



ENERGY SECURITY

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Energy Security: Definition

Since all economic activity requires the use of energy resources, the continuing availability of energy at a price that protects economic growth is a major concern of governments.

There is no single universally recognised definition for “energy security”. But, there are some factors describing the level of the security:

- Diversity of primary fuel mix
- Import dependence
- Market concentration (the dominance of a small number of producing countries in total trade of any one fuel
- Share of politically unstable regions in imports.

- Total world primary energy demand (2005):
 - oil (35%), gas (21%), coal (25%)
- Total world primary energy demand (2030):
 - oil (32%), gas (22%), coal (28%)

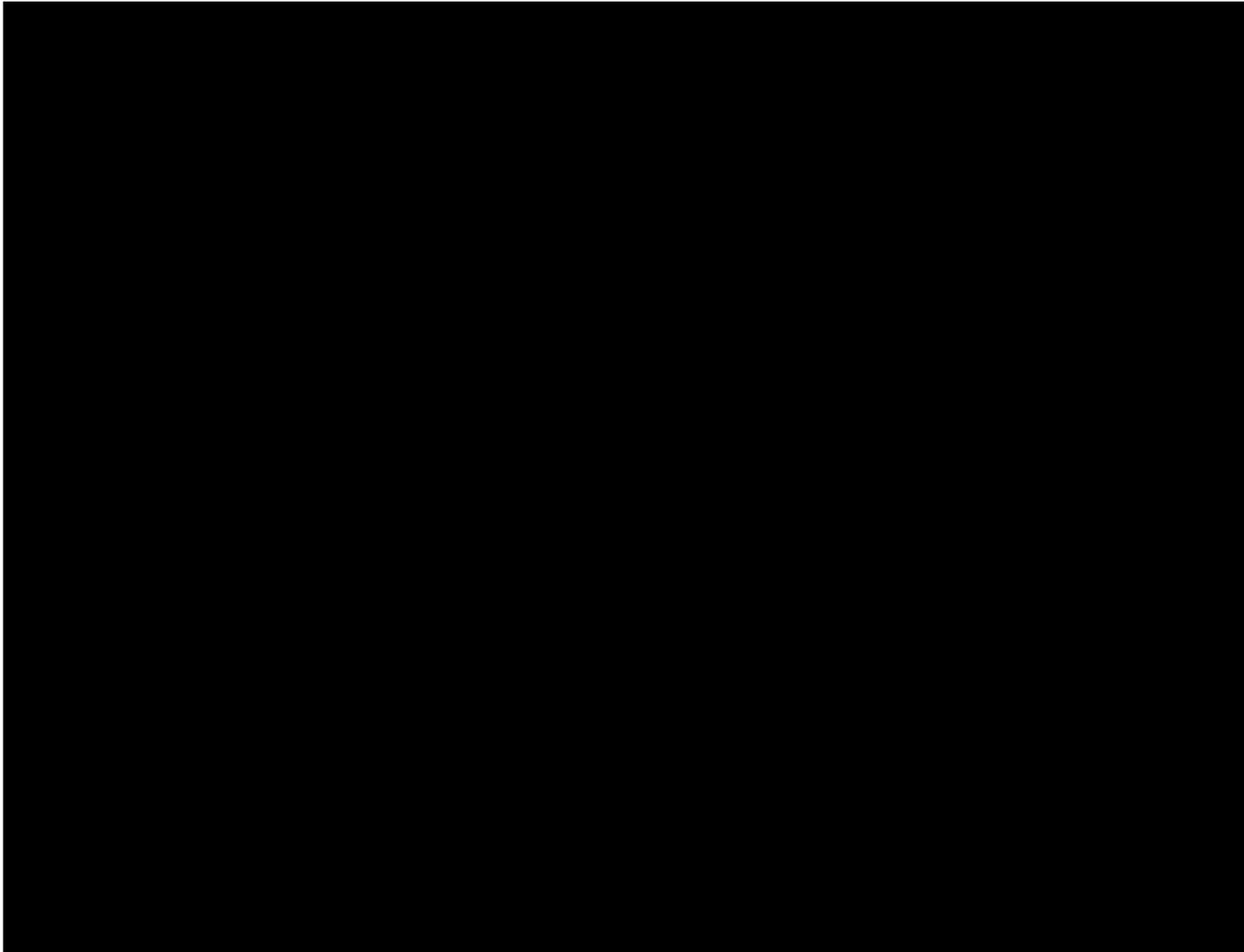
Since coal reserves are more evenly distributed, energy security sometimes are associated with security of supply for oil and gas.

