Navy's Energy Program

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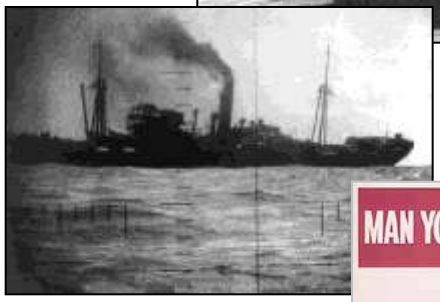
Back to the Future

NAVY ENERGY

World War II



Cold War

Tomorrow's War

70% increase

25% increase

60% increase

110% increase

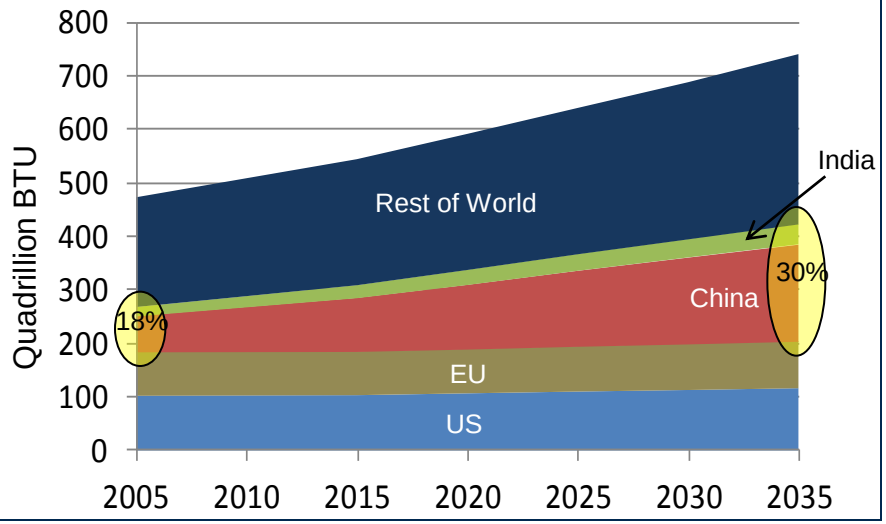
??% increase

- **Increased efficiency translates to greater combat capability**
  - **Consuming less fuel allows for greater range with same amount of fuel**
  - **Lower fuel consumption means reduced strain on supply lines**

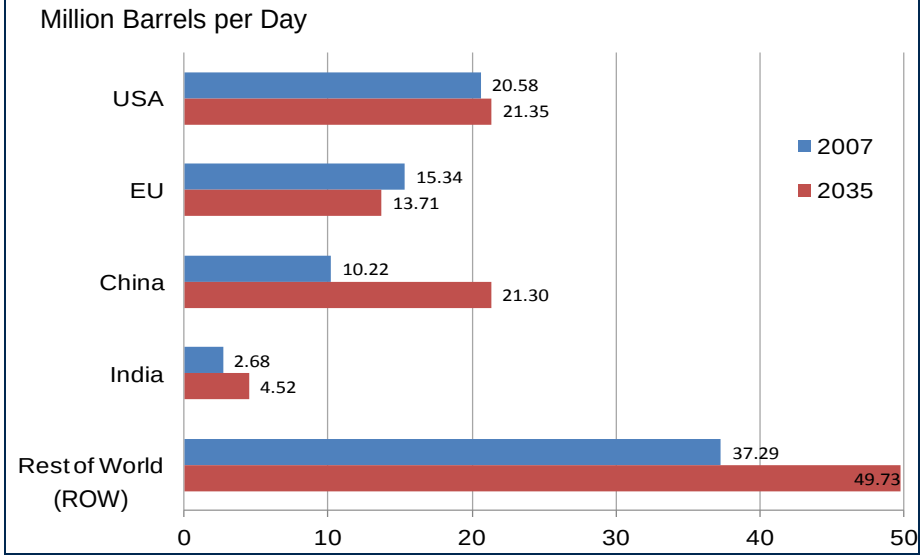
Efficiency is warfighting advantage

The Evolving Energy Demand Demographic

Worldwide Total Energy Demand* (2005-2035)



Worldwide Liquid Fuel Consumption** (2007 & 2035)

