spirae

The Power Behind Renewable and Distributed Energy

Microgrids within Distribution Networks

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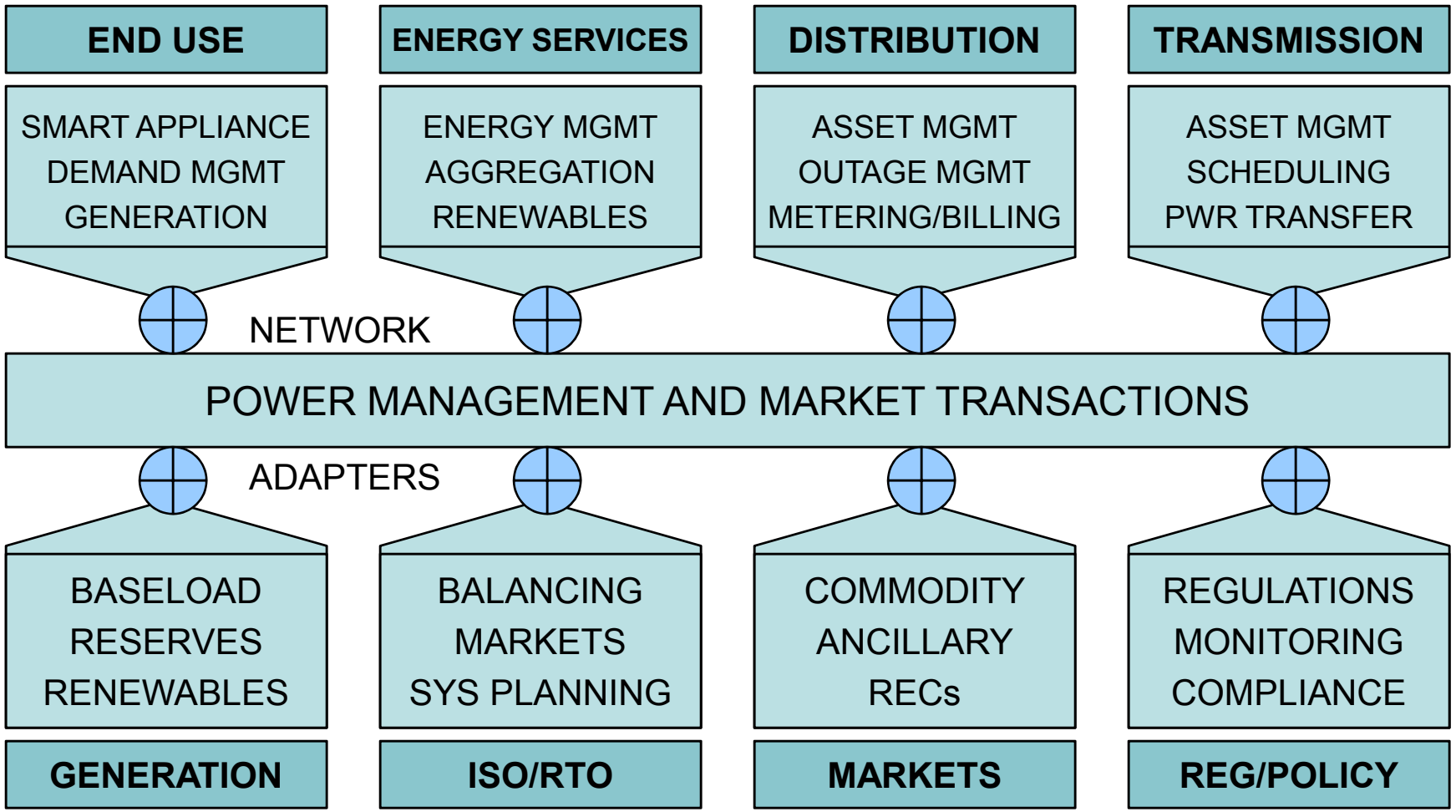
Overview

- Smart Grid Overview
- Microgrids within Distribution Networks
- Examples
  - Danish Cell Controller Project
  - Fort Collins Zero Energy District
- Summary

