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# Minutes

**Tidal Lagoons:**
**A Presentation by Henrietta Ridgeon,**
**Tidal Energy Leader at Arup**

**Wednesday 8 March 2017 at 12.00pm**
**Pierhead Main Hall, Cardiff Bay**

# Attendees

## Assembly Members

Dai Lloyd AM
Jeremy Miles AM
Llyr Gruffydd AM
Suzy Davies AM

## Industry Members

Alan Dennis, Arup
Aled Rowlands, National Grid
Andrew Hill, Natural Resources Wales
Angharad Davies, Cadno Communications
Ann Cousins, Arup
Ann Fitzpatrick
Carole Morgan-Jones, National Energy Action (NEA) Cymru
Carolyn Pugsley, Freshwater
Catrin Jones, Tidal Lagoon Power
Christian Silk, Simmons & Simmons LLP
Craig Harrison, Liberty SIMEC
Darren Shaw, Arup
Dave Finley, Hydrock
David Clubb, Renewable UK Cymru
David Fitzpatrick
David Palmer, Wales Co-operative Centre
David Tudor, The Crown Estates
Ella Maxwell, Invicta Public Affairs
Erin Gill, Arup
Graham Hillier, Tidal Lagoon Power
Graham Taylor, Unlimited Energy Technologies
Henrietta Ridgeon, Arup
Ian MacKinlay
Ian Taylor, NewWaves Solutions Ltd
Jamie-Lee Cole, Freshwater
Jenifer Baxter, Institution of Mechanical Engineers
Jennifer Pride, Welsh Government
Jeremy Fletcher, Arup
Jeremy Littlejohn, Boskalis Westminster Ltd
Jerome Furge, Bouygues Construction
Jon Fox, Wardell Armstrong LLP
Keith Davies, Natural Resources Wales
Keith Dee, Boskalis Westminster Ltd
Mark Durdin, Cardiff University
Mark Robins, RSPB
Mark Summers, Acuity Legal Ltd
Matthew Kennerley, Associated British Ports

Maxim Laithwaite, Bond Dickinson LLP
Melanie Johnson, Sustainable Wales
Michael Baker, Arup
Michael Fitzsimmons, Jan de Nul
Natalie Drury, Thomson Ecology Ltd
Natalie Jones, Acuity Legal Limited
Neil Woollard, Tidal Lagoon Power
Nick Speed, Centrica
Nia Lloyd, Renewable UK Cymru
Paul Davies, University of South Wales
Rachael Friel, Quatro PR
Richard Cowell, Cardiff University
Robert C. James, Bridgend College
Robert Proctor, Renew Wales
Robin Lewis, Office of Vikki Howells AM
Rosemary Grogan
Sean Evans, Research Service, National Assembly for Wales
Sharon Thompson, RSPB Cymru
Shea Jones, Institute of Welsh Affairs
Simon Moore, Simmons & Simmons LLP
Steve Knowles, Cardiff Council
Stuart Bechares, Acuity Legal Limited
Tim James, Port of Milford Haven
Tim Peppin, Welsh Local Government Association

## Welcome: Llyr Gruffydd

- Last CPGSE meeting in September on *Levelised Cost of Electricity* by John Fedderson was well-attended and glad to see this event also showing a good turnout.
- Today's event is on Tidal Lagoons. With failure of the Severn Barrage to gain government and public support, we're now looking into smaller options with less environmental impact such as tidal lagoons.
- Swansea Bay Tidal Lagoon is the big opportunity for Wales; assembly members recently wrote a letter to the UK government recently, wanting an early and positive decision to progress. We hope for an announcement in today's budget, though that may be unlikely.
- Speaker introductions: Henrietta Ridgeon - Arup's global tidal energy leader and an associate director with more than 20 years' experience of engineering design, with a focus on heavy civil, marine and offshore structures. Henrietta contributed evidence to Charles Hendry's recent report to the UK government. This evidence was informed by her work on the proposed tidal lagoon for Swansea Bay.

## Presentation: Henrietta Ridgeon (HR), Tidal Energy Leader at Arup: Harnessing the power of tidal lagoons

**Introduction**

The UK needs to harness alternative renewable energy resources and tidal range offers a portfolio of projects, which could offer up to 10% of the UK's electricity demand.

HR is encouraged by the government's decision to review tidal energy as there are good reasons to support this industry, and it can create a commercially viable energy solution for the UK. Charles Hendry laid this out in his report.

