has been that some of those recommendations have not been taken forward. That is just one aspect.

Another aspect is that many of the projects that we considered in the past were not necessarily the best projects for the Severn estuary, considering its importance. The key point is that the technology is viable, but we also need a very good project.

Sarah Williams-Gardener: I would add that the Western Gateway, which represents the 28 local authorities that span the estuary and the two Governments, was very keen to appoint an independent commission to have a look at viability. That commission used a lot of evidence that had gone before it. It proactively went out to 200 stakeholders and 500 individuals. Many environmentalists were approached proactively to be part of this decision.

Recommendations have been made before, but working collaboratively is really important. As you will see—some of my commissioner colleagues will talk you through them in detail later—the recommendations and conclusions have been made on the basis of consensus from all those varied parties. That is a very different approach this time round.

Shaun Gaffey: You pose a very good question. As the RSPB, we would probably echo that. It is not for us to comment on whether or not the technology is feasible, but, as set out in the report's own findings, there are significant gaps in the environmental data. Addressing these gaps is crucial to the proper consideration of the development within the estuary. Just as an example, those gaps include robust and up-to-date detail around impacts on bird and fish species. The same goes for long-term wider impacts in the estuary and beyond. There is also a need for evidence that shows that compensation for projects such as these is deliverable.

To echo Sarah's point about early collaboration and things like that, those are things that we would strongly recommend.

Q3 **Chair:** The commission says that circumstances have sufficiently changed from previous attempts to deliver this development to reconsider the case. Previously, there were financial concerns. Shaun, you briefly mentioned the environmental impact, but the need for subsidies was something that was also raised. In combination, those factors have consistently halted progress. Is the commission right that things really have changed enough to make this happen?

Shaun Gaffey: It still looks to be a very costly process, on the face of it. I cannot remember the exact details, but a barrage would be £33 billion on a conservative estimate. I am not an economist so I am probably not the best person to talk about cost, but those issues do remain and it needs to be demonstrated that they can be overcome.

Dr Angeloudis: If I can add on this, one of the issues is that we have to deal with the legacy of the projects. The number that was just quoted, £33 billion for a barrage, is not something that is on the table. It is not something that the Severn Estuary Commission recommended. In fact, we want to move away from those large-scale projects—this is basically what the Severn Estuary Commission said—and to look at more efficient and environmentally sustainable designs.

The other thing is that the circumstances have changed. We have commitments in terms of net zero. One of the plans that we have in that context is to increase the contribution of tidal energy in the UK as a whole. If we want to use tidal energy as a large-scale solution to contribute to this effort, there is no doubt that developing tidal range energy in the Severn estuary will help us move towards the net zero goals.

Q4 **Chair:** Is there anything the commission has not considered that it should have done?

Dr Angeloudis: One of the things that was not in the remit of the Severn Estuary Commission was to look at individual projects. They correctly state that the values of the projects are indicative because they need to do further studies.

We have heard this quote about the scheme costing £33 billion, which was deemed not feasible. That has been taken out of context for this discussion. It is important to take the recommendations on their own. Looking forward, we need to have a credible and robust scheme. This is one of the things that I would like to highlight. The value of £33 billion was in the description of the event for this session, which is in contradiction with what the Severn Estuary Commission noted.

Q5 **Chair:** What are the lessons from the Severn estuary project for other possible tidal schemes?

Dr Angeloudis: The larger barrage options effectively disrupt the movement of tidal flow in the estuary. This is what is causing a lot of the environmental impact. It also blocks migratory pathways. Those are credible concerns that we need to address in the follow-up.

The tidal lagoon concept is an evolution of this. Basically, we are trying to design those schemes in such a way that means they avoid these environmental impacts. We do not want the turbines to be in the routes of migratory pathways. We also need to address other aspects, such as sedimentation. To address those concerns, we will need to look at them as individual cases.

There is no doubt that you can design feasible credible options for a tidal lagoon. It is good to hear the Severn Estuary Commission's recommendation to step away from those large-scale, ambitious projects because they will not get us anywhere.

Q6 **Chair:** Do you think that is learning for elsewhere as well?

Dr Angeloudis: It is useful to learn from us because one of the challenges that we have faced is that we associate the impacts of the barrages with the impacts of the lagoons. Those are completely different matters.

Q7 **Chair:** Sarah, do you have anything to add?

Sarah Williams-Gardener: To come back to what I said, the commission engaged with a lot of stakeholders in the early stages, which is something that some of the other projects might not have done so proactively. Times have changed. You have a consensus. As I said, the report was independent. As you will see when you talk to them later, the commissioners are experts in their own fields. We did that intentionally. There are 28 local authorities in the Western Gateway. The findings were put to all the members of our pan-regional partnership, and there was agreement that now is the time to look to create a commercially viable project to get something off the ground. There is more learning and more data that is required to do larger projects, but we need to start with something, hence the reason why a commercially viable project was recommended.

The commission came up with other recommendations. One of those is quite significant, which is to recognise tidal range as part of the energy mix taking us forward. It is already recognised in the Welsh Government. Today, the Welsh Government have made another investment in tidal stream energy at Ynys Môn, which is a different type of tidal energy.

We want to work together. This is an opportunity for the UK to be at the forefront of tidal energy. We have the largest tidal range in the Severn estuary. It is the second largest in the world and the largest in the UK. This is something that is reliable. It is something that we can work with. It will be part of the mix for renewable energy.

The recommendation is very clearly to look to do something. It is to take the stakeholders together on that journey and create a vehicle that can bring the stakeholders together: the academics, the environmentalists and the economists. This will potentially have a significant economic impact on the local area. We looked at the potential for economic impact in the widest of senses, not just the energy that can be generated, but also the jobs and the high-value manufacturing that could be brought to that area. There is already quite a good skillset for some of that. There are some complementary skills that can fit with offshore floating wind.

There are some huge positive reasons for this. It feels as though the time is now to take some action.

Shaun Gaffey: I just want to respond and clarify the position from the RSPB's perspective. We welcome the acknowledgement that a barrage would be very difficult to deliver in terms of the compensation requirements. It is all set out in the report.

To push back on the lagoon point, in short, our position is that the evidence suggests that tidal lagoons can, in principle, be delivered in a way that is less harmful to biodiversity than barrages. However, that is not to say that we would be supportive of tidal lagoons in all locations or in high concentrations.

Just as an example from past studies, the Welsh Government's draft marine plan initially included a policy that would support a fleet of tidal lagoons in Wales. The detailed assessment that accompanied that plan could not rule out damage to more than 70 of the most important designated wildlife sites, including special protection areas, special areas of conservation and Ramsar sites in all four countries of the UK, the Republic of Ireland and as far afield as France. Consequently, the adopted plan now acknowledges that there is a degree of complexity and uncertainty associated with the sustainable development of tidal lagoons around the Welsh coast and it advocates for more research.

Our position is a precautionary one. We do not object, in principle, to tidal lagoons. We are fully on board with the net zero agenda, but these sites need to be carefully located.

Chair: Thank you very much. You are all starting to anticipate very well the questions that my colleagues were planning to ask you, which saves them asking.

Q8 **Claire Young:** Welcome to the panel. I will address my questions to Dr Angeloudis to start with. You would agree that tidal range energy in the Severn could create predictable low-carbon energy independent of weather conditions, but do you agree with the commission's assessment of the amount of energy that could be generated?

Dr Angeloudis: It depends on the kind of schemes that you will deploy. You will basically have a proportional energy yield. I can provide an estimate. Looking to the future, if the tidal lagoon option is viable and a commercial demonstrator project goes ahead, I would imagine that the Severn estuary could accommodate, specifically through lagoons, a deployment in the order of 5 to 7 GW or something, which would translate to about 3% of the UK's annual electricity.

If you push it further, you can get more energy, but that would basically lead to more environmental impacts. That would not be something that I would recommend. You can get a substantial amount of energy through there, and by trying to provide credible schemes that look to minimise the environmental impact as much as possible.

Q9 **Claire Young:** Would you say the technology involved in the construction of either tidal barrages or lagoons is sufficiently proven?

Dr Angeloudis: Absolutely, yes. We have schemes that have been operating around the world. There are differences because some of those schemes are very old. Right now, we are more environmentally conscious. Many of those technologies have evolved. For the commercial demonstrator project, we can rely on existing technologies. We can produce a viable scheme without any particular further research because that adds uncertainty to the process. We can make sure we get this right for any subsequent project, if it exists.

Q10 **Claire Young:** The report references previous consideration of a tidal

reef, which I understand is a subset of barrage in some ways. Should the commission have considered that in more depth?

