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Powering Offshore Oil and Gas with Marine Renewables

Conference Report

Columbus energy partners

Resen Waves

Aberdeenshire COUNCIL

1495 UNIVERSITY OF ABERDEEN

Note: This report has been edited and part written by David Toke, with help from Marc Gronwald, both from the University of Aberdeen. The presenters have written the sections of the report describing their contributions. A big thank you must go to the sponsors Columbus Energy Partners®, Resen Waves, Aberdeenshire Council, as well as a great deal of help from Opportunity North East.

Abstract

A coalition of non-government organisations, small and medium sized enterprises and academics is calling upon the oil industry and government bodies to collaborate to open up more opportunities to develop marine renewable, including wave power, using niche opportunities that exist in the offshore oil and gas sector. The prospect of powering offshore oil and gas activities with marine renewables offers opportunities for the energy industry and wider society. First, the extensive emissions from offshore oil and gas activities can be reduced. Second, opportunities for 'niche' market development can be given to marine renewables. The 'Powering Offshore Oil and Gas with Marine Renewables' Conference on September 18th 2019 held at the University of Aberdeen discussed these ideas. Besides possibilities for the development of offshore wind through floating wind turbines and the also lesser known possibilities for developing niche markets through the development of wave power machines, as well as other technologies, all emerged as practical propositions.

David Toke, a Reader in Energy Policy at the University of Aberdeen said: 'With oil prices at their rock-bottom now is the time for the oil and gas industry to invest in new technologies that help pave way for energy transition to renewable energy. There are some great opportunities for innovation in wave power being used to supply power to offshore oil and gas operations, as well as the steps forward that are being taken with offshore wind. That's what this report is all about, and why people should read it.'

The sections in this report are as follows:

1. Background to the Conference
2. Description and discussion of presentations made at the Conference
3. Discussion and conclusions

The following organisations support the call for the oil and gas industry to urgently review investment options for powering offshore oil and gas with marine renewable energy sources such as wave power, tidal power and offshore wind. They also urge people to read this report: (in alphabetical order)

Centre for Energy Transition, University of Aberdeen

Columbus Energy Partners®

Opportunity North East

Ocean Power Technologies

Resen Waves

Academic Individuals: Dr David Toke, Professor Alex Kemp, Dr Marc Gronwald (University of Aberdeen), Professor Peter Strachan (Robert Gordon University)

Background

Why hold the Conference?

The idea for the Conference emerged as it became clear to the author of this Conference summary (David Toke) that there were possibilities for developing marine renewable technologies, including wave power, tidal stream power and floating offshore wind turbines in the context of offshore activities. The biggest of these activities is offshore oil and gas, although there are many other offshore power needs including the need to deploy sensors to derive a range of meteorological and other data. It is very challenging and very often extremely expensive to supply power needs to offshore operations particularly because of the expense of sending boats out to deliver fuel supplies and/or batteries. Hence this presents the possibility of a 'niche' market whereby marine renewable can develop and optimise their operations (and thus lower costs) in the context where initial high technology costs do not matter so much.

The only reason that wind power and solar were able to develop in the way that they have is because they had niches that allowed designers to optimise the technologies, for example supplying wind power electricity to farming cooperatives in Denmark and through solar supplying off grid power needs. Certainly, it is possible that offshore marine renewable could follow this pattern if they can find business and in doing so develop the technologies as they do. Then they may be able to migrate to mainstream power markets.

So, if taking advantage of a niche market in providing power to offshore oil and gas in order to develop marine renewables is one good reason to promote the use of marine renewable in oil and gas, then a second good reason is that of reducing the carbon footprint of the oil and gas industry itself. As Professor Alex Kemp and also Lee Senoussi pointed out in their presentations, oil and gas offshore activities comprise over 3 per cent of total UK carbon emissions. Marine renewables stand to achieve this, alongside making oil and gas activities more low carbon.

People who made the Conference possible

I am indebted to Jacqui Watt and Colin McHardy from Opportunity North East for helping to organise and promote the Conference; without their help it would not have been possible. Initially RESEN WAVES agreed to sponsor the Conference, JacquiWatt was instrumental in encouraging Aberdeenshire Council and also Columbus Energy Partners® to sponsor the Conference. I am of course very indebted to the sponsors themselves, Resen Waves, Aberdeenshire Council and Columbus Energy Partners®. I would also like to thank Nicola Pearce and CPD Services of the University of Aberdeen for helping with the administration of the Conference and report publication.

Hence the key question facing the speakers at the Conference was what contribution marine renewables could make towards the aims of providing power and also of decarbonising oil and gas activities.

