Integrating Sustainability into DoD Acquisition Programs

October 2012

Paul Yaroschak, P.E.
Deputy for Chemical & Material Risk Management
Office of the Deputy Under Secretary of Defense
(Installations & Environment)

The Vision

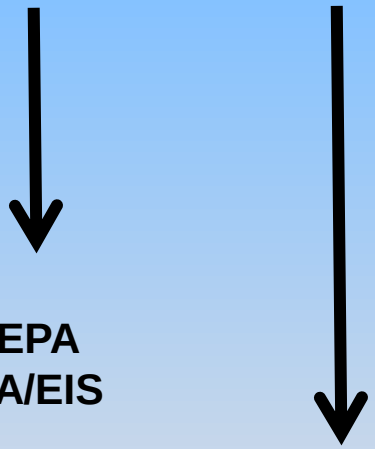
DoD developers, program managers, and prime contractors **analyze alternatives** for meeting mission requirements and **make informed decisions** that result in:

- **Sustainable Systems**
- **Lower Total Ownership Cost**

How? Sustainability Analysis Using Life Cycle Assessment (LCA) Methods

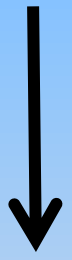
Sustainability Analysis

LCA + LCCA = Sustainability Analysis



NEPA
EA/EIS

Total Ownership Cost



Trade Space Analysis
Supportability Analysis
Business Case Analysis

Sustainability Analysis Outputs

1) **A diagram that compares alternatives by showing their *relative* life cycle human health and environmental impacts - a great decision tool for making sustainable decisions**

2) **Life cycle costs related to the impacts for each alternative…informs Total Ownership Cost estimates**
   - **Internal (to DoD)**
   - **External (to society)**
   - **Contingent (risks)**

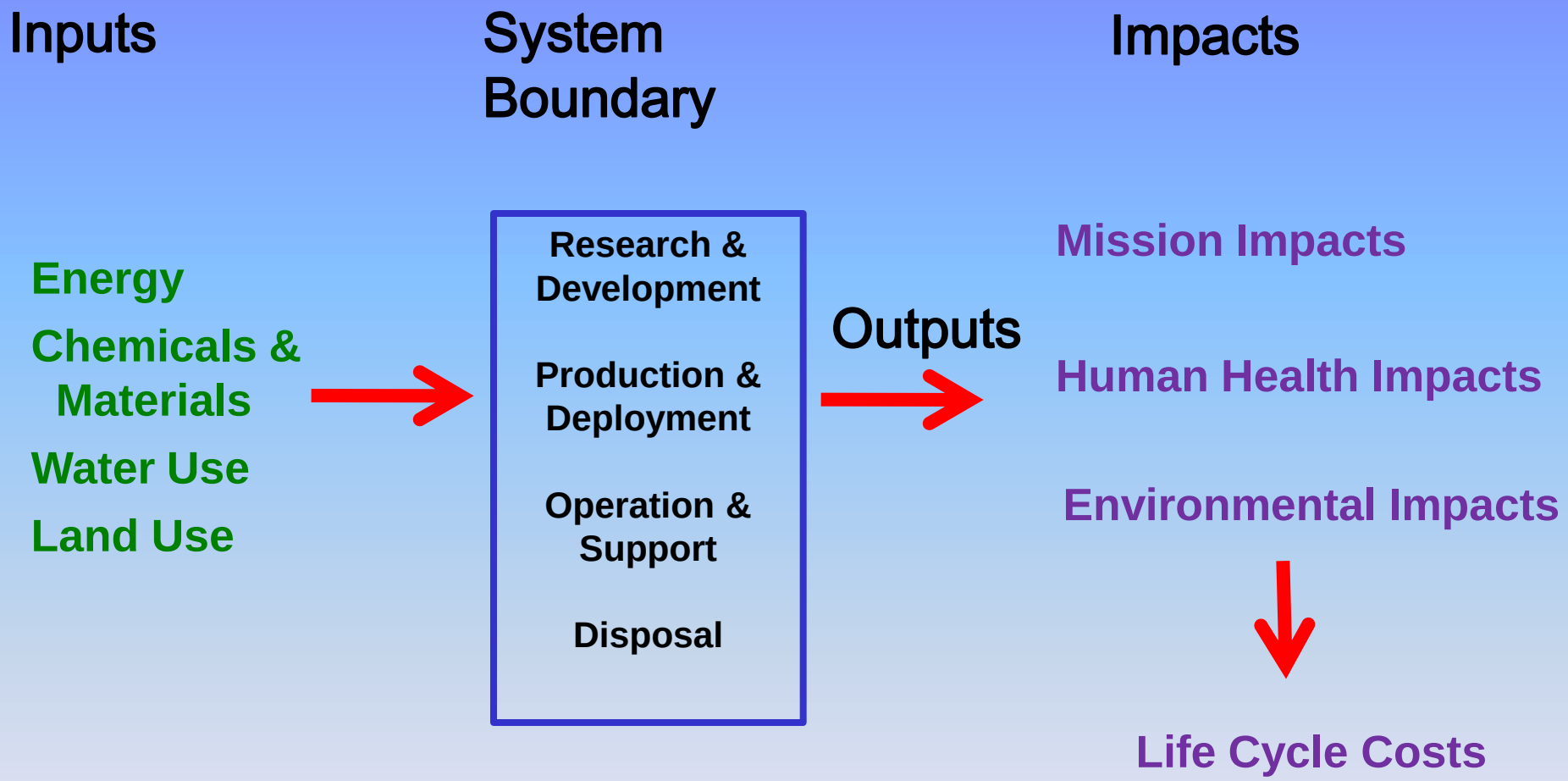
Hierarchy of LCA Methods

1) **Process level LCA (the gold standard per ISO 14040/44)**
   - **Life cycle inventory…data intensive**
   - **Life cycle impact assessment (LCIA)**

