# Energy Security Analysis in Support of DOD Missions

**Energy Collaborative Analysis Initiative**
**Web Forum**
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# Topics

Energy security analysis in support of DOD missions:

- U.S. Military Installations
- U.S. Military Operations and Deployments
- Strategic (Energy, Security and Development Nexus)

# Renewables and Energy Efficiency Planning (REEP)-1993

- Mission: Analytical methodology for evaluating the economic potential for investments in energy efficiency and renewable energy at major Army installations.

- Goals: Save energy, save money, improve environment, promote health, and strengthen national security.

- Key Metrics—in 1993 evaluated 49 major Army installations in CONUS:
  - Cost Savings: $249,446,020/year
  - Energy Savings: 16,823,804 Mbtu/year & 724,128 kW (demand reduction)
  - Pollution Prevention: 2,415,337 STONs/year (Greenhouse Gases)

- Status: Used for policy analysis, programming, and budgeting by the Army (and OSD) in the 1990s.

# Army Installation Energy Security Planning (AIESP) - 2002

- Mission: Analytic capability to generate investment strategies for a more secure energy supply using distributed generation (DG) for key missions at Army installations.

- Metrics:
  - Energy security: days of supply
  - Ease of implementation and appeal to personnel
  - Economics (payback/life cycle cost savings)
  - Energy savings (kW/kWh)
  - Pollution prevention (lbs of pollutants)

- Findings for three case study Army installations:
  - DG options available that are economically competitive.
  - Utilities expressed interest in owning and operating DG at Army sites.
  - Smaller, mobile DG technologies, though more costly, can support garrison and training base missions as well as homeland security and other deployments.

# Analysis of Deployable Applications of Photovoltaics in Theater (ADAPT); Renewable Energy Analysis for Strategic Responsiveness (REASR 1/2/3)-1999

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- Mission: Analyses and field assessments to evaluate the costs and benefits of using flexible, thin-film photovoltaic systems to support the energy needs of deployable Army forces.
- Goals: Meet energy needs, reduce logistics footprint for training and operational missions, reduce number of fuel convoys.
- Field assessments by 82nd Airborne between 1999 and 2005 at Fort Bragg and other sites such as National Training Center (NTC) in Fort Irwin and Hanau, Germany.

