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ACES Conference

USING ECOSYSTEM SERVICES TO DEMONSTRATE THE ENVIRONMENTAL SUSTAINABILITY OF ARCTIC OIL AND GAS EXPLORATION: A PROJECT LIFE CYCLE EXAMPLE

Arctic Ecosystem Services: Policy and Adaptive Decision Making

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Introduction

- Sustainability
- NEBA
- Siting: Planning and Permitting
- Operation
- Decommissioning
- Summary

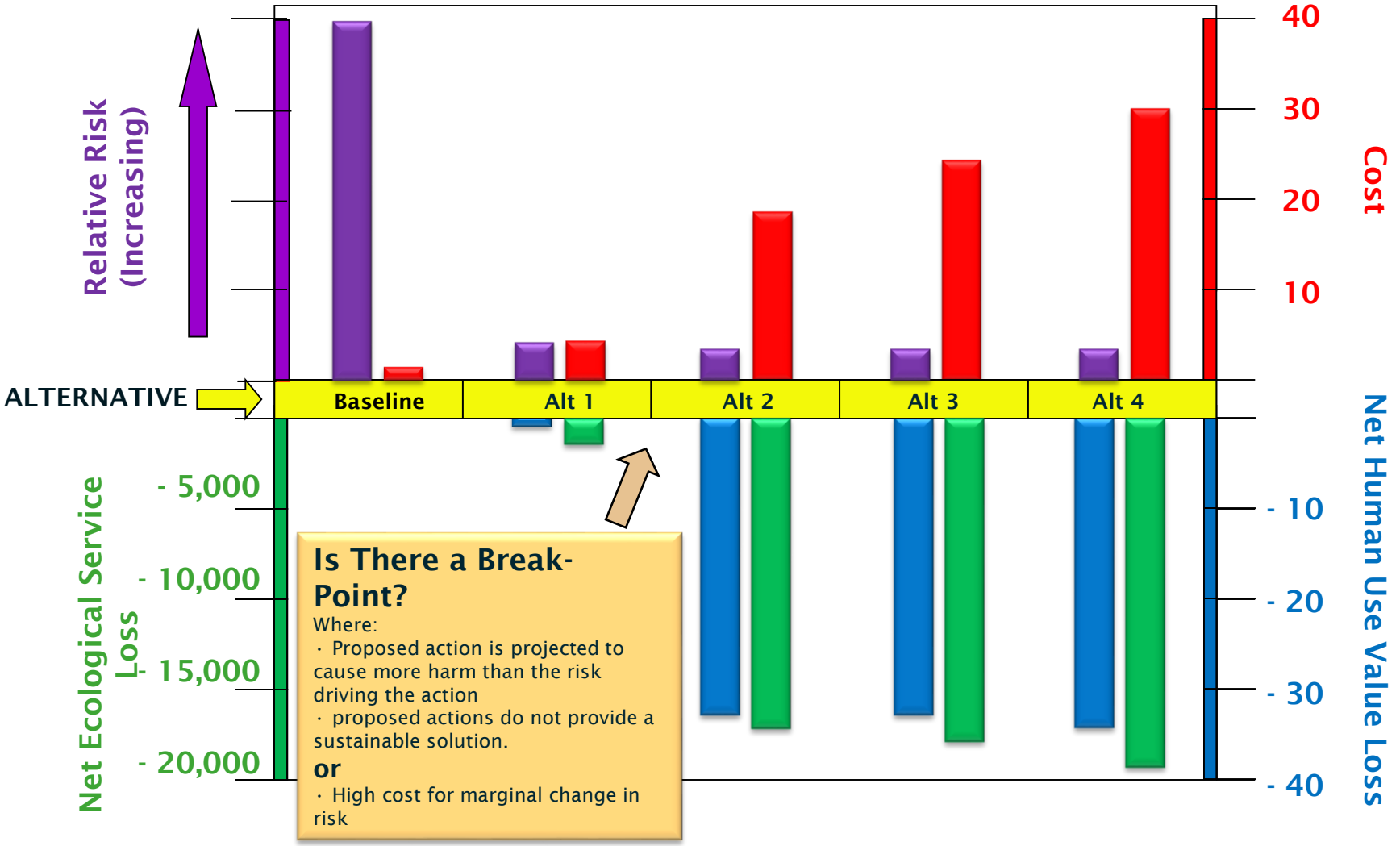
Key Tenets of Understanding Sustainability

