

Energy Security in the Built Environment

- **Dimitrios Koupatsiaris**
 - dkoupats@hotmail.com
- Commander, Hellenic Navy

Outline

- What is Energy Security?
- Is it applied in the Built Environment?
- If yes, what are the shortfalls?
- Is there really a need to mitigate the shortfalls?
- In which area could the mitigation focus?

Naming conventions

- Energy security
 - The uninterrupted availability of energy sources at an affordable price, both in short-term and in long-term.
- Built Environment
 - The ensemble of structures that are complex and complete technological products, and for which energy consumption is major part of life cost (buildings, land, sea and air vehicles).
- Systems engineering
 - An interdisciplinary field of engineering that focuses on the design and management of complex engineering systems over their life cycles.

International Energy Agency (IEA)

- Scope
 - Founded in 1974 (out of OECD), IEA advocates policies that enhance the reliability, affordability and sustainability of its member states and beyond.
- Focus areas
 - Energy security (prompt response to market disruptions, energy efficiency improvement)
 - Economic development
 - Environmental awareness (deploy low carbon technologies)
 - Worldwide engagement (global solutions)

Energy security in systems

Principles

Short-term: Robustness by backup and emergency systems.

Medium-term: Alternative supply arrangements.

Long-term: Strategic decisions to minimize cost.

