Global Ocean Energy
The Next Generation

Neil Kermode
Managing Director
Marine Energy as a driver of the regional economy

Highlands and Islands Enterprise

Calum Davidson

Director – Energy and Low Carbon
The Highlands and Islands of Scotland

• A rural region on the North and West of Scotland, with a population of 450,000
• Larger than Belgium, more coast than France, with 90 inhabited islands, with a Scandinavian style of rurality
• 25% of Europe’s tidal, wave and wind resource, 40 years of Oil and Gas reserves
Highlands and Islands Enterprise

• Scottish Government economic and community development agency
  – Business
  – Infrastructure
  – Policy
  – Internationalisation
  – Inward Investment
  – 250 staff and a budget of £75m+ pa

• Energy – one of 6 key sectors

• Major focus on Energy – particularly offshore Renewables and Oil and Gas
Why Marine Renewables?
Ambitious for growth
Policy- Government Renewable Energy and Climate Change Targets

UK Targets –

• 30% power from Renewables by 2020 - Currently at 10%
• 15% of Primary Energy from Renewables by 2020
• Kyoto target 80% emission reduction by 2050

Scottish Targets -

• 100% of electricity demand from Renewables by 2020
• 31% by 2011- Currently at 33% (2013)
• 30% of Primary Energy from Renewables by 2020
• Emission reduction target of 42% by 2020 - 80% by 2050
Scotland has 25% of European wind energy potential

Highest wind resource

(onshore, offshore)
Scotland’s Wave and Tidal Resource

- Scotland has over 70% of the UK’s tidal Power

Scotland’s position produces tremendously energetic waves
Clear opportunity to make the Highlands and Islands a global leader in a key emerging industry

And it turns the rural/urban economic development paradox on it’s head....

The periphery becomes the centre.
Supply Chain Opportunities

- Consenting process
- Design and engineering
- Construction and manufacture
- Deployment and installation
- Operation and maintenance
- Decommissioning
Scottish Offshore Activity

- World’s first commercial scale marine leasing round - 1.6GW

- Round 3 and STW projects – potential for over 4.7GW installed in the H&I

- Scotland’s peak energy demand = c6.6GW
N-RIP Stage 2 - Indicative Port Groups/Clusters

Legend
- N-RIP - 1st Phase Sites - Manufacturing
- Crown Estate - Scottish Territorial Waters
- Crown Estate - Round 3 Zones

Source: Scottish Enterprise GIS Team
Contact: kmaph@scotent.co.uk
Date: 08/07/2010

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Wave Prototypes
Tidal Prototypes
Hatston Pier

- The newly extended pier at Hatston has been utilised by 5 tidal energy developers in recent weeks – Alstom Hydro, ANDRITZ Hydro Hammerfest, OpenHydro, Scotrenewables Tidal Power Ltd, and Voith Hydro – with 4 devices currently at the quay.
Scrabster

- Scotrenewables Tidal Power Ltd, based in Orkney, has chosen Scrabster as the location for their most recent operations and maintenance work on their prototype tidal turbine, the SR250.
How can innovative Government support advance ocean energy development?

Chris Stark
Scottish Government

17 October 2013
History: UK Government support for energy technology

UK Total Public Sector RD&D 1974 - 2011 (2011 Prices)

- Nuclear
- Cross cutting technologies
- Other Power & Storage
- Hydrogen and Fuel Cells
- Renewables
- Fossil Fuels
- Energy Efficiency

Million Euro (2011 Prices)

The Scottish Government
History: UK Government support for new technology

UK Total Public Sector RD&D 1974 - 2011 (2011 Prices)

- Nuclear
- Cross cutting technologies
- Other Power & Storage
- Hydrogen and Fuel Cells
- Renewables
- Fossil Fuels
- Energy Efficiency

Million Euro (2011 Prices)
Government’s role in developing new technology

**Long term and stable support**

**Supply Push**
- Long-term support for basic and applied R&D
- Public-Private Partnership
- R&D in Universities
- Portfolio approach

**Demand Pull**
- Niche Market Creation
- Early and demanding customer
- Complementary and Enabling Infrastructure
- Maintaining open markets for new entrants
Scotland’s record

Long term and stable support

Supply Push

- Renewable Energy Investment Fund
- Marine Renewables Commercialisation Fund
- Supporting Array Technologies programme
- WATERS programme

Demand Pull

- Renewables Obligation (Scotland): Five ROCs for wave and tidal
- Saltire Prize

The Scottish Government
Four policy challenges for Scottish marine renewables

1. **Reframing the challenge**
   - This is still a public R&D project, not yet commercial electricity generation
   - Technology development and resilience remain the key
   - Still viewed as benign – but plan for the future competitive threats

2. **Addressing market uncertainty**
   - Reforms of the UK energy market
   - Projecting a consistent market opportunity
   - Reserving a space in the future generation mix
   - Government as a customer?