- Sustainable development is an obligation incorporated into alternative decision-making
- Need to develop a complete understanding of the consequences of actions (consider action implementation effects, GHG's, etc.), and uncertainties
    - Balance the risk, benefits and tradeoffs of decisions
- Demonstration needs to be transparent, scientifically defensible, and reasonable
- Incorporate internationally recognized concepts and approaches

NEBA Approach

- Net Environmental Benefits Analysis (NEBA)
  - Environmental benefits
  - Environmental costs
  - Understand the flow of value over time
  - Incorporates ecosystem service values
  - Uses quantified values, incorporates non-monetary metrics
- History of Use
  - Oil Spill Response and Planning (i.e., Exxon Valdez) to present uses (nationally and internationally)
  - Expanded to alternative analyses for actions that affect the environment

NEBA Results: Cost and Risk Profile Changes for each Response Evaluated



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Planning and Permitting

Siting: Planning and Permitting Opportunities

- Understanding and defining baseline conditions is critical
  - Basis for understanding the costs and benefits of actions
- Opportunity to regionalize/prioritize values through stakeholder engagement

Planning and Permitting - Government Lease Evaluation

- OECM Model (Offshore Environmental Cost Model)
  - Evaluates benefits and costs
  - Five year leasing program for nation
  - Lead Agency – Bureau of Ocean Energy Management (BOEM)
  - Several types of ecosystem services evaluated

Planning and Permitting - Government Lease Evaluation

OECM Model Environmental Categories

- Air Quality – Monetary Value of
  - Human Health
  - Agricultural Productivity and
  - Structural Damage Caused by Emissions
- Ecological – Restoration Costs for Habitats and Biota Injured by Oil Spills
  - Habitat Equivalency Analysis
  - Evaluates new risks but not
  - Footprint of platforms, rigs, pipelines, nor
  - Passive use values for sensitive species

Planning and Permitting - Government Lease Evaluation

OECM Model Social Cost Categories

- Recreation
  - Loss of recreational value from fishing and
  - beach visitation during oil spills
- Property Values – loss of value from
  - Visual disturbances from platforms, and
  - Damage from oil spills
- Subsistence Harvest
  - Replacement Cost for marine species killed in non-catastrophic oil spills

Planning and Permitting - Government Lease Evaluation

OECM Model Social Cost Categories (continued)

- Commercial Fisheries
  - Cost of extra effort imposed by platforms and pipeline buffer zones
  - Because most fisheries managed through catch limits, no impacts to harvest

Planning and Permitting - Government Lease Evaluation

OECM Model Example Results

Figure 1: Components of the Net Benefits Analysis

1	Anticipated Production of the Program Area	x	Assumed Oil and Gas Price Levels	=	**Gross Revenue**
2	Gross Revenue	-	Private Finding and Production Costs	=	**Net Economic Value (NEV)**
3	NEV	-	Environmental and Social Costs *less* Environmental and Social Costs of Energy Substitutes (Resulting from the NSO)	=	**Net Social Value (NSV)**
4	NSV	+	Consumer Surplus Benefits *less* Lost Domestic Producer Surplus Benefits	=	**Net Benefits**

Planning and Permitting - Government Lease Evaluation

OECM Model Example Results

Table 3: OECM Cost Categories for Central GOM

	Program Costs	No Sale Option Costs
	$ millions*	
Environmental Costs		
Air quality	5,681	17,193
Ecological impacts	3.76	10.83
Social Costs		
Recreation	259	229
Property values	0.11	0.24
Subsistence use	0.00	0.01
Commercial fishing	0.17	0.00

All values are discounted at a real discount rate of 3 percent.
* These values are the OECM results for the mid-price case with prices of $110 per barrel and $7.83 per mcf.