The Conference was opened by David Toke and also Marc Gronwald, respectively, from the Politics and Economics Departments of University of Aberdeen. What follows are thumbnail summaries of the presentations given at the Conference. The presentations addressed various types of issues and challenges the industry faces but also demonstrated the potential of commercial solutions and existing technologies. The presentations are set out in the order in which they were given. After this there was a panel session consisting of Maggie McGinlay, Opportunity North East; Professor Peter Strachan, RGU; Professor Alex Kemp, University of Aberdeen; and Dr David Toke, University of Aberdeen. Although this was generally a well-regarded session, it would be difficult to summarise the different contributions from this session.

Presentations made to the Conference

There follows, in order, presentations from,

1. Dr Susi Wiseman, Oil and Gas Technology Centre, and Lee Senoussi, SeaLand Projects
2. Sam Long, Aker Solutions
3. Paul Watson, Ocean Power Technologies
4. Per Resen Steenstrup, Resen Waves
5. Professor Alex Kemp, and George Colleran, University of Aberdeen
6. Giovanni Batista Picotti, Equinor
7. Fraser Pritchard, Columbus Energy Partners®
8. Keith Anderson, Wood plc

Oil and Gas Decommissioning and Power Needs

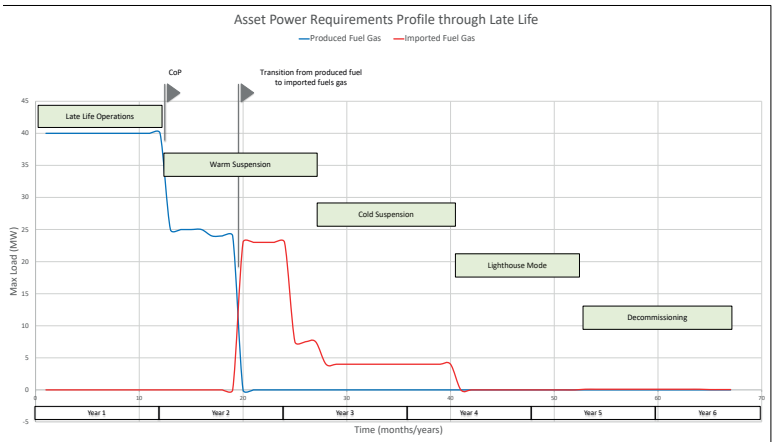
Dr Susi Wiseman, Oil and Gas Technology Centre, and Lee Senoussi, SeaLand Projects

Working in partnership with technology developer, SeaLand Projects, Susi Wiseman's presentation focuses on three key areas: first, the OGTC's technology focus for reducing decommissioning costs by 35% and identifying alternative power generation for late life and decommissioning, second, the power needs of an installation during late life of field and decommissioning, and, third, how the OGTC funded SeaLand Projects study is identifying different approaches to reducing carbon footprint and cost during this phase.

There are a range of power needs for oil and gas installations (including conventional platforms through to electrified sub-sea units). The OGTC Sealand Projects study specifically looks at the late life and decommissioning of platforms, when they have become economically unviable and when other power sources are needed either to extend field life or support decommissioning activities. Normally power needs will be supplied by gas turbines or diesel generators, as demonstrated in **the Figure below**, which shows the increasing quantities of imported fuel gas from Year 2 onwards.

The Sealand project looks at three scenarios for providing power: firstly by introducing an autonomous power source to the field by way of adjacent marine renewable power, specifically for this case study, a floating offshore wind farm; secondly by developing a 'satellite hub' to generate and distribute power to more than one neighbouring facilities, and; lastly by drawing power directly from existing offshore windfarms. The development costs and timelines associated with the floating wind farm scenarios present a challenge to potential energy consumers (O&G operators) in the near term in term of cost, timescale and surety of power supply, however opportunities have been identified that may allow a more staged development integrating power from shore within an accelerated timeline providing power surety. In certain cases, a satellite hub concept can more efficiently provide an alternative to power source with relatively quick return on capital investment.

This specific study did not look at possibilities for wave and tidal power providing power to O&G, however the OGTC is highly involved in the development of these technologies, e.g. supporting the OPT project also mentioned in this report.



Source: Presentation by Susi Wiseman

Late Life and Decommissioning

Sam Long, Aker Solutions

Sam looked at the nature and challenges of decarbonising energy used in upstream, offshore Oil and Gas (O&G) operations. He discussed a range of possibilities but paid particular attention to solutions regarding more efficient provision and use of energy through digitalisation, automation and optimisation.

He reported that attention should be focussed on issues such as compressor re-wheeling, pump and motor rating and specification / change out, fuel selection and Rotating Equipment (RE) management, asset electrification from shore, process optimisation and plant redundancy. Other options include Operations and Maintenance (O&M) optimisation, crewing and remote operations, asset life extension and LEAN solutions. Combined, these all help to reduce emissions, extend life and improve return.