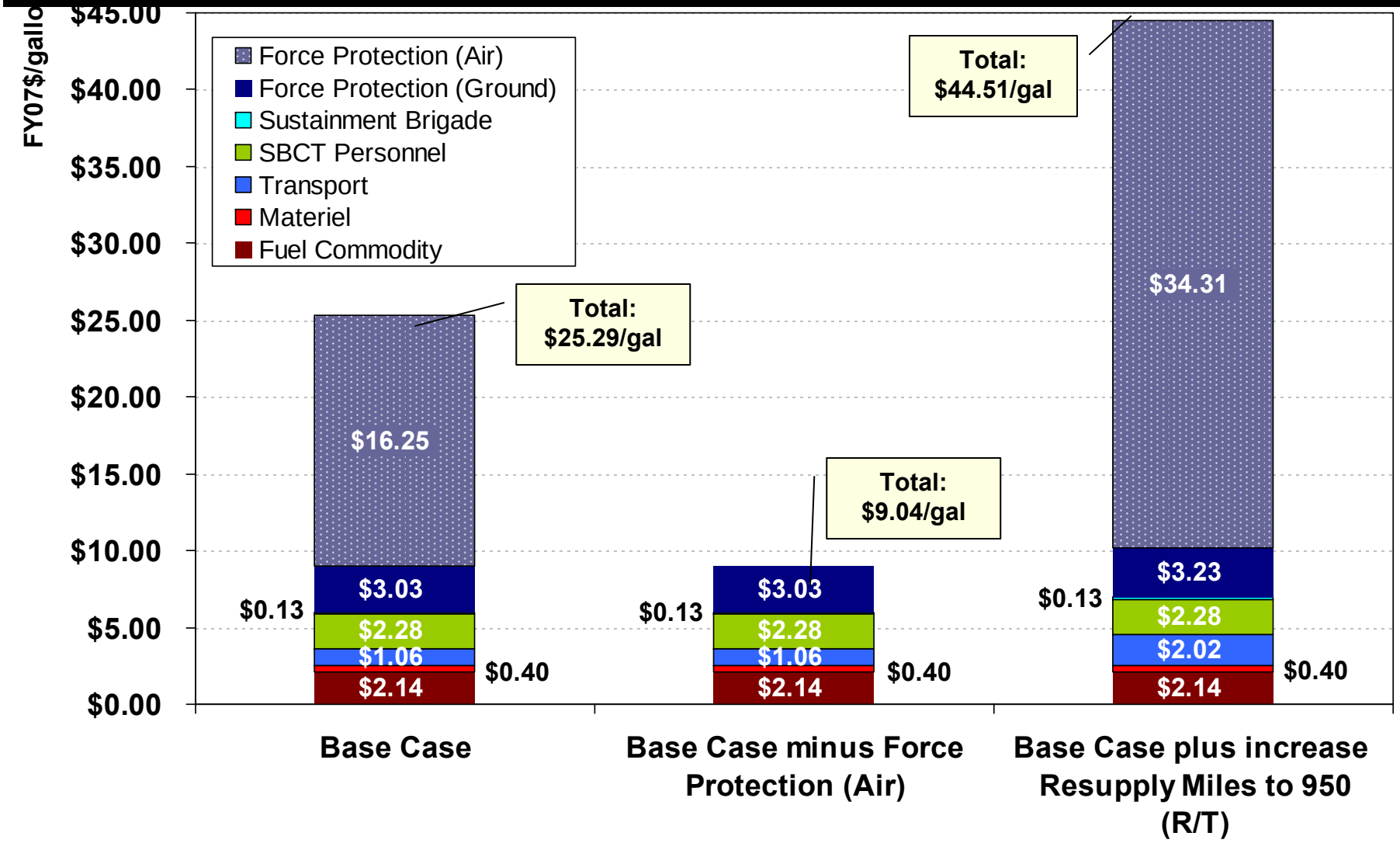
Field Assessment Measures (as assessed by troops):

- Signature (noise, visibility, heat)
- Ease of use
- Delivery of required power
- Mobility and Flexibility
- Supportability and Maintainability
- Reliability and Durability

Metrics for Quantitative Analysis:

- Economic (payback and life-cycle cost savings)
- Pollution Reduction (pounds of pollutants)
- Energy Savings (pounds of fuel)

# Fully Burdened Cost of Fuel Examples (Iraq) using the Sustain the Mission Project (SMP) Methodology



# Western Hemisphere Information Exchange (WHIX)-2002

- Mission: WHIX is a U.S. Southern Command Program to facilitate information exchange through technology demonstrations between U.S. and Latin American/Caribbean militaries in energy security and sustainability.
- Metrics:
  - Deployability and agility
    - Logistics footprint (lbs and cubic feet)
    - Ease of set-up and break-down
  - Life-cycle costs
  - Technical performance
  - Operation and maintenance
  - Durability
- Current activities: Energy security analysis in conjunction with field technology demonstrations in Latin American and the Caribbean:
  - Installation energy security: Two 50 kW biomass energy systems that generate electricity from local agricultural waste (FY2006-07)
  - Military operational missions: Four mobile potable water treatment systems powered by thin-film photovoltaic units—5 to 15 kW (FY2007)

# Energy Security Analysis: Strategic

Army developed stability indices to assess country security based on macro structural factors*:

- GDP per capita
- Infant Mortality Rate
- Life Expectancy
- Caloric Intake
- Trade Openness
- % of history spent in state of conflict
- Democracy
- Civil Liberties index
- Political Rights Index
- Youth Bulge
- Religious Diversity
- Ethnic Diversity

* from Analysis of Complex Threats and Operations (ACTOR)

# Energy and Country Instability (ECI)-2003

- Purpose: To study the effects of energy on country stability, quality of life, and social and economic development.
- Metrics:
  - Country stability (Army index)
  - GDP per capita
  - Life expectancy
  - Energy consumption per capita
- Findings: Energy consumption has a positive effect on:
  - Country stability
  - Public health (life expectancy)
  - Economic development (GDP per capita)