Dr Angeloudis: I have looked at the tidal reef concept in the past. There has not been detailed analysis on the viability of this concept, but the tidal reef would still span the entire width of the estuary. I would expect that to be more damaging than the tidal lagoon option. It also involves turbine technology that does not exist. We do not know so much about the costs and impacts of such a scheme at the moment.

Q11 **Claire Young:** The commission did not consider flood protection, but it did make some comments about it being a significant function of a tidal range structure. Do you agree with this?

Dr Angeloudis: This echoes the work of the Hendry review a few years back, which said that tidal range schemes should be assessed on the basis of its primary function, which is power generation. That is correct. I could list a number of benefits. There is definitely a benefit associated with flood protection, but there are a host of other good concepts. In order to keep us focused, we need to focus on the power generation side of things. There are aspects that could be additional benefits to such a development.

Q12 **Claire Young:** I do not know whether Shaun or Sarah want to add anything on the flood element.

Shaun Gaffey: On the flood risk point, the RSPB did commission a study. It is quite old now, a bit like a lot of the data on the Severn. That study compared a barrage—I know we are not discussing a barrage—with the Eastern Scheldt in the Netherlands, which is primarily a flood defence. There have been some unforeseen consequences that have arisen from that in terms of erosion and flood risk in different places.

In terms of tidal lagoons, the data appears to show a bit more variance. It depends on where these lagoons are sited. That goes back to the original point about the importance of initial site selection. Some lagoons can exacerbate flood risk and some lagoons can alleviate flood risk. Again, I would just repeat that point.

Q13 **Wera Hobhouse:** We have already gone into some of the environmental concerns. Shaun, if I hear you correctly, the view of the RSPB on a barrage is "absolutely not". For lagoons, it is "maybe", but you still have concerns. Chair, we can leave that question because it has already been answered.

I would like to understand the concerns that have been raised about missing environmental data. This is a question for all of you. Can we progress the project before we have the data? Should we do more research and get more of an understanding about the environmental impact?

Sarah Williams-Gardener: There is an opportunity to continue what has happened to date with the commission, which is running things

alongside each other. If you try to do these things sequentially, you are going to be waiting many more years. What we have seen with the commission is proactivity and collaboration between organisations. There is an agile approach that could be taken here, where you work very well with other stakeholders. Rather than doing it sequentially, you can do things at the same time. That would be my view. You can do that with a view to getting the data, learning, collaborating, sharing and making agreed decisions to go forward.

Q14 **Wera Hobhouse:** The whole point about doing it consequently is, first, to find out whether the impact is too high, which would mean we would not go ahead with the project. If you run it parallel, there is almost an assumption that the project is going ahead. You are collecting the data at the same time, but, on the whole, the decision to go ahead has been made. Is that not where the issue would be, particularly when the public looks at this?

Sarah Williams-Gardener: There are gaps in the data. Maybe Shaun can fill that in. We do not have no data at all. There are gaps in the data.

Q15 **Wera Hobhouse:** Yes, but the gaps need to be filled in. I will ask Dr Angeloudis first and then Shaun can come in as well.

Dr Angeloudis: First, there is going to be a feasibility study before any particular scheme progresses. That would involve extensive data gathering. There is no question about that. It will also be essential for any project to have a monitoring plan to reflect on any adverse effects that the development might have.

Before that, however, we have done a lot of research on modelling. We can predict many of the impacts that might stem from these projects. When we go and consider those schemes, we run models that can tell us what the potential impact will be in physical terms and so forth. Many of those processes are quite uncertain, but the fact that we have all of these tools, the feasibility studies, the monitoring and the modelling work, which will get updated as more monitoring takes place, provides you with a safe pathway to proceed.

Q16 **Wera Hobhouse:** Could you be very precise about the data? What are we looking at? What is the missing data? Some data already exists. What is the missing data? What is the RSPB concerned about, Shaun?

Shaun Gaffey: From the RSPB's perspective, we would recommend that there should be some initial data gathering from a bird species perspective because the Severn is an incredibly important non-breeding site for waders and wildfowl. I will not list all the species, but there are lots.

Just as an example—I can share this report with you all after—there was a report commissioned in 2015. Again, I appreciate that it is fairly dated, but it is as recent as we have. The impacts of a lagoon on bird species include disturbance, loss of and changes to intertidal habitat, changes to

salt marsh, changes to fish population, changes to freshwater wetlands, far-field changes in water levels and displacement effects.

In order that the impacts of these potential effects on birds can be assessed through an environmental impact assessment and that the impacts on the specific features of designated sites can be assessed through HRA, it is necessary that baseline data is gathered on a number of scales. There are four scales: within the area of a proposed tidal power lagoon; within the area of the Severn estuary as a whole; within the wider Severn estuary floodplain; and at other sites outwith the Severn estuary. It is important to take a whole-estuary approach to data gathering so we can understand where these best sites could potentially be.

Q17 **Wera Hobhouse:** Sarah, when you say there is already quite a lot of data, what data already exists?

Sarah Williams-Gardener: There was a lot of learning from the Swansea project. When I talk about these things happening consecutively, I am talking about progressing policy and seeing tidal in the policy, as well as doing the data gathering for birds in the estuary.

For some of the recommendations that we have in here, we can move at the same time. Legislation and getting tidal recognised is another piece that we need to do while we are understanding where the impacts will be on the environment.

We know the estuary, as Shaun has already said, is a really valuable and highly special area. Nobody wants to have an adverse impact on that. At the same time, we are balancing climate change and net zero. We need to have a commercially viable project where we can work together and learn together. The commission was very clear. It needs to happen now. There are some things that can happen in parallel. I meant that more on the policy side, so maybe I was a bit misleading on that.

Q18 **Wera Hobhouse:** You have already anticipated my last question. Do you think that there is the right balance between local environmental impacts and the national need for clean power? From what you are saying, although not all the data has been gathered and all environmental impacts fully understood, you think the balance between the two is right.

Sarah Williams-Gardener: The balance is right. The commission have approached it in the right way. They have worked very collaboratively and proactively, not only with environmentalists but also from an economic perspective.

There is a significant amount of commercial activity in the estuary, which comes through the ports. This is really important to the local area, to jobs in the local area and to supply chains. All these things have been taken into account. It is not a light piece of work to engage with 200 stakeholders and 500 individuals and take all of those views into account.

The commission has been out and spoken to the ports. I have also been to the ports and spoken to many people around the estuary. They have been really heartened by the fact that they have been listened to in this report. That is why the Western Gateway, which is 28 local authorities, two Governments and multiple political parties, supports the recommendations in this independently commissioned report.

Q19 **Wera Hobhouse:** We need to move on, but I was just possibly going to ask Shaun to contradict that—I don't know, what is your view?

Dr Angeloudis: If I can say something, as an academic I would always ask for more data for my research, but in some cases it becomes non-practical and prohibitive for something to progress.

We need to find the right balance. Enabling a commercial demonstrator project and creating the project delivery vehicle that the commission provides would enable us to develop something and for us to learn from this for subsequent projects. I worry that trying to have a perfect understanding of the site is almost an impossibility for estuaries as a whole. We need to find a balance in what is possible to achieve.

Considering the deadlines that we have for net zero, this is something that we need to start acting on now.

Q20 **Torcuil Crichton:** I have a quick question on the data. Shaun, you said the data is from 2015.

Shaun Gaffey: Yes.

Torcuil Crichton: Somehow we can ascertain from that data that these projects are going to be harmful to wildlife. Are there rare species at stake? What is at stake? Is it species displacement or species extinction?

Shaun Gaffey: It is displacement, not extinction, when it comes to birds.

Q21 **Torcuil Crichton:** No rare birds will die.

Shaun Gaffey: Birds will die, yes, but they will not become extinct. There is data out there that suggests that some fish population might go extinct if these things are put in the wrong place. The key message is that we need more data to understand how harmful these things can be.

Dr Angeloudis: I would just point out that tidal lagoon technology is learning from the larger previous schemes, which have obstructed migratory pathways and led to those issues. What is being discussed here are technologies that basically have learned from this in order to try to find something more sustainable. We are mindful of those issues.

Q22 **Mike Reader:** Building on the environmental matters, I will come on to habitat regulations specifically. Does the need to comply with habitat regulations present a significant barrier to development of tidal power in the Severn?

Shaun Gaffey: No. Those regulations would not necessarily preclude development, but any developer of a scheme such as this would need to show it can mitigate and compensate for any environmental harm that it does.

