Environmental Risks and Siting Challenges

Bonnie Ram

ENERGETICS
A Subsidiary of VSE Corporation

Energetics Incorporated

New York
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Overview

- **Products and Services:**
  - Strategic planning and analysis
  - Partnership building and implementation
  - Visions and technology roadmaps
  - Technology assessments and performance metrics
  - RD&D program management
  - Multi-media technical communications
  - Environmental analysis and compliance
  - Renewable technology assessment
  - Conference management and facilitation services

Energetics supports complex science and technology RD&D programs

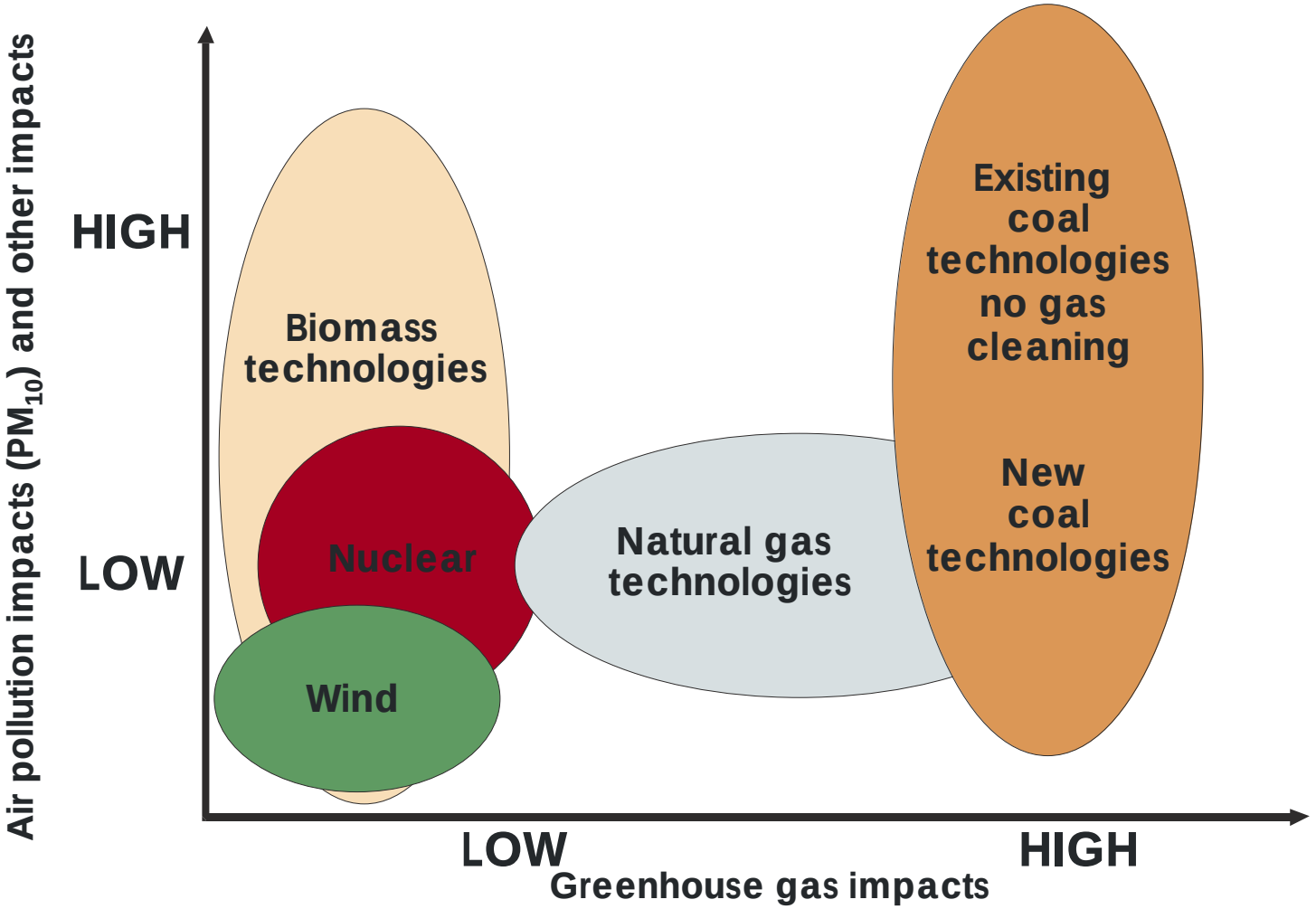
Overview

- **Clients: Federal Government, State Governments, Industry Associations, National Laboratories, Universities, Private Companies**
- **Staff: 112 professionals**
- **Offices: Columbia, MD (HQ), Washington, DC, Morgantown, WV**
- **Ownership: Established in 1979. Since 1995, wholly owned subsidiary of VSE Corporation.**

