## scottish renewables

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**Ocean Energy** 



Claire Mack Chief Executive Scottish Renewables

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## Where are we now?

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## Kersti Berge Director for Energy and Climate Change Scottish Government

# Vision for Scotland's energy future

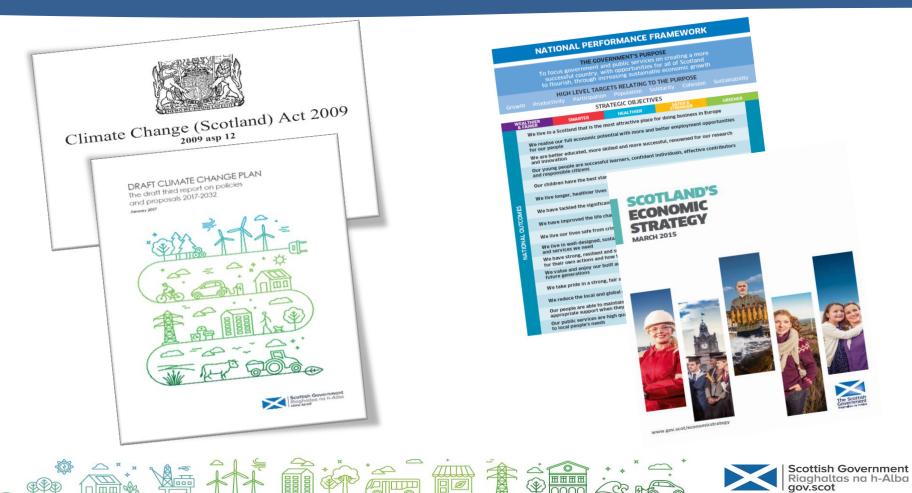
Kersti Berge Director for Energy and Climate Change

4



#### Decarbonising – the drivers

()



#### 2050 Vision

- Scotland has achieved almost complete decarbonisation of the energy system in line with domestic and international climate change targets
- The equivalent of 50% of all energy consumed in Scotland from renewable sources by 2030
- Scotland is a world-leader in renewable and low carbon technologies and services and continues to offer technology solutions in oil and gas, and excellence in subsea engineering. This knowledge and expertise is exported internationally
- Communities benefit extensively from low carbon heat networks
- Carbon capture and storage is operational at large scale and plays a crucial role in decarbonising Scotland's energy system and industrial processes
- New forms of flexible generation and demand management services are widespread
- Shared ownership of renewables and of local energy systems maximise benefits to Scotland's communities



### **Carbon Emissions**

### **Economic Impact**

### **Security of Supply**

### Fairness

### **Consumer Costs**



### Charting a new course – aims for energy policy

#### Scottish Energy Strategy



- 'Whole-system' view
- Economic modelling, informing view of Scotland's future energy supply and demand
- Integrated approach to heat, power and transport
- New 50% 'all energy' 2030 renewables target
- Renewed focus on energy efficiency and energy demand reduction
- Flexibility



### **Inclusive transition**

- Tackling fuel poverty and inequality
- Support "high carbon" communities through the transition
- Just Transition Commission



### A smarter model of local energy provision

- Encouragement for new localised models of energy supply and use
- Enhanced role for local planning and local ownership
- New economic opportunities of energy storage and 'smart' energy solutions



#### Success

#### Scotland remains the world leaders in marine:

- Atlantis Energy's MeyGen project in in the Pentland Firth the world's largest tidal stream array entered commercial operations in March 2018
- On 21 August 2018 **Scotrenewables** announced that its 'SR2000' tidal turbine in Orkney has generated 3 GWh in the past 12 months.
- EMEC has tested 30 different wave and tidal energy devices to date.
- Nova Innovation successfully deployed a third turbine at its Shetland Tidal Array

#### Commitments

- Support for innovation and cost reduction in wave energy, through continued funding for Wave Energy Scotland
- Finance support for marine energy projects through the Renewable Energy Investment Fund – and other financial support mechanisms



