

## WEATHER/CLIMATE RISK MANAGEMENT FOR THE ENERGY SECTOR: WORKSHOP RECOMMENDATIONS

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**Abstract.** Three working groups (WGs) were formed to address the five objectives of the Workshop. These objectives were: (A) To identify vulnerabilities of energy sector to extreme weather events in the context of climate change adaptation; (B) To identify impediments to the use of weather/climate information for the energy sector in the context of climate change adaptation; (C) To suggest ways to improve and/or facilitate the transfer of knowledge between weather/climate scientists and the energy experts to allow an optimal use of climate risk management; (D) To outline proposals to improve the way in which weather/climate information is used for modelling demand and to provide warnings for potential disruptions on energy operations and infrastructure; (E) To discuss possible contributions of the weather/climate scientists and the energy experts to climate change adaptation policies for energy security. All three WGs addressed the first two objectives in their early phases of discussion and then each of them went into greater detail in discussing C (WG1), D (WG2), E (WG3). Thus objectives C, D and E are the distinguishing attributes of the three WGs. The main recommendations of each WG are presented in this chapter. See also Troccoli et al. (2009).

**Keywords:** Weather; climate; energy; risk management; adaptation; policy

### 1. Recommendations from Working Group 1

WG1 concluded that it is important that the information needs of the Energy Sector be identified and communicated by the energy sector itself. Meteorology and climate offices can provide critical and valuable information, but it needs to be recognized as such by industry before industry will take

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advantage of it. There is therefore a need to develop a relationship of service provider and client. To achieve this, the development of energy advocacy groups that can communicate, on behalf of the industry, the weather and climate data and information needs to the met/climate research community is recommended.

Once the appropriate group is identified and formed, it is suggested that a conference or other forum to engage the energy industry are organized in order to elicit from them their interests and needs for climate and weather data. It is also recommended that a session on weather and climate information at a regularly scheduled energy sector meeting, such as “Sparks and Flames” be held.

Wider capacity building for the group or its members could be assisted by other activities such as awareness raising through concise summaries of this workshop to industry newsletters and popular science press. Target newsletters include: newsletters of World Bank, regional development banks, donor agencies, and industry newsletters (US Energy Association, World Energy Forum (<http://www.worldenergyforum.com>)). Popular press includes: Wired Magazine, Popular Science, Discover Magazine. In addition to these news articles, the development and dissemination of a “Climate and weather best practices” survey is recommended. The aim of the survey would be to identify examples of cases where the industry has used climate and weather information to improve the bottom line. Once best practices are identified through the survey, they should be analyzed for opportunities to propagate such practices in other places. It was noted that this process will require some seed funding for the website maintenance, organization of the survey, and preparation of sessions for the meeting.

## **2. Recommendations from Working Group 2**

The group recognized that there are different requirements for modeling and meeting demand for energy by the energy sector. Modelling demand requires information about temperature, precipitation and other variables that are already represented in weather and seasonal prediction, although greater efficiencies will be obtained as the medium and longer term predictions improve. There are more demanding and different requirements of weather data by the energy sector to allow it to meet the demands for energy efficiently. These are only partly met by the current delivery of weather information to the energy sector. The requirements of the renewable energy sector are particularly different; this sector is very likely to become more important in the future with demands for national energy independence and for reduced carbon emissions. Different data are required for routine efficient operation and for emergencies. Emergencies can be weather-induced,

for which accurate predictions are required. Emergencies can also be caused by other operational exigencies, and can require fast access to environmental information to predict and manage the spread of possible pollution, and to predict even the behaviour of possible pollution. In light of this discussion, specific recommendations address:

#### 2.1. NEED FOR OBSERVATIONS

The needs of the energy sector for observations are varied. There is a need to continue the observations to assimilate into weather forecast models, to supplement them for high-resolution models and to verify them for the energy sector. Observing System Simulation Experiments (OSSEs) need to be performed to verify that the observing system is fit-for-purpose for the requirements of the energy sector and to allow the error estimates and biases to be made on the predictions. This requirement is particularly important in areas where the energy sector is operating where there are few observations, such as in some developing countries or in circum-polar regions.

#### 2.2. CONSISTENCY OF DATA

For use in modelling energy demand and energy production models it is crucial that predicted data and historical data (analyses, re-analyses) are consistent. Small errors (bias, changes in statistical characteristics, etc.) might be amplified by the transfer models to unacceptable levels. It would be desirable to make available post-processed forecasts that are consistent with “observations”. For longer time scales the consistency of data sets should be ensured and re-analyses should be continued up to the present in (near) real time.

#### 2.3. ACCESS TO DATA

Ready and reliable access to data and forecasts of some weather services should be facilitated using live access servers and similar Grid computing technology. The lack of such access is a real hindrance, especially for smaller companies in the energy sector. Met Services must attribute resources (financial and manpower) to inform potential users about data and to ensure the availability of these data. Annual workshops or conferences, tailored to the energy sector in which the Met Services present their data and how to access them are recommended. A good example of such a practice is the annual Eumetsat User’s meeting.