Smart Grid


END USE
ENERGY SERVICES
DISTRIBUTION
TRANSMISSION
SMART APPLIANCE
DEMAND MGMT
GENERATION
ENERGY MGMT
AGGREGATION
RENEWABLES
ASSET MGMT
OUTAGE MGMT
METERING/BILLING
ASSET MGMT
SCHEDULING
PWR TRANSFER
NETWORK
POWER MANAGEMENT AND MARKET TRANSACTIONS
ADAPTERS
BASELOAD
RESERVES
RENEWABLES
BALANCING
MARKETS
SYS PLANNING
COMMODITY
ANCILLARY
RECs
REGULATIONS
MONITORING
COMPLIANCE
GENERATION
ISO/RTO
MARKETS
REG/POLICY

Smart Grid: Integrating Information and Power Management

Information Management

- Communications
- Data Management
- Cyber Security
- Application Interoperability
- Services and Billing
- Enterprise Integration

Power Management

- System Stability
- Ancillary Services
- Protection and Safety
- Interaction between DER
- Modeling and Simulation
- System Planning

The Smart Grid Challenge: Develop infrastructure compatible with legacy systems that integrates information and power management functions while enabling new applications, markets, business models and system capabilities.

Microgrids

- Microgrid control technologies enable active power management within small systems with diverse generation and load management capabilities
- Microgrids are typically designed as systems with static boundaries and well-defined grid connection point
- Network topology is often ignored in microgrids since its electrical significance is limited due to close proximity of assets and static nature

Microgrids within Distribution Networks

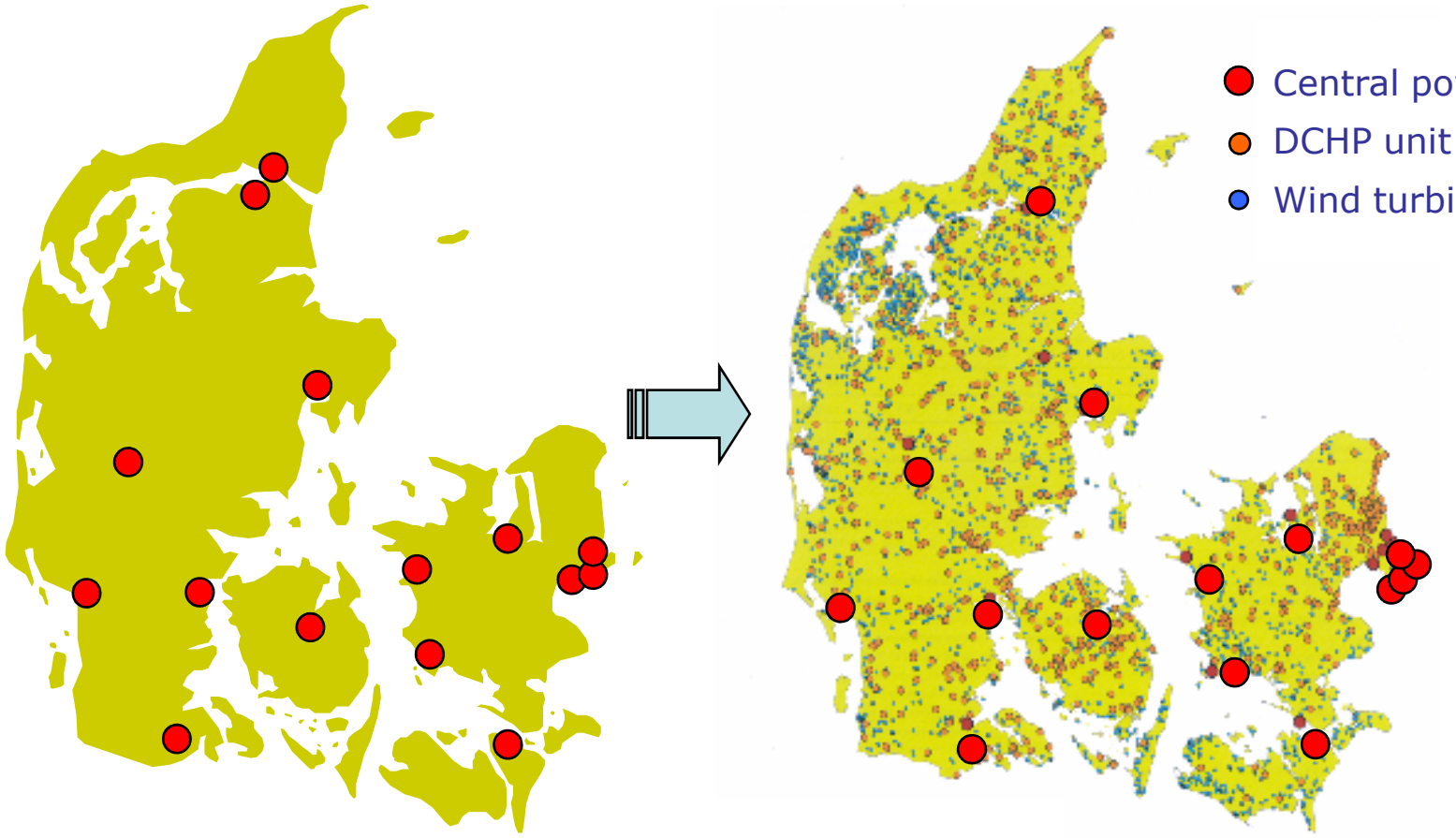
- Dynamically create “islandable” subnetworks
- Intentional Islanding and resynchronizing
- Local balancing of intermittent renewables
- kW/kVAr control at remote intertie
- Integrated network topology and power management
- Dynamically assign isoch/droop/load-share machines
- Automatic load/generation shedding/restoration