Specific cases were illustrated, including improvements in compressor efficiency, reduction in process heat consumption and also deriving power from shore. In regard to the latter it was shown that electrification of the Johan Sverdrup platform will result in fuel gas savings and CO2 emissions equivalent to 150,000 cars. Meanwhile, improvements made to compressor efficiency at Åsgard B have been identified as a way to reduce carbon emissions and is now a part of the customer's climate roadmap. Another example illustrated the value of innovative heat recovery to reduce direct power consumption.

Reference was also made to decommissioning and late life asset management, where power consumption changes significantly as activities change. An example platform, consuming power loads of 50 MW (made of two gas turbines at 25 MW each) was illustrated.

Sam also discussed possibilities for floating wind turbines to provide power for O&G facilities.

Finally, Sam detailed a checklist of considerations for individual assets, fields and basins that is intended to map decarbonisation opportunities for customers.

Wave Power and Offshore Oil and Gas

Paul Watson, Ocean Power Technologies

Source: Ocean Power Technologies

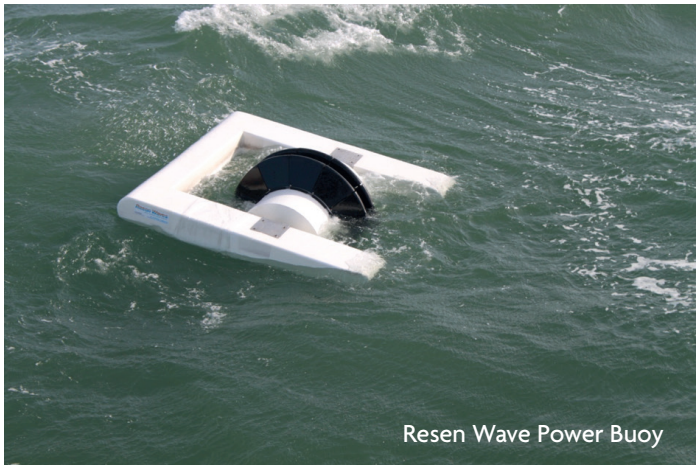
Ocean Power Technologies (OPT) is already providing power and comms services to oil installations through a wave buoy technology. The technology can provide power to unmanned underwater machines and other assets. It can, thus, avoid the considerable costs of providing fuel provisions and battery replacements by boat. It also improves safety for workers since they no longer have to engage in fuel supply work. The machine has a payload peak power of 3 kW.

The OPT PowerBuoy is described as a 'moored floating mini-spar'. Power is produced from waves and then stored in batteries in the buoy which can transmit available data continuously. Among the applications that OPT can support are: a) monitoring of areas such as exclusion zones, motions of subsea equipment and provision of real time well status data e.g. pressure and temperature; b) a range of power and control functions including powering of AUVs (autonomous underwater vehicles) and their docking stations, normally unmanned installations, meteorological data and control of various other activities such as chemical injection.

The first commercial OPT contract was with MES near Kozushima Island in the Sea of Japan, **as shown in the photograph above**. Currently the company is also testing a device with ENI in the Adriatic Sea involving charging a subsea dummy load. Over 1 MWh of energy has been generated. An OPT PB3 PowerBuoy is also deployed in the North Sea in the Huntingdon Field with Premier Oil doing monitoring work, including sensing intrusions and mooring status. After successful conclusion of this the project will move on to cover more functions involving providing power to wellhead and other equipment.

Resen Waves

Per Resen Steenstrup, Resen Waves


Resen Wave Power Buoy

Resen Waves supplies self-powering 300 - 700W instrument buoys, which provides real time data communication with customer specified instruments on the buoy and on the seabed, as a plug-and -play solution. Replacing batteries or refueling diesel generators is no longer required. The buoys generate its own power from the waves. It is a convenient way to install a spread of instruments in the sea.

It has been developed as a lightweight device that can maximize power output. The main mover behind the technology is Per Resen Steenstrup who led a previous part EU-funded project called 'Wavestar'. Per Resen Steenstrup argues that lightness of design is key to utilizing wave power in offshore niche applications. The advantages of the system are said to be based on: 'a) High efficiency, wave energy into mechanical energy, b) Low structural weight, c) Direct mechanical to electric drive and d) Simplicity – few moving parts' (quoted directly from presentation to the Conference by Per Resen Steenstrup)

