



Session 3

ARGONNE SUPPORT TO THE OSCE VIRTUAL COMPETENCY AND TRAINING CENTRE ON THE PROTECTION OF CRITICAL ENERGY NETWORKS (POCEN)
27TH OSCE ECONOMIC AND ENVIRONMENTAL FORUM, 11 – 13 SEPTEMBER 2019, CZERNIN PALACE, PRAGUE

CYBER-ATTACK ON THE BIG CITY ELECTRIC GRID



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PRESENTATION OUTLINE

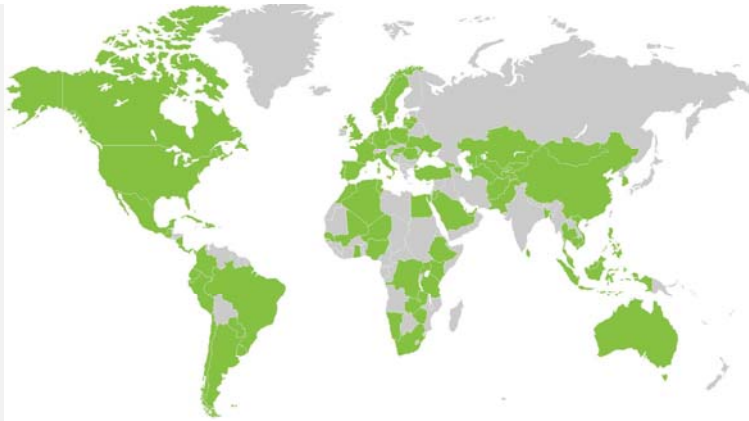
- Argonne capability overview
- Why we need to prepare: cyber attack outage scenario
 - Impacts to the Big City electric grid
 - Interdependencies and cascading impacts
- Argonne PoCEN contribution

 THE UNIVERSITY OF CHICAGO  U.S. DEPARTMENT OF ENERGY Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

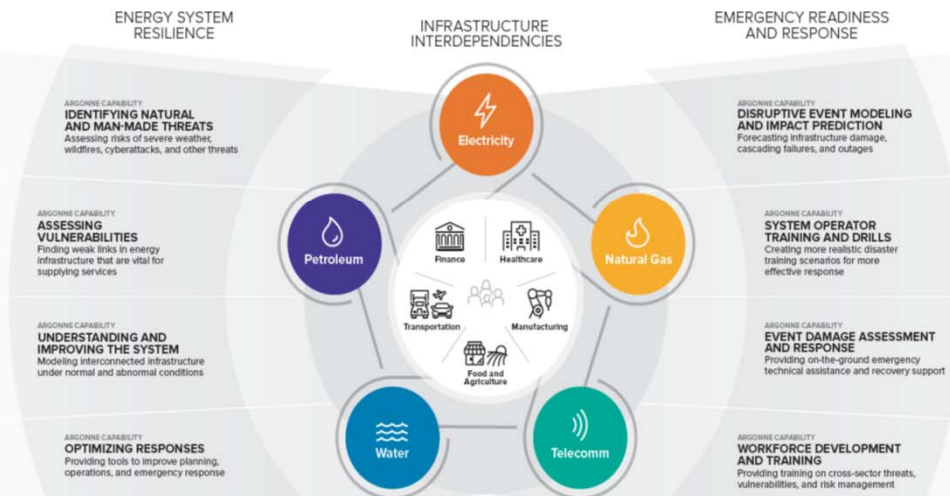
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ARGONNE GLOBAL TRAINING FOOTPRINT

- Extensive experience conducting energy security and resilience training for U.S. and international partners.
- We have conducted over 250 training events in the last five years for professionals in over 55 countries.