- Ministerial Marine Energy Taskforce maximising the opportunity
- Continue to engage with UK Government on an offer support for marine renewable technologies one voice
- Developing the economic picture
- Re-engaging the private investment community the strong industrial potential of marine energy



## Sue Barr Board Member Scottish Renewables

### **Claire Mack**

### Chief Executive, Scottish Renewables

## Kersti Berge

### Director for Energy and Climate Change, Scottish Government

### **Sue Barr**

**Board Member, Scottish Renewables** 

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**Ocean Energy** 



## Building momentum: telling our story

Tweet @ScotRenew



Peter Duncan Managing Director Message Matters



## Making waves telling your story

A Message Matters Presentation for Scottish Renewables Marine Conference



## The national political & policy environment









### See the opportunity in policy uncertainty





## **Opportunity: technological leadership**

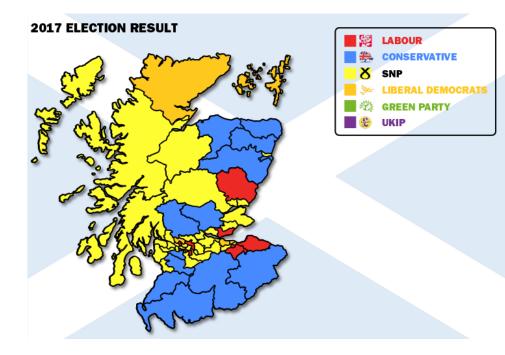




"Brexit *dividend*" being replaced by "brexit *imperative*"



## **Opportunity in the politics**



- Tiny government majority
- Scots Tories on back foot on onshore renewables
- Whisky comparison



## "Get your story <u>straight</u>, time it <u>perfectly</u>, and tell it <u>relentlessly</u>."

**Dan Pfeiffer** 



"The wind is changing direction on renewables generally. The only question is how quickly and how far will the implications reach?"

Scottish Govt adviser

"Far too easy for governments to play politics on marine technology. That's assisted by too many voices with slightly different messages - industry needs to speak with one voice"

UK Select Committee member

### Talk the right language

• Be absolutely clear on your ask -

investment/route to market

- Work together benefits will be shared
- Differentiate your message from wind

technology - fundamentally different



### **Speaking the right language**





### CfD policy

reversal

**Global technological** 

leadership

**Prioritised** 

investment





Key message: Don't be distracted seize this moment

## Audrey Maclver Director of Energy and Low Carbon Highlands and Islands Enterprise

### MARINE ENERGY: POWER, PEOPLE, PLACES

AUDREY MACIVER DIRECTOR OF ENERGY & LOW CARBON

26 SEPTEMBER 2018



## OUR VISION A HIGHLY SCOMPETITIVE SUCCESSFUL REGION For the Highlands and Islands to be a highly successful and competitive region in which increasing numbers of people choose to live, work, study and invest. OUR PURPOSE SUSTAINABLE SUSTAINABLE CONOMIC GROWTH To generate sustainable and inclusive growth across the Highlands and Islands.

### OUR PRIORITIES DEVELOPING CREATING SUPPORTING STRENGTHENING

- Supporting businesses and social enterprises to shape and realise their growth aspirations
- Strengthening communities and fragile areas
- Developing growth sectors, particularly distinctive regional opportunities
- Creating the conditions for a competitive and low-carbon region

#### DRIVERS OF CHANGE

1975





Establishment of Highlands and Islands Development Board (HIDB)

Local government reform



1970's

Exploitation of North Sea oil



1970/80/90's

Upgrading of transport infrastructure



Upgrading of telecoms infrastructure

1980/90/00s

2010/20s

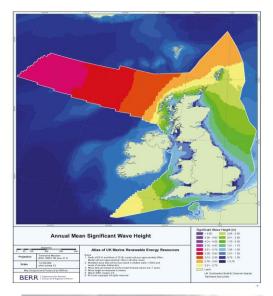


Marine Energy



## Why Marine Energy?

- Natural, competitive advantage
- Strong fit with HIE purpose
- Unique physical assets (>£160m invested in ports and harbours in last 8 years)
- Experienced supply chain (oil/gas diversification, marine operators, consultancy support, manufacturing)
- Academic excellence (ICIT, SAMs, ERI)