Q23 **Mike Reader:** You would need to develop quite a comprehensive habitat regulations assessment. We have heard that there is still a lot of data missing. How do we avoid over-engineering a solution and the plan becoming another bat tunnel?

Shaun Gaffey: You are looking at the report's conclusions in terms of advocating for more data gathering. That needs to go hand in hand with any scheme that comes forward. Any proposal that comes forward will need to demonstrate how it complies with the habitat regulations. I do not know whether that answers your question.

Q24 **Mike Reader:** It probably does a little bit. One way of dealing with habitat regulations could be the Planning and Infrastructure Bill and the ability to bypass regulations using the EDP process. Would that help speed up delivery or would that create environmental risk?

Shaun Gaffey: In my mind, it would probably do both. It would potentially speed things up by requiring a lower bar, which we do not agree with.

Q25 **Mike Reader:** You could therefore get the clean energy that homes desperately need and people desperately need to reduce their energy bills.

Shaun Gaffey: Absolutely, yes. Like Athanasios was saying, you could potentially get—what was it?—5% or 10% of the UK's energy.

Dr Angeloudis: That is if you push it. I am talking about 3% if we try to balance everything.

Shaun Gaffey: Exactly, yes. You could argue that there are probably less glamorous ways of filling that gap of 3%. Just thinking off the top of my head, there could be a retrofit programme for existing buildings. There is stuff that is less impactful in media terms and not as much of a legacy project. There could be a wider roll-out of solar panels on existing buildings, industrial units or homes. This is not the only technology available to address our much-needed journey towards net zero.

We have absolutely no problem with it in principle, as long as it meets the tests as required by the regulations. That would be our view.

Q26 **Mike Reader:** We can look at comparators, and Sizewell is a good example. The scheme has managed to restore an area of land to almost SSI levels to deal with mitigation on that scheme. Would this latest-case evidence of the ability to deal with mitigation give you confidence in what could be achieved on the Severn?

Shaun Gaffey: To be honest, I am not totally familiar with what has been proposed there so I would be cautious in answering you. I would be happy to answer after the Committee meeting in writing, if that is okay.

Dr Angeloudis: One of the challenges here is that we can do as much data gathering as possible, but there is always going to be a discussion on whether a project such as this is compliant or not. This is why we support a commercial demonstrator project in order to learn from this.

On the other hand, you can visit the other tidal range projects that exist in the world. If you visit La Rance, for example, there is a thriving ecosystem. The scheme in Korea has solved a lot of environmental issues. The motivation for that project was because it would improve the water quality in Sihwa Lake.

One of my fears is that we do not have a benchmark. We need to set some targets, which we can then revise and make more stringent as we learn in the process and we understand what engineering developments or environmental measures need to be taken going forward. At this point, if we do not develop something, we will never find out whether it is compliant or not.

Sarah Williams-Gardener: The other thing is that work has been happening in the Severn over many years and some damage has already been created. It would be brilliant to learn from projects such as Sizewell what they have done to improve and possibly restore some of the area. There could be possibilities such as those.

The approach taken by the commission was very much an open, learning and collaborative one. If there are more people that we could learn from around this commercially viable project, that is absolutely the way that we would want to go forward.

Shaun Gaffey: Just to add to that, organisations such as the RSPB should not be framed as the blocker or the person putting the brakes on this type of development. All we are saying is that we have no objection in principle, providing that the bars are met.

Q27 **Mike Reader:** Yes, that is fair. I have one final quick question. I will start with you, Sarah. Previous projects have not gone ahead because of environmental concerns over the construction of the projects and the impact that the construction would have. Would this scheme or even a demonstrator scheme have a similar limitation and restriction?

Sarah Williams-Gardener: The recommendation is that there is a commercially viable project. The actual site selection is still to be done. That piece will need to take all those things into consideration.

As we have heard, we could all continue to gather data and think about what we should do. Let us get a special vehicle together. Let us get the right bodies involved to take this forward. It could be that is GB Energy

and a combination of the Crown Estates. These people have been actively engaged in this project. We need the right vehicle to take it forward.

We need to look at something that is commercially viable so we can do that learning to know what mitigations we need to take forward. As I said, the impact around the Severn is not only in terms of energy generation but opportunities for jobs, a clean energy sector and innovation for the UK. We are at a pivotal moment. We can lead lots of these things for benefit.

As I said, we need to work with our colleagues from academia and from the environmental side as well as the commercial side. As I said, you will hear from the commissioners later. There is a lot of interest in this. There is a lot of private sector interest in this. If we can get the policy recognised and supported, there are some really good grounds to look to keep the momentum up. If we do not do it now, I suspect someone will be coming back to you in five years' time saying, "Maybe we should do this".

Q28 **Mike Reader:** Is the impact of construction works a limitation or is it not something we need to worry about?

Dr Angeloudis: The way that schemes of this kind were constructed before would be to block the entire estuary with a cofferdam. That was the issue that caused a massive impact. That was associated with barrages. When you consider a tidal lagoon, you can do it in stages in a way that does not restrict movement. You can make sure that during construction the estuary and the area that you are impacting still remain functional. You can do it in a sensitive way. There are technical solutions that we can provide, and the associated monitoring will help make sure this is the case.

Shaun Gaffey: Just to come in on that, I would reiterate and support the point that you have just made. It comes down to site selection. In terms of a CDP, if it is decided that something such as this is going to come forward in the short term, we think that is definitely the most logical solution as a bit of a pathfinder, provided that it can be environmentally deliverable and that comprehensive pre-application consultation with relevant stakeholders commences as early as possible at site selection stage.

Q29 **Claire Young:** If I can start with Sarah, what are the potential socioeconomic benefits to the Severn region from the construction and development of tidal range energy projects?

Sarah Williams-Gardener: Having looked at this, depending on the site selection and the actual size—you could go for small, medium or large, and that needs to be worked out in the feasibility study—there is potentially something in the region of 30,000 job years for a small project and up to 200,000 job years for a large project. The GVA impact is from

£1.6 billion up to £12 billion. As I said, one of the things that we really did take into account was that larger economic impact.

We also believe that around 70% of the content is achievable locally. These would be local, high-value manufacturing jobs for local people, and would give an opportunity for the region to be a significant generator of not only clean energy, but the innovation and the technology that is needed for it. It is quite a significant opportunity, based around place. As I said at the beginning, we have the second largest tidal range in the world in the Severn estuary—as quoted by one of my commissioners, a freak of nature—which we should be harnessing for the benefit of all the local economies.

Q30 **Claire Young:** What timescale were those figures over? You talked about the number of person years of jobs that it would create, but what over timespan would that be delivered? Once created, there would be a much lower level involved in maintenance, would there not?

Sarah Williams-Gardener: Yes. This will all depend on the feasibility. It will depend on the site selection. It will depend on the policy going through. As to the timescales, it is very difficult to predict, but you will have some in the early stages of feasibility and work, such as data collection, and then you have the construction. Those are going to build up over time.

Also, by showing the commitment to tidal range in UK policy, you will see confidence in commercial operations locating themselves in that part of the country and starting to build up those supply chains, which could mean more opportunities for, say, supplying offshore wind. We have quite a lot that is happening on that west coast. It is very difficult right now to give exact answers, because we have not started, hence it comes back to the recommendation of a commercially viable project to start learning, sharing, collaborating and being really transparent about how these things can grow going forward.

Q31 **Claire Young:** You talked about local jobs for local people, but will there be a need to invest in workforce development and supply chain readiness, and specifically turbine manufacture, if a tidal range infrastructure project is to be pursued in the Severn? At the moment, most manufacture is happening in China, I believe.

Sarah Williams-Gardener: Questions on details on turbines and manufacturing are most probably best answered by one of my colleagues. Most of these turbines, as I understand it, are developed outside the UK, but the construction and putting them together would be done here in the UK, hence there would be local jobs. That is why we are saying that it is about 70% of the content. The 30% relates to having to bring some of that technology in from countries that are leading in that innovation.

Q32 **Claire Young:** Do you not see this as an opportunity for us?

Sarah Williams-Gardener: It absolutely can be, and we should be looking at that, but, when we are going to start, we do not have all of it at the beginning. There is absolutely no reason why that cannot develop over time. We have highly skilled individuals in the west who have been in high-value manufacturing. Cross-skilling and upskilling them is absolutely possible, and we see lots of those programmes with offshore wind manufacture down on the west coast when we look at the Celtic freeports. There is always the opportunity to upskill more people. We would just need to have that focus.

Again, with a commercially viable project, you can bring the suppliers and the supply chain into that and work with them very proactively. As the jobs are going to be required, if we have the certainty of the policy and the commitment, there absolutely is an appetite from the private sector to work together on this type of project and to invest in it with both skills and finances.

