July 2022

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Grid Strategist-Defender

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

The Council of State Governments

Idaho National Laboratory

Background: From Cyber Defense to Climate Defense

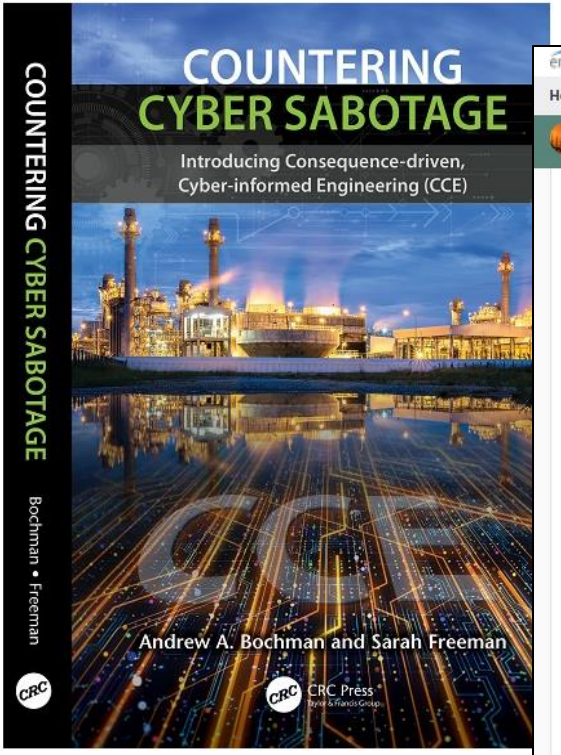
U.S. AIR FORCE

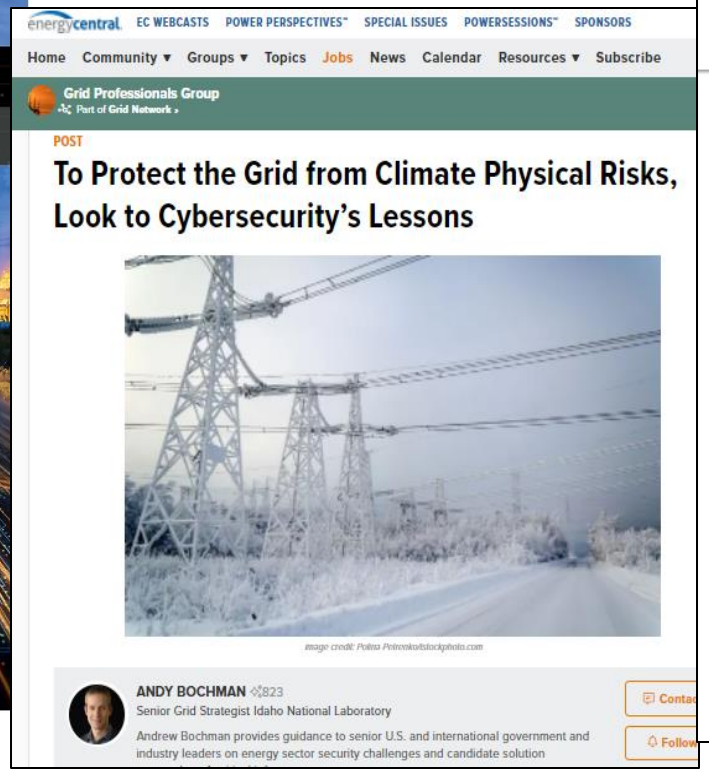
IBM

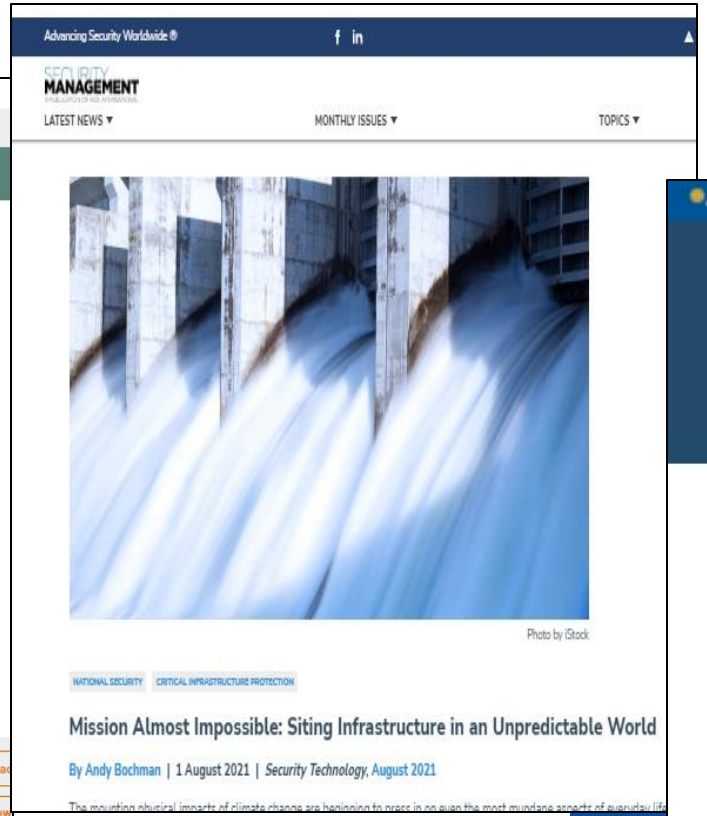
THE CHERTOFF GROUP

INL Idaho National Laboratory

Atlantic Council







Disruptive and Destructive Impacts on Infrastructure are Accelerating

Depending on the geography in question, there's likely one or more of these unwelcome guests already present and/or likely to be arriving faster than tradition infrastructure planning cycles can handle:

- Too much heat
- Too little heat (unexpected freezes)
- Too much water (aka floods, SLR)
- Not enough water (aka drought)
- Storms with higher velocity winds
- Melting permafrost