### **Our commitment to Marine Energy**

- Led development of EMEC
  - 2003 Wave site
  - 2006 Tidal site
  - Nursery sites
  - >£35m total investment
- Supported investment, innovation and R&D (e.g. WATERS, REIF, EIF)
- Established Wave Energy Scotland



### **EMEC**, Orkney

A GLOBAL CENTRE OF EXCELLENCE IN MARINE ENERGY TESTING AND RESEARCH











countries



Cumulative Impacts (up to 2017 <u>)</u>	Jobs	Earnings	GVA
	FTE years	(£m)	(£m)
Orkney	1,653	55.9	98.3
Highlands & Islands	1,969	65.0	116.3
Scotland	3,244	113.9	213.6
UK	4,227	149.8	284.7



### WES

- HIE subsidiary, est 2014
- 84 projects (PTO, Materials, NWEC, Control Systems)
- £30.9m invested
- 177 organisations
- 13 countries
- Over 100 documents published <u>http://library.waveenergyscotl</u> and.co.uk/.





## Near and Mid-term Ambitions

- Celebrate and communicate success
- Support/influence conditions necessary to create market (domestic and international)
- Marine Energy established as a key driver of the Marine and Rural Economy
- Competitive, agile, robust, internationally renowned supply chain
- Continued excellence in R, D & D







# **CLOSING REMARKS**

- We must continue to build a robust evidence base
  - Power
  - People
  - Place
- We have a fantastic story to tell let's tell it better
- We need a collective determination to stay the course – "keep the faith"
- Persistence and optimism is well founded



### THANK YOU

# Rémi Gruet CEO Ocean Energy Europe

Download presentation here

# Gavin McPherson Head of Policy and Research Nova Innovation



### **Building Momentum: telling our story**

Scottish Renewables Marine Energy Conference 26<sup>th</sup> September 2018 Gavin McPherson, Nova Innovation, Head of Policy and Research

**NOVA** INNOVATION

#### 26 SEPTEMBER 2018

#### Nova Innovation is a tidal energy technology and project developer We design, build, deploy and operate tidal

- We design, build, deploy and operate tidal turbines and develop tidal energy projects
- Based in Edinburgh, 35 employees

Nova Innovation

Introduction

2016: installed the world's first offshore tidal

array

- 3x Nova M100 turbines operational since 2016
- Investing in direct drive technology (TiPA, D2T2)
- Doubling array size to 6 turbines (EnFAIT) and adding energy storage (TESS)







# A 100kW 'plug and play' power station



#### Full water to wire solution

- Invisible seabed-mounted, no visual or navigational impact
- Simple low cost vessels; no heavy port infrastructure required
- Modular container-ready for easy transport by road, rail or sea
- Adaptable suitable for a wide range of site conditions – large addressable market
- Local small size maximises local benefits for small vessels and onshore operations
- **TESS** Integrated Tidal Energy Storage System

# **Telling our story**



## The Shetland Tidal Array: a Local Hero

#### - Array build: 80% UK content

- > Small scale device suits local UK supply chain
- > Steel, services, components
- > Operations phase > 90% UK content

#### - Array build: 25% local content

- > Vessels, services, blades (Shetland Composites)
- > 30+ suppliers from Shetland and Orkney
- Regional impact a huge benefit for small-scale marine energy projects

#### • UK content is great, but exports are better

- > Build a UK supply chain and export to the world
- > Learn lessons from Danish wind ...



