U.S. DoD Climate Leadership

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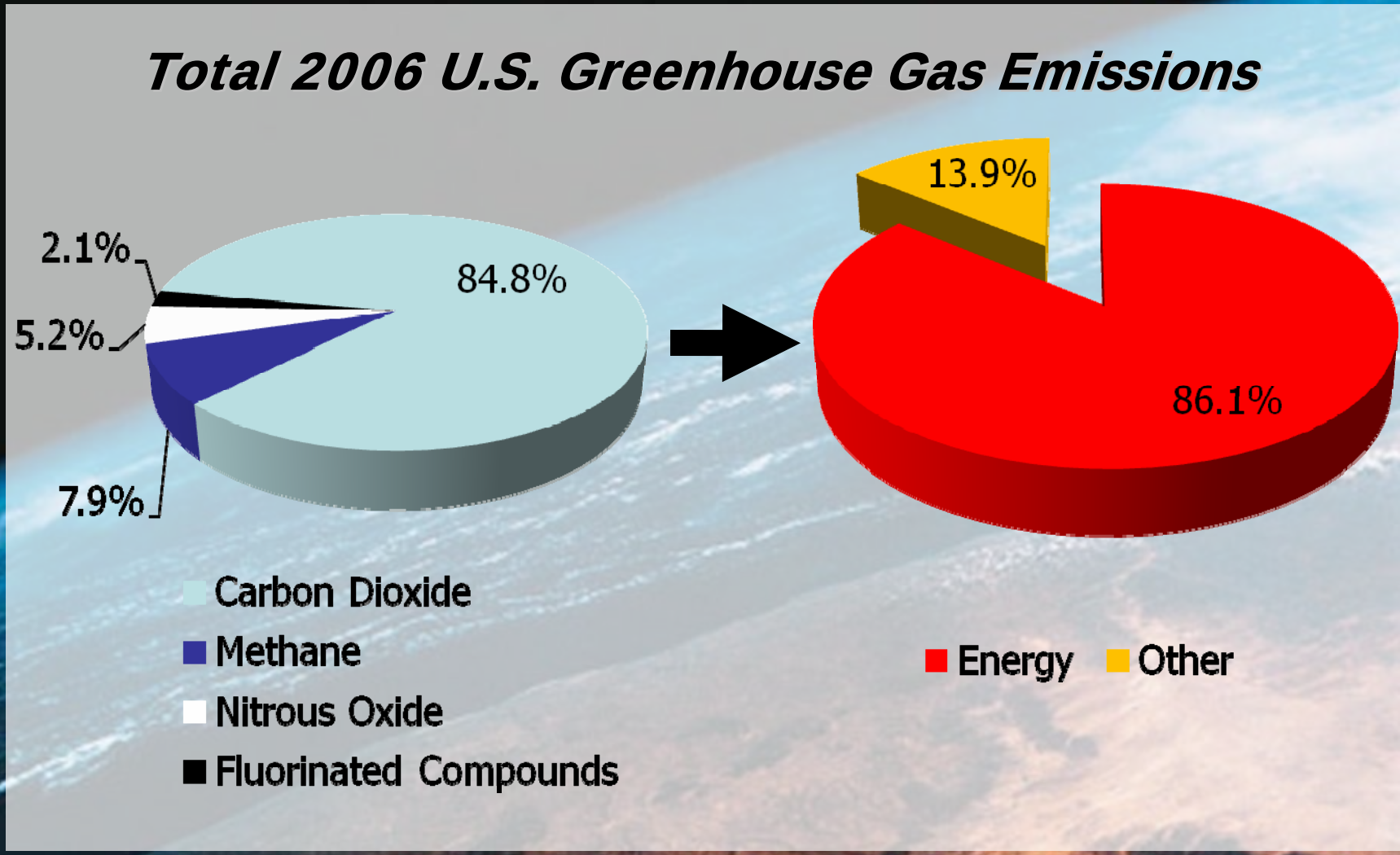
Current White House Position

- Climate Change is in part caused by manmade sources.
- Work with other major emitting countries to develop a process which allows economic growth while also reducing climate change gases.
- Position can be seen on www.whitehouse.gov

