Oncor’s Microgrid Experience & Vision

Bill Muston
Oncor

Chris Evanich
S&C Electric Company

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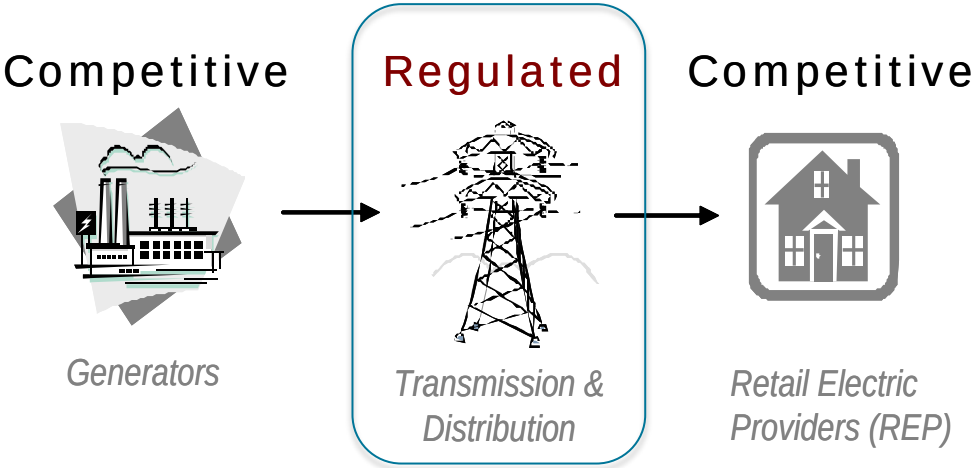
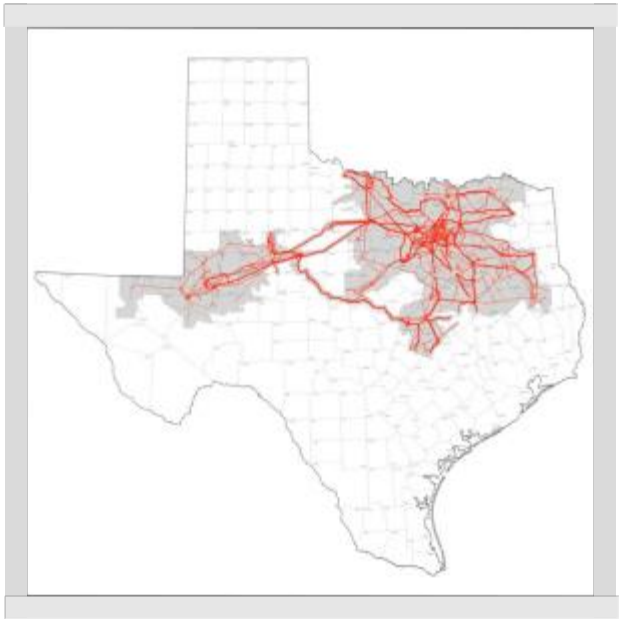
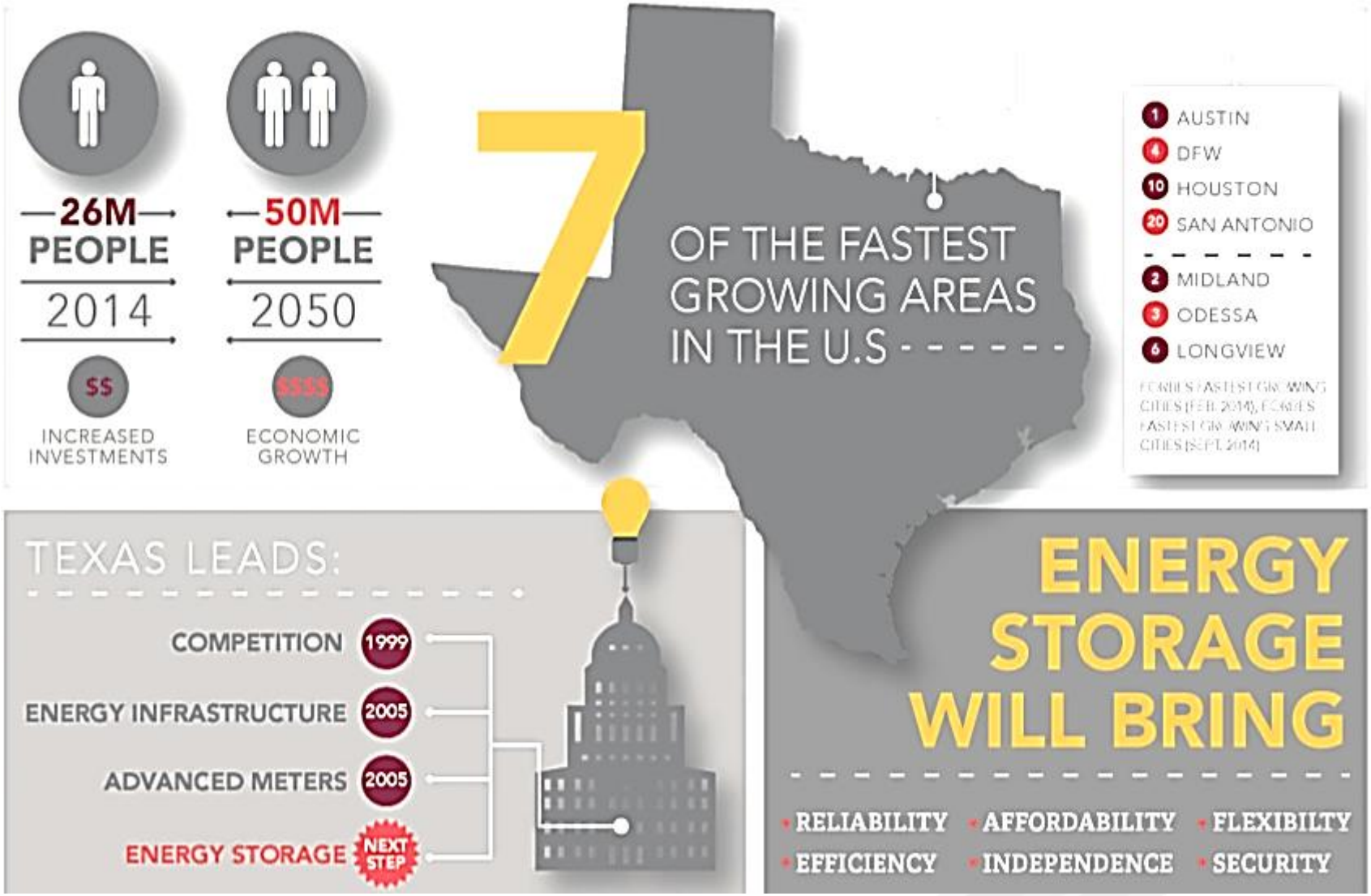
ONCOR ROLE