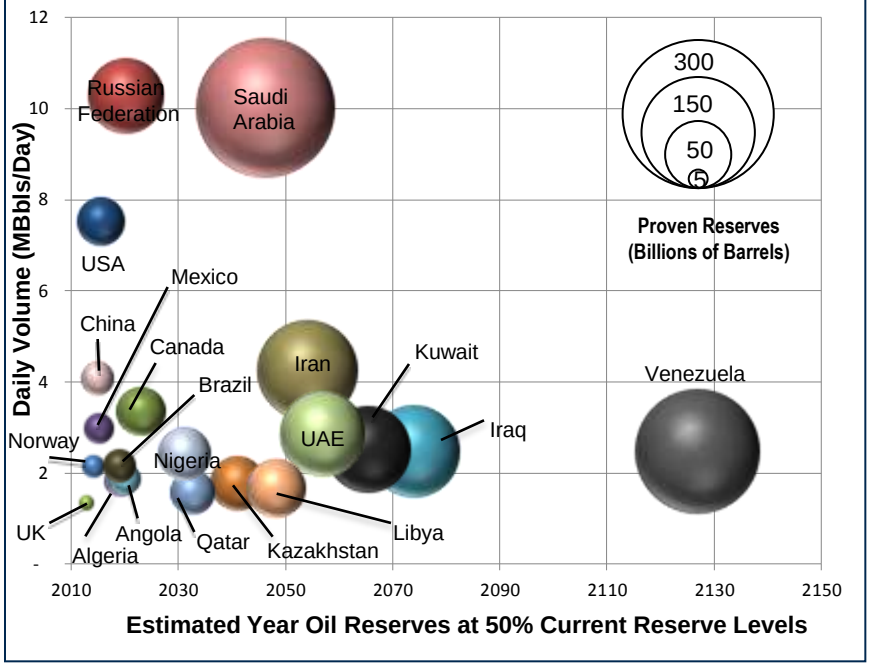


'Chindia' and ROW are becoming the global energy driver

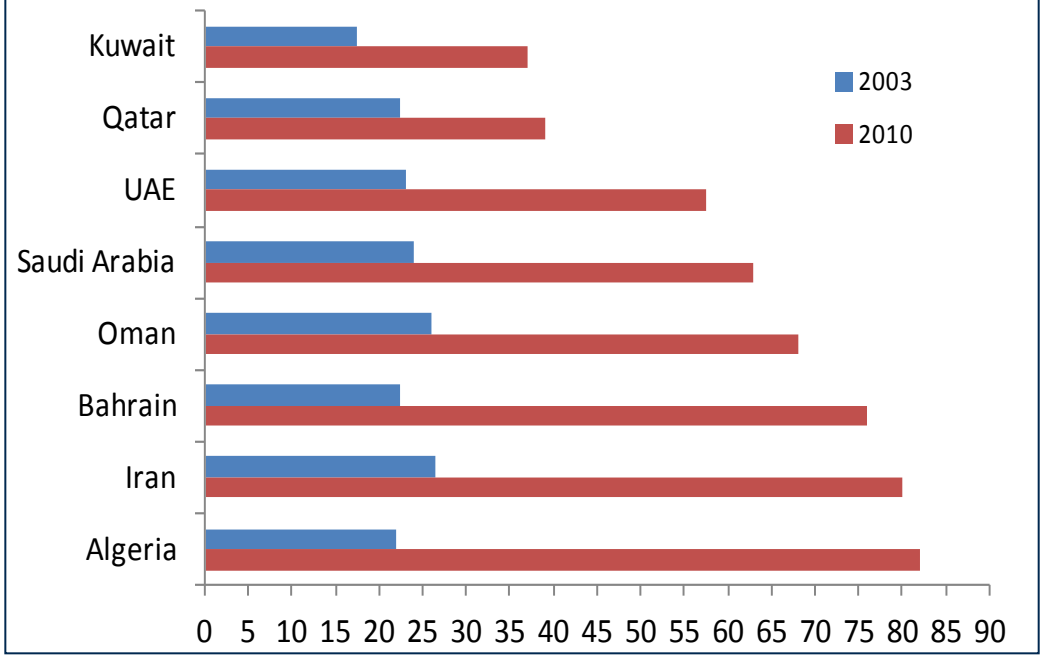
* Source: EIA International Energy Outlook 2010
** Source: EIA, International Energy Statistics database (as of November 2009), web site www.eia.gov/emeu/international. 2035: EIA, World Energy Projection System Plus (2010)

