Quantifying the FBCF and Energy Key Performance Parameter

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Congress has directed that energy performance be ‘baked in’ to force planning, requirements-setting, and acquisition processes

**PLANNING.**—In the case of analyses and force planning processes that are used to establish capability requirements and inform acquisition decisions, the Secretary of Defense shall require that analyses and force planning processes consider the requirements for, and vulnerability of, fuel logistics.

**CAPABILITY REQUIREMENTS DEVELOPMENT PROCESS.**—The Secretary of Defense shall develop and implement a methodology to enable the implementation of a fuel efficiency key performance parameter in the requirements development process for the modification of existing or development of new fuel consuming systems.

**ACQUISITION PROCESS.**—The Secretary of Defense shall require that the life-cycle cost analysis for new capabilities include the fully burdened cost of fuel during analysis of alternatives and evaluation of alternatives and acquisition program design trades.
DoD has set out new policies and guidance to implement the fully burdened cost of fuel (FBCF) and Energy Efficiency KPP

“Analyses of Alternatives (AoAs) must assess alternative ways to improve energy efficiency.”

Energy efficiency established as a new, selectively-applied KPP; includes operational fuel demand and related fuel logistics resupply risk considerations. Focus on mission success and mitigating the size of the fuel logistics force within the given planning scenarios.
These directives are reinforced by Senior Leadership in the most recent Quadrennial Defense review.

- Energy efficiency can serve as a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines, which are vulnerable to both asymmetric and conventional attacks and disruptions.

- DoD must incorporate … operational energy considerations into force planning, requirements development, and acquisition processes.

- To address these challenges, DoD will fully implement the statutory requirement for the energy efficiency Key Performance Parameter … set forth in the 2009 National Defense Authorization Act.
Recent studies sponsored by OSD add to the analytic body of knowledge about how to quantify the impacts of battlespace fuel demand

- OSD/Navy case study on a maritime platform
  - Validate FBCF methodology
  - Insights on Energy KPP

- OSD/JS (J4) framework, methodology and case study
  - Develop a decision framework
  - Apply KPP methodology to a legacy ACAT1D system
OSD sponsored a study on a Navy legacy platform to quantify FBCF and derive insights on Energy KPP

**TASK:** Conduct an independent assessment and investigate how the FBCF and Energy Efficiency KPP can help DoD understand, plan for, and manage energy costs and operational impacts

**APPROACH:** Perform a Case Study on the Perry Class Frigate

- Develop methodology for deriving the FBCF and Energy Efficiency KPP
- Apply them and derive insights
- Develop recommendations for implementation
Key finding: FBCF and Energy KPP require characterizing the scenarios for the system, and the fuel delivery LOG chain

The KPP quantifies operational impact from asset exposure and increased Operational capability – the FBCF quantifies cost of platform fuel demand

Energy Efficiency KPP

- Assess Impact of Modified Fuel Demand
- Assign Threshold, Objective Values

Fully Burdened Cost of Fuel

- Determine Commodity Cost
- Quantify Capital Costs
- Quantify Operating Costs
- Calculate FBCF Values

Apportion Across DAG 7 Burden Categories

- Commodity Cost of Fuel
- Direct Fuel Infrastructure O&S and Recapitalization Costs
- Indirect Fuel Infrastructure O&S Cost
- Primary Fuel Delivery Asset O&S Cost
- Depreciation Costs of Primary Fuel Delivery Asset
- Environmental Costs
- Other Service & Platform-Specific Delivery Costs

Shared by KPP and FBCF

- Characterize Scenario for Platform
- Characterize Fuel Logistics CONOPS
OSD also sponsored a study to develop a framework and methodology for the Energy KPP and apply to a legacy system

- The study team developed a decision framework and methodology for the Energy Efficiency KPP and applied it to a case study of the UH-60

- The case study results show that reduced energy demand can significantly decrease logistics requirements and increase platform capability
  - The study focused on understanding and quantifying the benefits and tradeoffs of potential efficiency improvements to inform decision making
  - A detailed technology assessment of the ability to achieve efficiency improvements was outside the scope of this study

- This work provides sufficient basis to begin implementation of operational energy considerations
Energy performance and cost of energy are addressed separately within hierarchy of KPPs and KSAs

**Mandatory KPPs**
- Force Protection KPP
- Survivability KPP
- Sustainment KPP
  - Material Availability
  - Operational Availability
- Net-Ready KPP

