

Energy Technology Investments: Maximizing Efficiency through a Maritime Energy Portfolio Interface and Decision Aid

ABSTRACT

As the Navy continues to emphasize increasing Energy Security, many energy saving technologies and programs are in development and implementation to reduce the Navy's energy consumption and reliance on foreign energy sources. The Maritime Energy Portfolio Management Approach is a methodology to effectively identify, evaluate, prioritize, and manage energy saving technology and initiative installations on Ships through the Maritime Energy Portfolio Interface and Decision Aid. The Maritime Energy Portfolio Interface and Decision Aid is a dynamic graphic user interface backed by an intelligent database that allows for quick graphical data analysis, status tracking, and Scenario Analysis for progress toward established energy goals and recourse optimization. By increasing the effectiveness of managing the Maritime Energy Portfolio we enhance our responsiveness and reduce total ownership cost.

INTRODUCTION

Issues due to rising petroleum fuel costs have driven energy security to the front of strategic and operational threats for the US Navy. In response to this challenge, the Navy established Task Force Energy (TFE) to identify opportunities that would have the greatest impact on SECNAV energy goals established in Oct 2009¹. Over half of the ships to be included in the Navy's 2020 Fleet are in-service today and as a result, it is necessary for the Navy to design, develop, and install Energy Conservation Measures (ECMs) into the Fleet as well as design and install ECMs in the ships of the future. ECMs are new and more energy efficient technologies and programs that aim to reduce

energy consumption by making our fleet more energy conscious. Increasing energy efficiency and energy consumption awareness will increase time on station enhancing mission effectiveness and reduce fuel consumption, reducing total ownership cost. Technology investment today sets a priority on ship safety and capability, with a change to start including energy efficiency as a priority. Establishing Energy Security as a top priority will provide emphasis with the Navy to design, procure, produce, and install ECMs into the ships, driving the Navy toward Energy Security. In support of emphasizing Energy Security through the implementation of ECMs, the Maritime Energy Portfolio Management Approach was developed to increase effectiveness and ultimately lower total ownership cost.

THE MARITIME ENERGY PORTFOLIO MANAGEMENT APPROACH

The Maritime Energy Portfolio Management Approach provides a means for determining the best course of action where several initiatives compete for scarce funds or resources involving complex evaluation factors. An end-to-end, sustainable Maritime Energy Portfolio Management Approach will provide the infrastructure to identify, evaluate, prioritize, manage, and measure the installation of Energy Technologies for in-service ships by utilizing the Maritime Energy Portfolio Interface and Decision Aid.

The Maritime Energy Portfolio Interface and Decision Aid

The Maritime Energy Portfolio Interface and Decision Aid allows for efficient cross-Navy use

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE FEB 2012		2. REPORT TYPE		3. DATES COVERED 00-00-2012 to 00-00-2012	
4. TITLE AND SUBTITLE Energy Technology Investments: Maximizing Efficiency through a Maritime Energy Portfolio Interface and Decision Aid				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Navy Program Executive Office, Ships, Washington, DC, 20376				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES ASNE Day 2012, Crystal City, Arlington, VA February 9-10, 2012					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 7	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

and application to quickly track, optimize, and analyze past, present, and projected fuel consumption and savings, and progress toward accomplishing established energy goals. The Maritime Energy Portfolio Interface and Decision Aid also provides a means for determining the best course of action where several ECMs compete for scarce funds. Efficient, user friendly use of the Maritime Energy Portfolio Interface and Decision Aid is possible through a fast, interactive, and dynamic Interface that serves to eliminate duplication of efforts in current management processes, increase efficiency, and optimize technology insertion into the fleet to reduce total ownership costs.

The Maritime Energy Portfolio Interface and Decision Aid will also serve as a repository of alternative technologies, attributes, and performance so that the in-service Fleet may monitor technologies in development as well as influence a fleet centric demand signal amongst the Navy's Energy Technology developers. This repository of information will be received and/or vetted through the Navy Program Managers and Subject Matter Experts for the various Energy Technologies. The Maritime Energy Portfolio Interface and Decision Aid has a modular, open architecture design in order to allow for dynamic technical and programmatic review processes and the insertion of new tools as ideas are modified and enhanced.

