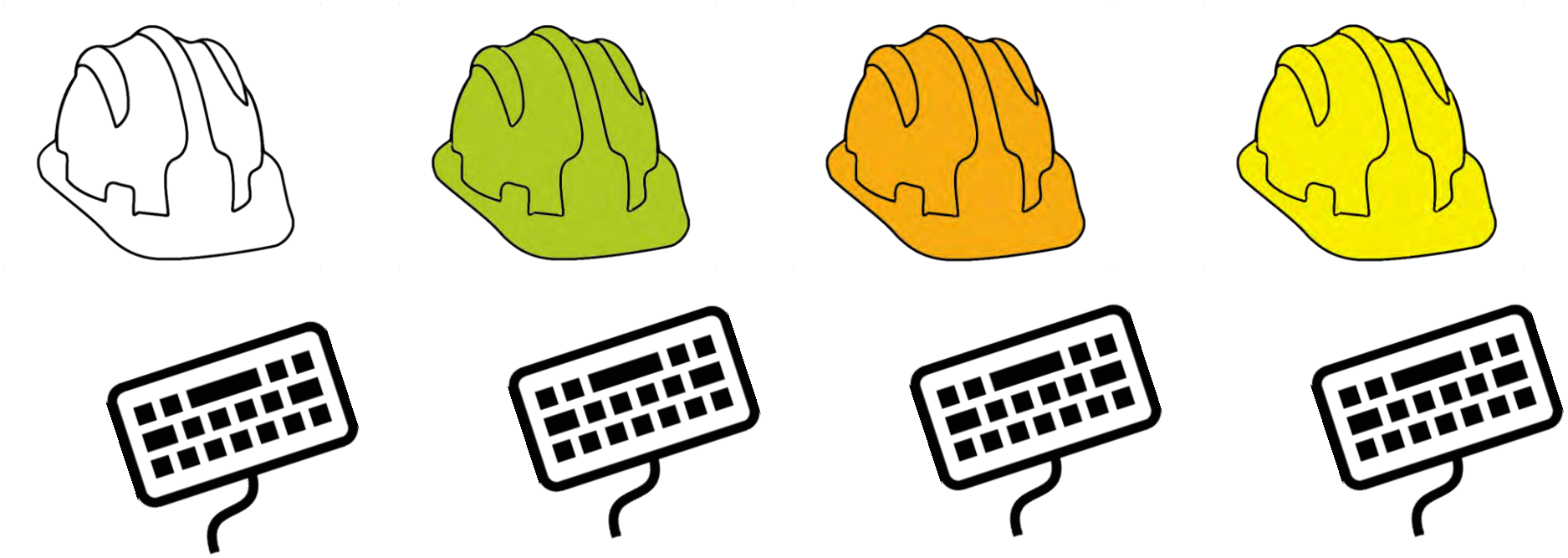
CYBER RESILIENT ENERGY DELIVERY CONSORTIUM

CREDC in a nutshell

- identify and perform cutting edge research and development **whose results are actually used** to increase cyber-resiliency of energy delivery systems



Supporting objectives

- Understand EDS cyber-resiliency investment from C-suite perspective
- Identify impediments and find highest impact *adoptable* solutions
- Develop, validate, verify high impact solutions, with industry
- Make solutions available
- Develop model of operation that is ultimately self-supporting

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Educational Goals

- Develop cyber/energy aware graduates for industry and academia
- Create workforce development curriculum
- Create and deliver workshops to industry (e.g. at industry oriented forums
- Create and deliver summer school
- Create K-12 hands-on and interactive educational materials

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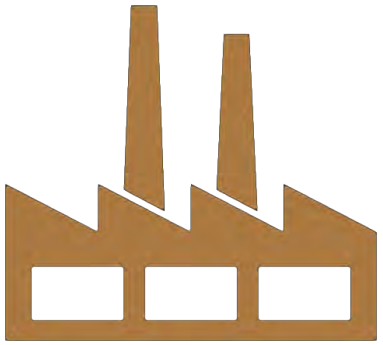