# Comparison of Country Stability and Development Indicators

**Country Stability Indicators***

1. GDP per capita
2. Infant Mortality Rate
3. Life Expectancy
4. Caloric Intake
5. Trade Openness
6. % of history spent in state of conflict
7. Democracy
8. Civil Liberties index
9. Political Rights Index
10. Youth Bulge
11. Religious Diversity
12. Ethnic Diversity

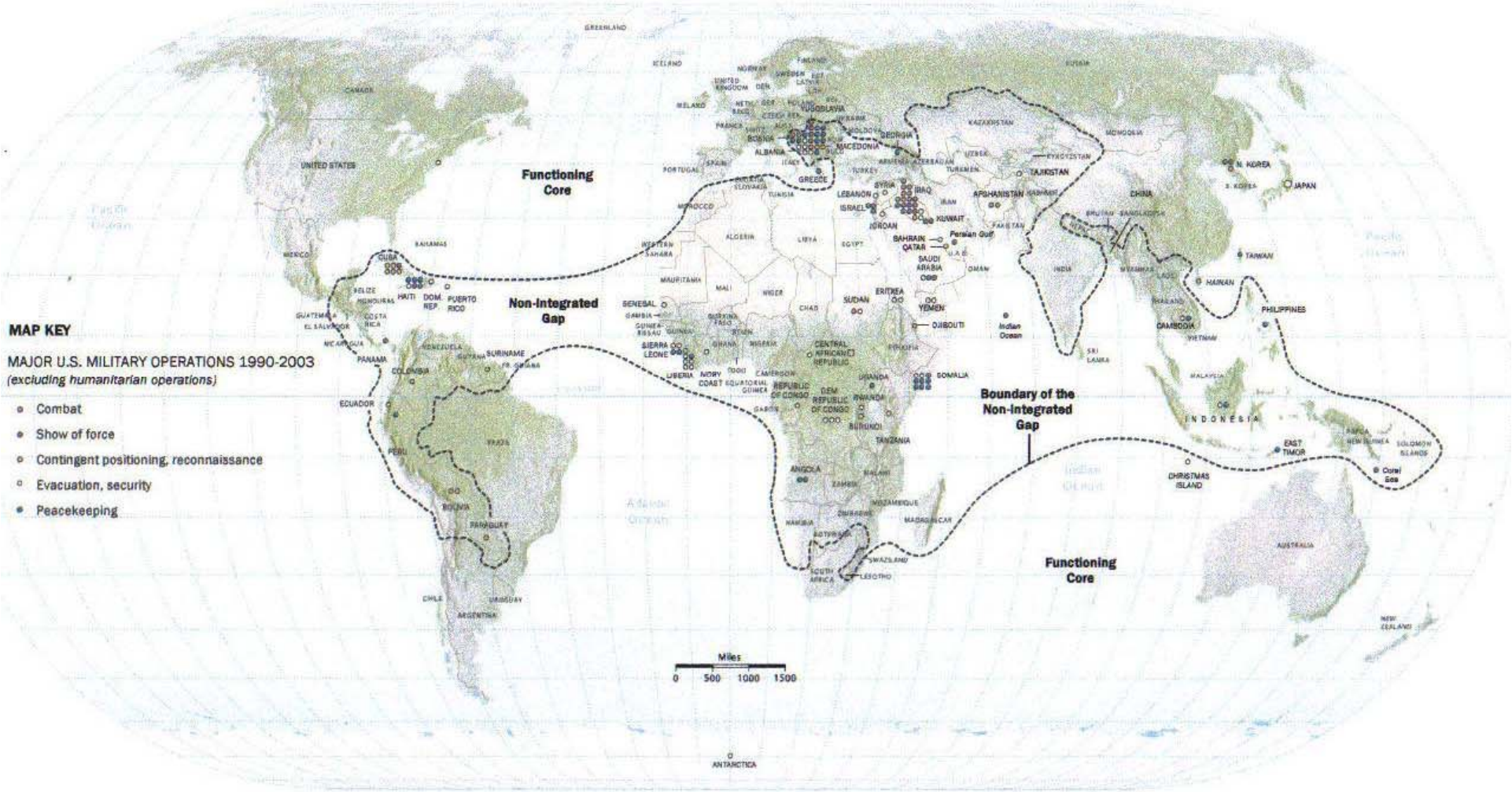
**Development Indicators****

1. GDP per capita
2. Infant Mortality Rate
3. Life Expectancy
4. Caloric Intake
5. Trade Openness
6. Democracy
7. Civil Liberties index
8. Political Rights Index
9. Youth Bulge

