

An aerial night photograph of a city, likely Shanghai, featuring a complex multi-level highway interchange with light trails from cars. In the background, a dense skyline of skyscrapers is visible under a dark sky. The text "Energy Efficiency Means Business in Your District" is overlaid in white at the top.

# Energy Efficiency Means Business in Your District

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# Solving industry's toughest power management challenges around the world.



Aerospace



Buildings



Data centers



Food and beverage



Government



Healthcare



Machine building



Marine



Mining, metals  
and minerals



Mobile machinery  
and equipment



Oil and gas



Pharmaceuticals



Rail



Renewables



Residential



Utilities

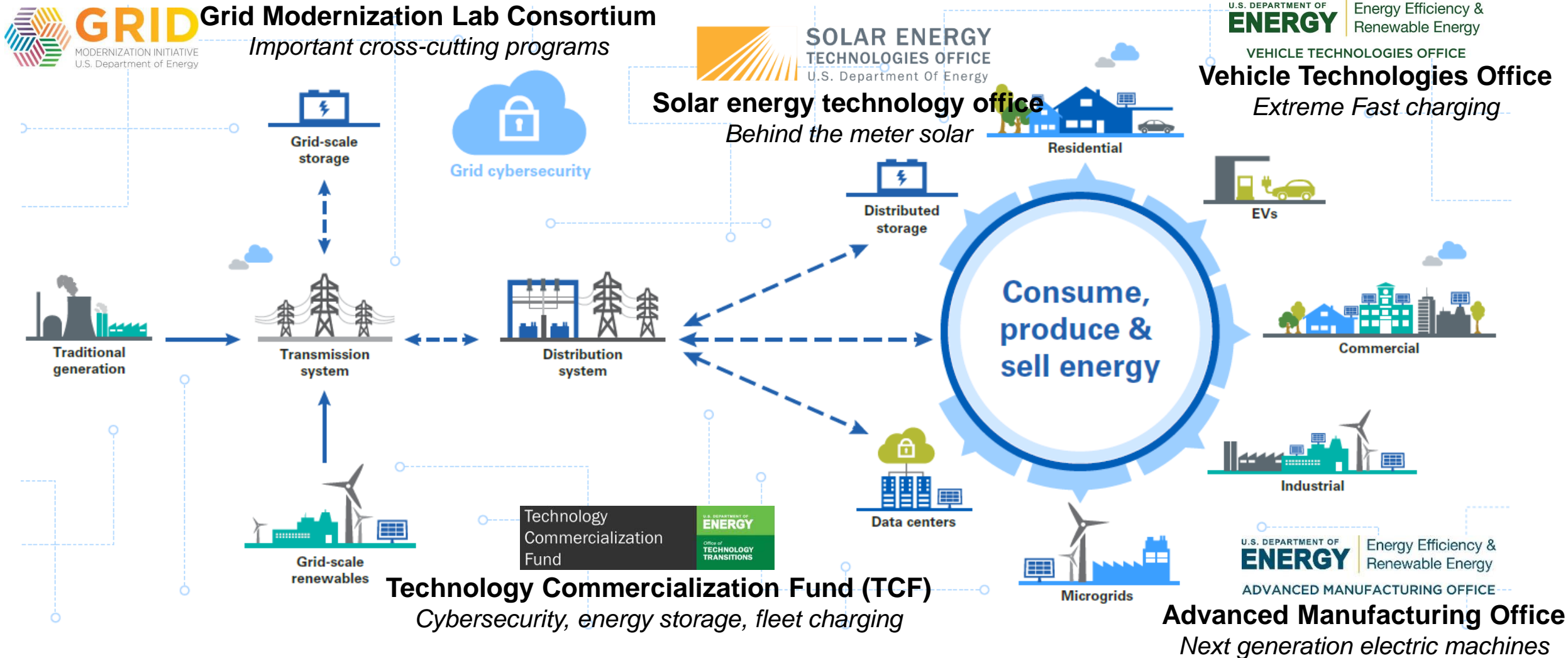


Vehicles



Water/wastewater

# EERE is making important investments that broadly invest in energy efficiency, resiliency and jobs

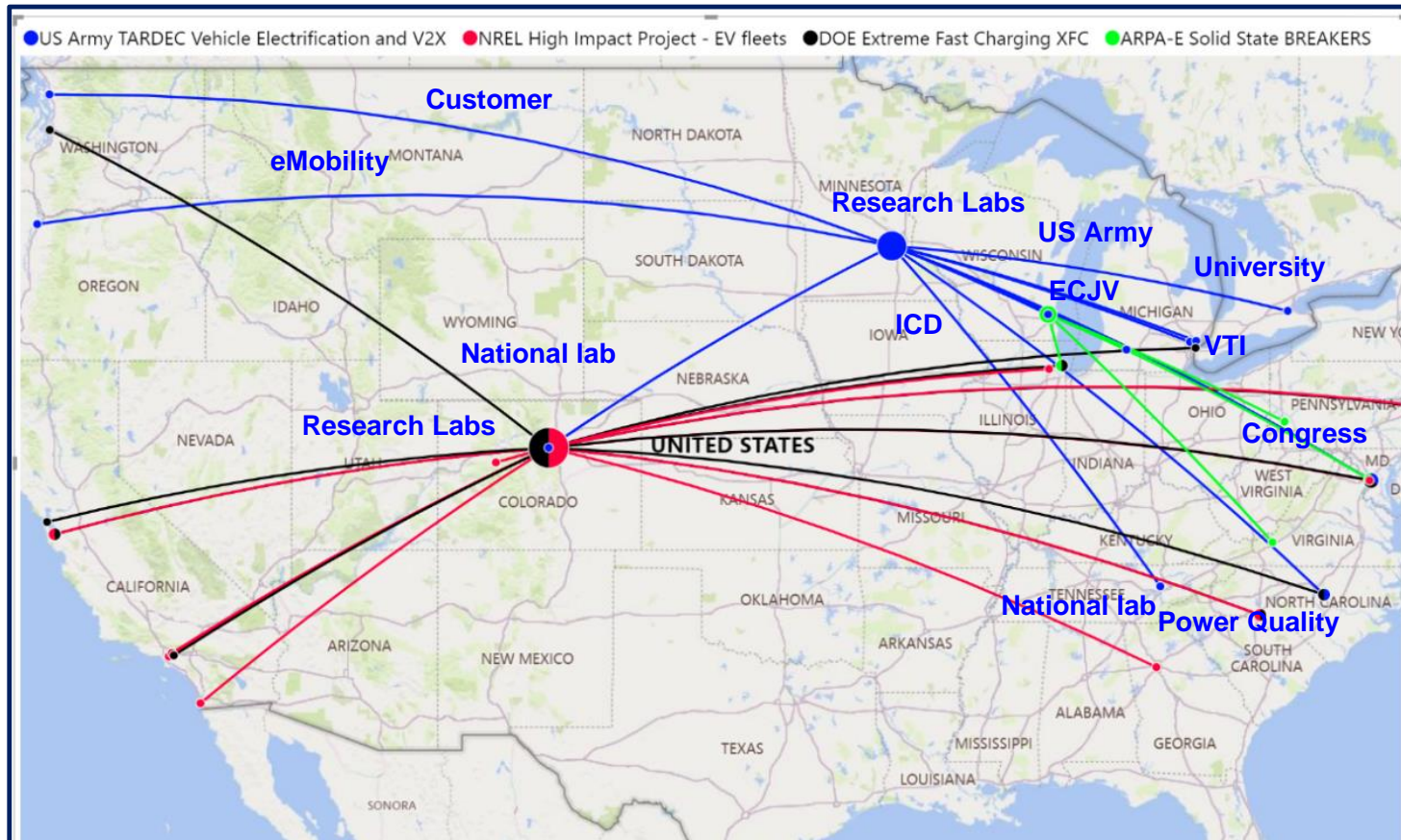


# Dept of Energy EERE enables unique partnerships

## *This collaboration only occurs on government programs*

### Partnership flow map for four different government programs

Partnering with Dept of Energy, customers, universities and national labs.



