World & National Energy Issues - Quick Overview

- World Energy Supply & Demand - Total & Regional

- Total world energy consumption expected to increase **57%** by 2025 - **40%** in US.
- China’s economic growth is expected to be the highest in the world and have the world’s largest economy.
The Environmental Impact Factor

\[ I = P \times C \times TF \]

Environmental Impact, \( I = \)

Population, \( P \times \)

Consumption, \( C \times \)

Technology & Fuel, \( TF \)
The Environmental Impact Factor

- **Coal** - abundant resource, but potentially huge environmental consequences.
  - Coal is the most abundant fuel – also most carbon intensive!

- **Petroleum** - only viable liquid fuel, but potential resource problems and a contributor to GHG emissions.

- **Nuclear** - waste disposal problems (?), potential proliferation aspects, but no real unsolvable environmental problems.

- **Renewables** - diffuse, intermittent, costly (?), but sustainable and “environmentally-friendly” and a means for climate change management.

Clean energy, but somewhat intermittent delivery.

---

Figure 2. Annual Production Scenarios with 2 Percent Growth Rates and Different Resource Levels (Decline R/P=10)

- **USGS Estimates of Ultimate Recovery**
  - Probability
    - Low (95 %) 2.248
    - Mean (expected value) 3.003
    - High (5 %) 3.896
  - Ultimate Recovery BBls

- **2 % Growth**
  - Decline R/P = 10

- **Source**: Energy Information Administration
- **Note**: U.S. volumes were added to the USGS foreign volumes to obtain world totals.
Improve total system efficiency with respect to all energy resources

Consider the “Total Picture”

- Resource Allocation (fossil fuels and renewables)
- Efficient Energy Use (efficiency and conservation)
- Effect on Environment (air, soil, and water quality)
- Development and Implementation of Alternative Energy Sources and Technologies
- Economics (true cost and life-cycle accounting)
Where Energy Comes From
Overview

The Challenge

- Energy Today - 214 MMBOE/D
  - US 45.6 MMBOE/Day
- Energy 2025 - 300 MMBOE/D
  - US 60.2 MMBOE/Day
- Energy – Basis for Civilization
- The Resource Is Adequate

China Oil Consumption is forecasted to increase 15% in 2004

OECD Oil Consumption is forecasted to increase 1% in 2004
Humanity’s Top Ten Problems
Next 50 Years


1. ENERGY
2. WATER
3. FOOD
4. ENVIRONMENT
5. POVERTY
6. TERRORISM & WAR
7. DISEASE
8. EDUCATION
9. DEMOCRACY
10. POPULATION

2003 6.3 Billion People
2050 8-10 Billion People
World Energy

GDP vs. Energy Consumption

GDP per capita (million Int. $ at PPP)

Energy Consumption (thousand metric toe per capita)
## The Need for Action

<table>
<thead>
<tr>
<th>Energy Today – 214 MMBOE/Day</th>
<th>Energy 2025 – 300 MMBOE/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>• US 45.6 Million BOE/Day</td>
<td>• US 64.3 MMBOE/Day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Growth 18.29 Million BOE/Day</th>
<th>Portfolio of Energy Options</th>
<th>Need for Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Over the next 25 years</td>
<td>• Technically Sound</td>
<td>• Technology</td>
</tr>
<tr>
<td></td>
<td>• Economically Sustainable</td>
<td>• Education</td>
</tr>
<tr>
<td></td>
<td>• Significant in Size</td>
<td>• People</td>
</tr>
<tr>
<td></td>
<td>• Minimize Environmental Impact</td>
<td></td>
</tr>
</tbody>
</table>

Today, 1.6 billion people – one quarter of the world population have no access to electricity.

In 2030, 1.4 billion people 17% of the world population will still not have electricity.

2.4 billion people rely on traditional biomass – wood, agricultural residues and dung – for cooking and heating.