ETIPOCEAN

European Technology & Innovation Platform for Ocean Energy

Adaptive Management Systems – Don’t make the same mistakes twice!

13 December 2017

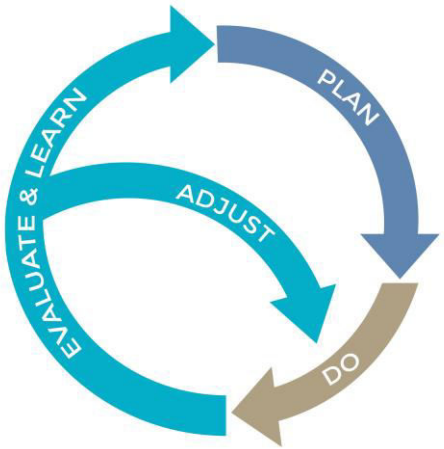
Agenda

Moderator: Kasparas Kemeklis, Ocean Energy Europe, ETIP Ocean

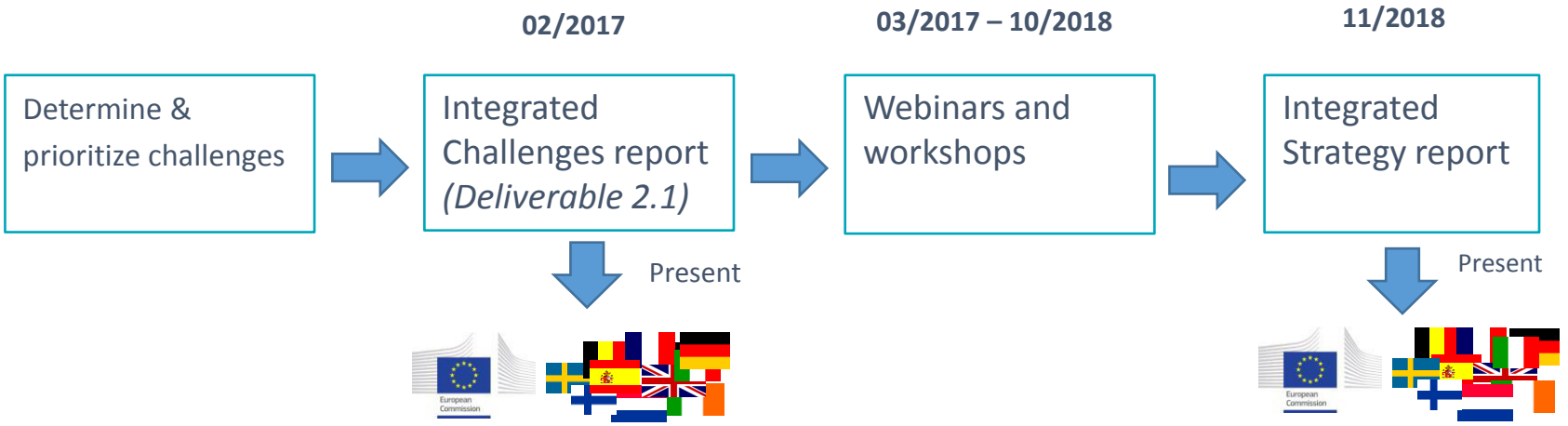
Presentations:

Finlay Bennet - Marine Scotland
Frank Fortune - Royal HaskoningDHV

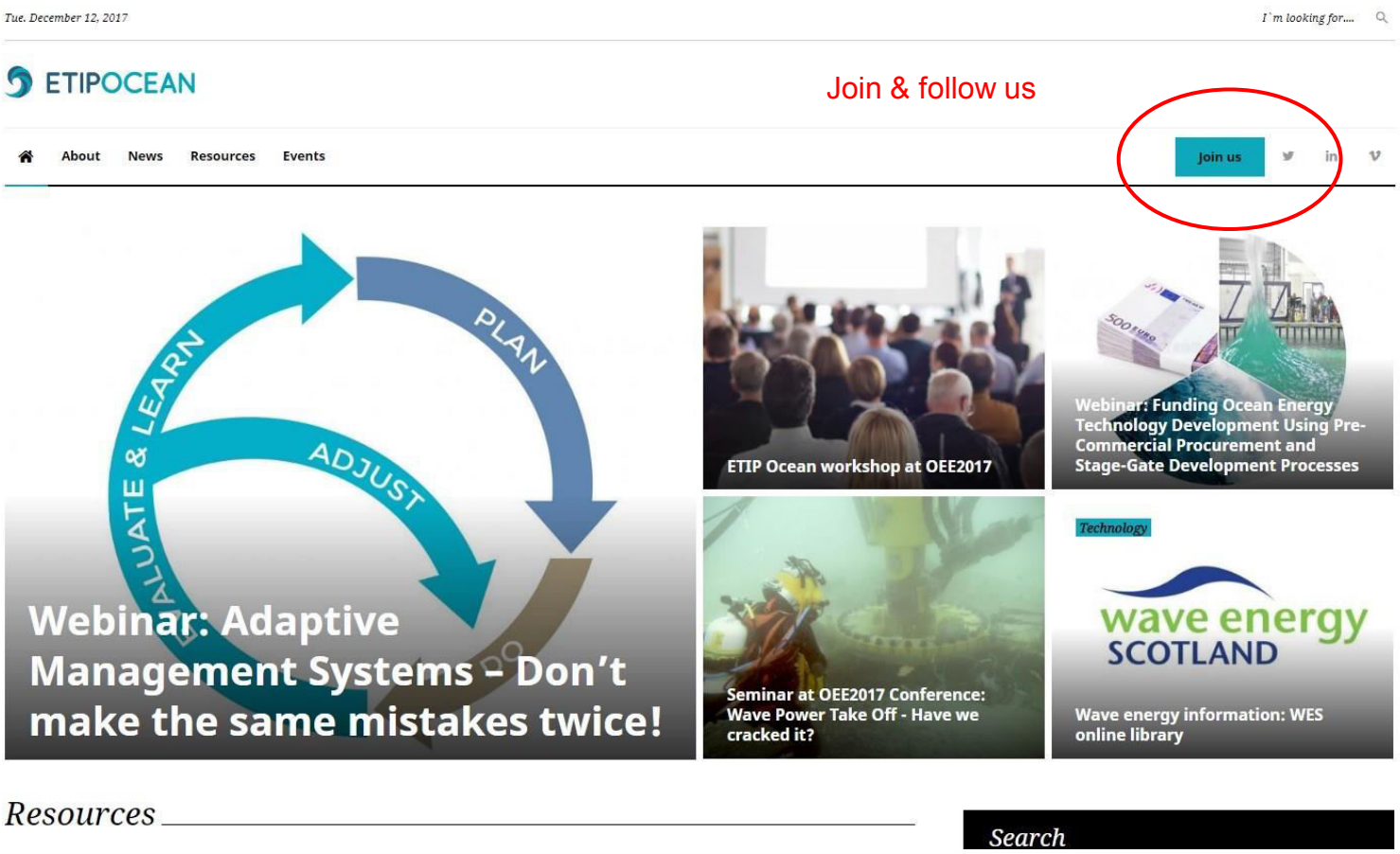
Q&A session with the audience



ETIP Ocean, objectives and timeline



A recording and summary report will be available on www.etipocean.eu



Adaptive management

The Scottish Government

Finlay Bennet

Scientific advisor

marinescotland science

Outline

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- Introducing Adaptive Management
  - What is AM?
  - Alternatives to AM
- Context of renewables
  - Key issues

The need for adaptive management

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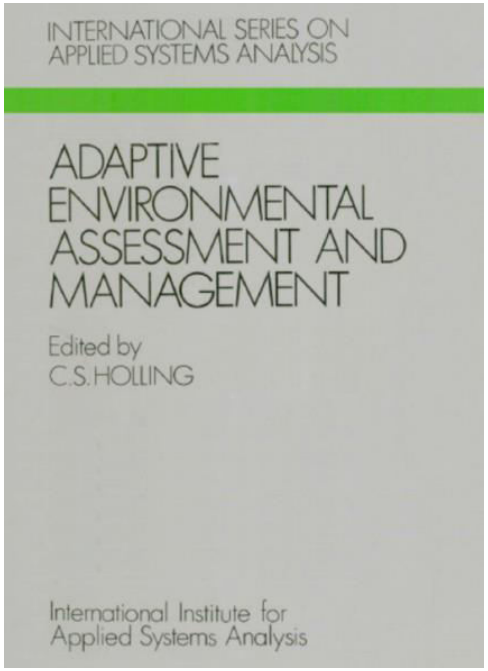
- inertia and paralysis
- is qualitative discourse really informative?
- gap between science and society
- natural resilience



What is adaptive management?

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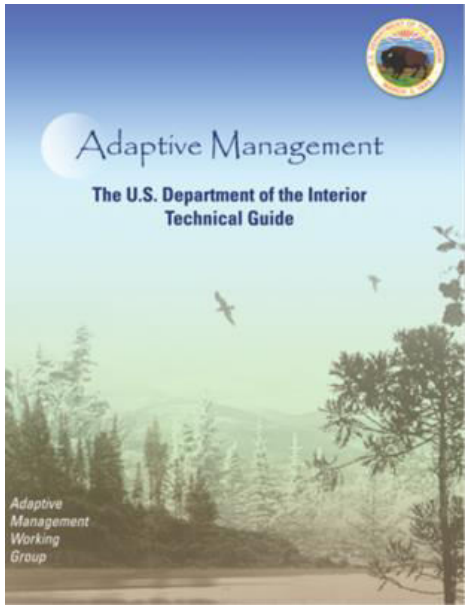
- improving confidence in models
- tolerance thresholds of (modelled) impact
- avoid DRIPy monitoring
- affordable