3. **Attracting investment**
   - Aggregation of projects
   - Utility investment (now or later?)
   - Institutional investment at a sectoral level
   - International collaboration to increase project size

4. **Enabling infrastructure**
   - Removing the perception of grid as a barrier
   - Seeking an interim solution to massive infrastructure investment on the regulated asset base
   - Growing testing and deployment to array scale – remaining flexible
Marine Licensing at EMEC: Regulatory Approach and Challenges

Jennifer Norris
Research Director
Starting point

- Establish framework for licensing
  - Site-wide or individual device licences?
  - Possible exemption from some legislation?

- EMEC – EIA for infrastructure and general activities & risks
Licensing process at EMEC full scale sites

Developers apply for own individual licences

Device-specific documents:

- Scoping report
- Environmental Risk Assessment
  - Including Monitoring and Mitigation Plan
- Navigational Risk Assessment
- Third Party Verification
- Decommissioning Plan
Update EMEC Site Description Documentation:

- **EMEC Site Navigational Risk Assessment**
  - regular vessel traffic surveys

- **Environmental Description**
  - include all common (generic) elements and risks
  - include species presence
  - acknowledgement of sensitivities (species)
  - EU Habitats Regulations Assessment for site usage
  - specify issues for which monitoring is needed

- **Site-wide licence for the site?**
  - Would build on the site-wide licence for scale sites
Licensing process at EMEC scale sites

- EMEC holds the site licence
- ‘Envelope’ description of device features and maxima
- EU environmental risk assessment undertaken for future site usage
- Environmental monitoring can be centralised – more efficient
- Faster, more efficient route for testing
Assessing unknown (environmental) risks

- Developers must address relevant risks in their documentation
- Some risks are unknown – introduces many challenges
- Identify ways of informing those issues (e.g. ‘deploy and monitor’ at early stages)
- Liaise with Regulators, their consultees, and other Stakeholders about potential risks
- Liaise with developers to understand constraints on their projects
EMEC Monitoring Advisory Group (MAG)

Numerous Academic Groups

EMEC Developer Research Forum (DRF)

Government

Many broader groups
Gathering the necessary information

- Knowledge gaps identified
- Develop specific project plans
  - Observations / monitoring at sites
  - Targeted research projects
  - In close liaison with Regulators and targeted Stakeholders
- Obtain necessary funding
- Support from developer community
- Initiate projects
Key unknowns at EMEC: 1

1. Collision

Potential for physical interactions (collision, causing harm or displacement) between marine wildlife and underwater moving parts of turbines

- Especially marine mammals, diving birds
Key unknowns at EMEC: 2

2. Displacement

Potential for marine wildlife displacement from habitual waters

- Especially marine mammals, diving birds
3. Noise emissions

Potential for harmful effects on wildlife of noise emitted underwater by installation and operation of devices

- Displacement
- Physical harm (hearing disruption)
Key unknowns at EMEC: 4

4. Navigational safety

- Marking devices in strong tides
- Under-keel clearance
- Safe co-operative use of the seas
5. Effects on leisure and commercial activities

- Interactions between crustacea (lobster and crab) and devices
- Fisheries project at Billia Croo wave site
Billia Croo fisheries project

Juvenile rearing

Tagging juveniles

Tag Injector

Discs with stage 8’s

Discs loaded for release

Releasing juveniles

Undersize tagging

Full size logging

Survey area

Jennifer Norris

EMEC Research & Consents

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Monitoring strategy

- Use learning from projects to integrate approaches and findings into site-wide monitoring strategies

- Keep projects current and relevant to Regulatory and Industry needs

- Disseminate project outputs to:
  - Regulatory authorities & advisors
  - Developer / industry community
Thank you
This presentation will provide information on the following:

- Licensing and consenting process in Scotland
- Streamlining at EMEC
- Future – more streamlining
Consents and Licences Required in Scotland

- Marine Scotland Act and Marine and Coastal access Act
- Section 36 of the Electricity Act 1989 (s.36)
- Section 44 European Protected Species (EPS)
- Town and Country Planning (Scotland) Act
- Full EIA required and HRA required where LSE is identified
Marine Scotland – Licensing Operations Team

- MS-LOT 31 staff
- Renewable and non-renewable applications
- Marine Licence Applications and Section 36 consents
  - S36 consents for renewable developments
    - Over 1MW within 12nm
    - Over 50 MW out with 12nm
- Environmental Impact Assessment (EIA) required for many of our projects
  - Environmental Statement is the product of EIA
- Small projects do not require EIA, only Marine Licence Application and supporting documents (This case!)
EIA PROCESS POTENTIAL TIME IMPACTS

Pre-Application Stage

- Scoping Review
- Consultation
- Consolidate Information

Process Time – 9 months

- Receive Application and Issue Information to Consultees
- Consultation & Issue Resolution
  - Consultees Review (6 weeks)
  - Local Authority Review (16 weeks)
  - Appropriate Assessment (6 weeks)
  - Public Consultation (6 weeks)
  - Resolve issues (12 weeks)
  - 1st Statutory Consultee Response Notice & consultation (6 weeks)

- Gatecheck MS-LOT Review
- Draft Application (Recommended)
- Finalise and release Application
- Submit Application

- Developer timeline

Estimated Time Impact:
- +14 months
- +26 months

Post-Application Stage

- Approved S36 Consent and Marine Licence issued to Developer
- Post Consent and Licence Engagement

Ministry Stage

- Receive Application and Issue Information to Consultees
- Minimum requirements not met – return application to developer
- Consultee extension (+3 months)
- Local Authority extension (+2 months)
- Further Information required - addendum (+8 months)
- Adendum Notice and consultation (+6 weeks)
- Adendum consultation extension (+1 month)

- MS-LOT Draft Recommendation
- Legal & Policy Review
- MS-LOT finalise Recommendation and submit to Minister
- Minister Decision & Announcement

- Public Local Inquiry (+9-12 months)
- Consent and Licence not approved

Time impact: Developer application update and resubmission timeline

4 Dec 2012
“Good News”

- Originally each developer had to apply for a licence from MS-LOT on their own merits with supporting information.

- This was found to be resource intensive and disproportionate as the environmental conditions on the sites are fairly uniform.

- Solution

- Step away from single applications to site wide licences with an envelope of consent.
“First Trial”

- At the two scale sites (Shapinsay Sound and Scapa Flow) we consented an envelope of devices
- The assessment of this considered the “worst case devices” that could be deployed at the sites
- MS-LOT undertook an Appropriate Assessment of this envelope

- Result

- Reduction from 12 weeks to 7 days to get approval to deposit a device at either site providing it fits within the preapproved envelope.
“Moving Forward”

• Scottish Natural Heritage have begun drafting an environmental assessment of the Fall of Warness (FoW) - main tidal site

• This will assess all environmental factors associated with deploying a device (within a specifically consented envelope) at the FoW

• Some documentation will still have to be submitted and consulted on [e.g. Navigational Risk Assessment, Project Environmental Monitoring Programme (PEMP)]
“The Future”

• Result of this
  – MS-LOT aim to reduce consenting time from 12 weeks to 5 weeks to get approval and licence to deposit a device providing it is within the preapproved envelope
  – MS-LOT aim to deliver this by Christmas 2013

• What about the future? Site wide section 36 consents allowing the testing of devices above 1 MW?
Conclusions

• Streamlining the licensing/consenting reduced the burden and facilitates industry to progress towards meeting the SG targets for 2020.