Presentation Overview

- The energy challenge
- Benefits of ocean renewable energy
- Existing environmental impact assessments
- Range of potential effects on environmental and human systems
- Why risk assessment essential
- Uncertainty analysis
- Recommendations

Comparative Impacts and GHGs



Source: 1

Environmental Effects

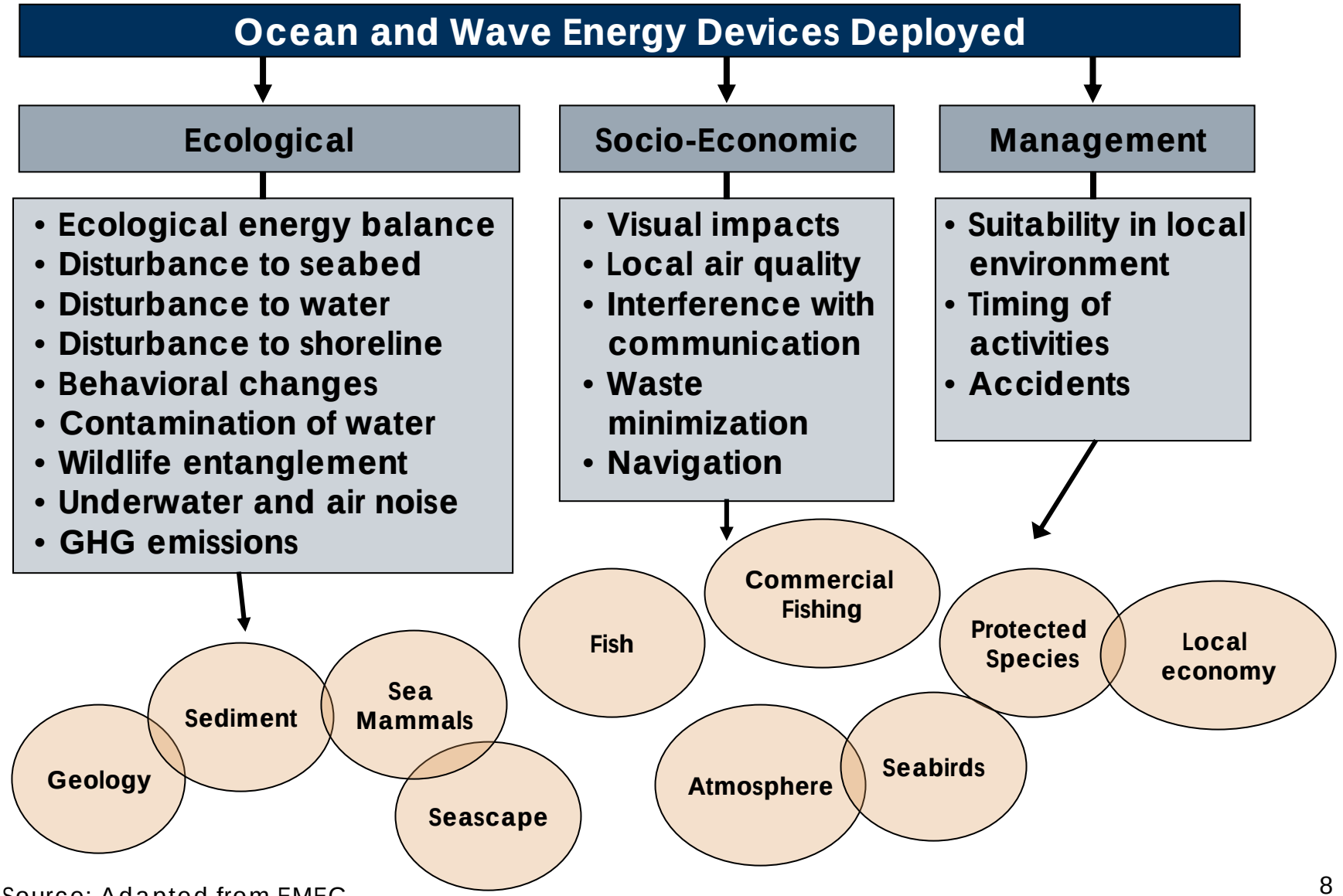
- Bathymetry
- Geology, seabed sediments, and sediment transport
- Marine and coastal processes
- Seabed contamination
- Water quality
- Protected sites and species
- Benthic ecology
- Fish and shellfish
- Marine birds
- Marine mammals
- Fisheries
- Cables and pipelines
- Military activities
- Disposal areas
- Electronic and magnetic fields
- Onshore grid connection
- Noise and vibration
- Decommissioning