Includes only monetary metrics

Alternative Approach

- NEBA incorporates non-monetary ecosystem service metrics
- Used to help in comparing how each management alternative affects ecosystem service values (environmental, economic and social):

NEBA - A Comparative Analysis						
Management Actions	***Ecological Service Value***	***Human Use Economic Value***	***Social Value***	***Human Risk Profile***	***Ecological Risk Profile***	***Cost***
Alternative 1						
Alternative 2						
Alternative 3						
and so on …						

Note: A NEBA incorporating ecosystem service valuation is also referred to as a *net ecosystem service analysis (NESA)*

Operation

Operational Considerations

- Monitoring
  - Permitted discharges and emissions
  - Footprint biological monitoring
- Spill Response and Planning
  - Previous presentation
- Ongoing Stakeholder Engagement

Oil Spill Response and Planning

Good Use of NEBA

Arctic Oil Spill Response JIP:
ENVIRON Leading the Development of a NEBA Tool for response decision-making and environmental impact assessments related to Arctic spills.

BP, Chevron, Conoco-Phillips, Eni, ExxonMobil, North Caspian Operating Company, Shell, Statoil, and Total

NEBA in Emergency Prevention Preparedness and Response Workshop – Focus on Dispersants

Arctic Council member states are Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, Russian Federation, Sweden and the United States of America.

Australian Government

FINAL GOVERNMENT RESPONSE
TO THE REPORT OF
THE MONTARA COMMISSION OF INQUIRY

The assessment of National Contingency Plans will develop a clear plan and delivery mechanism for the provision of environmental advice, preparation and maintenance of **Net Environmental Benefit Analysis**

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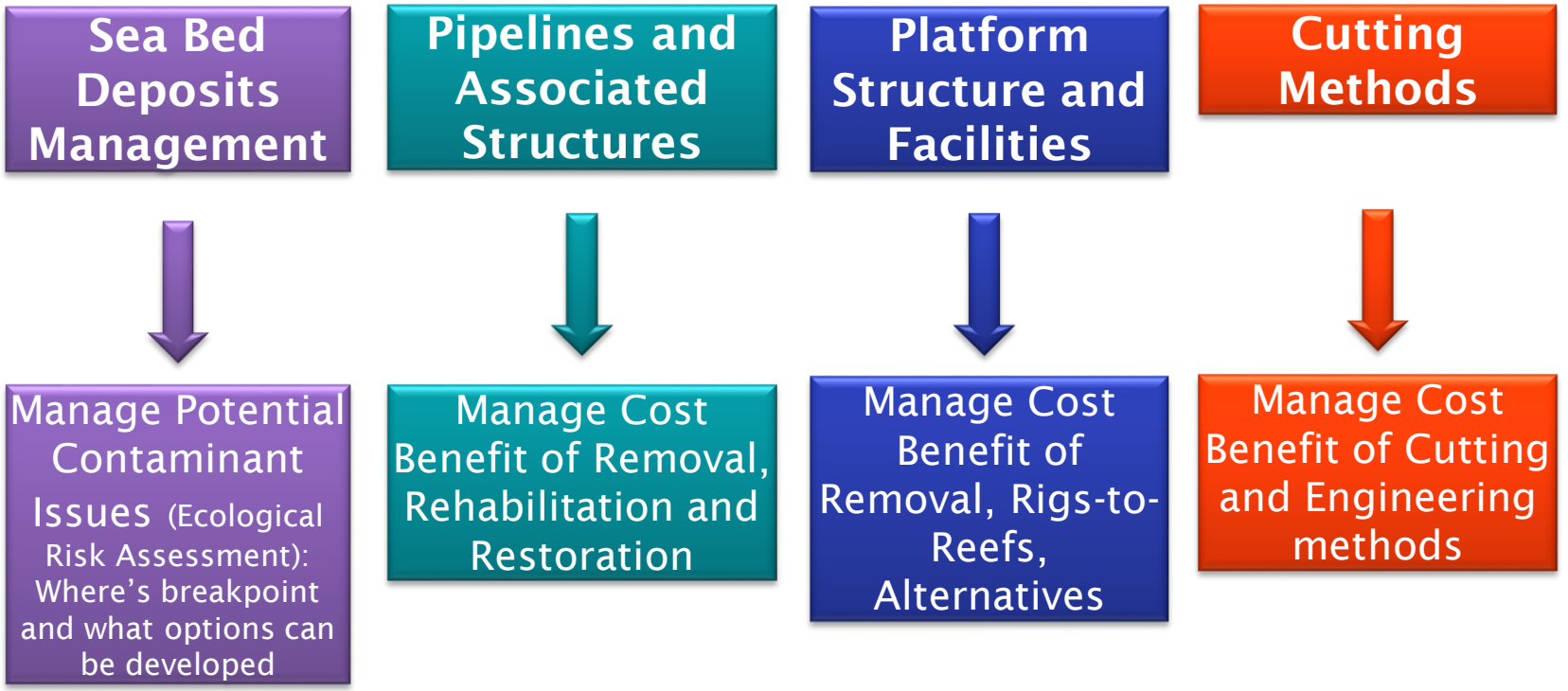
Decommissioning