Q33 **Claire Young:** I have one final point on the economic benefits. In the past, when tidal power from the Severn has been looked at, there has been a lot of concern from the ports about the impact that it might have on their commercial activity. Do the potential benefits outweigh any such impact or is that not an issue?

Sarah Williams-Gardener: When the commission looked at whether it was a barrage or a tidal lagoon, in talking to the ports, the ports made it very clear that a barrage would really hamper them from a commercial perspective. That was absolutely taken on board, and I know that the commissioners will be able to talk to you in more detail about that.

One of the reasons for the recommendation of a commercially viable lagoon project is so that we can learn and work, supportively and collaboratively, with the commercial activities already happening in the estuary. I have been out to see David Brown and his team at Bristol port, for example, and he was very heartened that he had been listened to, their business had been supported, and their concerns had been heard. He is very supportive of a lagoon project, because it would not close off the whole of the estuary to his business.

There has been a significant listening and empathetic understanding of those commercial businesses that are critical to the local area for jobs, as well as for bringing in lots of materials. We have seen Bristol port bringing in quite a lot of the materials for Hinkley Point, and so this is, again, a great opportunity to work collaboratively with local commercial businesses in order to enable a viable project to be built in the first place.

Q34 **Chair:** Do you see the project as an opportunity to build up UK manufacturing? Do you see it as a way of potentially exporting and generating export revenues?

Sarah Williams-Gardener: It absolutely has that opportunity. It will be really interesting to see the industrial strategy and where these things fit

into that when it is delivered. There is a huge opportunity for high-value manufacturing. We have seen catapults located down in Baglan, which is the Port Talbot site, where we have lots of businesses that are coming together and really innovating together. There is a huge amount of opportunity and potential with the right sort of backing behind it. As I said, it starts with policy. It starts with tidal being part of the overall energy mix, and we cannot underestimate that.

Q35 **Chair:** One of the reasons I asked that was that you made the point about the opportunity for the port, which is importing goods. I am just struck that that seemed to be your first option. How quickly do you see the potential to develop a domestic supply chain rather than having to import?

Sarah Williams-Gardener: Again, once you see a commercially viable project, you will get confidence in local suppliers and the supply chain being built up. It would be wonderful to say that we could manufacture all of this from day one, but I suspect that that is not the case. Building that capacity over time is absolutely a possibility. We need to make sure that any project that goes ahead is protecting and encouraging local jobs as best we can, and the feasibility study and the commercial project need to look at all of that.

Dr Angeloudis: A commercial demonstrator project would help with this, because it would provide the confidence to the sector that these are feasible. If you were going to go ahead with a massive, large-scale project to begin with, that might not have the benefit that you expect in the supply chain, because it would be just a single project. A small demonstrator project that shows that this can be applied in other parts of the UK, such as the Irish sea, would provide an incentive. If you did this gradually and on a small scale, it would provide a contribution.

There are other technologies that are being looked at beyond the UK, such as low-head pumped storage, and this technology could be used as a basis. This works well in conjunction with tidal, but there are exportable components that could be looked at separately. It depends on how you go about this.

Q36 **Mike Reader:** I just have a request for Sarah, if you would not mind writing back to us on how the 70% local content is calculated. That feels extremely high and optimistic, from my experience. Having delved into other major infrastructure projects recently that have very high local content, it is quite hard to substantiate. That figure will likely appear in the report, so we would need to have some substantiation as to what local content means, if that is okay.

Sarah Williams-Gardener: I do not have the next level of detail, but the commissioners might.

Q37 **Torcuil Crichton:** Thank you all for coming in. It is great evidence. Tidal range technology is the missing part of the jigsaw in clean energy. If we

could provide 3% to 5% of the UK's energy needs with projects such as this and projects in Orkney, then so be it. It seems to be strangled by habitat regulations here. You have wrangled 28 local authorities, two Governments and 4.8 million people behind this, but the birds are getting in the way, are they not?

Sarah Williams-Gardener: Our colleagues at the RSPB have come together with us to say, "We want to learn together". I would not say that they are getting in the way. We are all of a mind that says, "Let us look at something that is commercially viable so that we can learn from it". We are really mindful that the environment and the estuary is a very special place. Nobody wants to displace birds or fish, or any other of the natural habitats, or to cause any unintended consequences. We could allow the birds to get in the way, but, on this occasion, I do not think that we are.

We are working together to bring both worlds together, as I said, for the supply of energy that, as a nation, we want in order to grow economically and to be leaders in this field. This is based just on our energy needs today, but it would be reasonable to say our energy needs are going to grow over time. As you say, this is a missing piece of the jigsaw puzzle for renewable energy, but I do not think that the birds are getting in the way.

Q38 **Torcuil Crichton:** What do you need from the UK Government to get this commercial demonstration project into the lagoons? What two or three things do you need?

Sarah Williams-Gardener: The commission has made seven clear recommendations, but the top one is a recognition in policy that tidal is part of the mix for renewable energy. There are some activities ongoing at the moment, and some of my learned friends from the commission will be able to go into a little more detail there.

We have recognition from the Welsh Government that tidal is part of the mix, so it would be really positive to get that from the UK Government. The reason why that is important is that it gives investors assurance and confidence that this is backed, and then a special project vehicle to deliver this commercially viable project, which will need some up-front investment, for sure. Again, you will be able to get some more details on that type of investment from my colleagues who have looked at the commission.

The important thing here is that the Western Gateway, as you quite rightly said, represents a large number of people and constituencies. It wanted this commission to be independent. Its findings were brought back to us, and it was based on its recommendations and findings that we have come to this.

There are other things, and you can go through the seven recommendations, but, if we look at number 1, 2 and 3, number 3 is

most probably recognising regulated asset financing as a way to deliver these types of infrastructure projects. Again, my colleagues on the commission are far more learned on those matters than I am.

Q39 **Torcuil Crichton:** It sounds like this is why GB Energy was built.

Sarah Williams-Gardener: It sounds like that is a good place for this to be.

Q40 **Torcuil Crichton:** Shaun, where exactly is the RSPB on this? You say that there is no problem in principle, but, when you write a drama, there is text and subtext—no problem in principle, but the subtext is "anywhere except here".

Shaun Gaffey: I do not agree with that. I would just echo Sarah's comments there in terms of collaboration. We also agree with the report's recommendations that national policy should be updated to provide a robust framework for delivering tidal range power. We agree this in principle, as projects of this magnitude should not come forward in a policy vacuum.

In terms of your second point, I do not accept that. My background is as a planner. I am not an ornithologist. It is about taking each case on its own merit. I am an advocate of the planning system in this country; I think it is great. It is a nuanced way of deciding where development is best placed. If it can be demonstrated that one of these lagoons can be put somewhere that is safe from an environmental perspective, we would not object to that.

I oversee planning casework in Wales. For every planning application that we object to, there are thousands to which we do not. It is not a case of opposing it for its own sake. It is more about advising a precautionary approach. If a pathfinder lagoon comes forward, as important as the commercial and socioeconomic arguments are, we should also tie in the environmental monitoring. That should be front and centre, before they are proliferated more widely into the estuary.

Q41 **Torcuil Crichton:** Athanasios, just quickly, because we are running out of time, could you sum up for us the risks and the potential benefits for the whole of the Severn estuary and for the UK as a whole from these tidal projects?

Dr Angeloudis: In terms of the risks, there are cumulative impacts from these schemes. Let us say that we go beyond a commercial project. Basically, the effects can accumulate, and it is important to do further studies at that point in order to make sure that these are within sensible measures. The overarching benefit is that you can, basically, get an immense tidal energy supply from this. For example, the ringfencing that you did for tidal stream energy, which we worked on with companies in Scotland, has been a lifeline for that sector to develop.

I would stress that, if you want tidal energy at scale, a tidal range energy scheme is the easiest way to do this, considering the benefits that you get in terms of renewable energy. It is said that these schemes have a lifetime of 120 years. There is no reason why they should stop operating. As has been quoted before, it will be a no-regrets option to invest in and consider this, and establish at least a regulatory pathway that enables people to consider this more seriously.

Chair: That is a very good place for us to finish. Thank you very much. Can I thank our first panel for your evidence? We will suspend the session briefly for the changeover.

Examination of witnesses

Witnesses: Dr Andrew Garrad, Sue Bartlett-Reed, and Chris Mills.