Security risks include:

- New “high demand regions”
- System Reliability
- Climate change and other environmental risks
- Limits for alternatives
- Instability of the oil/gas producing zones
- Current transportation/distribution routes/lines
- Technological barriers
- Economical barriers

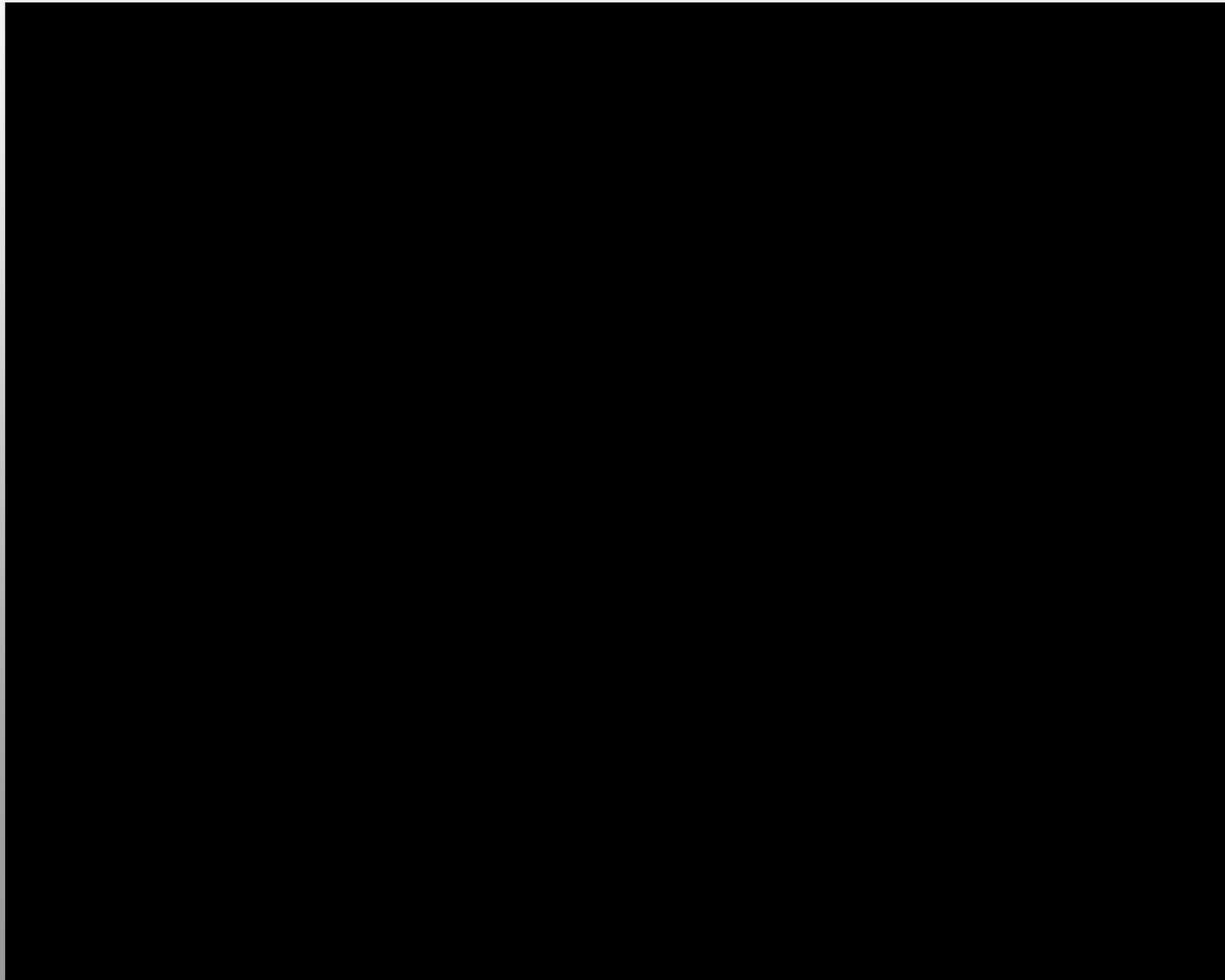
New “High Demand” Regions

2005



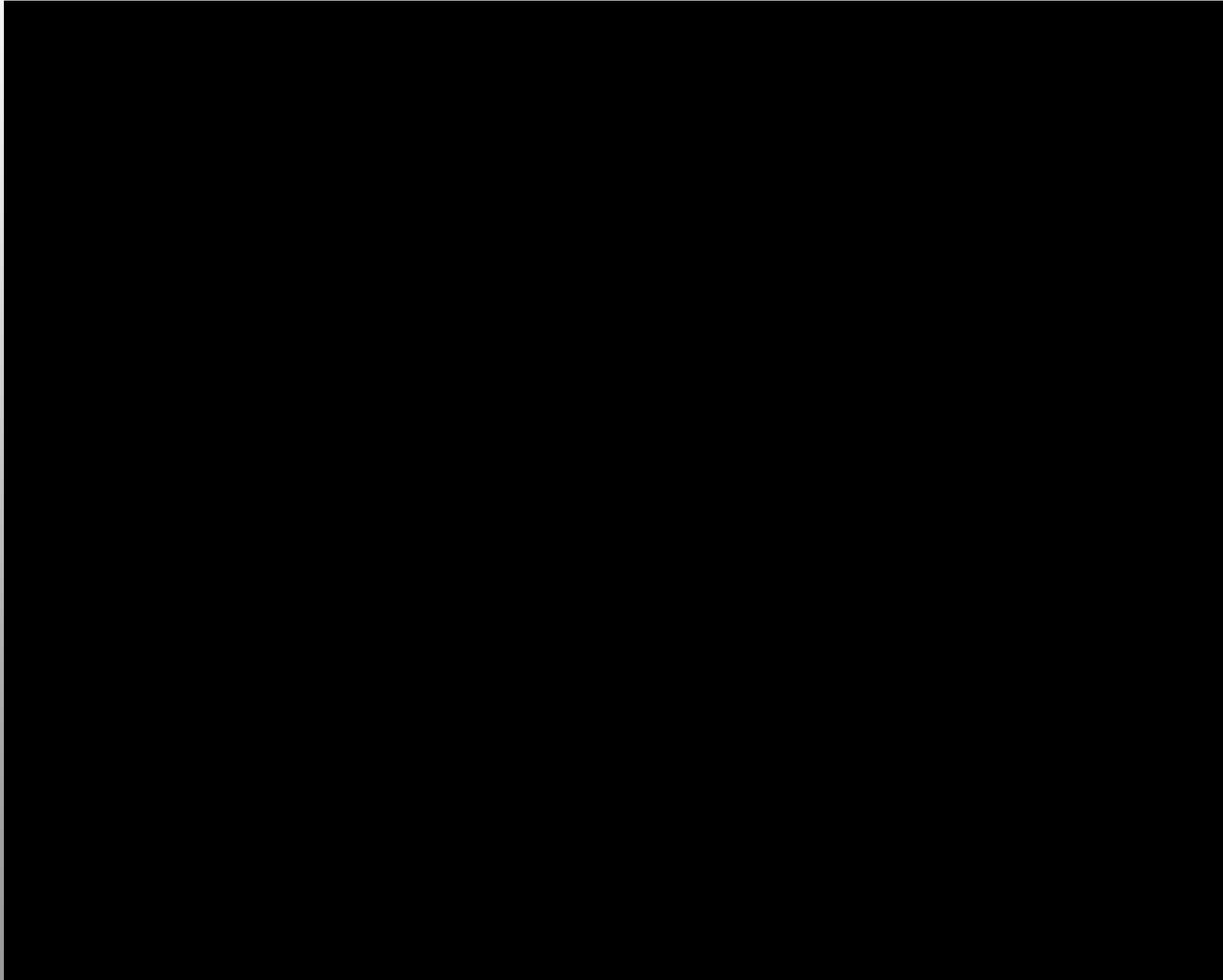
New “High Demand” Regions

2030



New “High Demand” Regions

2005-2030



System Reliability

Old infrastructure: Blackouts

