



Integrating Sustainability into DoD Acquisition Programs

October 2011



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Report Documentation Page

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The Vision

Acquisition, Technology and Logistics

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? Use Life Cycle Assessment Methods

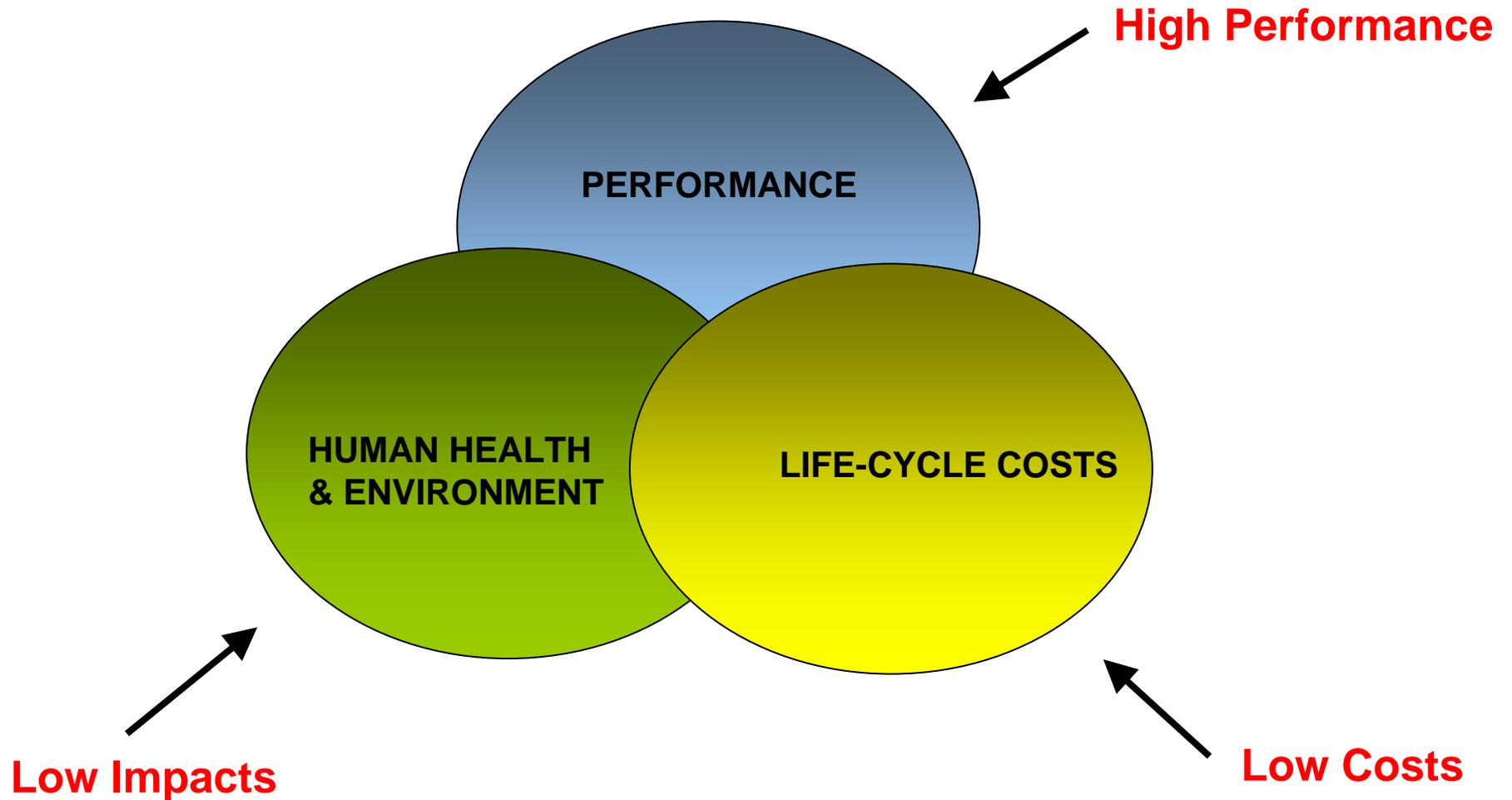
Current Situation

- **Some good practices & results exist**
- **But...Sustainability insufficiently considered across DoD**
 - **Examples: water use, noise, toxic chemical use**
- **Need better **Total Ownership Cost** estimates**
 - **Not all sustainability & ESOH life cycle costs are estimated and analyzed**
 - **Large operating & support (O&S) costs often passed to operators**
 - **New DoD O&S cost guidance will help**
- **Need a consistent, practical DoD methodology for analyzing life cycle sustainability & related costs**

Sustainability in DoD Acquisition

From Development through Disposal

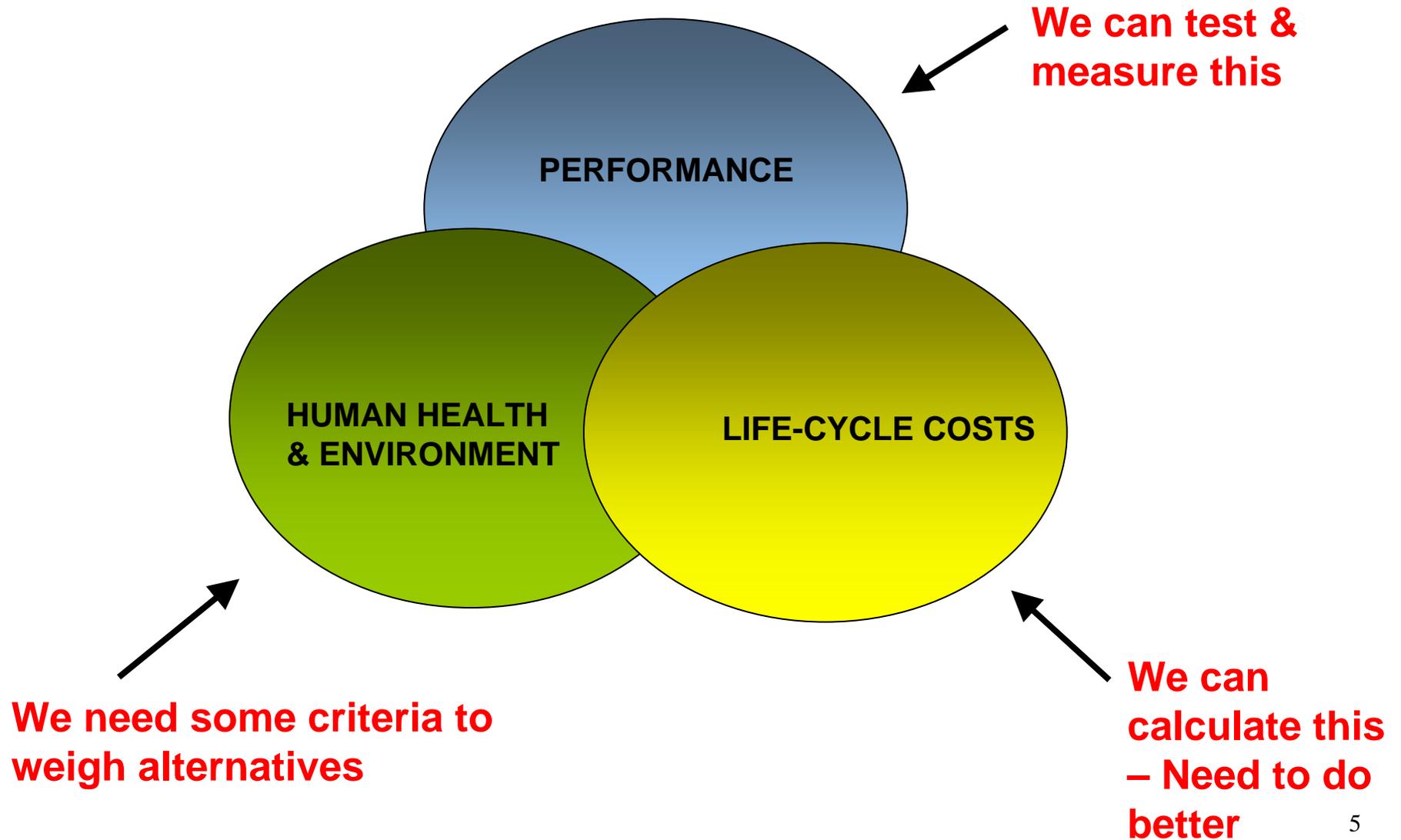
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Sustainability in DoD Acquisition