44



0.8 ₿

Graphical representation of wind

			exports per capita		
Country	Denmark	UK		Øresund BridgeBritish	
				WIESUIIU BIIUgeBritish	
Population	5.7 million	65.6 million		Bulldog	
Installed wind capacity	5,476 MW	18,872 MW			
Wind capacity per capita	1.0 kW/person	0.3 kW/person	204 M	Not actual siz	5
Wind sector employment	32,898	14,000			E.
Wind sector turnover	15.7 Billion EUR	7.8 Billion EUR	<b>→</b> ↓		
Wind sector exports	7.3 Billion EUR	0.3 Billion EUR		Tal-	1
UK arms exports 2016: 7.2 Billion EUR, whisky exports 4.9 Billion EU					
Wind exports per capita	1,280 EUR	5 EUR		WWW.NOVAINNOVATION.CC	M

# Lessons from wind: UK v Denmark, 1990

UK wind

in 1990



Danish wind in 1990

Installed capacity: 343 MW

Mostly ~100 kW turbines, almost all Danish machines

Building first **offshore** wind farm (Vindeby, 4.95 MW)

4 major turbine manufacturers (Vestas, Bonus, Nordtank, Micon)





 $\sim$ 

 $\sim$ 

Installed capacity: 4.3 MW

10 years behind Denmark

Building first **onshore** wind farm

(Delabole, 4 MW)

1 major UK turbine manufacturer (Wind

Energy Group)

By 1990 the Danes had built an unassailable lead (probably)

Lessons from Denmark Lesson 1: Capture first mover advantage Lesson 2: Create a domestic market

WWW.NOVAINNOVATION.COM

26 SEPTEMBER 2018

35

Spend (£ millions)

Annual Public R&D

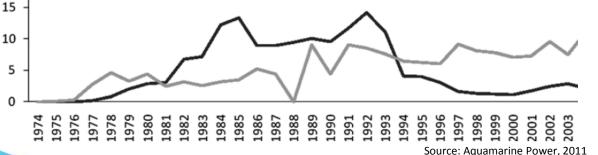
# Lessons from wind: what support mechanism?

#### Grant funding?

- Denmark and UK had similar levels of grant funding
- 1980-2000: Denmark 140m EUR, UK 170m EUR ٠
- Both focused on large-scale machines ٠
- Other countries also in the race; e.g. US spent 10x more U.K. Wind Energy R&D 30

Danish Wind Energy R&D

#### 25 Lesson 3: Grant funding on its own is not enough 20





630 kW Nibe B

Nibe, Denmark

Dansk Vindteknik

(1980)





3000 kW LS1 (1987) Burgar Hill, Orkney

Wind Energy Group

WWW.NOVAINNOVATION.COM



# Lessons from wind: what support mechanism?



### Market support?



- 1980 30% capital grant support for wind projects
- **1984** Fixed price tariffs for wind energy (combined with capital grants)
- 1990 Feed-in tariffs for wind
- 1980-90 26 Danish companies sold 3+ turbines
- **1992** 12,209 turbines installed, 72% exports
- 1998 Final UK large-scale wind turbine supplier WEG sold to Danish NEG Micon (now Vestas)
- 2000 700M EUR invested, 2.3 GW installed, 19TWh generated: 41 €/MWh
- 2016 7.3 billion EUR wind sector exports

- 1990 Non-Fossil Fuel Obligation
  - 6 years after Danish tariffs; auction not FIT
  - Seeking lowest cost; short-term deadlines; just 1 UK turbine supplier (WEG)
  - 49% of projects completed (32% by MW)
  - 83% of turbines were imported

'it is doubtful that another mechanism could have been more successful in supporting a foreign industry than compelling all developments to occur within a short period of time when the domestic industry is in its infancy' (UK Welsh Affairs SC 1994)