Source: 2 , 3

Human Effects

- Worker health and safety
- Integrity of coastal communities
- Tourism and recreation
- Aesthetics
- Cultural/historic views
- Property values
- Conflicting uses
- Shipping and navigation

Verdant; Horizontal Axis; East River, NY



Source: Adapted from EMEC

Challenges

- Environmental impact assessment requirements
  - Establishing thresholds of significance
- Difficult to make generalizations
  - Variety of sites, ecosystems, and technologies
- Smart siting policies
  - Marine spatial planning and GIS tools
- Early engagement with stakeholders essential
  - Avoid or minimize conflicts
- Do not have a risk framework
- Energy politics

Selected Documents from North America

Project Name	Organization	Environmental Documentation
Oahu Kaneohe, HI Ocean Power Technologies	Department of the Navy	Environmental Assessment January 2003
Makah Bay, WA Finavera	FERC	Draft EA October 2006
National Program	MMS	Programmatic Environmental Impact Statement November 2007 Record of Decision January 2008

Selected Documents from Europe

Location	Organization	Environmental Documentation
Orkney, Scotland	EMEC	Environmental Impact Assessment Guidance for Developers 2005
UK	South West of England Regional Development Agency,	Environmental Statement 2006
Strangford Lough, Northern Ireland	Royal Haskoning Ltd Marine Current Turbines, Ltd.	Environmental Impact Study 2005

Why is Risk Assessment Required?

- Specifics on probability and consequence
- Allows comparison of impacts, including ecological, social, and human
- Usually includes analysis of uncertainty
- Building block for decisionmaking
- Defines range & economics of mitigation strategies
- Setting priorities for research

A Simple Model of Risk
(Kaplan and Garrick, 1981)

$$\text{Risk} = f\{x_i, p_i, c_i\}$$

Where,

x_i = Adverse effect i	(What can happen?)
p_i = Probability of x_i	(How likely is it?)
c_i = Consequences of x_i	(So what?)

Source: 4

What is Uncertainty?

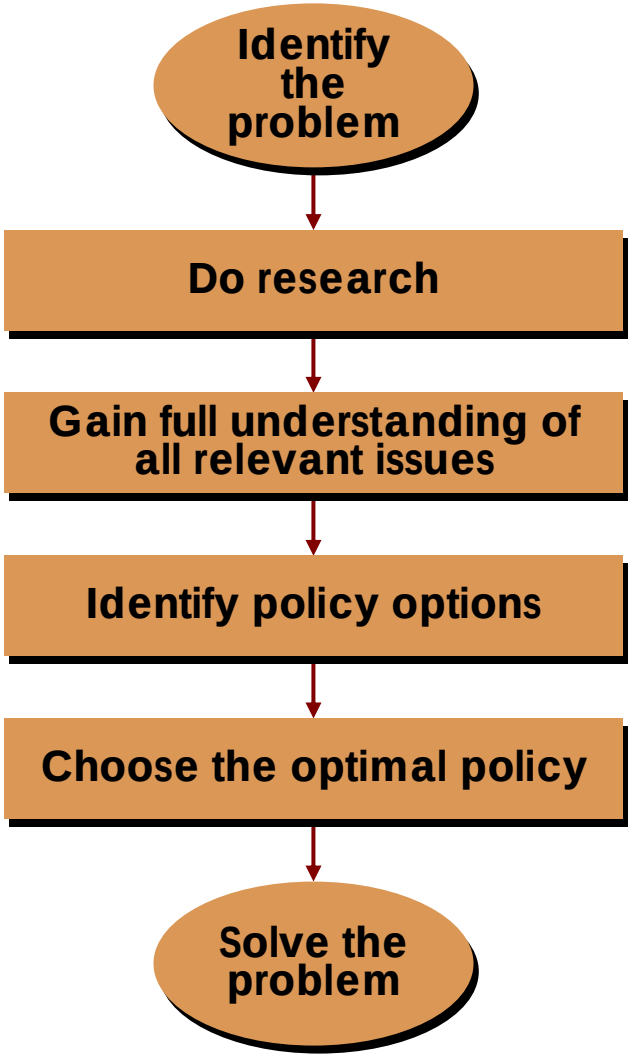
- All decisions involve uncertainty
- Where experience exists, we make our way in an uncertain world
- Uncertainty is a major challenge where:
  - Highly complex and interconnected systems exist
  - Novel problems or new technologies limit experience
  - Distant futures limit prediction
  - Human and technological systems are intertwined

Source: 6

Why is Uncertainty Analysis Essential?