From Development through Disposal

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Potential Life Cycle Assessment Methods

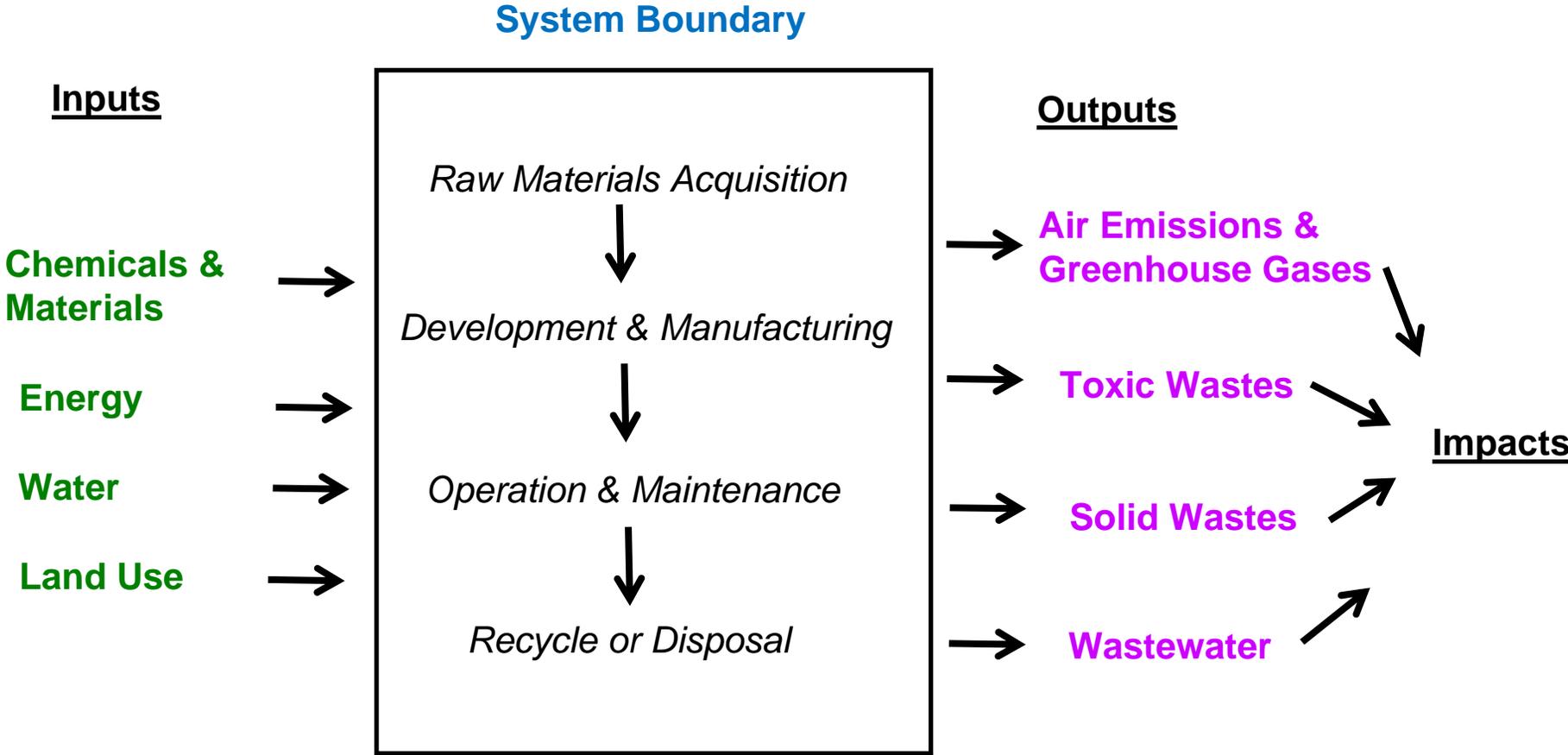
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- **Process Life Cycle Impact Assessment (LCIA)...very data intensive...not all data available**
- **LCA “Light”...modified for less data intensity**
- **Economic Input-Output LCA...uses available aggregate industry sector financial and “output” data (e.g., Carnegie-Mellon Green Design Institute)**
- **Hybrid EIO-LCA...adds some detailed LCIA data for most sensitive outputs/impacts**

Life Cycle Impact Assessment (LCIA)

ISO Standard 14040

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Early Decisions Have Long Term Cost & Health/Environmental Implications

The Way Ahead

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- **Convene a DoD steering group...done**
- **Benchmarking study on methods & tools for analyzing sustainability...done**
- **Collect quantitative case studies...underway**
- **Adopt method(s) to DoD acquisition process...underway**
- **Pilot/test the process with DoD prime contractors**
- **Develop a Military Standard -- “Life Cycle Assessment for Sustainability in Acquisition”...working draft done**
- **Ensure sustainability related costs are included in life cycle cost estimates (include in OSD-CAPE¹ guidance)**

¹ Office of the Secretary of Defense – Cost Analysis & Program Evaluation

Current Thinking – Part 1

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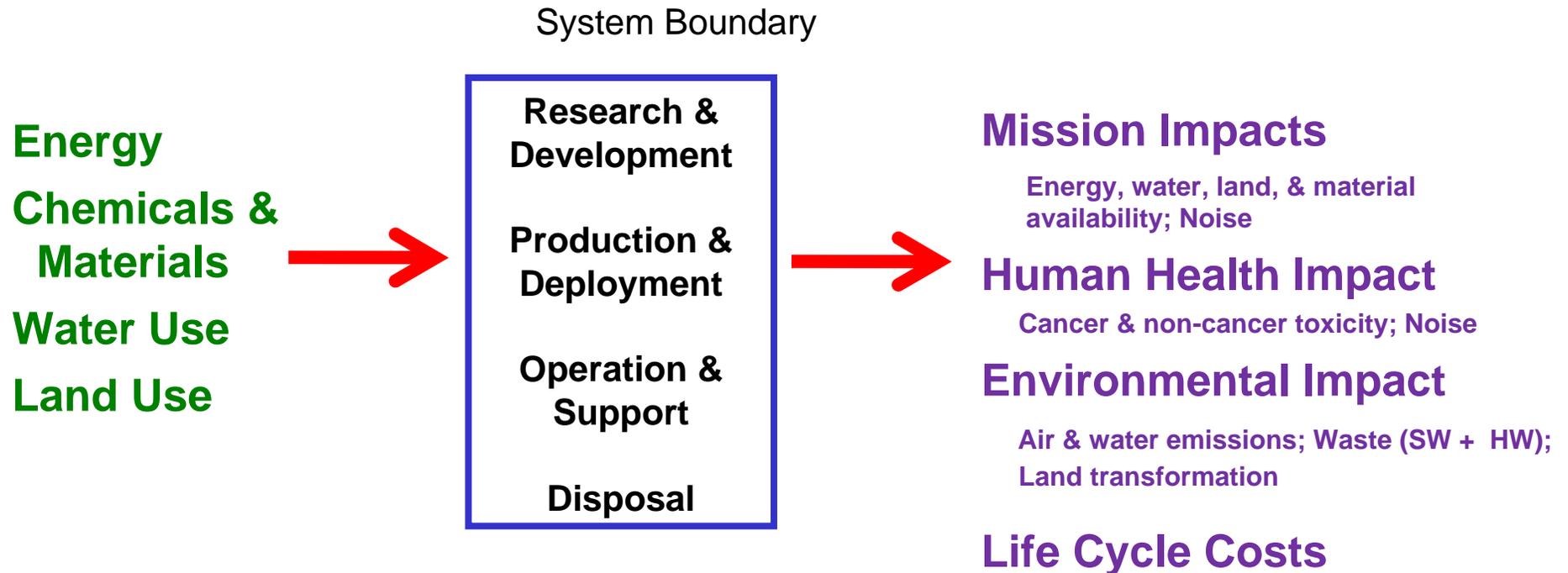
Focus on 3 key acquisition stages:

- **Analysis of Alternatives (AoA)...use an “LCA light” method or Multi-Attribute Analysis**
- **Development...more detailed analysis**
- **Design...as detailed as data availability & resources will allow**

Current Thinking – Part 2

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Focus on a few key “inputs” and “impacts”



Current Thinking – Part 3

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Establish a Hierarchy of LCA Methods

1) Process level LCA

- Life cycle inventory
- Life cycle impact assessment (LCIA)

2) Economic Input-Output LCA

3) Streamlined LCA

- Modified process for DoD acquisitions

Streamlined LCA - Attributes for Assessment

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- **Energy**
- **Chemicals & Materials**
- **Water**
- **Land Use**
- **Physical Hazards**

Measure of Performance (MoPs)

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Energy

- **System energy efficiency**
- **Support & sustainment energy efficiency**
- **Renewable energy use**
- **Energy source reliability**

Measure of Performance (MoPs)

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Chemicals & Materials

- **Mass utilized**
- **Recovery & reuse potential**
- **Use of toxic & hazardous materials**
- **Exposure potential**
- **Chemical/material availability**

Measure of Performance (MoPs)

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Water

- **System water efficiency (quantity)**
- **Water degradation (quality)**
- **Water availability (scarcity)**

Land Use

- **Land transformed (quantity)**
- **Land degradation (quality)**
- **Duration of use**

Measure of Performance (MoPs)

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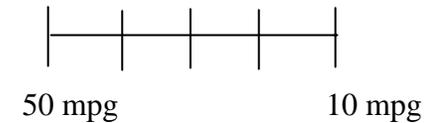
Physical Hazards

- **Noise -- Operator exposure, community exposure (adverse basing/operating potential), ecological exposure (e.g., marine mammals)**
- **Ergonomics**
- **Radiation – ionizing, non-ionizing, laser**

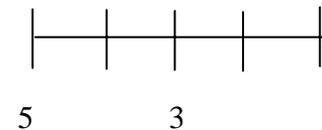
Scoring the Measures of Performance (MoPs)

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- **Quantitative Data Scale**



- **Qualitative Data Scale**



- **Ordinal Ranking**

1, 2, 3, 4, 5...

Scoring Method is based on what data is available

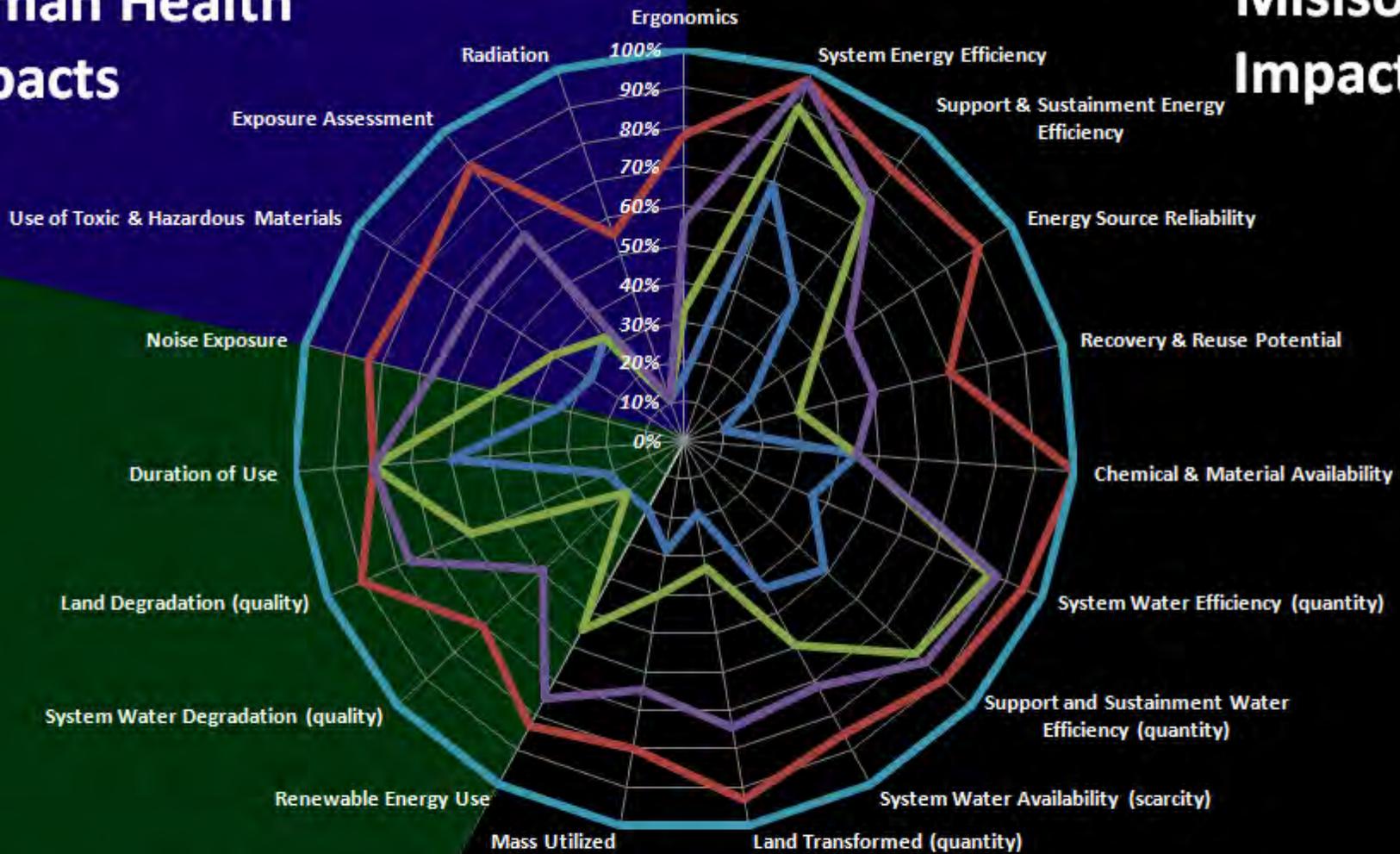
Displaying Outputs

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- **Bar graphs**
- **Spider-web diagrams**
- **Use of Data Envelopment Analysis (DEA)**
 - **Also called frontier analysis**
 - **Used in operations research & investing (portfolio theory)**
 - **Runs a series of optimization calculations...finds most efficient alternatives as compared to all others**

