U.S. DEPARTMENT OF ENERGY
Office of Electricity

TRAC Program Overview

Kerry Cheung, PhD

Program Manager

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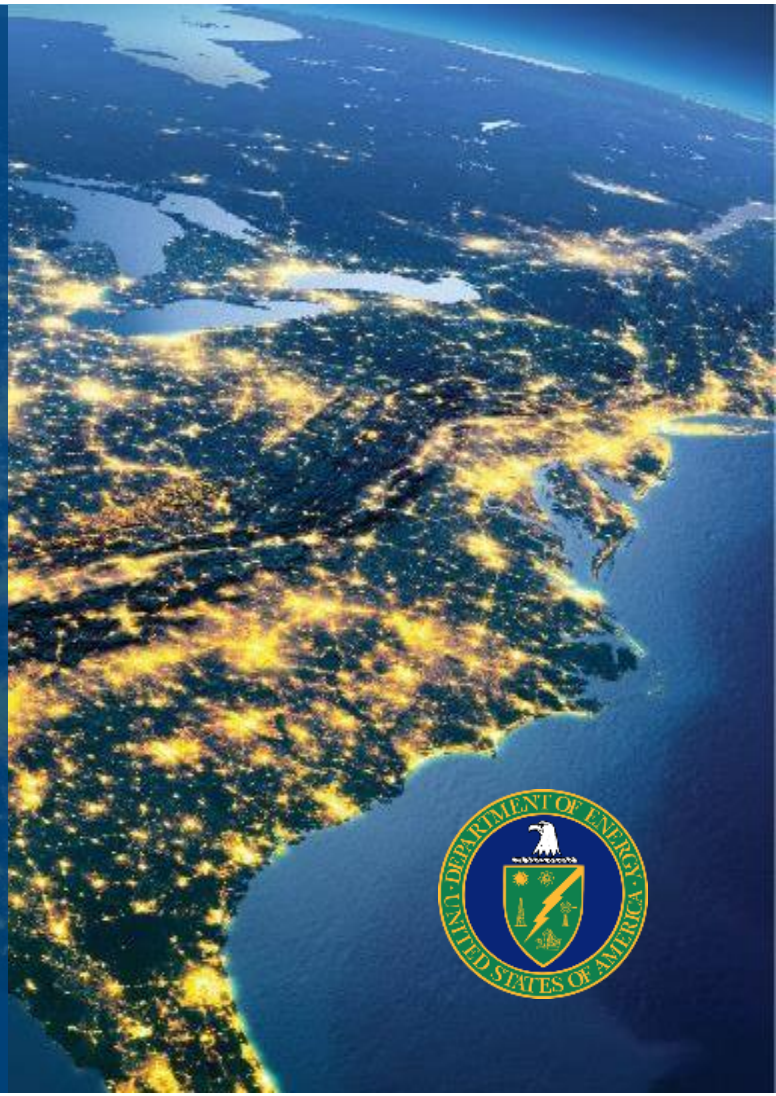
Mission

Office of Electricity (OE)