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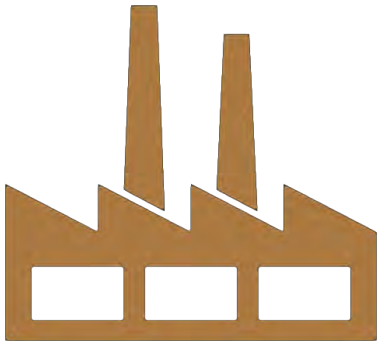

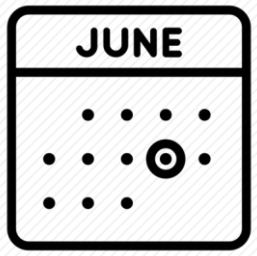

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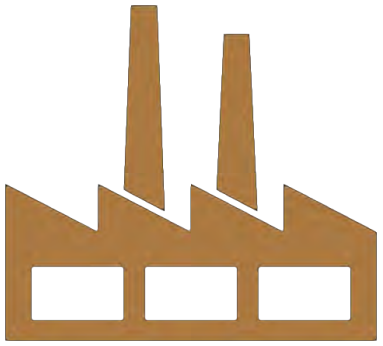
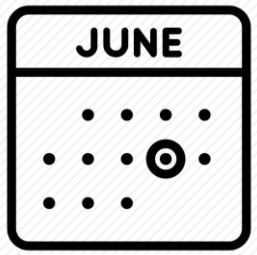

CREDC Research Team

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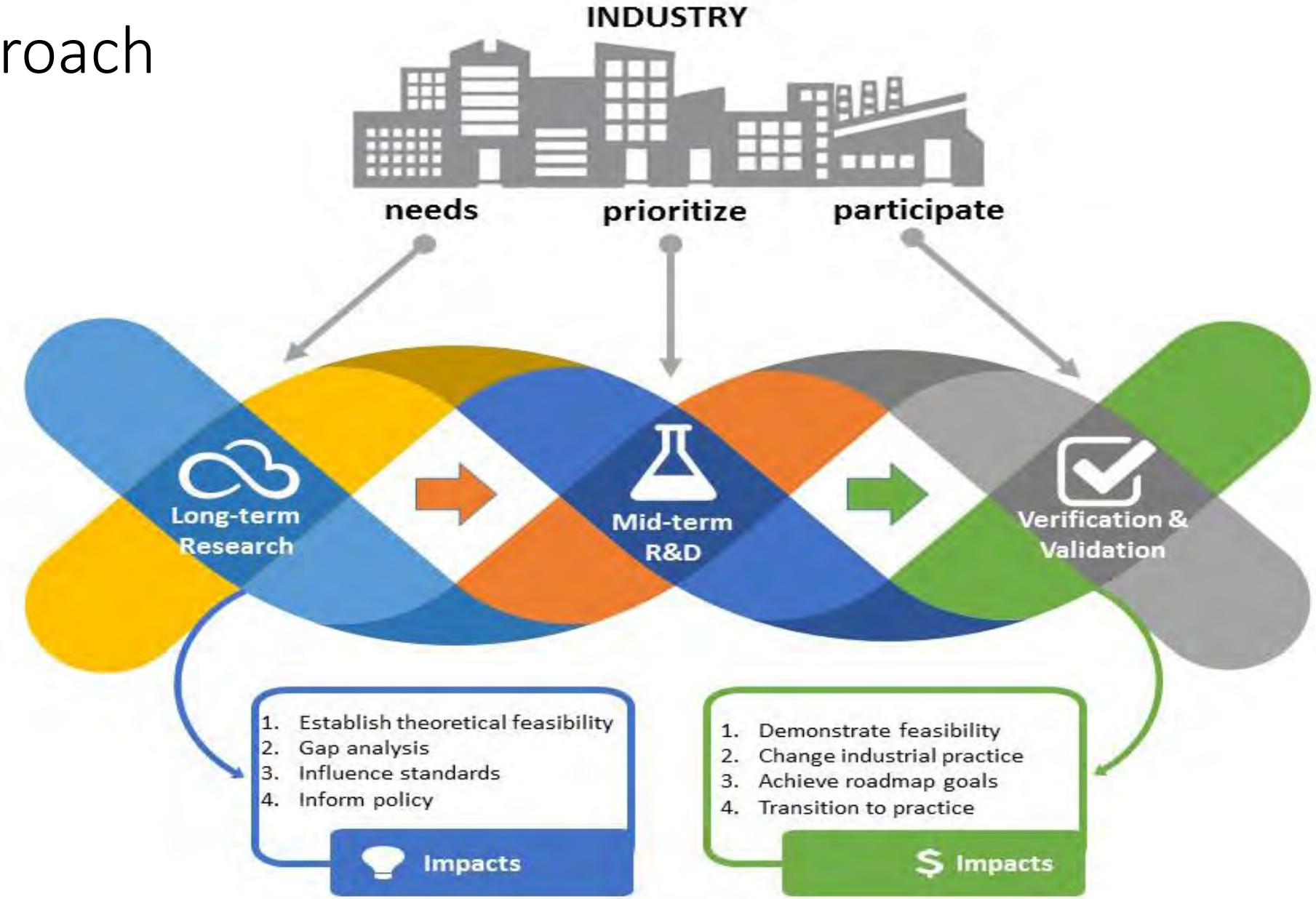
Paul Skare