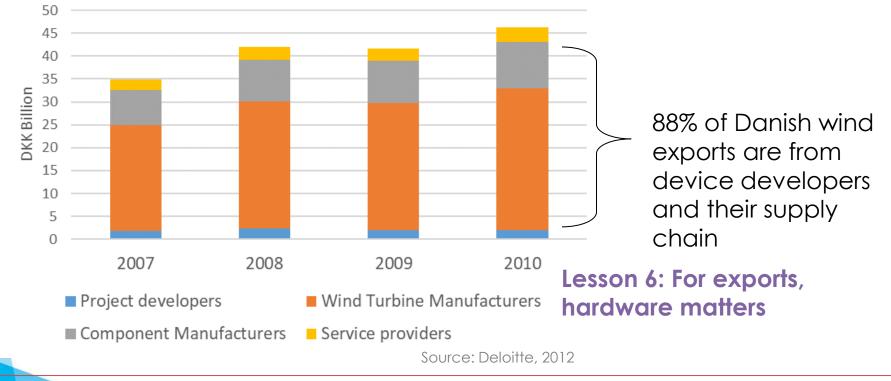
- 2000 300M EUR invested, 0.4 GW installed,
  4.6TWh generated: 67 €/MWh
- 2016 0.3 billion EUR wind sector exports

Lesson 4: Revenue support works ...

Lesson 5: ... but the structure and timing matters (e.g. CFD)

# Lessons from wind: which subsectors matter?





- Lesson 1: Capture first mover advantage
- Lesson 2: Create a domestic market
- Lesson 3: Grant funding on its own is not enough
- Lesson 4: Revenue support works ...
- Lesson 5: ... but the structure and timing matters
- Lesson 6: For exports, hardware matters



# Thanks for your attention





### **Sue Barr**

**Board Member, Scottish Renewables** 

### **Peter Duncan**

Managing Director, Message Matters

### **Audrey Maclver**

Director of Energy and Low Carbon, Highlands and Islands Enterprise

Rémi Gruet CEO, Ocean Energy Europe

## **Gavin McPherson**

Head of Policy and Research, Nova Innovation

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**Ocean Energy** 



# Lunchtime Event: Leading Europe's Marine Supply Chain Into Global Markets

# Download presentation here

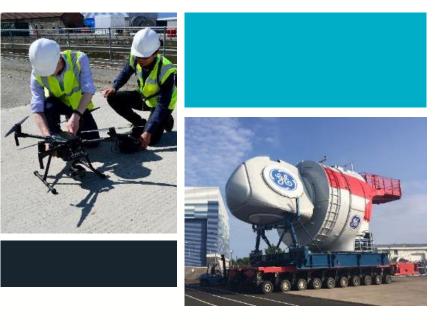


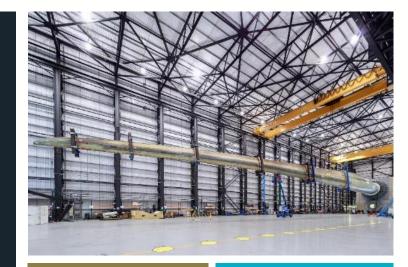
# Innovating our way down the cost curve and delivering a route to market

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# Miriam Noonan Financial Analyst Offshore Renewable Energy Catapult







26/09/2018 Miriam Noonan





### Agenda

- Introduction to the Offshore Renewable Energy Catapult
- Our place in the industry and how we work with SMEs
- Cost reduction pathway
- Supply chain route to market
- Case study: EnFAIT



#### Our mission

To accelerate the creation and growth of UK companies in the ORE sector

Our vision

By 2030, ORE Catapult will be the world's leading offshore renewables technology centre

- Centres of Excellence
- Academic Research Hubs in partnership with leading universities

• Expanding our assets in Blyth and Levenmouth the world's foremost open-access facilities



#### Marine energy has been assessed against 3 key tests



• The UK government's clean growth strategy has set out three tests.