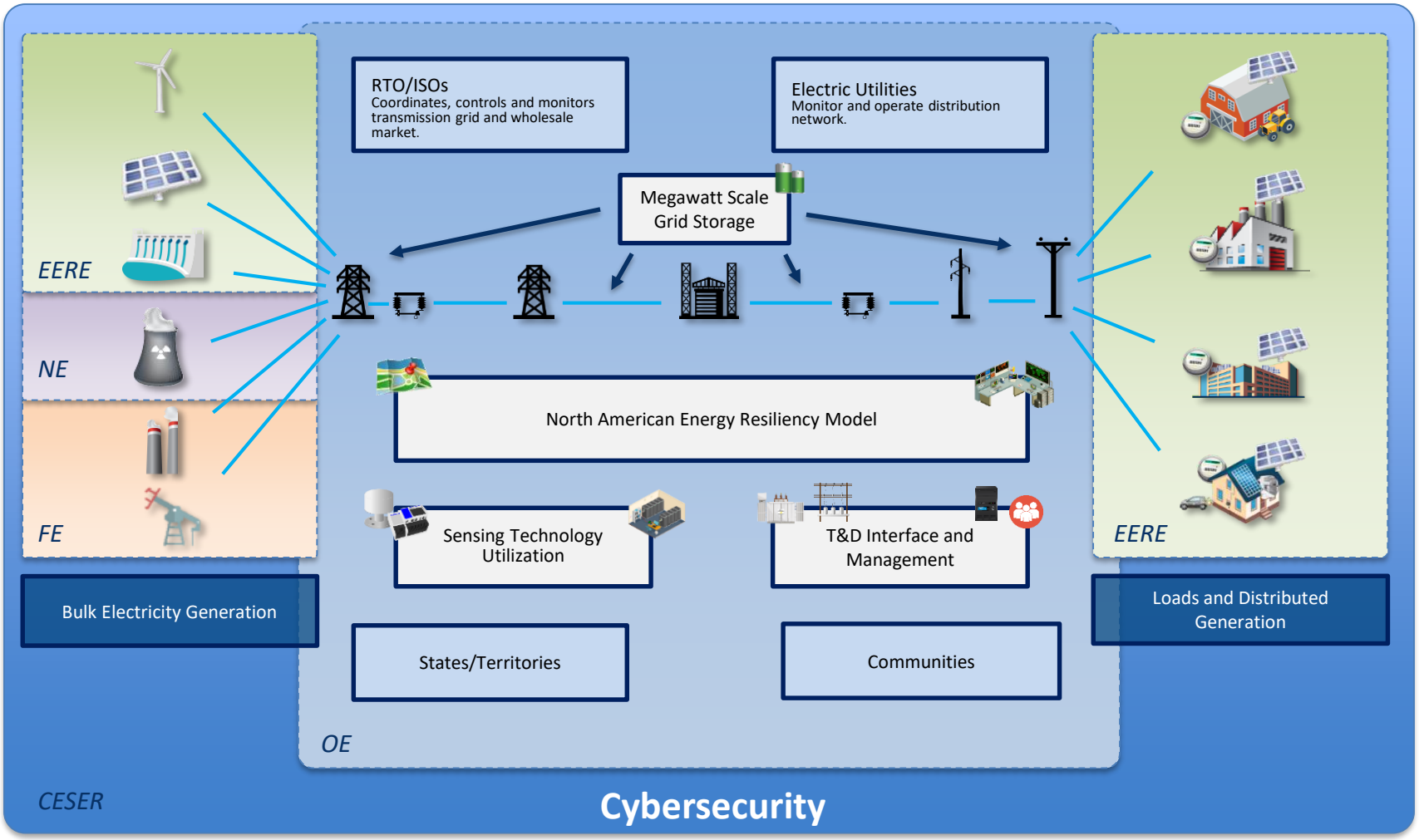
- Provide national leadership to ensure a secure, resilient and reliable energy delivery system.
- Develop technologies to improve the infrastructure that brings electricity into our homes, offices, and factories.
- Support development of the federal and state electricity policies and programs that shape electricity system planning and market operations.
- Drive electric grid modernization and resiliency through research, partnerships, facilitation, and modeling and analytics.

energy.gov/oe



Electric Power System vs. Electric Power Grid

Electric Power Grid



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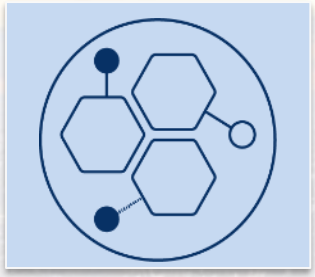
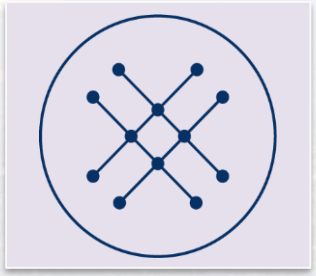
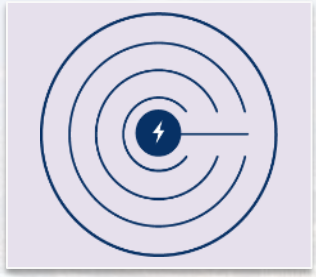
OE Advanced Grid R&D Portfolio