Alternative approaches

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The ecological risks and financial costs of learning

- Prioritising conservation value
- Minimising costs

For more information see:

Journal of Applied Ecology

Milner-Gulland & Shea (2017)

Embracing Uncertainty in Applied Ecology

Precautionary principle & adaptive management

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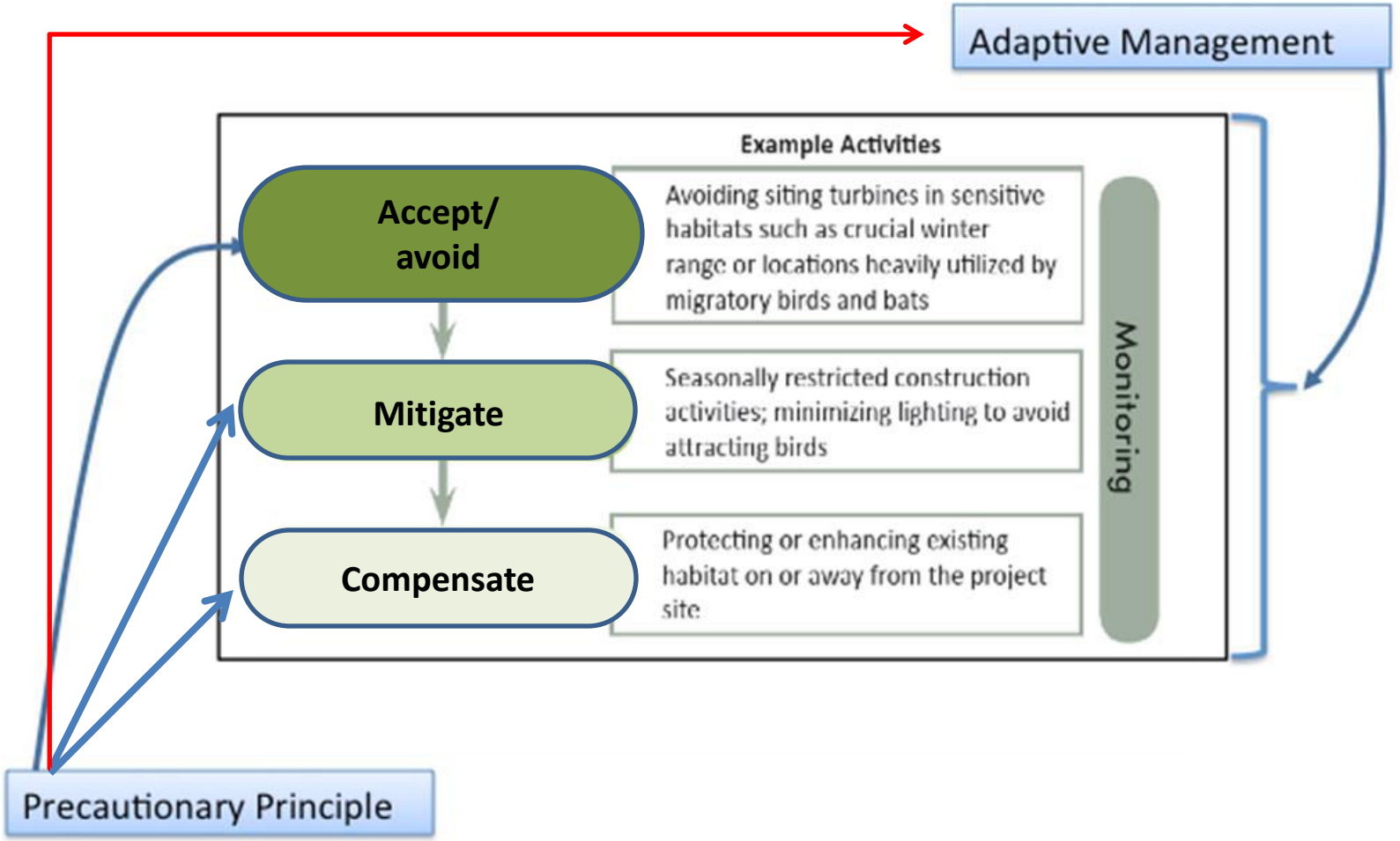