Grid Reliability is at Risk this Summer

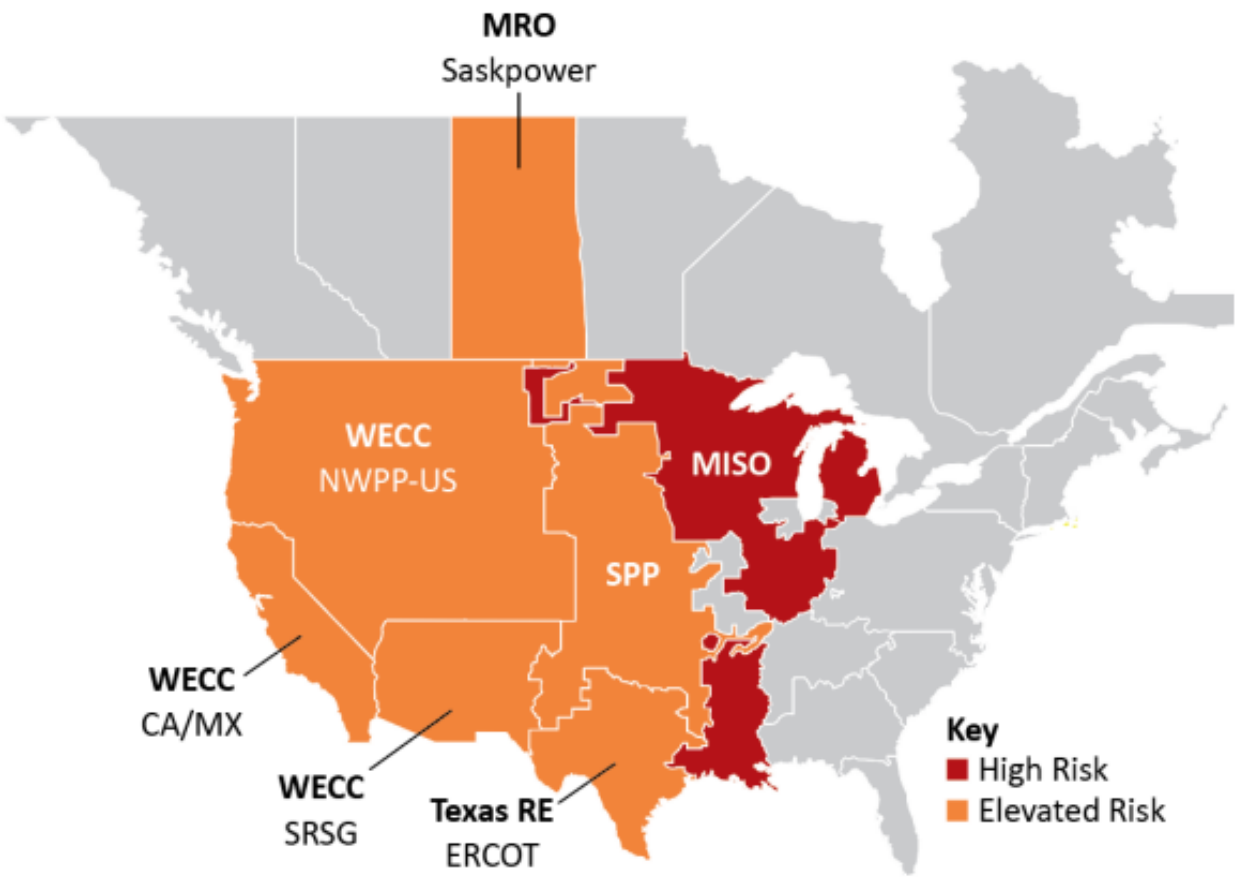


Figure 1: Summer Reliability Risk Area Summary

Seasonal Risk Assessment Summary	
High	Potential for insufficient operating reserves in normal peak conditions
Elevated	Potential for insufficient operating reserves in above-normal conditions
Low	Sufficient operating reserves expected

The West

Drought and extreme heat threaten reliable generation

MISO

Capacity shortfalls likely and transmission trouble

Mitigation is not Adaptation

Global Spotlight

- Yearly COP conferences since 1995

Metrics

- Tons of CO_2 and methane released

Targets

- Temp increase < 1.5 or 2.0 degrees C

Reporting

- IPCC, TCFD, FSOC / SEC

Rallying Cry

- Net Zero GHG emissions

Global Spotlight

- None – it's local

Metrics

- Emergency supplementals

Targets

- None

Reporting

- None

Rallying Cry

- Resilience!

Climate Impacts to Thermal Plants

ENERGYWIRE

CLIMATE AND WEATHER & 18 OTHERS

Severe heat, drought pack dual threat to power plants

BY: HANNAH NORTHEY, PETER BEHR | 06/28/2021 07:08 AM EDT

"Nationwide, more than 70% of the 1,100 gigawatts of U.S. power plant capacity requires cooling, and half of that supply comes from fresh surface water. All told, power plants suck up almost half of all fresh water used nationwide, and their operations can be curtailed if water levels in reservoirs, lakes or rivers drop too low, or discharges of heated water from plants raise water temperatures too high."

Climate Impacts to Water Infrastructures

Water treatment challenges:

- Stronger storms and flooding
- Sea-level rise and storm surge
- More frequent and intense droughts
- Saltwater intrusion, and
- Impacts to source water quality

Water management challenges:

- According to the ASCE, US dams and levees need billions of dollars of repairs
- And that's just to make them safe for the conditions of the previous century

Energy Assets to Defend

Generation
-- Coal, natural gas, nuclear, geothermal, hydro, wind, solar

Electricity T&D
-- Substations & transformers, transition lines & distribution feeders, towers

National and liquid gas T&D
-- Compressor stations, pipelines

Control centers
-- Electric, natural gas, liquid gas product

Energy storage
-- Pumped hydro, compressed air, battery, hydrogen

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Planning Methods are Proving Inadequate

"This weather system in Texas greatly exceeded the planning criteria in which they operate ERCOT."

This says so much.

-- Tom Fanning, Southern Co CEO

https://www.eenews.net/energywire/2021/02/19/stories/1063725479?utm_campaign=edition&utm_medium=email&utm_source=eenews%3Aenergywire

