

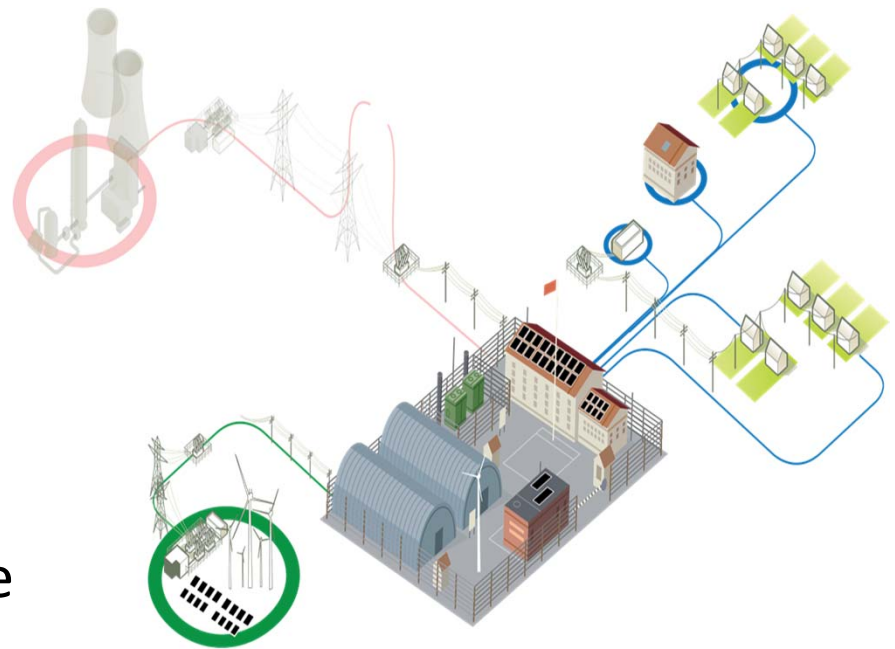
Implementation of Smart Grid Technologies in Microgrids

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What Is Needed to Implement a Microgrid?

- Alternate energy sources
- Energy storage
- Equipment and controls to achieve:
 - automatic fault isolation and service restoration and/or
 - automatic islanding
- Reliable, high-speed communication to enable these functions



Energy Storage

Sodium-Sulfur (NaS) Battery Storage System

- Provides megawatt-hours of energy storage
- Permits generated power to be dispatched when needed
- Can mitigate power ramp rates
- Allows peak shaving



<http://www.electricenergyonline.com>



Energy Storage

Community Energy Storage System

- Provides local backup power for consumers
- Provides voltage control along the feeder
- Integrates community's renewable power resources into the grid



Automatic Fault Isolation and Service Restoration

High-Speed Fault-Clearing System

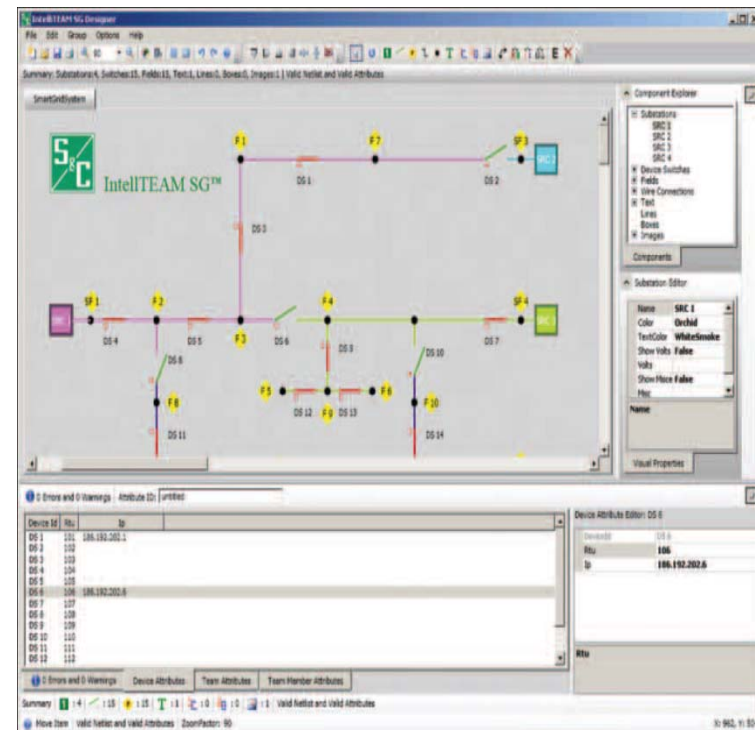
- Specially-configured Underground Distribution Switchgear that can be remotely controlled
- High-speed fiber communication system