Wind farm examples

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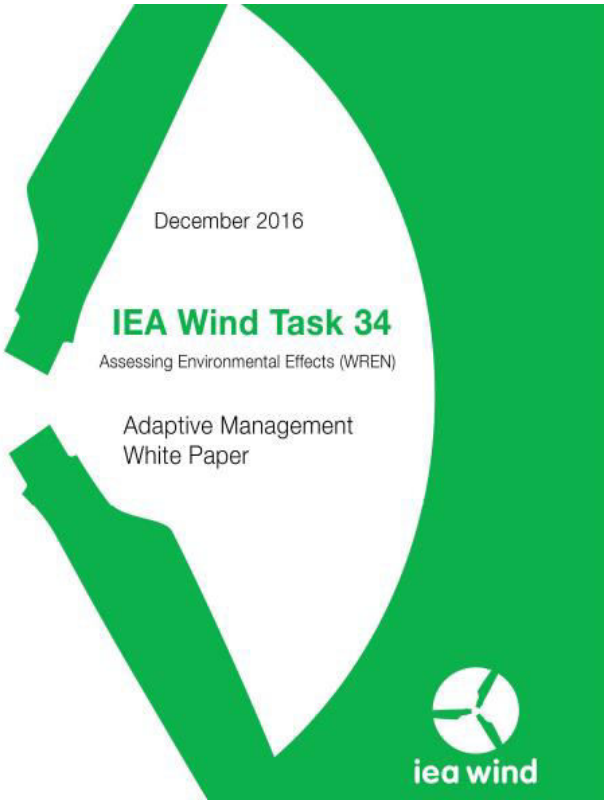
- 16 (terrestrial) US wind farm plans reviewed
  - Unclear definitions and variable content
  - Adaptive management plan ≠ mitigation plan
  - Increased financial uncertainty for industry

https://tethys.pnnl.gov/

- UK experience is very similar
  - MMO post-consent monitoring review (2014)
  - DRIPy underpowered monitoring



Implementation seldom cost effective and unlikely to meaningfully reduce scientific uncertainty

Learning by doing

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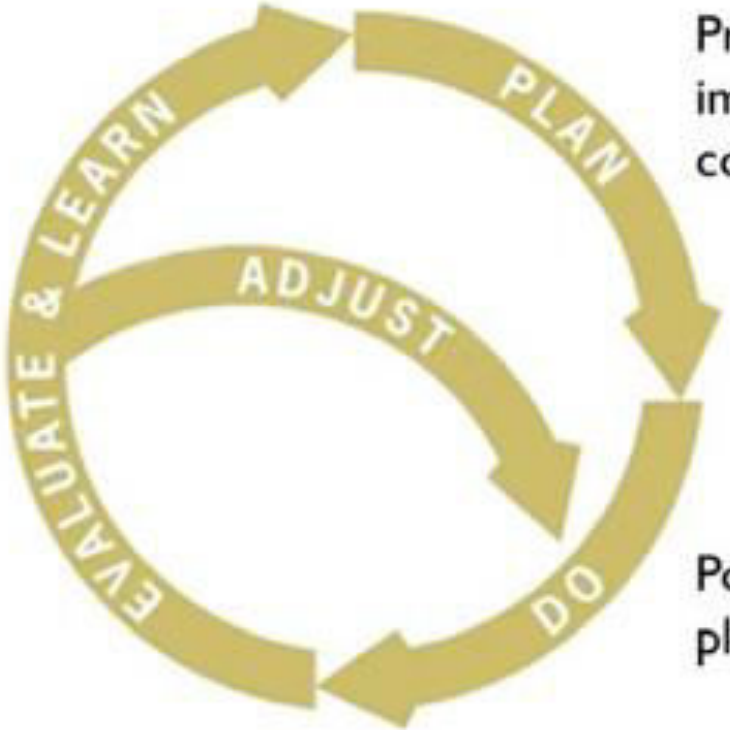

Pre-consent surveys, impact assessment & consent decision

Post-consent surveys, planning & data collection

Learning to either inform future plans or adjust measures at existing projects.

Summing up

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1. Use the Department of Interior's Technical Guidance

2. Poor implementation

3. Avoid DRIPy monitoring.

4. Addresses concerns that assessments are overly precautionary.

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thanks

Phil Gilmour

Head of Marine/Offshore Renewable Energy

Marine Scotland

Planning

- Significant wave, tidal and other forms of renewable energy resources around Scotland
- However sensitive marine environments and protected species
- Also other sectoral uses such as fishing and shipping
- Therefore require Sectoral Marine Planning to identify least controversial resources

Sectoral Marine Planning

- Requires Sustainability Appraisal
- This consists of SEA, strategic HRA, Socio-economic Assessment
- Effective consultation, including other sectors, regional workshops, environmental bodies
- Consultation Analysis informs holistic views of the assessed plan options

Consenting

- Most marine renewables development proposals consist of new technologies (although they can often be compared to existing technologies)
- New technologies create consenting risks as environmental impact significance is unknown
- Risk based consenting is required to allow initial projects to proceed

Risk Based Consenting

- Survey, Deploy and Monitor policy evolved in Scotland
- Requires Demonstration Strategy to check against perceived impacts
- EU RiCore project has tested the policy and developed processes
- SDM seeks to promote:
  - small scale arrays,
  - in less sensitive areas
  - and considers types of technologies and what ecosystem risks they are likely to create

Demonstration Strategy

- Demonstration Strategy applied at Meygen
- Passive and active sonars, video tracking, strain gauges on turbine blades
- EU EASME project will help facilitate research and monitoring to address impact risk issues
- Need to ensure that diving birds, fish and marine mammals are not significantly affected by turbine blades, moving cables, EMF etc.

