

MEETING SUMMARIES

PROMOTING NEW LINKS BETWEEN ENERGY AND METEOROLOGY

BY ALBERTO TROCCOLI, PIERRE AUDINET, PAOLO BONELLI, MOHAMMED S. BOULAHYA, CARLO BUONTEMPO, PETER COPPIN, LAURENT DUBUS, JOHN A. DUTTON, JANE EBINGER, DAVID GRIGGS, SVEN-ERIK GRYNING, DON GUNASEKERA, MIKE HARRISON, SUE ELLEN HAUPT, TREVOR LEE, PASCAL MAILIER, PIERRE-PHILIPPE MATHIEU, ROBERTO SCHAEFFER, MARION SCHROEDTER-HOMSCHIEDT, RONG ZHU, AND JOHN ZILLMAN

The growing body of knowledge and experience in weather and climate risk management in the energy industry has spurred a rapidly growing research interest at the nexus between weather, climate, and energy (Troccoli 2010; Troccoli et al. 2010; Ebinger and Vergara 2011; Marquis 2011). Although this increased attention has been stimulated by a renewed and fervent interest in renewable energy sources, weather and climate information is also critical to managing the energy supply from other energy sectors (e.g., offshore oil operations) as well as understanding and estimating energy demand. Until recently, such applied research was discussed in specialized sessions during conferences organized by industry-specific organizations related to wind energy (e.g., American Wind Energy Association), solar energy [e.g., Solar Power and Chemical Energy Systems (SolarPACES)], and meteorology (e.g., European Meteorological Society).

To take advantage of the substantial overlap between these energy activities and their use of weather and climate information, the International Conference Energy and Meteorology (ICEM) 2011 (www.icem2011.org/) was convened in Queensland, Australia. The objective was to provide a dedicated forum where scientists, engineers, economists, policy makers, and other specialists and practitioners involved in research or implementation activities at the intersection between weather, climate, and energy could discuss recent research findings and emerging

INAUGURAL INTERNATIONAL CONFERENCE ENERGY AND METEOROLOGY

WHAT: More than 170 participants from about 50 countries, including weather and climate scientists, engineers, economists, and other specialists in the use of energy, met with the aim of strengthening the links between the energy industry and the weather and climate community.

WHEN: 8–11 November 2011

WHERE: Gold Coast, Queensland, Australia

practices ranging from operational activities to long-term investment planning and to policy making. Such discussions were framed within the context of all energy sector uses, including climate change mitigation and weather/climate risk management practices. The four expected outcomes of this conference were as follows:

- i) to promote interaction between experts and service providers engaged in weather and climate research and product development for the energy industry to leverage experience and resources for better energy sector management;
- ii) to discuss frameworks for managing weather and climate risk, including in the face of projected climate change, and for planning, construction,

- operations, and decommissioning to improve upon existing risk assessment, management practices, modeling tools, or other approaches currently in use by energy practitioners;
- iii) to improve approaches to highlighting/transferring/exchanging information on best practice energy, weather, and climate risk management processes, especially between developed and developing countries; and
 - iv) to discuss the advantages of establishing an international society and/or networks aimed to provide more formal channels of communication between the energy and meteorology sectors.

INTERACTION BETWEEN ENERGY AND METEOROLOGY. Australia is a major exporter of uranium, coal, and gas to the international market and an early adopter of clean energy legislation. The continent is blessed with plentiful sunlight and has tropical and temperate climate regimes but is subject to extreme events from bushfires to cyclones and flooding rains. Therefore, it was entirely appropriate for Australia to host the inaugural ICEM. In the recent past, several meetings were dedicated to achieving an enhanced interaction between energy and meteorology (e.g., Troccoli et al. 2010; Marquis 2011). Thus, it seems that the energy and meteorology—including atmospheric and broader climate science—streams of research have begun converging in ways that industry, governments, and communities are now recognizing as being of substantial benefit.

More than 170 delegates from 50 countries met on Queensland's Gold Coast in early November 2011 in a two-phase event mainly supported by the climate and atmospheric research arm of Australia's national science agency, the Commonwealth Scientific and

Industrial Research Organisation (CSIRO), the World Bank-administered Energy Sector Management Assistance Program (ESMAP), and the Australian Government Agency for International Development (AusAID). More than half of the delegates were international visitors for the 1-day seminar and 4-day conference. The pace of growth in renewable energy, community attitudes toward this resource, food and biofuel production, forecasting to optimize energy generation, and support for decision making were common topics of discussion at the ICEM 2011.

An outstanding list of 20 experts in their fields provided keynote presentations around which more than 80 talks in parallel sessions were delivered (all presentations are available online at www.icem2011.org/resources.html). ICEM also attracted an important side event, the Solar Energy Forecasting Workshop, organized by the Australian Solar Institute, to map a plan for solar forecasting in Australia, particularly ahead of large-scale solar deployments.

