

Energy Challenges in the 21st Century

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Facing a New Era of

„Unprecedented Uncertainty“

Fatih Birol, Chief Economist of IEA (09/2010)

Four Critical Factors of Uncertainties:

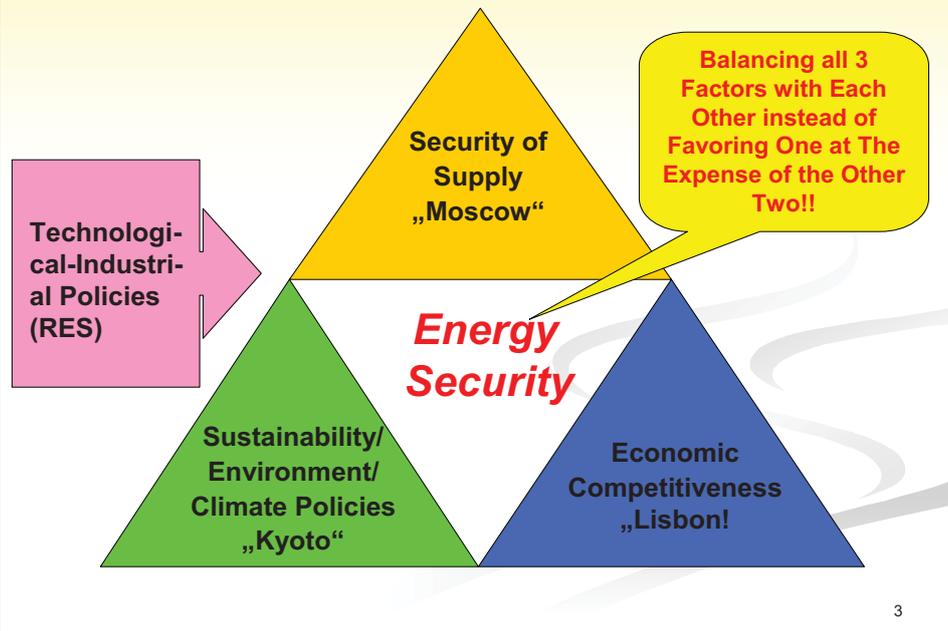
1. Major uncertainties over economic recovery, unconventional gas revolution (i.e. outside U.S.) and climate mitigation policies;
2. Growing insensitivity of oil demand and supply to changes in price;
3. China's increasingly huge impact on global energy dynamics;
4. Changing role of public energy policy in confronting those challenges.

5.+ Increasing geopolitical risks and

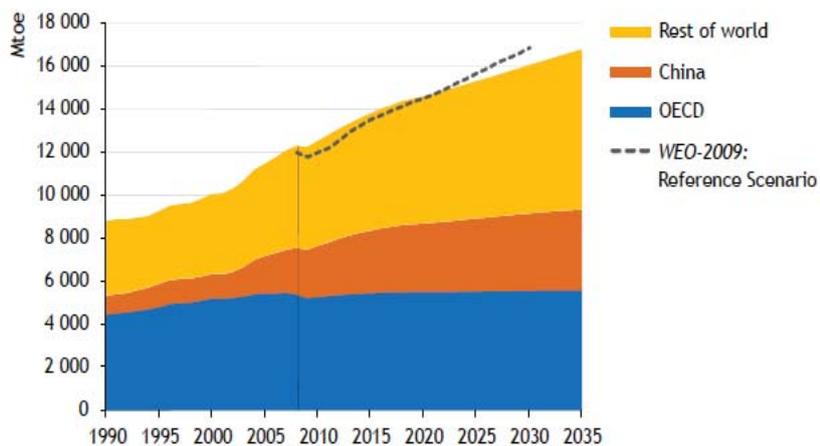
6.+ Rising threats to energy infrastructure security.

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Energy Triade – Objectives of Energy Security



World primary energy demand by region in the New Policies Scenario



Global energy use grows by 36%, with non-OECD countries – led by China, where demand surges by 75% – accounting for almost all of the increase

Geopolitical Risk Factors I

■ Future Concentration of Oil and Gas Resources in Fewer Countries and Unstable Regions:

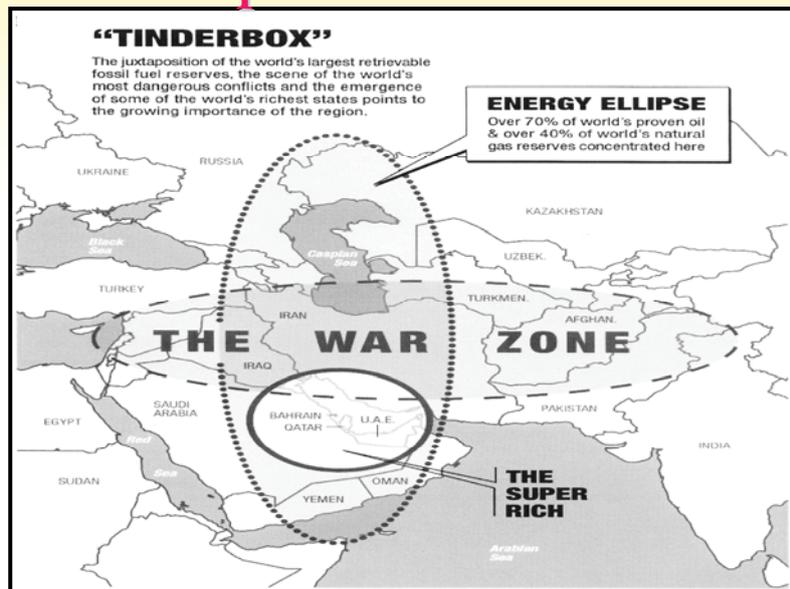
- **Producers:** 11 OPEC-members and Russia with only 6.5% of the world's nominal GDP control more than 80% of the total global proven oil and gas reserves;
- **Consumers:** OECD, China and India: producing more than $\frac{3}{4}$ of the global GDP, but control only about 10% of the total proven oil and gas reserves;

■ Impacts and Implications

- Global “values conflict” fuelled by “energy inequality”.
- Resource nationalism leads to counter-protectionism and insufficient global investments in time;

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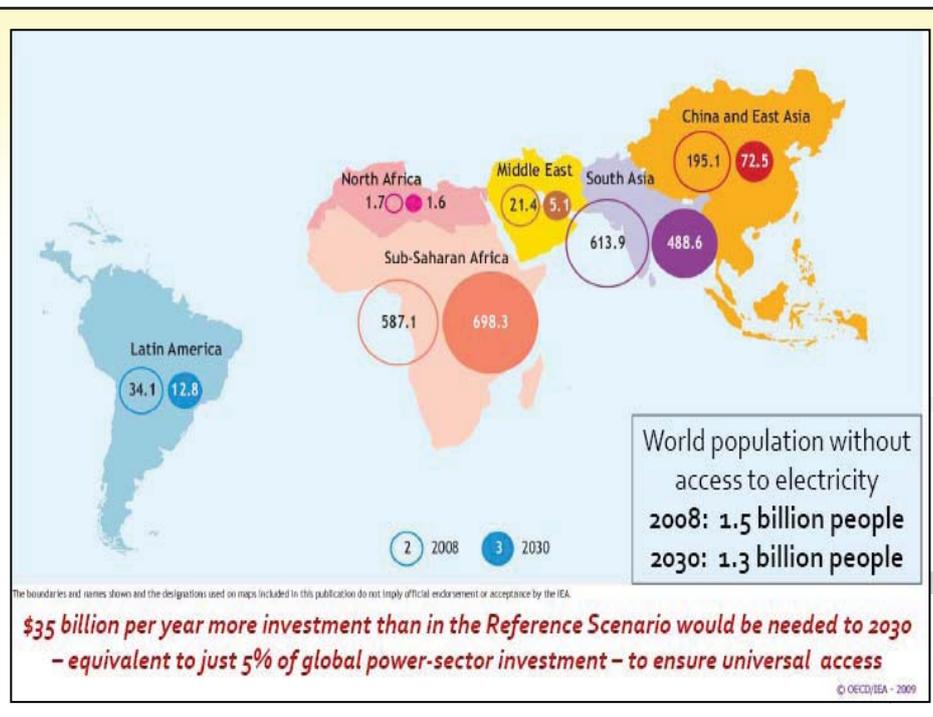
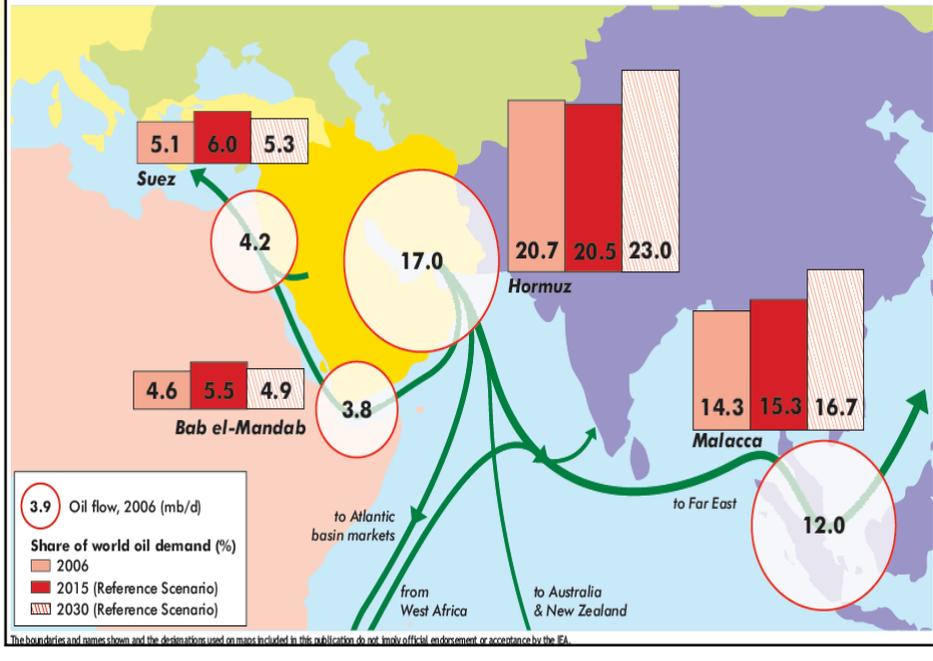
Geopolitical Factors I



