Advancing the Industry of Ocean Renewable Energy

Scenario Based Analysis

DoE Funded Market Acceleration Projects

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DoE Projects

Key issues must be addressed by the ocean energy industry

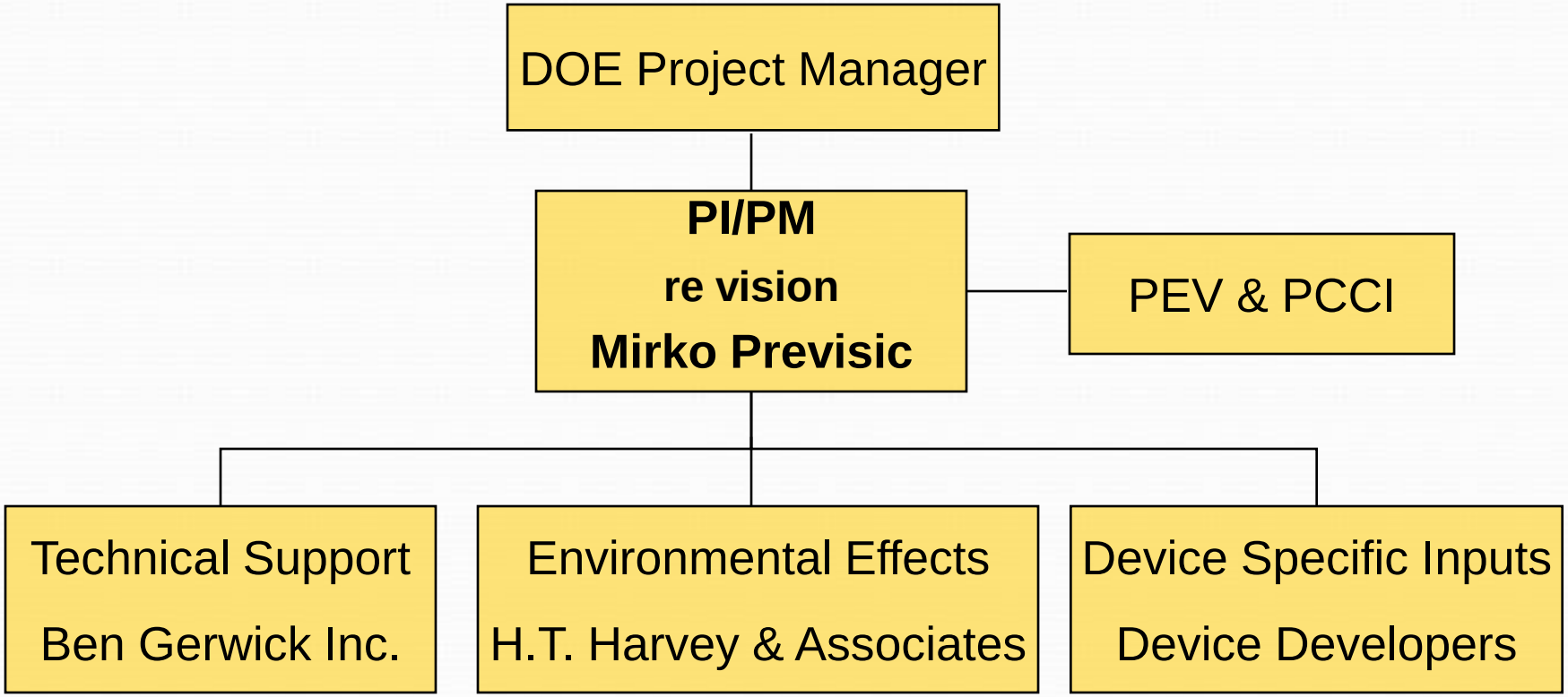
US DoE funding *Market Acceleration* projects to advance market acceptance

Industry Development Issues

DoE selected projects that specifically address the following key issues:

Environmental Uncertainties	Navigational Impacts
Technological Uncertainties	Regulatory Framework