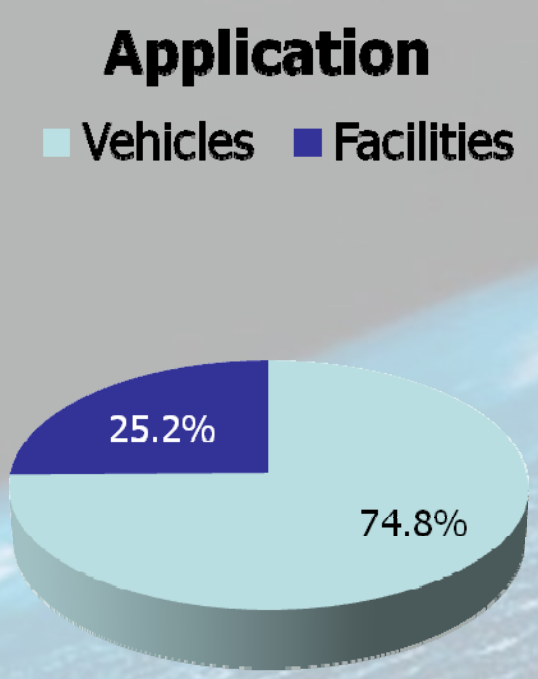
Presidential Candidates

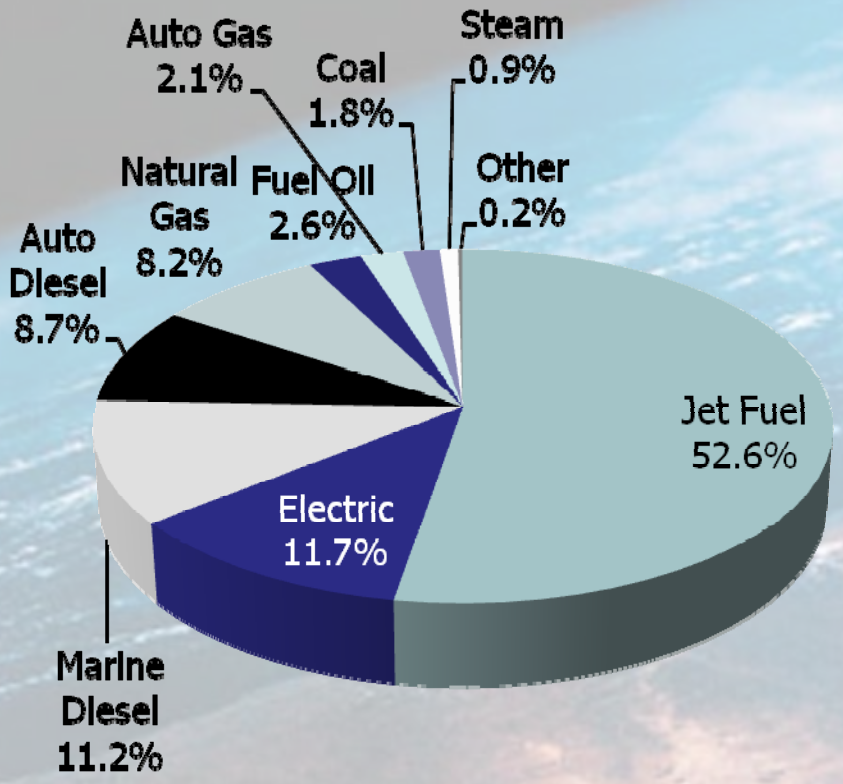
- Senator McCain
  - Proposes a cap-and-trade system that would set limits on greenhouse gas emissions
  - 2050: 60% Below 1990 Levels (66% Below 2005 Levels)
- Senator Obama
  - Implement an economy-wide cap-and-trade program to reduce greenhouse gas emissions 80% by 2050

Climate & Energy Linkage



DoD Energy Use (FY 07)