Precautionary Principle

- EU law requires the application of the PP
- 2 options:
  - where there is a significant risk do not proceed
  - or put in place strategy to address risk
- Research programme, through demonstration strategy and other research/modelling approaches should address risk to populations and species

Royal HaskoningDHV
Enhancing Society Together

Adaptive Management

A tidal stream example from the UK

Frank Fortune, Technical
Director, Royal HaskoningDHV
13 December 2017
Presentation for Ocean Energy Europe

Introductions

- Worked in tidal energy since 2004, when Royal HaskoningDHV started work on the SeaGen project Marine Current Turbines' 1.2MW device in Strangford Lough, Northern Ireland. I undertook initial baseline surveys, then EIA, then post consent EMP and adaptive management to 2012;
- Other wave and tidal EIA projects consented by RHDHV since 2004 include:

  - Sound of Islay tidal array (Scottish PowerRenewables), 10MW;
  - Lewis wave farm (Aquamarine Power), 40MW;
  - Perpetuus Tidal Energy Centre, 30MW.

  Currently working on Morlais tidal stream project in north Wales, 100MW.

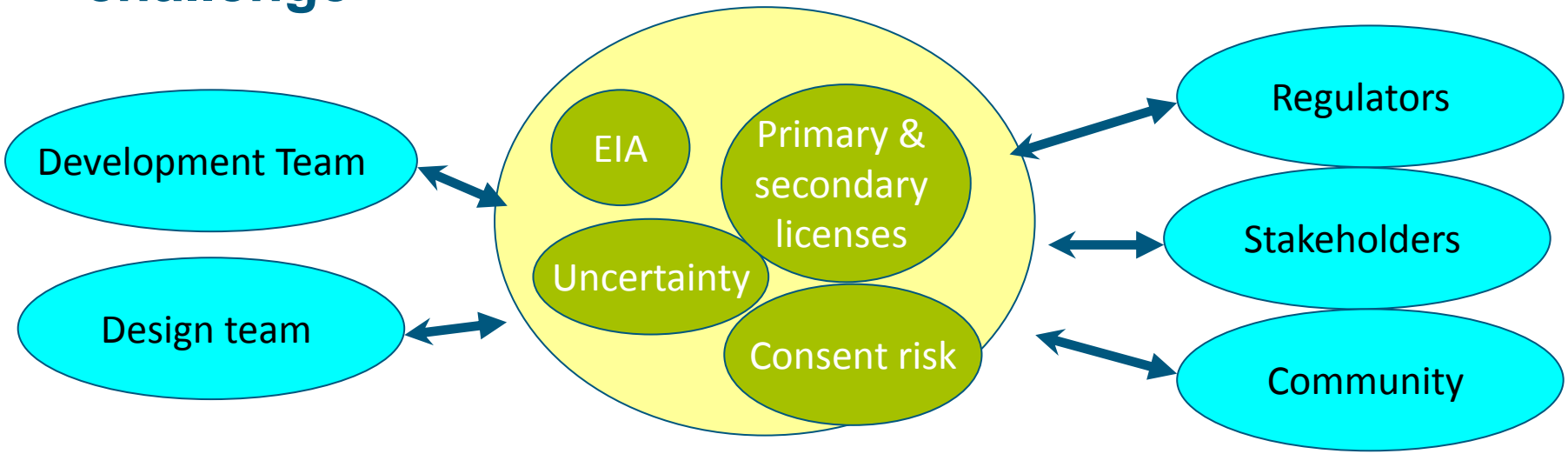
So, what is “Adaptive management”?

An iterative process where uncertainty regarding environmental effects is progressive reduced, through managed; science led monitoring of agreed indicators.