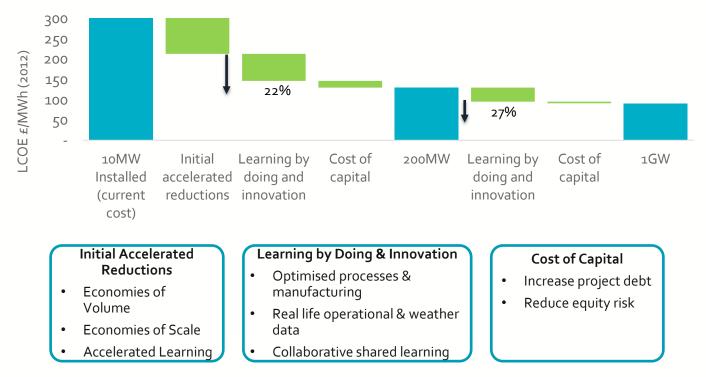
• This study is assessing how the UK's Tidal Stream and Wave Energy industries can perform against these tests.

<u>Link to report:</u> • \*Tidal stream has been assessed against all three test and wave energy against tests 2 and 3. <u>https://s3-eu-west-1.amazonaws.com/media.newore.catapult/app/uploads/2018/05/04120736/Tidal-Stream-and-Wave-Energy-Cost-Reduction-and-Ind-Benefit-FINAL-v03.02.pdf</u>

#### Test 1: Cost Reduction Pathway



#### Tidal Stream LCOE reduction



LCOE expressed in pre-tax real, 2012

#### Link to report:

https://sg-eu-west-1.amazonaws.com/media.newore.catapult/app/uploads/2018/05/04120736/Tidal-Stream-and-Wave-Energy-Cost-Reduction-and-Ind-Benefit-FINAL-v03.02.pdf



Qualitative Study with 25 industry stakeholders covering technology developers, supply chain companies, insurers, financers and research institutes.

Industry respondents highlighted a number of key areas where innovation is being driven through close co-operation between supply chain and project developers in order to reduce lifetime costs and improve performance and reliability.

 Using local suppliers who understand site conditions
 Device accessibility
 Expertise from other industries
 Standardisation
 Continuous project pipeline



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#### EnFAIT

# 

- EnFAIT will demonstrate a grid connected tidal energy array at a real-world tidal energy site, propelling tidal energy towards competing on a commercial basis with alternative renewable sources of energy generation.
- Project commenced in July 2017 and will run until June 2022 at the Bluemull Sound site in Shetland.
- Scale up Nova's existing operational Shetland Tidal Array of 3 x 100kW devices to 6 x 100kW, allowing the delivery of real-world results from day one and building upon significant existing investment.
  - EU €20.2 million flagship tidal energy project.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement number 745862.





# 

- Demonstrate the development, operation and decommissioning of the world's first tidal array of six turbines over 5 years to prove a cost reduction pathway for tidal energy and that it can be cost competitive with other forms of renewable energy.
- In a world-first, turbines will be repositioned to explore effects of array configuration on efficiency and on reducing cost of energy.
- Operation and maintenance strategies will be considered
- Computer modelling software will determine the most efficient and effective array layout.
- Generate common, fundamental learning for the wider ocean energy sector.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement number 745862.



Nova Innovation Ltd

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ore.catapult.org.uk 🔰 @orecatapult