Microgrids within distribution networks can provide power management and resource virtualization for creating and delivering “ancillary” services to different network locations

Danish Power System

1980's Primary Gen

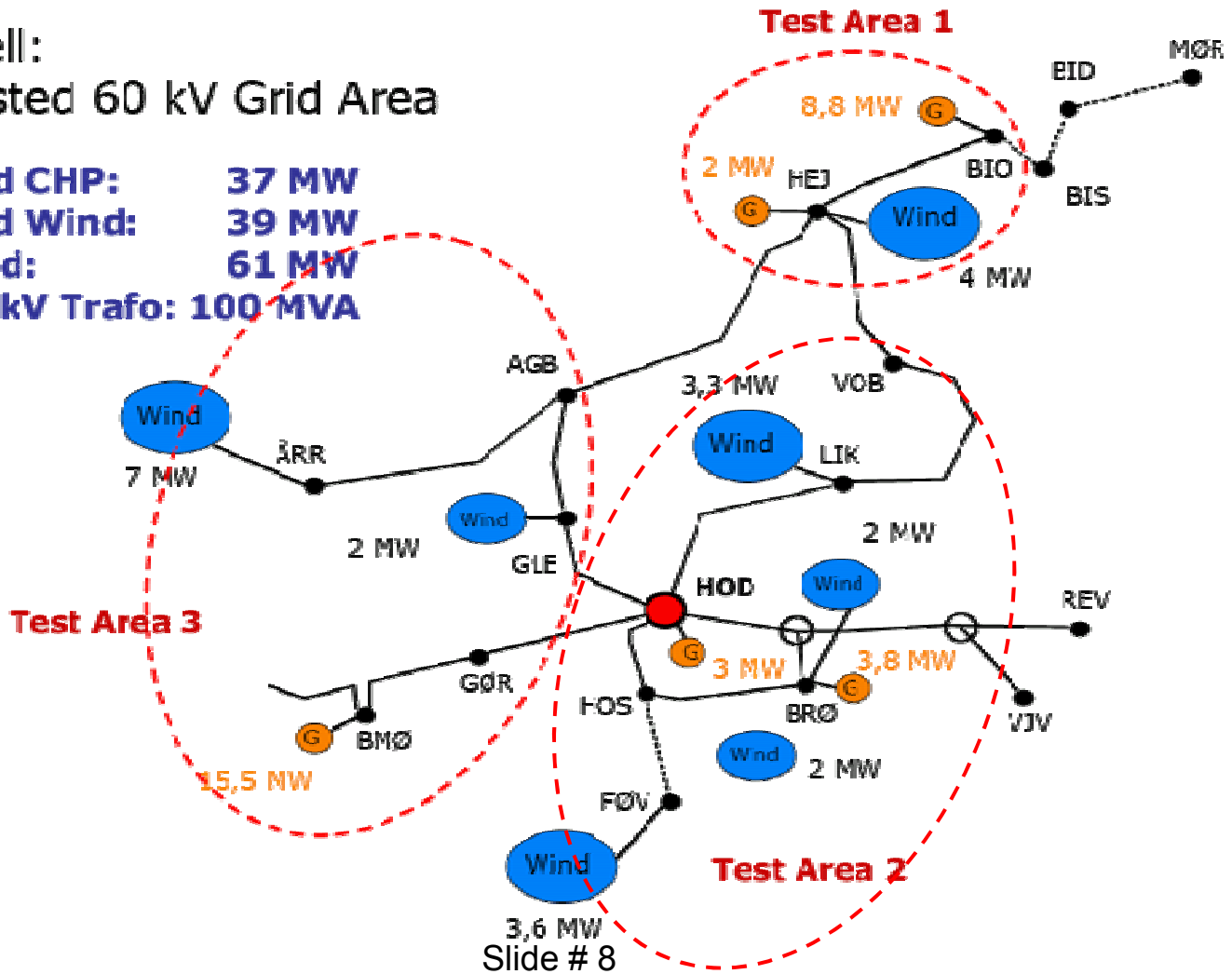
2000's Distributed Gen



Energinet.dk Cell Controller Project

Pilot Cell:
SS Holsted 60 kV Grid Area

Installed CHP: 37 MW
Installed Wind: 39 MW
Max Load: 61 MW
150/60 kV Trafo: 100 MVA