Project Organization

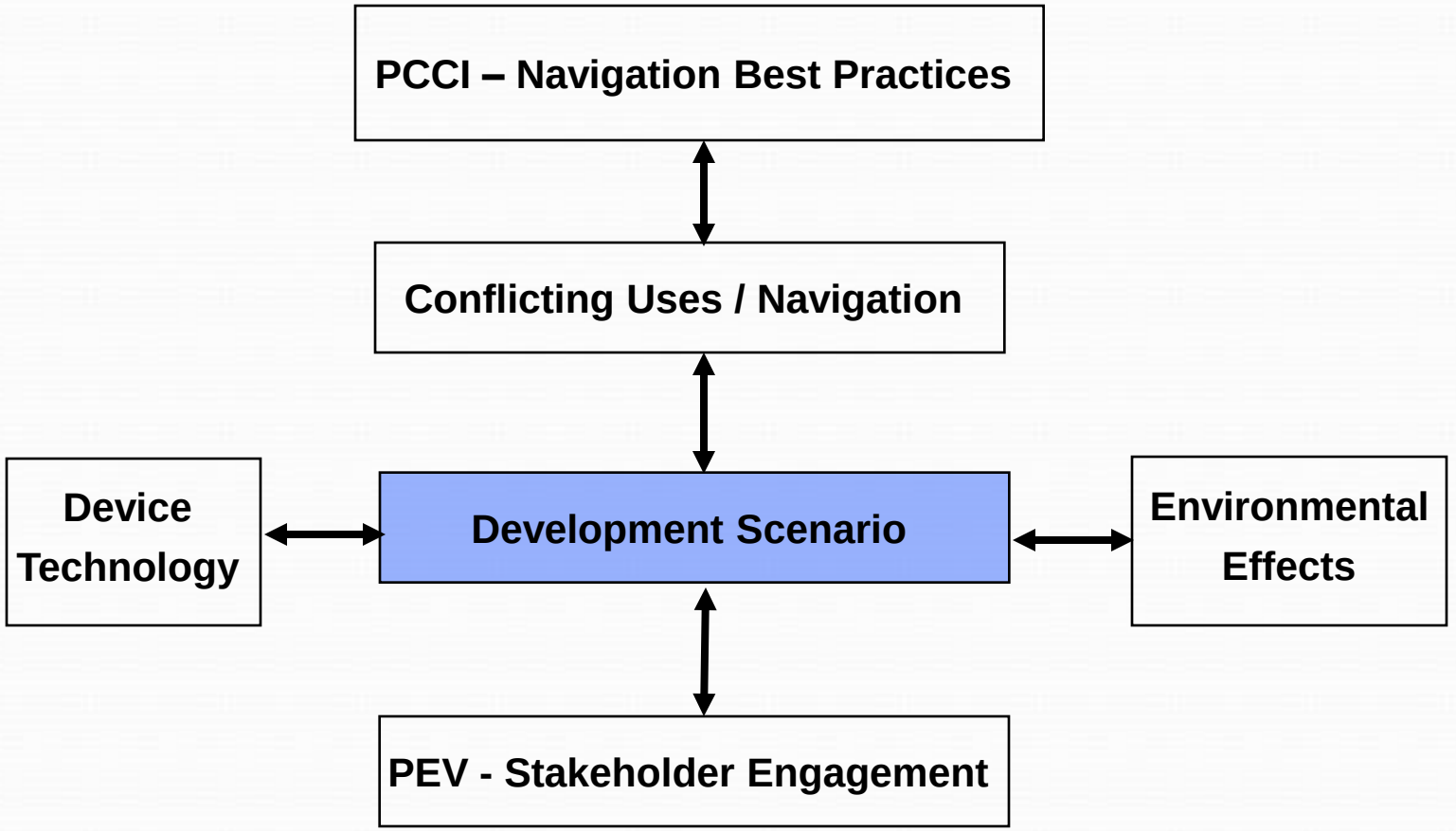


Evaluation of Environmental & Navigational Impacts

- A wide range of different device concepts
- Technological uncertainty introduces environmental effects uncertainty
- **GOAL:** Provide a clear understanding of the potential impacts of these technologies, considering different technological approaches, deployment scales, and future sites in the U.S.

re vision
Supporting visionary renewable energy projects

Capture important elements



Strategy

Baseline scenarios: Consider major technical approaches at different scales

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Framework for Environmental Effects

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Framework for Navigational Effects

PCCI

Outcome:

To provide a clear understanding of enviro & navigational effects

To establish a framework for the evaluation of environmental effects

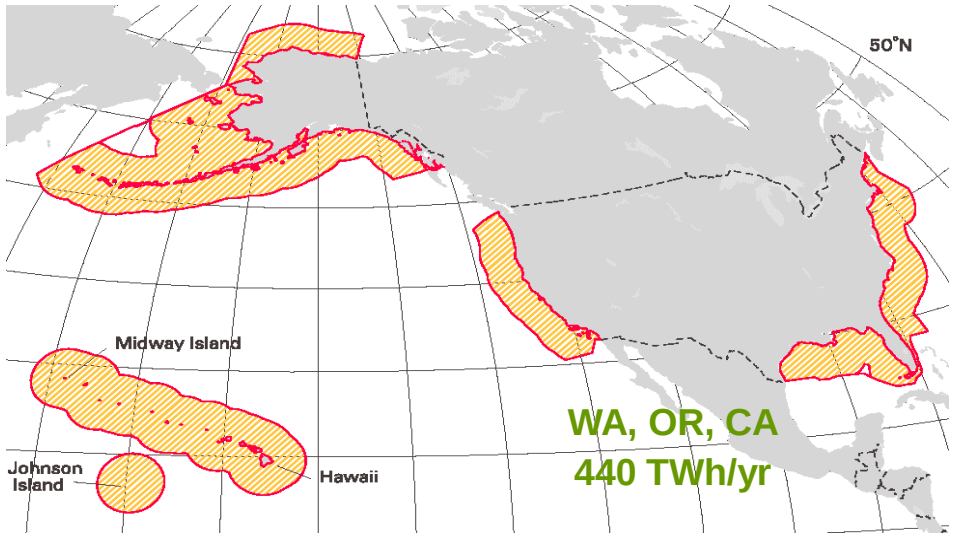
Environmental Assessment Framework

Important criteria:

- decision analysis
- identify uncertainties
- apparent to all

Address environmental issues:

- generic
- site-specific



Geographical Priority - Wave Energy

Hazard Identification

- Alteration of habitat/physical environment
- Proximity of project to important habitats
- Noise
- EMF
- Lighting
- Chemical

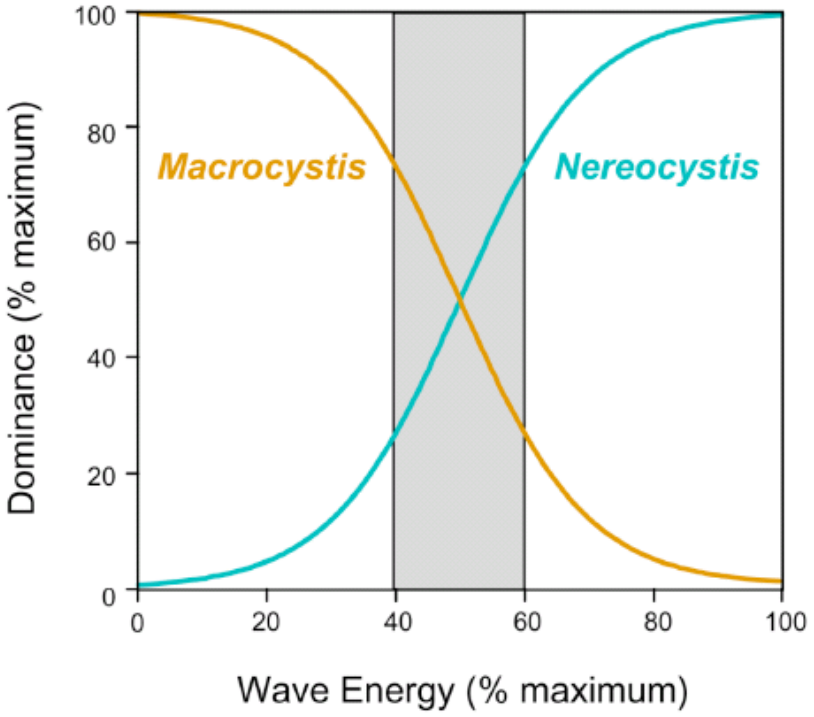


Figure 4.3: Hypothetical relationship between wave energy and the dominance of *Macrocystis* and *Nereocystis*

Lohse et al. 2008

Identify Resources of Concern

- species
- habitats
- life stages of concern
  - ontogeny
  - migration
- spatial/temporal distribution
  - species range
  - use of specific habitats (seasonal, life stage)