# Louise Dalton Senior Associate CMS

#### **Your World First**



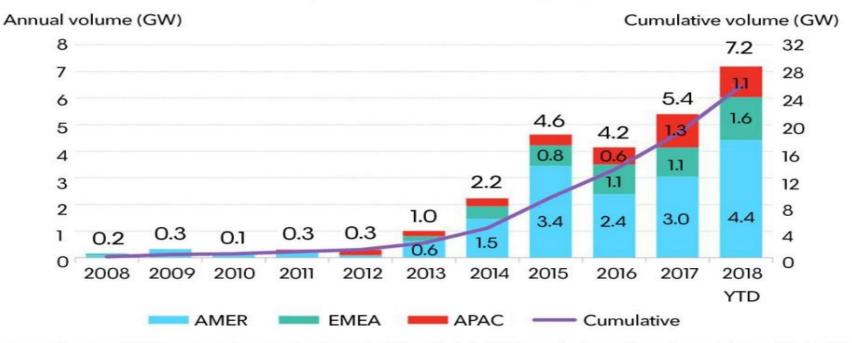
Law.Tax

# **Corporate PPAs**

### Louise Dalton, Senior Associate, CMS

### **Global volume of Corporate PPAs**

Global corporate PPA volumes, by region



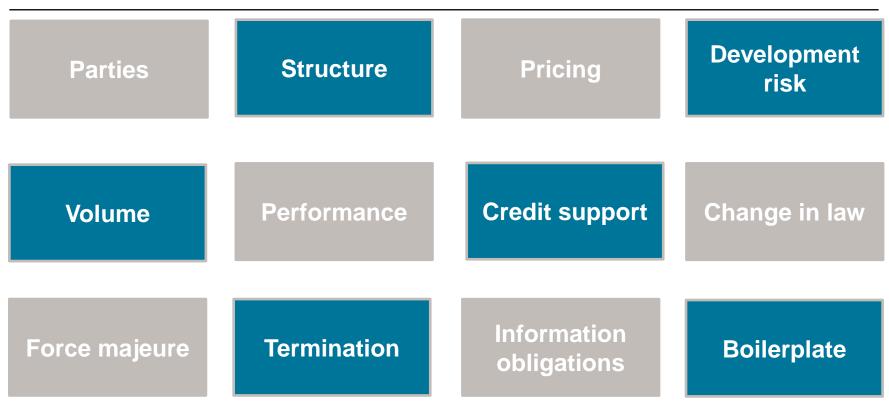
Source: Bloomberg NEF. Note: Data is through July 2018. Onsite PPAs not included. APAC number is an estimate. Pre-market reform Mexico PPAs are not included. These figures are subject to change and may be updated as more information is made available.

### **European Corporate PPA market**



Source: Bloomberg New Energy Finance

### **Corporate PPAs: Key issues**



# Jonathan Hodges Senior Innovation Engineer Wave Energy Scotland

### Wave Energy Scotland Research, Development and Innovation



HIE Highlands and Islands Enterprise Iomairt na Gàidhealtachd 's nan Eilear

Jonathan Hodges – Senior Innovation Engineer Scottish Renewables Marine Conference 2018

# Contents

- Wave Energy Scotland
- Work programme
- Supporting technology
- Innovation opportunities
- Next steps for the WES programme



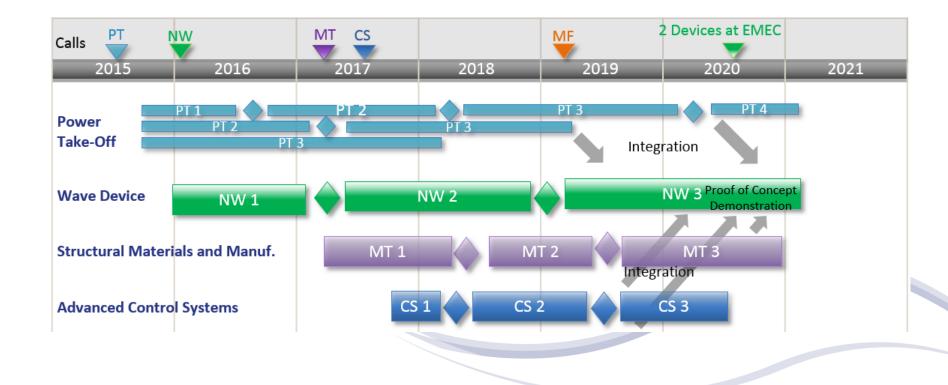


## Wave Energy Scotland



- Funded by the Scottish Government
- Established in Nov 2014 as a subsidiary of HIE
- Develop cost competitive wave technology
- Deliver objectives through a Research, Development and Innovation Programme
- Four competitive programmes, Device, PTO, Controls, Materials
- 177 Organisations
- £30.9m committed expenditure
- 84 Contracts
- 13 countries