Two threads common to many of the presentations were the critical role of meteorology in various aspects of energy (operations and planning among others) as well as the timeliness of the ICEM 2011. This was elegantly summarized in the concluding keynote address from the CSIRO Energy Transformed Flagship director, Dr. Alex Wonhas, who discussed three reasons for a new era of energy. As he noted, energy is becoming ever more critical for the sustainability, security, and prosperity of countries. Energy systems are being dramatically transformed and in this transformation the linkages between meteorology and energy are continually expanding. He also emphasized the need for a stronger involvement from the energy industry.

Moderate energy industry participation has been identified also in past studies (e.g., Mailier et al. 2008).

AFFILIATIONS: TROCCOLI, COPPIN, AND GUNASEKERA—Commonwealth Scientific and Industrial Research Organisation, Canberra, Australian Capital Territory, Australia; AUDINET AND EBINGER—World Bank, Washington, D.C.; BONELLI—Research on Energy Systems Spa, Milano, Italy; BOULAHYA—ClimDev Africa, Tunis, Tunisia; BUONTEMPO—Met Office, Reading, United Kingdom; DUBUS—Electricité de France, Paris, France; DUTTON—Prescient Weather Ltd., State College, Pennsylvania; GRIGGS—Monash University, Melbourne, Victoria, Australia; GRYNING—Technical University of Denmark, Roskilde, Denmark; HARRISON—Climate-Insight, Wolverton Common, United Kingdom; HAUPT—National Center for Atmospheric Research, Boulder, Colorado; LEE—Exemplary Energy, Canberra, Australian Capital Territory, Australia; MAILIER—Royal Meteorological Institute of Belgium, Brussels, Belgium; MATHIEU—European Space

Agency, Frascati, Italy; SCHAEFFER—Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; SCHROEDTER-HOMSCHIEDT—Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Wessling, Germany; ZHU—China Meteorological Administration, Beijing, China; ZILLMAN—University of Melbourne, Melbourne, Victoria, Australia

CORRESPONDING AUTHOR: Dr. Alberto Troccoli, Commonwealth Scientific and Industrial Research Organisation, Pye Laboratory, GPO Box 3023, Clunies Ross Street, Canberra ACT 2601, Australia
E-mail: alberto.troccoli@csiro.au

DOI:10.1175/BAMS-D-12-00061.1

In final form 3 June 2012
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Although sufficiently represented at the ICEM 2011, there was a sense that pressing operational concerns and perhaps reluctance to share potentially sensitive proprietary information had kept a portion of the energy industry away from this ICEM. However, if there were any skepticism from the industry around the value of attending an inaugural conference, this would likely be washed away with the next ICEM, which is being planned for 2013, based on the considerable positive feedback received from delegates to ICEM 2011.

In promoting a beneficial exchange between energy and meteorology it is also crucial to prepare specialists with a new set of skills. A panel session was devoted to a discussion on “Training the next generation of experts: Plans for an energy and meteorology degree.” It emerged that, although a specific degree in energy and meteorology might not be required in the foreseeable future, the two individual curricula, in energy and in meteorology, should increase cross fertilization of knowledge whereby meteorologists become better trained in energy applications and vice versa. For example, for meteorology this could be achieved by the development of training curricula by the World Meteorological Organization (WMO) or other appropriate unifying organizations. Among the options mentioned, the establishment of a series of summer schools or the offering of elective courses via distance learning sounded like some of the easier options to pursue. A training course preceding each ICEM was also suggested, as occurred with this inaugural meeting.

RISK ASSESSMENT, MANAGEMENT PRACTICES, AND MODELING TOOLS. In a period when weather events and changes in climatic patterns are increasingly affecting various aspects of societal activities, particularly the energy industry, the demand for relevant weather observations and meteorological prediction, on almost all time and space scales, is becoming increasingly evident. Presentations at the ICEM exposed a range of requirements for meteorological data, from the satellite-derived products, to the ground station observations, to the output from complex models such as numerical weather prediction (NWP) models.

Aside from data availability, critical aspects were identified in the consistency of the data, whereby informative quality control flags and uncertainty measures need to be provided. Moreover, access to data can be a very thorny issue, predominantly because of the commercial sensitivities embedded in the data, in terms of both numerical values and location of where data are sourced.

Overall, there is a growing bank of weather and climate information, in both quantity and complexity, relevant to the energy industry. While this is favorable, the focus now has to revolve on understanding and addressing users’ needs, especially access to the most appropriate information at the right time. As it was synthesized in an aircraft navigational analogy in Professor John Dutton’s keynote address, one has to “Show the pilot what he needs to know, now.”

For instance, wind observations at hub heights for wind farm planning and operations are relatively sparse; while NWP models have the ability to simulate wind at different heights, this information is not always stored and/or available as a model output. In order to provide timely and relevant data to the energy industry, a high-level discussion at a national and/or international level would therefore be advantageous.