$13.2B
864 Trillion BTU
0.8% of Total U.S. Energy Use

Climate Change & Military Readiness

- Primary Reason For DoD Energy Conservation Investment Is Not Climate Protection
- Facilities
  - Reduce Cost
  - Meet National Energy Goals
  - Enhanced Resilience Against Electric Grid Outages
- Tactical Platforms
  - Increase Combat Power
  - Reduce Logistics “Tail” & Security Burden
  - Reduce Cost

Climate Protection & Military Readiness Are Mutually Supportive

Facility Energy Performance

- Facility Energy Goals Established by Legislation & Presidential Executive Order
- Goal of 6% Consumption Reduction in FY07 (From Revised 2003 Baseline)
  - Actual 10.1%
- Goal of 3% Renewable Electricity
  - Actual 5.5%
  - 11.9% Of Total Energy Is Renewable
- All New Design Buildings At Least 30% More Efficient Than Industry Standard
  - Actual 39% of New Designs (Some Designs Predated Requirement)

Renewable Energy

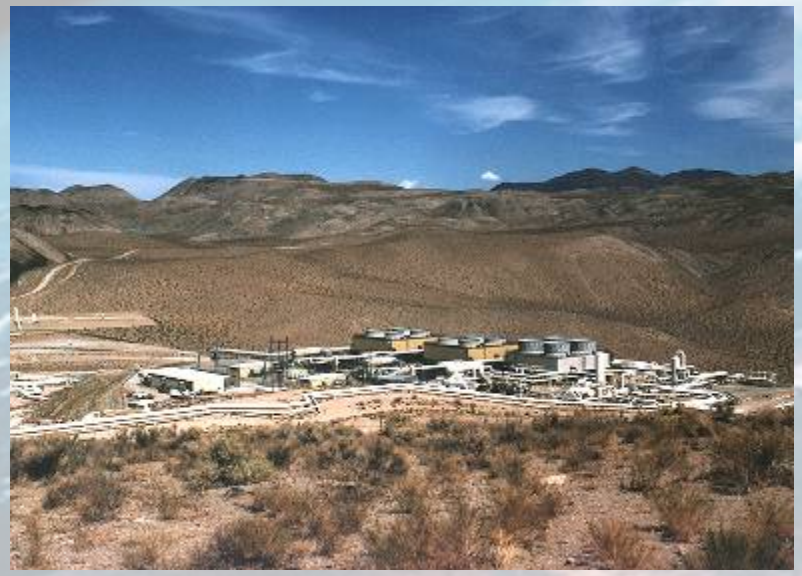
- Wind
- Geothermal
- Solar
- Other
  - Ocean
    - Wave Power
    - Ocean Thermal Energy Conversion
    - Tidal Power
  - Biomass
- SPECIAL NOTE – ENERGY ENCROACHMENT

Wind Energy

- Numerous Wind Turbines in Operation at U.S. DoD Facilities
- Often Used in Remote Sites Where Fuel Costs are High
- Example: San Clemente Island
  - Fuel Savings >140,000 gals/yr
  - CO_2 Reductions >1,400 metric tons/yr
  - Original ROI Calculated < 7 yrs (late 1990's fuel price)

Geothermal Energy

- Navy China Lake, CA Public/Private Venture in Operation Since Late 1980's – 270 MW Capacity
- Electricity Supplied to CA Grid
  - Equivalent to 5% of Total DoD Electricity Use
- Revenues Paid to U.S. Navy
  - $249M (1988-2003)
  - Revenue Used For Other Navy Energy Projects
- Other DoD Sites Planned
  - NAS Fallon, NV (30 MW– Up to 160 MW)
  - Hawthorne Army Depot, NV (30 MW)



Solar Energy

- Numerous Solar Energy Systems In Operation Or Planned At DoD Bases
- Nellis AFB, CA
  - 14 MW
  - Largest Photovoltaic System in Americas
  - $1M/yr Reduction In Energy Costs
- Fort Irwin, CA
  - Planned 500 MW Concentrating Thermal System (2014)
  - 25 Year Savings:
    - $21M
    - 4,015,000 tons of CO_2