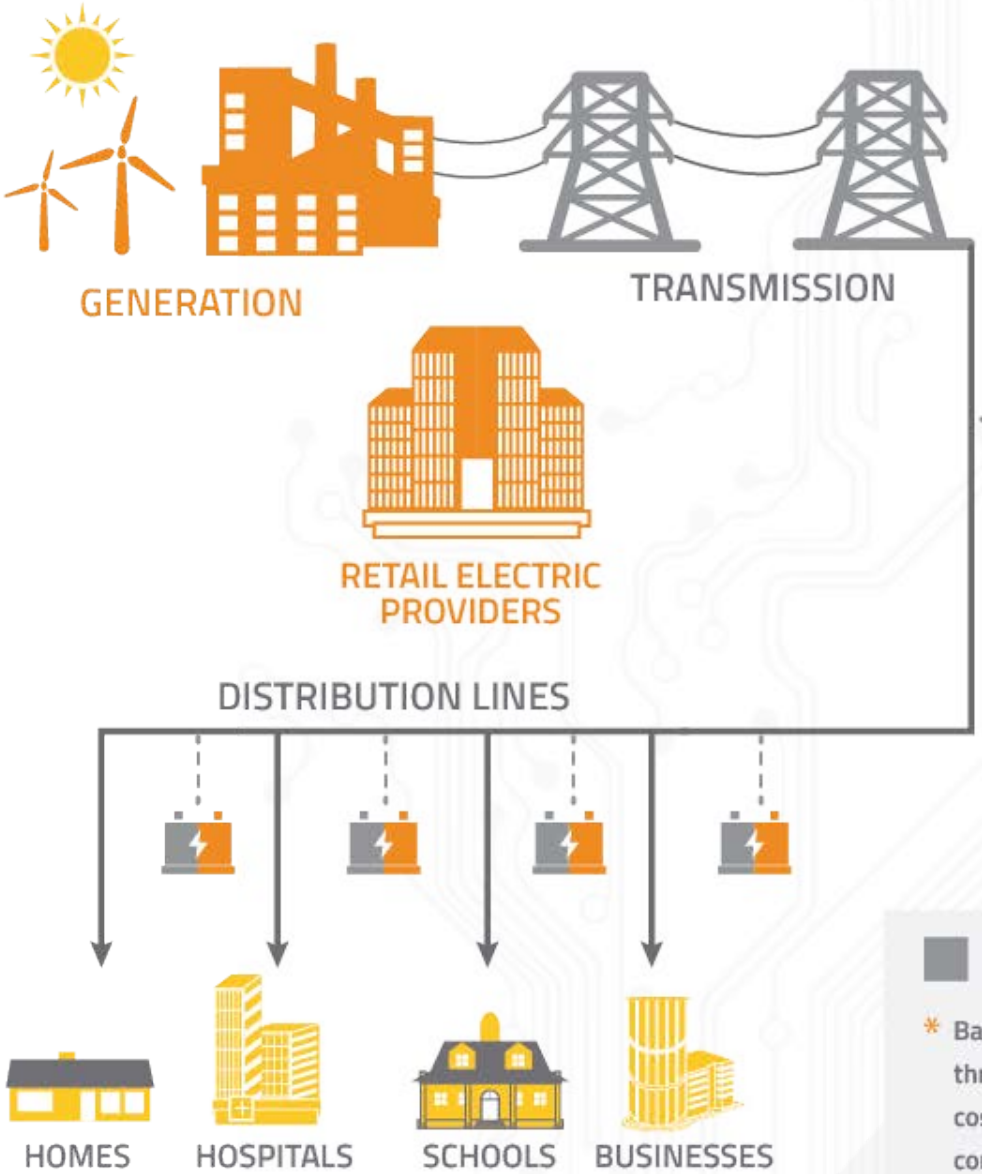




- **REGULATED DELIVERY & METERING, AS A SERVICE**
  - *Regulated delivery utilities – do not generate, own, or sell electricity*
- **The wholesale and retail electric energy markets in ERCOT have been fully competitive since 2002 for investor-owned players**

TEXAS' CHALLENGE: POWERING OUR FUTURE GROWTH





Regulated Competetive

* Based on PUC-approved plans, utilities would install energy storage throughout the grid, resulting in improved reliability. Customers' costs would be offset by an auction of this capacity to the competitive market, which could then provide power to customers when they need it the most.

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INDIVIDUAL VALUE STREAMS CREATED BY STORAGE

MARKET

- Renewable generation smoothing and dispatch
- Demand and time-of-use energy management
- Electric supply reserve capacity
- Peak shaving/load following
- Fast response ancillary services
- Capacity firming
- Frequency regulation
- Energy arbitrage

RELIABILITY

- Support local grid during outages
- Defer traditional transmission and distribution investment
- Relieve transmission congestion
- Integrate renewable sources to grid management for stability & voltage control
- Provide greater flexibility to market participants

CUSTOMER

- Increased reliability
- Increased grid efficiency and flexibility
- Technologically advanced grid infrastructure
- Lower customer bills

LET’S TURN TO ONCOR’s MICROGRID

SITE SELECTION: CONTROLLED ENVIRONMENT

- Implement at a location that is controlled by Oncor entirely
- Do not disrupt customers
- Meaningful experience with functionalities that Oncor will see on its grid, BUT that are outside of the role of Oncor as a delivery service in a competitive market