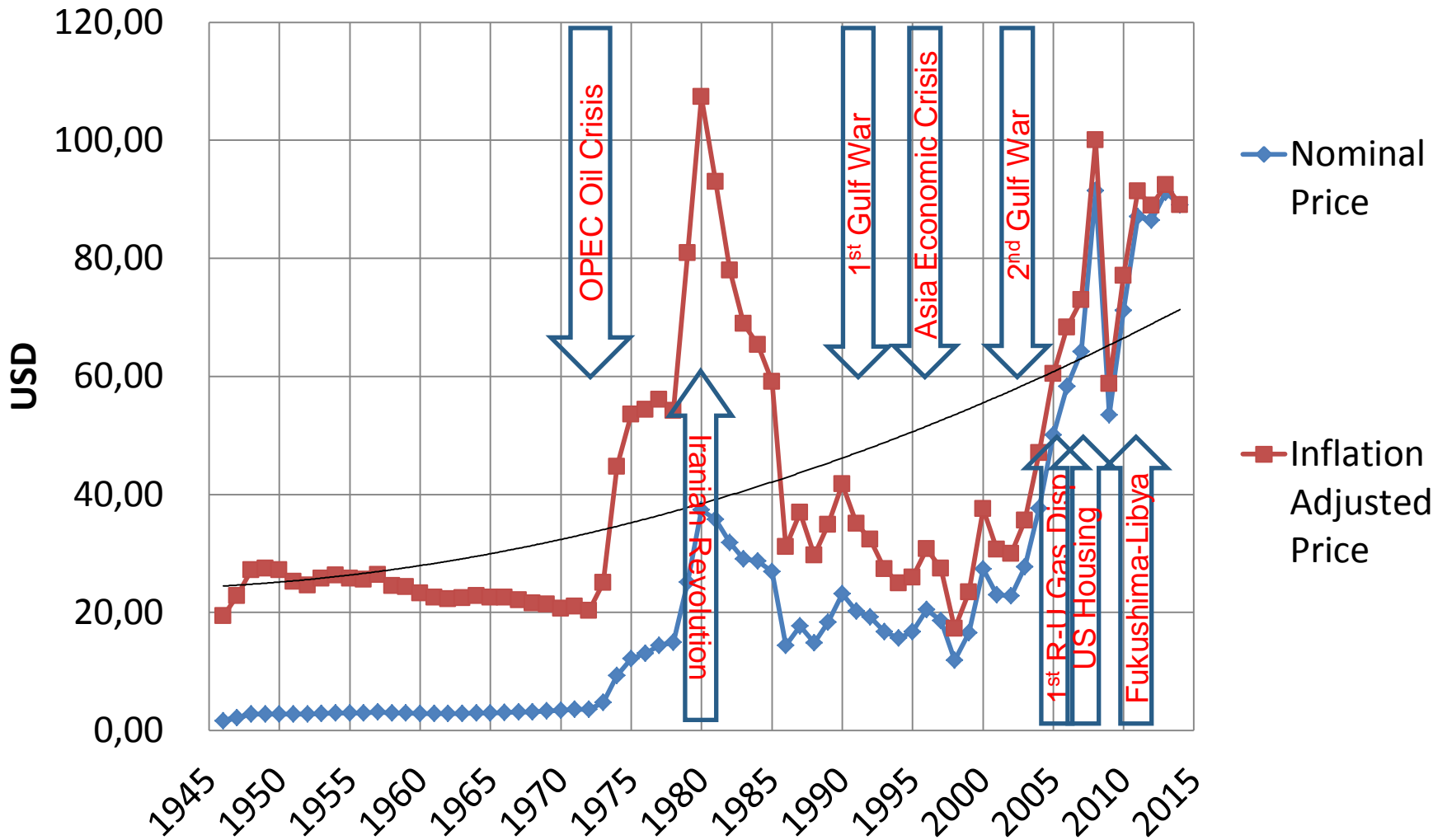
Practice

Multiple solutions, especially in the maritime and aviation industries.

