Discussion topics include climate challenges to energy generation and infrastructure, and heat pump technology.
Drought, Extreme Weather Events and Other Climate Risks & Challenges to Energy Generation and Infrastructure in the West

Climate impacts on water infrastructure include stronger storms and flooding, sea-level rise and storm surges, more frequent and severe drought, saltwater intrusion, and degraded source water quality. These impacts pose water management challenges; for example, U.S. dams and levees need billions of dollars of repairs to make them safe for the conditions of the previous century, not current or future projected climate conditions.

Energy assets in need of defense from climate change include Generation (coal, natural gas, nuclear, geothermal, hydro, wind, and solar), Electricity Transmission and Distribution (substations, transformers, transmission lines, distribution feeders, and towers), Natural and Liquid Gas Transmission and Distribution (compressor stations and pipelines), Control Centers (electric, natural and liquid gas), and Energy Storage (pumped hydro, compressed air, battery, and hydrogen).
Planning methods are proving inadequate to defend these assets. An alternative framework for protecting assets would be to:

1) **Prioritize infrastructure assets for defense** based on their importance to or (in the case of failure) consequences to national security, the economy and public health.

2) **Perform a predictive risk assessment** on the assets, considering physical climate risks and geo-temporal climate models.

3) **Include an interdependency analysis** of the asset(s), which considers the affected resources (no power for hospitals, national command centers, gas stations) and the hazards created by a climate-caused failure or destruction of the asset(s).

4) **Consider the resilience measures and functional adaptations** needed to protect the asset(s). The framework concludes with a cost-benefit analysis to guide decision-makers in identifying the energy infrastructure assets that must be protected first and best.

We cannot protect everything, but if asset protection, functional adaptation, and siting selections are based on what matters most, we will make the best use of scarce resources.

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**Resources:**

- Drought, Extreme Weather Events and Other Climate Risks & Challenges to Energy Generation & Infrastructure in the West

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**Presenter:**

Andrew Bochman  
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Non-Resident Senior Fellow  
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Geothermal heat pumps take advantage of the nearly constant temperature of the Earth to heat and cool buildings. Even though our climate changes with the seasons, a few feet below Earth's surface, the ground temperature remains relatively constant, between 50 and 60 degrees Fahrenheit. This temperature is warmer than the air above it and cooler in the summer.

A geothermal heat pump uses this by exchanging heat with the Earth through a ground heat exchanger. The heat exchanger is a series of pipes called a loop buried in the shallow ground near the building. A fluid – usually water or a mix of water and antifreeze – circulates through the pipes to absorb or release heat within the ground.

In the winter, the heat pump removes heat from the heat exchanger and pumps it into the indoor air delivery system, moving heat from the ground to the building's interior.

In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger, effectively moving the heat from indoors to the ground. The heat removed from the indoor air during the summer can also be used to heat water, providing a free source of hot water.

Geothermal heat pumps have many benefits as a renewable energy source because they:

- Use much less energy than conventional heating systems, since they draw heat from the ground
- Are more efficient when cooling your home
- Save energy and money
- Reduce air pollution
- Are suitable for all areas of the United States.

Presenters:

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