Human Health Impacts

Mission Impacts



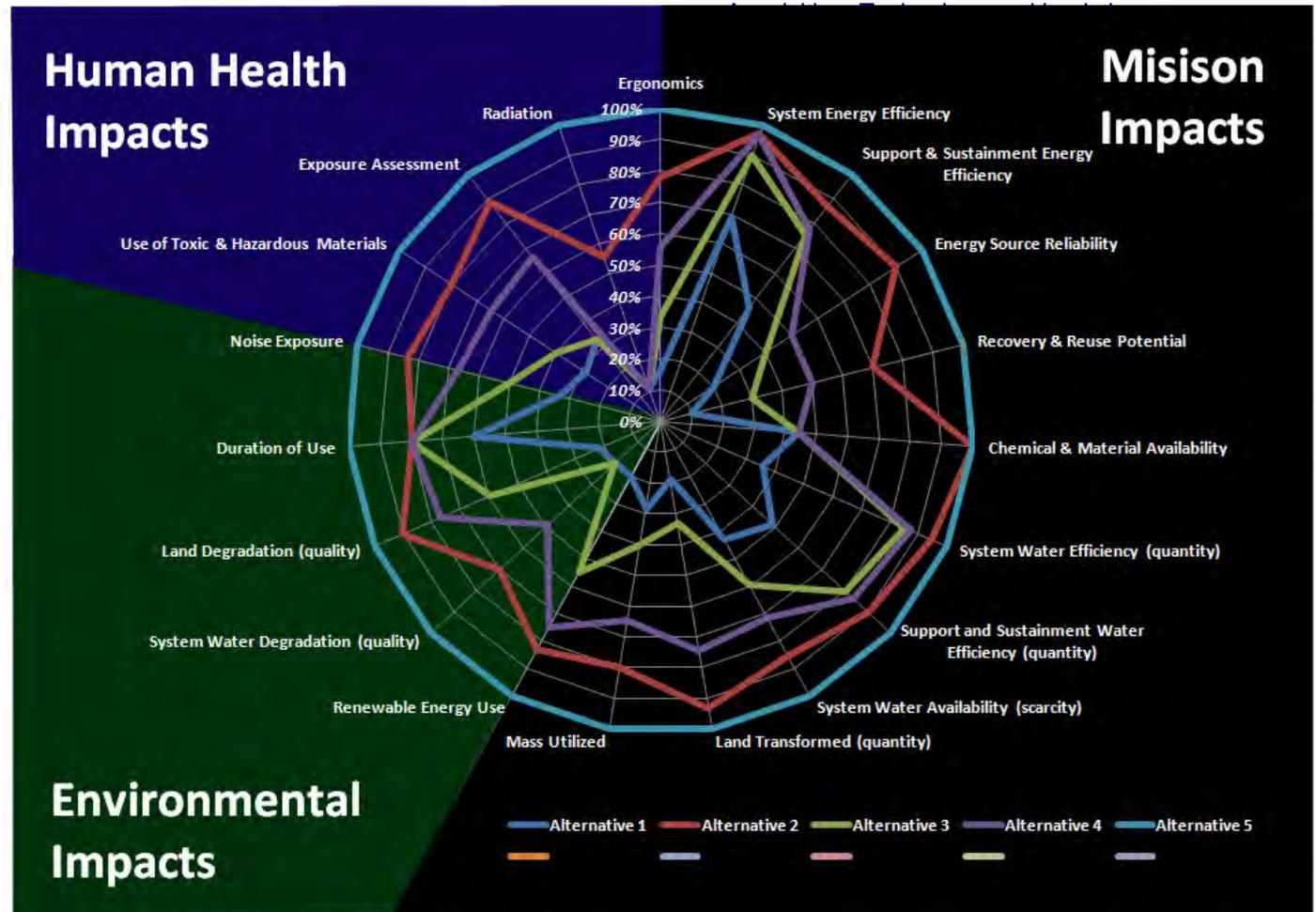
Environmental Impacts

Alternative 1 Alternative 2 Alternative 3 Alternative 4 Alternative 5

Top Ten Alternatives

	Alternative
<input checked="" type="checkbox"/>	Alternative 1
<input checked="" type="checkbox"/>	Alternative 2
<input checked="" type="checkbox"/>	Alternative 3
<input checked="" type="checkbox"/>	Alternative 4
<input checked="" type="checkbox"/>	Alternative 5
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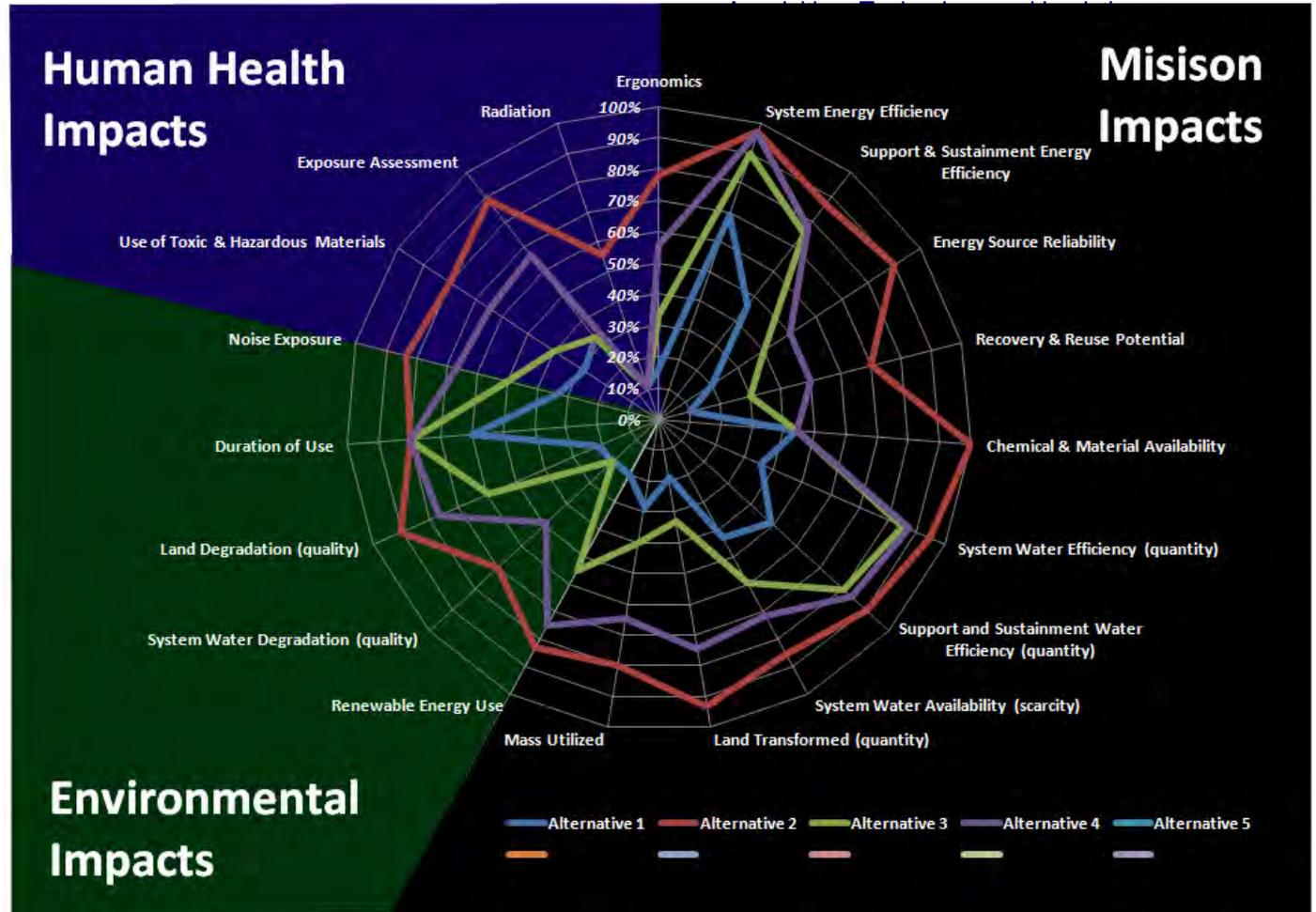
Outer Rings = Worse