The Maritime Energy Interface and Decision Aid is successful due to two key components: an appropriate database infrastructure and a dynamic user interface. By building intelligence into the database, and database infrastructure, the process of rapidly inserting new data and data analysis is optimized to reduce human error and inefficiencies. Just as important as building an intelligent database is giving the database an effective user friendly interface for quick interpretation of analyses and dynamic data filtering. Although the Maritime Energy Interface and Decision Aid refers to the user interface that tracks progress and helps aid decision making, the interface cannot succeed without the right database intelligence and infrastructure behind it.

PORTFOLIO DATABASE INFRASTRUCTURE

The Intelligent Portfolio Database design enables the capabilities to ingest and analyze data from multiple data sources and export in order to populate the Commercial off the Shelf (COTS) Interface and Decision Aid. Figure 1 depicts the flow of data through the portfolio.

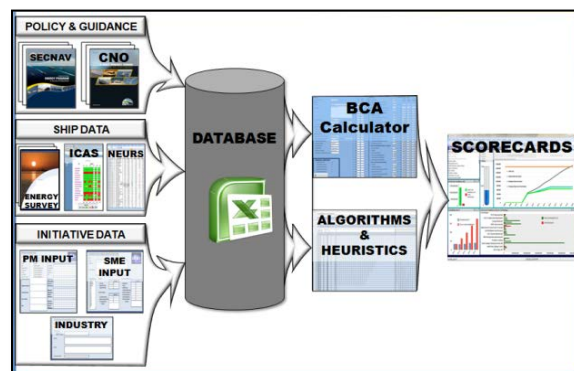
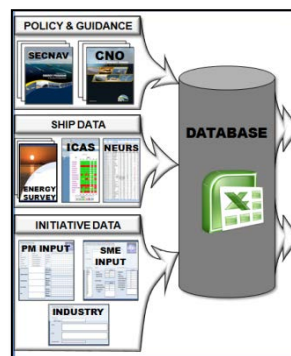


FIGURE 1. Intelligent Portfolio Database Design

Data Environment



The data environment for the Portfolio was structured using a relational database design. There are base tables that house raw data and relational tables that link the unique

identifying attributes of both the ships and the initiatives in order to associate the different data and reduce repetition.

The required data for this portfolio comes from a variety of sources:

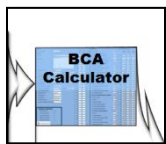
- U.S. Navy Policy and Guidance:
 - o Chief of Naval Operations' *The Navy Energy Vision*²

- o Secretary of the Navy's *The Department of the Navy's Energy Goals*
- Ship Data:
 - o Ship Class Baseline Survey Reports
 - o Shipboard Data Collection and Display Systems
 - o Navy Quarterly Fuel Consumption Database
- Initiative Data:
 - o Program Managers
 - o Subject Matter Experts
 - o Industry and Academia

Upon input into the database, the above data is formatted and consolidated to ensure there is no unnecessary repetition.

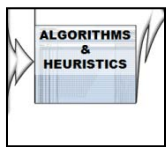
The data is stored on a per ship basis. In other words, for each ship data is collected for each potential initiative in order to accurately account for the ship's total fuel avoidance.

Data Analysis



Whenever it is necessary to make investment decisions, an initiative's business case must be considered. In this section of the portfolio, the Business Case for the various initiatives is performed. Using the collected data described above, an initiative's business case is performed for each ship application. Outputs from the Business Case Analysis (BCA) include: Return on Investment (ROI) and Break Even Point (BEP). These metrics are essential for determining whether an initiative would be worth pursuing.

Balanced Portfolio



Once all the data is collected and the analysis is performed, it is now possible to start processing that information in order to develop a balanced, intelligent portfolio.

Algorithms developed for this portfolio will allow the user to perform the following analyses:

- Prioritizing the largest and least efficient consumers with the earliest initiative implementation opportunity.
- Balancing investments across initiatives of various technical maturities to ensure continuous energy improvements across the Navy Fleets of Today, Tomorrow, and Future.
- Performing Scenario Analysis (i.e. determine how investment decisions vary with different funding amounts; determine funding and initiative requirements to meet new performance objectives, etc.).