** from World Bank: World Development Indicators (WDI)/Millennium Challenge Corporation (MCC) Indicators

* from ACTOR

# The Pentagon's New Map:
# War and Peace in the Twenty-First Century




*Response data source: U.S. Military Services via Dr. Henry Gaffney Jr. / The CNA Corporation*

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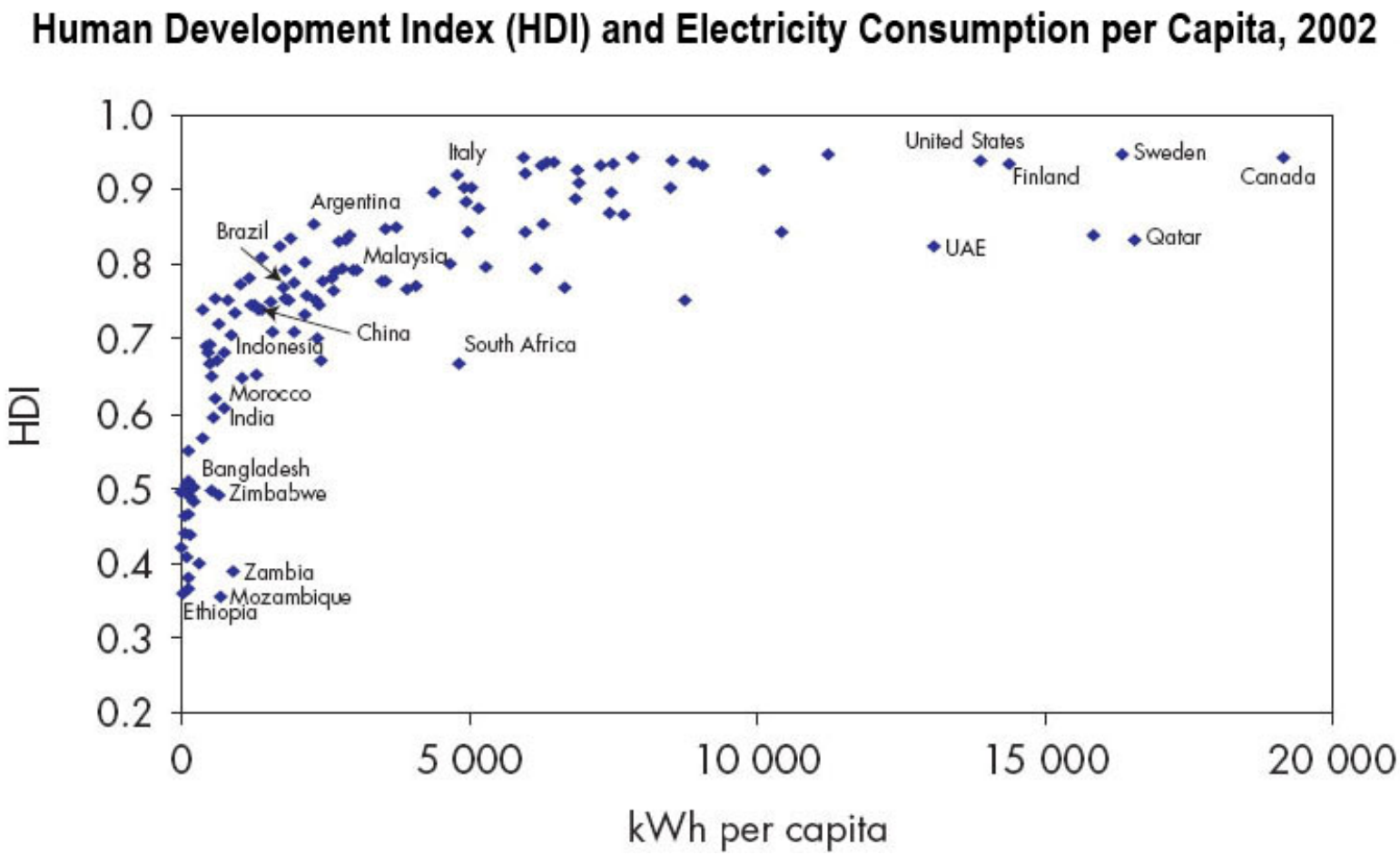
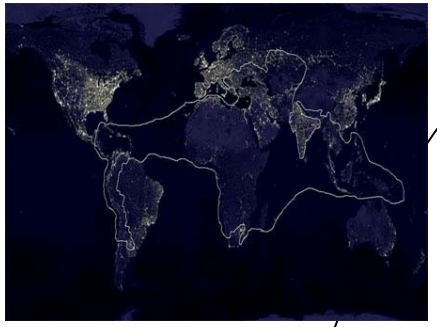
# Link Between Energy and Development






