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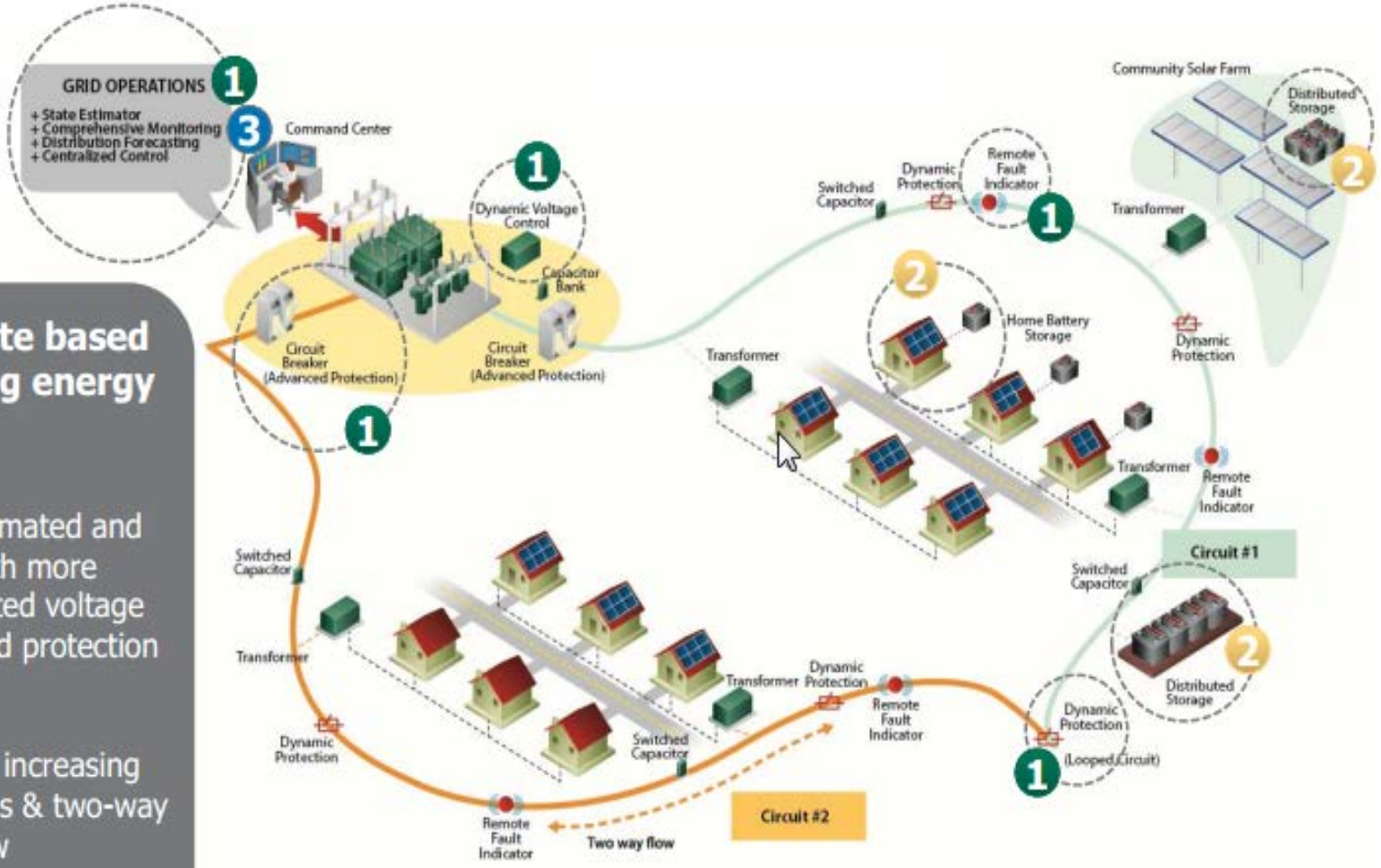
Managing Air Emissions via the Transactive Distribution Grid