NEBA Application Considerations



Evaluate combined ecological, human use, and economics values to provide information for an informed decision

Example Alternatives - Platform and Jacket

- Offshore O&G Platform
  - Jacket
    - Convert to Artificial Reef
      - Tow to Reef Site (one or multiple pieces)
      - Topple In-Place
      - Reef In-Place Upright
    - Remove & Reinstall
    - Onshore Recycle
  - Deck
    - Onshore Recycle

Decommissioning Process
Offshore

Good Use of NEBA

Structures and Facilities

- Topside vs. jacket substructure
- Topsides must be cleaned and decontaminated before removal for re-use, recycling and/or disposal
- Cleanliness must be audited by third party to ensure compliance with DEMP
- Using BPEO approach, substructures can be
  - Re-used
  - Removed
  - Left in place
- BPEO approach is needed to address removal involving cutting and explosives

Decommissioning Process
Offshore

Good Use of NEBA

Seabed Deposits Management (e.g., drill cuttings and muds)

- Management options
  - Leave *in situ*
  - Cap *in situ*
  - Remove & re-inject
  - Remove and dispose onshore
- Requires data on physical, chemical and biological aspects and impacts
- Assessed via BPEO
- *In situ* options require appropriate monitoring program
- Preferred option and monitoring plan must be submitted for approval