*From International Energy Agency. 2004. World Energy Outlook.

# Energy, Security, and Development Nexus

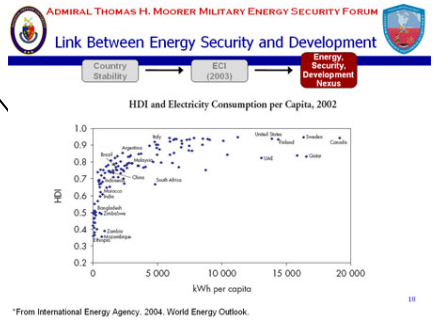


**ENERGY**

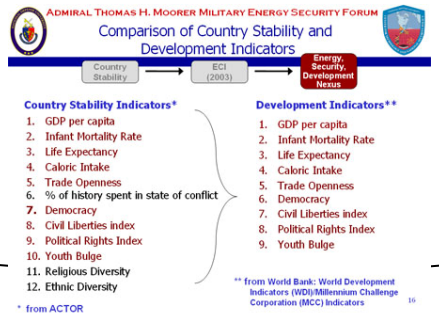
**(from ECI)**

**improves country stability**

**improves life expectancy, GDP/cap**

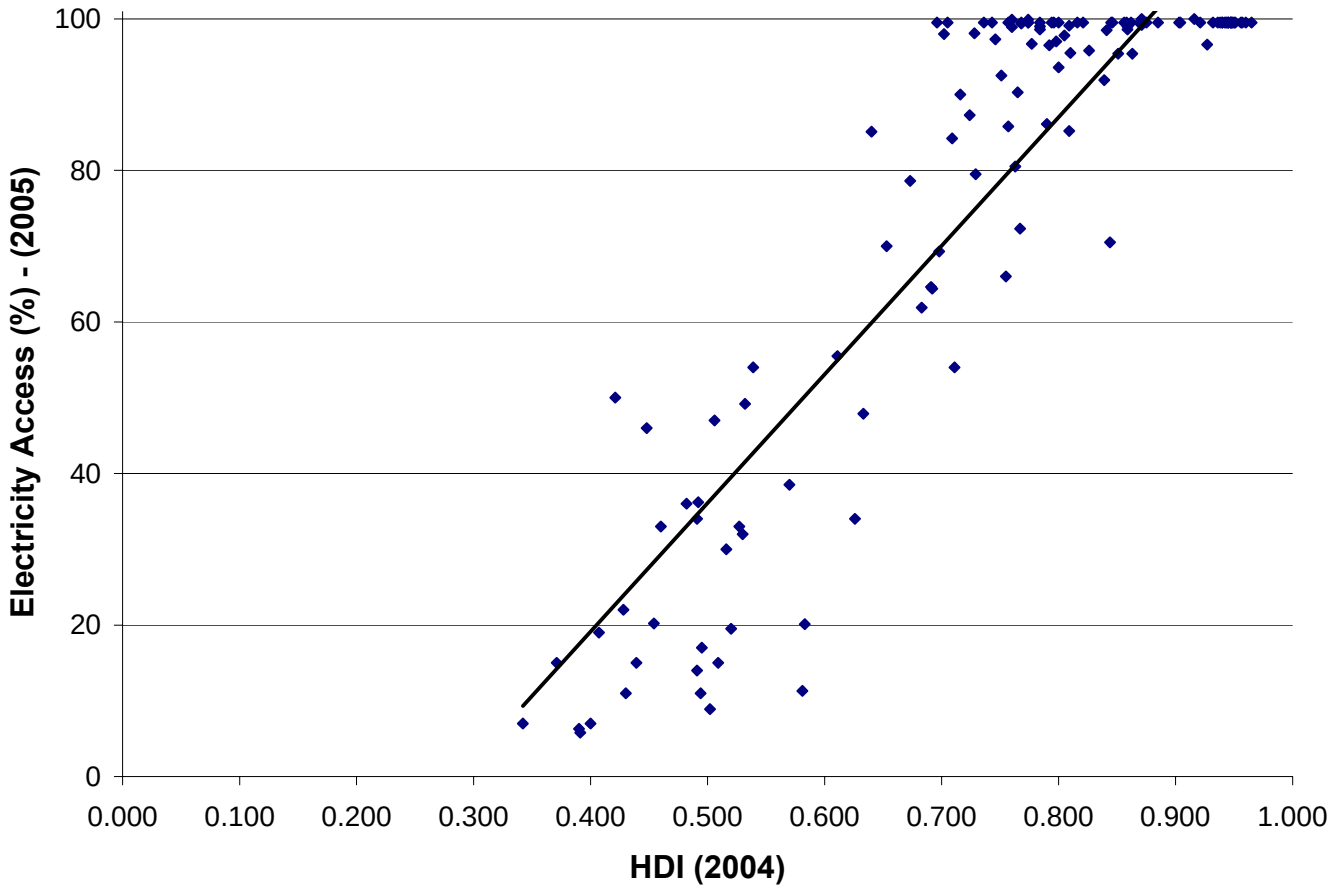



**SECURITY**




**DEVELOPMENT**

# Comparison of Human Development Index (HDI) vs. Electricity Access: 128 countries




2004 HDI: United Nations. 'Human Development Report 2006' http://hdr.undp.org/hdr2006/report.cfm

2005 Electricity Access: International Energy Agency. ' World Energy Outlook 2006' http://www.worldenergyoutlook.org/

# Country Security vs. Human Development and Electricity Access

- Countries experiencing severe crisis or war* tend to have relatively low human development index (HDI) and electricity access (EA) values
  - Severe Crisis: violent force is repeatedly used in an organized way
  - War: violent force is continuously used in an organized and systematic way-the extent of destruction is massive and of long duration.

- In 2004, 23 of 24 countries in severe crisis or war had low or medium HDI values (an additional four countries in severe crisis or war did not have HDI values).

- In 2005, 12 of 13 countries in severe crisis or war were in the bottom 50% of electricity access values (an additional five countries in severe crisis or war did not have EA values).