• Implemented streamlined licensing at EMEC

• Good results from first streamlining exercises

• Facilitating discussions on future streamlining

Research Opportunities

Matthew Finn
Research Coordinator
Research areas

- Device and system generators
- Equipment and components
- Guidelines and standards
- Tool development
- Infrastructure and enablers
Research areas

- Device and system generators
- Equipment and components
- Guidelines and standards
- Tool development
- Infrastructure and enablers

- Performance data collection
- 1st generation device trials
- 2nd generation device trials
- 2nd generation array trials
- Components and materials
  - Installation methods
  - Recovery methods
  - Low cost O&M techniques
Research areas

- Device and system generators
- Equipment and components
- Guidelines and standards
- Tool development
- Infrastructure and enablers

- Sensors
- Offshore connectors
- Control systems
- Power electronics
- Generators
- Device structure
- Foundations and moorings
- New component development
Research areas

- Device and system generators
- Equipment and components
- Guidelines and standards
- Tool development
- Infrastructure and enablers

www.emec.org.uk

- Design
- Manufacture & assembly
- Health and safety
- Certification
- Testing
- Performance
- Resource assessment
- Environmental

www.emec.org.uk/standards
Research areas

- Device and system generators
- Equipment and components
- Guidelines and standards
- Tool development
- Infrastructure and enablers

Environmental monitoring

- Resource analysis
- Site assessment
- Condition monitoring
- Device modelling
- Array design and modelling
- Techno-economic tools
- Failure mode modelling
- Reliability modelling
Research areas

- Device and system generators
- Equipment and components
- Guidelines and standards
- Tool development
- Infrastructure and enablers
- Site licensing
- Knowledge transfer networks
- Skills and training
- Supply chain development
- Marine testing facilities
- Long term market support
- Energy Storage
- Offshore grid
- Tank testing facilities
1. We prioritise industry-focused research

2. EMEC is a key resource - make use of it

3. Independent and well connected – we welcome your ideas for collaborative projects
Case Study 1: Resource Assessment

Dr John Lawrence
Hydrodynamicist
Site Properties:

- Resource level
- Resource quality
- Device survivability
Tidal resource assessment

Tidal Site:

• Main equipment in use:
  – Acoustic profilers
  – Marine radar

• Spot deployments

• Long term deployments

• Weather station
Tidal data:

- Hydrodynamic models
  - 2D regional flow model
  - 3D model of the Fall of Warness
  - Wave current interaction
- Berth selection
- Site variability
- Turbulence
Wave resource assessment

Wave Site:

- Wave data since 2002
- Waverider buoys
- Wave radar
- Weather station
- Acoustic profilers
Wave resource assessment

Wave data:

- Site variability
- Storm studies
- Regional wave model – 20 years
- Forecasting model
- Berth selection
Active research areas:

1. Data collection techniques
2. Measurement platforms
3. Equipment trials
4. Data analysis
5. Method repeatability
   - IEC TC114 & MaRINET
Case Study 2: Integrated Environmental Monitoring

David Cowan
Research & Consents Manager
Integrated environmental monitoring

Main driver:
- uncertainties captured in the regulatory process

Key environmental uncertainties:
- Collision;
- Underwater Noise;
- Displacement

Challenge:
- Complex issue in a complex environment

Solution:
- Integrated approach using a variety of complimentary measurement streams
Thank you
EMEC Operations

Stuart Baird
Operations Director
Operations Team

- Maintenance of Site Infrastructure
- Comms, IT & SCADA
- Test Environment
- Health & Safety
Lifecycle

- **Design & Manufacture**
  - Electrical Compliance
  - Health & Safety

- **Installation**
  - Electrical Compliance
  - Health & Safety
  - SCADA

- **Operation**
  - Health & Safety
  - SCADA
  - Performance Verification (If requested)

- **Decommissioning**
  - Health & Safety
Achievements

- Added new cables
- Fitted new cable ends
- Designed & Commissioned Scale Test Sites
- Upgrades to facilities
Site Permits
Onsite Activity Report  
Start date: Wednesday 28 August 2013

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Just another day.....
Incident Category

- Working at Height
- Welding
- Spill
- Slip/Trip
- Sharp Object
- Other
- Manual Handling
- Lost Time
- Lost Equipment
- Lost Consciousness
- Lifting
- Handling Goods
- Food Poisoning
- Falling Object
- Equipment Damage
- Dropped Object
- Collision
- Caught In/On
- Breach of Consent
- Bite

EMEC H&S Statistics
Drifting Ears
Drifting Ears
Thank you
The Impact of Wave and Tidal to The Crown Estate

Alexis George
Health and Safety Manager
Energy and Infrastructure
Scope

• The Crown Estate
• The E&I Portfolio
• How we work
• The future – Wave and Tidal
• Planning for increasing presence and emerging technologies
The Crown Estate

Landowner established in 1760, comprising all the land owned by the King. Public body (The Crown Estate Act 1961) acting as a commercial enterprise – but not part of UK Government.