Q42 **Chair:** Welcome back to the Energy Security and Net Zero Select Committee. We have our second panel in front of us to talk about the Severn estuary tidal commission. In fact, we have three members of the commission who are going to tell us all about why they recommended in favour. First of all, if you would introduce yourselves, please, that would be very helpful.

Sue Bartlett-Reed: Good afternoon. I am delighted to be here. I am Sue Bartlett-Reed. I am one of the commissioners from the Severn estuary. I also have an interest in tidal stream, which I hope will bring some capacity and knowledge to the tidal range discussion that we are having today.

Dr Garrad: My name is Andrew Garrad. I am chair of the commission. I am an engineer. I have spent 45 years in the wind business. When I was appointed chair of this commission, I knew nothing whatsoever about tidal range. Apparently, that was my qualification. I am now a little more knowledgeable.

Chris Mills: Good afternoon. My name is Chris Mills. I am one of the two environmental commissioners, along with Dr Madeleine Havard. In terms of my background, I have worked for most of my career for the National Rivers Authority and the Environment Agency, finishing up as director for Environment Agency Wales. I am now retired and have a couple of voluntary positions, with the Association of Rivers Trusts in Wales and with the Institute of Fisheries Management.

Q43 **Chair:** If I might, very unkindly, paraphrase, you know nothing about this subject. Why did you decide that this was feasible?

Dr Garrad: What I said was that I knew nothing when I started. I am now slightly wiser than I was a year ago. I was appointed because I have some 45 years' experience of renewables, but it was considered important to have a clean sheet as far as tidal range is concerned. I have

certainly discovered that there are plenty of axes to grind in the Severn estuary on this subject, so that was probably wise. It has been a very interesting education for me, and I have learned a lot about the environment, the technology and the politics.

Q44 **Chair:** Why have you decided that it is feasible?

Dr Garrad: I have decided that it is feasible as a result of reviewing a lot of information. You will be aware that we are the sixth or seventh study or commission. Pretty much all those studies and commissions, going back to the 1980s and beyond, have come up with the same findings. It is feasible. There is a huge amount of energy. Some 7% of the UK's electricity is available in the Severn. It is certainly fairly straightforward from an engineering or technical point of view.

The difference from our point of view is that the findings are the same, but the recommendations are different. They are different because we have taken a somewhat different approach. The commission has been very strong on environmental issues. Two of the commissioners are environmentalists, and the context is different. Everybody is now considering climate change. Everybody is now considering energy security.

You could say that the commission's own approach has been a co-design to look not just at engineering and money, but also at the environment. We have managed to do that and reach a conclusion, which is that a barrage, although technically feasible and, I have to say, very attractive from an engineering energy point of view, would simply be environmentally, commercially, politically and logistically unfeasible. What we have recommended is a lagoon, which could and should be built in the short term.

I was very keen, when I took on the chairmanship, that I did not have my report sitting on a shelf like the other half dozen that have come before me, and that we came up with something that is practical and feasible to turn into reality.

Q45 **Chair:** That is a very good point. How will you make sure that you are not ignored?

Dr Garrad: This is a very good start, I have to say. Thank you very much.

Chair: The whole world is watching us.

Dr Garrad: It is an excellent start. I should say thank you very much for inviting us. I am delighted that we have managed to come here so quickly after reporting. We reported only a month ago, and so to be sitting here with all of you after such a short time is very good.

You may also know that the timing of the production of our report was extremely bad, in the sense that our client was the Western Gateway,

which ceased to exist a couple of weeks after we produced our report. That was not a causality, but it was, unfortunately, a coincidence. We are taking action now to keep the momentum up.

In your previous panel, you did touch on this briefly. If you read the remit of GB Energy, you will find that it pretty much says that it should build a large green project in the estuary. The same goes for the National Wealth Fund. We have worked very closely with the Crown Estate, which has been a terrific support for us throughout our endeavours in the last year. We cannot speak for them, because they are all still forming their new coalition, but it would seem to me very logical that this sort of project could be taken forward by that sort of organisation. Presently, we are trying to keep the momentum going in the next nine months, which we shall do as we form a more cogent plan.

Q46 **Chair:** There has been criticism that your recommendation of the construction of lagoons and not barrages, as you have just told us, is underwhelming. How do you respond?

Dr Garrad: I am aware of that comment, which was made, as you may know, by an ex-Minister who had a commercial interest in developing a Severn barrage. There are others, and there have been a few naysayers, I have to say.

Generally, our commission report has landed well, but there is a real danger. Had we recommended a barrage, which Chris would certainly not have allowed us to do, I believe we would be back here in five or 10 years' time with another report saying, "We could build a barrage" and nothing would have happened. We were very keen to come up with something practical and achievable that could result in action rather than just another report.

In terms of a lagoon, the word "small" has been used several times. In our context here, small is a couple of billion pounds, so small is not that small. A medium-sized lagoon would produce 2% of the UK's electricity. A large barrage would produce 5% to 6%. We are talking big numbers anyway, and it is important to recognise that. We are not thinking about a little model or demonstrator. We are thinking about something that will demonstrate the principle and the feasibility, but will also produce a significant amount of low-carbon energy in a reliable form.

Q47 **Chair:** Do you see this being repeated elsewhere in the UK and around the world?

Dr Garrad: Yes. You touched on this in the first panel. There are no tidal lagoons in the world. There are two tidal barrages. One is in France, which I learned about when I did my French O-level 55 years ago. It is still going with the same turbine, which has never been changed. The other is in South Korea and is about 15 years old. Those are two barrages. There are no lagoons, so this would be a world first for the UK.

Our suggestion is that it should be in the Severn estuary. There are, as you are well aware, other tidal range schemes in the Mersey, in north Wales and so on. This could be the beginning of something very exciting. It could be the beginning of an industry not only demonstrating the low-carbon capability of tidal range, but also starting something that could become globally important.

Maybe I could just touch upon the comment of local content, which was mentioned earlier on. An important thing to recognise here is that roughly 70% of a tidal lagoon is civil works, so 30% is the mechanical and electrical bits. When you are looking at comparisons with other technologies, it is important to bear that in mind. It is substantially different from wind, for example.

Chair: Thank you. My colleagues will draw your fellow panellists into the conversation.

Dr Garrad: I am sorry.

Chair: No, that is fine.

Dr Garrad: I will stop talking.

Q48 **Chair:** I rather goaded you into answering once or twice there. You mentioned the Mersey tidal barrage, which is not a lagoon. Should they be considering a lagoon rather than a barrage? You will understand that I ask that as a city region MP.

Dr Garrad: Our conclusions are for the Severn estuary, full stop.

Q49 **Torcuil Crichton:** Thank you all for coming in. It is either underwhelming or it is huge; it is billions or is it millions. How feasible is it? Sue, how confident are you that the technology exists for a tidal range lagoon?

Sue Bartlett-Reed: I am 100% confident. We have seen the technology develop over a number of years. What you have is, effectively, what is known as a roundhead turbine. They are very well-established in terms of understanding how the turbines operate. They are engineered on the designs of impulsion propellers, so they are very similar in terms of the design and how they extract kinetic energy from water. That principle is very well understood.

We should also recognise that we have been looking at how to utilise tidal flows since the Persian times. We used them to fish. We looked at the tides and saw how we could operate our vessels and others by utilisation of the tides. We understand the fundamental physics of tides, primarily from studies over many years, as you have heard from other panellists.

The technology to extract energy from moving water put in either a barrage or a lagoon is really well understood. They have been operating in three barrages for a very long time. We did not talk about the

Annapolis tidal barrage in the bay of Fundy, which operated for a very long period of time and was decommissioned in 2021.

The fundamental physics and engineering is incredibly well understood. What differs, really, is how you put them into the receiving environment, so whether it is a large barrage that goes from one point on one side of an estuary to the other, or whether it is a lagoon that goes from a land-to-land point and confines water in a much smaller space. That is where you are asking, "Is it feasible?" We think that what is feasible is a lagoon, because, for the Severn estuary, in physics, economics and environment terms, as you heard from the earlier members, that can work from both a commercial and an engineering perspective.

We must remember as well that we know how to do the engineering around how to put things in the water. It is very similar to providing protection for ports and harbours, whether it is a caisson, so putting large concrete blocks in the water, or other forms of building in the sea. We are a maritime nation. It is something that we know how to do. That element of the 70% construction cost comes from the fact that we know how to build things in estuarine and marine environments.

Q50 **Torcuil Crichton:** Leaning on Chris's previous experience, lagoon technology is like a salmon net across a river rather than a bridge or a dam.

