Actions to Stimulate Change

How can climate models influence infrastructure investments?
How can climate models influence regulators/decisionmakers?

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March 29, 2022

GOAL: Actionable Information

Unknown [ˌənˈnōn]
NOUN
unknowns *(plural noun)*

1. an unknown person or thing.
2. that which is unknown.
3. an unknown quantity or variable.

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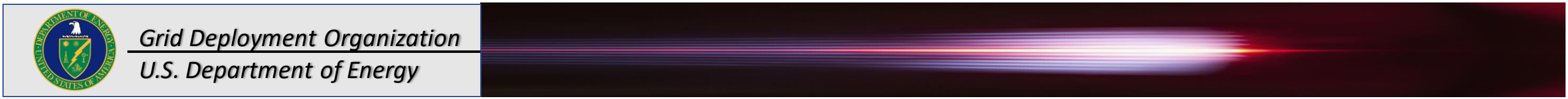
Uncertainties and Complexities in the Electric Grid

Delays Decisions by:
Policymakers, Regulators, Markets, Utilities

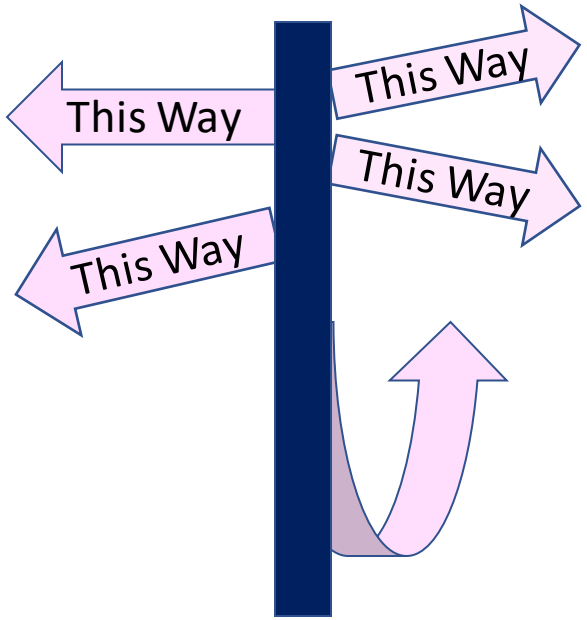


Electric Grid: Complex System of Systems

Variables and Influencers

- **Climate/Weather Change**
- Loads Growth
- Electrification of Vehicles and Industry/Buildings
- Generation Availability
- Storage
- DER

- Cost Recovery
- Markets
- Policies
- Regulations
- Security
- Interdependencies



Temporal and Spatial Analysis Building Blocks

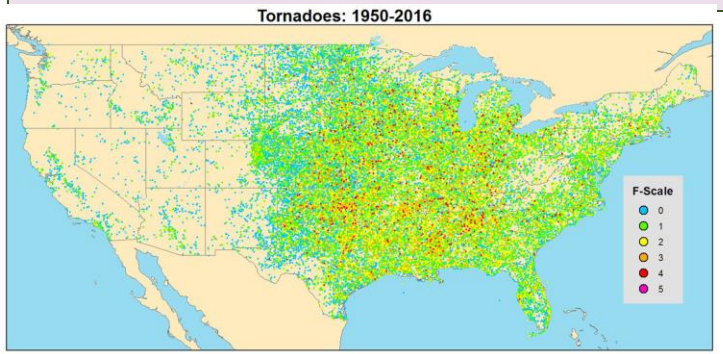
Frequency/ Severity and how this will change over time:

1. *Infrastructure Damage*
2. *Demand*
3. *Generation Availability*
4. *Operations- Regional Power Flows*

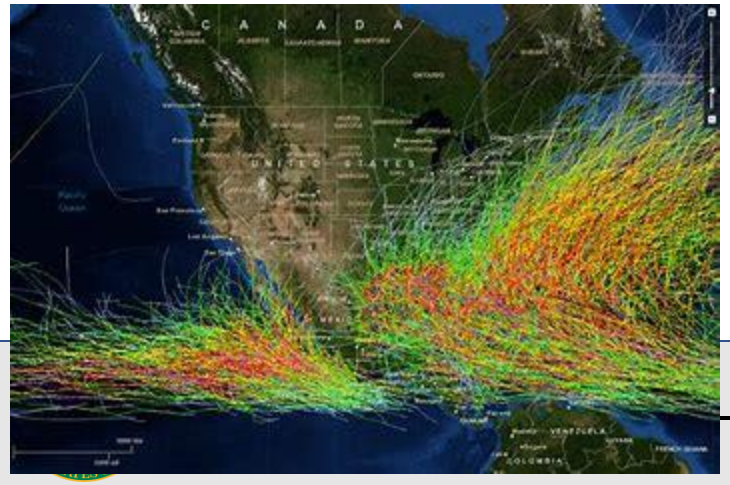
- Historical Trend
- Current Data Collection
- Future Trend
- Artificial Intelligence
- Long-term Prediction
  - Temperature
  - Precipitation
  - Wind Speed
  - Solar Irradiance