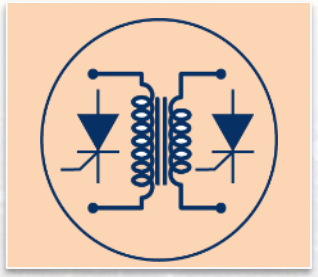
Advanced Grid Modeling



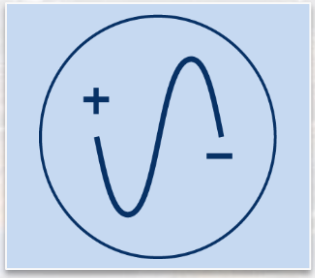
Microgrids



High Fidelity; Low-Cost Sensors

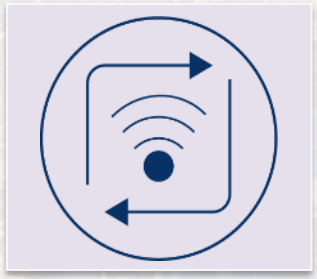


Advanced Power Grid Components

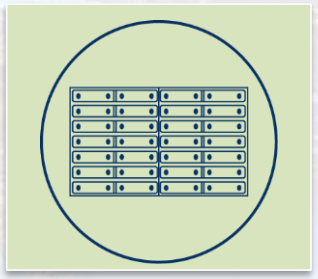


Synchrophasors

Advanced Distribution Systems



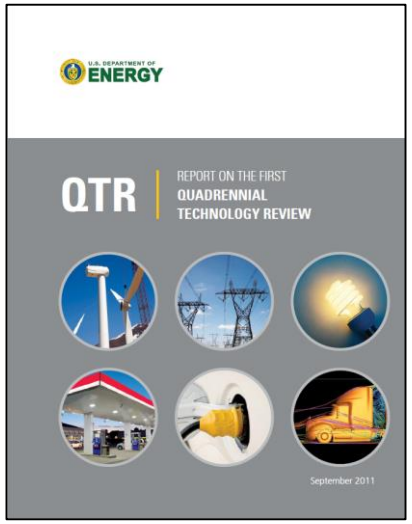
Dynamic Controls & Communications

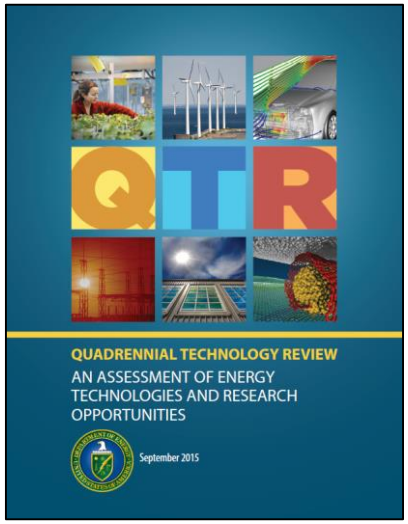


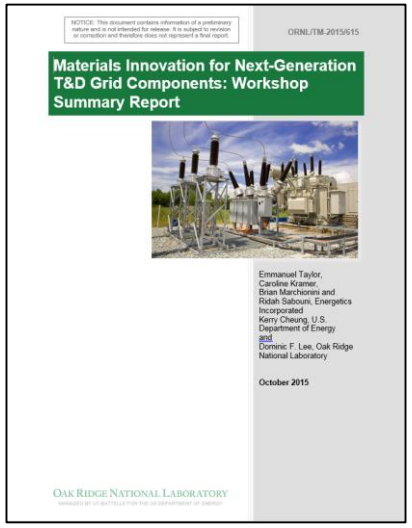
Energy Storage Systems

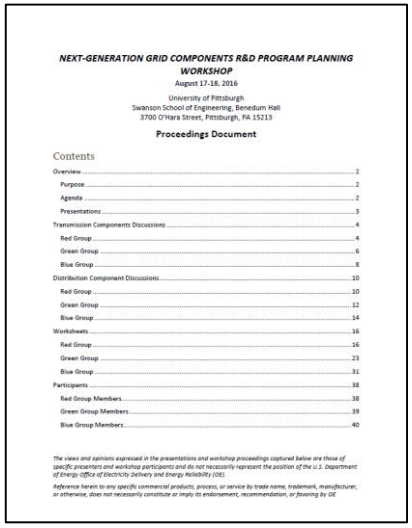
Transmission Reliability and Resilience	Resilient Distribution Systems	Transformer Resilience and Advanced Components	Energy Storage

