Energy Storage Technology Advancement Partnership (ESTAP) Webinar:

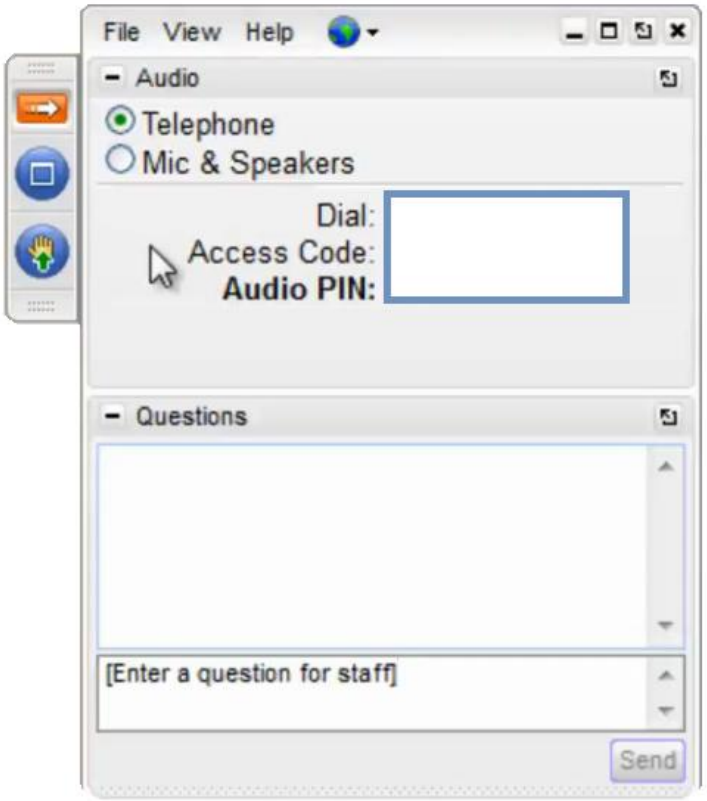
Retrofits for Resiliency - How to Make an Existing Solar PV System into an Islandable Resilient Power System

November 12, 2015

Hosted by Todd Olinsky-Paul
ESTAP Project Director, CESA

Housekeeping

All audience members are muted by default. Please click on the Audio selection to choose either “Telephone” or “Mic & Speakers” for your audio connection.



Telephone users will find dial-in information on your webinar console. Please enter your audio pin into the telephone keypad.

We will be opening the floor to questions and comments from the audience. Please “raise your hand” by clicking the icon to request to be unmuted.

You can also use the question box on your webinar console to type in a question, or to let us know if you are having technical difficulties.

This webinar will be recorded. Slides and a recording of this webinar will be posted on our website at www.cesa.org/webinars.

State & Federal Energy Storage Technology Advancement Partnership (ESTAP)

Todd Olinsky-Paul

Project Director

Clean Energy States Alliance (CESA)

Thank You:

Dr. Imre Gyuk
U.S. Department of Energy,
Office of Electricity Delivery and
Energy Reliability

Dan Borneo
Sandia National Laboratories

CleanEnergy States Alliance

Sandia National Laboratories

U.S. DEPARTMENT OF ENERGY

ESTAP is a project of CESA

Clean Energy States Alliance (CESA) is a non-profit organization providing a forum for states to work together to implement effective clean energy policies & programs:

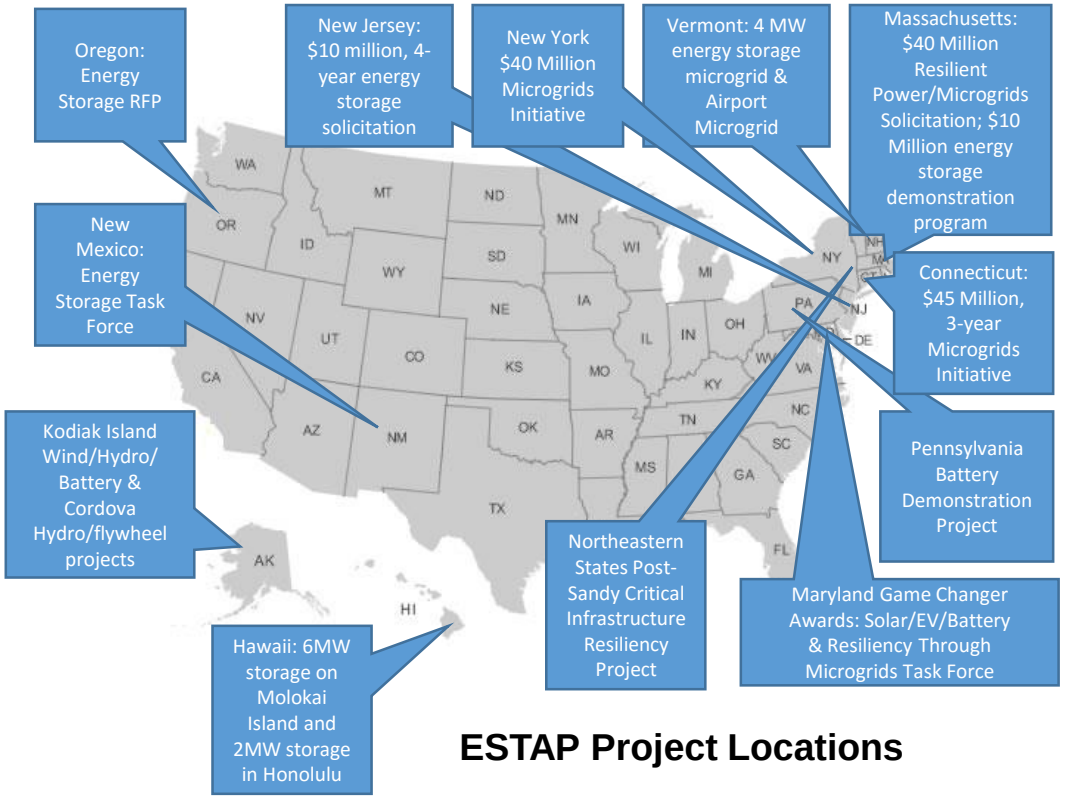
State & Federal Energy Storage Technology Advancement Partnership (ESTAP) is conducted under contract with Sandia National Laboratories, with funding from US DOE.

ESTAP Key Activities:

1. Disseminate information to stakeholders
   - ESTAP listserv >2,000 members
   - Webinars, conferences, information updates, surveys.

2. Facilitate public/private partnerships to support joint federal/state energy storage demonstration project deployment

3. Support state energy storage efforts with technical, policy and program assistance



ESTAP Project Locations

CleanEnergy States Alliance

Sandia National Laboratories

U.S. DEPARTMENT OF ENERGY

Energy Storage Technology Advancement Partnership

More CESA Projects

Overview
ESTAP Resource Library
ESTAP Webinars
ESTAP News
ESTAP Listserv Signup

ESTAP

Project Director: Todd Olinsky-Paul

Contact: Todd Olinsky-Paul, Todd@cleanegroup.org

SIGN UP FOR THIS e-MAILING LIST

The Energy Storage Technology Advancement Partnership (ESTAP) is a federal-state funding and information sharing project, managed by CESA, that aims to accelerate the deployment of electrical energy storage technologies in the U.S.

The project's objective is to accelerate the pace of deployment of energy storage technologies in the United States through the creation of technical assistance and co-funding partnerships between states and the U.S. Department of Energy.