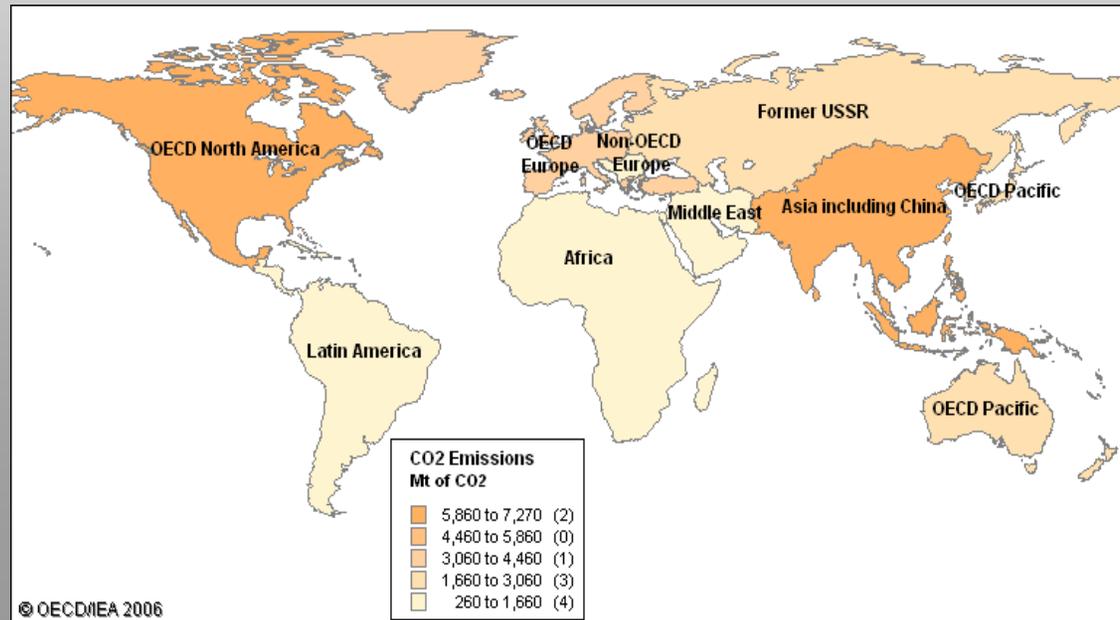
Natural Hazards

Terrorist Attacks

Accidents



Climate Change and Other Environmental Risks



Limits for Alternatives

(Gasoline + Diesel) : ? (Bioethanol + Biodiesel)

- Use of blends above B5 not yet warrantied by auto makers
- Lower fuel economy and power (10% lower for B100, 2% for B20)
- Currently more expensive
 - More importantly;
- Rise in corn prices
- Rise in imported edible oil
- Water shortages,
- Burning of animal + human feedstocks
- Not enough area for plantation,
- Tax losses

