HOW SUSTAINABLE IS THIS THING ANYWAY?

A Sustainability Assessment Framework for Evaluating Alternatives
David Stone Eady
Independent consultant
20 years experience in planning and analysis
  Past 15 working with the US defense community
  10 of the past 15 years as Policy Research Fellow with US Army Environmental Policy Institute (AEPI)
    5 years as Senior Research Associate at Georgia Tech
  Last 5 years working through the National Defense Center for Energy and Environment (NDCEE)
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OUTLINE

- Setting the Stage
- Roots of Sustainability Assessment
- Critiques of Traditional Assessments
- Framework for Assessment
- Trade-offs and Optimization
- Closing Thoughts
SETTING THE STAGE

- the search for sustainability

- to coin a phrase:
  - “sustain the mission – secure the future”

- the importance of systems thinking
  - multiple scales and relevant factors
ROOTS OF SUSTAINABILITY ASSESSMENT

- Impact-focus
  + NEPA and environmental assessments

- Objectives-focus
  + strategic environmental assessments

- Principles-focus
  + framework for strategic sustainable development

CRITIQUES OF TRADITIONAL ASSESSMENT

- Emphasis on monetization
- Inherent subjectivity and uncertainty
- Failure to address distributional issues
- Reliance on experts

FRAMEWORK FOR ASSESSMENT

- **Defining the “requirement”**
  - capability, objective, problem, opportunity, risk, etc.

- **Scoping the assessment**
  - setting the system boundaries

- **Designing the sustainability criteria**
  - KPPs, significant impacts, system conditions

- **Identifying and screening the alternatives**

- **Conducting the assessment**

- **Displaying and evaluating the results**
LEVEL OF ANALYSIS (EXAMPLE)

Data/Meth. Aggregation

Theater / Campaign

Force Level

Small Units

System & Technology

Sub-Systems, Engr & Technology

Organizational Mission

Fight and win our Nation’s wars by providing prompt, sustained land dominance across the full range of military operations and spectrum of conflict in support of combatant commanders.

Sustainability Vision

Simultaneously meet current as well as future mission requirements worldwide, safeguard human health, improve quality of life, and enhance the natural environment.

Sustainability Themes (Triple Bottom Line+)

Mission

Environment

Community

Cost

Sustainability Goals

Foster a sustainability ethic

Strengthen Army operations

Meet testing, training and mission requirements

Minimize impacts and total ownership costs

Enhance well-being

Drive innovation

Sustainability Objectives (Examples)

Reduce the use of fossil fuel transported in theater for deployed units 50% by 2030

Beginning in FY08, reduce water consumption intensity relative to FY07 baseline, 2% annually or 16% by the end of FY15

Reduce mission impacts from noise complaints associated with military training and operations

Reduce total ownership costs of weapon systems

Source: Sustainability Analysis Framework for Evaluating Investment Options, US Army Environmental Policy Institute (March 20007)
CRITERIA – PERFORMANCE ATTRIBUTES AND KPPs

- **Survivability KPP**
  - e.g., speed, maneuverability, stealth, redundancy
- **Force Protection KPP**
  - focused on protecting the system operator or other personnel
- **Sustainment KPP**
  - comprised of availability, reliability, and ownership cost
- **Energy Efficiency KPP**
  - operational fuel demand and related logistics resupply risk

Reference: Manual for the Operation of the Joint Capabilities Integration and Development System (JCIDS), 31 July 2009
Sustainable System Conditions

- No systematic increase in concentrations of substances extracted from the lithosphere and deposited in the biosphere.
- No systematic increase in concentrations of substances created in the techno-sphere that cannot be assimilated into the biosphere.
- No systematic disruption of bioproductivity, reduction in biodiversity or degradation ecosystem services.
- No adverse impact on “human security” – the ability of people to meet basic needs.

Performance Parameters

- Net waste generated.
- Use of non-renewable energy.
- Net impact on water resources.
- Use of toxic chemicals.
- Net impact on ecosystem services.
- Net impact on human security.
Quality Function Development (QFD)

Notional Energy Systems QFD

## Notional Screening Example

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Green Result</th>
<th>Red Result</th>
<th>Performance for each Investment Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>≤ 5,000 lbs</td>
<td>&gt; 5,000 lbs</td>
<td>4,500 lbs</td>
</tr>
<tr>
<td>Use-phase energy consumption</td>
<td>≤ 4 kWh/unit</td>
<td>&gt;4 kWh/unit</td>
<td>4.7 kWh/unit</td>
</tr>
<tr>
<td>Meets TB MED 577 water quality levels</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Results:
- Fail
- Pass
- Pass
- Fail
- Fail
NOTIONAL RESULTS – NORMALIZED

![Diagram showing normalized results for Baseline, Option 1, Option 2, and Option 3 across categories of Cost, Energy Use, Toxic Emissions, Readiness, and Footprint. The diagram visually compares the performance of each option across these categories.]
EVALUATING TRADE-OFFS

The diagram illustrates the comparison of trade-offs among different designs. Each bar represents a specific factor, such as Ozone depletion, Global warming, Tropospheric ozone formation, Human particulate effects, Human carcinogenic effects, and Fossil fuel depletion, among others. The bars are labeled Design 1 to Design 6, showing the variation across different scenarios.
CRITERIA WEIGHTING – ONE APPROACH

Notional Example using the Analytical Hierarchy Process (AHP)

Source: Sustainability Analysis Framework for Evaluating Investment Options, US Army Environmental Policy Institute (March 20007)
MULTI-ATTRIBUTE DECISION ANALYSIS

Technique for Ordered Preference by Similarity to Ideal Solution (TOPSIS)

Evaluating Alternatives through TOPSIS
DISPLAYING “OPTIMIZED” RESULTS

Notional Scenarios

Scenario Favoring Fossil Fuel

Scenario Favoring Renewable Energy

CLOSING THOUGHTS

- How we ask the question...
  - defining the requirement(s) and scoping the assessment

- Why we ask the question...
  - focusing on operational capability and life-cycle performance

- When we ask the question...
  - striving for sustainability from conception
CONTACT INFO

David S. Eady
678-570-9030
dseady@gmail.com
david.s.eady@us.army.mil