* Conflict Simulation Model (COSIMO)-Heidelberg Institute for International Conflict Research (HIIK) at the Department of Political Science, University of Heidelberg.

# Examples of Externalities to Keep on the Radar

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**DEFENSE:**
**Importing oil from the Persian Gulf—region with highest defense expenditures—is equal to adding $7.41 to each gallon of gasoline consumers buy at the pump.**
(Testimony of Milton R. Copulos before Senate Relations Committee, March 2006)

**HEALTH:**
**Annual U.S. health costs associated with auto air emissions estimated at $34.2-$79.8 billion per year.**
(Delucchi, Murphy & McCubbin. 2002., *J. Environ. Manag.* 64.)

**ENVIRONMENT:**
**Socioeconomic and environmental costs of 42,860 oil spills (≥ 50 gal.) occurring 1980-2002 in U.S. (EPA jurisdiction) cost $63.2 billion ($2.7 billion/year).**
(Etkin DS. 2004. Modeling Oil Spill Response and Damage Costs.)

**CLIMATE CHANGE:**
**An estimated 160,000 deaths were attributable to climate change in 2000.**
(World Health Organization, 2003.)

# Concluding Remarks

- Energy security analyses should include full costs and benefits

- Information exchange on energy security analysis should occur on a recurring basis in support of policy and decision making.

# Questions?

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