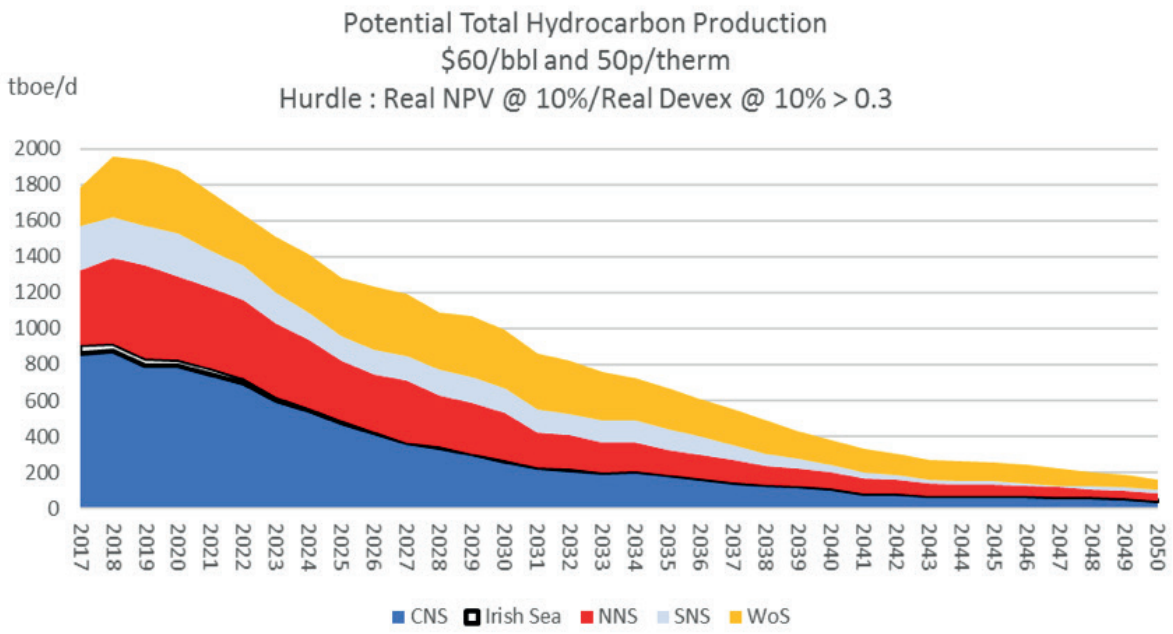
It has been offered a test cycle at the European Marine Energy Centre (EMEC) and is hoping to win contracts dealing with one or more of the following end purposes: 'Time critical monitoring in the Offshore Oil and Gas sector, Tsunami Early Warning System, National security for detecting under water intruders and Oceanographic measurements related to global warming' (quoted directly from presentation to the Conference by Per Resen Steenstrup). Resen Waves is currently doing testing at a site which is hoped to be launched as a commercial project (**see photo above**).

In general, Resen Waves operates from a 'bottom-up' approach, namely that small-scale devices are used to fill appropriate niches allowing the technology to be optimized so that it can be increased in scale to serve wider markets.

Towards a Reconciliation of Maximum Economic Recovery and Emissions Reduction in the UKCS

Professor Alex Kemp and George Colleran, University of Aberdeen

Using the assumption that oil and gas market prices remain roughly what they are today, Professor Kemp projects that current hydrocarbon production (oil and gas) from the UK North Sea will decline by nearly half by the year 2030. **A breakdown of the projected production levels according to different parts of the UK resource is given in the figure below.**



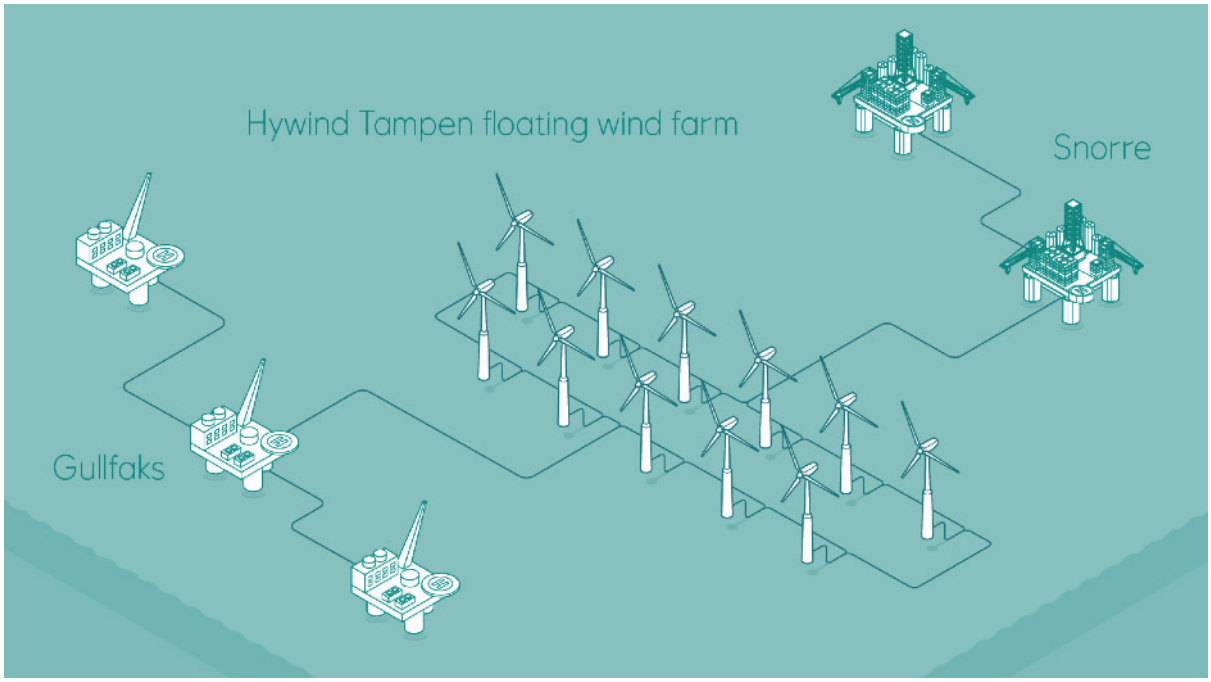
Professor Kemp examined some ways in which the industry could adapt, one technique being to work oil and gas fields in so-called clusters. His presentation argued that: 'Formation of clusters should enable economies to be made in supply of power to the constituent fields, reducing need for generation capacity and thus reducing emissions. Further research needed to discover scale of the economy'.