Top Ten Alternatives

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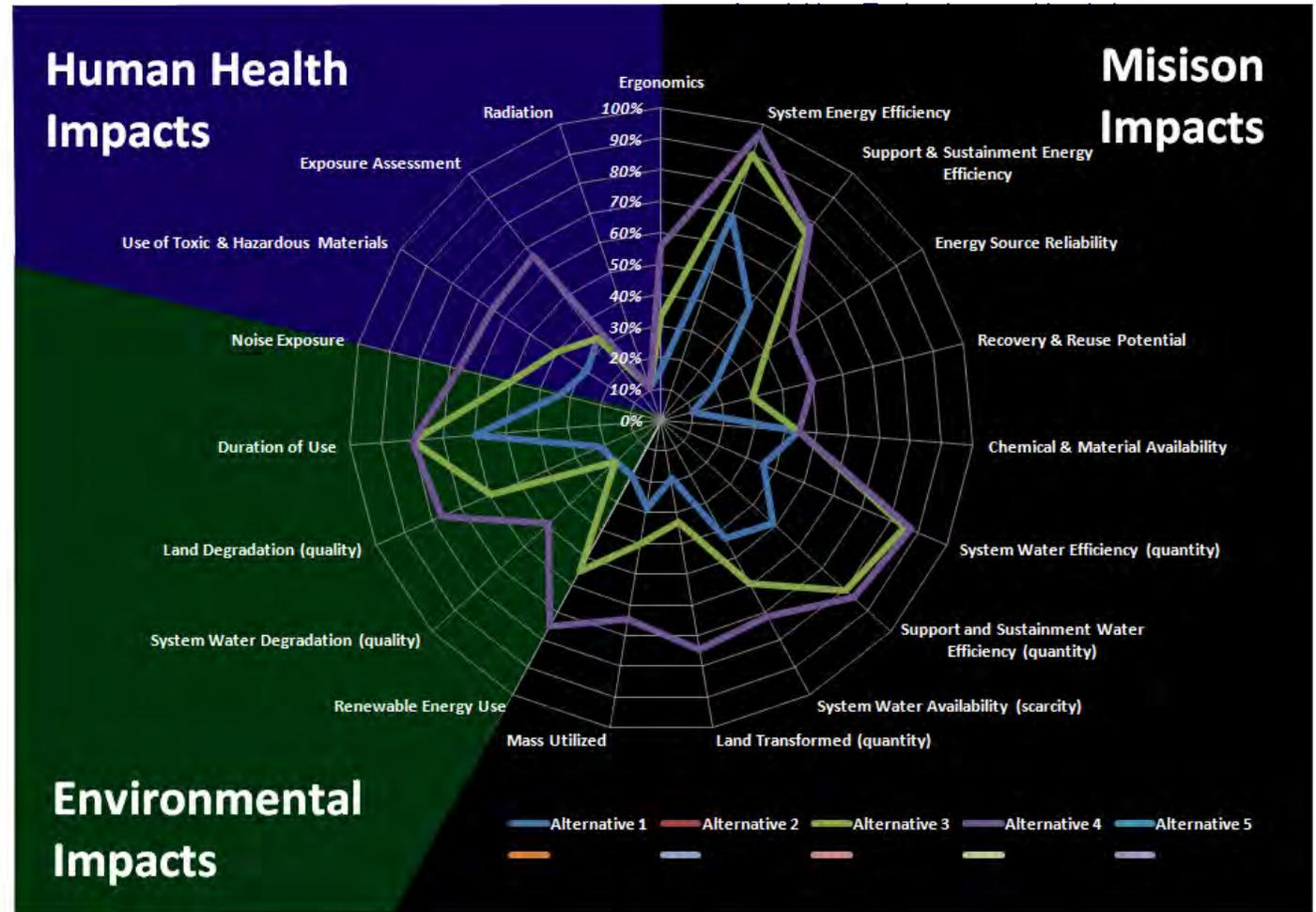
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Top Ten Alternatives

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<input checked="" type="checkbox"/>	Alternative 1
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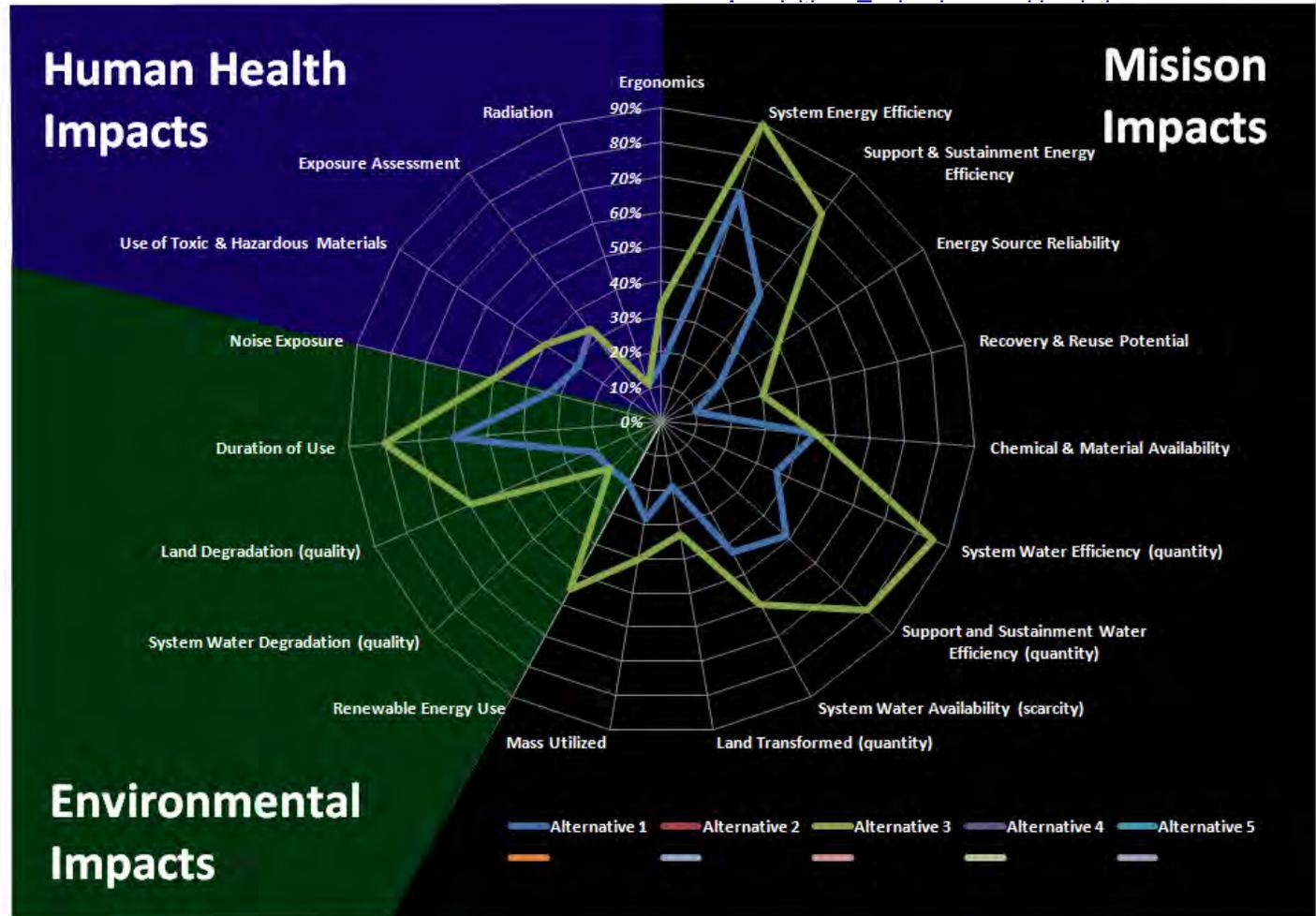
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Top Ten Alternatives