Grid of the Future

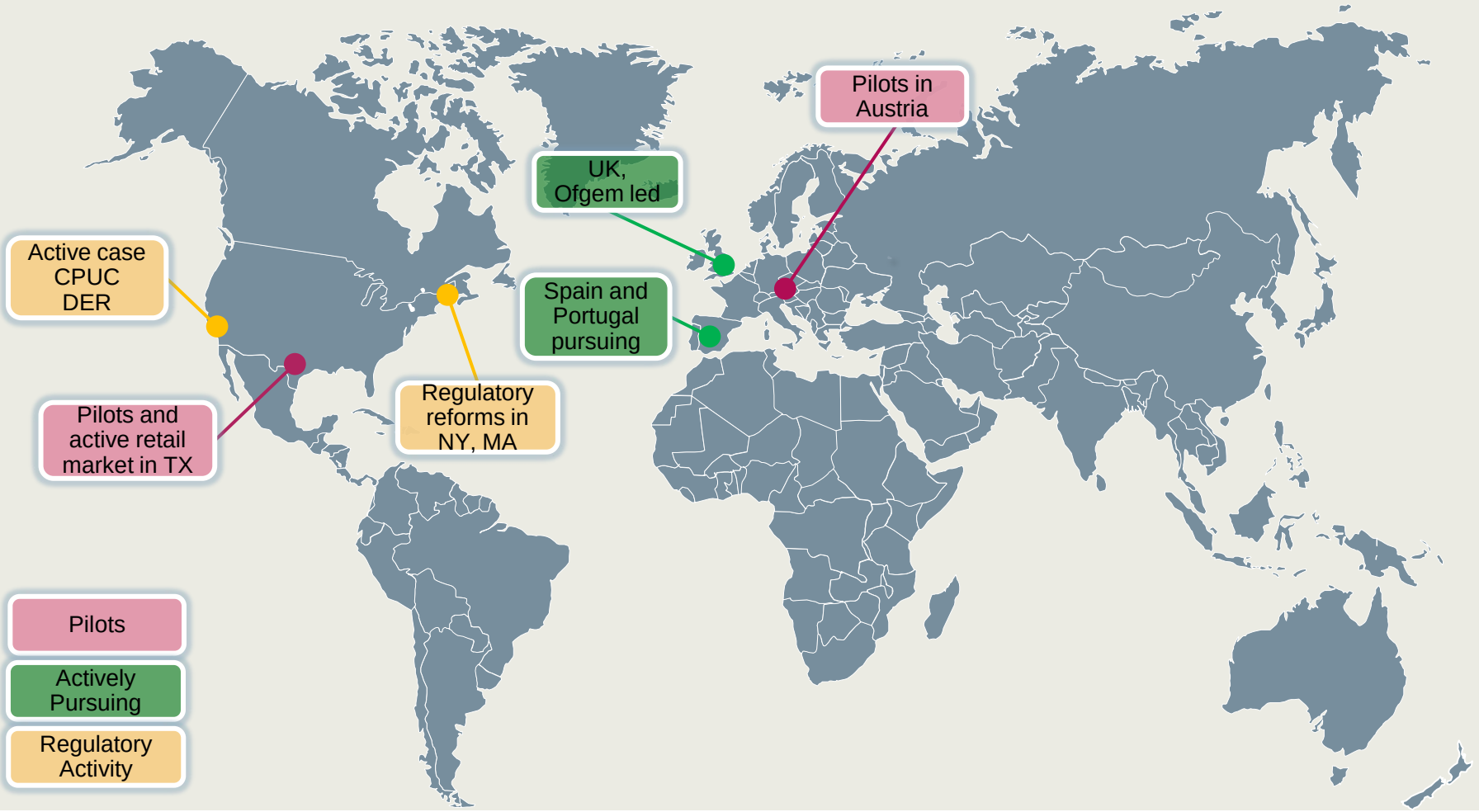


Future state based on evolving energy landscape

1. More automated and digital, with more sophisticated voltage control and protection schemes
2. Facilitates increasing renewables & two-way power flow
3. Cyber mitigation must be included