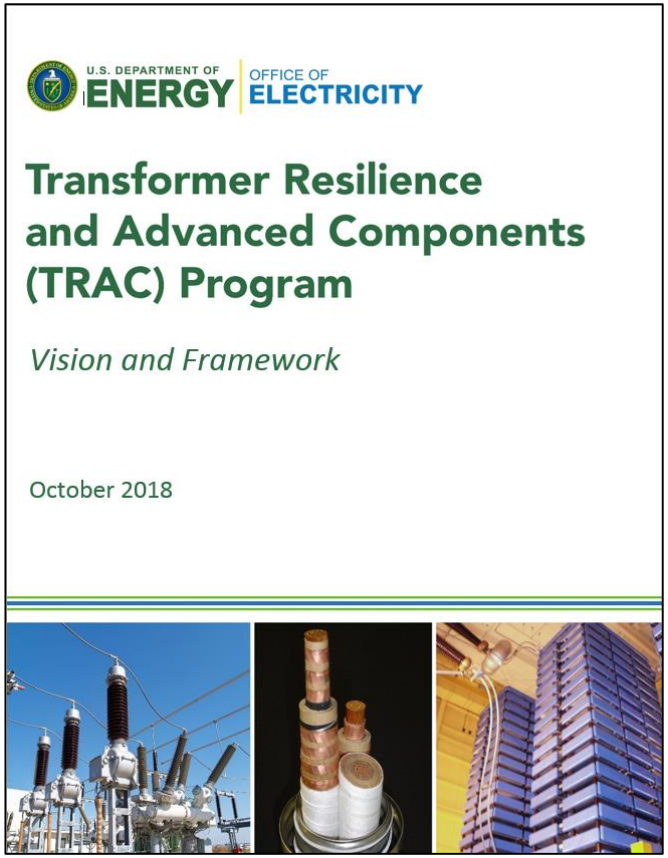
Genesis of the TRAC Program











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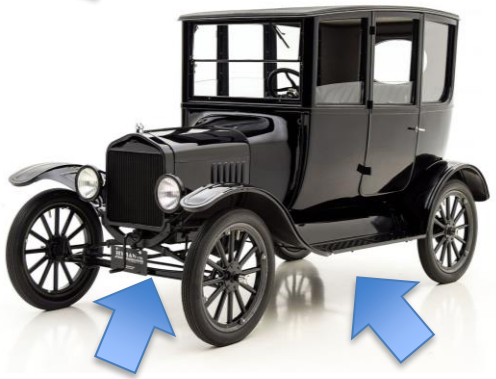
Program Motivation

“Smart” Ford Model-T vs. Tesla Model-X



Advanced sensors and software can improve *operator* performance…

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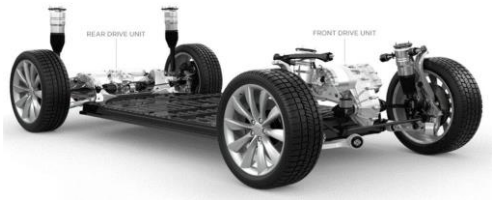
But hardware advances are needed to improve *actual* performance



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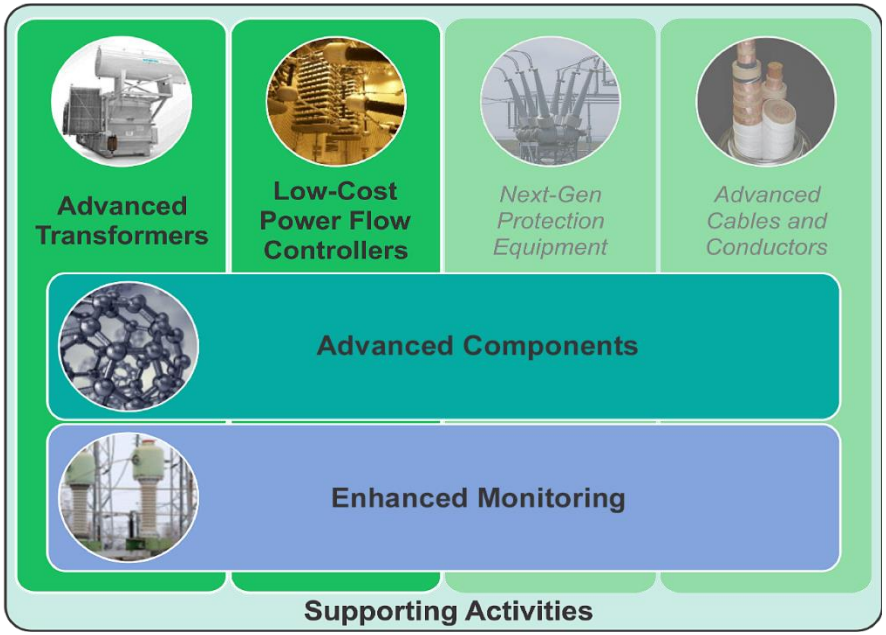
TRAC Program Overview

***Program Vision**: Technologies and approaches will be developed that help maximize the value and lifetimes of existing grid components, and enable the next-generation of grid hardware to be more adaptive, more flexible, self-healing, resilient to all-hazards, reliable, and cost-effective compared to technologies available today.*

Advanced Grid Component Design Features

- Modularity and scalability
- Local intelligence and adaptability
- Inherent cyber-physical security
- Manufacturability and sustainability



