The Office of Electricity

Grid Controls and Communications Division

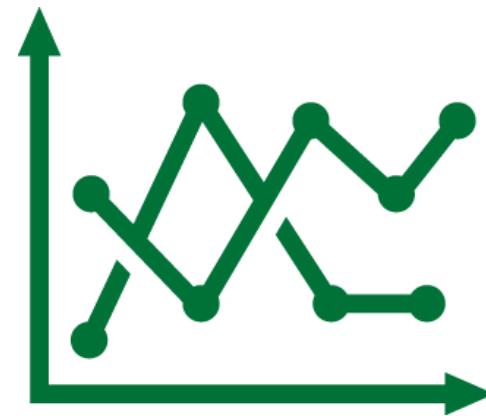- The Division is responsible for driving and catalyzing innovations related to data acquisition and communications, modeling and analytics, and operational and planning "software" tools for both transmission and distribution

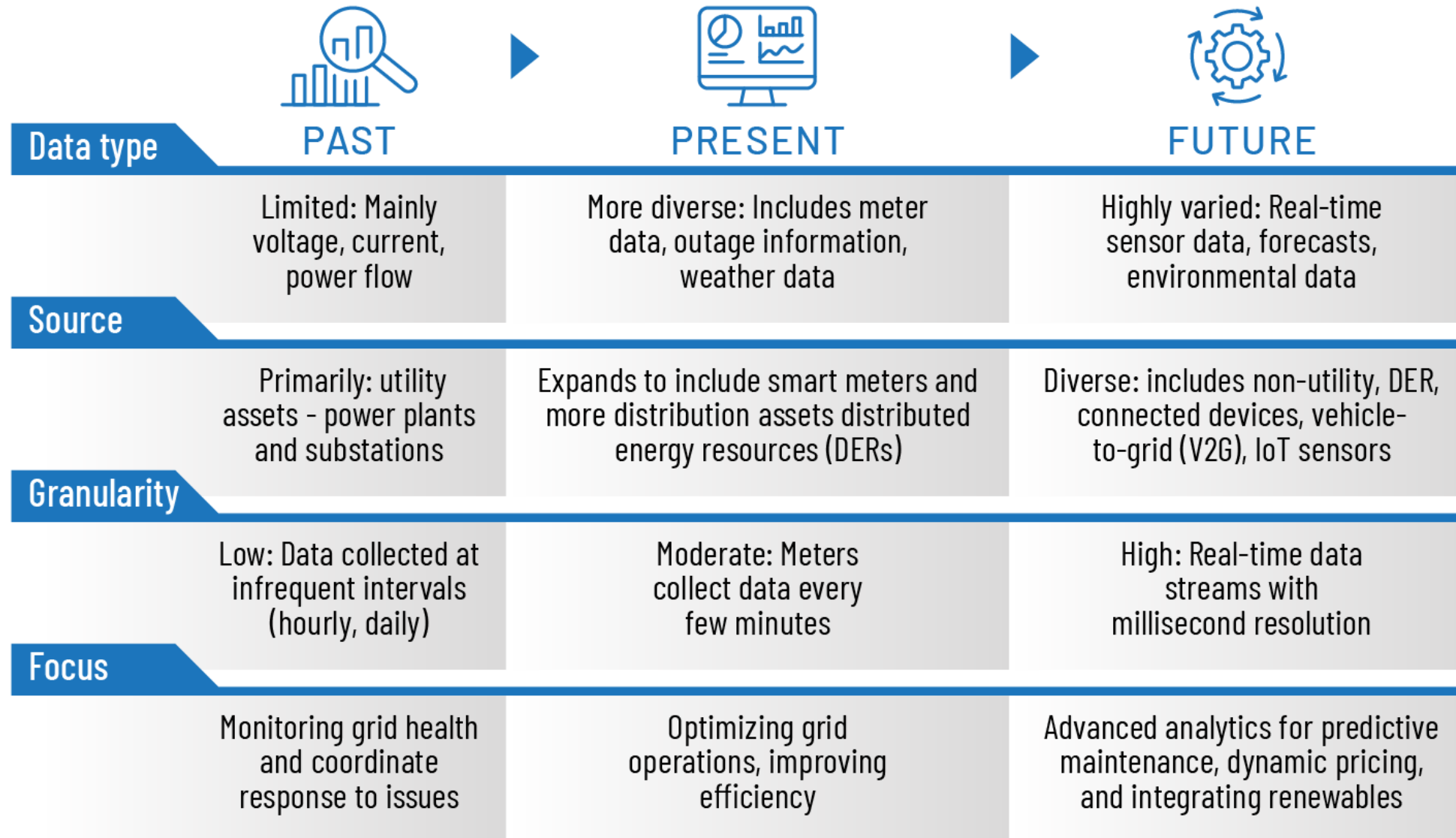| Grid Controls Team	Grid Modeling Team	Grid Cybersecurity and Communications Team	Integrated Systems Planning and Coordination Crosscut