Argonne NATIONAL LABORATORY

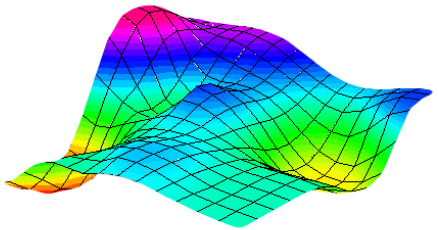
Shabbir Shamsuddin

Approach


INDUSTRY
needs
prioritize
participate
Long-term Research
Mid-term R&D
Verification & Validation
1. Establish theoretical feasibility
2. Gap analysis
3. Influence standards
4. Inform policy
Impacts
1. Demonstrate feasibility
2. Change industrial practice
3. Achieve roadmap goals
4. Transition to practice
Impacts

Trends shaping CREDC research and DOE Roadmap goals

- Technology that creates new attack surfaces,
  - IoT, cloud, distributed generation, electric vehicle infrastructure
- Evolving adversary
- Push towards standardization and compliance
- Increased integration of renewable energy
- Increased monitoring and control



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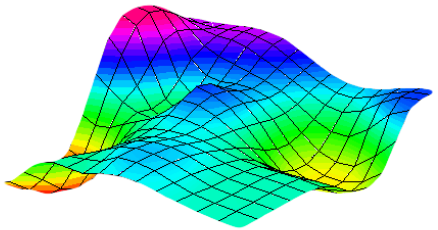

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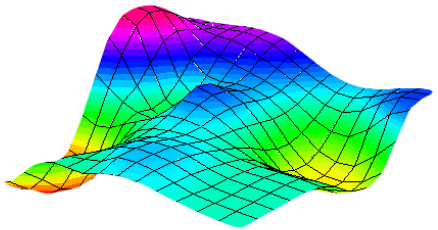

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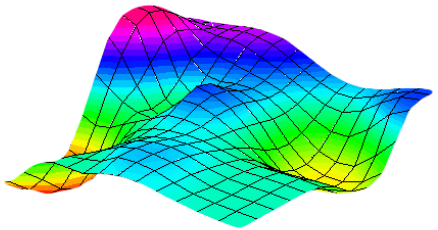

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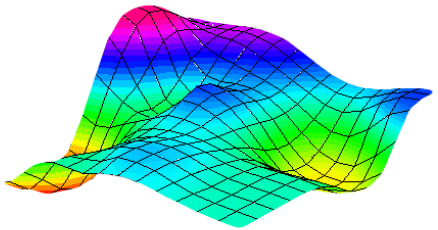