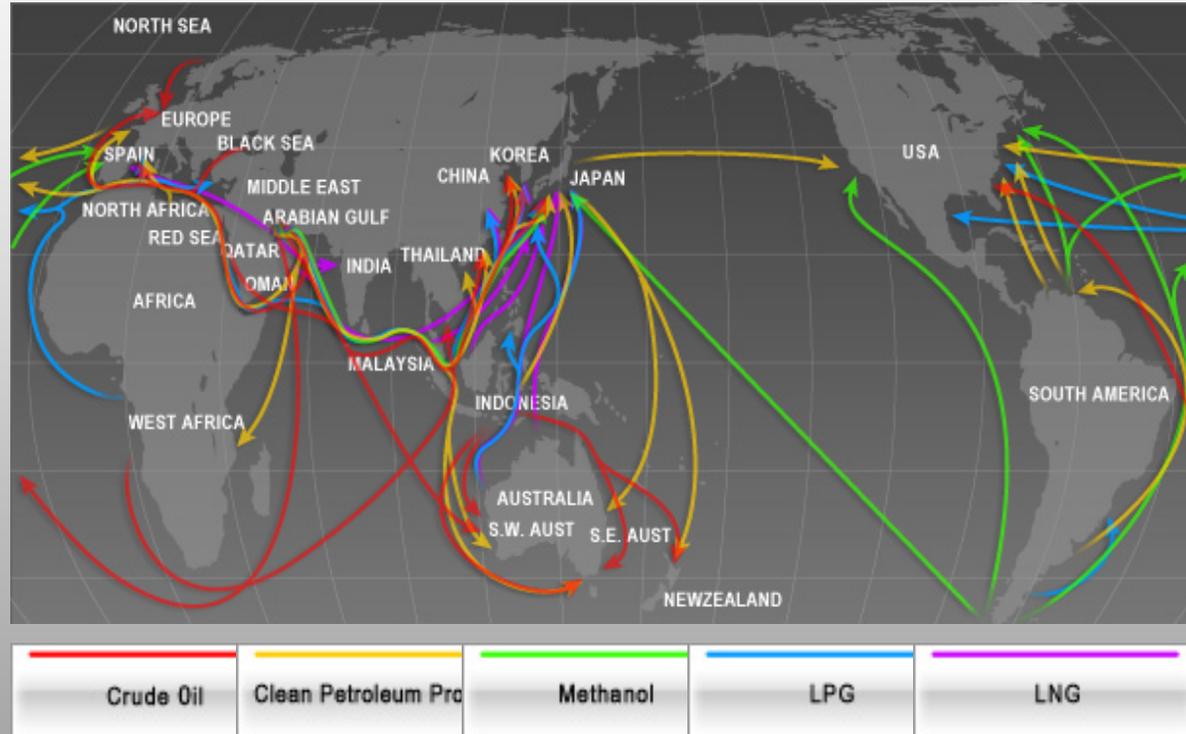


Instability of the oil/gas producing zones

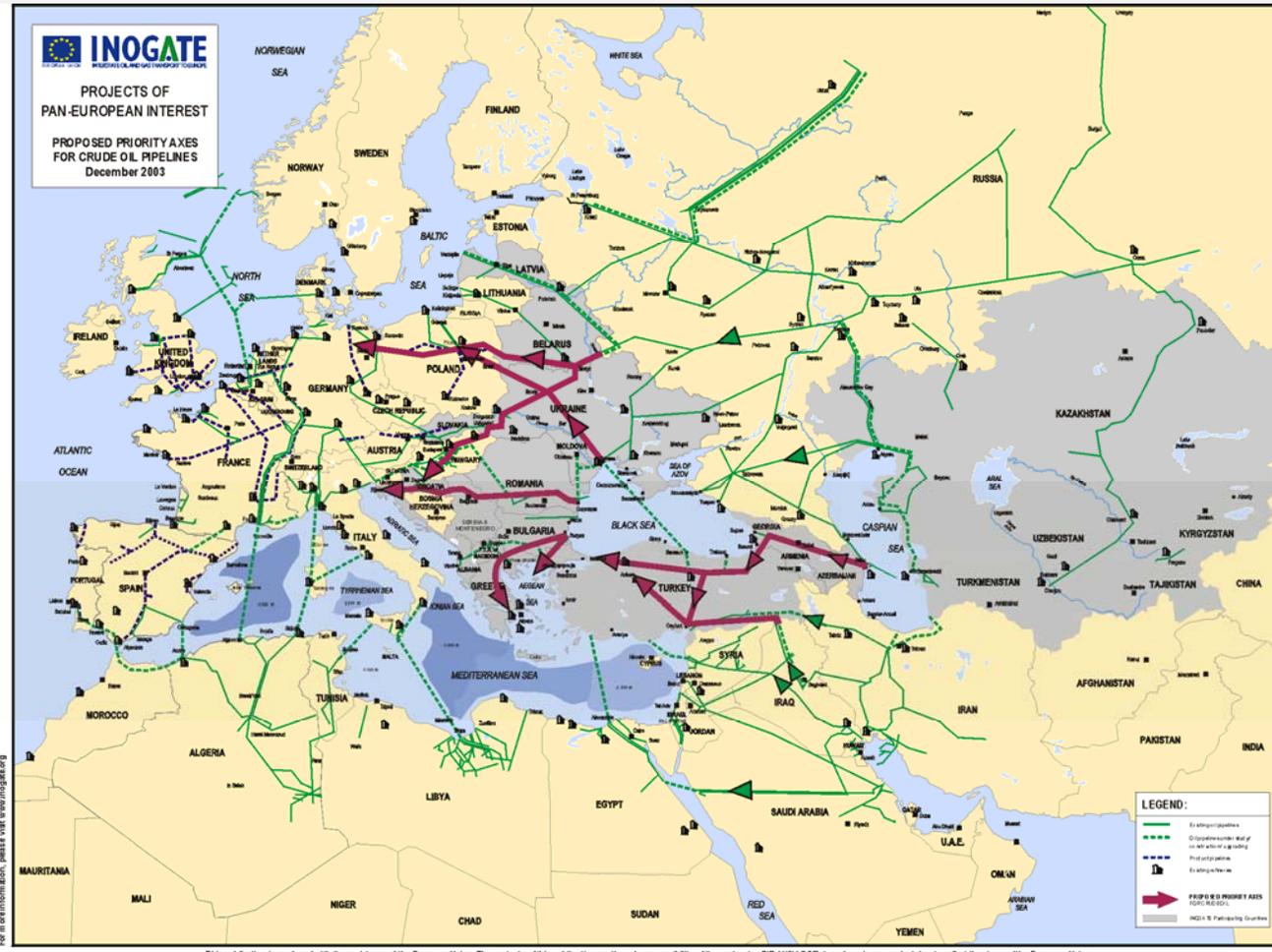
- Democracy
- Open market economy
- Political stability
- Economical stability
- Military actions are the facts of daily life
- Not secure investment zones (most cases)
- Monopoly
- International companies & international rules are leaving their space to national companies & local rules.