BUILDING CRITICAL ENERGY INFRASTRUCTURE RESILIENCE





CYBER-ATTACK SCENARIO OVERVIEW

Power outage incident analyzed for Big City region is a catastrophic cyber-attack on the power grid

- Conducted by unidentified hostile actors.
- The resulting blackout impacts 4 states leaving 7 million people without power
- Power is projected to be restored to the majority of people in the Big City within 24 hours
- Approximately 30% of the area will be without electricity for 14 days or longer

Significant cascading effects include impacts to one of the nation's largest refineries, which may be out-of-service for one month, multiple international airports that will struggle to operate on backup power supply, and disruptions to the region's water and communications infrastructure

Hypothetical scenario while improbable is technologically possible:

- Analysis assumes events can theoretically occur as they are presented

NOTIONAL

DETAILS OF CYBER-ATTACK

Hackers covertly disable safety systems that protect the generators from desynchronization events

- Cyber-attacks prompt generator desynchronization, partially destroying some generators
- Attack occurs during summer peak-day conditions
- Sudden reduction in generation at multiple sites leads to cascading outages and blackouts

NOTIONAL

RESULTS OF CYBER-BASED ATTACK ON ELECTRIC SECTOR IN BIG CITY REGION

Cyber attack affects large power plants in Big City

- Overall total load loss is about 150 GW of the 170 GW overall demand for Big City region
- **A large portion of the grid interconnection collapses due to desynchronization events**



NOTIONAL

ESTIMATING DAMAGE TO AFFECTED POWER PLANTS FOR ALL UNITS IN BIG CITY

Analysis approach assumes that power plants with on-site staff would shift control to manual operations and shut down plant

- Assume that on-site staff would either hear the generator(s) bounce and shake or observe smoke
- Quick action by the onsite staff is assumed to limit the amount of damage
- Assume **MINOR DAMAGE** with an average repair time of 14 days



The diesel generator used in the Aurora Generator Test beginning to smoke

NOTIONAL

ESTIMATING DAMAGE TO AFFECTED POWER PLANTS FOR ALL UNITS IN BIG CITY (CONT.)

It is assumed that remotely controlled power plants (those without on-site staff) could incur major damage

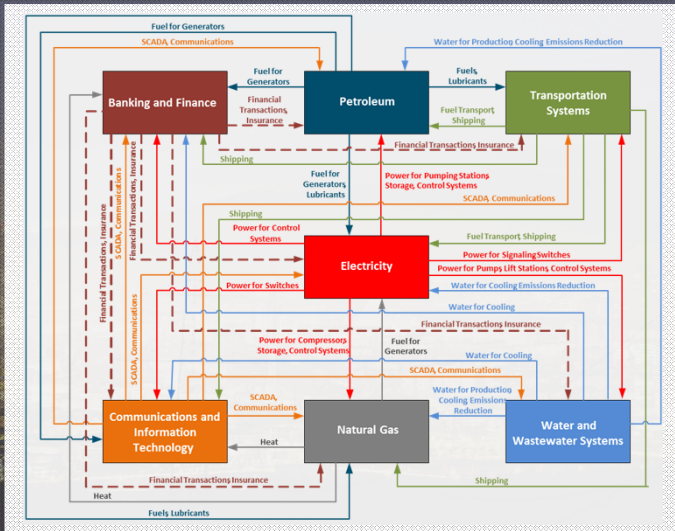
- Remotely located control room staff initially would be unaware of any problems at the power plant and therefore would not shut down the affected units
- Potential for generator to spin uncontrollably and incur major damage
- Assume **MAJOR DAMAGE** with repair times of 6 months and beyond



The diesel generator used in the Aurora Generator Test beginning to smoke

NOTIONAL

CRITICAL INFRASTRUCTURE INTERDEPENDENCIES



Electricity infrastructure is highly interdependent with other sectors.



ENERGY: OIL SUBSECTOR

Petroleum

- 4 refineries have lost all grid-supplied electricity, including nations largest
- 8 of 17 petroleum pumping stations affected
- 39 of 60 affected petroleum bulk terminal storage sites affected



NOTIONAL



WATER SECTOR

Water treatment plants

- 450 affected water treatment plants
- 110 affected wastewater treatment plants



NOTIONAL

TRANSPORTATION SECTOR

Transportation

- 3 major public airports affected
- 5 of 7 petroleum ports affected
- Regional mass transit system affected



NOTIONAL

ARGONNE FY20 POCEN CONTRIBUTION

Deliver the following proposed courses:

- Introduction to Risk Analysis
- Intermediate Risk Analysis
- Cyber Analysis
- Critical Infrastructure Fundamentals
- Dependency Analysis

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