Owner of the seabed around the UK.

Owner of approximately half the foreshore and coastline of the UK.

Assets £8.1 billion.

Four separate “portfolios” of property.

Urban

Rural

Estates

Energy and Infrastructure
How do we work?

- Landlord – lease seabed through leasing rounds
- Co-investment in development
- Facilitator and advisor – working closely with Industry and Government
The Future – Wave & Tidal

Increase in distance and size
- Diving operations – adequate hyperbaric environments
- Personnel transfer
- Competency and training (and adequate supervision)
- Search and Rescue capabilities
- Communication and leadership
- First Aid resource availability and suitable training
- Welfare capabilities
- Availability of fit for purpose vessels
Photo from EMEC courtesy of Mike Brookes-Roper.
Photo from EMEC courtesy of Mike Brookes-Roper
Planning ...

... For increasing presence and emerging technologies

- Safe by Design
- Vessel Construction Safety Guide
- Health and Safety Award
Safe by Design

- What and Why?
- TCE will be hosting its first Wave, Wind and Tidal workshop on 27th November 2013.
- Fundamental topics

All Photos from EMEC courtesy of Mike Brookes-Roper
Vessel Construction Safety Guide

• Wave, Wind and Tidal developments is a relatively new and rapidly growing business working in deep waters and in hostile wave and tidal environments.
• The intention to provide guidance in the process, selection and management of vessels and to ensure all are ‘Fit for Purpose’ and operated within a diligent Health & Safety culture.
• Working in conjunction with the Energy Institute and the G9 Group.
• The aim is for publication early 2014.
Health and Safety Award

• The Crown Estate sponsor the Health and Safety award in conjunction with Renewable UK, now in its 3rd year
• Encourages sharing of best practice
• Applications from single companies, projects/JV’s and any business working in the renewable energy
• Excellent rewards in the past 2 years going to EON and last year to Technip Ltd.
• The 2014 Renewable Energy Health & Safety Award will be presented on the eve of conference reception on the 28th January 2014 in Birmingham.
Summary

The Crown Estate is becoming more recognised across the offshore wind industry as leaders and facilitators in Health and Safety.

“Our vision is to demonstrate leadership and support within the Energy and Infrastructure sectors that The Crown Estate operates in, setting high standards, promoting best practice while delivering and maintaining optimal performance. Working with our tenants and industry partners The Crown Estate will assist in developing and promoting solutions that result in improved industry Health, Safety and Environmental performance and in doing so secure the sustainability of The Crown Estate's business in the future”.
Alexis George
Health and Safety Manager
Energy and Infrastructure
The Crown Estate

Alexis.george@thecrownestate.co.uk
Why International Standards?

John Griffiths
Technical Director
(Chairman of UK National Committee on Ocean Energy Standards PEL/114)
Standards grow with technology

BSI publications by year (1901-2003), log scale

Exponential Growth in Technology = Exponential Growth in standards

(Source: BSIPERINORM)
Successful industries...  

... ARE HIGHLY STANDARDISED!

27,000 active standards:

- Automotive
  - 400 standards
- Aerospace
  - 800 standards
• AIRBUS aircraft are assembled in Toulouse and Hamburg

• Wings in Filton & Broughton

• Fuselage/Cabin in Hamburg, Bremen & St Nazaire

• Tail assemblies at Hamburg, Stade, Getafe, Illescas & Puerto Real

• This could never be achieved without detailed standardisation
A Bit of History

2003: First draft standard - Wave Device Performance

2004: UK Government Wave & Tidal Protocols for Performance Measurement

2005: DNV Guidelines on Design and Operation of WECs

2007-9: EMEC draft standards and guidelines

2008-11: EquiMar Protocols and deliverables, EU project

2008 on-going: IEC International standards (Secretariat through BSI)

2012/13: First International Technical Specifications published
Myths and Arguments

1. Too early for Standards
   - No: EMEC had to have standards to measure W&T resource and device performance
   - No: The international marine energy industry needs to measure and understand resource on a common basis.

2. Standards will stifle innovation
   - No: Aerospace and automotive industries constantly innovate yet depend on standards
   - These industries are very commercial and highly successful.
3. Standards will limit diversity in ocean energy
   • No: US DoE lists 261 different wave and tidal technologies
   • There are 8 types of WEC and 7 types of TEC plus hybrids – there is great diversity.