Resource Challenge

Oil Depletion Timeline*



Breakeven Price Rising for Petro-Revenue Dependent Countries**



Not only is oil a finite resource, but cost of production rises as the cheapest sources are exhausted

*Source: Based on 2011 BP Statistical Review (assumes current rates of production continue and no new reserves found).
** Source: Brad Bourland, Chief Economist, Jadwa Investment Group, Riyadh

Navy Energy Goals

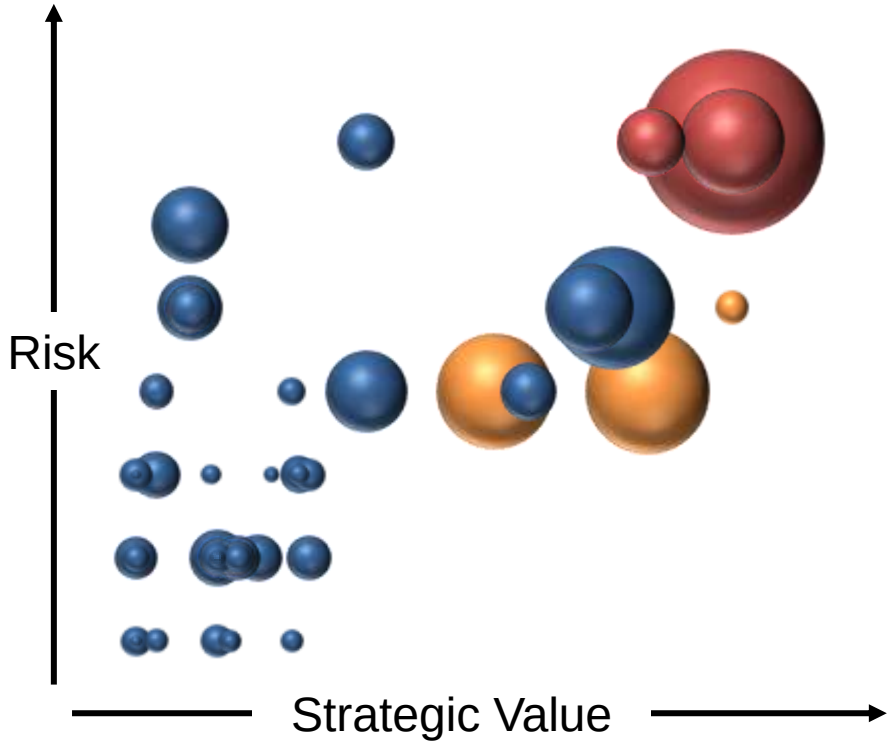
SECNAV Targets

Increased Alternatives Afloat 2020	50% of total DON energy consumption from alternative sources
Increased Alternatives Ashore 2020	At least 50% of shore-based energy from alternative sources; 50% of installations net-zero
Sail the "Great Green Fleet" 2012/2016	Green Strike Group: local operations/sail
Reduce Non-Tactical Vehicle Petroleum Use 2015	Reduce petroleum use in commercial vehicle fleet by 50%
Energy Efficiency Acquisition	Evaluation of energy factors mandatory when awarding systems/buildings contracts

