Global Energy Assessment
Toward a Sustainable Future

Nebojsa Nakicenovic
Director

www.GlobalEnergyAssessment.org
From 7 bn people, 3 bn cook with solid fuels and 1.5 bn lack access to electricity

Efficiency and decarbonization bring multiple benefits for health, security, climate change

Financing requirements are huge, but achievable with right and sustained policies
Final energy access (non-commercial share) in relation to population density

Source: Pachauri et al, 2012
Lessons: successful outcomes more likely when electrification integrated with wider developmental and poverty alleviation efforts as:

- Universal access achieved faster
- Financial sustainability of utilities better
- Overall welfare enhancement greater

Source: Pachauri et al, 2012
Gas Hydrates
～100,000 GtCO₂

Historical Emissions
～1900 GtCO₂

Preindustrial Atmosphere
～2000 GtCO₂

Present Atmosphere
～3060 GtCO₂

Cumulative Emissions for 2°C Stabilization

Gas Hydrates
～100,000 GtCO₂

Historical Emissions
～1900 GtCO₂

Preindustrial Atmosphere
～2000 GtCO₂

Present Atmosphere
～3060 GtCO₂

Coal
～30,000 GtCO₂

Unconventional Gas
～4,550 GtCO₂

N. Gas
～340–500 GtCO₂

Oil
～660–1,000 GtCO₂

Unconv. Oil
～1,100–1,500 GtCO₂

Biomass
～1,600–1,650 GtCO₂

~2450 GtCO₂

~850 GtCO₂
Europe Population vs. Energy Demand Density

WEU: 21% of demand below renewable density threshold

EEU: 34% of demand below renewable density threshold
Potential Synergies between New Energy and Transport Infrastructures: Asian “Supergrid”

Source: Y. Yamagata, NIES. 2010
Global Primary Energy

no CCS, no Nuclear

Energy savings (efficiency, conservation, and behavior)
~40% improvement by 2030

~35% renewables by 2030

Nuclear phase-out (choice)
Oil phase-out (necessary)

Source: Riahi et al, 2012
Energy savings (efficiency, conservation, and behavior)
~40% improvement by 2030
~35% renewables by 2030
Limited Intermittent REN
Oil phase-out (necessary)
Limited Bioenergy
Bio-CCS – “negative CO₂
Nat-gas-CCS
Coal-CCS
Renewable
Nuclear
Gas
Oil
Coal
Biomass

Source: Riahi et al, 2012
~30% renewables by 2030

Source: Riahi et al, 2012
Supply Technologies Cost Trends

Source: Grubler et al., 2012
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
<td>2010</td>
<td>2010</td>
<td>2010 - 2030</td>
</tr>
<tr>
<td>Efficiency</td>
<td>&gt;&gt; 8</td>
<td>~ 5</td>
<td>300</td>
<td>~400</td>
</tr>
<tr>
<td>Renewables</td>
<td>&gt; 12</td>
<td>~ 20</td>
<td>200</td>
<td>~400</td>
</tr>
<tr>
<td>Access</td>
<td>&lt; 1</td>
<td>&lt; 1</td>
<td>~ 9</td>
<td>~40</td>
</tr>
<tr>
<td>Total</td>
<td>&gt; 50</td>
<td>&lt; 150</td>
<td>1250</td>
<td>~1750</td>
</tr>
</tbody>
</table>

Source: Grubler et al & Riahi et al, 2012
Added costs of ES and PH are comparatively low when CC is taken as an entry point.

Source: McCollum, Krey, Riahi, 2012