Energy Storage: Utility View

NARUC Winter Conference
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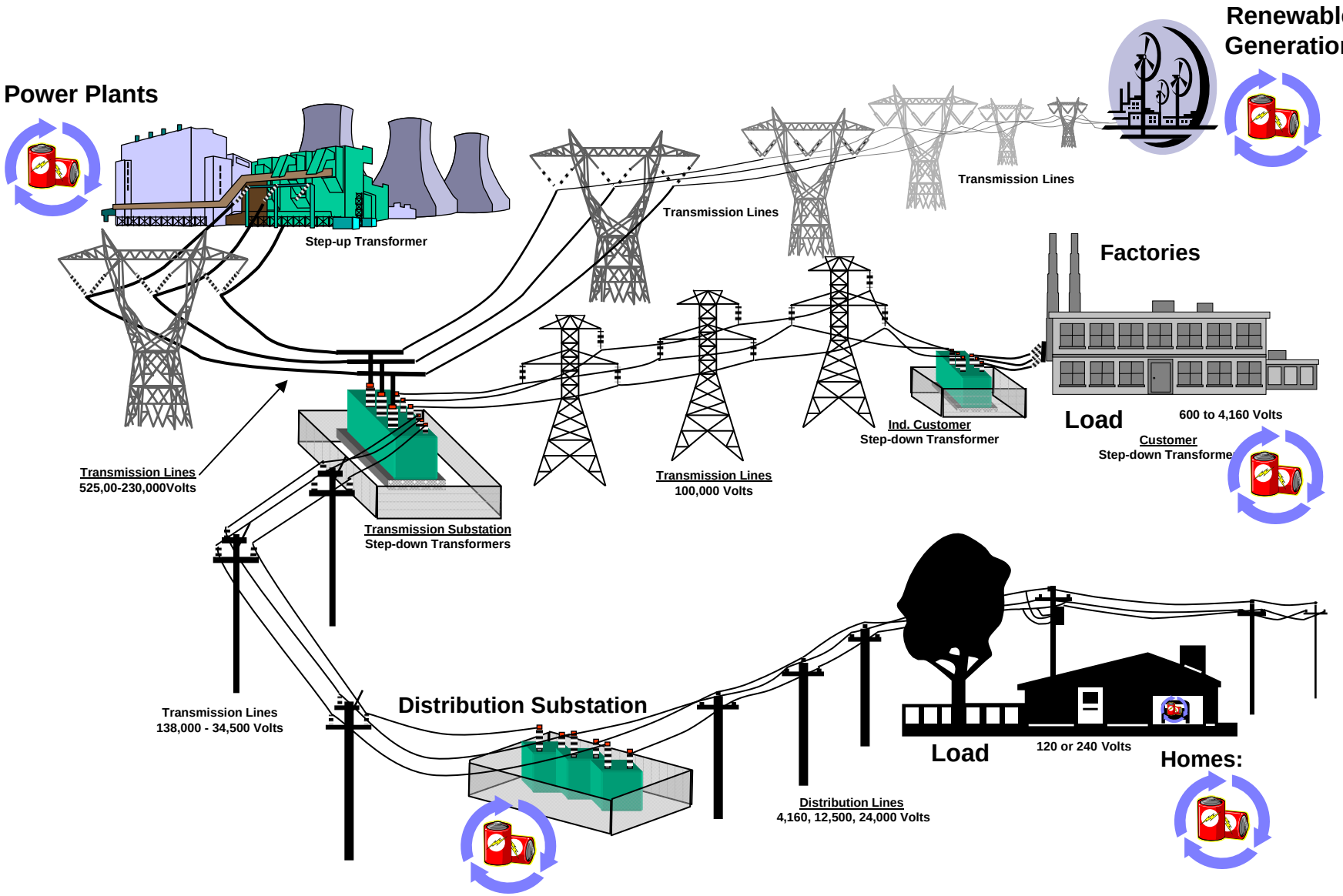
Overview

- Duke Energy Vision for Energy Storage
- Our Process
- Value of storage
- Major criteria for each application
- Pilots:
  - Current projects
  - Applications still in design phase
- Hurdles