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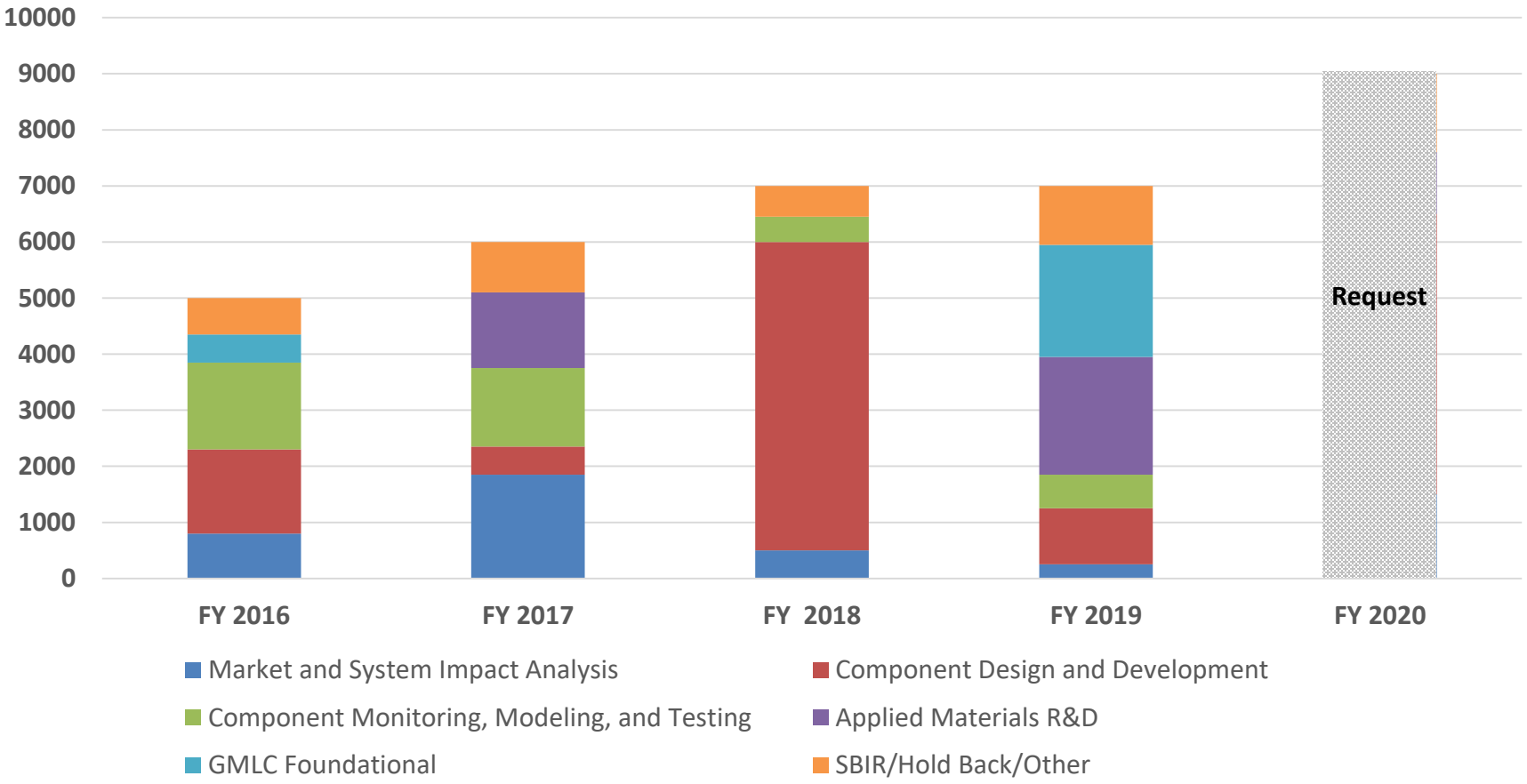
TRAC Program Areas

Program Areas	Objective	Benefit
 Market & System Impact Analysis	• Understand system impacts of new technologies and functions • Techno-economic analysis for costs/benefits of advances	Reduces the uncertainty and costs of technology integration
 Component Design & Development	• Design and prototype components with enhanced features/functions • Field validations to demonstrate and evaluate new capabilities	Reduce the risk and cost of next-generation components
 Monitoring, Modeling & Testing	• Develop embedded sensors and intelligence to improve reliability • Testing and model validation to understand limits and performance	Improve knowledge of component operations and accuracy of models
 Applied Materials R&D	• Evaluate and develop new materials and devices that underpin advanced components	Foundational to improved performance and costs

Program Funding History



FY18 and FY19 Conference Report Language: "The Department is directed to continue to support research and development for advanced components and grid materials for low-cost, power flow control devices, including both solid state and hybrid concepts that use power electronics to control electromagnetic devices and enable improved controllability, flexibility, and resiliency."