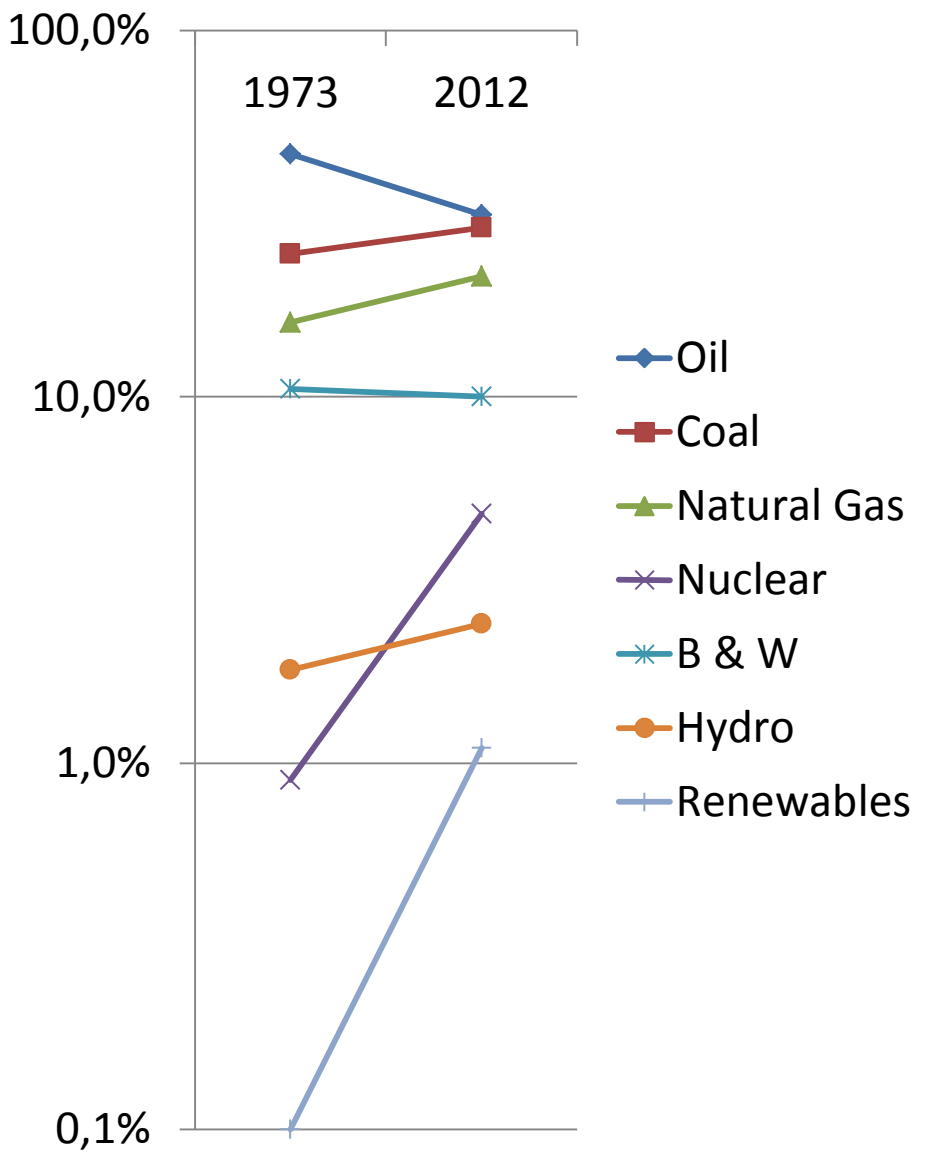
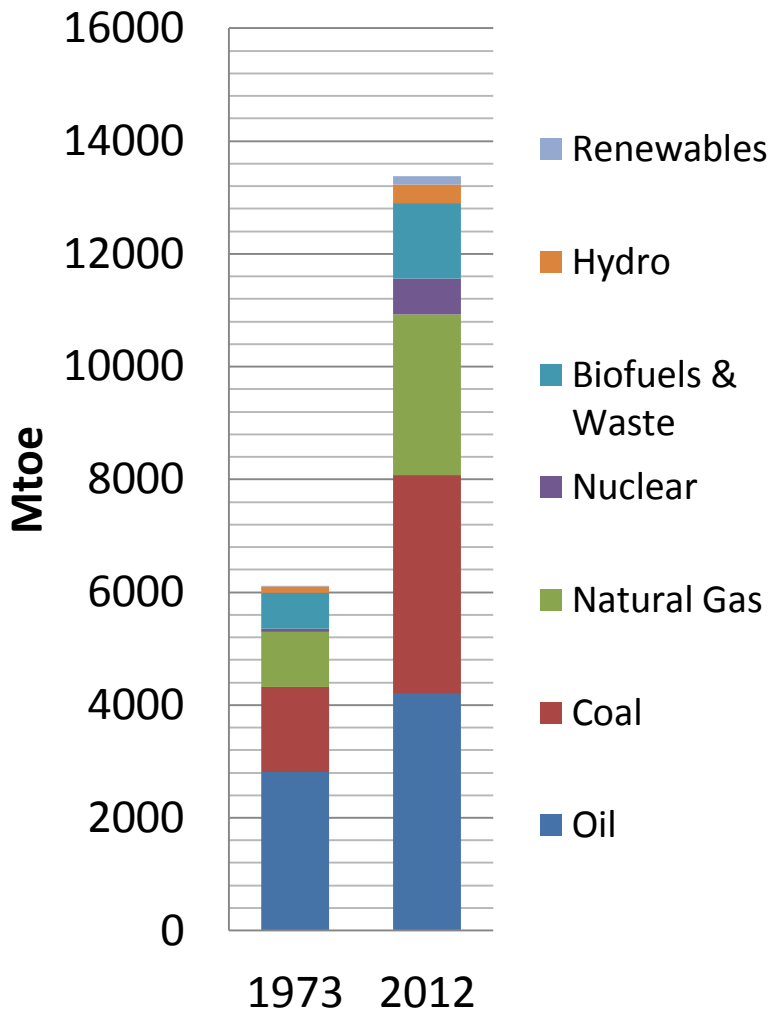
Contingency plans for alternate providers. Energy efficiency gains attention.