VALIDATION AND VERIFICATION

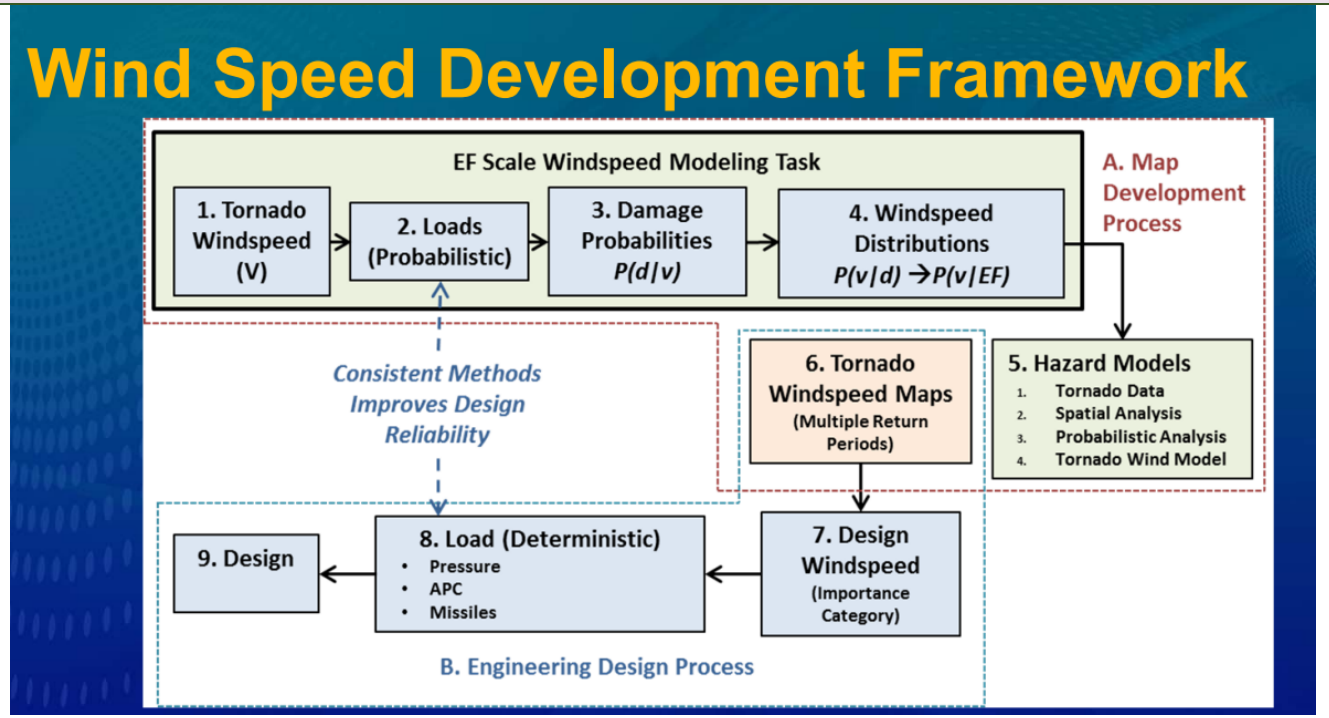
Infrastructure Damage – Wind Speed



Source NIST/NOAA Microsoft PowerPoint - levitanm-w21-pv.pptx (windows.net)