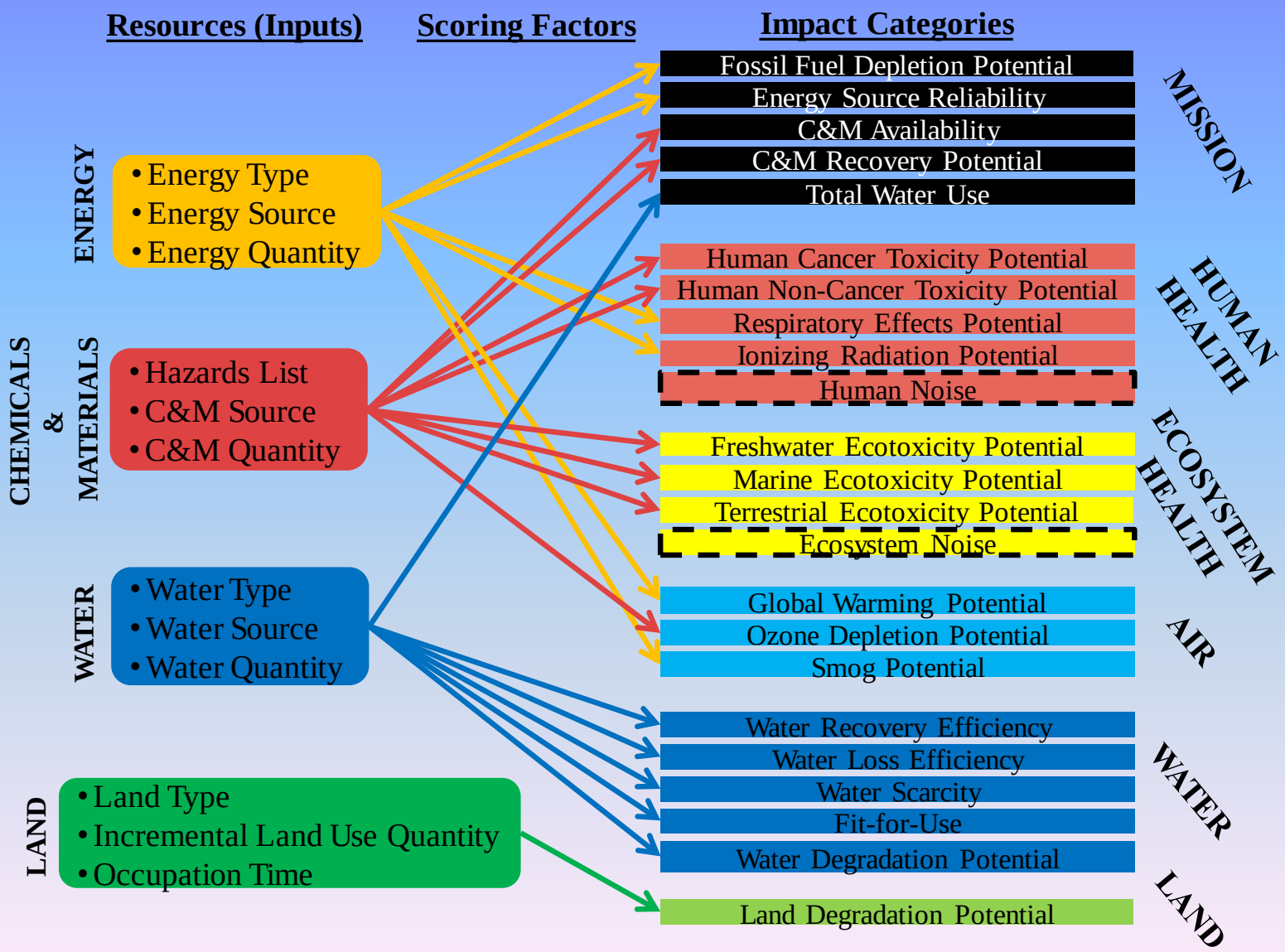
2) **Hybrid Economic Input-Output LCA**
   - **Focuses on attributes with most impact**
   - **Monetizes the impacts for LCC estimates**
   - **Pilot test underway – DOD/Boeing/Sikorsky**

3) **Streamlined LCA (SLCA)**
   - **Modified process for DoD acquisitions**
   - **Employs Multi-Attribute Analysis**