Fossil fuels are standard choice. Efforts to introduce renewables depend on subsidies (buildings, industry). Attempts in the transportation sector fail to reach production

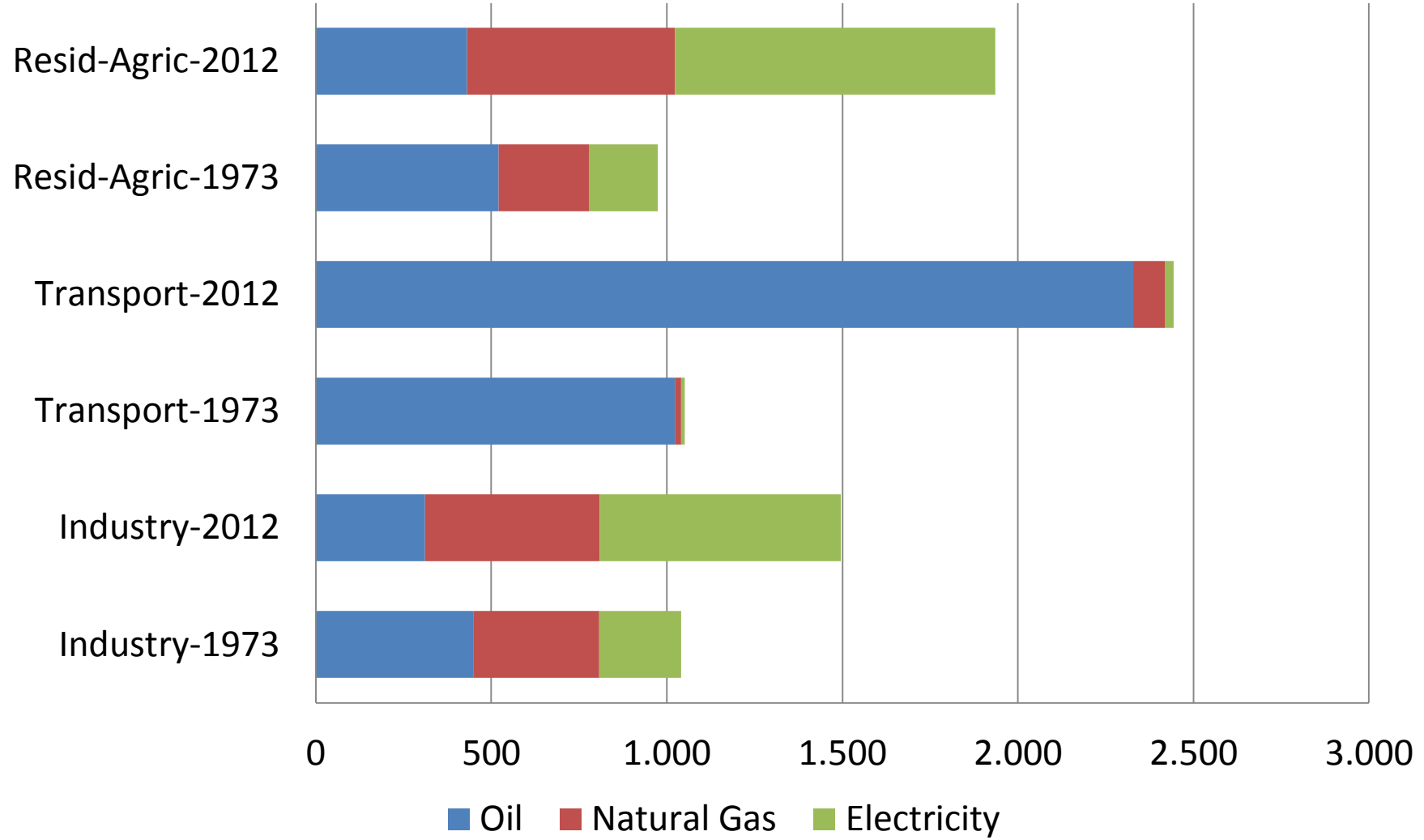
Crude Oil Barrel Price in US Market



Total Primary Energy Supply



Energy Consumption by Sector 1973-2012 [Mtoe]