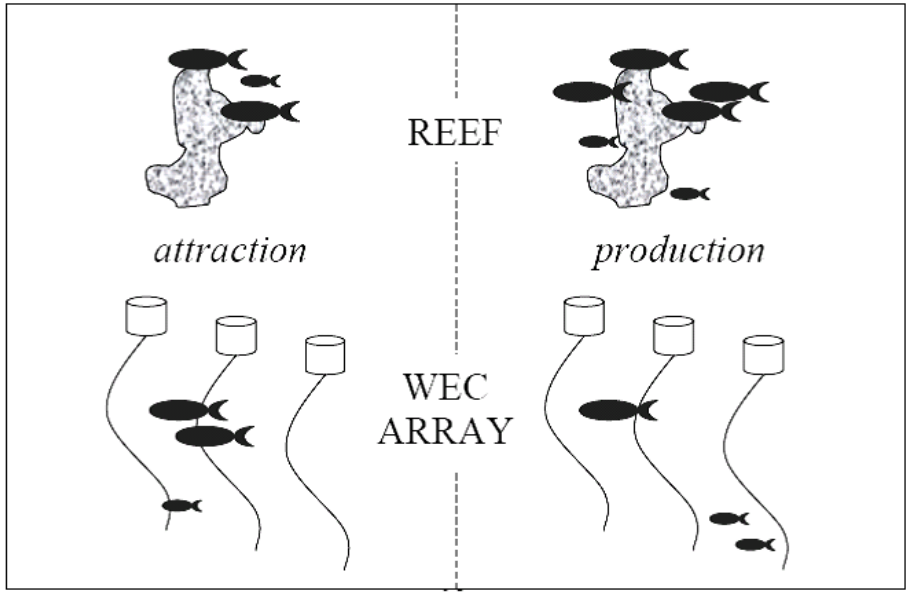
Effects Assessment

Conceptual models:

- driver-linkage-outcome approach
- nature and direction of effect
- importance or magnitude
- understanding underlying effect
- predictability

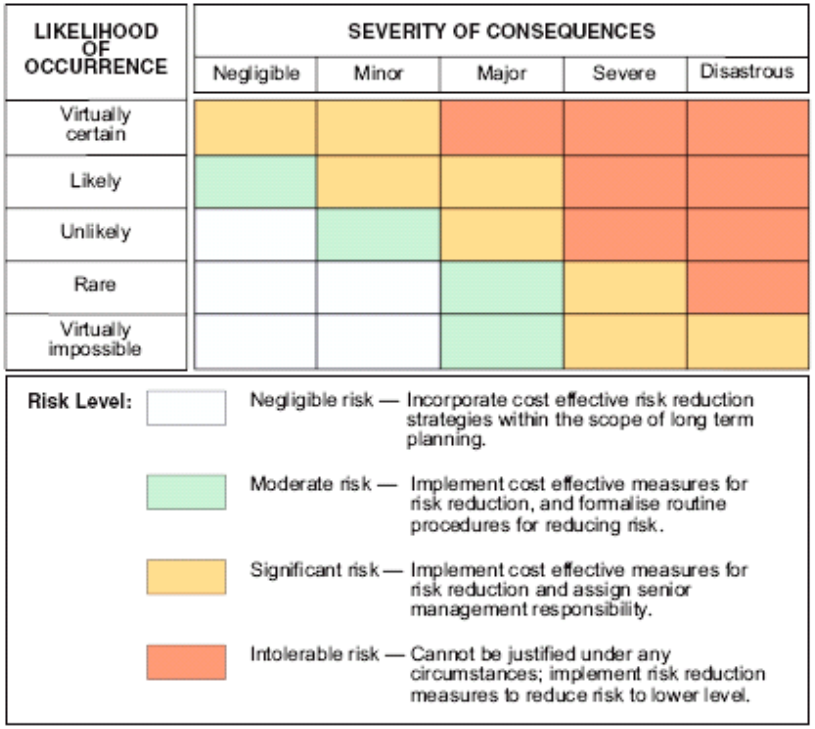
Transparency:

State all assumptions



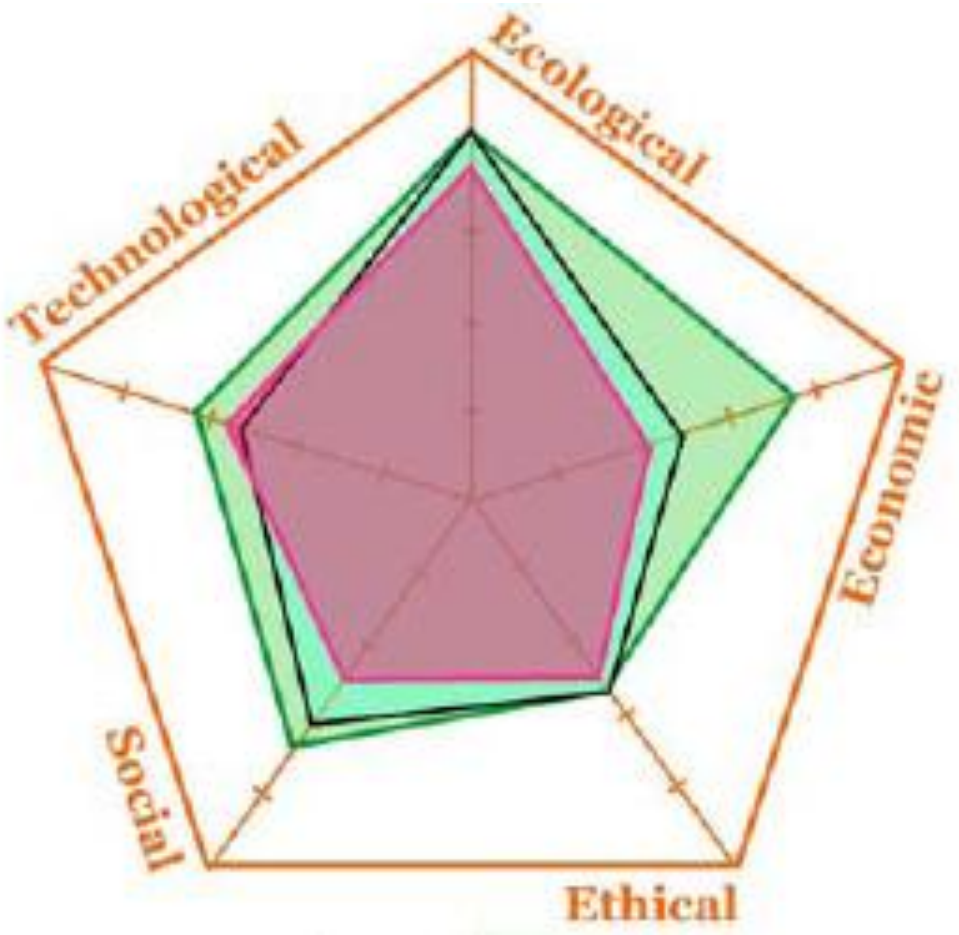
Risk Characterization

- magnitude and certainty of outcomes
- positive vs. negative outcomes
- identify gaps in knowledge
- rank risk vs. worth
- reversibility
- opportunities for learning



AS/NZS 4360:1999—*Risk Management*, Standards Australia and Standards New Zealand.

Multi-Dimensional Framework



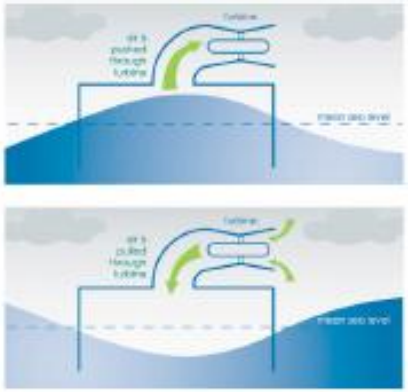
(University of British Columbia, Fisheries Centre 2006)

http://www.fisheries.ubc.ca/archive/projects/rapfish.php

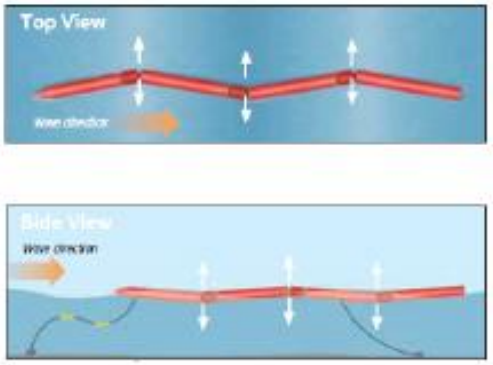
Why analyze scenarios?

- Technology diversity
- Deployment Scales → Cumulative impacts
- Establish a solid technical baseline as a primary strategy to reduce uncertainties

Oscillating water column devices and attenuators



Oscillating water column device: Oceanlinx.

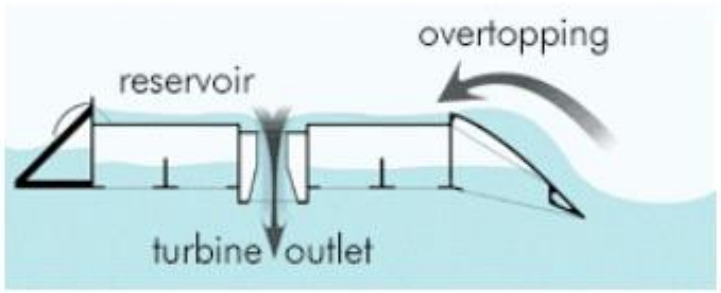


Attenuator: Pelamis

(Nelson et al. 2008)

Overtopping devices and point absorbers

Overtopping device: Wave Dragon



Point absorber: AquaBuOY

(Nelson et al. 2008)

Capturing the effects of deployment scale is important to evaluate cumulative effects

Scale	Size	Cumulative effect
Pilot plant	1 to 3 units in array	Likely not measurable
Small commercial	10-20 MW	Measurable
Commercial plant	> 100 MW	Measurable

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