Presentations also emphasized the fact that approaches to using meteorological data for planning and operations purposes are not always straightforward. For example, although NWP models offer a strong baseline, they often have to be used in conjunction with other methods (e.g., statistical methods) in order to better inform decisions taken by energy sector specialists. In other words, methods that may appear adequate to meteorologists are not necessarily appropriate for decision makers in the energy industry.

EXCHANGE OF INFORMATION BETWEEN ENERGY AND METEOROLOGY. The way in which information and data are shared between the meteorology community and the energy sector varies considerably. Examples range from the very protective attitude, one for which information sharing is viewed as a commercial threat, to a more collaborative approach, one for which external input is viewed as strengthening the business. While ICEM 2011 has definitely helped in the process by opening additional channels of communication between the energy industry and the meteorology community, that more protective component of the energy industry might still prefer other ways to interact with the meteorology community. Presentations from industry leaders such as Mr. Peter Cowling of General Electric encouraged opening the dialogue with the energy industry. His talk conveyed a genuine interest in strengthening collaboration as a means to increase the success of project funding and consequent implementation.

Options to improve the exchange of data were addressed during the panel session “What will be

the new role of meteorology/climate in the planning and operations of future energy systems.” Discussion focused on issues such as the growing demand for more and new meteorological data and information relevant for the energy sector, as well as their accessibility and delivery in a timely and user-friendly manner. The role of public versus private sector entities in generating and disseminating meteorological data and information for the energy sector highlighted the need for closer collaboration between energy and meteorology communities.

Overall, greater emphasis on the practical/operational (as well as the research) aspects of meteorological service provision is needed for the energy sector, both conventional and renewable, in most, if not all, countries. In the case of renewable energy, for instance, it is clear that an increase in its share implies a much higher dependence of energy systems on weather and climate information, including the need for the development of tailored weather products to assess and manage the intermittent nature of renewable energy. Other energy sources are, however, also increasingly exposed to the vagaries of weather. Moreover, the “aggregating” nature of energy demand (as it indirectly entails all sources of energy supply) implies that meteorological information is fundamental to reducing overall uncertainties in energy pricing and, therefore, in increasing the efficiency of the energy system as a whole, as was eloquently explained by Mr. Tim George of the Australian Energy Market Operator (AEMO). Proper channels for the exchange of meteorological information would be beneficial across the entire energy sector.

NATIONAL AND INTERNATIONAL FRAMEWORKS FOR COLLABORATION BETWEEN ENERGY AND METEOROLOGY.

One option for an improved exchange of information is via national, or better still, international networks or frameworks. The keynote by Dr. John Zillman, a former president of WMO, articulated the many ways in which meteorology has interacted and collaborated throughout its history with various societal sectors. He indicated the Global Framework for Climate Services, being formulated under the leadership of WMO, as a potentially very good candidate for an international interaction between energy and meteorology.

Other options for interaction were also discussed during the conference, as in the case of the important high-level initiative of ESMAP, aimed at improving climate risk management in the energy industry

in developing countries, presented by Dr. Pierre Audinet (see also Ebinger and Vergara 2011); the more operationally driven collaboration between AEMO and the research community to build the Australian Wind Energy Forecasting System (www.aemo.com.au/electricityops/awefs.html); the European Weather Intelligence for Renewable Energies (WIRE; www.wire1002.ch) network focused on developing forecast algorithms coupling weather prediction models output and energy data; or the energy phases 1 and 2 projects that brought the Met Office and leading U.K. energy companies together in a joint effort to try to assess the effects of climate change on the British energy industry (www.metoffice.gov.uk/services/climate-services/case-studies/energy).

Regardless of the size and focus of interactions between energy and meteorology, it is crucial that the energy industry finds value in these interactions and that they play an active role in formulating an effective network/framework to exchange information. It is also important that the larger energy companies lobby governments to invest properly in public good observation networks, serving all sectors of the community. As a first small step in the direction of improving exchange of information, a mailing list has been set up for people interested in improving the interaction between energy and meteorology, starting with the ICEM 2011 delegates (the mailing list can be joined via http://icem.info/mailman/listinfo/icem_icem.info).

CONCLUDING REMARKS. Through the extensive range of presentations given and the ensuing discussions during sessions and breaks, ICEM 2011 promulgated a wealth of ideas that are likely to generate collaborations and relationships as a bridge between the energy and meteorology sectors. The main message emerging from the conference is that delegates found ICEM 2011 to be a timely, information-rich, network-broadening event; they are looking forward to the next ICEM. The ICEM series is currently planned as a biennial event, with the next conference likely to occur in the first half of 2013. In the meantime, a book with selected lectures from ICEM 2011 is being compiled.

ACKNOWLEDGMENTS. The authors would like to thank CSIRO (particularly the Climate and Atmosphere theme), ESMAP, and AusAID for funding this conference; the organizing and local committees; and Conference Action for the management of the conference. Feedback on an early version of the manuscript from Craig Macaulay is greatly appreciated.

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