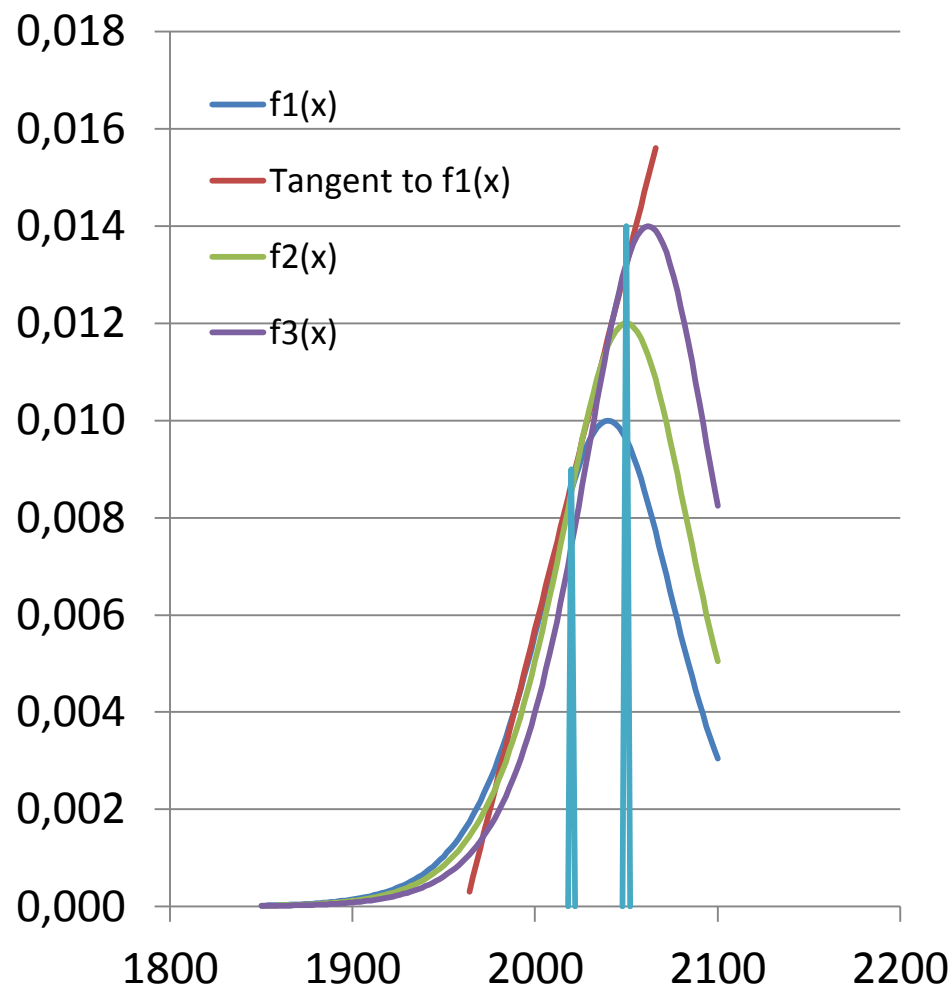


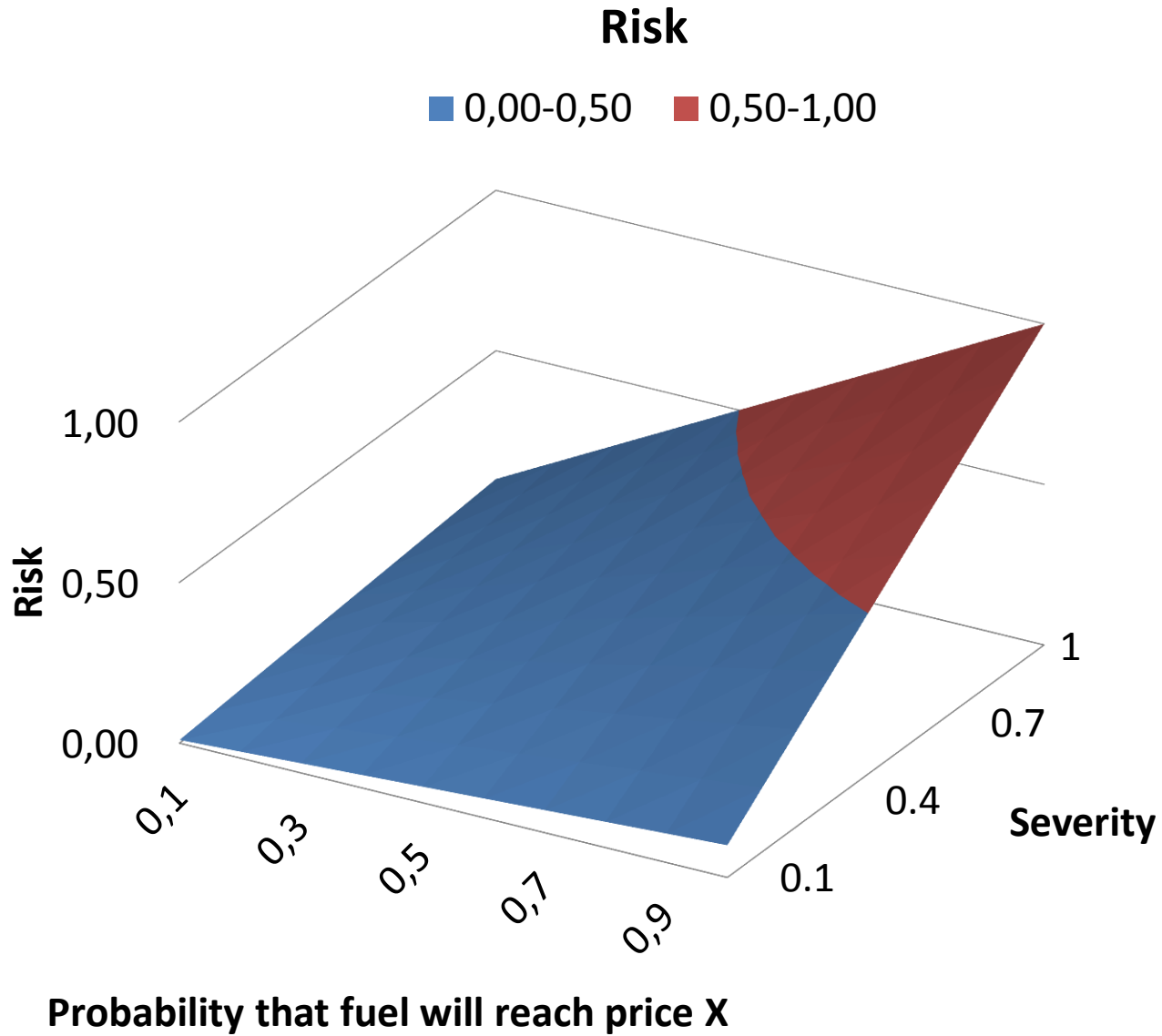
Peak oil consideration

- Hirsch report for peak oil
 - Cannot be predicted, also due to disclosure of data.
 - Severe liquid fuels problem for the transportation sector.
 - Dramatically higher oil prices.
 - Mitigation requires at least a decade of intense, expensive effort.
 - Efficiency is essential, but neither sufficient nor timely enough to solve the problem.
 - Risk management problem.

Hubbert peak theory

- Applies to all finite resources.
- Can predict peak point if global reserves are known.
- Inflation-free resource price likely follows geometric progression.
- Probability of price increase, together with likelihood of affecting system operations, define a risk.





Systems Engineering Engine

System Design

Requirements Definition Processes

- Stakeholders Expectations Definition
- Technical Requirements Definition

Technical Solution Definition Processes

- Logical Decomposition
- Design Solution Definition

Technical Management

Technical Planning Process

Technical Control Processes

- Requirements Management
- Interface Management
- Technical Risk Management
- Configuration Management
- Technical Data Management