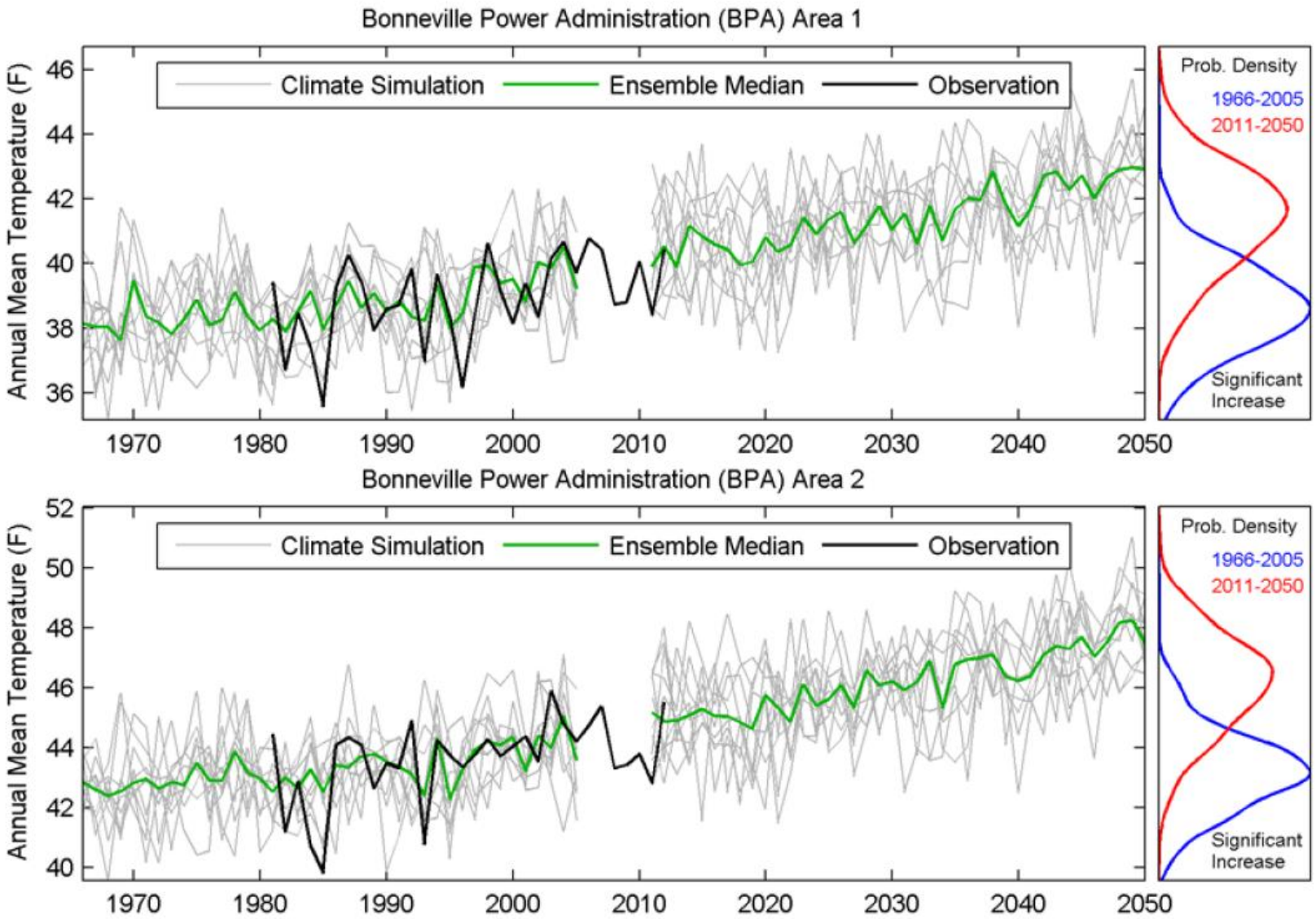
Source: Department of Commerce



NIST FRAMEWORK

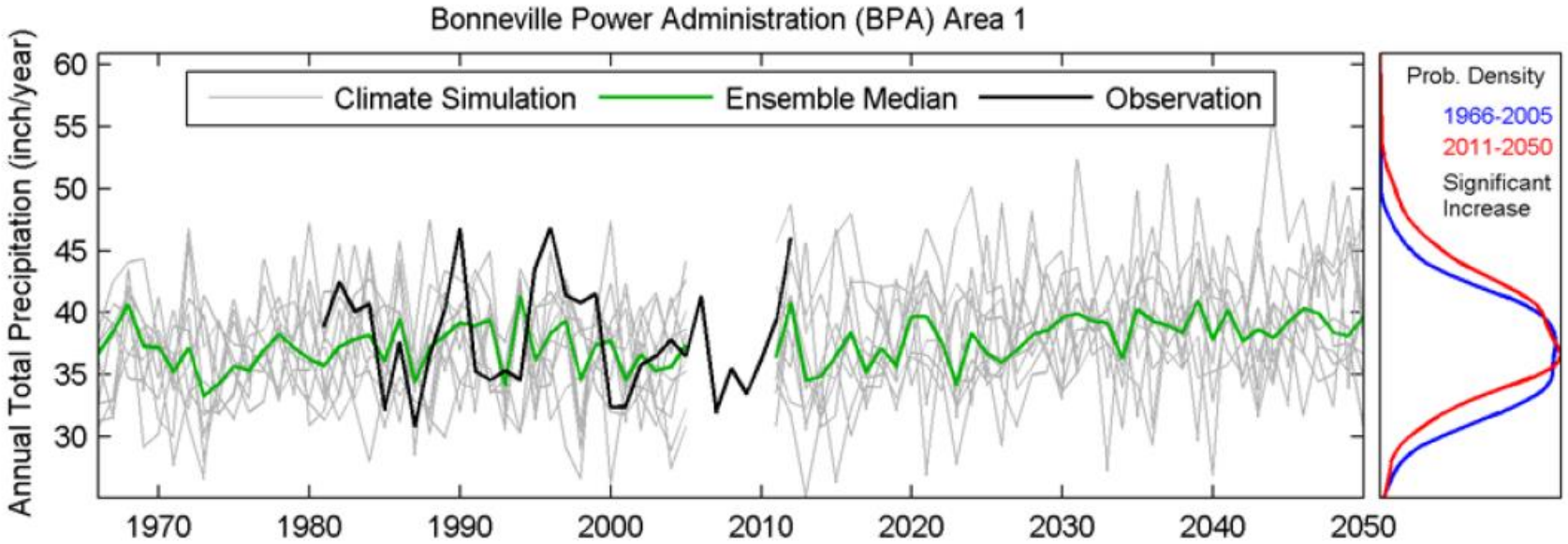