Key Program Activities

FY16

- LPT Design FOA
- GMD/EMP modeling

FY17

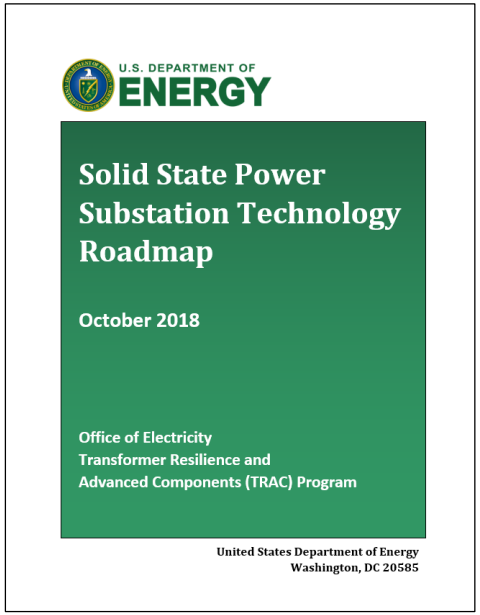
- HVDC modeling and controls
- Silicon steel additive manufacturing

FY18

- LPT Prototype FOA
- Low-cost power flow controllers

FY19

- Solid State Power Substation
- Power electronic materials



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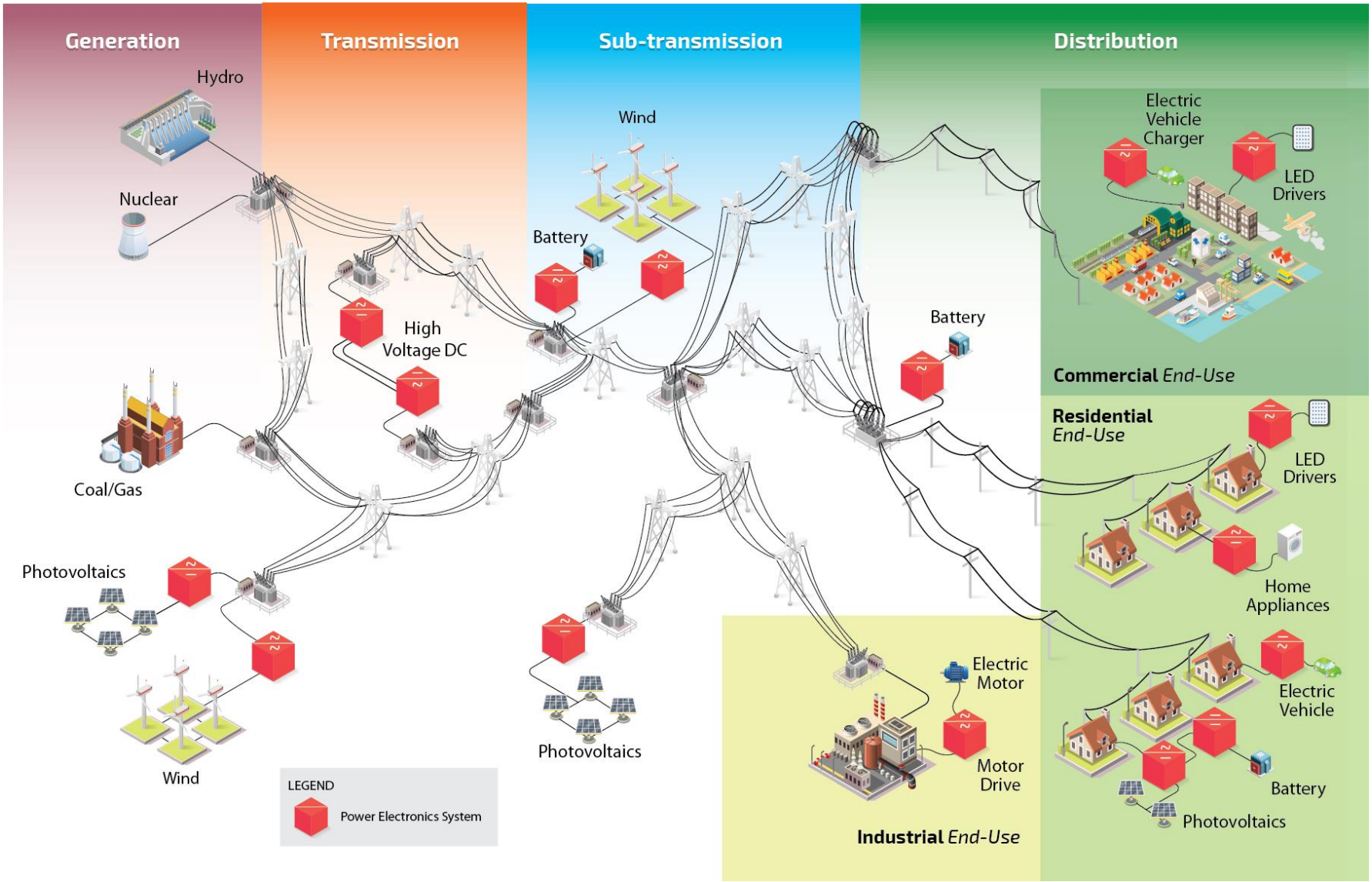
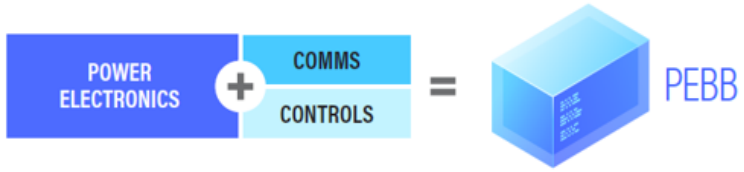
Increased Emphasis on Power Electronics