Activity Tracks

Long-term Research

- Long-term issues, multi-year research, prime pump for mid-term research

Mid-term Research and Development

- Industrial prioritization, industrial partnership, 2-year horizon to prototype

Verification and Validation

- Develop testbed capabilities, support evaluation, curate open data

Industry Outreach and Impact

- Industry day, workforce development, white papers, liason, summer school

K-12 Education and Public Outreach

- outreach to students and educators r.e. resilient energy delivery

Industry

Key Roles : Advising, partnership, support

Industry Advisory Board (IAB)

- Executive level “Inner circle” who work with CREDC leadership on strategic research & transition to practice

Industry Participation Board (IPB)

- Technical partnership on medium-term activities, expertise all levels, sustained interaction

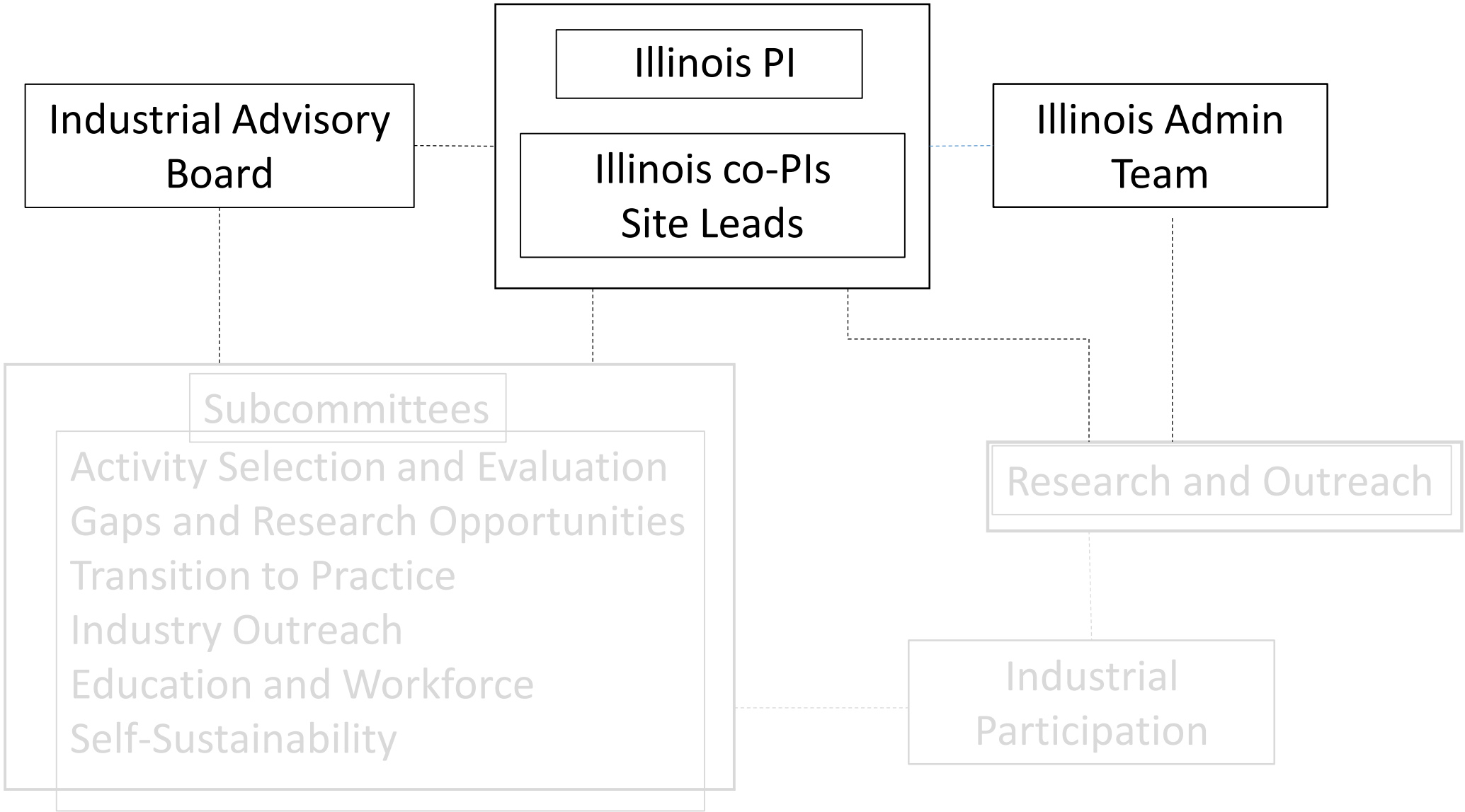
CREDC Members

- Membership paying entities, early access, direct mid-term activity input

Industrial Advisory Board

- **Mark Browning,** Exelon Utilities
- **Dennis Gammel**, Schweitzer Engineering Laboratories
- **Richard Jackson**, formerly with Chevron Corporation
- **Himanshu Khurana**, Honeywell Building Solutions
- **Blake Larsen**, Western Refining
- **Scott Mix**, North American Electric Reliability Corporation (NERC)
- **Paul Myrda**, Electric Power Research Institute (EPRI)
- **David Norton**, Federal Energy Regulatory Commission (FERC)
- **Kymie Tan**, Jet Propulsion Laboratory, Cyber Defense Engineering and Science Directorate
- **Zach Tudor**, SRI International, Computer Science Laboratory

Project Management



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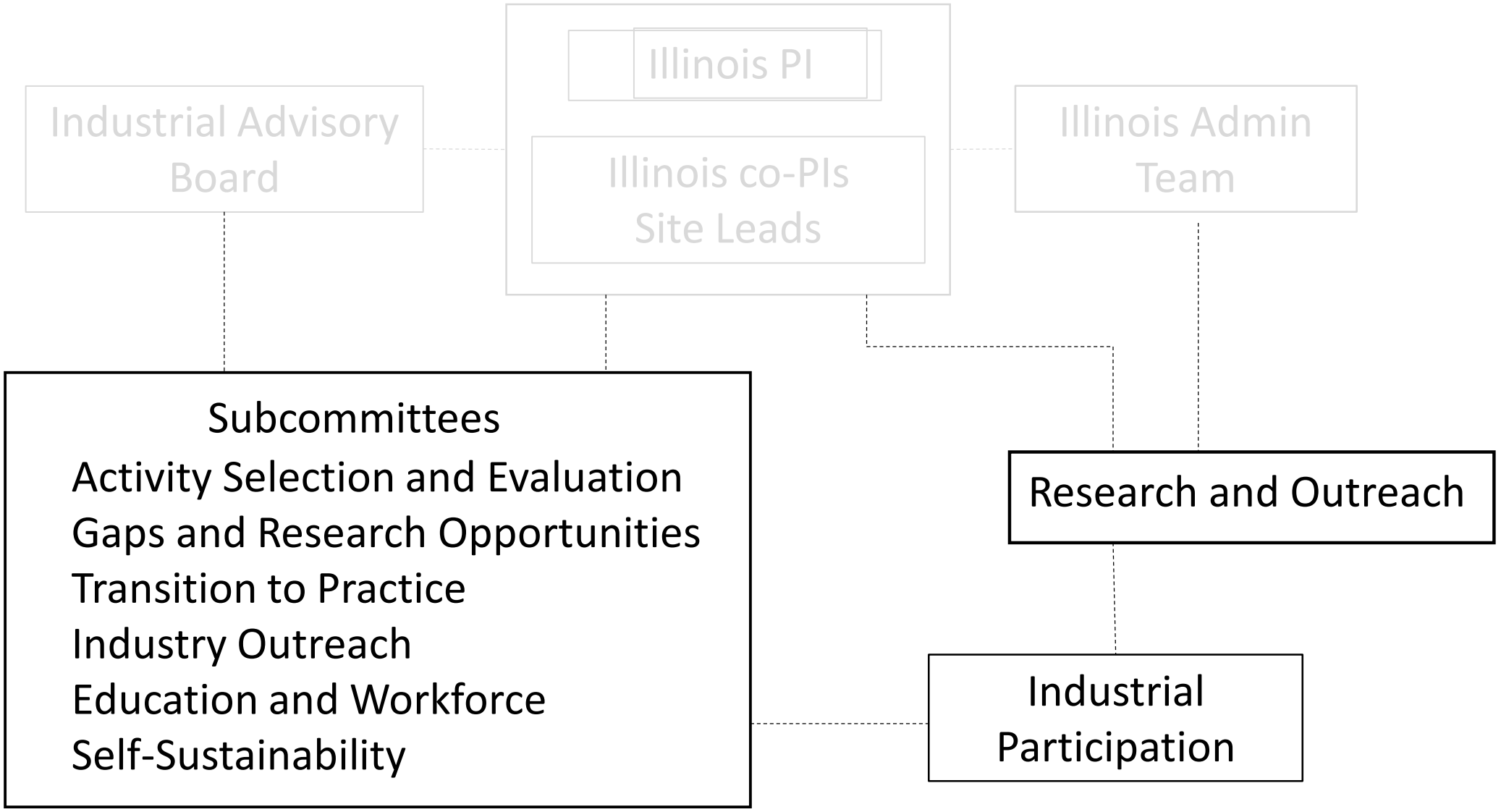