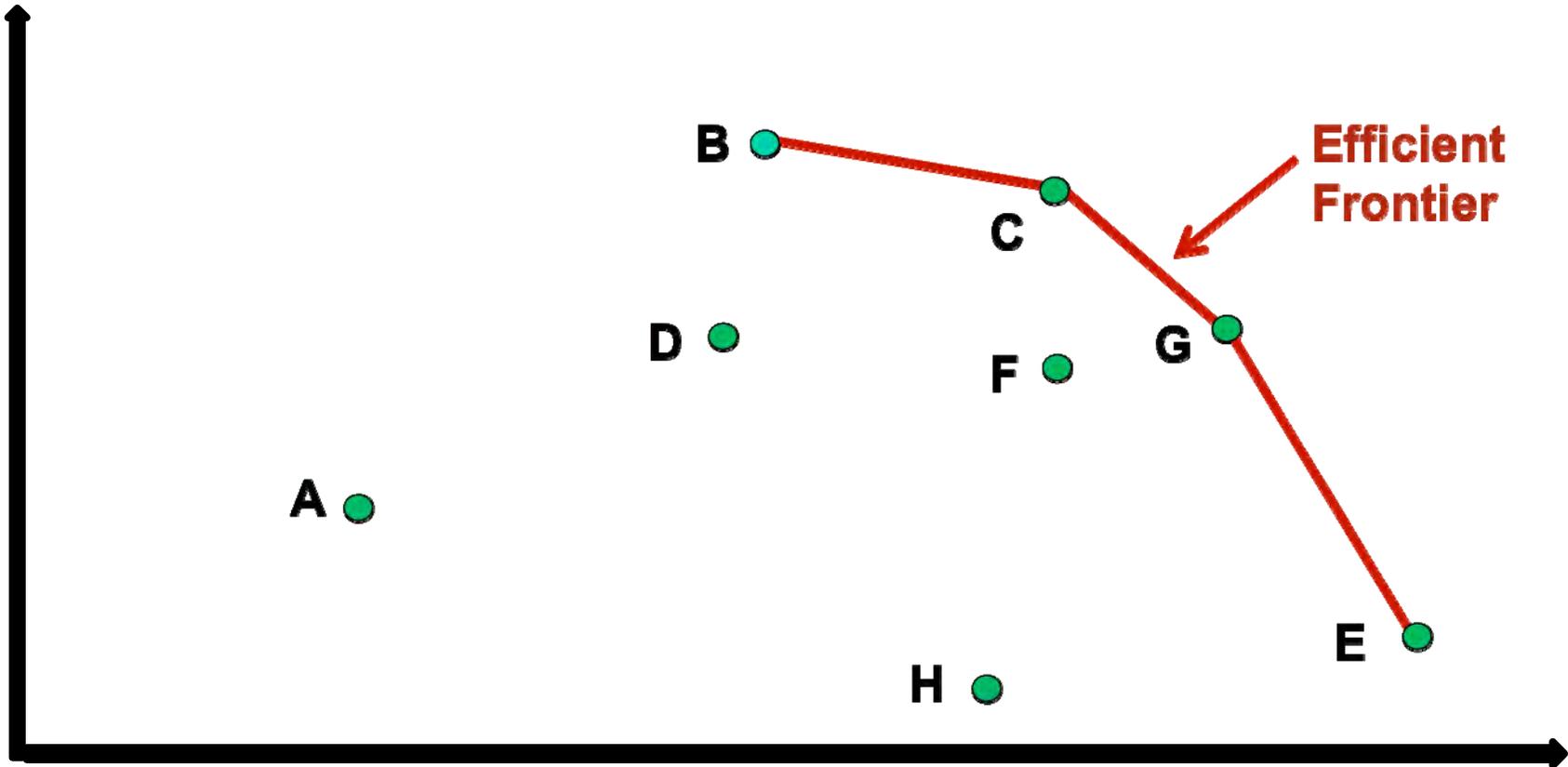
	Alternative
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<input type="checkbox"/>	Alternative 4
<input type="checkbox"/>	Alternative 5
<input type="checkbox"/>	

Outer Rings = Worse



Data Envelopment Analysis - Notional

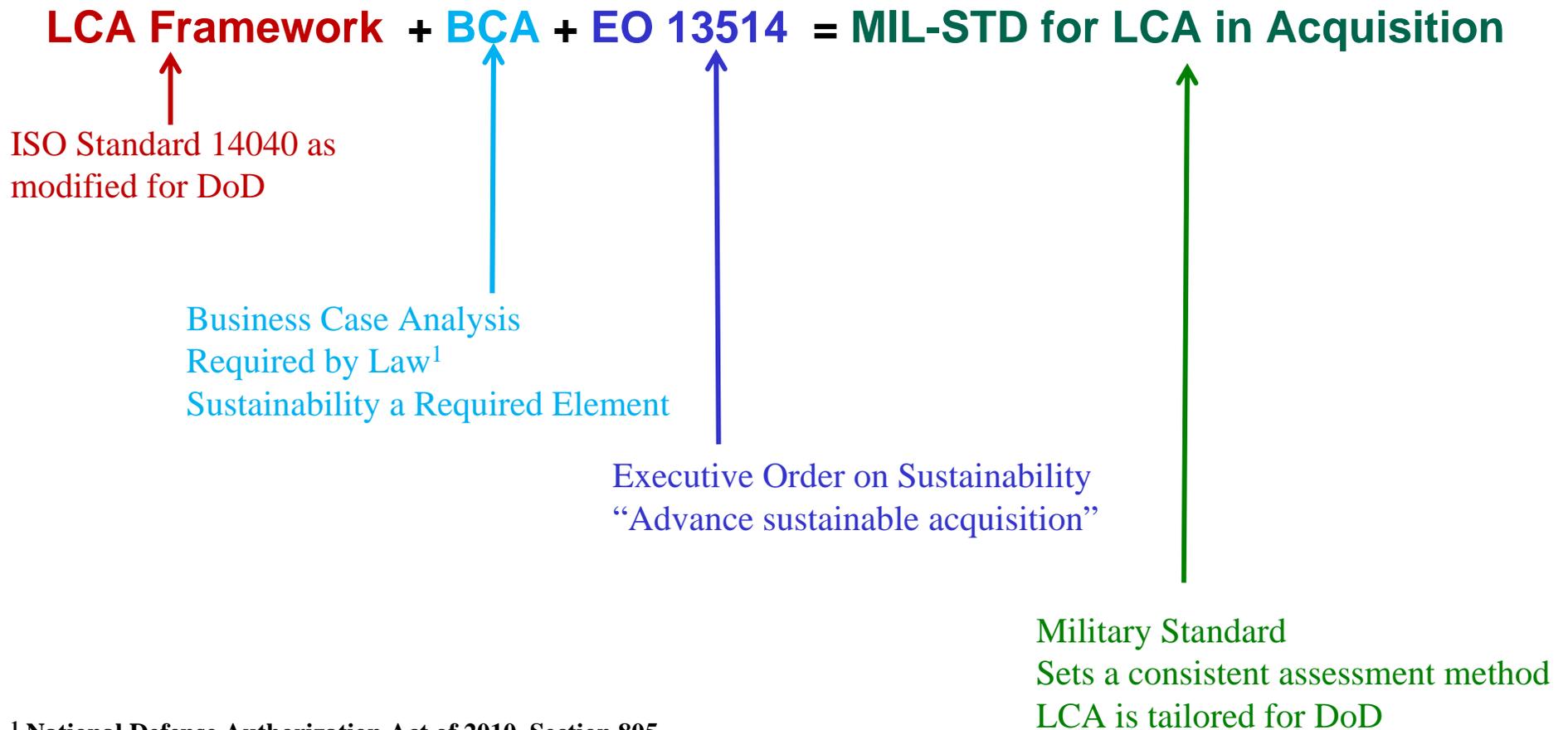
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Alternatives B, C, G & E are most sustainable