Optimization will be performed using heuristic modeling in order to accomplish the below:

- Maximizing ROI while Minimizing Total Cost.
- Performing Scenario Analysis (i.e. determine what the total cost would be for maximizing possible fuel avoided, etc.).

These techniques will allow the user to consolidate the various initiatives and ships to see an overall impact, or allow the user to drill down to the unit level for per ship or per initiative analysis.

PORTFOLIO INTERFACE AND DECISION AID

The Portfolio Interface and Decision Aid was developed to be a dynamic, graphic user interface to the Intelligent Portfolio Database that serves three main functions. The first of these is to track both the progress toward achieving the goals and individual ECM fuel savings. The second is to aid decision makers with live Scenario Analysis so limited resources can be used effectively. The last of these is to increase management efficiency by reducing duplication of efforts by standardizing interface format and report generation.

Tracking Fuel Savings and Progress Towards Energy Goals

In response to the SECNAV and CNO energy goals announced regarding increasing energy efficiency and reducing energy consumption by certain dates, the Navy has accelerated the development of ECMs. Although a number of these new ECMs have begun to be implemented on ships, many ECMs are installed as Proof of Concept (POC) demonstrations or are in the early stages of transitioning from either R&D to POC, or from POC to full scale implantation. This makes the tracking of the ECMs statuses in phases of R&D, POC, and Implementation essential to accurately represent actual progress toward energy targets and the projected path to achieving energy goals.

The Portfolio Interface and Decision Aid provides an ECM Scorecard where the characteristics of all the ECMs are tracked and an Executive Summary of fuel savings against the goals. ECM Scorecards were created to track characteristics like fuel savings, Business Case, and milestones that are kept up to date to give a quick snapshot of an ECM's profile. All ECM profiles are automatically generated in a standardized scorecard to allow for quick analysis of all ECMs. This is made possible through filtering; when an ECM is selected from a list the scorecard automatically updates with the ECM's information. This can be seen in Figures 2 and 3 where the profiles of two ECMs are populated into the developed scorecard structure. This has proven to be an effective method of keeping ECM characteristics up to date as Navy Program Managers and/or Subject Matter Experts can quickly identify inaccuracies and areas that require updating for their respective ECMs.

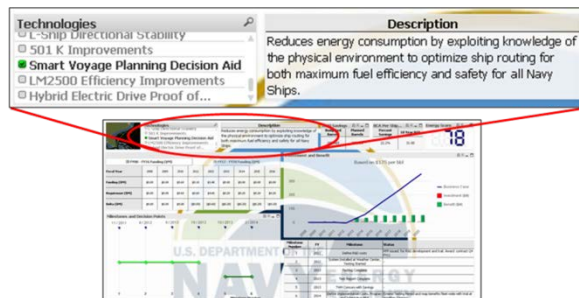


FIGURE 2. Profile of ECM Smart Voyage Planning and Decision Aid loaded into ECM Scorecard

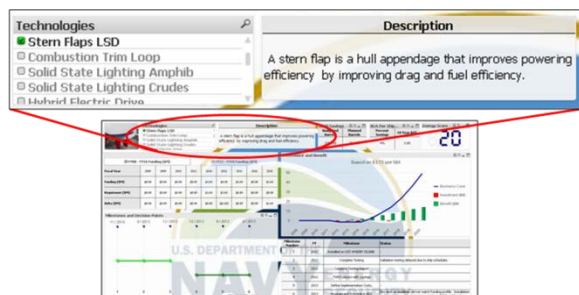


FIGURE 3. Profile of ECM Stern Flaps loaded into ECM Scorecard

ECM characteristics feed into the Executive Summary Scorecard that provides an over arching view to all energy saving efforts. Figure 4 shows a notional Executive Summary Scorecard that can be used to give a clear and quick update on how the Navy's ECMs are progressing to meet the energy goals. Besides tracking savings toward energy goals, other important summary characteristics include total ECM installations by FY and total Benefit vs. Investment.