Other Renewables

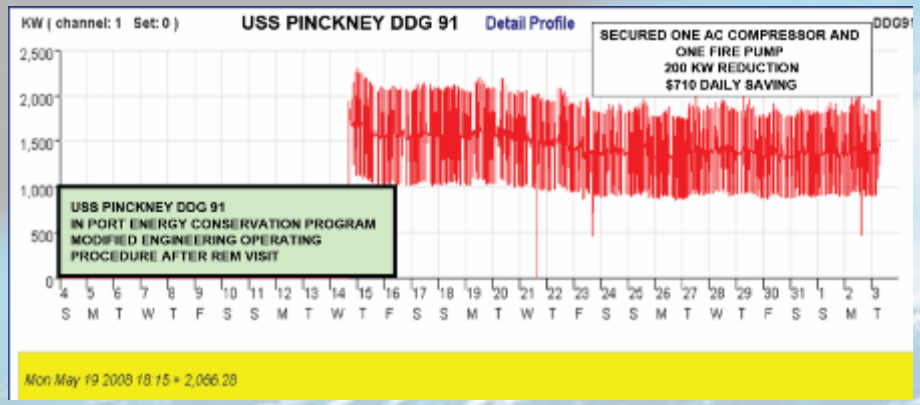
- Wave Power
  - Marine Corps Base Kaneohe Bay, HI
  - Buoys First Deployed in June 2004
  - Testing Ongoing
- Ocean Thermal Energy Conversion (OTEC)
  - Proposed System For Naval Support Facility Diego Garcia
  - 8 MW Electricity, 1.25M gals Water/Day
- Tidal Power (Underwater Turbines)
  - Private Sector Cooperative Research & Development Agreement (CRADA) with the U.S. Navy
  - Use of Naval Surface Warfare Center Carderock Division Engineering Facilities
- Biomass
  - Army Partnering With Defense Energy Support Center
  - Six Army Bases & 1 DLA Facility Conducting Biomass to Fuel Demonstrations
  - Potential For Up to 1M barrels of Fuel/Day

Tactical Energy Use

- Defense Science Board Reports
  - Acquisition Decisions Not Based on True Cost of Fuel
  - Fully Burdened Cost of Fuel (FBCF)
  - Energy as a Key Performance Parameter (KPP)
- Lessons Learned From Iraq & Afghanistan
  - Logistics Tail
  - Force Security Burden
- Rising Fuel Cost Threatens Readiness
- Many Efforts Underway to Reduce Tactical Energy Consumption
  - Change Operational Procedures
  - Develop New Energy Efficient Systems
  - Retrofit Energy Technologies Where Cost Effective
  - Examples On Following Slides

Ship Operational Procedures

- "Cold Iron" - Significant Energy Use by Ships Inport
  - Lighting, Air Conditioning, Air Compressors, Fire Pumps, 400HZ Motor/Generators
  - San Diego Pilot Study
  - Modify Engineering Operating Procedures
  - No Impact to Mission, Schedule, Safety or Quality of Life
  - Energy Savings From August 2007 – May 2008
    - $4M
    - 50,000 MBTUs
    - 14,000,000 kwh
- Navy Incentivized Energy Conservation (I-ENCON) Program
  - Engineering Procedures, Guidelines, and Training For Maximum Fuel Efficiency Without Impairing Mission Objectives
  - Provides Cash Rewards to CO Discretionary Fund of Ships Saving Fuel
  - $104M Fuel Cost Avoidance in 2007
  - 2008 Expectations:
    - $157M Cost Avoidance
    - 1.14M Barrels of Oil Saved