Grid Controls Team

- Mission: **Develop tools to enhance grid operator visibility and control to ensure effective and efficient utilization of new technologies, systems, and resources connected to the grid.**

- OE Grid Controls RDD&D efforts include:
  - Power system situational awareness and measurements
  - Grid edge integration and interoperability standards
  - Electric Sector Data Strategy development
  - Development of controls for integration of new resources and technologies
  - Risk science, decision science, and human factors

The Evolving Role of Grid Data (Operational Perspective)

Data type	PAST	PRESENT	FUTURE
	Limited: Mainly voltage, current, power flow	More diverse: Includes meter data, outage information, weather data	Highly varied: Real-time sensor data, forecasts, environmental data
Source	Primarily: utility assets - power plants and substations	Expands to include smart meters and more distribution assets distributed energy resources (DERs)	Diverse: includes non-utility, DER, connected devices, vehicle-to-grid (V2G), IoT sensors
Granularity	Low: Data collected at infrequent intervals (hourly, daily)	Moderate: Meters collect data every few minutes	High: Real-time data streams with millisecond resolution
Focus	Monitoring grid health and coordinate response to issues	Optimizing grid operations, improving efficiency	Advanced analytics for predictive maintenance, dynamic pricing, and integrating renewables

Credit: Pacific Northwest National Laboratory, for US Department of Energy, Office of Electricity

FOA 3127: Data Analytics Demonstrations

FOA Objectives: support **sensor data analytics** demonstrations for system monitoring and control:

- Demonstration of applications **utilizing existing AMI data**

- Demonstration **utilizing high fidelity synchronized measurement** for grid stability monitoring and control

- Demonstration of applications **utilizing mixes of different sensors** for improving grid resilience, security, and safety leveraging commercial off-the-shelf sensors

Goals: advance the state of the art in utility data analytics

- Tools need to incorporate best practices for human factors, decision science, and cognitive science as much as physics and mathematical methods to be effective.

- Demonstrations that involve direct partnerships with data providers and power sector utilities ensures that the sensor data is useful for the humans that operate, maintain and plan the power system.

Prime Applicant	Project Title
Arizona State University	Data-Driven Reliable and Resilient Operation of Active Transmission and Distribution Systems
Guam Power Authority	Sensor Data Analytics Demonstration
Iowa State University	Data-Driven Automated and Proactive Asset Management to Enhance Reliability and Resilience of Rural Distribution Grids
North Dakota State University	Development and Demonstration of Graph-Based Sensor Data Analytics Tool for Grid Stability Monitoring and Control
New York University	Reliability-Enabled Secondary Distribution Visibility Based on Synergistic Sensor Data Analytics
UC-Riverside	Enhance Data Quality, Event Detection, and Situational Awareness with Machine Learning Algorithms Using Synchrophasor and AMI Data
University of Kentucky	Sensor Data Enabled Utility Asset Capacity Utilization Maximization, Load Modeling, and Event Detection and Location
Vermont Transco LLC	Model-based Adaptive Platform Environment for Real-Time Dynamic Operating Envelopes and Operator Trust (MAPLE ROOT)