- Reveals weak links in current understanding of "significant" risks and actual impacts
- Assists in prioritizing research:
  - How reducible are different uncertainty types?
  - What issues will give greatest traction on understanding overall risk?
  - What methods are likely to be most successful?
  - When should the 'precautionary principle' prevail?
- Provides guidance on the selection of a management and mitigation strategy

Two Risk Models
Model 1 – Command and Control



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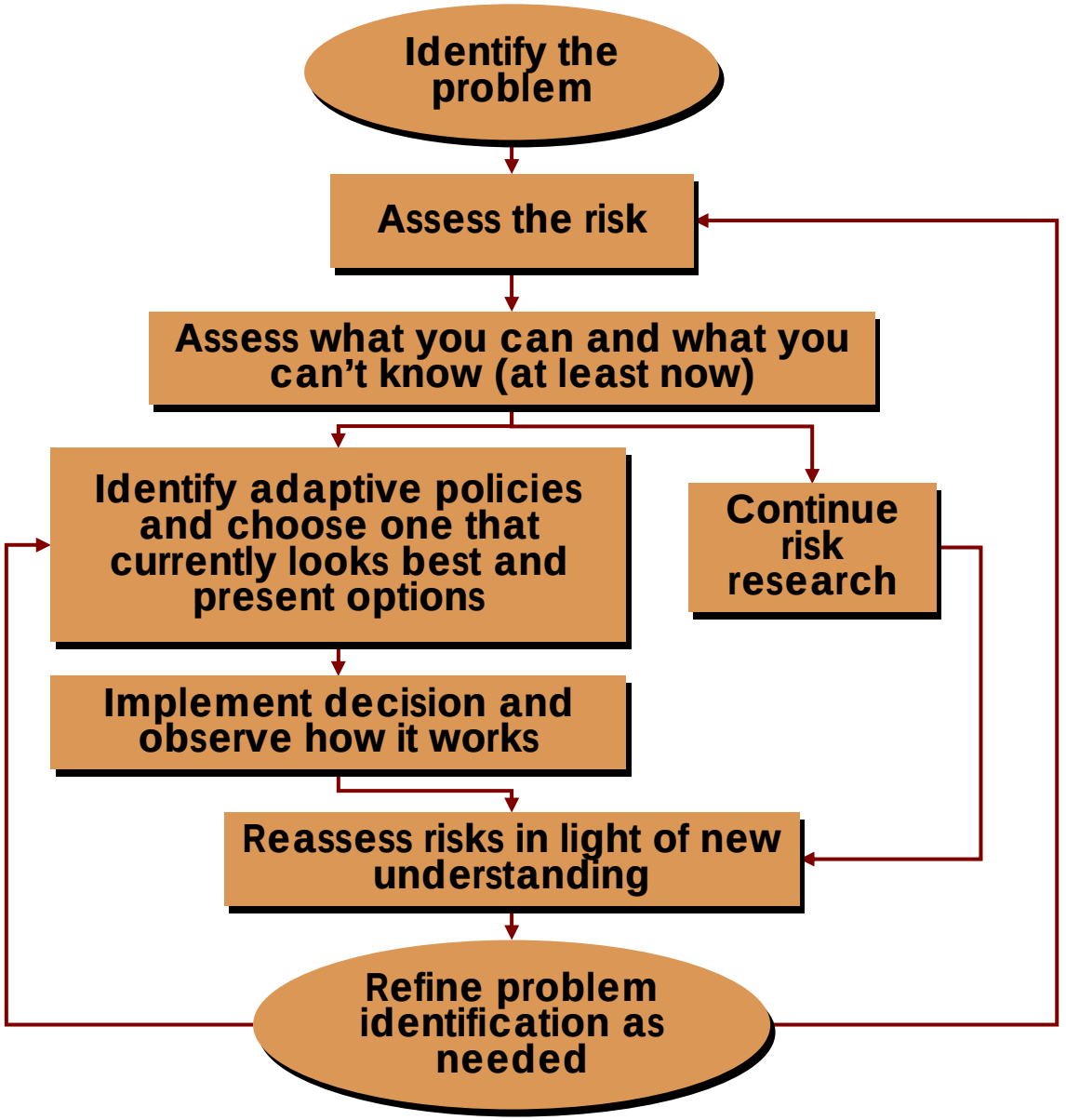
Model 2 – Adaptive Management