CREDC Research Tasks

Mid-term Research and Development

- Light-weight, delay-aware, and scalable cryptographic services for Smart-Grid systems
- Secure, dynamic interoperability of micro-grid assets
- PMU Data Quality (transition from TCIPG)
- Robust and Secure GPS timing (transition from TCIPG)
- Anomaly Detection for Securing Communications in Advanced Metering Infrastructure (transition from TCIPG)

Long Term Research Areas

- Cyber Protection Technologies
- Cyber Monitoring, Metrics, and Event Detection
- Risk Assessment of EDS Technologies and Systems
- Data Analytics for Cyber Event Detection, Management, and Recovery
- Human and Organizational Decisions
- Resilient EDS Architectures and Networks
- Impact of Disruptive Technologies on EDS

Cyber-protection Technologies

- Develop new technologies and enhance existing technologies to protect EDS from cyber-attack, emphasis on using physical models for validation / spoof detection

Cyber Monitoring, Metrics, and Evaluation

- Identify metrics that correlate with cyber events
- Monitor w/o disturbing EDS
- Leverage physical state for validity checks
- Account for uncertainties and unknowns in data, metrics correlation with cyber-events, risk of non-response, costs of dynamic response, effectiveness of solution

Risk Assessment of EDS Technology and Systems

- Forecasting cyber security events in EDS
- Cyber-physical modeling and analysis, quantification of risk
- Security risks in dynamic EDS
- Data privacy in EDS information systems

Data Analytics for Cyber Event Detection, Management, Recovery

- Analyze volumes of EDS data to identify evidence of events that threaten resiliency, such as the presence of malicious actors or tampered data

Human and Organizational Decisions

- Understand how the perception of humans and organizations w.r.t. security and resiliency impacts decision-making. Develop communication-to-C-Suite strategies

Resilient EDS Architectures and Networks

- Explore how emerging networking technologies (e.g. software-defined networking) can be used in EDS to increase robustness, security, and resiliency

Impact of Disruptive EDS Technologies on EDS

- Identify technology gaps impacting EDS resiliency in anticipation of coming impacts on how EDS systems are organized, cyber-technologies used on them, and on new threats to resiliency that will be exposed.

Verification and Validation

Ensure that CREDC technologies is designed to meet customer needs, is implemented correctly, and meets technical specifications

Remote Management

- Design, execute, analyze experiments without physical access

Test-bed Federation

- Develop technology for combining assets of distributed test-beds, and an understanding of the contexts where this is technically and scientifically feasible

Design and Execute V&V Evaluations

- Final step in mid-term project delivery

What’s next?

Engage energy industry stakeholders with CREDC research and development efforts.

- **Lightning Talks**
  – proposals due March 1
- **Breakout Sessions**
- **Featured Presenters**
- **Research Poster Session**

Important Deadlines:
Feb. 27: Hotel Block
Mar. 1: Lightning Talk Proposals
Mar. 14: Registration
http://cred-c.org/iw2016/

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