Duke Energy Vision for Energy Storage



Our Process

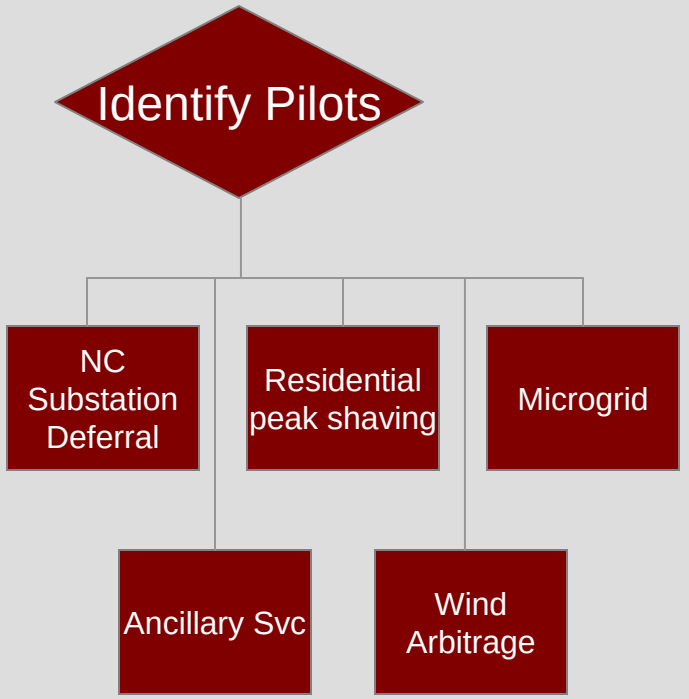
Identify Utility Applications

- Substation capital deferral
- Substation emergency backup
- Substation backup power
- Distributed storage at customer premise
  - PHEV as a subset
- Supplement renewable energy
- Grid stabilizing ancillary services

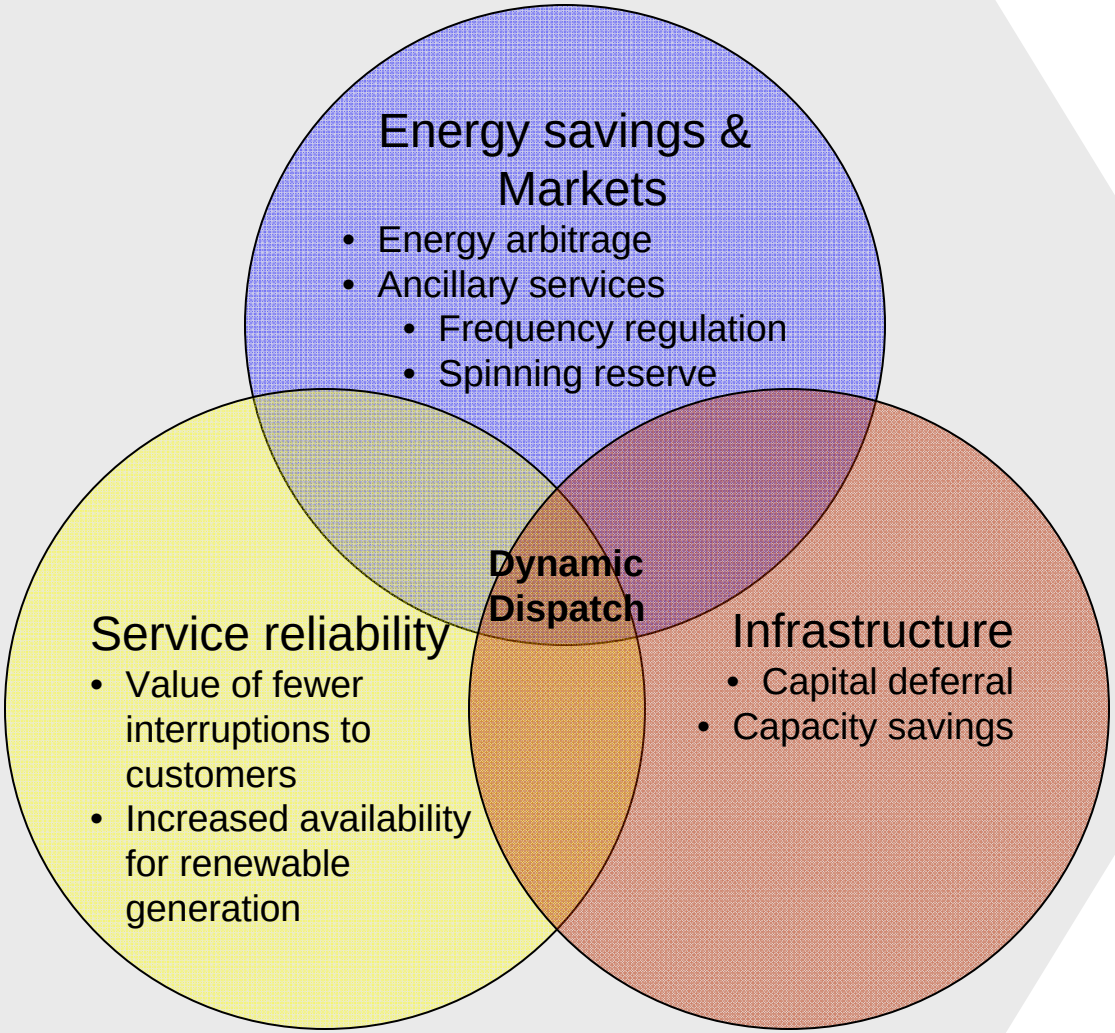
Conduct Industry Survey

- Survey sent to all major vendors
- Received responses from 10
- Identified fit between applications and solutions