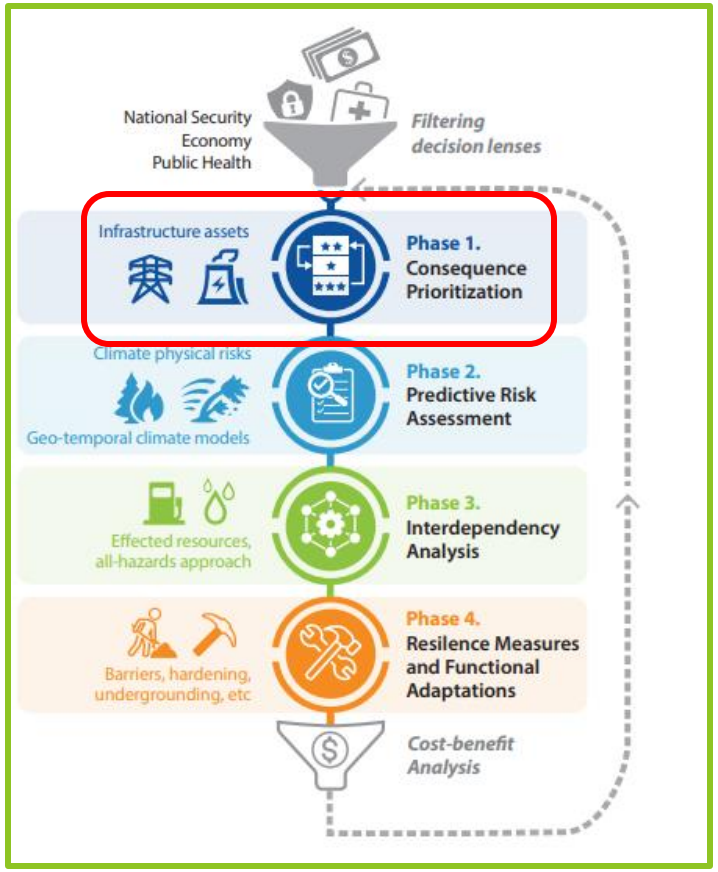
So, Then what Can We Do

???

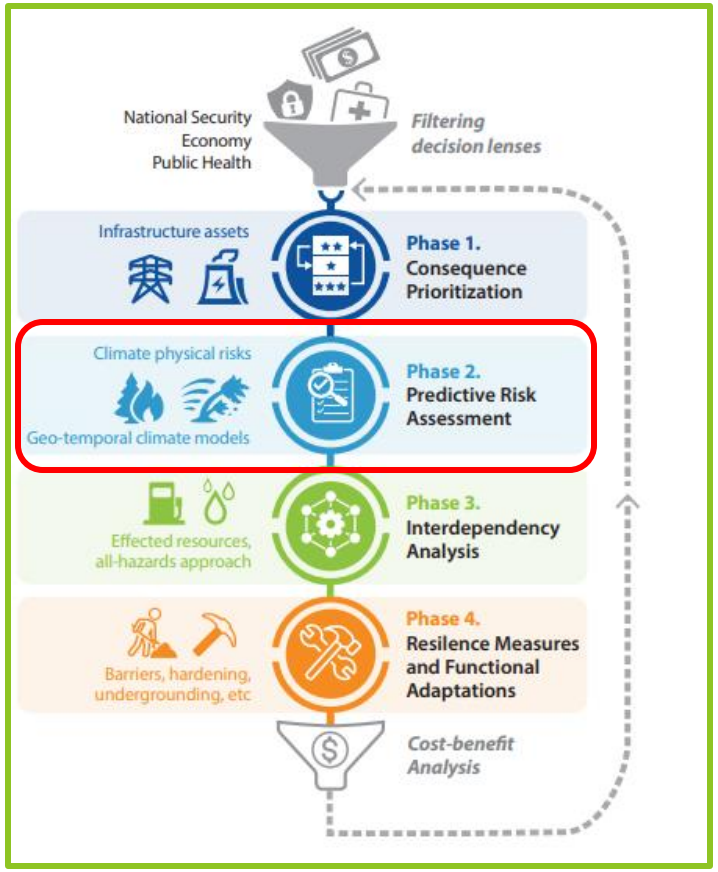
A Conceptual Decision Support Framework for Decision Makers

Figure 1: ICAR Workflow

Tailorable filters play a role at several different stages of the ICAR workflow. National Security, Economic Security, Public Health, Equity and more can be included or excluded, and weighted to accommodate the circumstances of the missions supported, loads served, geography, community and timeframe.