### Partnering on DOE Solar program

Maximizing use of behind the meter solar energy



### Partnering on joint DOD/ DOD program

Solving challenges in vehicle electrification for commercial and military applications



# DOE National Lab Partnering Strategy

## Lab network providing access to cross cutting technology

Lab Competencies	Advanced Computer Science, Visualization, and...			High Performance Computing, Simulation, and L...			Renewable electricity production and use			Strategic energy analy
	Advanced Materials and Manufacturing			Integrated energy system engineering and testin...			Sensing and measurement technologies			
			Batteries					Smart grid	Solar energy	
Next Gen Power Electronics		NETL			NETL	OAK RIDGE National Laboratory				
Additive Manufacturing	Lawrence Livermore National Laboratory			Lawrence Livermore National Laboratory						
DERMS	INREL		Pacific Northwest NATIONAL LABORATORY				INREL	Lawrence Livermore National Laboratory	INREL	Pacific Northwest NATIONAL LABORATORY
xPower Genome	OAK RIDGE National Laboratory			Argonne				Argonne	INREL	
EHM	Argonne	SLAC			OAK RIDGE National Laboratory					OAK RIDGE National Laboratory
Grid intelligence	INREL			Lawrence Livermore National Laboratory	INREL		INREL	NETL	INREL	INREL
Lightweighting and sustainability	Lawrence Livermore National Laboratory			INREL				Argonne		
Advanced Energy Storage			Argonne							
Novel machinery										
Digital manufacturing										

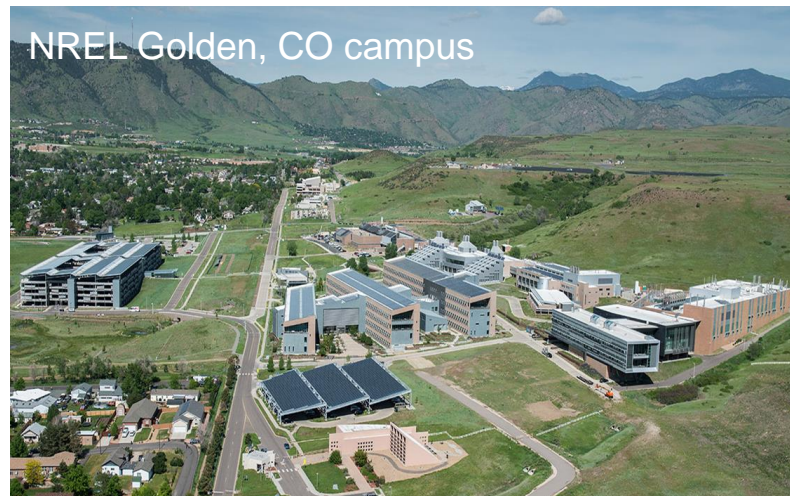


# Eaton and NREL Partnership

*Corporate research team first ever to be located at NREL ESIF in April 2018*

## Unique NREL – Eaton partnership

- Eaton moved 15 PhD researchers on-site to the Energy Systems Integration Facility at NREL.
- The Energy Systems Integration Facility (ESIF) is a unique \$140M+ grid integration testing facility.
- Unprecedented partnership between a multi-national company and a DOE national lab.
- Plan to grow to 18 team members at NREL ESIF in 2020 and 45 employees by 2025.
- Locating Eaton researchers at this User Facility provides access to world-class facilities and NREL personnel, faster value prop testing, increased customer co-development and reduced capital investment.