SITE OVERVIEW

RELIABILITY & RESILIENCE FOR A KEY OPERATIONAL SITE

- **100-acre industrial-campus site with key operations for meter testing, transformer testing and refurbishment, communications, and environmental labs and compliance**

- **During major grid outages, site takes on 24x7 roles for restoration and environmental management**

Original site: 10 metered services, UPS & 3 emergency gensets, with limited site operations during local grid outages

Project objective: single primary-metered point of service, site-wide microgrid, adaptable to a variety of situations

MICROGRID

- ***A microgrid is a group of <u>interconnected loads and distributed energy resources</u> within <u>clearly defined electrical boundaries</u> that acts as a single controllable entity with respect to the grid. If desired, a microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.***

- ***Microgrid Key Attributes (Defining Characteristics)*:**
  - Grouping of interconnected loads and distributed energy resources
  - Can operate in island mode or grid-connected if desired
  - Can connect and disconnect from the grid if desired
  - Can act as a single controllable entity to the grid

EXPERIENCE WITH DISTRIBUTED STORAGE AND SOLAR

- **Design & specification**
- **Siting & commissioning**
- **Integration with system protection, SCADA, control of traditional utility switchgear**
- **Operational experience**
  - Reliability – backup on a distribution feeder to upstream utility power
  - Inverter-based systems – IEEE 1547
  - Solar smoothing
  - Reactive power management

STORAGE TO ANCHOR A MICROGRID

- **Demonstrate capability of storage to anchor a distributed microgrid DURING LOSS OF UPSTREAM GRID POWER**

- **Type: Behind-the-meter campus-styled microgrid**

- **Type: Utility feeder segment anchored by storage**
  - Customer loads
  - Solar by customers & 3rd-parties
  - Dispatchable natural gas generation by 3rd-parties & customers

A key evolutionary capability for electric utilities with distributed energy storage

TECHNOLOGY DEVELOPMENT & EDUCATIONAL CENTER (TDEC)

- **Create a friendly, non-technical center for conversations about the future**
  - Customers
  - Developers
  - City leaders
  - State officials
  - Competitive market players

TEAM AND VENDORS

WHAT IS NEEDED TO IMPLEMENT A MICROGRID

- **Distributed Energy Sources**
  - Solar, wind, energy storage, microturbines, diesel gensets
- **Equipment and controls to achieve:**
  - Automatic fault isolation and service restoration and/or
  - Automatic islanding
- **Energy Storage**
  - Anchor to manage load and source variabilities
- **Reliable, high-speed communication to enable these functions**
- **Expertise in planning, designing, and constructing microgrids**
- **Prioritization of loads and sources**

SOLAR ARRAYS

- **Large Array**

  Carport Canopy

  South Facing

  - *maximum energy*

  104 kW_{ac} from 6 inverters

- **Small Array**

  West Facing

  - *peak demand*

  2 kW_{ac} inverter

TESLA & S&C ELECTRIC BATTERIES

- **Power: 200 kW**
- **Energy: 400 kWh**
  (6 x 70 kWh Li-Ion batteries)
- **480 V, 3-phase Input**

- **Power: 25 kW**
- **Energy: 25 kWh**
- **240 V, Single Phase**

MICROTURBINE

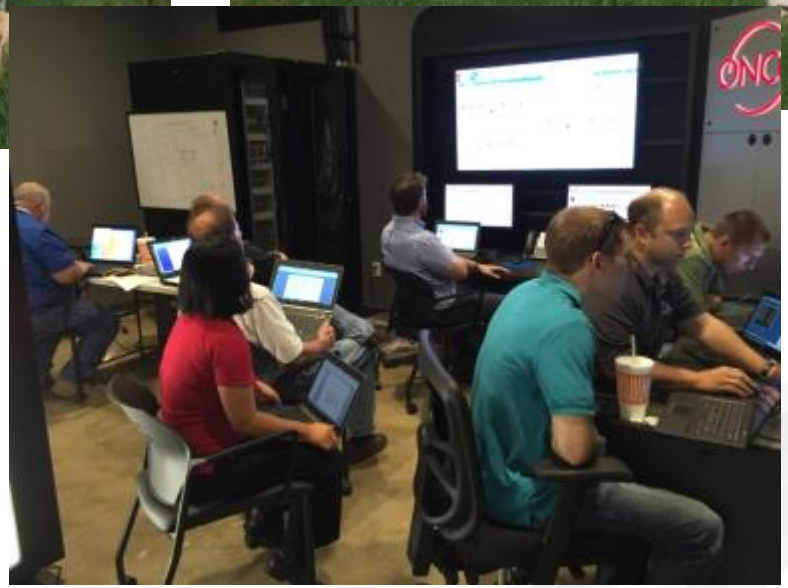
- **Power: 0 to 65 kW**
  96,000 RPM peak
  500 degree exhaust