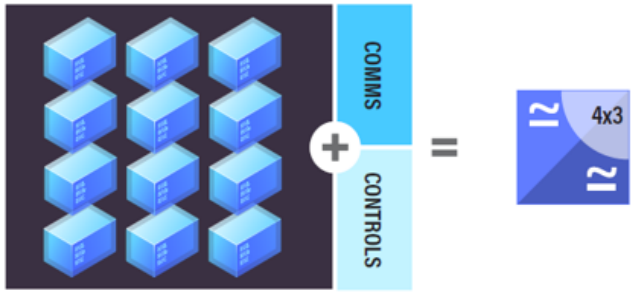
Solid State Power Substations (SSPS)

SSPS: substations with the strategic integration of high voltage power electronic converters that provide enhanced capabilities and support evolution of the grid.

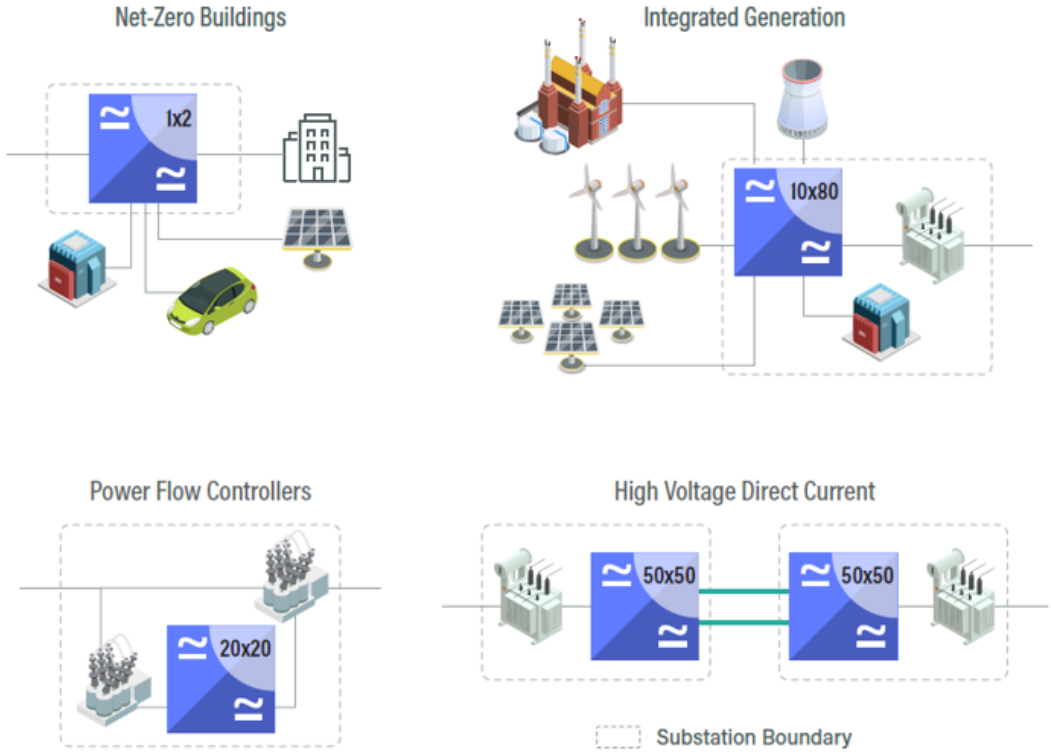
SSPS Power Electronic Building Block (PEBB)



