Climate Impacts on Energy Systems

Jane Ebinger, ESMAP

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Energy...Rising Demand

Without action tripling of GHG emissions by 2050

Source: World Bank, Infrastructure Brief
...Changing Development Pathway

The full portfolio of existing measures and advanced technologies, not a silver bullet, will be needed to get the world onto a 2°C path.

Sources: WDR team with data from IIASA 2009.
Changing Climate Parameters

- Increasing temperatures over land & more variability in some areas (e.g. W Africa)
- Increased risk of heat waves
- Rising sea levels
- Permafrost degradation
- Changing precipitation patterns – more intense rainfall, longer periods of drought
- Variations in peak solar production (e.g. decrease E Africa)
- Decreasing mean mid-latitude wind speeds
- Possible increasing storm intensities
In 2005 alone climate extremes accounted for a 13% variation in energy productivity in developing countries (WDR, 2009)

ENERGY SERVICES WILL BE INCREASINGLY AFFECTED
Year-to-Year Variability in Hydropower Output (1990-2006)

Hydroelectricity as a Share of Electricity Production

Variability in Output/Capacity

- Least Developed Countries
- Other Low Income Countries
- Lower Middle Income
- Upper Middle Income
- High Income
Significant Hydropower Development Expected

Source: O Dione, World Bank
But …Hydropower Generation May Benefit or Suffer (or both) by 2050

...heating will reduce but cooling demand will rise

- Inter-annual variability and cold periods will remain
- Seasonal demand profiles will shift for buildings, infrastructure, agriculture
- Temperature tolerance of infrastructure will be tested
... and other wide ranging impacts

<table>
<thead>
<tr>
<th>ENERGY IMPACT</th>
<th>CLIMATE CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable energy resources</td>
<td>Changes in runoff, wind, crop response, ocean climate, atmospheric transmissivity</td>
</tr>
<tr>
<td>Energy supply</td>
<td>Hydro – water availability and seasonality</td>
</tr>
<tr>
<td></td>
<td>Wind – variable wind regime</td>
</tr>
<tr>
<td></td>
<td>Bio-fuels – reduced transformation efficiency</td>
</tr>
<tr>
<td></td>
<td>Solar – reduced solar cell efficiency</td>
</tr>
<tr>
<td></td>
<td>Thermal - Generation efficiency and cooling water availability</td>
</tr>
<tr>
<td></td>
<td>Oil &amp; Gas – extreme events</td>
</tr>
<tr>
<td>Transport/ Transmission &amp; Distribution</td>
<td>Extreme event frequency, sea level rise</td>
</tr>
<tr>
<td>Design, Operations &amp; Maintenance</td>
<td>Location – sea level rise, extreme events</td>
</tr>
<tr>
<td></td>
<td>Downtime/ trade – extreme events</td>
</tr>
<tr>
<td>Demand</td>
<td>Temperature rise, inter-annual variations</td>
</tr>
<tr>
<td>Cross sector</td>
<td>Water resource management/ competition &amp; locations</td>
</tr>
</tbody>
</table>
“Guarantee the supply of energy, and balance production and consumption throughout time and space” – an ongoing process

ADAPTATION IS NOT AN OPTIONAL ADD ON
Prevent Effects or Reduce Risks

- Technological responses
  - Physical protection (e.g. targeted refurbishing)
  - Design standards (e.g. pipelines in discontinuous permafrost zones)

- Behavioral responses
  - Reconsider location (e.g. coastal infrastructure)
  - Anticipate arrival (e.g. better forecasting, contingency plans)
  - Change O&M (e.g. adapt to river flow patterns)
Share Responsibilities… Exploit Opportunities

- Financial instruments (e.g. weather derivatives, insurance)
- Diversify the energy system
- Energy/ water saving and demand side management
- Decentralized energy structures
- Urban policy & land use planning
INTEGRATED RISK BASED PLANNING WILL BE CRITICAL
“Responding to climate involves an **iterative risk management process** that includes both mitigation and adaptation, taking account of actual and avoided climate change damages, co-benefits, sustainability, equity and attitudes to risk” (IPCC 2007)
Integrated Planning is Highly Important

- Integrate plans
  - Within the sector
  - Between sectors (e.g. water/energy/agriculture)
  - Across stakeholders (e.g. national/local, public/private etc)
  - Mitigation and adaptation (e.g. RE)
“The formal knowledge base is still at an early stage of development” (Willbanks et al., 2007)

AWARENESS, KNOWLEDGE AND CAPACITY ISSUES
Weather & Climate Services
...gaps in capacity

- Many services below WMO standards
- Historic records lacking or inaccessible
- Lack local skills and capacity for climate modeling
- Lack of tailored information and dialogue (cross sector)

BLUE: stations for which more than 90 percent of the reports were received
GREEN: stations for which 45 to 90 percent of the reports were received
ORANGE: stations for which less than 45 percent of the reports were received
RED: silent stations
Near-term Actions

- **Climate Information**
  - Nature and timing of climate change
  - How climate parameters affect energy systems
  - Assessment of climate information needs for energy
  - Tailored and timely flow of climate information to the energy sector

- **Decision Making**
  - Practical tools and guidance for CRM
  - Emerging adaptation practices and new standards
  - Expanded knowledge base (e.g. water/energy, mitigation/adaptation interactions, research on technologies/modeling, economic assessment)

- **Implementation**
  - Policy instruments to support action
  - Awareness and exchange knowledge
  - Capacity building
Thank You!

For more information:

Jane Ebinger
jebinger@worldbank.org
www.esmap.org

Study completed with representatives from: Basque Climate Change Center, ClimDevAfrica, CSIRO Australia, Danish Meteorological Institute, ESMAP, Federal University of Rio de Janeiro, Oxford University, UNEP Risoe, World Bank