Source: J.Kemp (Nixon-Center)

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Figure 3.11 • Oil export flows from the Middle East



“Climate Change and International Security”

(High Representative and the European Commission to the European Council of March) 14, 2008

- **Seven Sources of Threats of Climate Change to Worldwide Peace and Security:**
 - Conflict over depleting resources such as arable land, water, food and fish stocks;
 - Economic damage and risk to coastal cities and critical infrastructure (20% of global GDP per year);
 - Loss of territory and borders;
 - Environmentally-induced migration, which the UN has predict to be millions by 2020;
 - Situations of fragility and radicalisation, particularly in weak and failing states by overstressing the already limited capacity of governments.
 - Tensions over energy supply arising from intensified competition over access to, and control over, energy resources;
 - Pressure on international governance.
- **But: Climate Protection Policies Constrain Energy Security & Supply Options and Strategies in Mid-Term Future!**

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Critical Energy Infrastructure Protection (CEIP) I

- **Changing Conditions Since 2001: Increase of Security Threats to CEIP:**
 - **Attacks by:**
 - terrorist groups;
 - (transnational) crime organizations and groups;
 - Private hackers;
 - Natural disasters.
 - **New Forms:**
 - Physical (attacking tankers, pipelines, refineries, electricity systems etc.);
 - **Cyber Threats as the Fifth Domain of Warfare:**
 - stealth, anonymity, unpredictability and lack of legal authority in the international law make the attacker stronger than the defender.
 - Internet has blurred the lines between military and civilian strategies and targets.

Increasing Worldwide

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Critical Energy Infrastructure Protection (CEIP) II

■ Cyber Threats:

- Attacks have risen in numbers and to an unprecedented level of sophistication;
- **Asymmetric Threat:** attacker have advantages by being better armed, can freely choosing the intensity of the attack as well as the target, no longer constraint by any geographical distances and frontiers as well as enjoying stealth, anonymity and inability to identify them;
- **Stuxnet-Virus 08/10:** specifically designed virus against industrial energy infrastructures and destroying/manipulating SCADA systems;
- **Botnet Threat “Conficker”:**
 - infected 1.5 million computers, able to function autonomously by recruiting and commanding 5 million computers in 122 countries;
 - Fear: coordinated simultaneous attacks on the economic system, critical national infrastructures, and the national defence structure of a country – all of them very interdependent of each other.
- **Even protected *Infranets* of companies and ministries are not immune to cyberattacks as Pentagon officials admitted.**

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Conclusions and Perspectives

- World Becoming More than ever Dependent on Fewer Producer Countries, which at the same time are More Unstable
- Interlinkages of the Energy Supply Security-Climate Change Nexus with worldwide implications;
- **Renationalisation of Energy Sectors Leading to:**
 - Insufficient Investment;
 - Petro-Authoritarian impacts on their domestic policies and more aggressive/confrontational FP/SP;
- Globally/ASIA: More efforts need to be taken for mitigating GHGE-missions and mobilising investments for RES.
- Electricity Supply Security Will Become Top Concern.
- **Need for developing new energy security concepts (i.e. „networked energy security“).**

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