#### 2.4. ACCESS TO OBSERVATIONAL DATA FOR DOWNSCALING AND VERIFICATION PURPOSES

A quality-checked set of reference observations should be provided in a user friendly way that can be used for downscaling and verification purposes. This data set should be updated in (near) real time. For the assessing and modelling of energy parameters (production, demand) the access to climate and energy data with high temporal and spatial resolution is essential but the related datasets are still not easily accessible in most parts of the world. The problem is threefold. Firstly, although datasets exist, they are not publicly available. Especially across administrative borders, the collection and use of relevant data can be tedious, amongst others due to different standards. Secondly, owing to lack of meteorological/climatological observations even basic data is not available in many developing countries and scarcely populated areas. Thirdly, distributed energy generation systems such as are now being introduced, especially with renewables, often do not record data in a way that can be used for national or supranational strategic energy management and planning purposes. It is recommend therefore that the monitoring of climate and energy system should be extended particularly when distributed energy generation systems are installed; that the energy and climatological data from observations and models should be readily available; that the exchange of energy data (even aggregated) between the energy companies and the regulatory and scientific communities should be enhanced to improve the introduction of new ways of using the observations and model products; and consequently that the aggregation of energy data should take into account the needs of climate/energy research, although the raw data are often sensitive (relevant for business).

### 3. Recommendations from Working Group 3

After having agreed on definitions of key terms such as “Energy Security”, “Extreme Weather Event” and “Climate Change Adaptation”, WG3 made observations and recommendations on each of the three objectives in its Terms of Reference. Of these, a select list is provided here.

With regard to objective A, it was observed that (a) Proposed that the optimal initial way forward is to examine and deal with current vulnerability; (b) Vulnerabilities should be examined through the life cycle of energy generation/use, namely: exploration, extraction/production, transportation, refining, generation, transmission/delivery, disposal; further, the life cycle as listed should be interpreted, as appropriate, for all types of energy source, both mined and renewable. The WG concluded tentatively that the most vulnerable part of the energy life cycle to climate variability and change is

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likely to be either transportation or transmission. Noting that current funding for adaptation, at least under the GEF and UNFCCC schemes, is roughly US\$500 million as compared to requirements estimated for Africa alone as between US\$7 and 10 billion, the WG expressed a view on the need for further research to be conducted into methods for increasing funding, suggesting the funding should be counted outside of Official Development Assistance and might possibly be a mix of grant and concessional loans; additionally the WG agreed that funding should not be restricted to structures such as GEF and UNFCCC and that ways should be explored to link climate change adaptation in the energy sector to existing financial instruments such as the global carbon market, especially where adaptation strategies overlap with mitigation actions (e.g. energy efficiency; demand side management).

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In terms of objective B, the WG recommended research on: the creation and storage of data; the extent to which data are used in practice (any issues identified may be provide significant implications regarding training and research); regional and site-specific models; weather/climate maps, including risk maps, appropriate to all aspects of the life cycle for individual energy sources (e.g. wind maps, water resource maps), that would act additionally as educational tools. Regarding adaptation the WG recommended developing sociological and institutional tools to involve populations in defining local needs, and research into the financing of adaptation projects; noting that adaptation is so wide in context that engaging sufficient financing is a major international issue, the WG expressed the opinion that fund diversion, perhaps from, say, military or other government spending, would likely be required. A further recommendation was the production of guidelines for the use of weather and climate information in energy projects through their life cycles covering project structure and design, data requirements, science issues, funding issues, management requirements and case studies. Following the above, the WG proposed the concept of “energy teams” (a particular need was identified for biomass projects in developing and dry countries, but the concept is readily extendable) that would have mixed representation to facilitate open debate. Additionally the WG noted the need for facilitating policy level discussions, particularly in regard to: (a) tariffs/taxes (the WG agreed the perception that these, currently, were often created only to fill holes in exchequers rather than to address environment/climate/energy issues and that governments needed to take steps, including research, to address this); (b) development of the energy sector in consideration of weather/climate issues, focusing on mitigation, adaptation and energy security – the model of the ‘Bali Breakfast’ was offered within this context as a way of generating opportunities for discourse with policy makers and for engaging jointly the “weaker” environmental ministries with the “stronger” energy and financial ministries; (c) development and implementation of

national energy strategies, legal and regulatory frameworks, and public/private partnerships.

Finally, with reference to objective E, the WG recommended the development of benchmarks for energy security specific to individual countries as models to be considered by other countries; these would be based on a wide spectrum of considerations and would assist in distributing information on vulnerabilities and options. The WG recommended that all projects be examined by experts for weather/climate sensitivities and that such sensitivities be accommodated within project designs, management and outcomes and in terms of both mitigation and adaptation; the 'Climate Disclosure Project' (<http://www.cdproject.net/>) was mentioned as a possible model. Returning to the issue of financing research the WG identified the following priorities: research in applied climatology, including in transfer to action; research into metrics and indicators re weather/climate and energy (e.g. see Michaelowa et al., 2009, Chapter 5, this volume); undertaking of a gap analysis, covering, but not limited to, science for climate resilience re energy and options for action; given that GEF funding is sometimes over complex, research into funding availability outside official lines (noting a call in a UNFCCC paper that 85% of funding for adaptation should originate from the private sector); research into training and capacity building requirements, into policy definition and into policy processes; research into improved building codes and monitoring. Lastly, national and international institutional frameworks were a frequent issue of debate, with consensus that these frequently are not fit for purpose within at least the energy context (lack of time restricted detailed examination of reasons perceived, but these included inadequately drawn terms of reference, duplication and competition, and limited constructive interaction between organisations); improved frameworks should incorporate on-the-ground needs of populations (rather than of governments) and inclusion of all interest groups (business and social).

## References

- Troccoli A, Boulahya MS, Dutton JA, Furlow J, Gurney RJ and Harrison M (2009) Weather and Climate Risk Management in the Energy Sector, to appear in *Bull. Am. Meteorol. Soc.*