SSPS Converter



SSPS Converter Applications within Substations



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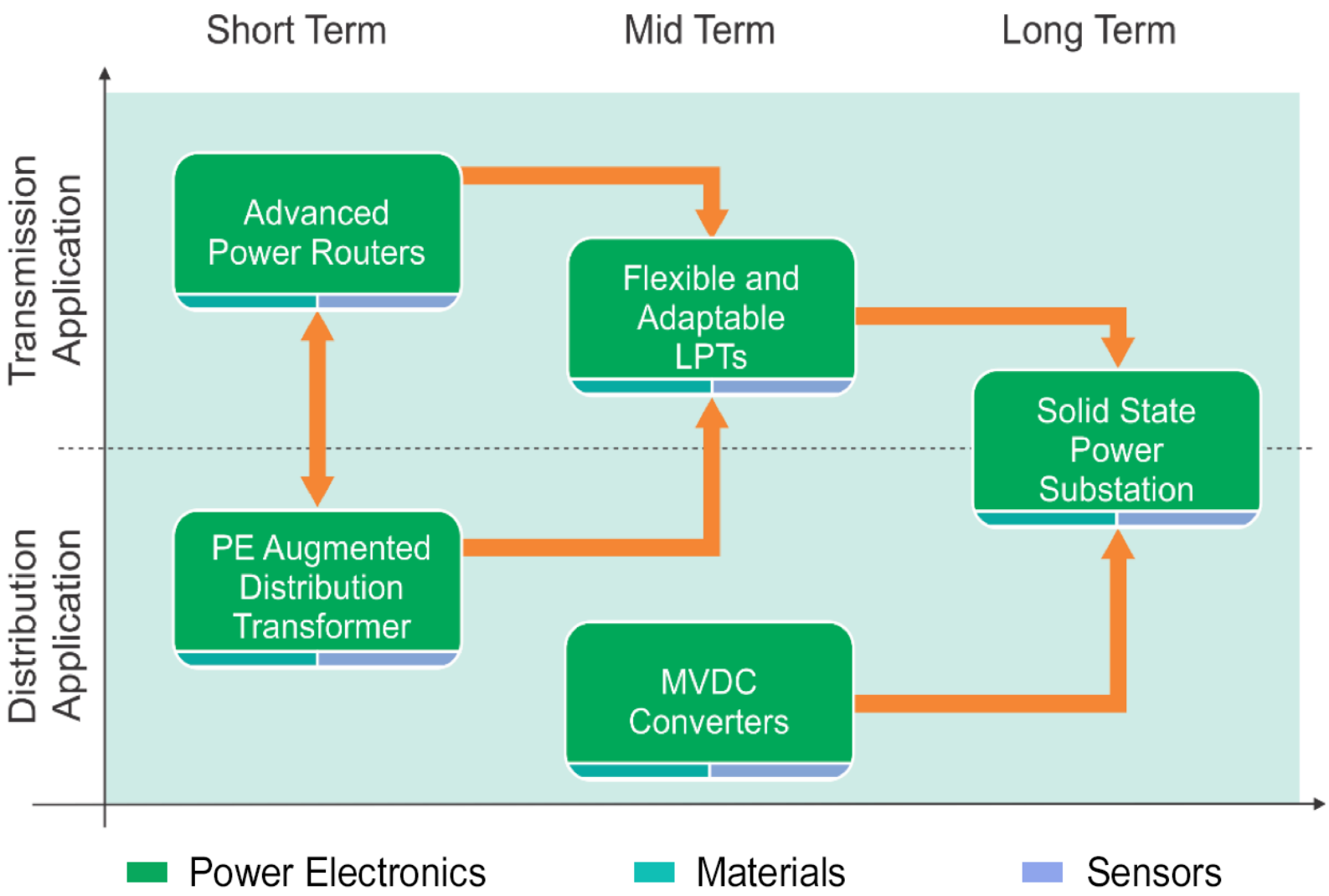
Program Trajectory



Program Improvement Process

Questions?

Contact Information:

Kerry Cheung, PhD
Program Manager/Strategist
Office of Electricity
U.S. Department of Energy
(202) 586-4819
kerry.cheung@hq.doe.gov