U.S. DEPARTMENT OF ENERGY | OFFICE OF CYBERSECURITY, ENERGY SECURITY, AND EMERGENCY RESPONSE

# Cyber Resilient Energy Delivery Consortium (CREDC)

## University of Illinois

**Prof. David M. Nicol**

**Cybersecurity for Energy Delivery Systems Peer Review**

November 6-8, 2018

# Summary:

CREDC
CYBER RESILIENT ENERGY DELIVERY CONSORTIUM

## Objective

- Identify and conduct cutting-edge research. Develop and demonstrate solutions and technologies that advance cyber security and resiliency in energy delivery systems (EDS)

## Schedule

- Oct 2015 to Sep 2020
- CREDC emphasizes that solutions must be adoptable, validated in realistic settings, and available. The consortium has a programmatic goal of achieving self-sufficiency at the end of the project performance period

| | |
|---|---|
| **Total Value of Award:** | **$ 28.1 M ($22.5 + $5.6)** |
| **Funds Expended to Date:** | **50.49% (Fed portion)** |
| **Performer:** | **University of Illinois at Urbana-Champaign** |
| **Partners:** | **Argonne National Laboratory, Arizona State University, Dartmouth College, Massachusetts Institute of Technology, Old Dominion University, Oregon State University, Pacific Northwest National Laboratory, Rutgers University, Tennessee State University, the University of Houston, Washington State University and Industry** |

# Advancing the State of the Art (SOA)

Viewed broadly…beyond just our research projects

Value-add of an academic consortium to industry is

- knowledge sharing: webinars (6 industry presenters this year), and newsletters, workshops and industry events reportedly all has value to industrial stakeholders
- access to students

## Sample Research Projects

### Cyber-protection Technology

- ASSURED CYBER SUPPLY CHAIN PROVENANCE USING PERMISSIONED BLOCKCHAIN *(with EPRI, Reliability First, NRECA )*
- PREVENTOTPHYSDAMAGE: ANTICIPATING AND PREVENTING CATASTROPHIC OT PHYSICAL DAMAGE THROUGH SYSTEM THINKING ANALYSIS *(with ExxonMobil, Engie, Hitachi, Schneider Electric )*
- REAL-TIME CYBER ANALYSIS TO IMPROVE OPERATIONAL RESPONSE TO A CYBER ATTACK (*with Austin Energy )*
- LARGE-SCALE AND LONG-LIVED ENERGY DELIVERY INFRASTRUCTURE *(with Automatak, Dover Energy, General Electric, Waterfall Security )*

# Advancing the State of the Art (SOA)

**Cyber Monitoring, Metrics, and Evaluation**

- ANOMALY DETECTION FOR SECURING COMMUNICATIONS IN ADVANCED METERING INFRASTRUCTURE *(with IBM Research, Cisco, Schneider Electric)*
- EVALUATING EFFECTIVENESS OF AN EMBEDDED SYSTEM ENDPOINT SECURITY TECHNOLOGY ON EDS OT *(with Siemens, Schneider Electric, NRECA )*

**Data Analytics for Cyber Event Detection, Management, and Recovery**

- SUPPORTING SECURITY WITH ADVANCED MULTIMODAL GRID DATA ANALYTICS *(with Riverside Public Utilities, EPRI, OSISoft)*
- TOWARDS ATTACK RESILIENT DATA ANALYTICS FOR POWER GRID OPERATIONS *(with Schweitzer Eng. Labs, Pacific Power )*