Wind Turbines, CHPs, Load Control for Distribution Operations

Cell Controller Field Tests in Denmark – Nov 2008

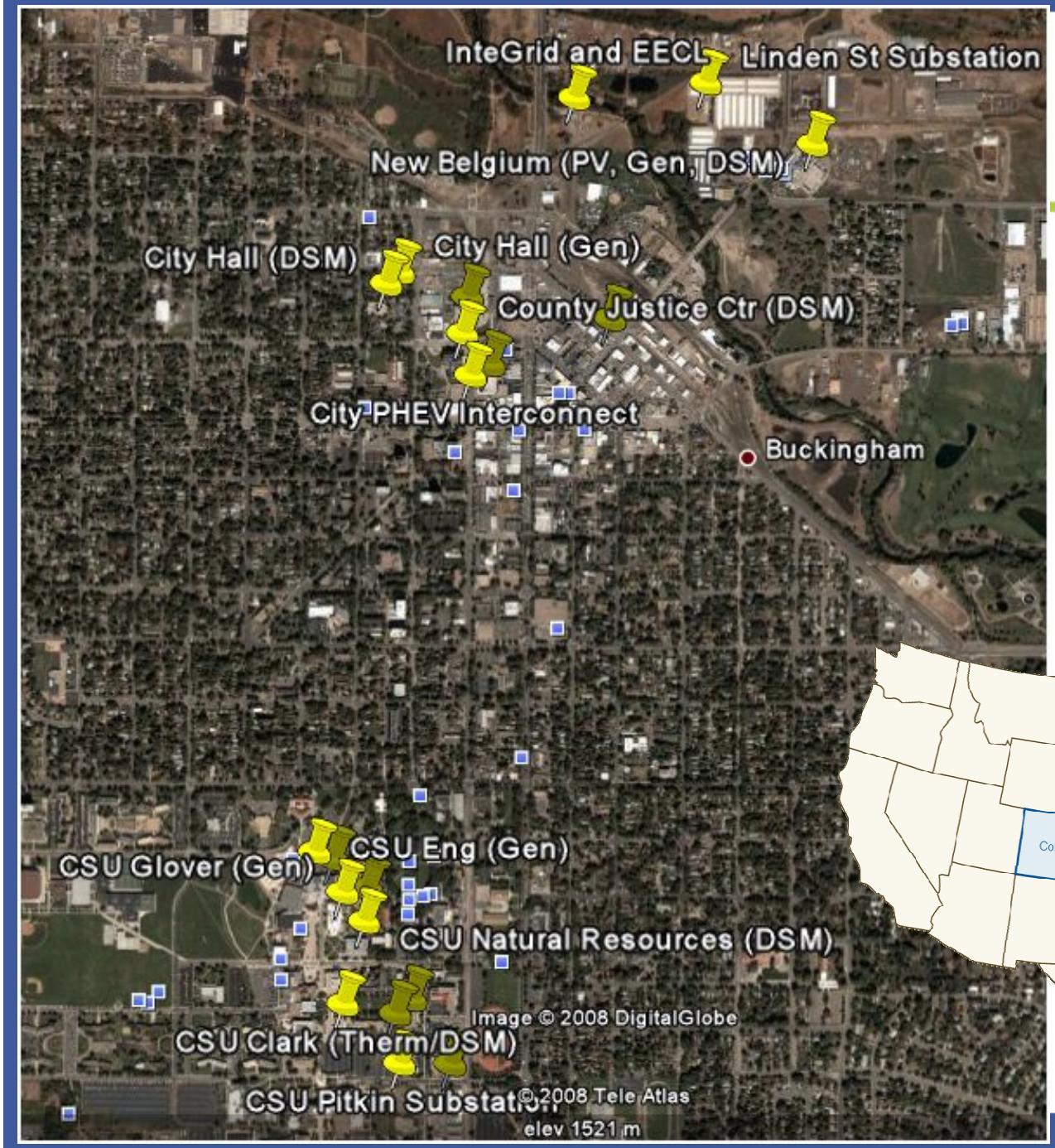
FortZED - RDSI

ZERO ENERGY DISTRICT: A Zero Energy District is one that creates as much thermal and electrical energy locally as it uses.

PEAK LOAD MANAGEMENT: Active management of peak loads on a substation using Distributed Energy Resources.

IMPORT/EXPORT CONTROL: Actively control active and reactive power based on remotely issued set points at specified interconnection points.

INTERMITTENCY MANAGEMENT: Balance intermittent renewable production with demand management, conventional generation, and fast-acting loads/generation.