FIGURE 4. Executive Summary with chart showing progress towards energy goals

Investments Decision Aid through Scenario Analysis

Today's Navy is confronted with the challenge of reducing energy consumption, while working in an environment of constrained budgets and resource competition. Scenario Analysis allows for the user to determine the priority of ECM characteristics including: total savings, payback period, breadth of influence, and mission capability influence, against user selected funding scenarios to find a user optimized solution. Scenario Analysis is made possible by the optimization algorithms and heuristic modeling in the database with some user control of range and percentage in the interface. This allows for the most effective use of resources in meeting energy goals and increasing Energy Security.

Portfolio Interface and Reporting

A COTS Interface was selected for application in the Portfolio Interface and Decision Aid that met the following criteria:

- Ability to import multiple file types

- Automatic establishment of data relationships
- Dynamic data filtering ability
- Ability to export tables and figures
- Automatic report generation

By minimizing the amount of file manipulation needed to allow the file to be correctly imported by the Interface, the Interface was able to become usable faster and would allow for future files to be incorporated with minimal manipulation and time. Automatic establishment of data relationships also allowed for the Interface to become operational quicker and reduced potential user error from manually establishing data relationships. In order for the Interface to enable quick visual analysis of data, dynamic data filtering was required to allow the user to populate predetermined charts and tables based on a data selection or a range of selections. This greatly reduced duplication of efforts and allowed for a standardized format. A reporting element was also required for the user to select a range or one ECM, Date, Ship class, etc. and select print reports to have all the information populated and printed in a predetermined format for all values selected. This also reduced duplication of efforts or generating and gathering updates, often in different formats. The resulting Interface and Decision Aid increases our effectiveness towards reducing total ownership cost.

CONCLUSION

The Maritime Energy Portfolio Interface and Decision Aid is a combination of intelligent database and graphic user interface that manages current ECMs and progress toward goals in a standardized format, aids in balancing investments and resource Scenario Analysis. The Maritime Energy Portfolio Interface and Decision Aid is key in the Maritime Energy Portfolio Management Approach which aims to prioritize, analyze, and manage identified energy savings concepts for in service ships in the most effective manner. The Maritime Energy Portfolio Management Approach increases the focus on ensuring future Energy Security for the Navy.

REFERENCES

¹Mabus, R. (October 2009). The Department of the Navy's Energy Goals. Retrieved from http://www.navy.mil/features/Navy_EnergySecurity.pdf

²Cullum, P. Presentation of The Navy Energy Vision (October 2010). Navy Energy Forum. A Navy Energy Vision for the 21st Century. Regan Building and International Trade Center Washington, DC. Retrieved from: <http://greenfleet.dodlive.mil/files/2010/10/Navy-Energy-Vision-Oct-2010.pdf>

ACKNOWLEDGEMENTS

Glen H. Sturtevant is the Director for Science and Technology assigned to the Navy Program Executive Office, Ships in Washington, D.C. Mr. Sturtevant holds a BS in Civil Engineering from the University of Delaware and a Master of Public Management degree from Indiana University. His current duties include Senior Advisor for Energy to the PEO and NAVSEA's Deputy Commander for Surface Warfare, Project Manager for the DDG 51 Hybrid

Electric Drive Proof of Concept Project, and the PEO's Small Business Innovation Research Program Manager.

Kathleen T. Schneck is a Senior Engineering Consultant at Herren Associates and supports the Navy's efforts to reduce energy costs by assisting the development and management of NAVSEA's Maritime Energy Portfolio of Technologies. Ms. Schneck is a certified Lean Six Sigma Black Belt and a graduate of the Georgia Institute of Technology with Highest Honors and a degree in Industrial Engineering.

Cathryn L. Leffler is an Engineering Consultant at Herren Associates and works in a team of engineers in the evaluation of Naval and Marine Energy Technologies and their impact on the Navy's Energy Posture as well as supporting technology development, integration, and insertion. A graduate of Virginia Polytechnic Institute and State University, Ms. Leffler carries a degree in Mechanical Engineering.