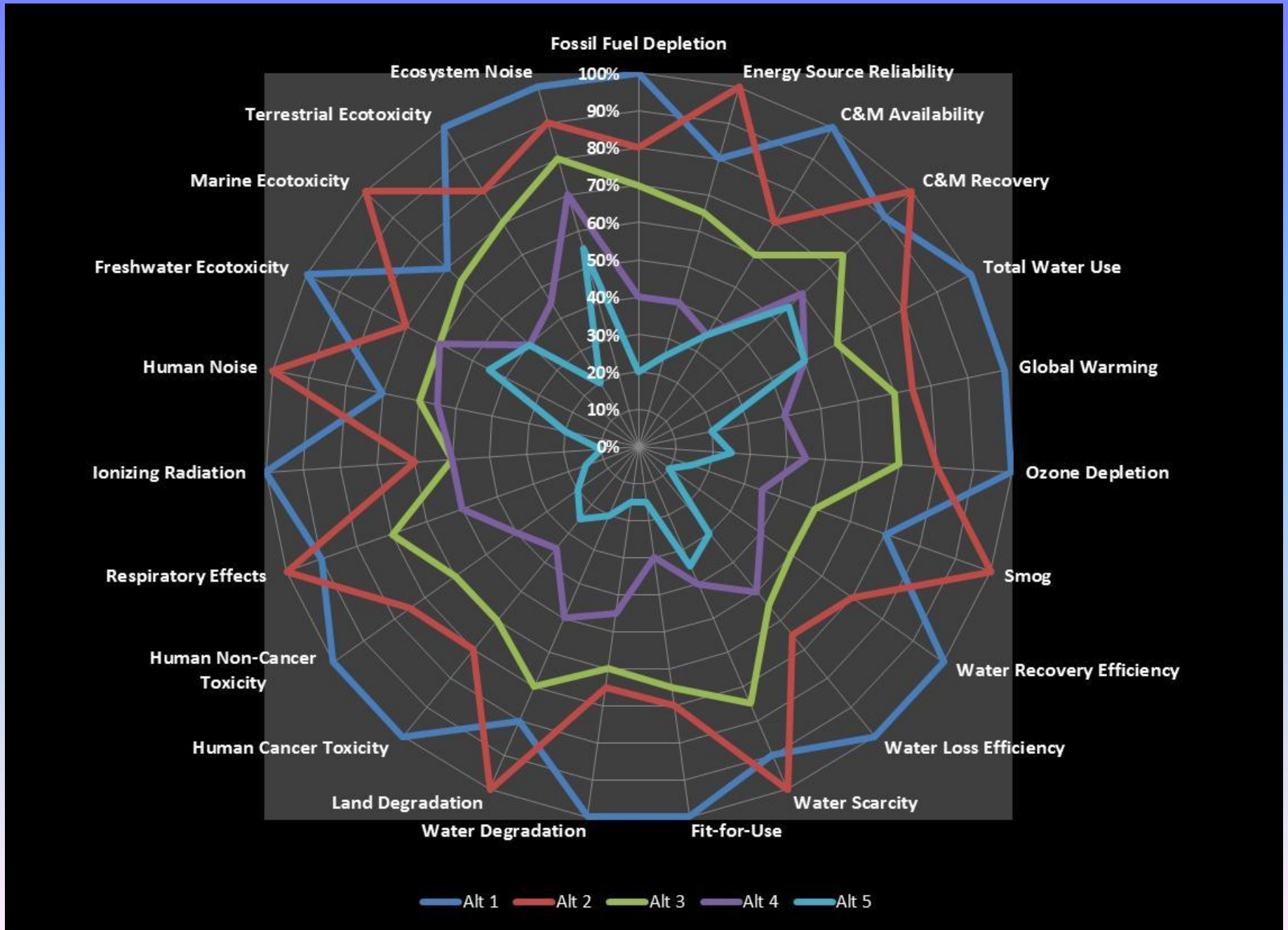
LCA Model for DoD

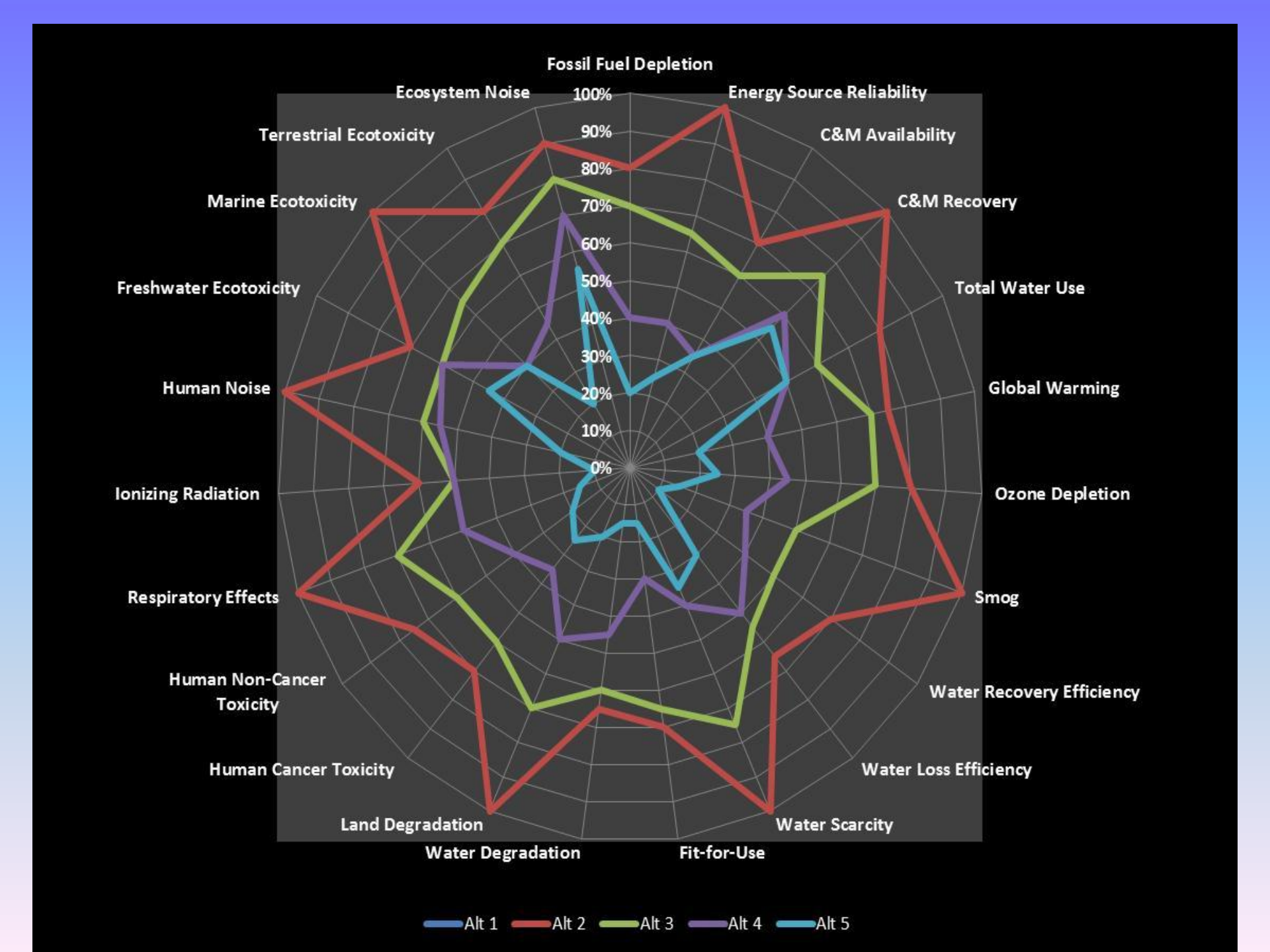


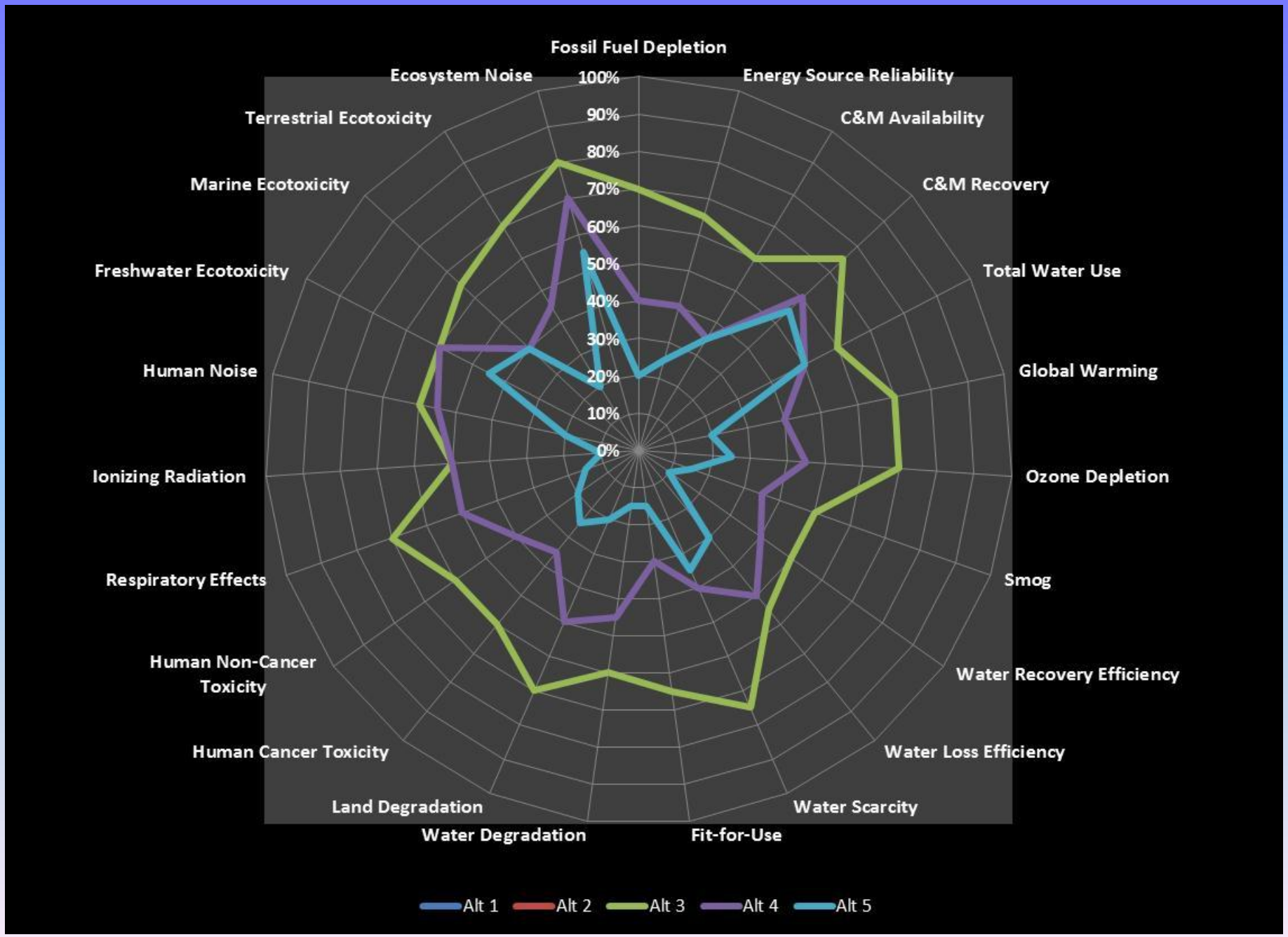
Impacts

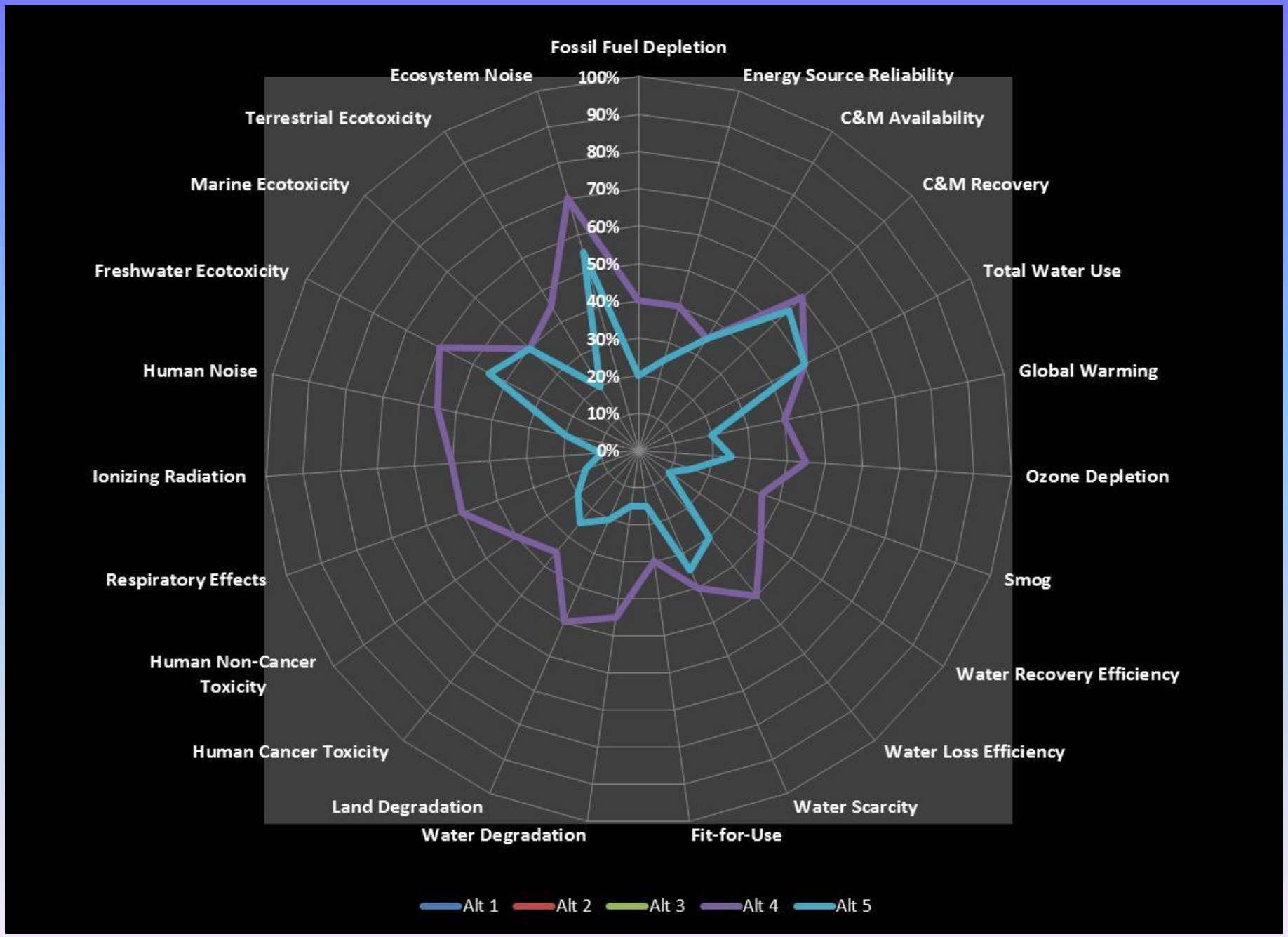

Resources (Inputs)
Scoring Factors
Impact Categories
ENERGY
• Energy Type
• Energy Source
• Energy Quantity
CHEMICALS & MATERIALS
• Hazards List
• C&M Source
• C&M Quantity
WATER
• Water Type
• Water Source
• Water Quantity
LAND
• Land Type
• Incremental Land Use Quantity
• Occupation Time
Fossil Fuel Depletion Potential
Energy Source Reliability
C&M Availability
C&M Recovery Potential
Total Water Use
MISSION
Human Cancer Toxicity Potential
Human Non-Cancer Toxicity Potential
Respiratory Effects Potential
Ionizing Radiation Potential
Human Noise
HUMAN HEALTH
Freshwater Ecotoxicity Potential
Marine Ecotoxicity Potential
Terrestrial Ecotoxicity Potential
Ecosystem Noise
ECOSYSTEM HEALTH
Global Warming Potential
Ozone Depletion Potential
Smog Potential
AIR
Water Recovery Efficiency
Water Loss Efficiency
Water Scarcity
Fit-for-Use
Water Degradation Potential
WATER
Land Degradation Potential
LAND