4. International agreement leads to lowest common denominator
   • No: higher level definition accommodates varying views whilst retaining essential guidance
   • Over-prescription is stifling and limiting to good design
Making of Standards – Structure

- International Body
- Technical Committee
- Project Teams (draft standards)
- National Committee (nominate experts)
- Mirror Committees

International Electrotechnical Commission (IEC)

TC/114 – Ocean Energy

e.g. PT 62600-200 The assessment of performance of tidal energy converters

PEL/114 – Ocean Energy (UK)

Support National Experts

John Griffiths

International standards

© www.emec.org.uk
• **Three standards published:**
  – Terminology
  – WEC Test
  – TEC Test

• **8 international project teams:**
  – Design Requirements
  – Wave Energy Resource Assessment
  – Tidal Energy Resource Assessment
  – Assessment of Moorings Design
  – WEC Power Performance at Second Location
  – Power Quality
  – Tank Testing – Wave
  – Ocean Energy Thermal Conversion

• **Working Group – Certification & Compliance**
### Member Nations of TC/114

- All these nations are potential markets!
- All want to get involved

(P) Denotes Participating Members
(O) Denotes Observer Members

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<td>United States of America</td>
<td>US</td>
<td>P-Member</td>
</tr>
</tbody>
</table>
Index of Typical Test Standard

1. SCOPE
2. NORMATIVE REFERENCES
3. TERMS AND DEFINITIONS
4. SYMBOLS, UNITS AND ABBREVIATIONS
5. SITE AND TEST CONDITIONS
6. TIDAL ENERGY CONVERTER DESCRIPTION
7. TEST EQUIPMENT
8. MEASUREMENT PROCEDURES
9. DERIVED RESULTS
10. REPORTING FORMAT
Annex A (Informative) Description of Availability
Annex B (Normative) Categories of Error
Annex C (Informative) Uncertainty Case Study
An example of things you don’t need near your device under test:

- The wake from a submerged buoy
- This is an upwelling, arising from a “hump” in the seabed
Deployment of ADCPs – fixed device:

- Red areas denote where ADCPs may be placed.
- Note that no part of the beam must be closer than 2DE from extraction area.
Conclusions

- Standards needed to show a maturing industry
- Standards do not stifle innovation
- Testing of MECs need to be the same method all over the world
- Defining the energy in the resources needs to be common
- International manufacture and assembly will rely on standards and shared methods
For further information or involvement contact John Griffiths
john.griffiths@emec.org.uk
Northern Lighthouse Board

EMEC: Ten Years of Marine Energy Experience

17 October 2013
The General Lighthouse Authorities of UK (GLAs)

Commissioners of Irish Lights

Northern Lighthouse Board

Trinity House
THE NORTHERN LIGHTHOUSE BOARD
Legislation

First formed by statute in 1786 and now provided for in 1995 MSA:

“the general lighthouse authorities shall have the superintendence and management of all lighthouses, buoys and beacons within their areas”

fulfilling the UK’s International obligation contained within the Safety Of Life At Sea Convention:

“each contracting Government undertakes to provide .....such aids to navigation as the volume of traffic justifies and the degree of risk requires”
International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)
IALA

- International body founded 1959
- National, Associate & Industrial members
- Produces Recommendations & Guidelines - non-binding but best practice
- Guidance on marking of man-made structures in Recommendation O-139 (currently under revision)
- Also Maritime Buoyage System
IALA recommendation O-139

- On The Marking of Man-Made Offshore Structures, December 2008
- Allows for local interpretation (e.g. UK Standard Marking Schedule)
- Includes:
  - Daymark properties
  - Lighting of individual or groups of structures
  - Use of sound signals, racons or AIS
NLB & renewable energy

- Developers require consents under Marine Licensing & Electricity Acts
- Applications include a Navigational Risk Assessment, MCA – MGN371
- NLB is a statutory consultee and comments on all licence applications, stating marking requirements
- These become binding within Marine Licence
Wave & Tidal Energy

- Emerging industry
- Prototyping at EMEC, Strangford Lough, SW West Hub etc.
- Testing of increasingly larger devices in more severe conditions
Charting: EMEC test sites

Billia Croo

Fall of Warness
Wave & Tidal Energy

- Well-established process towards site consents (scoping) & significant informal discussions between NLB and developers – based on 10 years experience of working with EMEC and at IALA.