InteGrid and EECL
Linden St Substation
New Belgium (PV, Gen, DSM)
City Hall (DSM)
City Hall (Gen)
County Justice Ctr (DSM)
City PHEV Interconnect
Buckingham
CSU Eng (Gen)
CSU Glover (Gen)
CSU Natural Resources (DSM)
CSU Clark (Therm/DSM)
CSU Pitkin Substation
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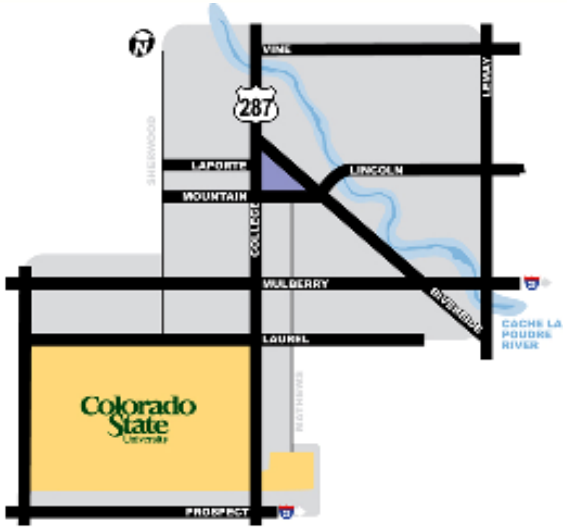
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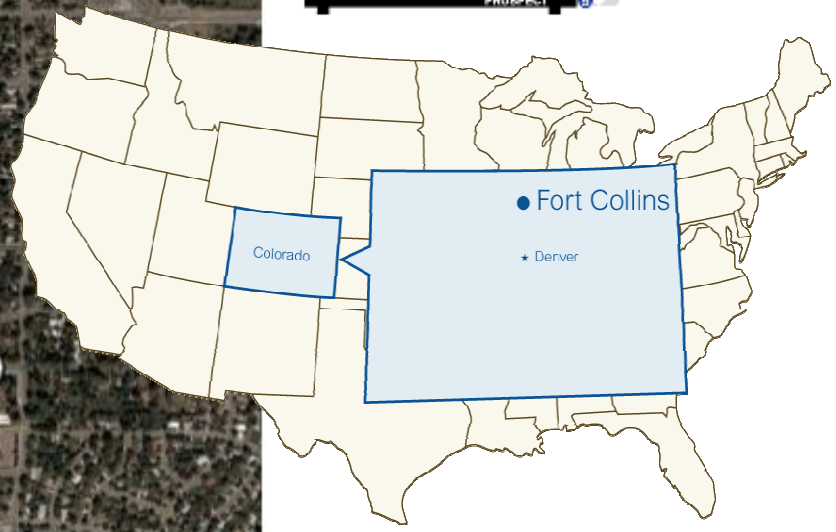
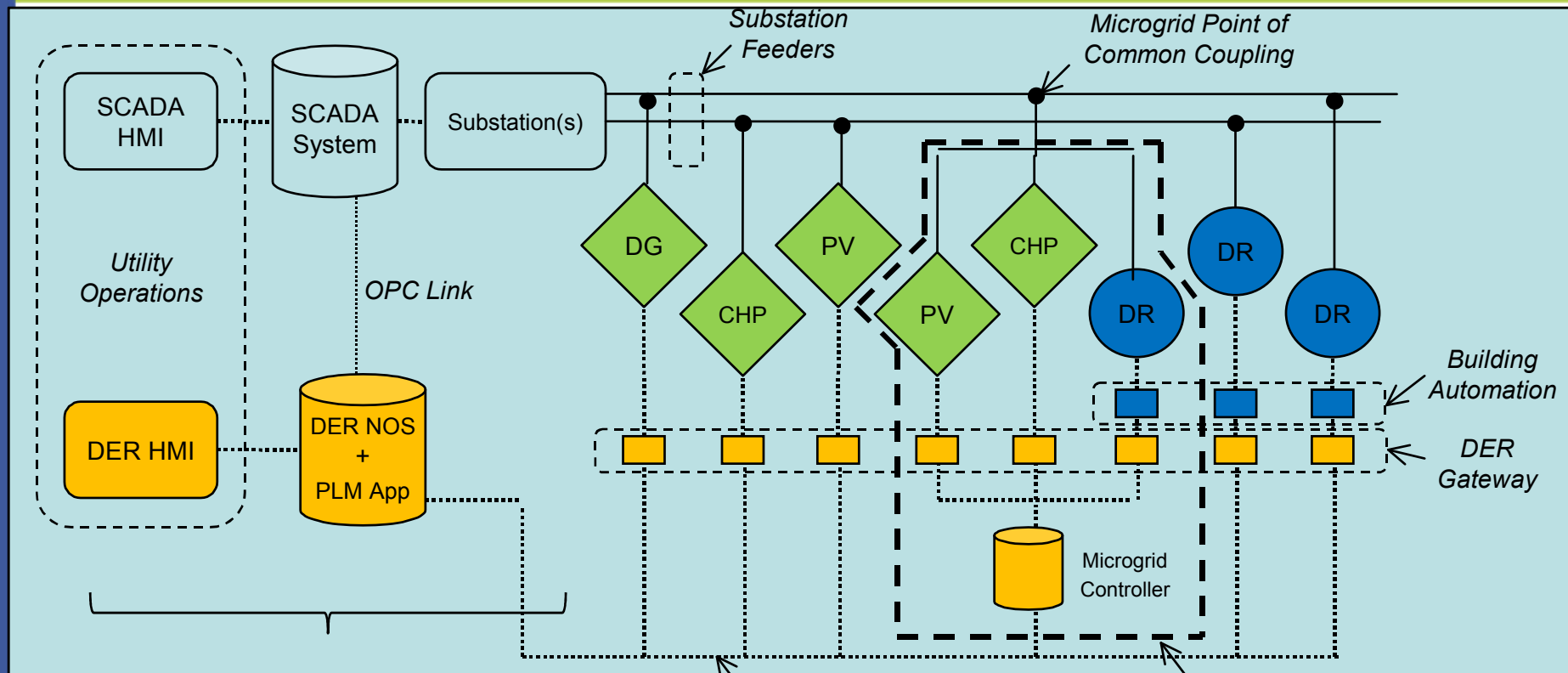
LAPORTE
MOUNTAIN
LINCOLN
COLLEGE
MULBERRY
LAUREL
PROSPECT
Colorado State University
CACHE LA POUDRE RIVER


