Joint ICTP-IAEA Workshop on Vulnerability of Energy Systems to Climate Change and Extreme Events

19 - 23 April 2010

Weather Extremes and Energy Systems: Workshop Introduction and Overview

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IAEA

Vienna

Austria
Weather Extremes and Energy Systems: Workshop Introduction and Overview

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Overview

1. IAEA Mandate and Work
2. CC: Vulnerability, Impacts, Adaptation VIA
3. CC - Weather Extremes - Energy Systems
1. IAEA Mandate and Work

"Atoms for Peace" to promote safe, secure and peaceful nuclear technologies:

- Safety and Security: Nuclear installations
- Safeguards and Verification: NPT
- Science and Technology - peaceful applications of nuclear science and technology: Health, agriculture, water, ...
- Nuclear Energy: Efficient and Safe Use of Nuclear Power → Planning and Economic Studies
1. IAEA Work in Energy Planning

IAEA Mandate:
- develop energy planning tools
- build capacity for applications
- training and technical support

For:
- Energy system modeling
- Economic, financial and environmental assessments
- Analysis of options for energy strategies
1. IAEA Work in Energy Planning

- Transfer planning models tailored to developing countries
- Transfer data on technologies, resources and economics
- Train local experts
- Jointly analyze national options
- Help establish continuing local expertise
1. IAEA Work in Energy Planning

- Model for the Analysis of Energy Demand
- Model for Energy Supply System Alternatives and their General Environmental impacts
- Financial Analysis of Electric Sector Expansion Plans
- Simplified Approach for Estimating Impacts of Electricity Generation
1. IAEA Work: Economic Studies

Exploring issues of broad interest:
- Climate change and nuclear power
- Nuclear energy and sustainable development
- Energy security

Developing tools:
- Energy Indicators for Sustainable Development EISD
1. IAEA Work: Economic Studies - EISD

- Prepared by 5 agencies*
- 3 Dimensions of SD (economic, social, environment)
- 30 Indicators
- Guidelines, caveats, methodology (data, construction)
- Important now is how to use the EISD

*UNDESA, IEA/OECD, IAEA, EUROSTAT, EEA

A UN-ENERGY Demonstration Study

conducted by

- Department of Economic and Social Affairs (DESA)
- Food and Agriculture Organization (FAO)
- International Atomic Energy Agency (IAEA)
- United Nations Environment Programme (UNEP)
- United Nations Industrial Development Organization (UNIDO)

with assistance from the Ghana Energy Commission
Assessing Policy Options for Increasing the Use of Renewable Energy for Sustainable Development: Modelling Energy Scenarios for Sichuan, China
1. Summary IAEA

IAEA: not only
- atomic: SED, 3E analysis, national energy planning – full set of resources and technologies
- energy: nuclear applications in many areas – medicine, agriculture, water mgmt, …

Capacity building: energy planning, 3E analysis – models, methods, indicators, data + training

UN Energy: joint projects; case studies: thematic (energy efficiency w/ UNIDO), national (Ghana):
  to demonstrate SED concepts, applicability, implementation
2. CC: Vulnerability, Impacts, Adaptation VIA

**Adaptation**: *Adjustment* in natural or human systems in response to actual or expected *climatic stimuli* or their *effects*, which *moderates* harm or *exploits* beneficial opportunities (TAR)

**WG II Ch 17**: explored adaptation in the context of vulnerability and adaptive capacity

**Vulnerability – adaptive capacity** to CC:
- V: propensity of human and ecological systems to suffer harm
- AC: ability to respond to stresses imposed as a result of climate change effects
Vulnerability of a society to climate change is influenced by:

- development
- physical exposures
- distribution of resources
- non-climate stresses
- social and government institutions

V determined by a combination of exposure and response capacity
Adaptation to climate variability + change

Adaptation to [current] climate change is already taking place, but on a limited basis

- long history of adaptation to prevailing climate and variability: crop diversification, flood control, irrigation, air conditioning

- newly emerging risks: droughts, heatwaves, hurricanes
Adaptation measures:

Adaptation \textit{considering} [future] climate \textit{change} are being implemented, on a limited basis

- increase water buffer capacity (Tsho Rolpa lake in Nepal: 0.23 km$^2$ 1957 to 1.65 km$^2$ 1997
- snow-making (Alpine ski industry)
- infrastructure (transport, coastal defence)

== Confederation Bridge (Canada): 13 km mainland to Prince Edward Island; ocean-going vessels 50m clearance $\rightarrow$ built 1m higher

Key: long-lived infrastructure
Adaptation in a broader context:

Adaptation measures are seldom undertaken in response to climate change *alone*.

- Response to *current extreme* events (heatwaves, cyclones).
- Broader *sectoral policies* (water, coastal areas: NL: next 20-30 years major renewal; or - development → upgrade to higher protection: Malaysia).
- Many *other* things change: incomes, lifestyles, preferences, technologies → producers adjust.
Adaptation costs:

Many adaptations can be implemented at low cost, but comprehensive estimates of adaptation costs and benefits are currently lacking.