Also: 'Windfarms might more economically supply power to a cluster compared to individual (small) field' and 'Further development of EU ETS type scheme with higher auction prices for allowances, and/or the development of a CO2 tax offshore could lead to readier substitution of power generation from diesel or gas to generation from renewable energy sources; thereby reducing CO2 emissions'.

George Colleran led on from Alex Kemp to explain a financial analysis of the idea of powering oil and gas fields with continuous power using a hybrid gas turbine/offshore wind turbine(s) system. When power was not needed by the oil and gas facilities the wind power would be transmitted into the conventional electricity grid. The study concluded that the financial viability of marginal oil and gas developments could be improved with such a system.

Floating Wind Turbines

Giovanni Batista, Equinor



Equinor is moving strategically into the floating offshore wind business with the aim of building a strong offshore wind portfolio, whilst also using offshore wind farms to reduce the carbon footprint of their existing oil and gas activities. Floating wind turbines, relative to bottom fixed turbines, are still in a relatively early stage of development, but Equinor is continuously working on optimizing and opening up new markets for the technology.

Equinor began the demonstration phase of the floating technology with a 2.3 MW prototype in a Norwegian fjord in 2009. Next came the Hywind project off the Scottish coast which was partly financed under the UK Renewables Obligation. Now Equinor has decided to move ahead with the next stage, an 88 MW project (11 turbines) sited off the Norwegian coast to power the Snorre and Gullfaks oil installations. **A diagrammatic representation can be seen in the photo above.**

Following on from this, the company is planning some 200+ MW projects around the world. This, in turn will pave the way for 1GW scale utility projects, which will enable full industrialization of the technology allowing costs to fall to the 40-60 euros per MWh range by 2030.

How to Integrate Renewable Energy with Oil and Gas

Fraser Pritchard, Columbus Energy Partners®

All major oil and gas operating companies are evolving their strategies in an attempt to thrive as the energy transition hastens. Investment from the oil gas sector in renewables technologies is diverse. The focus is on relatively mature technologies such as wind, solar and batteries. Investment in this sector is dominated by the major oil and gas companies. There are few examples of the small and medium oil and gas companies or the engineering contracting companies promoting and using renewables.

Oil and gas and renewables key powering examples include subsea battery storage; wave energy generation for subsea; modular topsides wind and solar energy; generation; powering subsea control systems; wind powered water injection; combined floating wind and wave for high power demand.

Oil gas & renewable are "more than just powering" examples. There are a diversity of examples where renewables technologies can apply to the oil & gas sector: solar and ocean, gas to wire (power) generation, hydrogen generation (electrolysis and gas conversion), modular gas to syn-fuels and synproducts, high capacity power storage systems, macro power hubs, carbon capture, storage and enhanced recovery.

For energy system integration, we need point and system solutions.