Identify Pilots



Value Components



- Evaluate each application's economic value using all relevant savings impacts
- Combine applications where possible to capture the greatest value
- Prioritize projects by combined economic impact

Major criteria for each application

Application	Major Criteria
Substation capital deferral	Long discharge time (> 1 hr) Scalability Relocatability/movability Footprint
Substation emergency backup	Movability Footprint
Substation backup power	Low maintenance requirements
Distributed storage at customer premise	Footprint High cycle life
Supplement renewable energy	Long discharge time (> 1hr) Scalability
Grid stabilizing ancillary services	Fast discharge capability (~15 min) Footprint

Lifetime Cost, environmental impact, reliable operation and safety are important criteria in every application

On-going Projects - Stationary

Residential Scale Storage

Goal:

Reduce peak demand and increase reliability through a network of distributed storage units

Status:

Testing across 2 pilots using lead-acid technology

Coupled with residential energy management systems to test dynamic optimizations and dispatch capabilities

Substation Deferral

Goal:

Use energy storage to defer substation capital projects by 2-6 years

Status:

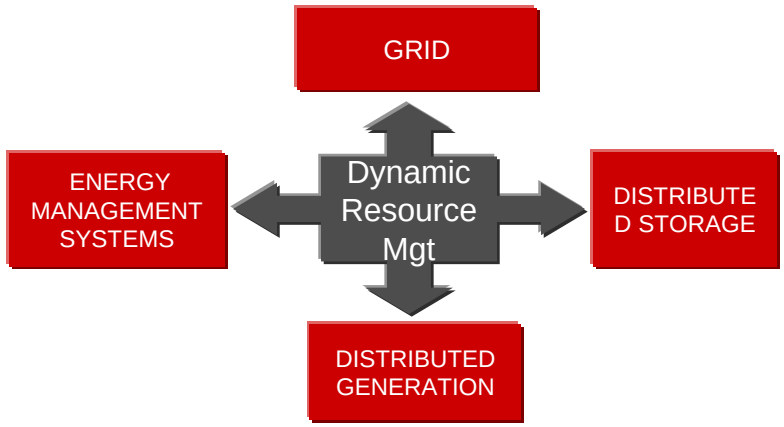
2.5MW project, consisting of 5 Transflow 2000 units, underway in Charlotte, NC

First unit to be commissioned in 2009

Grid Optimization

Goal:

Real-time optimization across a network of distributed resources while providing 100% reliability



Status:

Transflow 2000 has been chosen for the substation scale storage unit

Smaller residential scale storage solutions are still being evaluated

On-going Projects - Mobile

Smart Charging

Goal:

Use Energy Storage capability of PEVs to optimize charging times for improved system load factor.

Status:

Testing with PHEV conversions and stationary storage.

Working to establish capability and expectations with early production vehicles

Vehicle to Grid

Goal:

Utilize vehicle storage bi-directionally for system benefits

Status:

Pilots to understand feasibility and value.

Can not be rushed to the detriment of vehicle success.

Economic Distributed Energy Storage

Goal:

Plug-In Vehicles as catalyst for development of economic residential scale energy storage

Status:

Energy Storage advancements for vehicle market may lower cost to make stationary application viable at the home.

Evaluating cost/benefits of Mobile storage vs Stationary.

Need for standards on interconnection, communication, and physical dimensions.

Design phase applications

Supplementing Renewables

Goal:

Firm wind generation and provide grid stabilizing support

Need:

- Minimum 100 kWh blocks
- Control system with dynamic dispatch capability
- Complete charge in 4 hours or less
- Low maintenance needs*
- Stand alone installation at the site substation

*prefer no more than annual inspection

Ancillary Services

Goal:

Increase efficiency of generation plants by eliminating the need to ramp up and down

Need:

- Fast discharge capability – prefer full discharge in 15-60 minutes
- Charge time requirements still being developed
- Control system with dynamic dispatch capability
- Small footprint and mobility

Hurdles

Applications	Major Hurdles
•Substation capital deferral •Substation emergency backup •Substation backup power	Primary hurdle is cost • Storage competes with conventional solutions •Lifetime cost approach would support newer, cleaner technology adoption compared to first cost approach
•Supplement renewable energy	Recognition of shortcomings in delivering renewable energy
•Grid stabilizing ancillary services	Market structure and recovery mechanisms
•Distributed storage at customer premise •Stationary •Mobile (PHEV, EV)	Need to explore new rate mechanisms to incentivize customers adoption Expect a paradigm shift in approach to metering •Mobile storage has potential to introduce a shift from single meter per customer