**Mandatory KSAs**
- Reliability KSA
- Ownership Cost KSA

**Selective KPPs**
- System Training KPP
- Energy Efficiency KPP

*Other KPPs, KSAs, and Attributes can be added on an as-needed basis*

**Additional Nuclear Survivability KPPs and CBRN Attributes are also addressed by JCIDS Manual & DoDI 3150.09**

Sets energy performance based on relative impact on fuel/energy logistics chain – number of assets involved and for how long to satisfy fuel demand

Considers life-cycle cost of fuel demand as a Key System Attribute – As calculated by FBCF methodology
The study team proposed (selective) Energy KPP Decision Framework

<table>
<thead>
<tr>
<th>Operational Efficiency KPP Question Set for consideration</th>
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<tbody>
<tr>
<td>Does the system (family/system of systems) consume fuel in a battlespace environment during deployment/employment?</td>
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<tr>
<td>Would increased energy efficiency improve platform operational effectiveness?</td>
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<tr>
<td>Does the system (family/system of systems) represent a net increase in operational fuel demand for the force compared to the system it replaces?</td>
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<tr>
<td>Are there technological alternatives that lower fuel demand for the system (family/system of systems)?</td>
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<tr>
<td>Do fuel savings reduce logistics infrastructure/OPTEMPO requirements (and increase overall force effectiveness)?</td>
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<tr>
<td>Can similar or redundant Service-funded programs be terminated to divert funds to develop and sustain joint solutions?</td>
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<tr>
<td>Are fuel costs projected to be a significant part of total life cycle costs?</td>
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Case Study Methodology

1. Assess UH-60 fuel demand in historic surge – OIF 2007
2. Quantify the exposure of assets associated with fuel delivery to satisfy UH-60’s in OIF
3. Assess the benefits of increased fuel efficiency had it been part of the UH-60 design
   - *Increased flight hours, system availability*
   - *Decreased delivery asset exposure time from lower fuel demand*
4. Build-out a discrete mission based on an approved future planning scenario
5. Overlay land-based asset delivery model and quantify asset exposure times
6. Assess UH-60 performance/logistics impacts against fuel demand
   - *Number of missions*
   - *Assets exposed during required fuel delivery operations*
7. Describe processes for future AoAs
   - *Determine data that will be required to do this for another system*
   - *Describe method for doing the trades for future systems*
The logistics impact is a function of the expected CONOPS for fuel delivery in the specific Scenario.
Reduced fuel demand increases number of missions possible with same amount of fuel over the Future Surge Scenario

Additional Missions that Could be Flown in the Future Scenario with Improved UH-60M Fuel Performance

- Heavy Lift
- Troop Transport
- Combat Assault
- Command & Control

Efficiency Improvement

Additional Missions That Could Be Flown Over the 365 Day Surge Scenario
Increased fuel performance significantly reduces the logistics assets and hours involved in the Future Scenario

Reduction in Fuel Supply Asset Hours Required from Improved UH-60 Fuel Performance in Future Scenario

Efficiency Improvement

Protection Asset Time

HEMMT Time

Tanker Time
Number of convoys (one MoE) can be linked to gallons/hour (the MoP) to inform Threshold & Objective values

Fuel Convoy Break Points vs. Increased Energy Performance
Number of Convoys Over Future Scenario

Total convoys required to support platform over the specific Surge Scenario

Delta between T and O: 14 fuel convoys

Threshold

Objective

Fuel Efficiency Breakpoints

Convoys in this diagram are defined as having 4 HEMMT Trucks carrying 20,000 gallons of fuel in total, with proportional force protection
Energy KPP study recommendations

- Emphasize operational energy requirements in strategic guidance (NDS, NMS, GDF and implementing directives and instructions)

- Incorporate operational energy requirements/implications into the CCJO and other JOpsC concepts

- Revise the CJCSI/M 3170 series to emphasize system energy demand during the conduct of CBAs
  - Assess requirement for operational energy performance attributes during ICD development
  - Provide relevant FCBs (Force Application, Protection, Force Support, Logistics, etc) with a framework to determine completeness and supportability of energy efficiency analysis documents in the ICD

- Provide capability sponsors with guidelines to determine if energy efficiency is a critical element for the capability

- Draft an instruction similar to the CJCSI 3312, Joint Military Intelligence Requirements Certification to certify for operational energy

- Incorporate the operational energy KPP methodology in analysis of resets of legacy systems

- Consider making the operational energy KPP mandatory