Formula for Success

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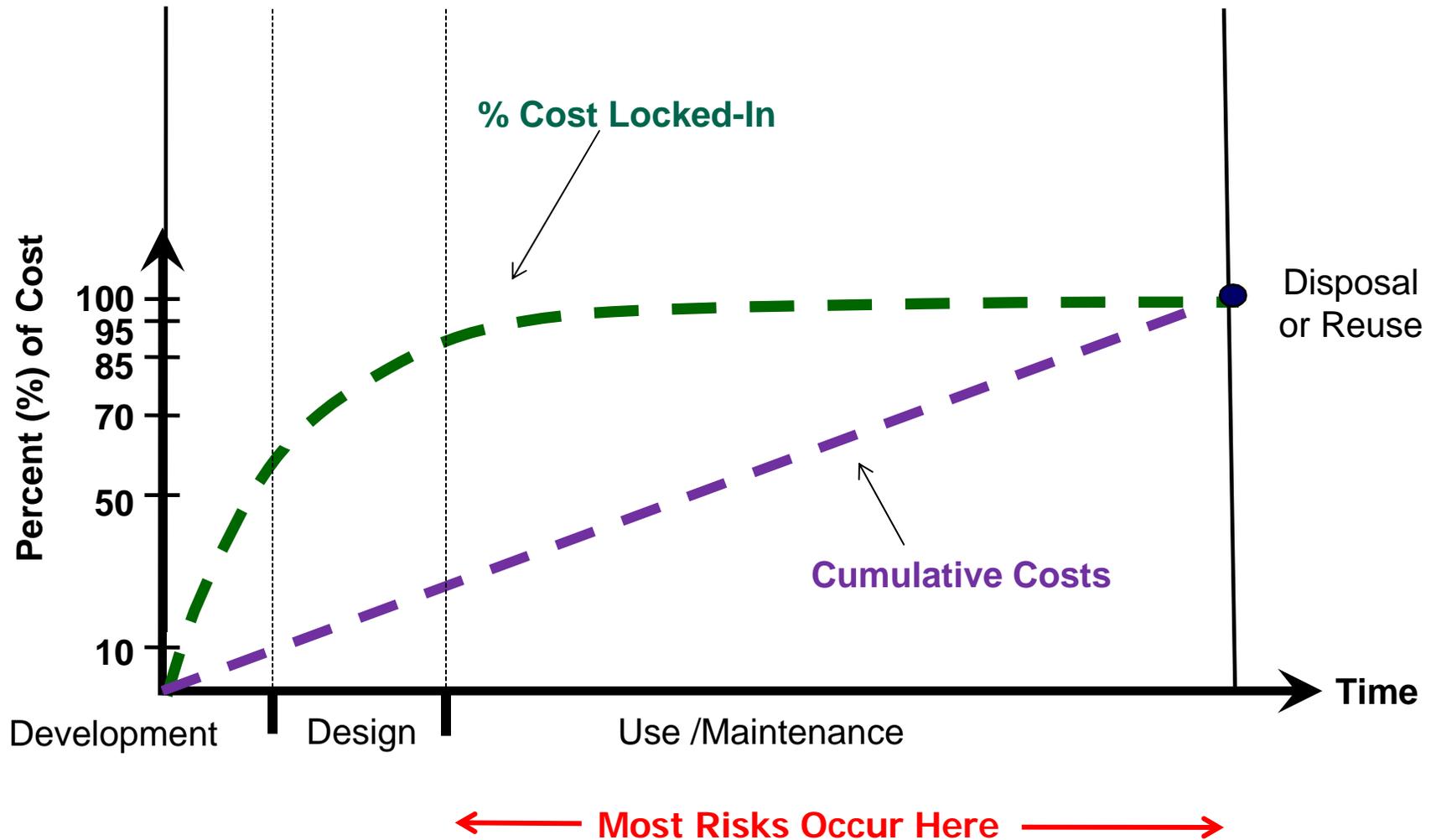
¹ National Defense Authorization Act of 2010, Section 805.

Questions & Discussion

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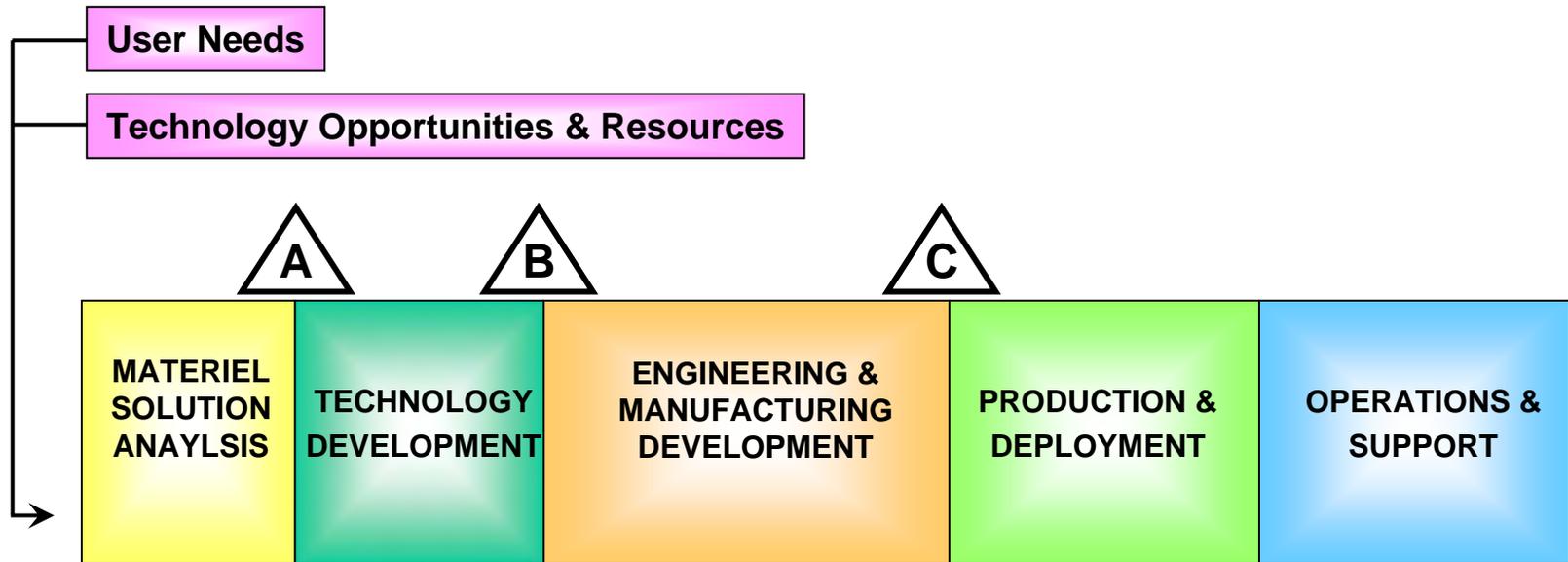
Life Cycle Costs & ESOH Impacts Are Locked-In Early