## WES Technology Work Programme



## Supporting technology

- Competition and collaboration
- Integration support
- Standardisation
  - Standards development
  - Metrics
- Structured Innovation
  - Tool development DTOceanPLUS



wave energy SCOTLAND HIE Highlands and Islands Enterprise

## Seeking innovation



#### Seeking further step-change LCOE reductions....

• Supporting Infrastructure

# Electrical Connection









# Next steps





Questions?

See.

# Andrew Smith Managing Director Deja Blue Consulting

### DEJA BLUE

SR Marine Conference 2018 Innovating our way down the cost curve and delivering a route to market

#### An investment perspective

MEMBEROF scottish renewables 2017-2018



Ocean Energy Europe



- Preparing for and executing fund raising
- Contributing to the Development of EU Fund Design
- Structure and close the financing of projects
- Associates of Greenbackers Investment Capital who are cleantech investment specialists and represent an SEIS/EIS fund
- Running bespoke pitching events
- Non exec and board roles e.g. Our Community Energy Chairman





### How wave & tidal technologies might reduce costs

- Marcella Askew, Seabased: "There's nothing more exciting than working in an industry that does not exist. ...... and you can save the world at the same time.
- "If I was going to have a challenge I would say R&D needs to start talking to commercial from day one, and commercial needs to figure out how to talk to R&D and respect their answers. If we have more of this, things could move a bit faster."
- step changes not gliding down a cost curve
- deployment, recovery, maintenance
- collaboration, consolidation, look around is your space crowded?
- If you are developing a technology really think about what is new about what you are doing – do you need to spend time, effort and money on a bespoke element if a tried and tested one (and thus a bankable one) already exists







- why is it important to talk about the cost curve? is it important from an investor perspective?
- are we falling into a trap? cost of capital as a factor;
- £57.50! Offshore wind for 2022/23 ......
- a halving in price in just over 2 years ...
- a multi-billion pound industry with great benefits for the UK supply chain
- a new, homegrown industry with manufacturing, jobs and profits all retained in UK and with the knowledge and expertise anchored here which can become a strong, post brexit, high growth, exporting industry ? ..... well NO – all of that was lost to UK when we failed to carry on supporting the development of the turbines just a few short years ago.......
- what can we learn from that ...... the next 2 big off shore technology sectors that will dominate the energy business worldwide are happening right here off the UK coast – floating wind and tidal energy and the third, the much larger but harder to crack wave sector is "anchored" here too! But not for much longer





# Revenue opportunities in a smart, flexible energy system

- what are you selling? hybrid? electricity? solutions?
- think about communities as a positive source of funding, support, shared ownership as a key part of a really good narrative that will benefit from delivering on policy objectives
- play the "blue" card
- sustainable islands
- collaboration
- the Blue Economy







- Collaborate
- Communities
- Preparation
- Datarooms
- Identify risks, look at them from an equity & banking (debt) perspective, mitigate them, allocate them
- If you are funding a project make it bankable seabed, cable, grid, consenting, contracting, solve the problems before you ask for £ if you don't you wont get £ and you will lose credibility
- Engage early with supply chain how its manufactured, to be deployed and recovered and maintained should inform design decisions





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Ocean Energy Europe

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#### Louise Dalton

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# **Priorities for action**

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#### **Hannah Smith**

#### Senior Policy Manager, Scottish Renewables

#### **Sian Wilson**

#### Senior Development Manager, Crown Estate Scotland

#### **Cameron Smith**

**Director, SIMEC Atlantis** 

#### **Andrew Scott**

Chief Executive Officer, Scotrenewables Tidal Power

**Richard Yemm** 

Director, Quoceant

**Patricia Hawthorn** 

Partner, Shepherd + Wedderburn LLP

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