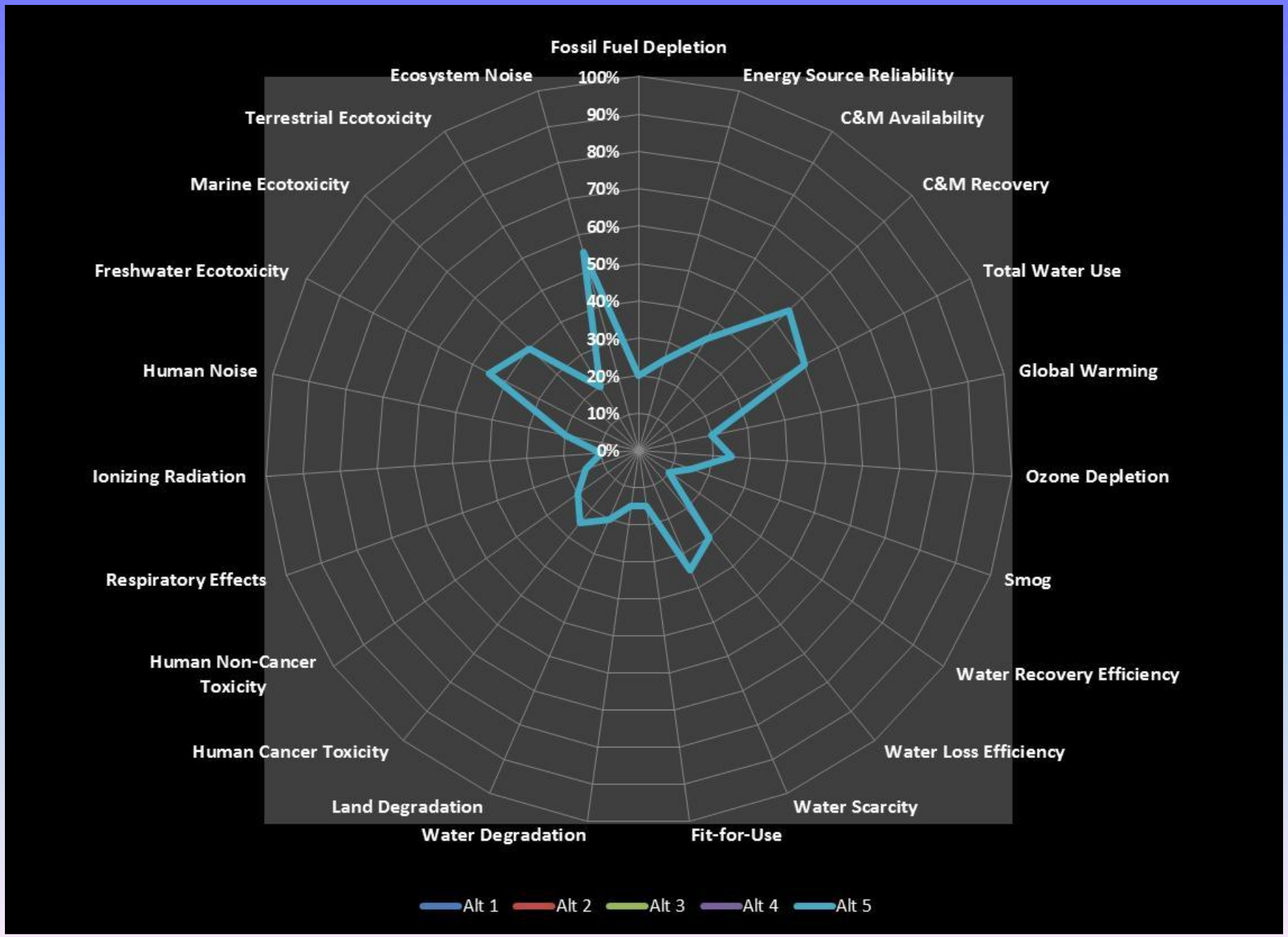
Spider-Web Decision Diagram



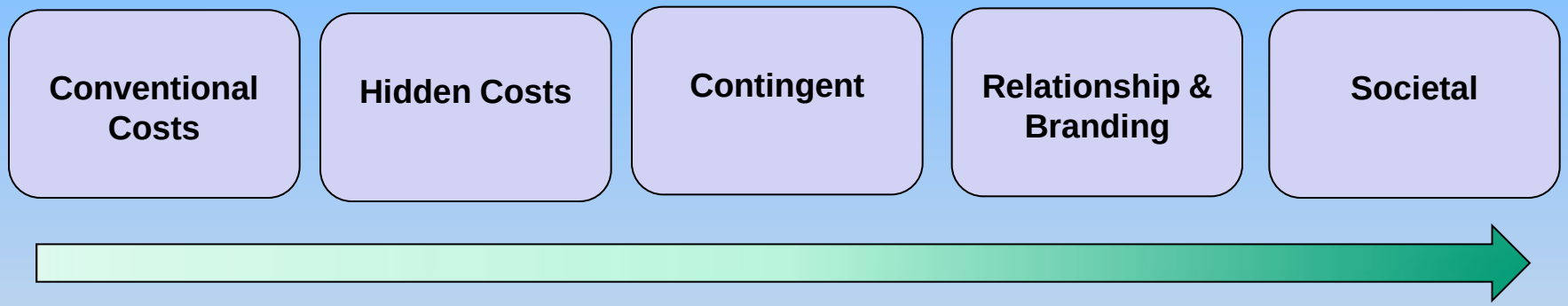

Fossil Fuel Depletion
Energy Source Reliability
C&M Availability
C&M Recovery
Total Water Use
Global Warming
Ozone Depletion
Smog
Water Recovery Efficiency
Water Loss Efficiency
Water Scarcity
Fit-for-Use
Water Degradation
Land Degradation
Human Cancer Toxicity
Human Non-Cancer Toxicity
Respiratory Effects
Ionizing Radiation
Human Noise
Freshwater Ecotoxicity
Marine Ecotoxicity
Terrestrial Ecotoxicity
Ecosystem Noise
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Alt 1
Alt 2
Alt 3
Alt 4
Alt 5


Fossil Fuel Depletion
Energy Source Reliability
C&M Availability
C&M Recovery
Total Water Use
Global Warming
Ozone Depletion
Smog
Water Recovery Efficiency
Water Loss Efficiency
Water Scarcity
Fit-for-Use
Water Degradation
Land Degradation
Human Cancer Toxicity
Human Non-Cancer Toxicity
Respiratory Effects
Ionizing Radiation
Human Noise
Freshwater Ecotoxicity
Marine Ecotoxicity
Terrestrial Ecotoxicity
Ecosystem Noise
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Alt 1
Alt 2
Alt 3
Alt 4
Alt 5