## Tidal lagoons

***Tidal range energy – different types of structure***
Barrage (rivers), lagoon (offshore) and tidal lagoon (tied to the shore).

***Tidal range – components of the three types are similar***

1. Turbine powerhouse - creates a difference in water level height
2. Sluice gate - makes the energy more productive
3. Bund - made of sand and rock

***How does tidal energy work?***
Force of the pressure from the high side, creates energy. Water can be inside or outside of the lagoon.

***Changes to water levels***
Traditionally we have looked at one-way energy generation – the water level inside the lagoon is high and the water outside the lagoon is low or vice versa. Recent improvements to two-way tidal turbine technology means that you can combine that cycle on both sides, so you know how much energy you're going to get and when – consistent and reliable.

## Key facts about Tidal Range Energy

- The energy is reliable and renewable and unique to the UK.
- The engineering knowledge and construction techniques are available to build tidal range power stations – if organised properly, a supply chain could be created in order to deliver a portfolio of projects, which would create new jobs and GDP.
- The environmental impacts can be identified during the planning stage, minimised in some instances and compensated appropriately all within the terms of environmental law and approached in a timely manner.
- The cost model for tidal range, to calculate its value to the UK economy, needs to be appropriate.
- Market certainty would drive down costs and empower the supply chain.

***Reliable, renewable and unique to UK***

- Tidal energy could produce 10% UK electricity power supply
- Low carbon energy source
- Predictable
- Grid integration
- Job creation
- Mature technology
- Less reliance on diminishing oil and gas supply

- Increase land value – house prices around Hinckley are dropping but it's an exciting time for Swansea.

***Tidal range varies significantly around the UK***

- Location will affect energy production.
- Can be combined with regeneration, flood defence and transport infrastructure – needs to be catered for in the evaluation of schemes.
- Effect on fluvial processes need to be understood in a timely matter – it affects cost.
- Ground conditions can have a large effect on capital cost.

***Construction techniques are known***

***La Rance, France:***

- 240MW – annual generation 540GWh.
- £600M construction cost (2016 prices).
- Operational since 1966 (50 years).
- 145m long barrage.
- 22 km² impounded.
- Pay back 20 years, energy now 9p/kWh.
- Being retrofitted with 2 way variable head turbines.

***Sihwa Lake, Korea:***

- 254MW – Annual generation 540GWh.
- Operational since 2010.
- 12.5 km seawall.
- 30 km sq. impounded area.
- 8m tidal range.

***Environmental impacts and certainty***

- Lagoons need to assess flood risk on surrounding areas but they can also help with flood risk behind the wall.
- Bund can take away parts of under the sea wall but the embankment can become a food source in its own right.
- Barrages have a bad name – one-way turbines lead to change in food sources and habitats for birds, for example. Two-way turbines have helped to reduce this.
- Potential reduction for port access time and increased dredge channel regimes - ports and local areas need to be consulted and feedback should be included in future design work.
- All turbines pose a risk to marine life and need to be assessed, evaluated and compensated for.
- We've come a long way since La Rance and we can now build habitats, limit construction time and have two-way turbines.
- The upfront EIA should be used to consider impacts and benefits of the scheme and portfolio of schemes.
- Dealing with these matters upfront and agreeing the approach to assessment is essential.
- Where there is inherent uncertainty - monitoring and adaptive management can be deployed to make the proposal acceptable.

***Benefits***

- Use of impoundment space
- Tourism
- Transport
- Flood defence
- Environmental enhancements e.g. reef
- Reduction in $CO_2$

***Levelised cost of energy (LCOE) and appropriate cost model***

Definition:

- One of the key ways the utility industry measures energy cost.
- Calculated by accounting for all costs over a project lifetime from construction to decommissioning, and then dividing by the total lifetime expected power output.

Factors which can affect LCOE: discount rate, construction costs, model period, market certainty and supply chain.

It is appropriate to make the business case over a longer period of time.

***Possible UK pipeline – estimates***

Products developed to a certain level already: Swansea Bay, Wye Barrage, Cardiff Bay, Newport, Solway, Colwyn Bay. These add up to approx 9.2GW – 10% of the UK electricity supply.

***Market certainty leads to cost reduction***

Go ahead on a national tidal range programme from government would facilitate a tidal range industry – short to medium-term energy costs would be the same as existing green technology and long-term could challenge existing low cost energy suppliers.

***Market certainty - tidal technology***

We already have skills and technology that have been used for 50 years, but there's potential to improve the technology and the environmental impact further.