Chris Mills: Yes. The lagoon encompasses part of the coastline. It has many of the same characteristics as a barrage, except that it does not create a barrier right across the estuary in terms of having impacts on water levels, for example. It is much more localised and could be sited in a position where it would have much less impact on the highly protected areas that are within the inner estuary. From that point of view, you can mitigate some of the environmental impacts.

Q51 **Torcuil Crichton:** Andrew, we know that it would work, but what are the big commercial and development challenges that you face to make this a reality?

Dr Garrad: Of course, that is one of the hurdles that we have seen in the past. It is quite important to distinguish this type of development from a power station of any sort. A conventional combined cycle gas power station has a lifetime of 30 years. Hinkley may have 60 years, and an offshore wind farm typically 30. This has an asset life of 120 years, so four times that of a conventional station.

It has quite a long construction time of between six and nine years, has a very long asset life of 120 years, and requires a big chunk of money to get it going. The conventional way of comparing different technologies and forms of electricity generation is to use discounted cash flow and look at the levelised cost of energy. That militates very unfavourably against something that has such a long asset life.

We have spent quite a lot of effort looking at the right way of funding and financing a tidal range project. We have come up with the conclusions that the costs are comparable to offshore wind, and rather cheaper than nuclear. The way to do it is through a regulated asset base approach, which has been used by the Thames tideway tunnel, is now being adopted by small modular reactors, and is likely to be adopted by Sizewell C.

We were shocked—or at least I was, and perhaps this was my naivety—when we started looking at this and discovered that 67% of the Hinkley C strike price was financing costs, and roughly half of that was a risk premium. We needed, first of all, to address the characteristics of a tidal range project, and, secondly, to deal with the risk and the way that it is expressed in terms of costs. Roughly a quarter of our effort has been looking at how to come up with commercial, sensible financing for what is, essentially, a big infrastructure project. We have been successful in that, but there is work to do there, having established that that is the right process.

Q52 **Torcuil Crichton:** Are people interested?

Dr Garrad: Yes. We held two sets of stakeholder workshops for the finance community. The first was developer interests, so would anybody be interested in developing such a project? The second was construction, so the big bucks. Is the money available to build the project? The answer to the second is that there are lots of people who would be prepared to finance, given the right circumstances. RAB would be included there.

There are plenty of people who would be prepared to finance the construction. There is very little appetite for the development cost, which is why one of our recommendations is this project development vehicle, which we believe needs to be, at least in part, financed publicly to get to a buildable project, and then private finance can take over, and build and run it for 120 years.

Q53 **Torcuil Crichton:** Sue, this may be a very simple question with a very complicated answer. How do you come to the determination that tidal range energy will bring down wholesale electricity prices, particularly when everything relies on the price of gas right now? The tide will not stop flowing, but, when everything else stops, we have to turn to gas anyway.

Sue Bartlett-Reed: There are a couple of elements to that. One is the discounted rates and cost of capital. Over the lifetime of the project, you see the costs reduce. You have this initially high capital cost to build what is, effectively, an infrastructure project, but it creates generation. Normally, if you have offshore wind or other projects, your major cost is the turbines and the installation costs, and then operation and maintenance. There is very little operation and maintenance baked into a tidal lagoon. It requires very little maintenance and, as we have already

heard, has a very long asset lifetime, so the costs of capital and of energy come down over that time as you are discounting the costs.

The other element that is really important to understand, as we talked about earlier, is that there are other ways of producing renewable energy that may be important. Tidal is predictable, which has a value-added benefit to your grid. You could find ways to reduce distribution costs. You also have generation that is close to demand. The areas in which we are looking at potential lagoons, for example, are very close to centres of habitation where there will be offtake of that power.

There is a range of factors within that that are slightly different from other renewable energy projects. You have predictability. You have a long asset life. You have the reduced cost over time as the project becomes more established and is generating over a longer period. Ultimately, it adds to the lower distribution cost of energy systems. It can add value where other forms of renewables cannot, because of that predictable nature, and that is equally applicable for tidal stream and tidal range. Because of the energy that you can take out of a system, and because of the way that it acts on the grid in terms of frequency, tidal range is really important in those costs and being able to look at the project as being valuable to the UK energy system.

Q54 **Torcuil Crichton:** Andrew, you started where we are, with very little knowledge, but you do have knowledge now. Could anything that can be done on the Severn be done here on the Thames, on the Mersey or on the Clyde?

Dr Garrad: The Severn is rather bigger. We went to visit the Mersey, and we know the Mersey people very well. I had the pleasure of steering the Mersey ferry as a result, which was a major benefit. It is well defined and highly industrial, so the feeling of the Mersey is completely different, with these industrial applications all the way along.

Wherever there is flowing water, there is energy, but we should recognise that the Severn is quite spectacular in the amount of energy that it has. Some 7% of the UK's electricity could, in principle, be produced there. The national figure is about 12% for tidal as a whole. Starting in the Severn is the right place to go, and then, of course, it could go elsewhere, although it might be at different scales.

Q55 **Torcuil Crichton:** You say that it could be between 7 TWh and 21 TWh. Presumably, that is the scale.

Dr Garrad: We need to differentiate between barrages and lagoons. It may be helpful to think about it in terms of percentage of UK electricity. As I mentioned, there is, in principle, 7% from the Severn—5% from a barrage and 2% from a big lagoon. It will be less as you move elsewhere, but it is an untapped resource. You guys have to double our generating capacity in 25 years. It is pretty easy for people in Westminster to write that down, but to deliver a 100% increase in electricity generation with

low-carbon sources is one hell of a task, and so it seems to me quite contrary not to be looking at all the possibilities. They need to be done properly, and Chris can come in on this.

Chris Mills: I was going to just comment on your question, "Could it be done here on the Thames?" Of course, there is the Thames barrage, but it has a completely different function, which is to prevent flood risk and tidal surge. The important thing there is that it allows for navigation. Again, one reason why a barrage would be very difficult within the Severn estuary is that the ports are very against it and would see it as an impediment to navigation through the estuary. You have to decide what the other competing demands are in your estuary as to whether it would be possible to generate electricity.

Q56 **Melanie Onn:** Andrew, I was struck by your comment about the turbine in France being the same for 50 years. In our previous evidence session, there was a suggestion that there could be some reindustrialisation that comes from tidal technology, but 50 years does not indicate that lots of turbines will suddenly be required for replacement purposes.

Dr Garrad: You are right. It is quite remarkable that it has gone on for 60 years. As an engineer, I regard that as a great success. Maybe as a businessperson, it is a terrible disaster because it is too reliable. What I see is the industrialisation potential. It is important that we make a very clear distinction between this industry and the one that you are more familiar with, which is the wind business, where it is absolutely industrialised. It has become very sophisticated and very effective because of the volume. The volume is not going to be the same here. A big chunk, or 70%, is civil works, and 30% is the machines.

We had discussions with two out of the three manufacturers, and both said that they would expect to be asked or compelled to make things locally. They also said that they would expect to be paid for doing that. It would be much cheaper for them to produce them in Brazil, but, if they had to produce them in south Wales, they would.

These are big chunks. Each one is 20 MW, so it is comparable with the biggest machines that we are producing for the wind business now, and it is just starting. The market is much smaller, but we are particularly well endowed in Britain with tidal range. I do not want to suggest that this is a repetition of the wind business. It is not, but it is a significant extra chunk of industrial activity.

Q57 **Chair:** Is it more like the nuclear business, then? They last for a long time, and you do not make very many of them.

Dr Garrad: This is a very leading question. It is not like the nuclear business, in the sense that the costs and the construction time will be quite controlled, but it is of a similar size. If we were discussing a barrage, it would be very similar to Hinkley in terms of energy production. The cost of Hinkley used to be £35 million and may now be

£50 million. The cost of a barrage would be £33 million, so they are comparable. Both would be producing a comparable amount of energy. The barrage would last probably twice as long as Hinkley. Indeed, the financing structure is very much borrowed. Just to answer your question, it would be a new industry. It would not be another wind industry, but it could be something that is very special to the UK.

Q58 **Melanie Onn:** Could I move on to environmental impact? We have heard about the Severn estuary's ecological and environmental importance, but there is a severe lack of current environmental data. The last survey data that the RSPB presented earlier this afternoon is from 2015. Does that lack of information make the development of a tidal lagoon completely unviable until we get more data?

Chris Mills: The way that I would approach this is to look at the consenting regime and what you need to get compliance with the habitat regulations. That is the crucial thing here. What that tests is, "Is there an adverse impact on the designated sites and features?" The first thing that you need to be able to do there is to know what the condition of those designated sites and features is. Some of that data is lacking and some is out of date, so that is a critical thing to fill the evidence gap in with.