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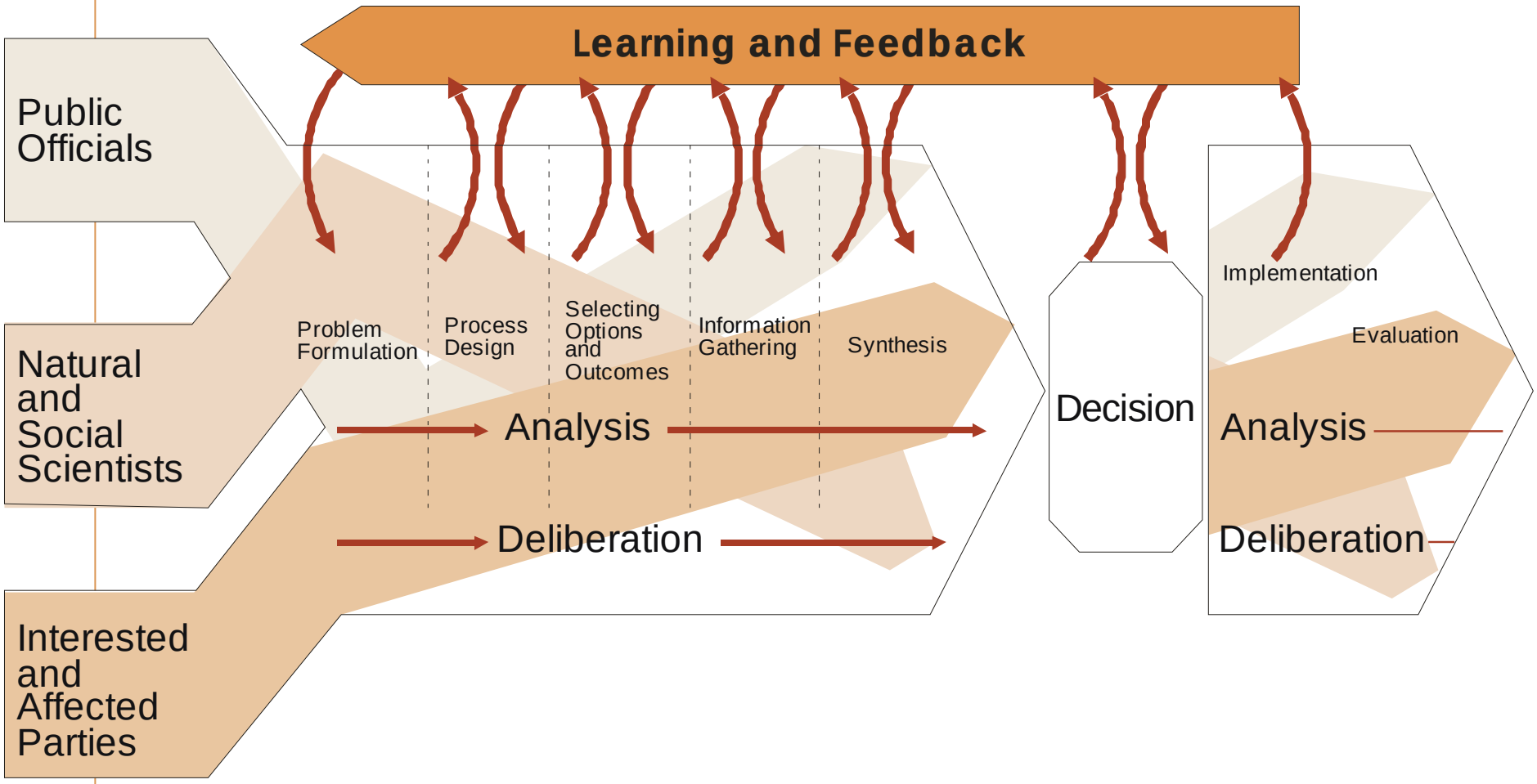
Risk Decision Process



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Environmental and Siting Challenges

- Smart siting strategies for demonstrations
- Public perception and involvement
- Scientific research and environmental documentation
- Risk analysis
- Regulatory framework
- Interagency leadership on ocean energy policy
- Lessons learned from other industries

Elements of a Siting Process

- Continue solving the leadership voids and overlaps
  - Federal, states, local, and regional
- Define the demand and electric utility interest (RPSs)
- Streamline permitting needs
- Well-sited demonstrations lead to big payoffs
- Avoid sensitive habitats
- Process evolves with experience — Just do it
- Setting reasonable standards and monitoring performance and effects
- Commitment to public response research

Research Recommendations

- Agencies define their roles
  - Partnerships with states
- Allocate resources to major risks and uncertainties

- Commitment to sustained public involvement
- Move forward while applying lessons learned (adaptive management)
- Establish a knowledge base for comparative risks and benefits of energy options

Bonnie Ram
bram@energetics.com

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