FOA 3127 Selections for Data Analytics Demonstrations

Energy Department Invests $7.5M to Enhance Grid Reliability and Resilience through Data Analytics | Department of Energy
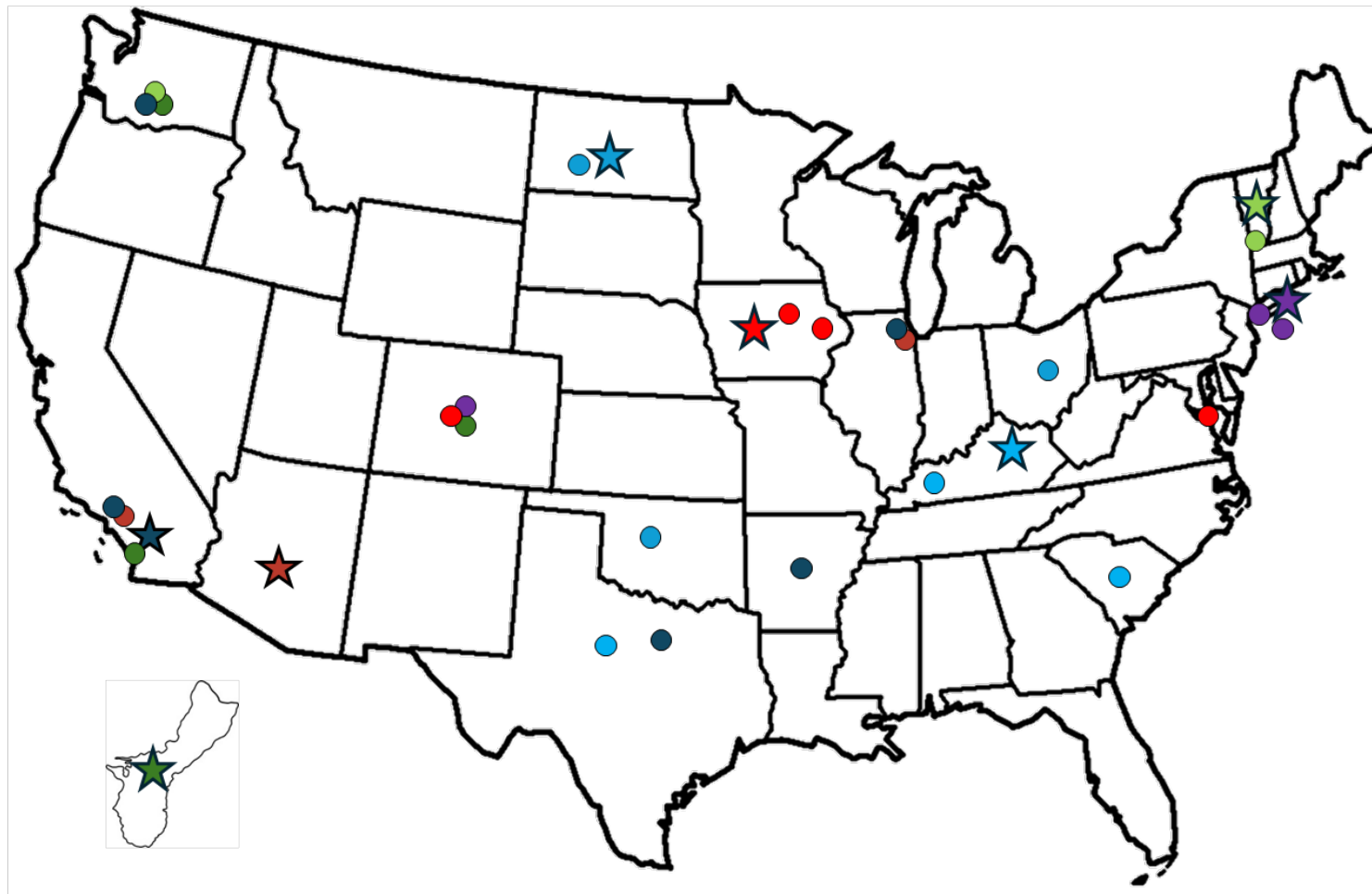
Project Team Location

UK — WKRECC, Milsoft, Sensus

ASU — EPG, Com Ed

UC RIVERSIDE — EPG, Com Ed, SPP, PNNL, Altitude Grid

GPA — PXiSE Energy Solutions, PNNL, NREL

**VELCO** (Vermont electric power company) — Univ. of Vermont, PNNL

IOWA STATE UNIVERSITY — NREL, SparkMeter, Linn County REC, AES, CFU

NDSU — OK Gas & Elec, AEP, MT-Dakota Utilities Co.