# High Power Fast Charging for EV Fleets

*DOE program bringing in significant partners for new business models*

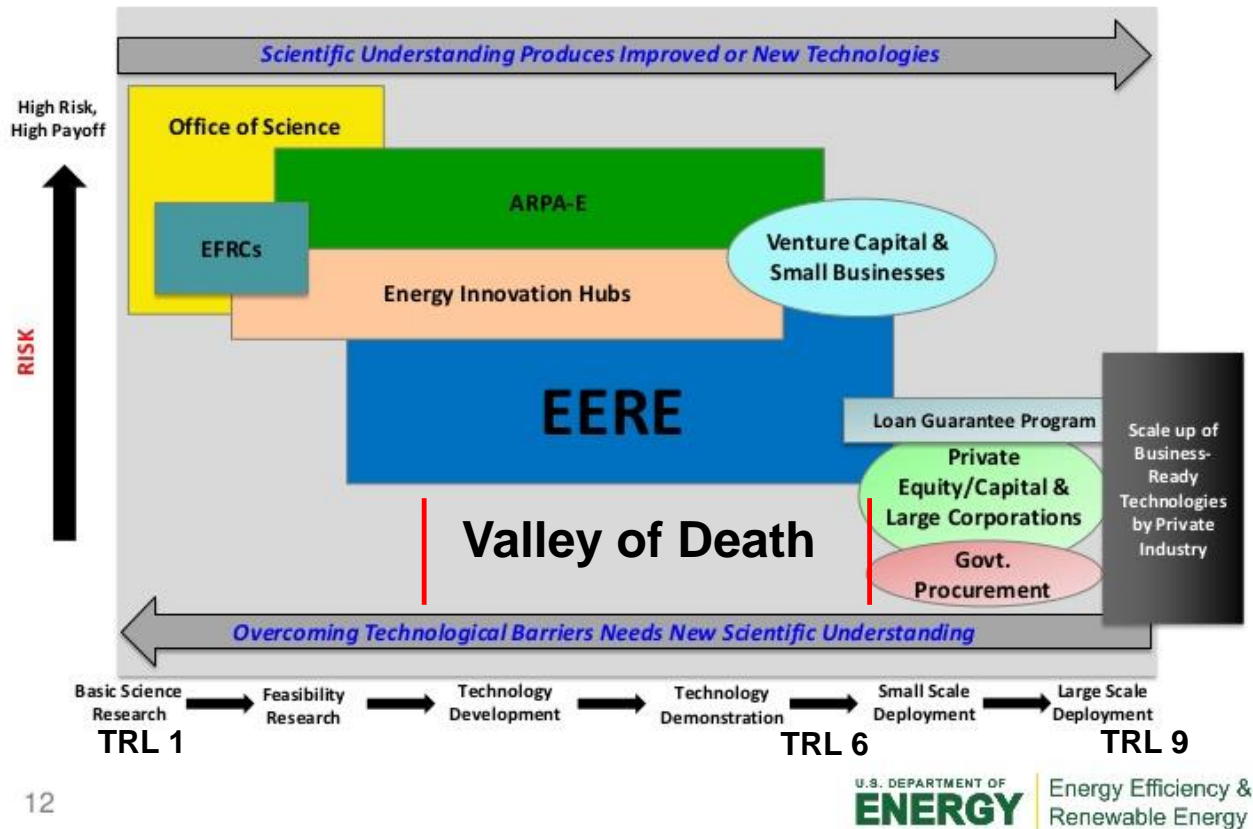
- Cost effective charging for large EV fleets
- New business model for utilities – DC
- Partnership enabled by DOE FOA VTO



# Commercialization

## *Fill knowledge and funding gaps through TRL6 demonstration*

### EERE Guiding Principles: Leveraging Technology Investments



- Asset-heavy energy technology companies focus RDT&E investment on commercialization TRL 7-9.
- EERE and OE currently address the “valley of death” in TRL 4-6 and “pull” technology into mature industries.
- Customers in energy technologies (grid, vehicles) require real-world demonstration before making investments & commitments.
- Commercial firms create partnerships through DOE that would otherwise not occur to explore high risk areas and demo new technologies.
- EERE/OE and ARPA-E are fundamental to research and commercialization of technology.

# Thoughts to Accelerate Energy Transition

## **Cross-cutting technologies (major role for national labs):**

- Artificial intelligence, modelling and simulation - special testing facilities at national labs
- New materials research – address foundational technology (power electronics, motors and solar) and critical minerals shortages
- New business models – create specific FOAs to address this broad gap based on economic analyses
  - Ex. Value of batteries on fleets of vehicles to the grid
- Consider DOE programs on broader scope subjects
  - 30 partners or more including numerous competitors looking at different work packages but with very specific requirements for communication of results and commercialization

## **Vehicles**

- Next generation design philosophies that include artificial intelligence and machine learning
- Large scale fleet electrification programs – includes both vehicles and charging infrastructure; batteries and fuel cells
- Off-road vocational, construction and agriculture vehicles: hybrids and highly electrified

## **Aerospace**

- Electrification – ARPA-E has first program here, near term potential but need to work with DOD

## **Electrical: Grid intelligence**

- Charging infrastructure
- Grid business models: non wires alternative (Behind The Meter assets – DE. Solar, controls)
- Microgrids for grid stability with utilities / fire mitigation / resilience / Regional/Communities demo
- Intelligent buildings