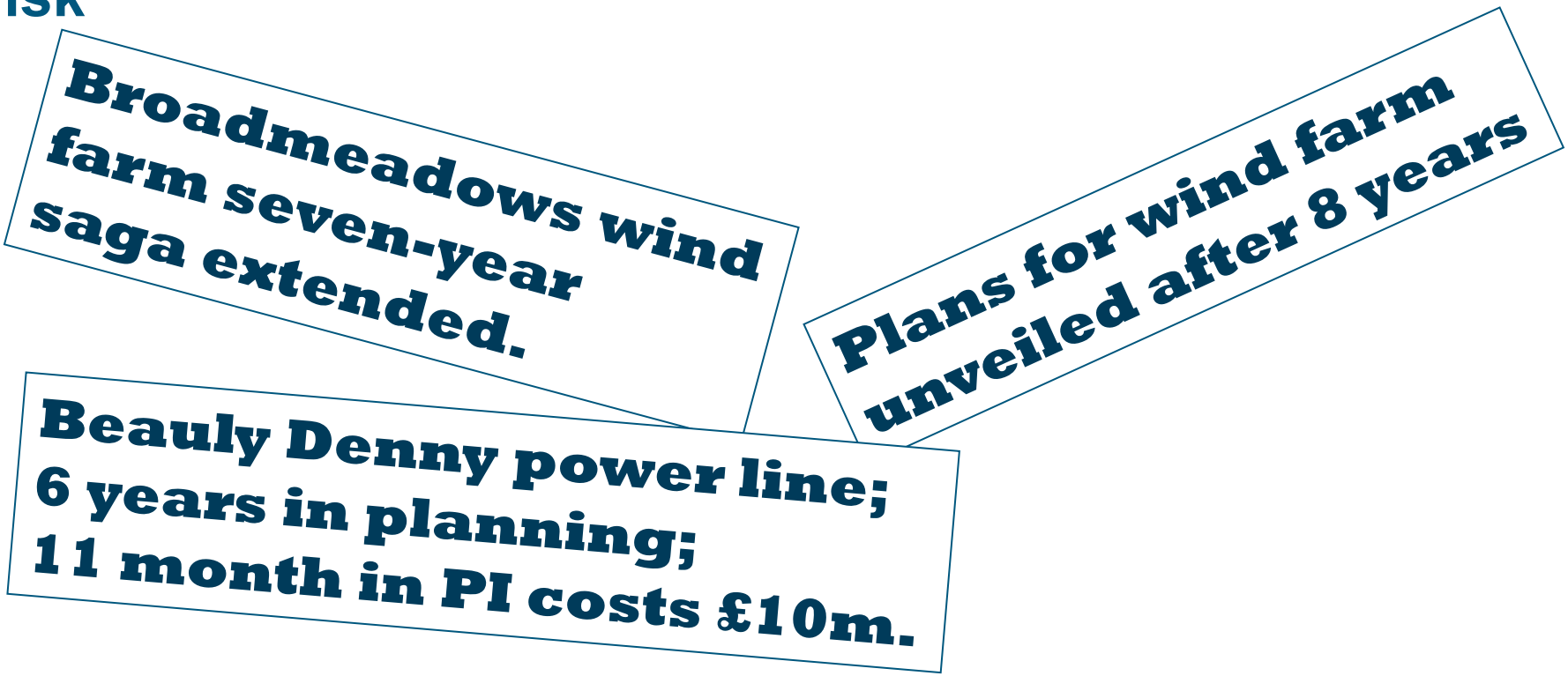
In the face of uncertainty, regulators will tend to favour a conservative approach, even when the objective of a project is broadly supported. Adaptive management allows risks and project needs to be balanced with , within an agreed framework.

In areas of particular environmental sensitivity, it may be necessary to put in place a number of short term precautionary mitigation measures, to reduce potential for effects to a level considered acceptable to regulators and stakeholders.

Remember that consenting a project can be a big challenge



And don't forget that consenting problems can be embarrassing, expensive and pose a serious project risk



Aim should be to minimise that risk through an open, science based approach to EIA and other works. Adaptive management can be a key part of this process

Reducing project risk should always be a key project aim

There are various ways to minimise risk including:

- Good data (temporal, spatial, fit for (a clearly defined) purpose (baseline and monitoring);
- Agree approach with regulator and take an adaptive approach to management where uncertainty exists;
- Good project communication;
- Be open and acknowledge what is unknown, an adaptive approach may offer a way forward

So what is challenging about consenting tidal stream technology?

- Technology often remains under development, meanwhile design is fundamental to identifying potential receptors and the scale of impacts;
- Design decisions can increase or decrease the significance of potential impacts on multiple receptors simultaneously;
- Greater design certainty decreases project consenting risk;
- Consent increases confidence in the sector & opportunities for financial investment, but the opposite is also true;
- While some issues may be shown to be less concerning with knowledge gained over time, others may become apparent. This can lead to a need for new research and developing assessment strategies with regulators;

Case study – SeaGen turbine - Strangford Lough, Northern Ireland

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About Strangford Lough…….

- Significant tidal resource;
- Sheltered environment with easy access;
- Grid connection;
- Queens University Belfast marine station; and
- Local skills base for assembly and O&M.