New Army Hybrid Vehicles

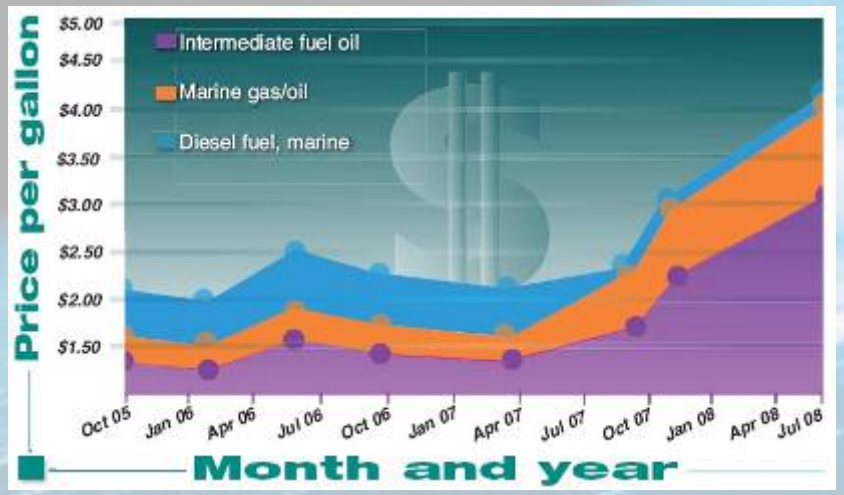
- Eight New Manned Ground Vehicles Being Developed As Part of Future Combat Systems Program
- Hybrid Electric Propulsion Systems
  - Electric Drive Motors - Run Off Batteries - Diesel Engine Charges Batteries
  - Increased Fuel Economy
  - Increased Power For Integration of Sensors and Computing Systems
  - Exportable Electric Power (No Towed Generators)
  - Enhanced Low Speed Maneuverability
  - Smaller Overall Vehicle Profile for Concealment
  - Low Acoustic Signature & Quiet Ride
- Other Medium & Heavy Duty Vehicle Hybrid Technologies Being Developed for Dual Military/Industry Use
  - Trucks
  - Construction Equipment

New Aircraft Engines

- USAF Adaptive Versatile Engine Technology (ADVENT)
  - Develop Engine With High Thrust Capability That Can Switch To Fuel-Efficient Loiter
- Highly Efficient Embedded Turbine Engine (HEETE)
  - Technologies For Substantial Reduction in Specific Fuel Consumption
  - Potential Benefits:
  - 30% Range Increase or
  - 50 % Payload Increase for Future Transports
  - 90% Increased Loiter Time for Surveillance and Reconnaissance Unmanned Aerial Vehicles (UAV);
  - Double Radius or Loiter Time For Notional Navy Combat UAV

Shipboard Energy Conservation Retrofits

- Stern Flaps
  - Already Retrofit on Some Navy & Coast Guard Vessels
  - Increased Fuel Efficiency & Top Speed
  - Proposed Installation on Amphibious Ships
    - 4,300 Barrels/Ship/Year Fuel Savings
- Online Gas Turbine Engine Washing
  - Allows More Frequent Washing By Replacing Offline Manual Crank Washing
- Combustion Trim Loop
  - Improved Combustion Controls For Steam Boilers
- Advanced Hull & Propeller Coatings
  - Fouling “Washes Off” While Underway



The Future : Regulation

- Scheme for regulating greenhouse gases is evolving
- Judicial Branch – 2007 ruling that Greenhouse Gases are pollutants which can be regualted.
- Executive Branch – EO 13423, Strengthening Federal Environmental, Energy and Transportation Management – 3% decrease per year from 2003 to 2015; proposed rule on reporting greenhouse gas emissions in development at EPA; fuel efficiency standards.
- Legislative Branch – many bills, such as cap and trade have been introduced; Nat'l Defense Auth Act requires DoD to consider operational implications of CC

State Government Action

- In absence of Federal Regulations, 40 or 50 states have initiated legislation
- DoD is developing a policy on how to respond.

- Taken together, DoD can expect:
  - Cap and trade + CAA reguloations + State Reqs
  - Voluntary registry for estimating and reporting emissions
  - Increased interest in aviation and maritime emissions

Inventories & Responses

- Air Force –
  - Developing a preliminatry, comprehensive top down GHG emissions inventory
  - Initiative to assess biological seqestration impacts
  - Alternative energy development
  - Aviation fuel demand management
  - Facility conservation efforts
  - Engine airframe improvements

Air Force Emissions and Sequestration Sources

- Ground vehicles and equipment
- Refrigerants
- Aviation Fuel
- Vegetation and Landcover
- Solid Waste and Wastewater
- Weapons Platforms
- Facility Energy
- Alternative Fuel

Questions?

- Please contact me to keep the dialogue going…….
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