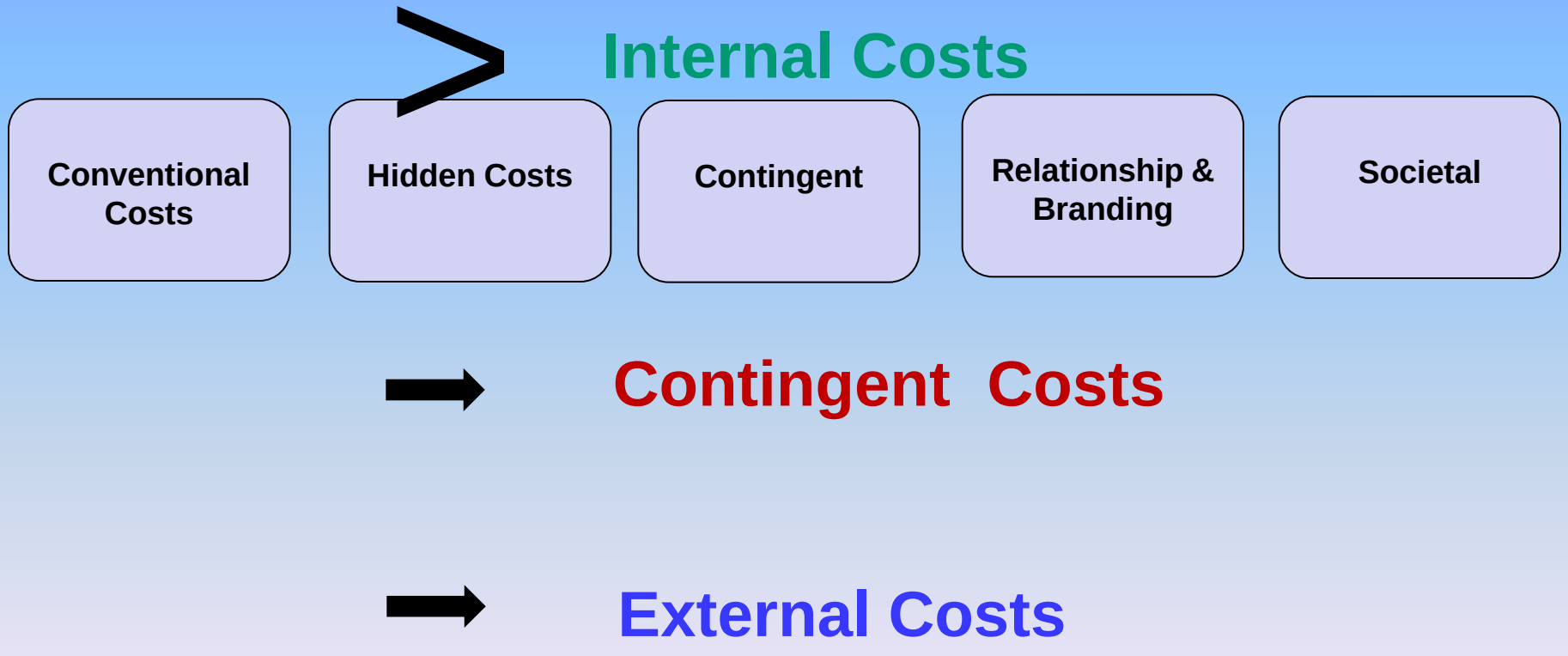

Fossil Fuel Depletion
Energy Source Reliability
C&M Availability
C&M Recovery
Total Water Use
Global Warming
Ozone Depletion
Smog
Water Recovery Efficiency
Water Loss Efficiency
Water Scarcity
Fit-for-Use
Water Degradation
Land Degradation
Human Cancer Toxicity
Human Non-Cancer Toxicity
Respiratory Effects
Ionizing Radiation
Human Noise
Freshwater Ecotoxicity
Marine Ecotoxicity
Terrestrial Ecotoxicity
Ecosystem Noise
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Alt 1
Alt 2
Alt 3
Alt 4
Alt 5


Fossil Fuel Depletion
Energy Source Reliability
C&M Availability
C&M Recovery
Total Water Use
Global Warming
Ozone Depletion
Smog
Water Recovery Efficiency
Water Loss Efficiency
Water Scarcity
Fit-for-Use
Water Degradation
Land Degradation
Human Cancer Toxicity
Human Non-Cancer Toxicity
Respiratory Effects
Ionizing Radiation
Human Noise
Freshwater Ecotoxicity
Marine Ecotoxicity
Terrestrial Ecotoxicity
Ecosystem Noise
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Alt 1
Alt 2
Alt 3
Alt 4
Alt 5