However, the lough is a European Marine Site (SAC and SPA) and hosts European Protected species (seals, cetaceans and otter). So gaining consent was not without its challenges!

What were the challenges for SeaGen?

- Site selection – heavily designated;
- Regulator concerns;
- Monitoring and mitigation programme providing high financial burden;
- Operating restrictions – shutdowns for marine mammals;
- Supply chain issues required foundation design alterations to allow installation using available vessel – ES addendum.

Main uncertainties identified by EIA?

- Harbour seals *Phoca vitulina*

1) Will the patterns of usage of the Narrows by seals be altered by the turbine installation and operation?

2) Will seals (or other large marine animals) be struck by the turbine rotors?

- Reef (rocky and biogenic)

1) Will the installation and operation of the turbine significantly effect the extent, quality or composition of seabed communities?

Adaptive management - monitoring studies

- Marine mammal studies (SMRU/ SMRU Ltd)
    - TPODs (PAM)
    - Shore based surveys (vantage point studies)
    - Telemetry (tagging studies)
    - Aerial survey (counts at haul outs)
    - Carcass surveys & post mortem coordinated by NIEA
- Benthic ecological monitoring
- Acoustic Doppler Current Profiling
- Bird surveys

Environmental Monitoring Programme

Broad objectives of the EMP:

- Detect, prevent or minimise impact;
- Provide on going monitoring to determine any adverse impacts.

Detailed questions focus around:

- Alteration to marine mammal density and behaviour;
- Changes to use of seal haul out sites;
- Displacement and barrier effects;
- Annual trends;
- Causes of mortality;
- Changes to benthic ecology;
- Changes to flow dynamics;
- Impact on seabirds, in particular diving birds.

Adaptive management – mitigation of marine mammal collision concerns

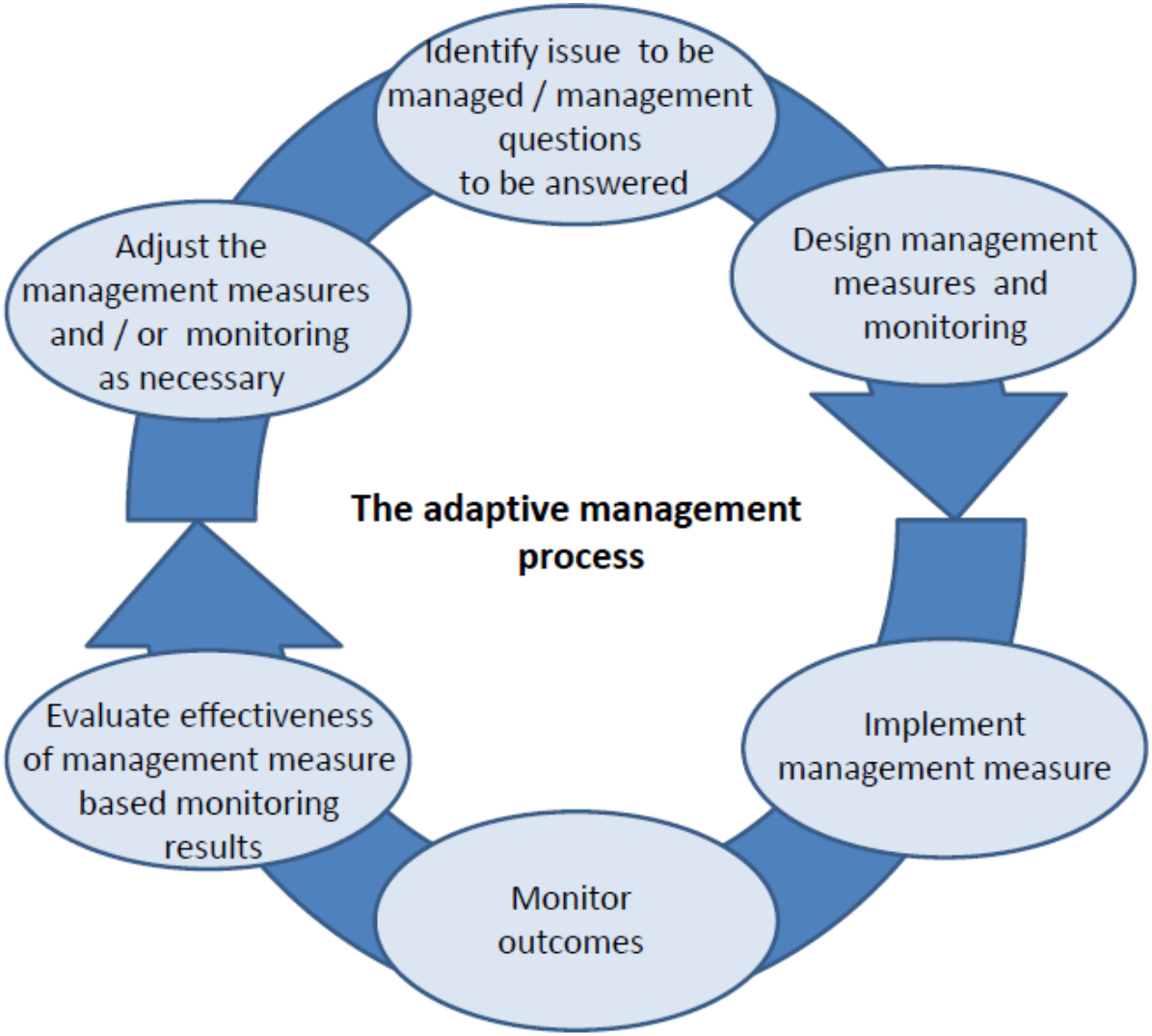
	Date	Species	SeaGen operational activity (twin/ single rotor)	Distance from turbine (m)	Behaviour	State of tide	E-stop initiated by?
1	08/07/2008	Common seal	Single	130	Drifting	Flood	MMO
2	06/10/2008	Common seal	Single	50	Drifting	Flood	MMO
3	07/10/2008	Unidentified target	Single	60	Travelling	Flood	ASO
4	15/10/2008	Common seal	Single	80	Drifting	HW Slack + 1 hr	MMO
5	15/12/2008	Common seal	Twin	50	Travelling	HW Slack + 1 hr	MMO
6	13/05/2009	Common seal	Single	40	Drifting	Flood [1]	MMO
7	27/05/2009	Common seal	Twin	40	Travelling	Flood [2]	MMO
8	27/05/2009	Common seal	Twin	80	Milling	Flood [3]	MMO
9	27/05/2009	Common seal	Twin	70	Travelling	Flood [4]	ASO
10	08/06/2009	Common seal	Twin	40	Travelling	Ebb	ASO
11	10/06/2009	Common seal	Twin	80	Drifting	HW Slack + 1 hr	MMO
12	22/06/2009	Common seal	Twin	38	Travelling	LW Slack + 1 hr	ASO
13	02/07/2009	Common seal	Twin	20	Travelling	Ebb	MMO
14	02/07/2009	Unidentified target	Twin	44	Travelling	Ebb	ASO
15	06/07/2009	Common seal	Twin	40	Travelling	Flood	MMO