Source: SCE

Key examples of transforming the Distribution Grid



NY Reforming the Energy Vision Proceeding

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Goals:

- Support empowered customers, distributed energy resources, load management, and energy efficiency
- Animate the New York market for these services
- Modernize the regulatory framework to support creation and operation of a "DSP" to achieve these goals

DSP Definition: The DSP is an intelligent network platform that will provide safe, reliable and efficient electric services by integrating diverse resources to meet customers' and society's evolving needs. The DSP fosters broad market activity that monetizes system and social values, by enabling active customer and third party engagement that is aligned with the wholesale market and bulk power system.

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Transactive Distribution Grid Functions (New York)

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Grid

- Real-time load monitoring
- Real-time network monitoring
- Adaptive protection
- Enhanced fault detection and location
- Outage and restoration notification
- Automated feeder and line switching (FLISR/FDIR)
- Automated volt/VAR control
- Real-time load transfer
- Dynamic capability rating
- Diagnosis and notification of equipment condition
- Power flow control
- Automated islanding and reconnection (microgrid)
- Electricity storage
- Algorithms for grid control and optimization

Customer/DER/ Microgrid

- Direct load control
- DER power control
- DER power factor control
- Automated islanding and reconnection
- Electricity storage
- Algorithms and analytics for Customer/DER/Microgrid control and optimization

Market

- Dynamic event notification
- Dynamic pricing
- Market-based demand response
- Dynamic electricity production forecasting
- Dynamic electricity consumption forecasting
- M&V for producers and consumers (premise/appliance/resource)
- Participant registration and relationship management
- Confirmation and settlement
- Billing, receiving and cash management
- Free-market trading
- Algorithms and analytics for market information and operations

Developments Around the Globe Depict Similar Vision and Goals

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	GridWise Architecture	California DER Proceeding	UK Modernization (RIIO)	Massachusetts Modernization Act
Basic Goals	Framework for reinventing the distribution grid to accommodate DER at bulk power supply as well customer	Define role of distribution grid amid DER. Create frameworks that make distribution grid open, efficient, and resilient.	Transition to a low-carbon economy so as to better deliver value to energy consumers over the longer term.	▪ Consumers, including low-income customers, renters, and small business customers, to benefit from grid modernization ▪ Customer engagement
Future Vision	Create a "transactive energy" environment that manages generation, consumption or flow of electric power through market constructs	▪ Distribution Planning ▪ Distribution Design ▪ System Operations ▪ DER Integration into Operations	▪ Connecting small scale renewable and CHP to the low voltage distribution network ▪ Extending the high voltage transmission grid to connect renewable generation, ▪ Balancing the electricity network with renewable generation	▪ Reduce the effect of outages ▪ Optimize demand, which includes reducing system and customer cost ▪ Integrate distributed resources ▪ Improve workforce and asset management

Germany Study: Smart Grid Cuts Cost of Renewables Integration by Half

- German Ministry of Economics
- „Using conventional planning methods, the energy transformation will require considerable reinforcement of the German transmission and distribution grids.“
  - „By 2032, depending on the scenario, total investment required is between 23 and 49 billion Euro“
- „Innovative planning concepts, in association with intelligent technologies, greatly reduce the forecasted grid reinforcement needs“
  - „The optimal combination of innovative planning concepts and use of intetlligent technologies can halve the required investment and reduce the average annual operation and maintenance cost increases by up to 20%“
- Regulatory challenge: under traditional regulation, utilities make more money by investing more
  - Solution: share benefits 1/3 all customers, 1/3 participating customers, 1/3 utility?

Thank you.

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