**Resilient EDS Architectures**

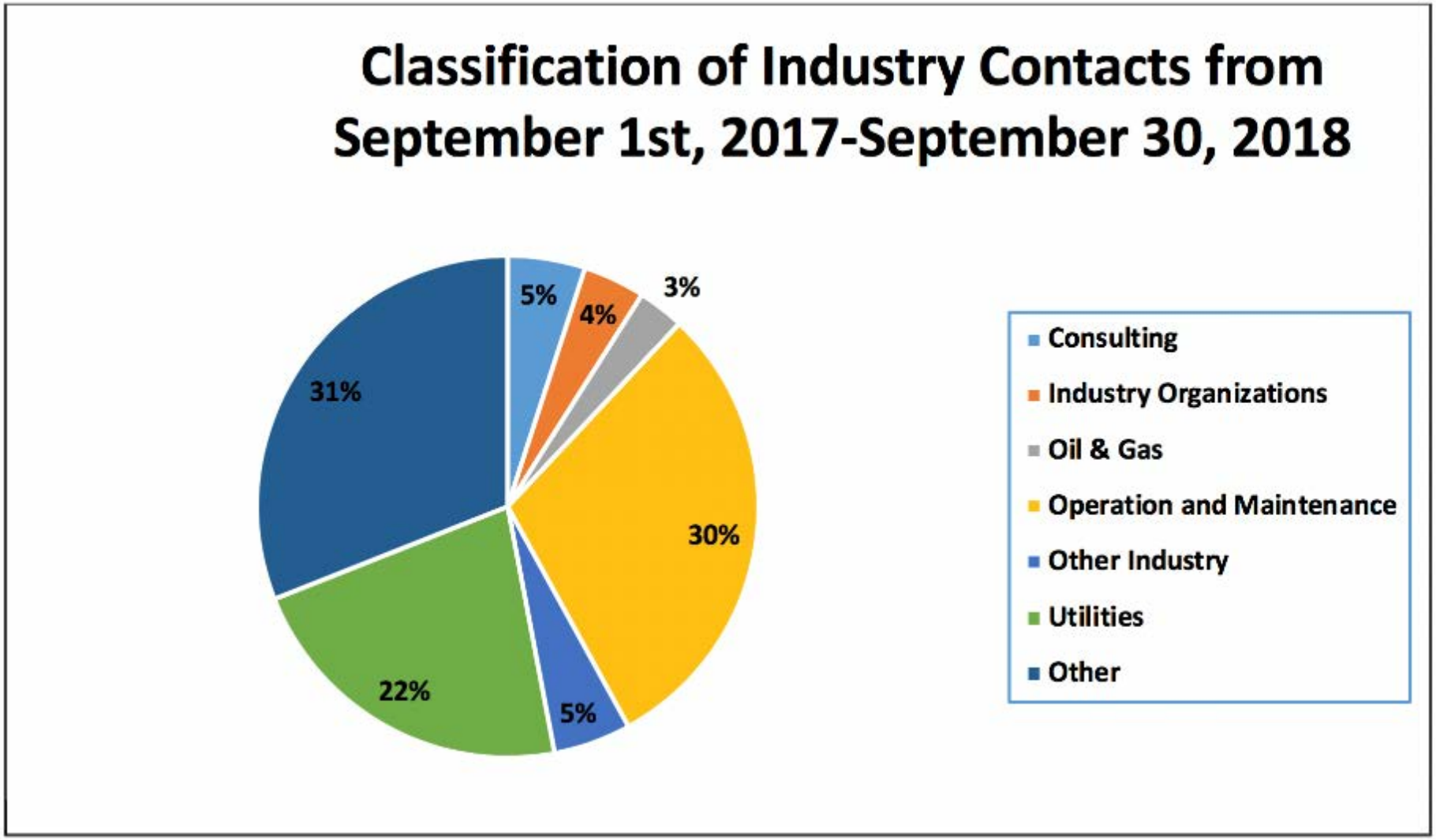
- MODELING SECURITY RISK TO AND RESILIENCY OF EDS USING SOFTWARE-DEFINED NETWORKS AND ROBUST NETWORKED CONTROL SYSTEMS *(with Accenture Technology Labs, MidAmerican Energy )*

# Progress to Date

## Major Accomplishments

- 30 concurrent research projects to address the cybersecurity and resiliency of the EDS.  21 report involvement with industry (the others are being pushed…!)
  - Sep 17- Sep 18, 53 presentations, 106 publications
- Concrete tech transfer to industry (e.g. collaborations with Reliability-First, GE, Siemens and Cisco Systems)
- Increased interaction with industry
  - 94 distinct entities in Sep 17 – Sep 18
- MOU signed with Electric Power Research Institute (EPRI) to explore research collaboration / funding post award
- SEEDS & CREDC selected for NSF-IUCRC  planning grant
- Successful 2018 CREDC Industry Workshop with overall increase in attendance with increased industry attendance and participation

# Progress to Date



# Challenges to Success

## Continue to face challenges in establishing partnerships with Oil and Gas industry

- Attend and present at Oil and Gas industry forums (e.g. LOGIIC annual meeting, AGA member meetings, Discussions with AFPM and Gas Technology Institute for future collaboration)
- Next CREDC industry event to be in Houston

## Sustainability model

- Align activities with the value industry sees in academic consortium
- Number of industry entities wanting university developed *artifacts* is small. Number wanting university *knowledge* is large
- Have to develop viable model for transition to practice
- Have to develop other means which can support research funding
  - Services, education

# Collaboration/Technology Transfer

## Transfer of technology/knowledge to end user

- CREDC research projects benefit across spectrum
  - Some benefit asset owners, some benefit vendors, some benefit other companies
  - The successful tech transition paths were recently showcased at the 2018 CREDC Industry Workshop on September 11-13
    - Reliability Metrics, with Reliability-First
    - LangSec, with General Electric
    - AMI anomaly detection, with Cisco
    - PLC security, with Siemens
  - Some of the same paths were also published in the July 28 issue of the DOE's FROM INNOVATION TO PRACTICE: RE-DESIGNING ENERGY DELIVERY SYSTEMS TO SURVIVE CYBER ATTACKS report
  - V&V process for software artifacts in transition

# Next Steps for this Project

## Approach for the next year or to the end of project

- Continue to build and develop existing and new industry connections
- Encourage research focus on meeting industry identified gaps leading to more tech transition opportunities
- Work towards sustainability model with strategic research alliance with EPRI
- Develop within the NSF-IUCRC
- Increase industry focus in CREDC Industry Workshop and Summer School format
- Expand, educate and encourage collaboration between academia and industry

# Questions?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