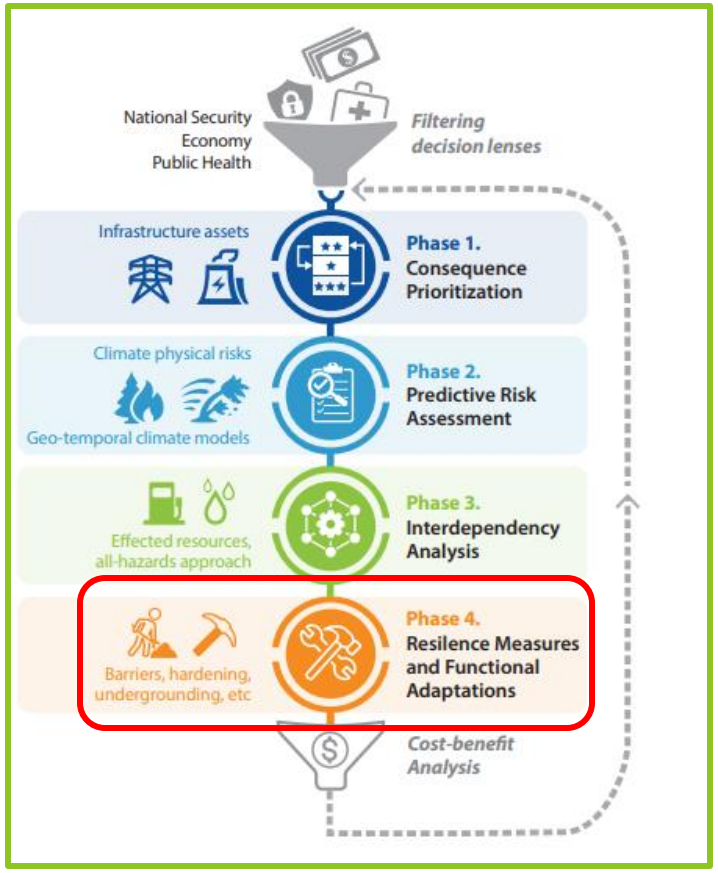


Identifies the energy infrastructure assets that must be protected first and best. We're not going to be able to protect everything, but if we base our asset protection, functional adaption and siting selections on what matters most, we'll be making the best use of scarce resources—including perhaps the most important one: time.



The second phase requires we look to the future with as much as confidence and precision as possible. ICAR imports downscaled data from global climate models to help planners understand the physical risks that will likely assail currently acceptable locations in coming years and decades. Key info to be generated: what impacts are projected, where, and by approximately when.

This phase ensures grid and other sectors' functions are fully factored into the recommendations produced by the framework. For example, thermal generation plants often require substantial amounts of water. For electricity to reach customers, transmission lines and distribution feeders, and the substations that connect them must not be harmed by fires, floods, or temperatures well outside their operating parameters. Water and wastewater treatment requires power. Without proper functioning of water and wastewater treatment plants, their failure brings grave health, environmental, and economic consequences. Other key interdependencies include transportation and communications.



There's a lot that can be done once the assets requiring attention have been identified. Once the risks and the most likely time horizons for their arrival are well described, the most appropriate adaptive design and engineering alternatives are explored, with the best options recommended in prioritized order based on cost-effectiveness and efficiency. At the end of each analysis, ICAR does not seek to provide the best answer, but rather identify the best suite of options, prioritized by weightings tailored to each current protective/adaptive and future siting challenge.

Cost-benefit Analysis

Once all the resilience and adaptation options are generated, CBA is performed drawing on inputs including:

- Confidence – that the measure will provide the required level of asset or function protection against present and projected physical risks
- Duration - anticipated timeframe in decades that the candidate resilience or adaptive measure will continue to perform as required
- Time to execute – how long the project will take to complete, including considerations of funding, permitting, siting (if a new build), etc.
- Cost - initial and full lifecycle costs

Partners & Stakeholders

USG Stakeholders

DHS, DOE, DoD (including USACE), DOT, FEMA, FERC & NERC, etc.

Professional & Trade Associations

ACEC, ASCE, AWWA, EEI, APPA, NARUC, NRECA, AGA, NASEO, ISI, EPRI, and more

Partners & Prospective Partners

National Laboratories with strengths in engineering and climate modeling, NOAA, NCAR, Universities and selected EPC (engineering) firms.

Thanks

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