Even if you are not able to meet that test, you can get a derogation, but you have to meet three quite stringent tests. First of all, you have to be able to demonstrate that there is no viable alternative. You then have to demonstrate that there are imperative reasons for overriding public interest. If you can demonstrate that, you would have to compensate for any damage done.

This very much led, from the environmental perspective, to challenges to my engineering colleagues, asking, "Would you be able to get through the habitats regulations?" Our conclusion was that you have a far greater chance of doing that if you can site your lagoon well away from the designated sites in the inner estuary and try to find locations where there is the least environmental damage.

A particularly important factor that has plagued earlier developments has been the impact on fish, particularly migratory fish such as salmon and shad. If you are going to build a lagoon, one of the prerequisites is to try to avoid anywhere near a river mouth or adjacent to an important river that supports migratory fish.

I wanted to give the message that getting through the habitats regulations, even with the Planning and Infrastructure Bill, which might lower the bar slightly but certainly will not remove it, is still going to be challenging and complex. I and my fellow commissioner, from the environmental point of view, felt that with what was being proposed here, if we could find the right location with the least damage, we would have a fighting chance of doing that.

There is also increasing support from the environmental sector. It could take years and years to try to fill some of these information gaps, given the complexity of the estuary. What we need is a real-life situation to test how these issues might transform into practice in real life.

I have dealt with these issues for some considerable time as a regulator, and the mood has changed somewhat from being totally against any sort of development. There is certainly still very much a feeling that a barrage is not feasible and would create far too much damage, but there is a reasonable degree of support among the environmental sector for the idea of this commercial development project. It would then demonstrate, once and for all, whether there is a viable route forward.

Sue Bartlett-Reed: If I may, this highlights a really important point, which is around taking consideration of environmental and planning constraints in isolation. What the commission has been able to do is to look in the round across the silos of planning, environment, economics and technical feasibility, which is the way that we should be managing the marine environment. It is a much more holistic way of looking at the approach to the marine environment. It does not mean that any of those elements should outweigh others, but it has allowed us to look in the round at how you could deliver a project, staying within the environmental constraints.

There are also the transboundary issues around the Welsh-English coastline, the application of habitats regulations, and two different regulators in terms of a barrage. Those governance issues are really important. A tidal lagoon, done at scale in the right way as a commercial demonstrator project, would allow us to look at how you work across those areas to make sure that you are delivering something that is sustainable, that meets the needs of net zero, that reduces environmental impact, that can speak to the policy, planning and legislation we have, and that can provide an economic return. It is a really great microcosm for analysis of how we do things better in projects.

Q59 **Torcuil Crichton:** Is it a model for a Government Department?

Sue Bartlett-Reed: I would love to think so. As an ex-regulator from round 1 and round 2 offshore wind, we tried to do this in isolation. You do now need to think, to Chris' point, that we are in a different world. We have a climate crisis. We have a biodiversity crisis. We need to think holistically about how we do better.

Dr Garrad: One of the things that we found from the various environmental stakeholder engagements was that we needed a strategic spatial plan for the estuary, not just for energy, but for everything. The fish do not know whether they are on the Welsh or the English side, and quite often the humans are pretty confused too. That was very much a request from the environmental stakeholders.

Q60 **Melanie Onn:** You have recommended that a commercial development project in the form of a tidal lagoon be pursued as the first step in developing tidal range energy in the Severn. What are the potential benefits of that approach of having a pathfinder project?

Dr Garrad: We have not used the word "pathfinder". It was used by Charles Hendry.

Melanie Onn: Somebody used it beforehand.

Dr Garrad: Yes, it has been used in here.

Melanie Onn: I adopted it.

Dr Garrad: That is very polite of you. It is deliberately not in our report. We have talked about a commercial development project, because we all now believe that the time has passed for a little model. Time is now pressing. You have the 2035 targets and the 2050 targets. If you are going to deliver something for 2050 with tidal range, you need to start now, and it needs to be significant.

What are the benefits? We have talked a bit about the socioeconomic benefits. The Government have a goal of net zero by 2050, which means doubling our electricity production in the next 25 years. Sue has described a few of the positive characteristics of tidal range. We have the inherent storage. We have predictability, which is pretty important.

We will have a lot more wind. I have spent the last 45 years saying how wonderful wind is, and how predictable it is, but tidal is even better, and it does have inherent storage. You can have maybe three or four hours' storage. It is often close to loads. The timing is wrong, but I would love to see, as Port Talbot is replaced with electric arc foundries, for that to be powered by a power station in Severn estuary. That would be fantastic.

Something that is very topical right now as a result of events last week in Spain and Portugal is rotational inertia. A lot of nonsense has been talked about what happened in Spain and Portugal last week, and it is not caused by wind. The way in which wind and solar react to such an event is different, and we do need more rotational inertia. These devices would naturally have that rotational inertia, so they support the grid. They offer low-carbon grid support, frequency support, local jobs and low-carbon benefits, and, I hope, a mechanism to do this in conjunction with the environmental lobbies. Co-design is a crucial part of what we have been proposing.

Chris Mills: I would say just a few words about where the environmental benefits would come. One of the stumbling blocks for the Swansea tidal lagoon was potential entrapment and damage to fish. There was controversy about the modelling and whether it was correct. This would give us a real-life situation to test that against, so we would find out whether fish are sucked into and trapped in the lagoon on the incoming

tide in any great number, and whether, in trying to escape from the lagoon, there would be damage going through the turbines.

How will the ecology within the lagoon be affected? Will there be issues with sedimentation within the lagoon? Would it have to be dredged on a frequent basis? What are the effects on coastal processes adjacent to the lagoon? What is the efficacy of mitigation measures, such as fish acoustic deterrent mechanisms that would prevent fish from going in there in the first place? There are a lot of these unanswered questions, which, frankly, we are only going to get the answer to if we have a real-life situation to test it against.

Sue Bartlett-Reed: A final point is knowledge capacity. We talked about export potential and building out future lagoons. You are building capacity in your workforce, in your supply chain and in the ancillary services. Whether we want to understand fish, sediment, or electrical convection through the turbines, this all requires people and skills. If we build the capacity here in the UK to build tidal lagoons, and we have a demonstration project, that capacity is exportable globally to those areas where there is tidal range capability. The socioeconomic benefits are not derived just from a single lagoon, but from the knowledge capacity that you build and then becomes an exportable service globally.

Q61 **Melanie Onn:** We were talking about workforce shortages and timescales to get these people trained up, and that really benefiting the local economy in Wales. How long will it take to get a skilled workforce to do the construction side and then all these other jobs that are yet to exist?

Sue Bartlett-Reed: For me, it is less about how long it will take to upskill people to do the work. As I said previously, we know how to build things in the marine environment. We have built ports and harbours all around the UK.

Q62 **Melanie Onn:** How long will it take?

Sue Bartlett-Reed: It depends on the project itself.

Q63 **Melanie Onn:** Do you have enough people?

Sue Bartlett-Reed: That is the bigger question. It is about whether we have enough capacity to bring that forward in the short term and other demands on capability. The offshore wind sector and vessel operation, et cetera, would be part of this project as well. Ultimately, we have the baseline skills and experience. It is about building that workforce and potentially moving it in a slightly different direction to have capability in lagoons.

Dr Garrad: We have Hinkley Point running in the very same place. There was a discussion about the workforce in the ports, so we should mention that we expect all the ports to be involved in making components, probably caissons, both in south Wales and in Bristol. You are right, and

there is a big chunk of work that we have done in looking at skills and labour, what is available and what is needed. We employed the same people who did the investigation for Hinkley to follow on with our work, which has been very useful, but it is definitely a live issue.

Q64 **Mike Reader:** I was going to ask about funding and finance, but, just before I do, I would like to paraphrase what I have just heard. If we could find the right site, and we do not know where that site is, and if we get public money to do the viability, and we do not know if we can get that yet, we could possibly build a commercial demonstrator project, which would take five years or more, by the time it got through planning and judicial reviews by people who worry about fish, and then building the thing.

You talked about the purpose of that being to understand the impact on ecology and on operations, et cetera. Did you make an assessment of how long you would run the CDP for before you would be confident that this is a viable scheme that you could take to the market?

Chris Mills: You would be talking about at least five years, and possibly slightly longer. You have to think in terms of generation time for certain species, which might be a lot longer, but you would need to do some pre-construction surveys to see what your baseline was. You would need to survey during construction, and then you would have this period afterwards to be surveying what the impacts are.

Q65 **Mike Reader:** So we are potentially 15 years away from being able to deliver at scale.