Automatic Fault Isolation and Service Restoration

Automatic Restoration System

- Uses peer-to-peer communication with distributed intelligence to track system conditions
- Excess capacity of alternate sources, including stored energy, is used to initiate service restoration in seconds
- Can be used to pick up load selectively in a microgrid to prevent alternate source overloading



Military Microgrid — Dyess Air Force Base

- Paralleling switchgear
- 14 Automated Switches
- Automatic Switch Controls
- Automatic Restoration System

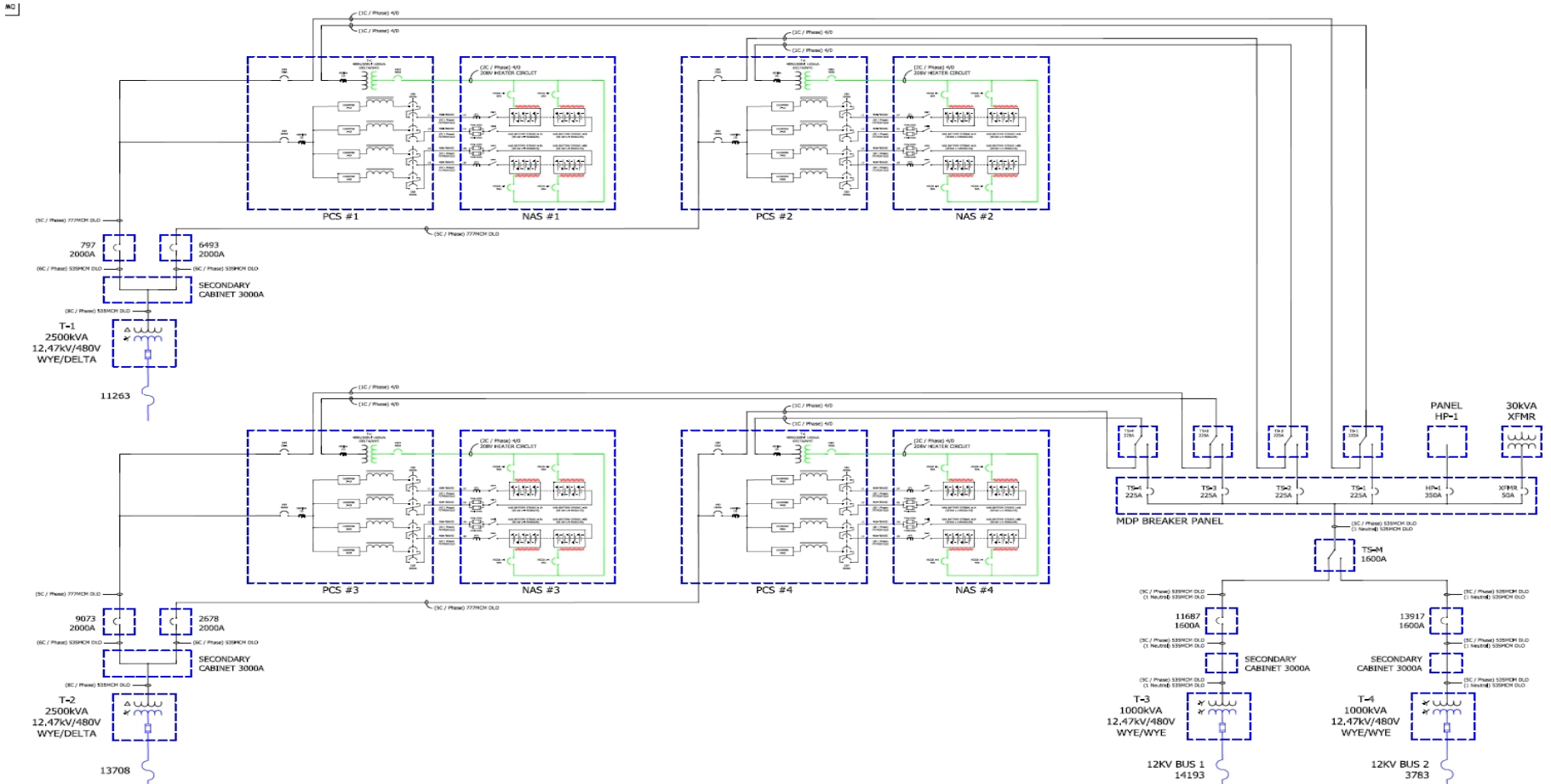


Military Microgrid — Fort McNair

- High-Speed Fault-Clearing System
- Underground Distribution Switchgear
- Microprocessor-relay controls
- Fiber-optic communication