CNO Targets

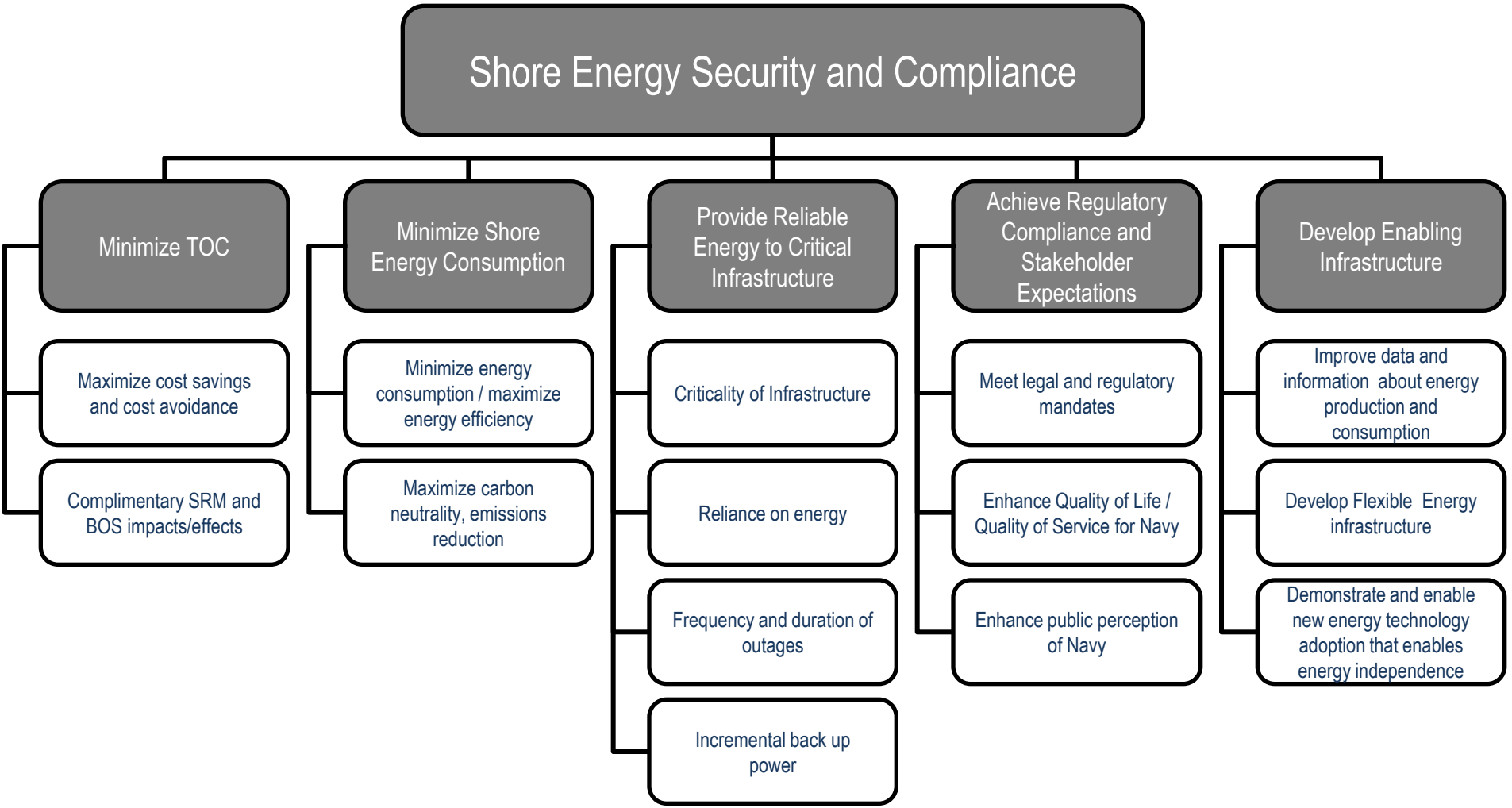
Reduce Consumption Afloat 2020	Navy will increase efficiency and reduce consumption afloat by 15%
Reduce Consumption Ashore 2020	Navy will increase efficiency and reduce consumption ashore by 50%
Protect Critical Infrastructure 2020	Navy's critical infrastructure will have reliable backup/redundant power systems where viable

Retooling the Fleet



Expanding tactical reach and enhancing combat capability

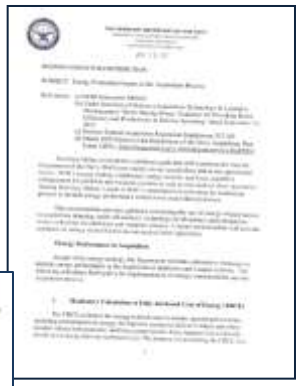
Energy ROI (eROI)

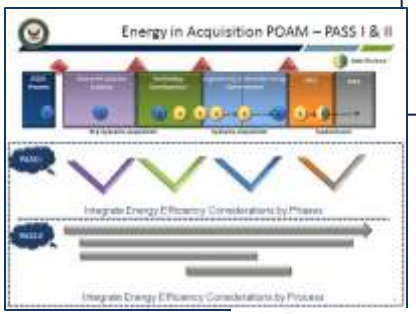


True eROI is complex and consists of both quantitative & qualitative factors

Changing the Acquisition Process

- **Policy Progress**
  - **Program Requirements Manual**
    - Energy Efficiency Key Performance Parameter (KPP)
    - Fully Burdened Cost of Energy (FBCE) reference into Sustainment KPP
  - **ASN (RDA) Memo**
    - Energy evaluation factors in the Acquisition Process
  - **Total Ownership Cost Guidebook**
    - Energy expenses to Operations &Support Costs section