NYU — Con Ed, NREL, Itron

Primary Applicant Location: ☆   Team Member Location: ○

- Managing stability grid issues from IBRs
- Cloud-based real-time monitoring
- Health monitoring of distribution transformers
- Data cleaning, event detection, classification
- Distribution capacity utilization
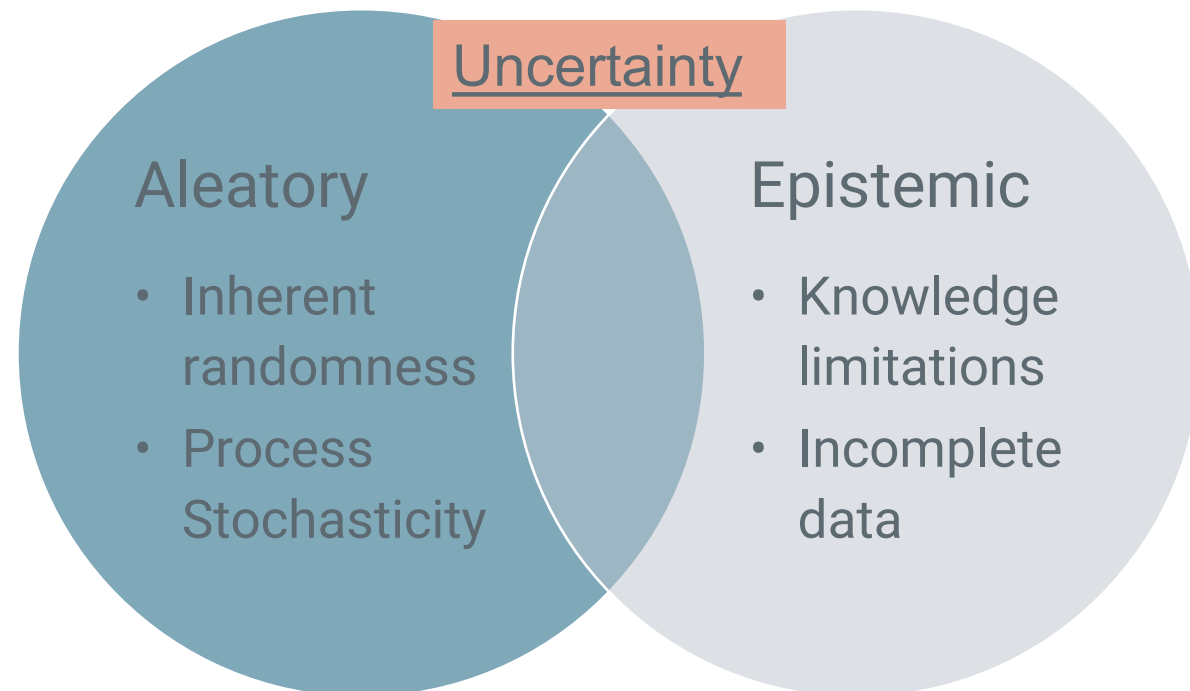- DER load modeling
- Dynamic operating envelopes