Temperature = Demand

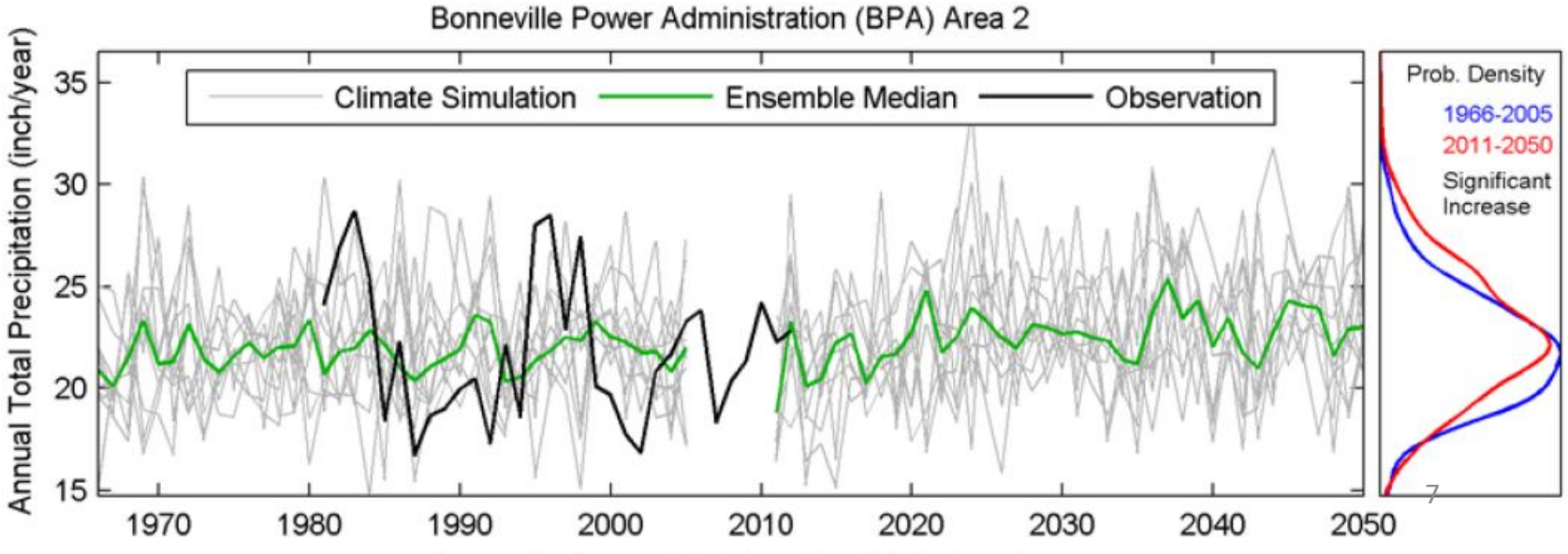
Source: ORNL, September 2016; Water Power Technologies Office, DOE