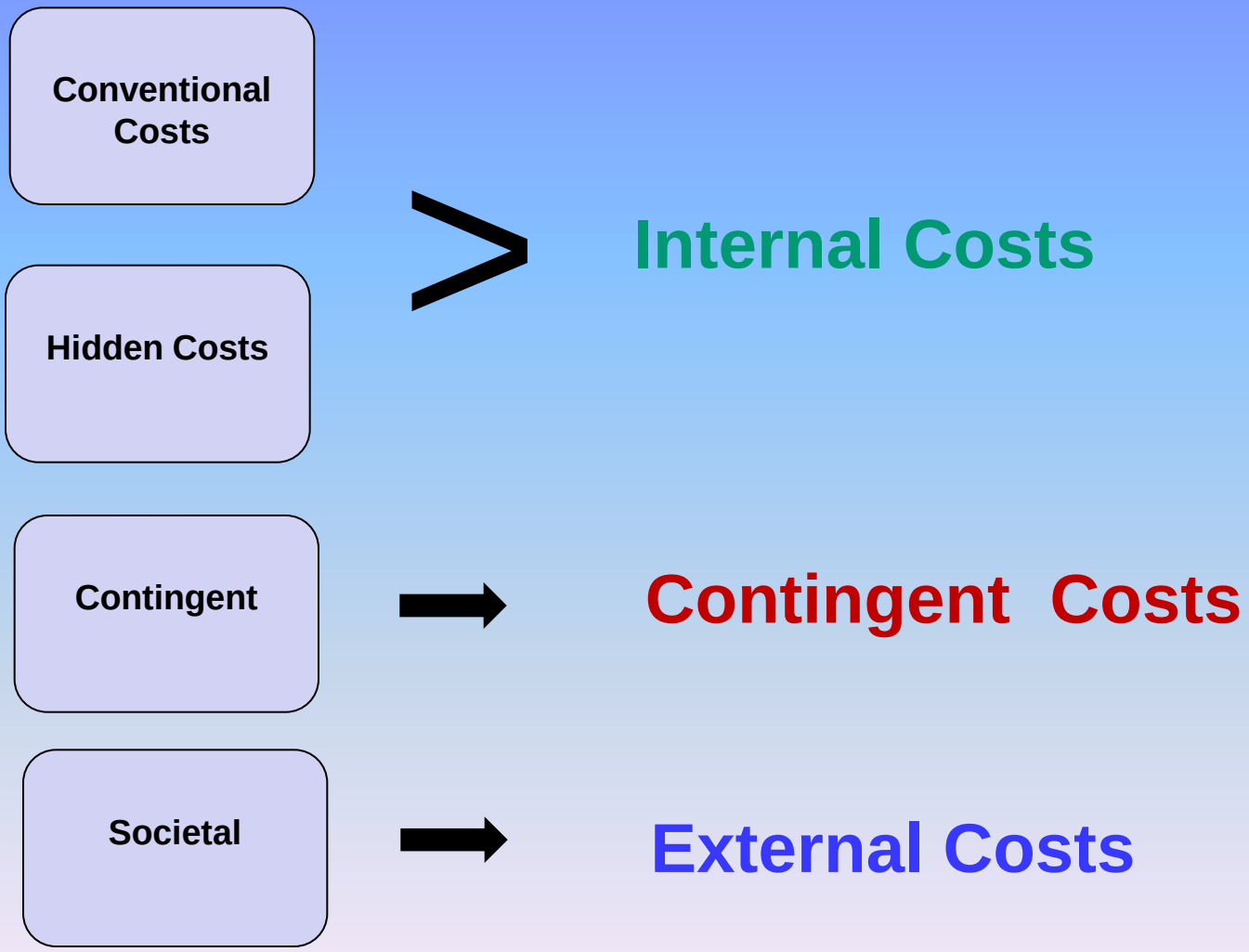
Traditional Environmental Costing



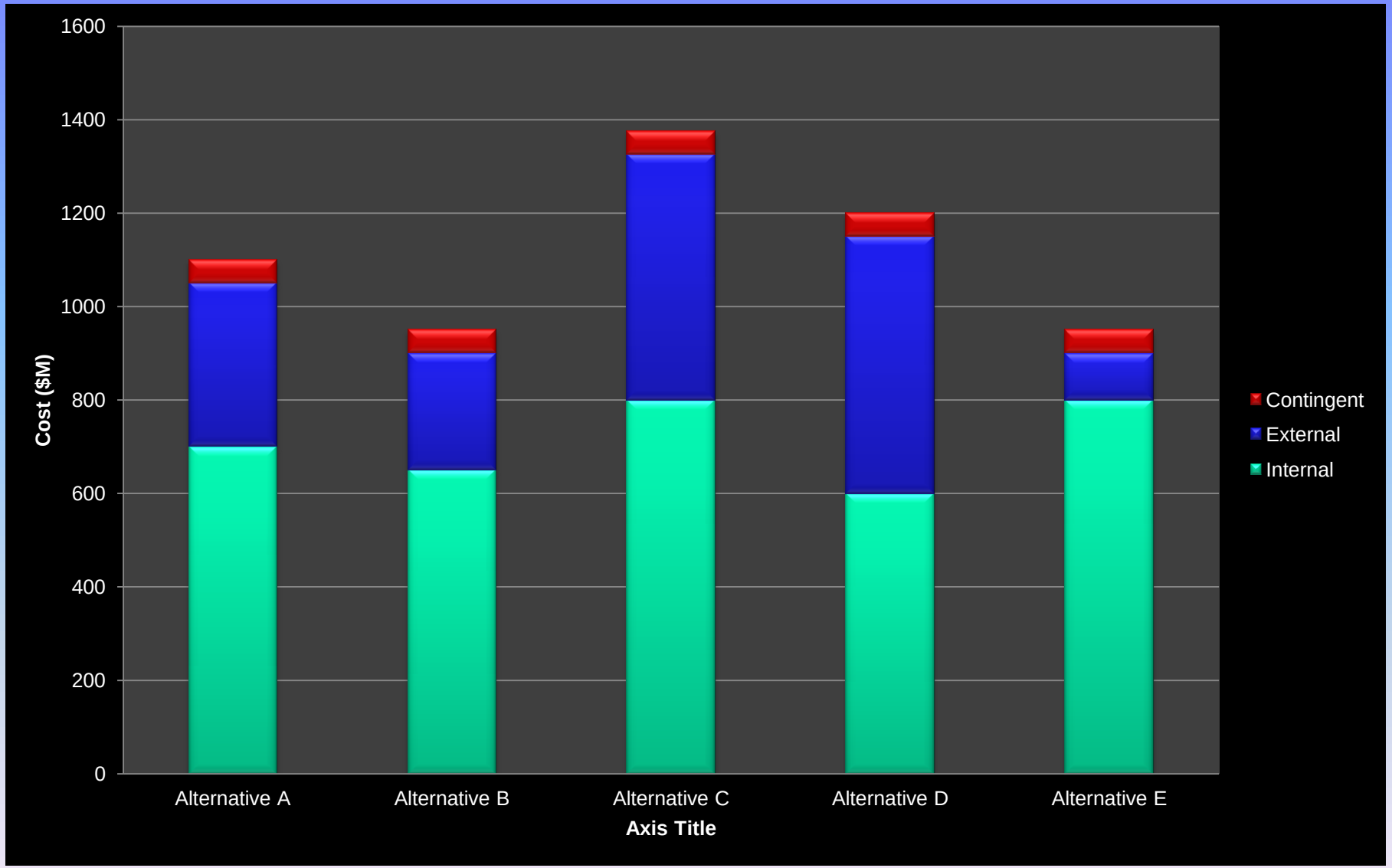
Sustainability Costing using EIO-LCA



Sustainability Costing using EIO-LCA



Total Cost of Ownership



EIO-LCA Pilot Project

- **Calculate impacts & life cycle costs of two design alternatives for two current acquisitions:**
  - **Boeing P-8**
  - **Sikorsky H60R**
- **Design alternatives: a fully chromated coating system and a non-chromated system manufactured and sustained over 30 years**
  - **Chosen due to amount of data available**

EIO-LCA Pilot Project Objectives

LEARN

- **Where does life cycle cost data reside in DoD and at what level of detail?**
- **What barriers arise in trying to identify sustainability/ESOH life cycle costs?**

DEVELOP

- **A consistent method for characterizing impacts and their associated costs.**
  - **Use available data & Enviance Integrated Hybrid Total Cost Assessment (IHTCA) tool**

Progress - Strategic

- **Benchmarking study on LCA methods & tools**
- **LCA framework truth-tested with Boeing, Lockheed-Martin, General Dynamics, Raytheon & Sikorsky…all positive**
- **Coordination with key OSD offices & Services**
  - **Systems Engineering, Logistics & Material Readiness, Operational Energy, Manufacturing & Industrial Base Policy, Defense Standardization Office, Services' ESOH Acquisition IPT, OSD-CAPE**
- **Briefing to DoD Senior Systems Engineering Forum with positive results**

Progress - Tactical

- **Sustainability section drafted for the Defense Acquisition Guidance, Chapter 4**
- **Detailed Guidance for Streamlined LCA (SCLA) developed along with automated tool**
- **Sustainability to be an element in Supportability Analysis and Business Case Analysis – SLCA provides “how to”**

Benefits of Sustainability Analysis

- **Provides a practical yet rigorous and consistent analyses**
- **Forces thinking about life cycle activities of system:**
  - **Human health & environmental impacts**
  - **Life cycle costs of impacts**
- **Bottom line: More informed decisions with more thought to life cycle implications**

Questions & Discussion

Paul Yaroschak
Deputy for Chemical & Material Risk Management
Office of the Deputy Under Secretary of Defense
(Installations & Management)

Backups

Paul Yaroschak
Deputy for Chemical & Material Risk Management
Office of the Deputy Under Secretary of Defense
(Installations & Management)

Current Situation

- **Some good practices & results exist**
- **But…Sustainability insufficiently considered across DoD**
  - **Examples: energy, water use, noise, toxic chemical use**
- **Need better Total Ownership Cost estimates**
  - **Not all sustainability & ESOH life cycle costs are estimated and analyzed**
  - **Some costs are in different "stovepipes" (e.g., installation O&M)**
  - **Large operating & support (O&S) costs often passed to operators**
  - **~70% of Total Ownership Cost in O&S category**

What's Needed?

- **Practical "doable" method for LCA**
  - **Not resource or data intensive**
  - **Modified process for DoD acquisition process**
- **Must be flexible enough for a variety of systems, equipment, & platforms – big or small**
- **Must be flexible enough to be used from Analysis of Alternatives (AoA) through design phases**
- **Integrates with Systems Engineering process**
- **Must help identify sustainability/ESOH related life cycle costs for Total Ownership Cost estimates**

The LCA Steps

STEP 1: Defining the Functional Unit (Section 6.1)

STEP 2: Defining the Scope (Section 6.2)

STEP 3: Defining the System Boundaries (Section 6.3)