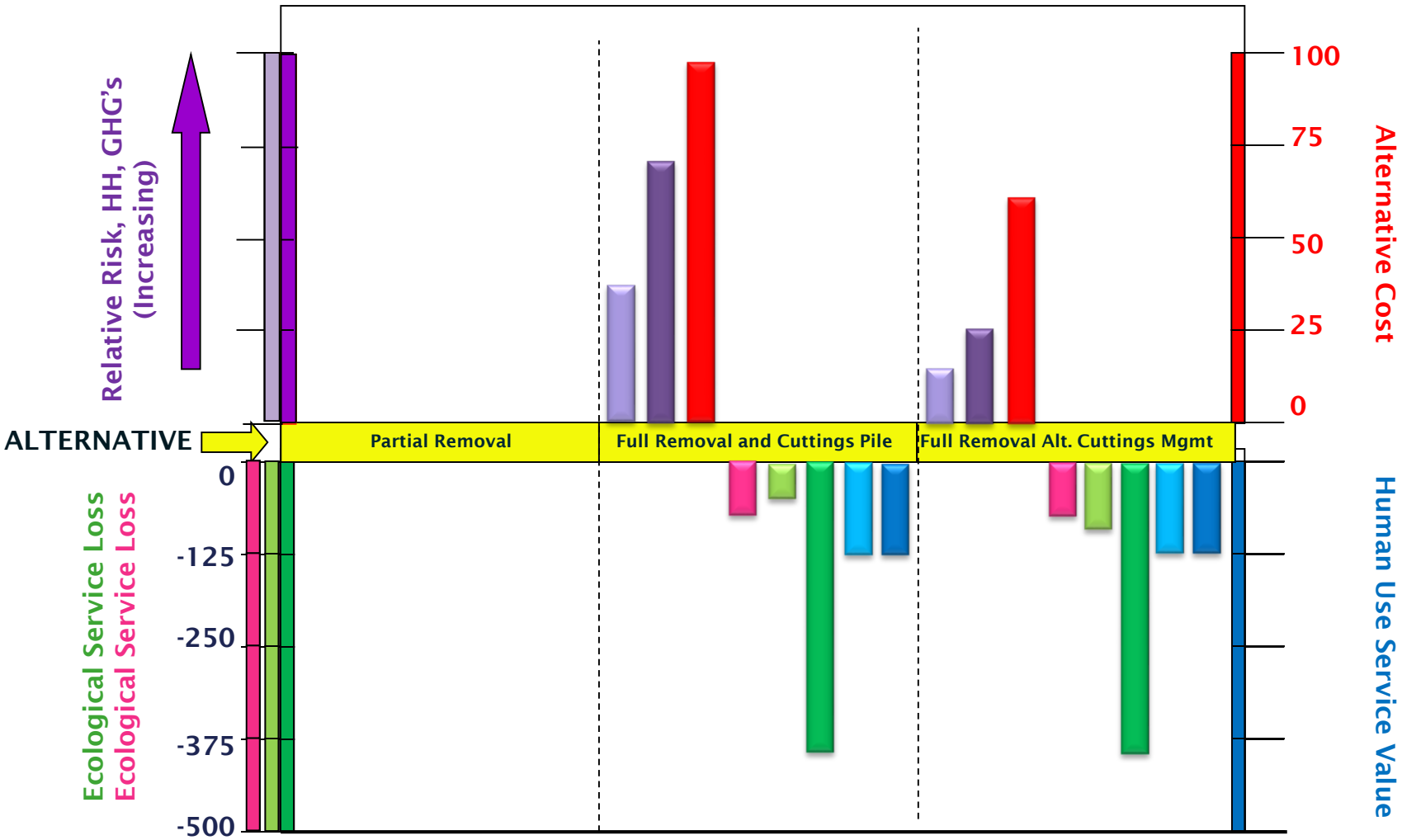
Decommissioning Process
Offshore

Good Use of NEBA

Pipelines and Associated Structures

- Pipelines and subsea equipment including manifolds, wyes and tees
  - Leave *in situ*
  - Remove & re-use
  - Remove and dispose
- Decision via BPEO, designated authority to approve
- If *in situ*, verification of decontamination is required
- Structures protruding above seabed pose hazards to fishing, navigation and other users and must be removed and disposed onshore
- Structures must be cleaned for safe handling

NEBA Results: Conceptual Example



Summary

- Opportunities for NEBA to better inform O&G development decision-making in the Artic.
- NEBA process fundamental to Oil and Gas Development in the Arctic
- Used by Most Arctic Nations (Spill Response)
- U.S. includes many ES in OECM, but… excludes other services that are not easily monetizeable
- NEBA offers opportunities to better engage stakeholders, gather needed data and adaptively manage the O&G development lifecycle