- **Major Program Progress**
  - **OHIO-Replacement:**
    - Energy Efficiency Key System Attribute (KSA) for Capabilities Development Document
  - **Landing Ship, Dock (LSD(X)):**
    - Recommended Operational Energy as an attribute under the Mobility & Endurance Capability
  - **Fleet Replenishment Oiler (T- AO(X))**
    - Energy Efficiency KSA to be evaluated during the AoA phase

SSBN-X

T-AO(X)

- **Next Steps**
  - **Navy Operational Energy in Acquisition Team (EN-ACQT)**

Culture Changes

- Education
  - Master's Program (Engineering and Policy)
  - Executive Education
- Fleet
  - Energy 'E'
  - Aviation
    - ENCON: Improve fleet usage of fuel
  - Maritime
    - i-ENCON: Successful program
  - Expeditionary
    - SEAL Team Initiative: Goal of Net Zero Water/Energy
    - NSW Village Stability Operations
    - EX-FOB

Navy Biofuel Program

Alternative fuel must be a drop-in replacement, invisible to the operator

- ✓Meets current fuel performance requirements
- ✓Can be mixed or alternated with petroleum fuel
- ✓NO change to aircraft or ship configuration
- ✓NO change to transport/storage infrastructure

Current

Hydrotreated Renewables Test & Certification

- ❑ Chemical & Physical Properties
- ❑ Component Performance
- ❑ Platform Performance
- ❑ Long-term Operability

Near-Term Future

Feedstock/Process Validation

- Biological Conversion
- Biomass-Butanol-Fuel
- Pyrolysis
- Others

Longer-term Biofuel Solution

Integrated Alternatives

Multiple Feed-stocks

Scale Up

Cost-Effective

Engineer the fuel not the platform

Potential JP-5/F-76 Non-Petroleum Production Pathways

	Process	Feedstock	Composition	Producers
Hydrogenated Esters and Fatty Acids (HEFA)	Deox/ Hydroprocessing	Triglyceride oils	Iso & N paraffins	UOP, Sapphire, Dynamic, GA, Neste, Solazyme
Fischer Tropsch	Gasification/FT & Hydroprocessing	Coal/NatGas Biomass	Iso & N paraffins	SASOL, Shell, Rentech
	Gasification/FT & Hydroprocessing	Coal/NatGas Biomass	Iso & N paraffins & 1-ring aromatics	SASOL, Shell, Rentech
Alcohol to Fuel	Fermentation-olig/hydrotreating	Sugar to Alcohol	Iso & N paraffins	GEVO, Cobalt, Zeachem
	Fermentation-olig/hydrotreating	Sugar to Alcohol	Iso & N paraffins & aromatics	Byogy, Swed Biofuels, Logos
Direct Sugar To Hydrocarbon	Fermentation	Sugar	Paraffins	Amyris-Total
Thermocatalytic	Hydrotreated, thermo-catalytic	Lignocelluosic	Paraffins & aromatics	KiOR

Testing complete in FY12

Approval via Similarity

Lab test: On-going
Test Stand: Late 2012

Commercial Adoption

- Regulation
  - Jul 2011, ASTM approval of 50/50 jet fuel
  - January 2012, EU Carbon Tax
- Wright brother moments
  - Dec 2008 – Air New Zealand first 'drop-in' biofuel flight
  - Jan 2009 – Continental US carrier biofuel flight
  - Mar 2011- AeroMexico first commercial translant Boeing 777
- Paris Airshow – Translant biofuel flights
  - Boeing 747-8 with all engines burning biofuel
  - Gulfstream 450 first business jet to complete leg
- Commercial long term testing of biofuels
  - Alaska – Seattle/DC and Seattle/Portland
  - Lufthansa – Frankfurt/Hamburg

Aligned with CNO Sailing Directions

- Warfighting First
- Operate Forward
- Be Ready