***Tidal technology – government support***

Policy support from government would allow for investment and commitment from construction and marine industries. This will allow for the expansion of the existing UK tidal supply chain and will overall bring down cost of tidal energy generation. Planning will help to achieve this. All elements together will help reduce the risks and the costs of tidal lagoon energy.

***Supply chain***

UK has strong track record in large construction and novel energy projects and is well-placed to develop tidal range projects. A range of projects would create a diverse range of engineering and design, increasing jobs and GDP.

***Skills – let's set up a new industry***
Work includes, but is not exclusive to: environmental services, design, planning, maintenance, construction, manufacture and scoping.

This would establish Wales and the UK as front-runners in tidal energy and would position the UK to share our expertise with other countries that have tidal ranges such as Canada and Mexico.

***What are the next steps?***
HR agrees with Charles Hendry's next steps:

1. Choose and back the pathfinder project
2. Create a tidal authority to support and nurture the industry

***Swansea Bay Tidal Lagoon – pathfinder***
Tidal Lagoon Power has done a lot of work to consult with the community, undertake an environmental impact assessment, obtaining a development consent order (DCO) and creating a supply chain to deliver the project in a way that would benefit the south Wales economy. The project is ready to progess and just needs government support on an announced CFD price. There is no upfront cost to government.
Details:

- 320 MW power plant
- 500 GWh generated per year
- £1 billion investment
- 11.5 km sq. impounded area
- 9.5 km wall length

***Tidal Authority***
A Tidal Authority needs to be set up relatively quickly, should be independent from government, should identify and evaluate sites to progress, drive through the first stages and be run by industry experts. A tidal authority could be the catalyst to making a step change to the industry, providing 10% of the UK's energy, and empowering the local supply chain. Denmark's offshore wind model has brought industry-leading companies there – impressive for a small country. Norway is now market-leading in hydropower. The UK could do this.

**Conclusion**

- Successful and resilient industrial sectors and supply chains don't magically emerge and private investors are not enough. It requires government support and foresight.
- Sustained commitment and planning from governments and an understanding of what they need to help their economy and maintain their global market share is what we need.
- A Tidal Authority could play an important part in this to set up and facilitate.
- If any other country had 10% of their electricity supplies on their doorsteps, they'd use it.

## Questions and Answers

- **Question:** *David Fitzpatrick* stated that it's a 'Why not?' question. The Hendry review was good. Why does the government seem not to be listening? When you have 10% on our doorstep – and the technology – that we could export everywhere. It would be nice to have something about it in the government budget (8 March). What can we do to encourage the government and decision makers to make the right decisions?

- **Response (HR):** The people who support it need to express support to local politicians – and they can pass their messages on. There has been a lot of support both side of Severn Estuary, who have written to PM and Secretary of State to say 'Do something'. There are a few political things going on in the world at the moment that could be distracting them – but hopefully they will listen.
  **Response (LG):** As previously mentioned, AMs have sent a letter to the UK government – three parties hold strong cross-party support for Swansea to happen ASAP. Other forces are at play.

- **Question:** *Jess Baxter* from *Institution of Mechanical Engineers* expressed that they are broadly for tidal lagoons in the UK, but is curious about the idea of creating a new Tidal Authority, what would be the purpose, as opposed to the Infrastructure Commission and the regional branches of that, to do that role? Wouldn't it just add more inertia - creating new organisation, putting it together and having to get them up to speed to deliver it - when we could encourage our current systems to do it effectively?

- **Response**: Should the Tidal Authority be an existing organisation, whose remit is tweaked, or should it be completely new organisation? It could be either. But it *must* promote the industry and is not regulatory. They are there to help promote and get the industry off the ground on a large scale.

- **Question**: *Ian McKinley* expressed concern that Hendry made some assumptions – one is that the government doesn't go ahead with carbon capture storage. Does HR have a comment on that?

- **Response**: Don't know the answer.

    - **Counter question:** How many elected representatives - AMs / MPs – are here today? Three parties here today. Pretty poor show. Elected representatives, in general, don't attend enough of this type of event.
    - **Counter response (LG):** Point taken, but this is reflective of a cross-party effort.

- **Comment**: *Sharon Thompson* from *RSPB Cymru* supports the move to low carbon energy production and understands the enthusiasm for tidal lagoons and other forms of renewable energy. The RSBP supports the right renewables in the right place. Sharon gave a word of caution to move forward

individual tidal lagoons at pace. She said that we need to make sure that we have dealt with, effectively, the environmental issues that are coming up on a case-by-case basis. It's right that we need a pathfinder – but it needs to meet legal obligations in terms of environment.