- Initially - MMO present on pile with ability to shutdown SeaGen – removed after proof of active sonar;
- Limited to daylight operation – changed to 24 hours after proof of active sonar;
- Active sonar field trials to assist marine mammal detection – approach proven;
- Environmental Monitoring Programme in parallel to mitigation and informing need for and nature of that mitigation.

Adaptive management the project to…..

- Prove SeaGen could shut down more rapidly than initial conservative assumptions;
  - Precautionary shut down distance for marine mammals reduced in stages from 200m to < 30m.
- Demonstrate active sonar technology;
  - Greater understanding of marine mammal use of the waters around SeaGen.
  - Removal of pile based MMOs.
  - Remote operation of active sonar.
  - Allowed 24/7 operation.

To summarise the process….



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Strangford Lough outcomes?

- MCT was been able to install and operate for over 5 years justifying confidence in the technology and supporting future projects;
- Demonstrate stable and significant export to grid;
- Learning regarding effects (or lack) of SeaGen on the marine environment and key receptors;
- Demonstrate adaptive approach with mitigation measures progressively reduced in parallel to reductions of uncertainty;
- Regulator comfort from monitoring effects of changes to mitigation and the capacity for reinstating if required;
- Final removal of remaining shutdown protocol not achieved before decomissioning.

More information….

A useful summary of the works undertaken can be found at….

- **2014** Savidge, G, Ainsworth, D., Bearhop, S., Christen, N., Elsaesser, B., Fortune, F., Inger, R., Kennedy, R., McRobert, A., Plummer, K. E., Pritchard, D. W., Sparling, C. E. and Whittaker, T. J. T. 2014. Strangford Lough and the SeaGen tidal turbine. *In* Marine Renewables and Society. Ed. by M.A. Shields. Springer, Dordrecht.

Some observations

1. Invest in early - strong pre installation baseline
   - Good data drives good decisions
   - Driver for management and monitoring
   - Do we need multiple years of data for characterisation?
2. Deal with the uncertainties
   - Design uncertainty
   - Impact uncertainty – acknowledge it and consider adaptive approach
3. Anticipate consent conditions
   - Look at results of EIA work and work with regulator to determine a sensible, evidence driven approach. Where sites are very sensitive consider an adaptive approach using tiered mitigation.
4. Evidence base for monitoring and adaptive management
   - Identify key questions to be answered by monitoring and mitigations needed;
   - Ensure monitoring is appropriate to answer those questions in a reasonable timeframe


Thank you
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