- **Inverter-Based**

- **Fuel: Propane**
  10 day storage capacity
  9 gallons per hour

- **Efficiency: 30 – 35%**
  Could be up to 80% with CCHP

INTEGRATION WITH LEGACY EQUIPMENT



MICROGRID

TRANSFORMER DELIVERIES
& PICK UPS ONLY
ALL OTHER
TRAFFIC MUST TURN
CENTRAL SHOP
LABORATORY
VISITOR & EMPLOYEE
PARKING TOC

10
1280367
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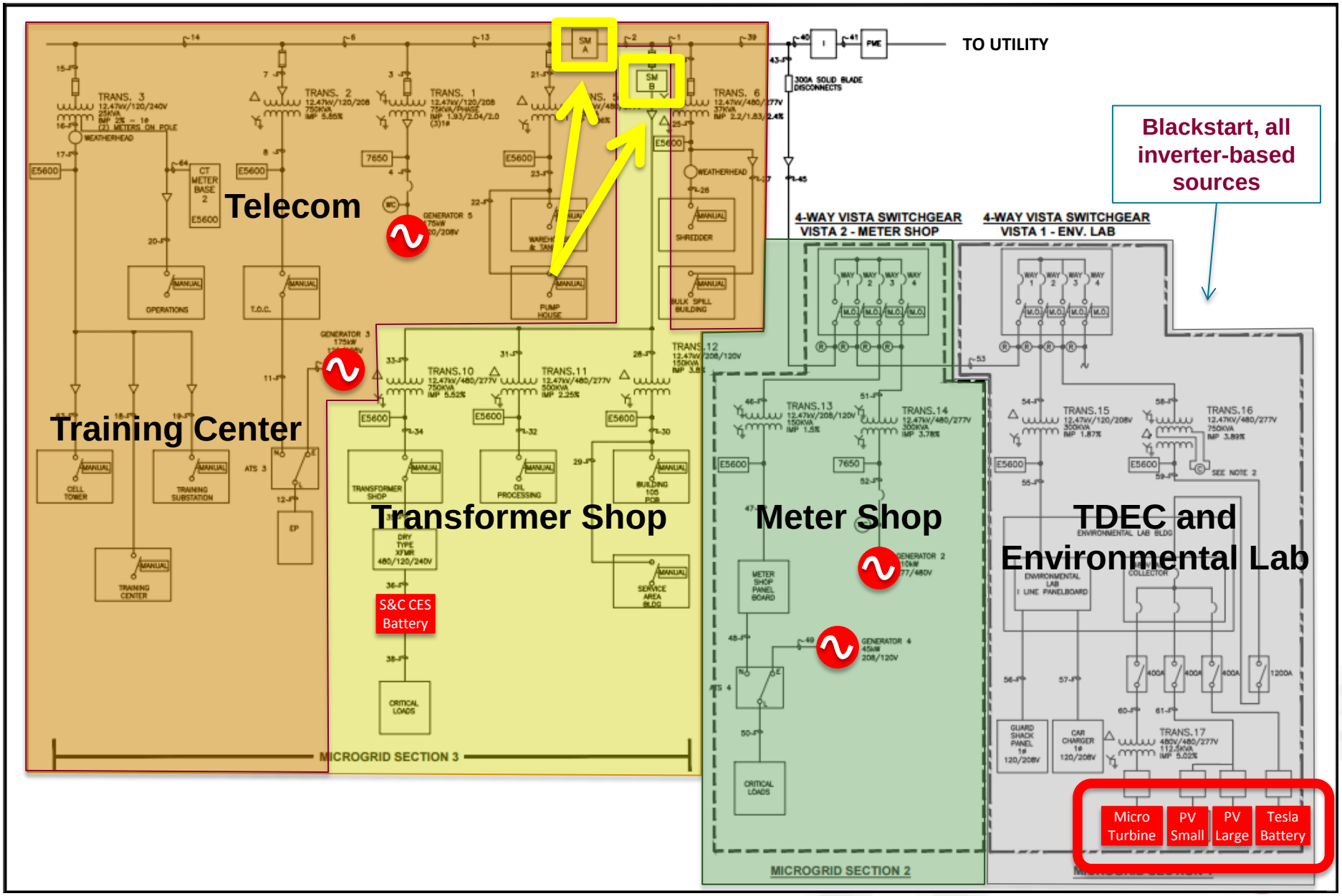
TECHNOLOGY DEVELOPMENT & EDUCATION CENTER