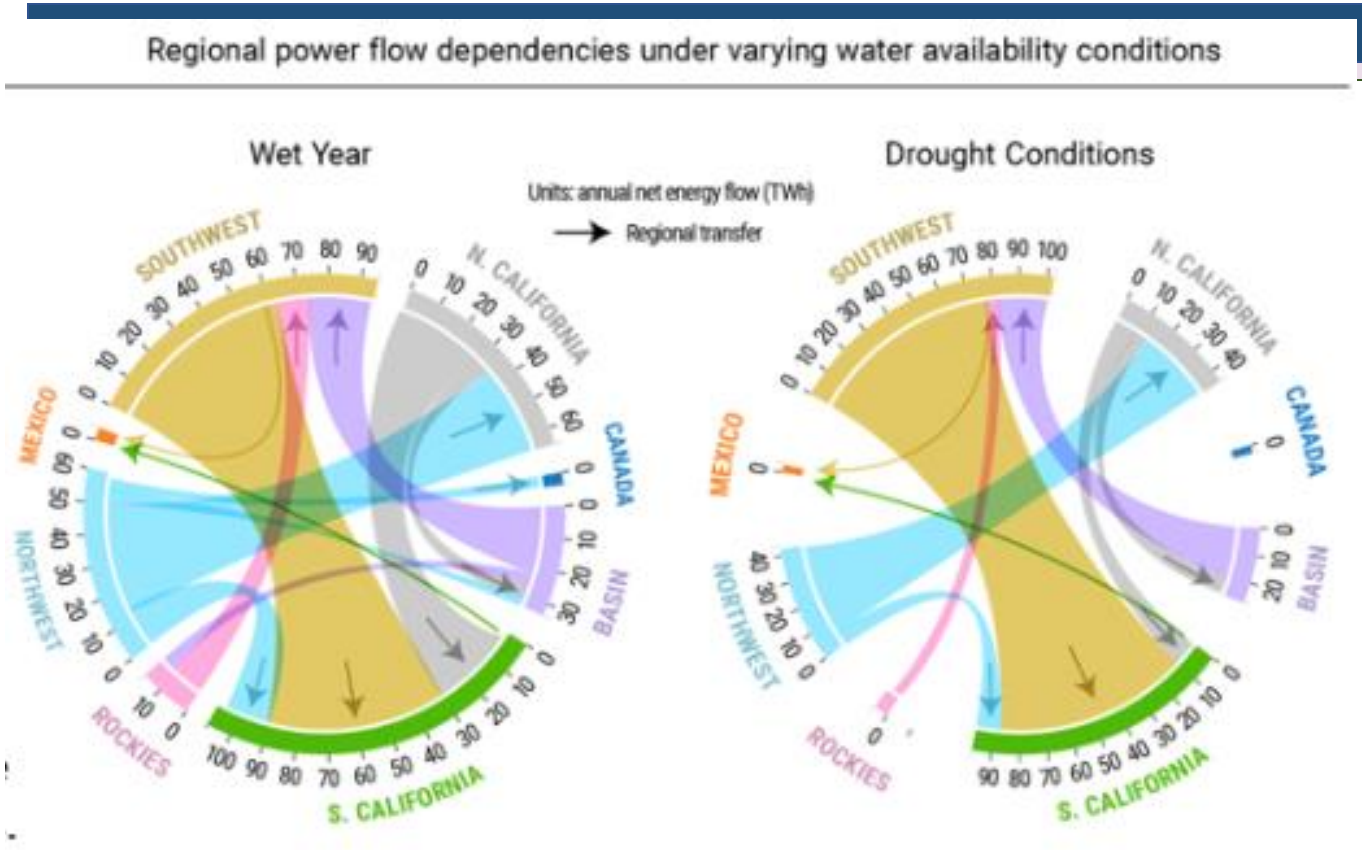
Precipitation- Flooding/Droughts- Hydropower Availability