Chris Mills: Yes, 10 to 15 years.

Mike Reader: I just wanted to clarify that.

Dr Garrad: Can I just interrupt there? I have tried to make this point before. You said "at scale". This commercial demonstration project is not just a little model. It is a commercial project, so it will be delivering at scale.

Q66 **Mike Reader:** The challenge is also that you need grid connection. I imagine this is not in the NESO plan, so we are going to have all sorts of challenges around that. I just wanted to clarify that, because this is a great thing we could do, but we are talking about 15 years' time, in which case the workforce challenges and capacity challenges in the market could be different. If I was an investor, would I invest in a relatively proven technology such as wind or a relatively unproven technology such as this? I think that is an interesting question for us to explore separately. Your recommendation was to go down the regulated asset base model, but obviously not for the commercial demonstrator project. What brought you to that position?

Dr Garrad: Sorry, can I just go back? You asked Chris how long he would need to make measurements after the building and he said five years. We would have a project now in 10 years' time, so it would be 15

years until the second one. When you say "at scale", this would be at scale. This would be a commercial project, so we need to be clear about that. This is not just a little model. It is a commercial project and we can do it in 10 years.

We looked at all the different schemes that could be used. We looked at the CfD, we looked at cap and floor, we looked at public-private partnership, and we had a specialist finance company considering that specifically. I mentioned earlier the huge financing costs for Hinkley C, and we saw what was being used for SMRs and Sizewell C. We came to the conclusion that, for an infrastructure-type project, this was the right way to go. That is what this is: it is not a power station; it is an infrastructure-type project. There is an argument that, if we did only one, maybe we could not afford all of the overhead of establishing the RAB system. The expectation is that this would be the first of several, not necessary in the estuary, but Mersey is already quite advanced. There are other projects around the place.

It was risk sharing. I mentioned the 67% for Hinkley C; 37% of that was a risk premium. RAB introduces a way of cheaper finance, but also sharing risk, and that seems like a very sensible plan. I mentioned that we had two financial stakeholder meetings with serious investors who have done big power projects. Almost all of them agreed that RAB was the right way to go. There were a couple who had said they would much prefer higher risk, higher return, which is fine. Certainly, if you go to RAB, you do move to a different investor class. There is no doubt about that, but that investor class is there.

We looked at the alternatives and we decided that the cheapest way of doing this, the most effective, and the way that is most likely to attract private finance, would be through RAB.

Q67 **Mike Reader:** In your recommendations as a commission, you said that Treasury needs to expand the application of funding and financing frameworks based on the model. What changes do you think you need to see from Treasury?

Dr Garrad: That is a very good question. What we mean by that is that there is a precedent now in energy that, as Sizewell C goes on, it is likely to use RAB. SMRs seem likely to use RAB. Those are both energy projects. RAB to date has been used on some grid issues and on the Thames tideway tunnel. There is precedent in the energy industry for RAB. Ofgem is already available, as is the Low Carbon Contracts Company.

To be honest, I do not know whether this is a simple administrative change and you could cut and paste, taking out "TTT" and putting in "tidal range", or whether it is a huge Act of Parliament. We are investigating that right now. To me, it seems, if it is already being used for other energy projects to do something very similar, it cannot be that

difficult, but that may be a very naive approach. We are looking into that right now.

***Sue Bartlett-Reed*:** If I may, to the point on whether investors would come in behind an unproven technology, that is not the challenge. The engineering and the technology is very well understood. The only thing you would do with normal tidal range turbines is improve the efficiency. They are at a similar level to offshore wind, except that we have a much larger capacity in offshore wind. We have a lot more technology in the water.

In terms of the financing, it is very difficult to finance a project if there is no long-term policy to sit in front of it. Investors are uncertain about the intent around tidal range, and I think, to the point of what statutory or regulatory changes you would make to enable financing to happen, it is very difficult in the absence of any national policy statement for tidal range. That would have to precede any changes to the financing mechanisms. There would need to be an intent to bring investors behind it.

Chair: We are going to come on to some questions about that shortly.

Q68 **Melanie Onn:** I think, Sue, you mentioned the decommissioning of a lagoon. I just wondered why it had not been repowered rather than decommissioned, or had something else set up in its place. I am just thinking about whether they found it to be effective.

***Sue Bartlett-Reed*:** This was the Annapolis tidal barrage in the bay of Fundy in Canada and, really, it had become less cost-effective over time because of the bay of Fundy and some of the impacts. They had not really put the money in to make it more efficient and to look at the fish. They could have repowered that project had they had the financing to do it, but they chose not to.

The bay of Fundy is an interesting case in point. It is the east coast of Canada, Nova Scotia province. It has some really interesting economics in terms of fish species and the lobster fishery. If anyone has ever savoured a Nova Scotian lobster, they are very high value. It had a high degree of protectionism around the estuary itself. This really leans back to the need for this integrated policy and approach if we are going to deliver something that is useful on all fronts.

Q69 **Claire Young:** You have called for a tidal range energy national policy statement to reinforce government commitment and strengthen regulatory certainty. What discussions have you had with both the UK and Welsh Governments regarding this recommendation?

Dr Garrad: I will kick it off and perhaps Sue can carry on. What we have found, from both the finance community and the supply chain, is that such a statement was an absolutely necessary, but not sufficient, condition. We are not going to be taken seriously unless that is in place. The Welsh Government already have such a policy in place. We have

discussed the Welsh, saying, "Thank you very much. You have a good policy." We do not have a policy from the UK Government. Maybe you can carry on from there, Sue.

***Sue Bartlett-Reed*:** Tidal has fallen out of favour over many years and has been lacking in policy structures. We know that the energy system operator, NESO, is looking at what we need to make the energy system effective, and it is recommending that 5 GW of tidal range or tidal power needs to be on the system. That is a function of the predictability of the power and some of the frequencies that we were talking about.

We are here today to talk about that, but one of our leading recommendations is that, in the absence of policy, it is very difficult to bring in the confidence and the support of both project developers and anyone who would back a commercial demonstration project if it is not viewed as being an essential part of the energy mix. We know we need to make a significant number of changes to our energy system to make sure we electrify and we can meet the needs and demands.

We feel that it has a role to play and it needs to be written into policy, or there needs to be a statement around what tidal range could mean for the UK, and we are initiating those discussions. Without that policy framework, as we know, regulation is the what and policy is the how. If we do not have the policy statements that can sit alongside the statute, it is very difficult for anyone in a commercial development project to understand how they navigate that to deliver on a project. We would be calling for a policy statement to be delivered in conjunction with the industry, which is much broader than this commission. The industry itself has been calling for a national policy statement through the Tidal Range Alliance for some time, but we think we need a policy statement to be able to support project development.

Q70 **Claire Young:** Just to be clear, you have not had direct discussions as a commission with the UK Government on this specific point.

Dr Garrad: No. As a bit of background, presently, DESNZ is conducting, together with NESO—the National Energy System Operator—a systematic investigation of the role that tidal range can play in the national system. They are likely to report within May, so in the next few weeks. We detect a reticence in making any such statement until that NESO investigation is finished. We employed the same consultant to do equivalent work for us, but obviously in the Severn estuary, following the same methodology. We have had informal discussions. We have talked to GB Energy, to the Crown Estate, to the National Wealth Fund, and to some of the officials in DESNZ, but until that NESO report is finished we are unlikely to get anything more definitive.

Q71 **Claire Young:** Talking about NESO, you have called for it to review its strategic spatial energy plan to include a pathway for tidal range energy. How would this help encourage investment into tidal energy, and how would that interact with the national policy statement you are referring

to?

Dr Garrad: NESO already has a small amount of tidal range in its plan. It is systematically investigating how much more it can have in the context of the need to double the capacity. If the NESO study were to come out and say, "We don't want this stuff," it is very unlikely that we would get a national policy plan in favour. Assuming it does come out favourably, and we have every expectation that that will be the case, I hope it could be followed by a statement.

I am out of my depth here a bit, but what I anticipate we need is something quite quick, stating that the Government are in favour. I understand that a formal national policy plan takes some considerable gestation period to produce. What we have certainly found is that the investors, the funders and the supply chain need that sort of policy confidence. Without that, it will be very hard for us to go further.

Of course, we have the usual conundrum of the planning horizon. This project is 10 years to fruition whereas the policy statements change more frequently, so we have to address that. We have been told by all third parties that a clear policy is needed and, without that, it will be very hard for us to progress.

Chair: Thank you for your evidence. We very much appreciate what you have said to us and we look forward to ongoing discussions. With that, we will end the session.