- **Question**: *Simon Moore* from *Simmons and Simmons LLP* commented that the capital cost of these projects is very high, which means the CFD strike price is going to be high. How do you sell the wider socio-economic benefits of these types of projects?

- **Response (HR):** Depending on what you take in terms of assumptions, the figures being quoted for Swansea Bay are anything from £168-£125 per megawatt hour. Subsequent projects could make more savings. The socio-economic impact is a very interesting question. It has a massive value to UK economy, which isn't taken into account at the moment. If you look at initiatives like the Olympic Park – if the rationale was on the basis of the economics of games, we'd never have done it, but it has regenerated a whole part of London, which is very valuable.
  **Response (LG):** Who champions and who drives the project in terms of politicians? Tough question. This is not unique to energy projects and there are so many ways to look at it. Swansea is making a good effort in terms of community involvement - clearly there are opportunities and economic benefits beyond energy, in terms of tourism. The biggest arguments for tidal in North Wales would be flooding across the coast and wider benefits. And it's about quantifying that. Do we have to monetise? Yes I guess we do, as it's the language, but there are other things to look at.

- **Comment**: *Graham Hillier* from *Tidal Lagoon Power* noted that in terms of tidal costs, HR is right on the initial costs. However, over the course of the lifetime of the project, it comes to about the same costs as a Hinckley. We need to articulate this and comparable costs for energy. In Hendry's report, he said that even in the pathfinder project case, it's the equivalent of the cost of a pint of milk extra per year per household on their energy bill. These discussions, as well as the environmental discussions, makes lagoons look very attractive for the country's future.

- **Question:** *Graham Taylor* from *Unlimited Energy Technologies* agreed with the need to generate renewable clean energy and had three questions:
  (i) Will the lagoon produce the energy at peak periods?
  (ii) Where are you going to store it? In a battery?
  (iii) What is the carbon footprint of building the lagoon? This was not mentioned in the presentation. For a wind generator generating 1 MW of wind power, the pay back is 156 years.

- **Response**:
  (i) and (ii) With regards to peak periods and storage – that's an interesting one. We need to adapt as a society. Part of our adaption is how we *use* energy, as well as how we *store* it. There is a lot of work being done in these

areas.
(iii) A number of years ago, we did the calculations for the bund and concrete and housing – from recollection – it was a footprint of around 5-7 years. Which is more than some and less than others when compared to other technologies.

- **Question**: *Rob James* from *Bridgend College* said, we know about peak periods; when tides are going in and out and when to open and shut the gates. You can control it – but there are still environmental impacts. Do we have the local skills and are we using local colleges on our doorstep to deliver and send around the world? Are we talking to educationalists locally to upskill students for the future?

- **Response (HR)**: On controlling the gates and tide, you can but there are environmental impacts to weigh up. On skills, Tidal Lagoon Power has done a lot of work in this area and yes, we are talking to industry leaders and universities. It has to be planned and catered for.

    - **Counter response (Greg Hillier, *Tidal Lagoon Power*):** Agree that they've looked at supply chain and the Welsh government has helped commission studies into finding the skills shortage to meet future lagoon projects, development needs and creating competition. On the tidal sequence issue about peak demand, this is correct. The tide will change through the course of a day and lagoons can only be part of an energy solution as we are going to be reliant on other forms of energy anyway. Single lagoons will be generating power at peak times and days of the year, but a fleet of lagoons around the coast will see a 24 hour generation of energy.

- **Question**: *Craig Harrison* from *Liberty SIMEC* asked, in terms of manufacturing and pathfinder projects, and there being a delay – what would you say to a manufacturing outlet when work drops off? How would you address that?

- **Response (HR)**: As long as the supply chain knows when the break is and how long the break is going to be, it is not worried. Moving from Swansea to Cardiff, we're going to have to up the game as we need preparation time for a bigger scale. Where they are worried is if it's not controllable and we don't know when it's going to happen, as it creates lot of nervousness about investment in the industry.
**Response (LG)**: This dip in work was raised with the minister, Ken Skates in the Assembly. Where is the work that can keep these companies going in the meantime, if no other major infrastructure is happening in Wales? There are opportunities there, and it needs to be coordinated and well-planned.

## Close

LG thanked HR for her presentation and invited suggestions for future topics for meetings from attendees.

The next CPGSE meeting will be held on Wednesday 28 June.