Residential Community Microgrid – Presidio, Texas

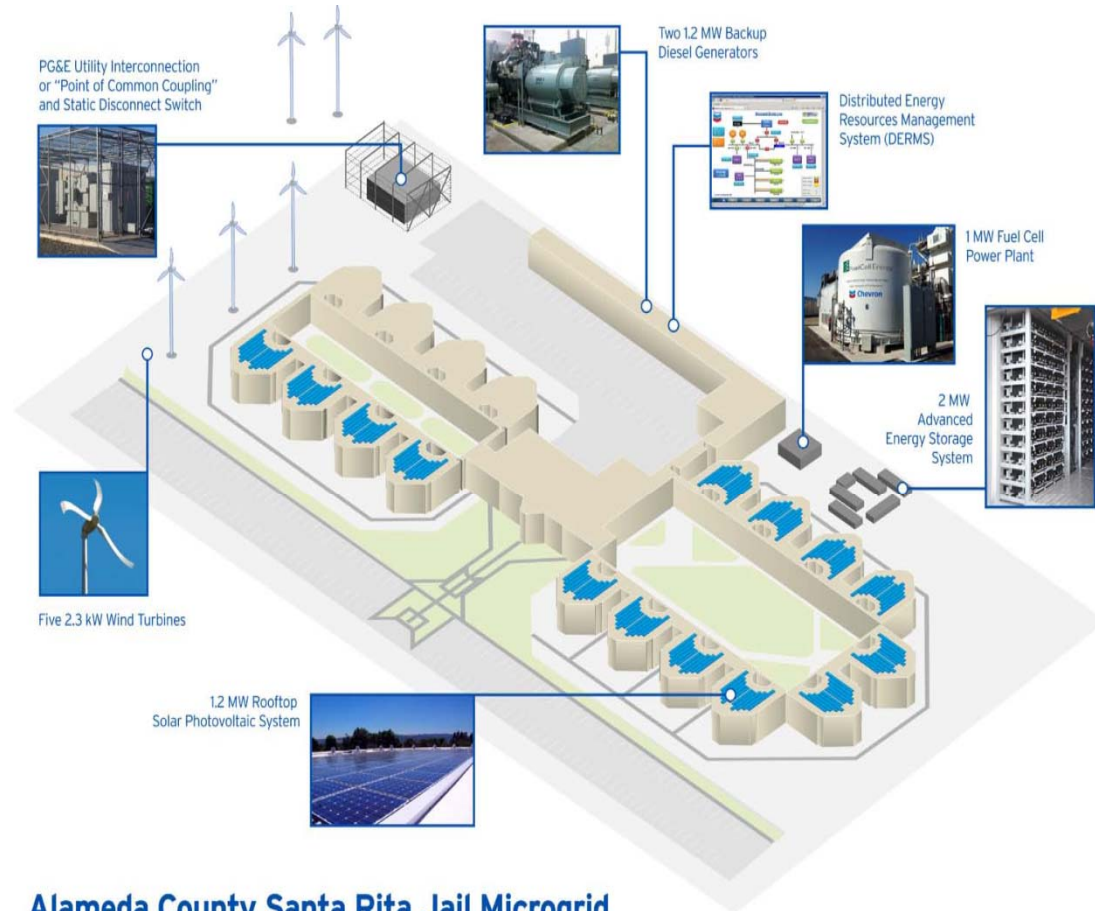


Residential Community Microgrid – Presidio, Texas

- 4 MW, 24 MWh NaS Battery Energy Storage System, installed indoors
- Automated switches with pulse closing technology
- Alternate utility source as backup



Campus Microgrid – Santa Rita Jail, Dublin, California



Alameda County Santa Rita Jail Microgrid
Microgrid Components

Campus Microgrid – Santa Rita Jail, Dublin, California

- 2 MW, 4 MWh Lithium-Ion Battery Storage System

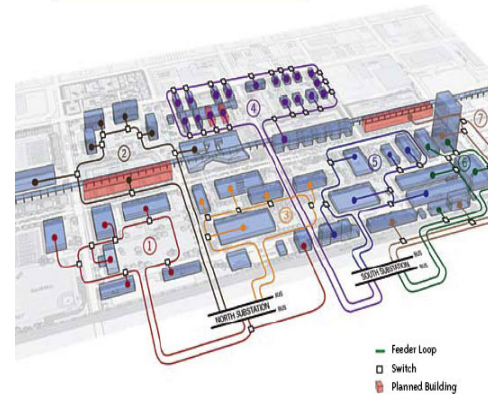


University Microgrid – Illinois Institute of Technology Main Campus

- Underground Distribution Switchgear
- Microprocessor-relay controls
- Fiber-optic communication
- Will ultimately incorporate wind turbines and photovoltaic panels, expand to the rest of the campus



HIGH RELIABILITY DISTRIBUTION SYSTEM
(DRAWING NOT TO SCALE)



www.iit.edu/perfect_power



Thank you!