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Current Paradigm

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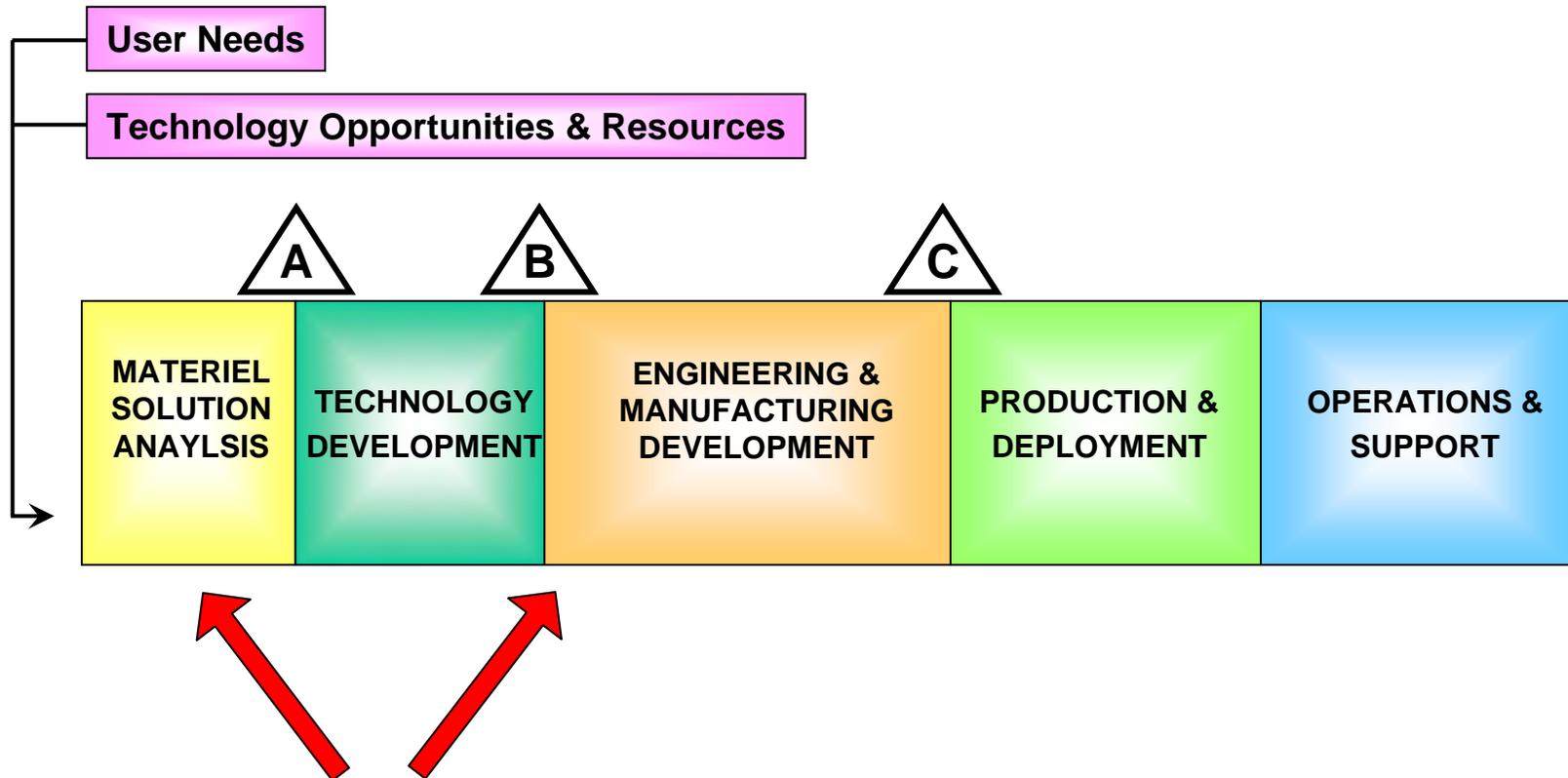


**Identify & Mitigate ESOH risks by
Milestone B & document in PESHE¹**

¹ Programmatic Environmental Safety & Health Evaluation

Desired Paradigm

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

Current Thinking

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Focus on 4 key life cycle stages:

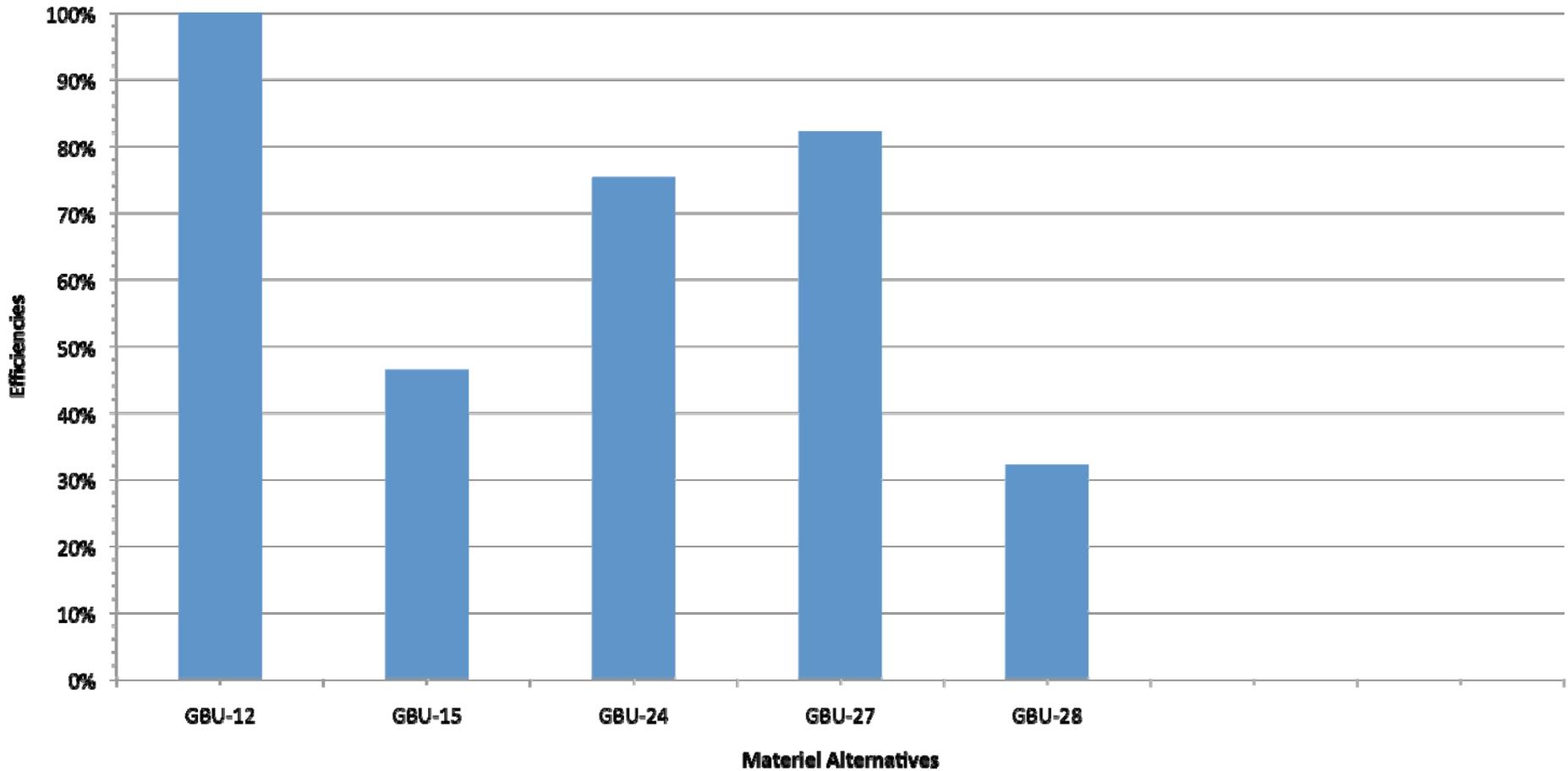
- **Research & development**
- **Production & deployment**
- **Operation & support (O&S)**
- **Recycling/demilitarization/disposal**

Stages are consistent with DoD O&S Cost Estimating Guide

Bar Graph Display of Relative Sustainability

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System Sustainability Scores



End Product

DRAFT – Pre-decisional

NOT MEASUREMENT
SENSITIVE

MIL-STD-XXX
as of 19 August 2010

DEPARTMENT OF DEFENSE
LIFE CYCLE ASSESSMENT PROCESS FOR
SUSTAINABILITY IN DOD ACQUISITIONS



Not for distribution outside the DoD Sustainability in Acquisition Working Group.