- Immersion Room
- Control Room
- Sustainable

SOSF MICROGRID OPERATIONAL ZONES



TYPICAL MICROGRID SERVICES REQUIRED

- Analysis of existing distribution system
- Load flow, coordination, and arc-flash hazard studies
- Microgrid design
- Adaptation of existing equipment
- Communication system design
- Equipment procurement
- Coordination with local authorities
- Construction management
- Asset management

LESSON'S LEARNED – SUPPLIERS

- Your Utility is Your Friend
- Understand Your Funding
- Create & follow a proper Preconstruction and Design plan
  - Know your drivers - source and uses
  - Understand constraints and goals
  - Identify the critical and less critical loads
- Model the System Before You Build
  - Understand control operations in each Sequence of Operations
  - Investigate Transient Stability
  - Review Protection Schemes for Non-Island and Island Modes
- Design Your Control & Monitoring System Early
- Permitting and Interconnect
  - Involve the Utility Early
  - Drawings will be Required

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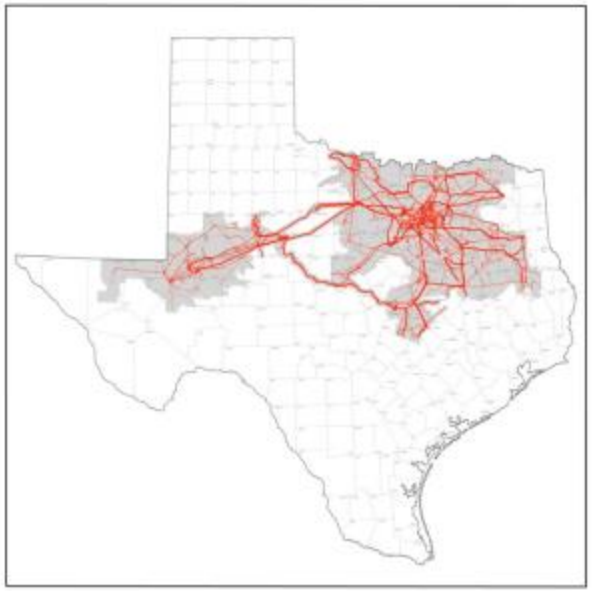
LESSON'S LEARNED – UTILITY

- Pick Established Suppliers
- Define Your Sequence of Operations Early
- Factory Acceptance Testing & Simulation
- Commissioning
- Monitoring & Performance Verification Plan
- Set up Your O&M Plan as Part of Your Plan

BLUE SKY – UTILITY SERVICES WITH MICROGRID

- Microgrid functionalities that may evolve over several years enable possible new service options
- Feeder-based critical community services – eg medical district, airport & FAA, phone network locations, fire, police, prisons
- Utility integration with customer-sited microgrid for campus-style environment with multiple utility points of connection
- Reliability option for customers with high-reliability requirements who already will pay extra – dual-feed, battery as anchor

CONTACT



Bill Muston

Manager of R&D - Oncor

bill.muston@oncor.com

214-486-3015

Chris Evanich

Application Director of Microgrids – S&C

S&C Electric Company

Chris.Evanich@sandc.com

813-340-7946