Harnessing Contemporary Risk Science to Ground Grid Reliability and Resilience Efforts
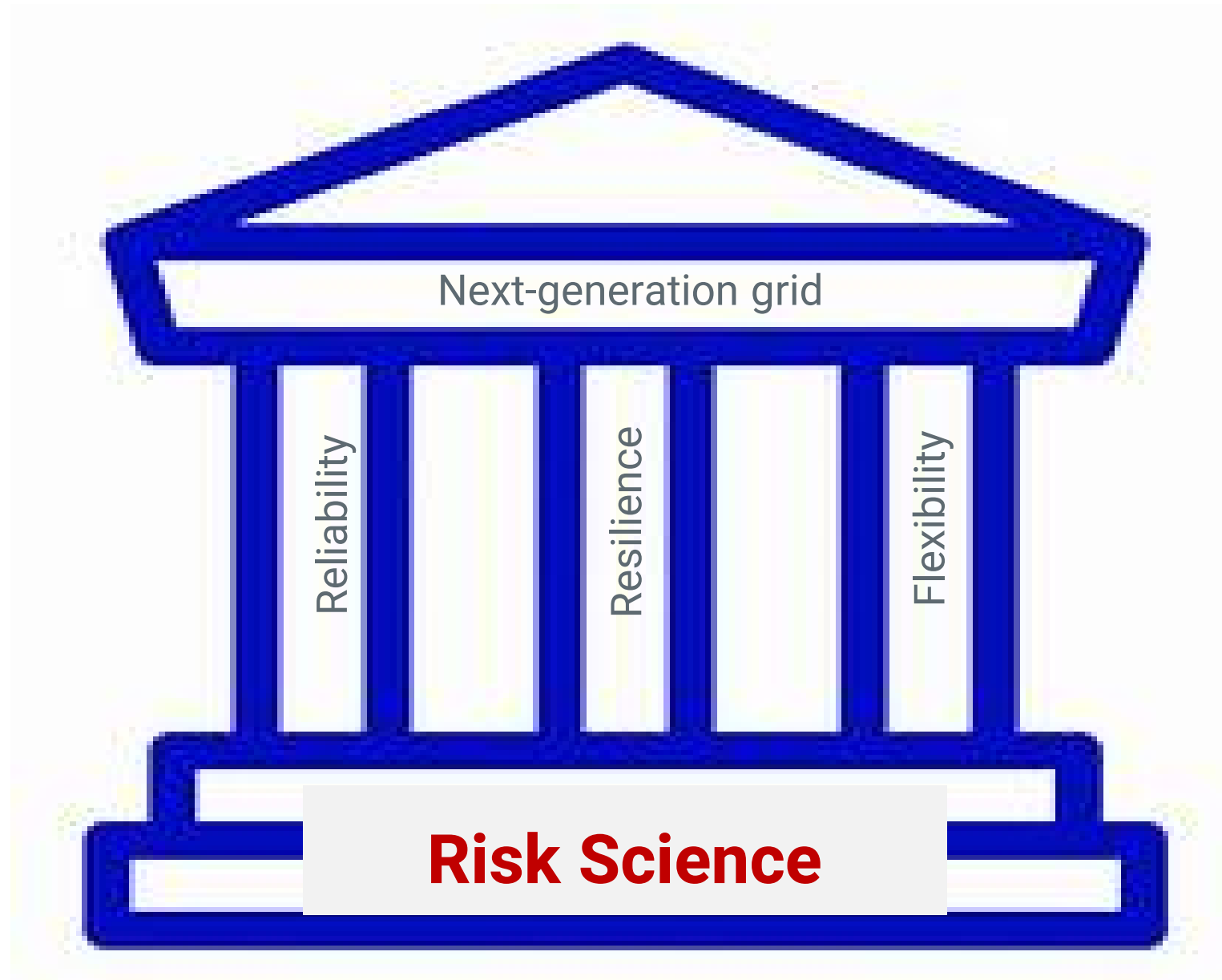
Risk Analysis

✓ What can go wrong?

✓ What are the consequences? Over what time frame?

✓ What is the *likelihood*?

Risk Description=(Hazard Scenarios, Consequences, Uncertainties)$_t$

Uncertainty

Aleatory
- Inherent randomness
- Process Stochasticity

Epistemic
- Knowledge limitations
- Incomplete data

Both types of uncertainty are important to distinguish for risk analysis.

There are significant gaps in how Epistemic uncertainties are reflected in models/approaches/frameworks.

NOI: Human-Centric Analytics for Resilient & Modernized Power sYstems (HARMONY)

Notice of Intent issued on September 17, 2024: [FedConnect: Opportunity Summary](#)

Expected Notice of Funding Opportunity (NOFO) Issue Date: end of CY 2024

Anticipated Objectives:

- Advance the state of the art for power system uncertainty and risk metrics

- Help human operators receive actionable information to better understand, predict, prevent, and mitigate cascading failures in power grids

Anticipated Awards:

- Due to earlier stage R&D focus: Higher education and research institutions preferred leads

- Partnerships with utilities and technology providers are highly encouraged

- $5M Total DOE Share

- Up to four (4) awards in FY 2025

- Three-year period of performance for R&D activities

[OE announcement linked here](#): **Two New Grid Modernization Funding Opportunities**