The Energy Sector and Earth Observations, Sciences, and Services

A Policy Statement of the American Meteorological Society

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Energy production, distribution, and use are highly sensitive to weather, water, and climate. Heat waves, droughts, anomalies in the wind, solar and water resource, ice and snow, tornadoes, hurricanes, floods, wildfire, and solar storms disrupt the generation and delivery of electricity, the extraction and refining of oil and natural gas, and the short-term consumer demand for energy. Disruptions to the energy sector from extreme events often occur over large geographic areas and have substantial economic impacts.

Weather and climate variability across all timescales affect all energy sources. For example, modest or rapid changes in wind speed or cloudiness can substantially alter the output from wind and solar generation. Drought and elevated cooling-water temperatures can limit the operation of conventional fossil fuel and nuclear power stations, and extreme cold and heat can result in forced outages and fuel shortages. Biomass and hydroelectric power vary over seasonal and annual timescales depending on growing conditions and water availability. Changes in weather, especially wind speed, cloudiness, temperature, and humidity, have a large influence on generation and demand for electric power and natural gas.

Renewable energy technologies are rapidly becoming the cheapest forms of electricity generation and this trend is expected to accelerate. Thus, a wholesale transition to mostly renewable power generation is expected due to both market and policy forces. Because renewable energy is frequently weather-driven, it is crucial that the energy sector is provided with the weather and climate knowledge and tools to strategically deploy and integrate renewables in a way that ensures grid reliability and resilience, especially during periods of concurrent anomalously high/low demand and anomalously low/high wind, solar, and water availability. In addition, because energy infrastructure involves multi-billion-dollar investments that are planned, constructed, and operated over timescales of 20 years or more, it is crucial that climate impacts are quantified and communicated as widely as possible.

Therefore, improvements in Earth observations, sciences, and services (Earth OSS), particularly those related to weather and climate, will provide direct benefits to the United States' energy sector, including the following:

1. Development of more robust baseline historical datasets, including observational and reanalysis products, will better inform resource assessment, load management, and trends analysis.
2. Increased forecast accuracy and confidence, and better communication of risk, will reduce the energy sector's vulnerability to extreme weather events by reducing threats to life and property (including the energy workforce) and make it easier to pre-position assets needed for system operations, recovery, and restoration.
3. Improved short-term to medium-range forecast accuracy (from minutes to weeks) will enable more cost-effective integration of renewable sources of electricity, particularly wind and solar, which vary over time and with location. Better forecasts can reduce the need for reserve power and enable better use of energy storage, transmission, and demand response.
4. Increased accuracy and confidence in longer-term prediction (from two weeks to several years) will help companies and consumers improve their energy production and consumption strategies.
5. Improved decadal-scale projections will help energy producers and commercial customers anticipate and adapt to climate variability and climate change and to corresponding shifts in the patterns of energy supply and demand. The energy industry will need these improvements to occur at local and regional scales to enable full incorporation of the potential consequences of climate variability. More comprehensive Earth system measurements will provide the information needed to facilitate strategic deployment of renewables as we move toward the new energy economy. Deeper penetration of renewables, while maintaining grid stability and reliability, will require advancing our understanding of weather and climate events (through observations and modeling) that affect production, distribution, and consumption of energy.
6. Energy production and use also impact the Earth system through emissions of greenhouse gases, aerosols, and pollutants, consumption of water resources, and changes to the landscape. Earth OSS (including more accurate air chemistry measurements and a better inventory of pollutant emissions) will help society identify, manage, and minimize the harmful unintended consequences of energy production and use.

Public–private partnerships involving the energy sector, and those who provide Earth OSS to the energy sector, have great potential for societal benefit but require careful navigation by policy makers. Some private-sector companies that rely on public-sector data and forecasts from the federal government provide services that are targeted to particular energy-sector business areas and clients. Meanwhile,

competing energy companies collect weather and climate data that they view as sensitive proprietary information. Increased availability of these data would likely improve forecast skill and facilitate integration of a wide variety of energy resources. Policies to encourage the sharing of data, while still protecting the business interests of private-sector companies, have considerable potential to benefit the energy sector.

Therefore, AMS recommends:

- Robust federal and state support for Earth observations, sciences, and services;
- A comprehensive assessment of the energy sector's needs and priorities for Earth observations, sciences, and services;
- Research to 1) better understand how existing, enhanced, and newly deployed observing systems can most effectively improve weather forecasts for all energy sources, 2) quantify the sensitivity of energy resources to climate variability and change, and 3) improve the skill of weather and climate models at simulating energy-sensitive weather and climate conditions;
- Policies and protocols to promote sharing of data relating to Earth OSS and energy demand among the research, forecast, and operations communities spanning the public, academic, and private sectors;
- Safeguards to protect the business interests of private-sector companies that share proprietary data; and
- An improved national data collection and quality-control capability for weather and climate observations, including for data contributed from nontraditional sources. This would provide ready access to high-quality data for decision-makers, private companies, the media, and members of the public.

Together, these recommendations will help reduce the energy sector's vulnerability to anomalous weather events and longer-term climate change, enabling more cost-effective integration of renewable sources of electricity onto the nation's grid, and refining the nation's energy production and consumption strategies.

[This statement is considered in force until September 2024 unless superseded by a new statement issued by the AMS Council before this date.]