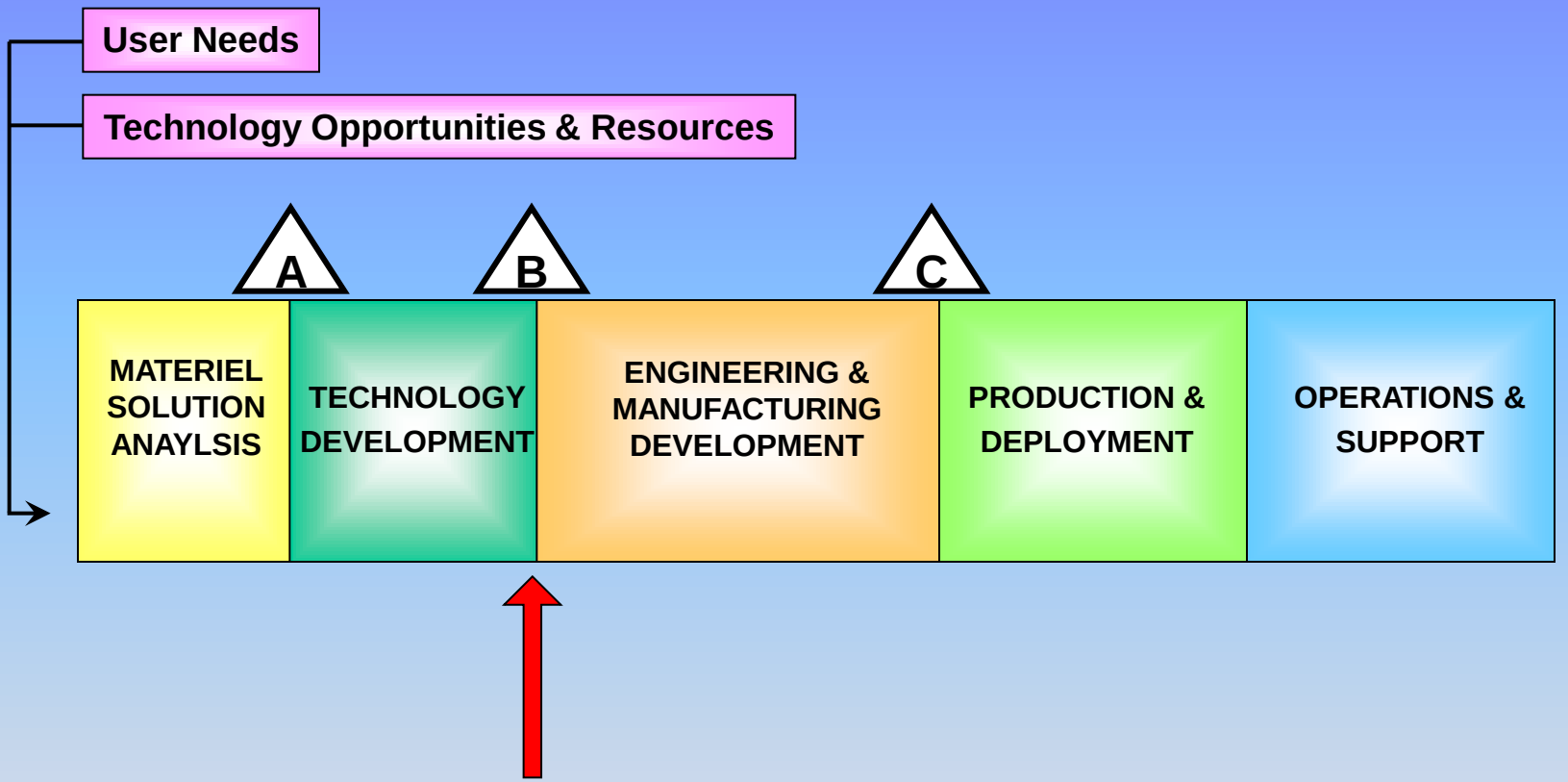
STEP 4: Building an Input Inventory (Section 6.4)

STEP 5: Assessing Human Health and Environmental Impacts (Section 6.5)

STEP 6: Comparing Alternatives (Section 6.6)

Goal: Select the most sustainable system that meets performance requirements

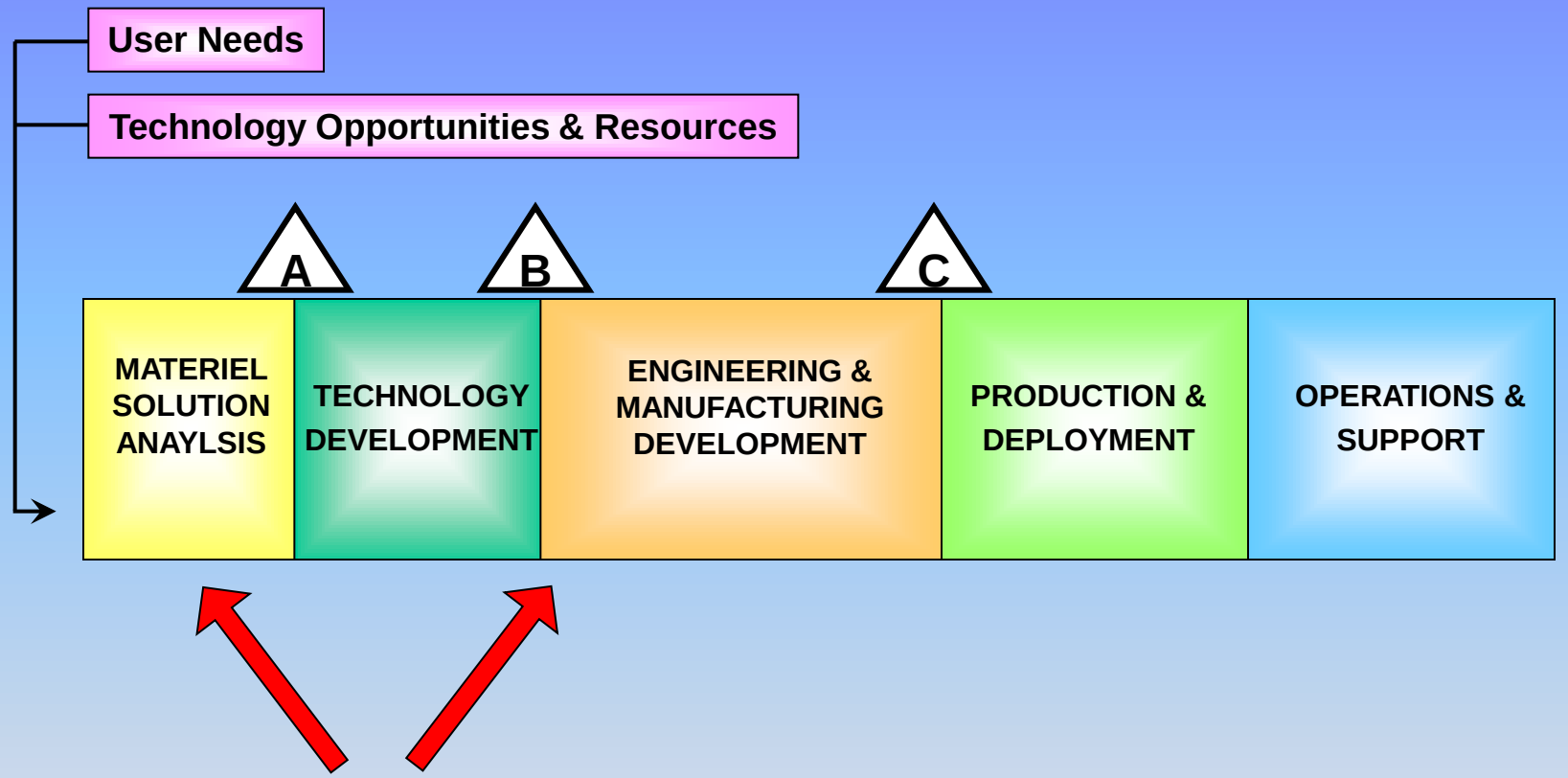
Current Paradigm



At Milestone B, identify & mitigate ESOH risks & document in PESHE[1]

[1] Programmatic Environmental Safety & Health Evaluation

Desired Paradigm



Incorporate sustainability "up-front" starting in Analysis of Alternatives (AoA) & continuing through design

Example Life Cycle Costs

Chemical & Materials Attribute

- Personal protective equipment
- HAZMAT training
- Workplace IH monitoring & medical monitoring
- Hazardous waste management and disposal
- Air handling/waste treatment systems
- Emissions/discharge permits
- Contingent liabilities for health/environmental damages

Life Cycle Costs

Illustrative