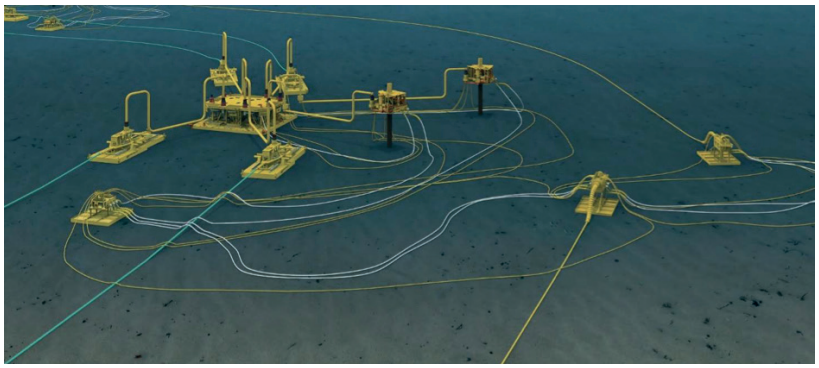
The Oil and Gas sector has been producing for 150 years. The world's energy sector is seeing a fundamental shift across all dimensions (social, political, economic) to sustainable development. Sustainable energy systems are needed today and will only grow. We need to transition faster. Oil and Gas does not need to remain as oil and gas. Oil and Gas needs system / macro use of renewables as well as point usage. Conventional development and exploitation models need to be smarter to be sustainable. Integrating the renewables and oil gas sectors is a win-win for both sectors.

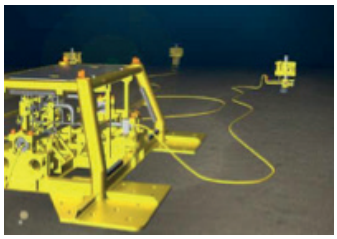
Marine renewables is a worldwide resource which requires diverse approaches. Oil and Gas is slowly embracing renewables usage though much more can be done to integrate. It is too easy to say integration is unconventional and cannot be done. Sustainable development is here and is growing and is needed everywhere. There is immense diversity of solutions for renewables as Oil and Gas power and for transforming Oil Gas value. We need to recognise and deploy the potential for integrating Renewables and Oil Gas to benefit both sectors. All forms of energy can be converted into other forms of energy, so there is no excuse not to integrate. Hence the message for the business is: do not remain isolated – adopt a system approach to deliver the right commodity.

Source: Oil and Gas Authority

Powering Subsea Developments with Marine Renewables

Keith Anderson, Wood plc





Picture of electrified sub-sea systems

Keith stated that currently traditional oil platforms have relatively large power needs, generating power from gas compression of diesel generators to satisfy anywhere from 5MW for limited operations up to 150MW+ of demand. Power generation is critical to operations, from maintaining safe operations on manned installations, economically for maintaining production and avoiding adverse reputational impacts from power blackouts offshore as has been seen in the media over the last few years.

The power demand of offshore platforms is too large to be satisfied by marine renewables. There are opportunities to reduce the carbon footprint of oil and gas activities on traditional platforms through providing balance of power in later life and reduced demand during decommissioning, but is this really a significant play for marine renewables other than offshore wind?

There is an alternative opportunity to power the subsea architecture for platform tiebacks. Currently the standard industrial practice involves electrohydraulic (hydraulics and electric power / signal) control systems to drive valves, modulate signal and control, and provide a means for chemical injection. This is services via an 'umbilical' connection with the subsea architecture. Yet this is expensive, time-consuming and also vulnerable since it involves a single point of failure.

With the electrification of subsea equipment including remote communications, subsea hydraulic power units and subsea chemical injection solutions the power demands are significantly less than on the host platform and open up the possibility of power supply from marine renewables.

Power requirements can be reduced to a few 10s of kW peak load with significantly less constant load for the control and injection services of a small multi-well tieback, if we exclude subsea pumping and compression facilities for more advanced developments. The power generator should be sized for constant demand plus sufficient excess to allow trickle charging of battery storage facilities. Peak load would be supplied through this battery storage, reacting to valve commands and attenuating peak load requirements on the power generator whilst providing back up for times of low energy generation.

Such a system opens the doors for supply from a range of marine renewable solutions and potentially thermal generation.

As a conclusion, industry has been edging towards negating umbilical connection with the subsea architecture to reduce costs in marginal developments. Technology development now supports remote subsea facilities with localized equipment. Remote power generation and storage is implicit in this solution. Operators will want a holistic solution to developing these subsea fields, the opportunity now is to integrate these aspects and provide that solution.

Concluding comments from a panel discussion

The discussion in this section was coordinated by Fraser Pritchard from Columbus Energy Partners® and Jacqui Watt from Opportunity North East.

The Conference ended with a panel discussion, and some of the key comments can be seen below (as reproduced following a post conference discussion):

David Toke

We may see a situation where we have tremendous development for offshore wind power particularly offshore floating wind power in the future than smaller developments in the offshore industry which is not just oil and gas of course, there are other power needs – offshore meteorological for instance and other needs that can be supplied by wave power and these niches can allow a bigger industry to develop because if you get an increased number of machines required then economies of scale can occur and you can cut the costs of the wave power machines and at the same time perhaps scale them up to be bigger. So in this way we can get an industry going.