Colorado
Fort Collins
Denver

System Architecture



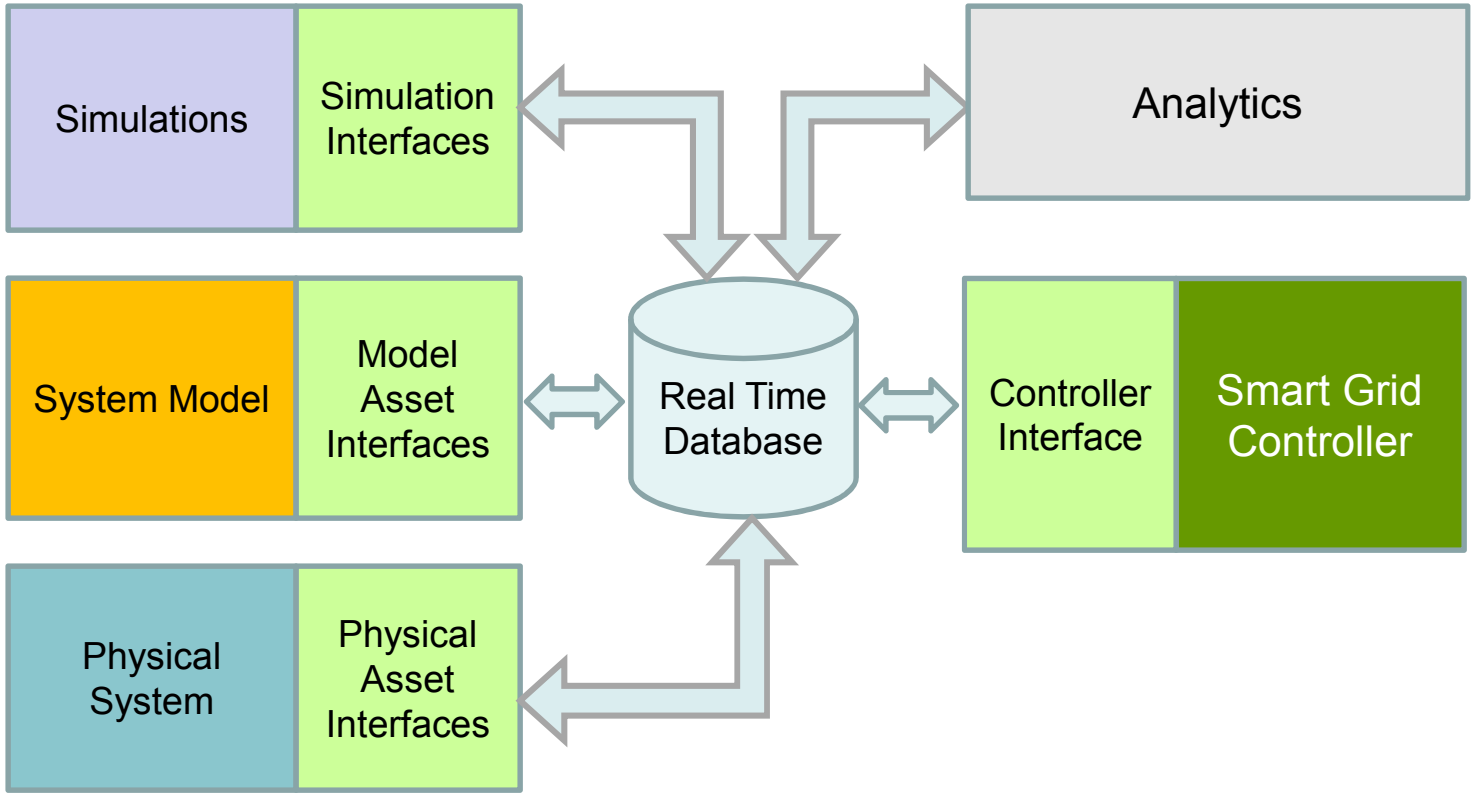
Functional Capabilities

- Monitor Substation Loads
- Monitor DER Assets
- Issue Dispatch Commands
- Monitor and Track Response
- Store Data and Analyze

Measurement and Control

- Metering
- Availability, Status
- Dispatch

Modeling, Simulation, and Field Installation



Summary

- Microgrids are becoming more broadly applied within distribution networks
- Microgrid power management functions can be leveraged to virtualize distributed resources and deliver services to different network locations
- Microgrids can be dynamically formed to address time-varying needs of the network and availability of DER
- Whether you call them Cell, ZEDs, or Smart Grids, the power management capabilities of microgrids enable the full participation of DER for grid operations and optimization

Thank You for your Attention!

Q&A

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