Technical Assessment Process

Technical Decision Analysis Process

Product Realization

Product Transition Process

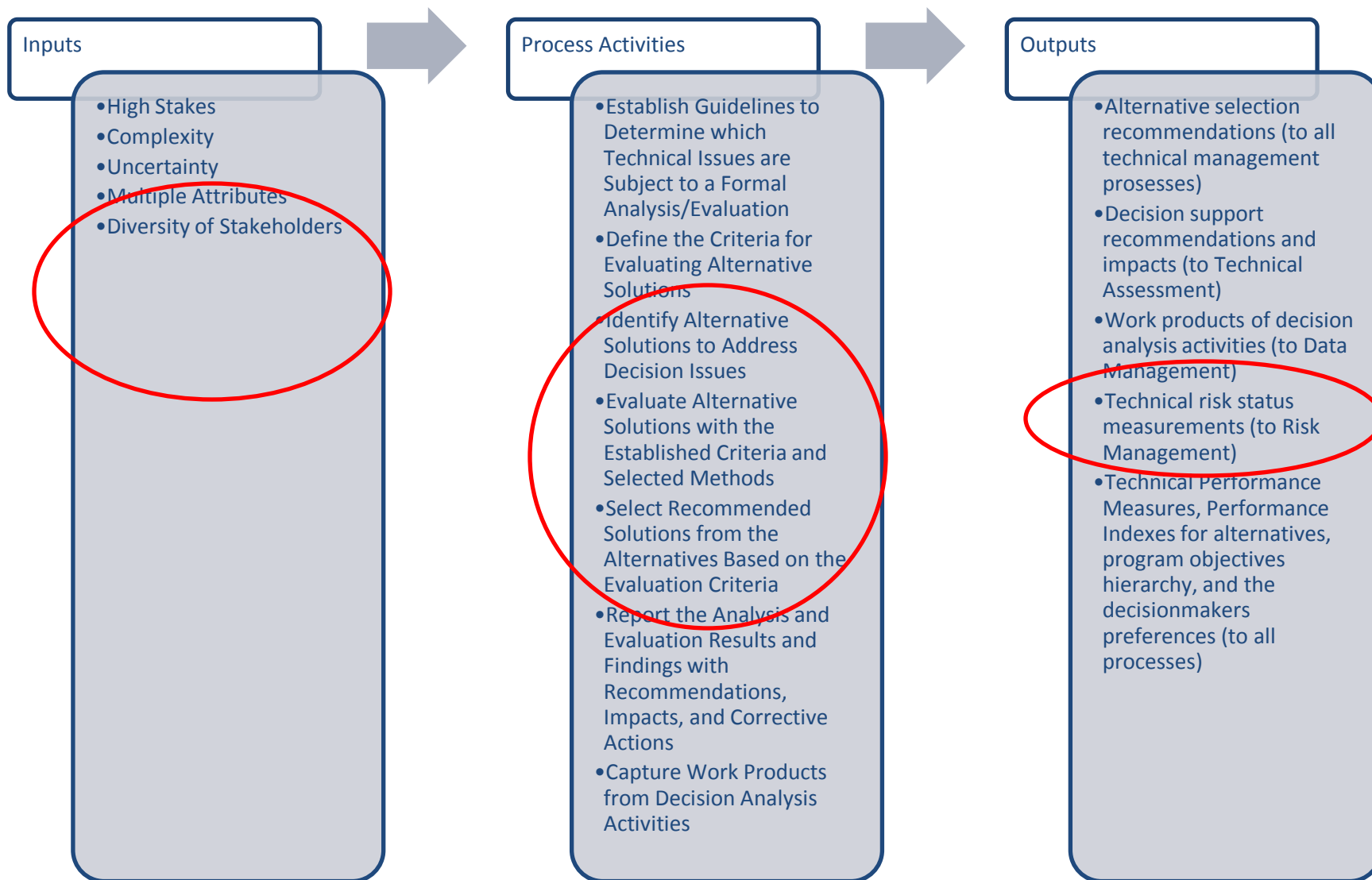
Evaluation Processes

- Product Verification
- Product Validation

Design Realization Processes

- Product Implementation
- Product Integration

Decision Analysis Process



Conclusions

- In addition to the impact to the environment, the era of fossil fuel dominance is closing to an end, including natural gas, coal and nuclear fuel.
- More aggressive measures to include renewable energy sources must be taken, especially in the transportation sector.
- A possible way to handle the associated risk rationally and methodically, is to acknowledge the counter-acting risk of fuel cost increase during system design.
- Ship-building industry is the best candidate to pioneer the paradigm of mixed energy usage, due to the nature of the ship as a platform.

Dimitrios Koupatsiaris

dkoupats@hotmail.com