Equinor are using the oil and gas installations' power needs as a niche for developing floating wind turbines. Of particular interest is the way that a couple of wave power companies at this conference explained how they are, or could be, supplying power in different ways for existing oil and gas installations whether it be conventional rigs or to subsea automated systems involving power for batteries and autonomous vehicles and so on.

The transition to marine renewable can move ahead with a mixture of the right sorts of regulatory changes and incentives for the energy industry itself and a little lateral far sighted thinking from the energy industries themselves to get things moving in the right direction. One of the challenges is that there is a certain lack of confidence in these new technologies. The situation might be helped by additional government grants and incentives. That's a different picture.

At the end of the day in theory it should not need that because there are potential cost savings from for instance wave power machines providing power to offshore installations. The different tariffs are very considerable because you don't have to send expensive boats in to deliver fuel or replace batteries so it is a matter of greater confidence in the industry themselves they have got an awful lot to gain in these things and relatively little to lose because technologies are not actually that expensive compared to the potential cost savings.

Marc Gronwald

In general, on the one hand, I was a bit surprised about how much carbon is emitted in the context of offshore oil and gas production, maybe 2 - 3% of UK's annual carbon emissions, if I remember that correctly; so that surprised me a little bit. But I thought at the same time, while that is a bit of a negative surprise, I was also positively surprised to learn about all these existing technologies we learned about at the seminar; both floating wind turbines and these wave energy machines. I was actually positively

surprised to what the industry is already doing. I am also positively surprised about the awareness within the industry about the problems and the challenges so I think this is a good sign that the industry is aware that something has to be done.

To what extent are the industries aware of technologies? I assume in principle there is awareness but then facilitating events such as the one we facilitated is important as it helps to bring people together. I am sure people also meet at events such as Offshore Europe. Sometimes I am thinking maybe more networking events would help bring people together. Essentially demand and supply for technology meet, to express this in economic terms. A facilitating place where people can meet and exchange ideas, learn about what needs are and what possible solutions are. I think that is maybe a way to help in this process.

Alex Kemp

I was very impressed with the range of technologies which are either undergoing R and D or they are a bit more advanced than the R and D phase. That was a bit of a revelation to me to hear about how many technologies were being at least at the R and D stage and some at the implementation stage. I am quite happy with what the others said about all that. I am an economist and I am more interested in the economic viability of it and that is where more needs to be discussed. The policy is to encourage these technologies. We can have an idea of the potential benefits they will have in terms of reducing the emissions and I should say at this stage that my research proposal with a potential sponsor is really entirely devoted to the economics of some of these technologies and their application in the North Sea. My scope of work which we would be proposing to research involves probably offshore oil and gas fields supplied by windfarms and batteries on the sea bed providing back-up. We are maybe going to do a joint research on subsea batteries for example with an SME.

Then there is the possibility of providing power from onshore windfarms for offshore oil and gas operations. And we want to look at the economics of decommissioning. The power requirements there are actually very substantial because the activity demands a lot of power. And then the there is the future of the EU emissions training scheme or any post Brexit alternative to foster the substitution of diesel and gas with other non CO2 producing sources.

One of the issues will be the operator requiring evidence that the new technology will actually work as the developer says. That is always an issue because there will be a big risk if it doesn't work at all. That is one issue. The other is the uncertainty about the future of the turbine price. How big will it be. At the moment the oil companies on a precautionary principle are making shadow calculations of the price that the CO2 emissions allowances or carbon tax might be. As we know, no final decisions have been made because we are not in a post Brexit situation yet and we can't be quite sure what the government will do even though it is committed to net zero by 2050 or 2045.

There was a discussion between **David Toke** and **Alex Kemp** about the economics. **Alex Kemp** argued that increases in the carbon price were necessary to make wind power competitive with the price of natural gas. On the other hand **David Toke** argued that wave power machines already offered large savings in niche offshore operations where there are no power lines or pipelines and where gas or power had to be expensively shipped in, and thus the carbon price was not an issue.

Marc Gronwald argues that carbon pricing is a key instrument in this context. As Alex said before, if natural gas is readily available, it is the cheapest so something has to be done to at least make it relatively more expensive. Thus, introducing or increasing the carbon price in this context helps because then other technologies become relatively cheaper. I think carbon pricing is a key instrument.

David Toke, on the other hand argued that further increases in carbon prices may not be necessary since it was policies involving issuing premium price long term contracts (e.g. feed-in tariffs) which provided niches for wind power and solar power. This allowed the technologies to optimise and their costs dropped very greatly as a result. Setting high carbon prices are not politically popular and they increase prices by a lot more than feed in tariffs. Rather we should set the right incentives and the right regulatory environment to promote the range of technologies that are appropriate.