CCIA: from 2*CO2 to more sophisticated increasing use of scenarios (exposure Us) monetary damage estimates fewer costing A options or C/BA even less

So far: mainly in OECD regional/project level for SLR, Ag, energy, water, infrastructure:

Many low-cost measures, high NPV, no-regret A
Adaptive capacity:

Adaptive capacity is *uneven* across and within societies – *Determinants* (recall vulnerability):

- economic resources (no malaria >3K$ GDP/c)
- natural resources
- human resources
- institutions (prop.rights, legal, market)

== also determinants and results of development

So: improve these factors →

develop = will reduce vulnerability to CC

AND: remedy equity issues in I-V-A
Limits to adaptation:
There are substantial limits and barriers to adaptation
- when factors of adaptive capacity obstructed:
  eg: water scarcity – market – ancient w rights
Key: information: adapt to what, how, when

Devg countries: Adapt cap low; impacts severe
+ barriers ➔ need special assistance:
NAPAs: Nat. Adapt. Programmes of Action
Examples – Adaptation initiatives, activities

Sudan – Drought:
Expanded use of traditional rainwater harvesting and water conserving techniques;
building of shelter-belts and wind-breaks to improve resilience of rangelands;
monitoring of the number of grazing animals and cut trees;
set-up of revolving credit funds
Examples – Adaptation initiatives, activities

Botswana – Drought:
National government programmes to re-create employment options after drought;
capacity building of local authorities;
assistance to small subsistence farmers to increase crop production
2. Summary: CC – VIA

- *Adaptation* to weather/climate: human history
- Anthropogenic CC: useable old knowledge but also new challenges: magnitudes, rates
- *Options*: many known but room for innovation (technology, institutions, social organization)
- *Private* adaptation: market sectors, own interest, profit max, private CBA - but public policies affect e.g. Agriculture: national; EU CAP’13); Trade (Doha)
- *Public* adaptation: public/club goods; social CBA, Cost-effectiveness (standards, targets)

*Planning A*: consider previous policies/evolving trends
Vulnerability of Energy Systems to Climate Change and Extreme Events

Motivations

- CC → possible increases in frequency and intensity of extreme weather events
- Energy systems: vulnerable under current climate regime and weather patterns; effort to reduce vulnerability
- IEA: USD 26 trillion investments to provide demand; 10.5 trillion extra to reduce GHG emissions
- IAEA: account for WEs in energy planning
### 3. CC - Weather Extremes - Energy Systems

<table>
<thead>
<tr>
<th>Phenomenon(^a) and direction of trend</th>
<th>Likelihood that trend occurred in late 20th century (typically post 1960)</th>
<th>Likelihood of a human contribution to observed trend(^b)</th>
<th>Likelihood of future trends based on projections for 21st century using SRES scenarios</th>
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<tbody>
<tr>
<td>Warmer and fewer cold days and nights over most land areas</td>
<td>Very likely(^c)</td>
<td>Likely(^d)</td>
<td>Virtually certain(^d)</td>
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<tr>
<td>Warmer and more frequent hot days and nights over most land areas</td>
<td>Very likely(^c)</td>
<td>Likely (nights)(^d)</td>
<td>Virtually certain(^d)</td>
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<tr>
<td>Warm spells/heat waves. Frequency increases over most land areas</td>
<td>Likely</td>
<td>More likely than not(^f)</td>
<td>Very likely</td>
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<tr>
<td>Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas</td>
<td>Likely</td>
<td>More likely than not(^f)</td>
<td>Very likely</td>
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<td>Area affected by droughts increases</td>
<td>Likely in many regions since 1970s</td>
<td>More likely than not</td>
<td>Likely</td>
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<td>Intense tropical cyclone activity increases</td>
<td>Likely in some regions since 1970</td>
<td>More likely than not(^f)</td>
<td>Likely</td>
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<td>Increased incidence of extreme high sea level (excludes tsunamis)(^g)</td>
<td>Likely</td>
<td>More likely than not(^f)</td>
<td>Likely</td>
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<tr>
<th>Sector/Extreme</th>
<th>Temperature</th>
<th>Precipitation</th>
<th>Wind</th>
<th>Tropical cyclones</th>
<th>Floods</th>
<th>Droughts</th>
<th>Coastal storms</th>
<th>Forest + wild fire</th>
<th>Landslides</th>
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3. CC - Weather Extremes - Energy Systems

Workshop - commissioned keynotes:
Climate science: CC change ➔ extreme events: columns
Energy systems: from coal to grid:
   one per row ➔ relevant cells: possible impacts;
   options to adapt / reduce vulnerability
Assessment and integration:
   risk assessment tools
   energy planning tools
3. CC - Weather Extremes - Energy Systems

Workshop – volunteered contributions:

Specific energy technologies:
  in general or in a region/country

National/regional case studies:
  vulnerability of the energy system: present and future
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Workshop – other presentations:

ICTP overview

ICTP keynote: Prof Marsili
3. CC - Weather Extremes - Energy Systems

Post-workshop activities:
- Select papers for inclusion in publication
- Revise selected papers for peer-review
- Post-review revisions
- Editing, copy-editing
- Submission to publisher
...atoms for peace.