Current Transportation/Distribution Routes/Lines



Current Transportation/Distribution Routes/Lines





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Energy Security Risks

Technological Barriers

	Near-Term	Mid-Term	Long-Term
<u>Goal #1</u> Energy End-Use & Infrastructure	<ul style="list-style-type: none"> • Hybrid & Plug-In Hybrid Electric Vehicles • Engineered Urban Designs • High-Performance Integrated Homes • High Efficiency Appliances • High Efficiency Boilers & Combustion Systems • High-Temperature Superconductivity Demonstrations 	<ul style="list-style-type: none"> • Fuel Cell Vehicles and H₂ Fuels • Low Emission Aircraft • Solid-State Lighting • Ultra-Efficient HVACR • “Smart” Buildings • Transformational Technologies for Energy-Intensive Industries • Energy Storage for Load Leveling 	<ul style="list-style-type: none"> • Widespread Use of Engineered Urban Designs & Regional Planning • Energy Managed Communities • Integration of Industrial Heat, Power, Process, and Techniques • Superconducting Transmission and Equipment
<u>Goal #2</u> Energy Supply	<ul style="list-style-type: none"> • IGCC Commercialization • Stationary H₂ Fuel Cells • Cost-Competitive Solar PV • Demonstrations of Cellulosic Ethanol • Distributed Electric Generation 	<ul style="list-style-type: none"> • FutureGen Scale-Up • H₂ Co-Production from Coal/Biomass • Low Wind Speed Turbines • Advanced Biorefineries • Community-Scale Solar • Gen IV Nuclear Plants • Fusion Pilot Plant Demonstration 	<ul style="list-style-type: none"> • Zero-Emission Fossil Energy • H₂ & Electric Economy • Widespread Renewable Energy • Bio-Inspired Energy & Fuels • Widespread Nuclear Power • Fusion Power Plants
<u>Goal #3</u> Capture, Storage & Sequestration	<ul style="list-style-type: none"> • Advanced Fission Reactor and Fuel Cycle Technology • CSLF & CSR • Post Combustion Capture • Oxy-Fuel Combustion • Enhanced Hydrocarbon Recovery 	<ul style="list-style-type: none"> • Geologic Storage Proven Safe • CO₂ Transport Infrastructure • Soils Uptake & Land Use • Ocean CO₂ Biological Impacts Addressed 	<ul style="list-style-type: none"> • Track Record of Successful CO₂ Storage Experience • Large-Scale Sequestration • Carbon & CO₂ Based Products & Materials • Safe Long-Term Ocean Storage
<u>Goal #4</u>	<ul style="list-style-type: none"> • Geologic Reservoir Characterization 		<ul style="list-style-type: none"> • Integrated Waste Management

Economical Barriers

- **Oil and gas industry investments: 340 billion USD (2005)**
- **Refinery investment: 51 billion USD (2005)**
- **LNG investment: 73 billion USD until 2010.**
- **Nuclear investments, Power Plant Investments, Pipeline/tanker investments, old infrastruce replacements, energy import bills, renewable investments, environmental taxes, increase in the price of oil/gas, etc...**
- **Still, the world will cope with the energy poverty and for a massive number of people, commercial energy will not be accessible.**

The following measures can all make positive contributions to energy security in many circumstances

- Demand reduction: Energy conservation / Energy efficiency
- New technologies
- Cleaner production (clean coal, etc.), more nuclear
- Diversifying supply
- Open and competitive energy markets
- Increasing domestic supply capacity using local energy sources to meet future energy demand growth

- Energy security is becoming the most important security related issues.
- It has technical, economical, social, environmental, as well as military related aspects.
- The problem is getting worse, international co-operation/collaboration is a must.
- There is no unique, single solution. For short term; oil/gas investments, medium term; new generation nuclear and clean coal, long-term; renewable seem to meet the world's energy needs.



**THANK YOU
FOR YOUR KIND ATTENTION**