Challenges and opportunities

David Toke

Well, the challenge is the potential for the declining or lack of increase initially in oil demand. And the opportunity is for the oil industry to be more far sighted in investing in innovative renewable energy technologies including wave power and they have got a fantastic opportunity to do this in offshore operations. The challenge for the integration of the oil and gas and the renewable energy industries, or what really is the transition from one into the other is the lack of confidence in new technologies. The oil and gas industry need to appoint more people and get through to the people who order the contracts, they need to prioritise innovation

Alex Kemp

OK, the big challenge is for the government to come forward with an energy policy which will show how we, Scotland and the UK, are going to meet their targets for reducing emissions. They have conspicuously failed to do that. They do not exhibit policy instruments. It is incumbent on both governments to indicate clearly what their policy instruments they propose that ensure that we get to zero emissions 2050 or 2045. In the political debate it is shocking that none of them really address the issues.

They just said what we are going to do, we are going to electric heating in our houses but they do not come up with the policy instruments. The same applies to the offshore which, in terms of the overall picture in the UK. I must remind that 3% emissions is quite a lot but it is nothing like we all emit in our cars and heating our houses at the moment. So that is the big challenge and our politicians have failed us so far.

As far as the new technologies are concerned that we talked about at the conference, I got every indication that the SMEs were coming forward with bright ideas and in fact I have already had talks with one of them and we are maybe going to do a joint research on subsea batteries for example, we will look at the economics of that. The SMEs will come forward with ideas but they have got to know what the policy framework is whether subsidies, for what length of time.

The subsidies in the past have been put on and then taken off for various renewable energy sources. We need a policy framework. The SMEs, well they certainly respond. The operators will want some assurances that the technologies are going to work and we might have mentioned that the OGTC now has a program in place where they can help with testing a technology, so that is a great step there so I don't think we need worry about the willingness of companies to enter the industry, come up with resources, that is all fine. But they do need a clear policy framework and similarly the oil companies they might make big commitments. They will want to know what the policy framework is.

Concluding comments

David Toke

Yes, I can go along with a lot of that. But I'm sure that we can all agree that the oil and gas industry can do a lot now by taking not much of a risk by investing in wave power and other marine energy devices to supply power for offshore oil and gas activities. Everybody agrees that there is big niche potential for marine renewable energy devices, wave or tidal stream, to provide power to the increasing trend towards sub-sea autonomous power operations. And we can see that wave power is already being used to supply power to offshore activities in demonstration schemes. Such technologies promise to save lots of money in the process and create immense opportunities for the industry to transition to sustainable renewable energy sources.

Colin McHardy, SME Diversification Manager, Opportunity North East

The oil and gas industry will be critical in supporting and helping develop the supply chain to deliver clean energy technologies. Scaling up these technologies and bringing down their costs will rely on large-scale engineering and project management capabilities, qualities that exist within the sector. As an industry it is imperative that we adopt innovative technologies in line with delivering cost efficiencies and reducing carbon emissions.

Summary

This section provides a short summary of some of the issues raised by the presenters. Note: this summary is the responsibility of the editors and does not necessarily reflect the views of the presenters themselves.

Two issues were addressed by the presenters. First, strategies are required that can reduce the carbon footprint of the offshore oil and gas industry and, second, how this may involve marine renewables. It does seem that many opportunities exist for techniques which result in using energy more efficiently. Regarding the use of marine renewables, the following can be said:

a) Floating offshore wind turbines appear to have a considerable potential in providing power to existing oil platforms, and such opportunities seem likely to provide opportunities for the technological optimisation of floating wind power.

b) On the other hand, opportunities for provision of power from renewable for decommissioning are plausible, but need to be well planned and coordinated in order to fit in with planning and operational timelines.

c) Opportunities may exist for supply of power to oil rigs from 'hybrid' systems involving wind power combined with gas turbines to produce 'firm' constant levels of power – or, more conventionally from shore based renewable energy systems.

d) Some presenters argue (with evidence, for example, demonstrated by Ocean Power Technologies (OPT)) that there are various types of power needs that may be supplied by marine renewables, including wave power machines, for conventional oil rigs.

e) On the other hand, there is a strong argument that there are excellent opportunities, perhaps the best opportunities, for relatively small sized marine renewables, including wave power machines, to provide power to electrified sub-sea oil systems. Such systems involve both a reduction in power usage compared to conventional rigs but also provide opportunities for marine renewables to provide power to batteries which can then deliver outputs as required for different purposes.

f) All operators need to think pro-actively and holistically in order to achieve more energy efficient technologies that help a sustainable energy transition through offering niches for marine renewable and lower carbon solutions.

END

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