- Includes consideration of cumulative effects and practicality of marking sites – can safety be assured by use of vertical separation?

- Early discussions avoid expensive misunderstandings!
Pentland Firth & Orkney Waters
Marking & Lighting - surface

- Advice based on IALA O-139 in conjunction with experience gained at EMEC
- Surface-piercing / floating devices to be (predominantly) Yellow in colour, lit as Special marks, also radar reflectors
- Areas containing devices may marked with Cardinal Marks or other buoys as appropriate
- Contingency plans in case of device or mooring failure
Marking & Lighting - subsea

- Advice based on IALA O-139 in conjunction with experience gained at EMEC
- Difficulty in marking underwater tidal devices; primary protection by charting & minimum clearance depths
- Areas containing devices may marked with Cardinal Marks or other buoys as appropriate
- Contingency plans in case of device or mooring failure
Wave & Tidal Developments

- Crown Estate lease areas
  - Bernera - Pelamis Wave Power Ltd
  - Moray Firth - AWS Ocean Energy Ltd
  - West Islay - DP Marine Energy Ltd
  - Mull of Kintyre - Nautricity Ltd
  - Bluemull Sound - Nova Innovation Ltd
  - Sanda Sound - Oceanflow Development Ltd
  - Skerries - Marine Current Turbines Ltd
  - Strangford Lough - Minesto UK Ltd

- Also Aegir SW of Shetland
navigation@nlb.org.uk

Thank You
Navigation Safety and Renewable Energy Development in the Pentland Firth and Orkney Waters (PFOW) area

Jim McKie
Marine Scotland, Marine Laboratory, Aberdeen
Introduction

- PFOW wave and tidal development and test sites
- Stakeholders
- Potential Navigation Impacts and Mitigation Options
- Success Stories – EMEC and Consented Projects
- Ongoing Work – Shipping Study, ScotMap, SANAP, MSP & RLG
- Conclusions
Stakeholders

• Northern Lighthouse Board
• Maritime and Coastguard Agency
• Commercial Fishing Associations
• Ferry Operators
• Recreational Users – RYA, SCA, sea angling groups, SaS
• Ministry of Defence
• Commercial Shipping Interests – CoS, SG Ports & Harbours
• TCE
• EMEC
• 12 PFOW Developers
• Harbour Authorities
Potential Navigation Impacts and Mitigation Options

**Potential Impacts**
- Increased Traffic and Congestion
- Displacement
- Allision and Collision
- Access restriction (navigable route depths and widths)
- Cumulative and In-combination effects

**Mitigation Options**
- Site Layout
- Marking / Charting (e.g. EMEC)
- Routeing Measures (e.g. ATBA)
- Follow Guidance (IALA, MCA)
- Safety Zones (DECC)
- Notice to Mariners
Success Stories – EMEC and Consented Projects

• EMEC
  – Billia Croo, wave test site
  – Fall of Warness, tidal test site
  – Small scale test sites, Scapa Flow (wave) and Shapinsay Sound (tidal)

• MeyGen Phase 1
  – 86MW tidal project, Inner Sound, Pentland Firth

• North West Lewis Wave Array
  – 40MW wave project, Outer Hebrides
Ongoing Work

• MS Shipping Study of the Pentland Firth and Orkney Waters
  – Commercial shipping and recreational vessels focus

• MS ScotMap project
  – fishing vessel activity, <15m fleet
  – Draft report focusing on PFOW available online

• Strategic Area Navigation Appraisal (SANAP) of PFOW
  – TCE commissioned (MS part of working group)
  – Cumulative and in-combination effects of projects
  – Identifies potential impacts and mitigation options

• PFOW Marine Spatial Plan and Regional Locational Guidance
  – Examines how development can progress in a way that avoids conflict with existing users of the sea
Conclusions

• In order to successfully develop marine renewable energy projects in the confined area of the PFOW, it is essential for MS-LOT and PFOW Developers to engage with stakeholders to establish practical and appropriate solutions to the identified navigation hazards

• The cumulative and in-combination effects of the PFOW projects is a key concern and is being addressed partly by the SANAP

• The ongoing work mentioned should continue and will allow us to be prepared for current and future navigation safety challenges