Source: ORNL, September 2016; Water Power Technologies Office, DOE





Regional Power Flows

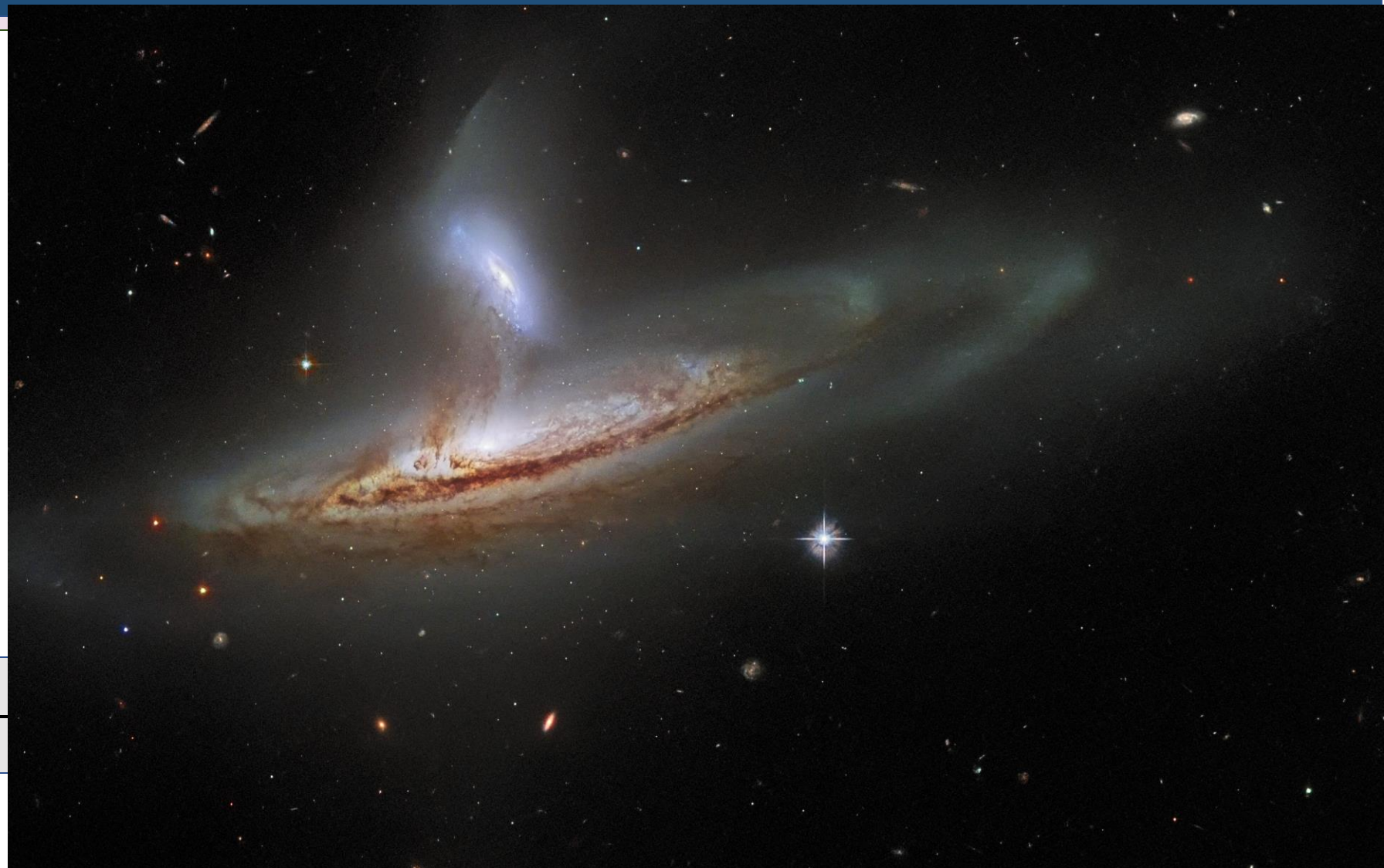


Net interchange between region pairs for wet and drought year conditions in TWh/year. The sensitivity of regional dependency paths to water availability is conserved under climate change conditions.

- [MultiSector Dynamics | Earth & Environmental Systems Modeling (energy.gov)]
- Source: Grid Vulnerability and Resilience to Climate Change Associated with Regional Interconnections; DOE Office of Science, PNNL. Ms. Rice, October 2020

Building Blocks – Not Field of Dreams

Realm of Possibility-influence



Source: NASA Hubble telescope, NASA Goddard Space Flight Center; Feb 11, 2022