ESTAP conducts two key activities:

1) Disseminate information to stakeholders through:

- The ESTAP listserv (>500 members)
- Webinars, conferences, information updates, surveys

2) Facilitate public/private partnerships at the state level to support energy storage demonstration

NEW RESOURCES

June 22, 2015
Clean Energy Champions - The Importance of State Programs and Policies
By Warren Leon, Executive Director, CESA

June 12, 2015
Solar+Storage News 6.12.15
By Clean Energy Group

April 7, 2015
ESTAP Webinar Slides: Upgrading Distribution Resilience - A DOE-OE

UPCOMING EVENTS

August 27, 2015
Webinar: Electricity Markets and the Economics of Energy Storage,

More Events

LATEST NEWS

May 21, 2015
ODOE to Offer Research and Development Funds for Energy Storage

Today's Guest Speakers

- **Ben Schenkman**, Senior Member of Technical Staff, Sandia National Laboratories
- **Chris Larsen**, Senior Sales Engineer, Dynapower Company LLC
- **Dan Cohee**, Vice President, Pacific Data Electric

Sandia National Laboratories

DYNAPOWER COMPANY

PDE Total Energy Solutions

Contact Info

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Dan Borneo
(drborne@sandia.gov)

Webinar Archive: www.cesa.org/webinars

ESTAP Website: http://bit.ly/CESA-ESTAP

ESTAP Listserv: http://bit.ly/EnergyStorageList

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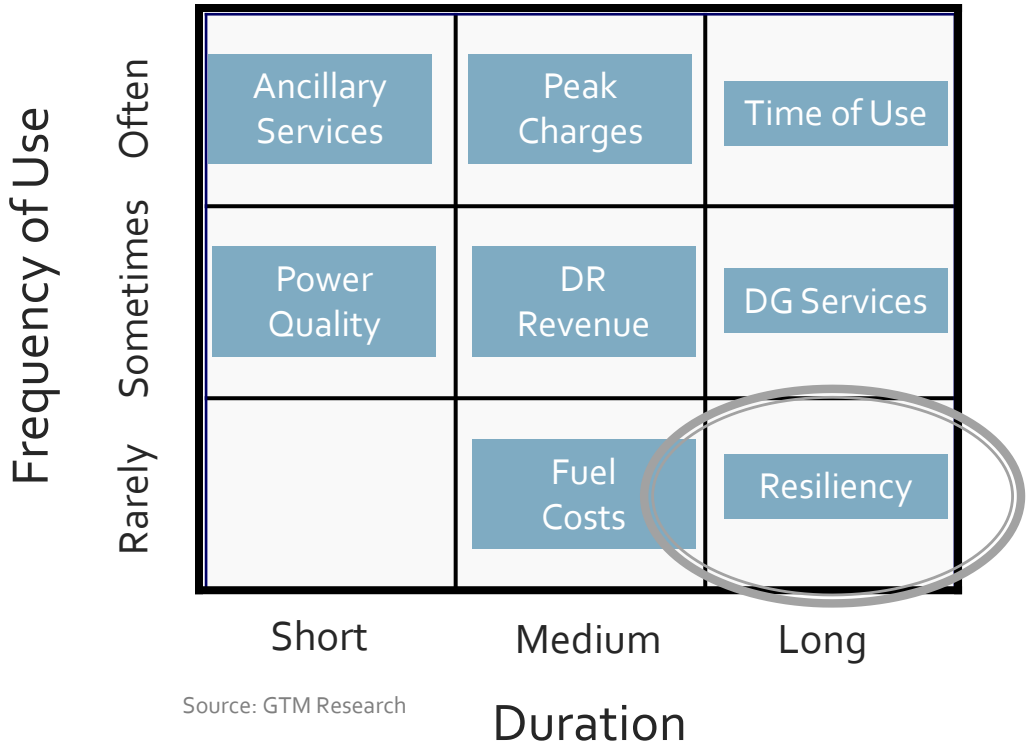
Solar + Storage Retrofit Options

Chris Larsen
Dynapower Company
clarsen@Dynapower.com

Multiple Value Streams

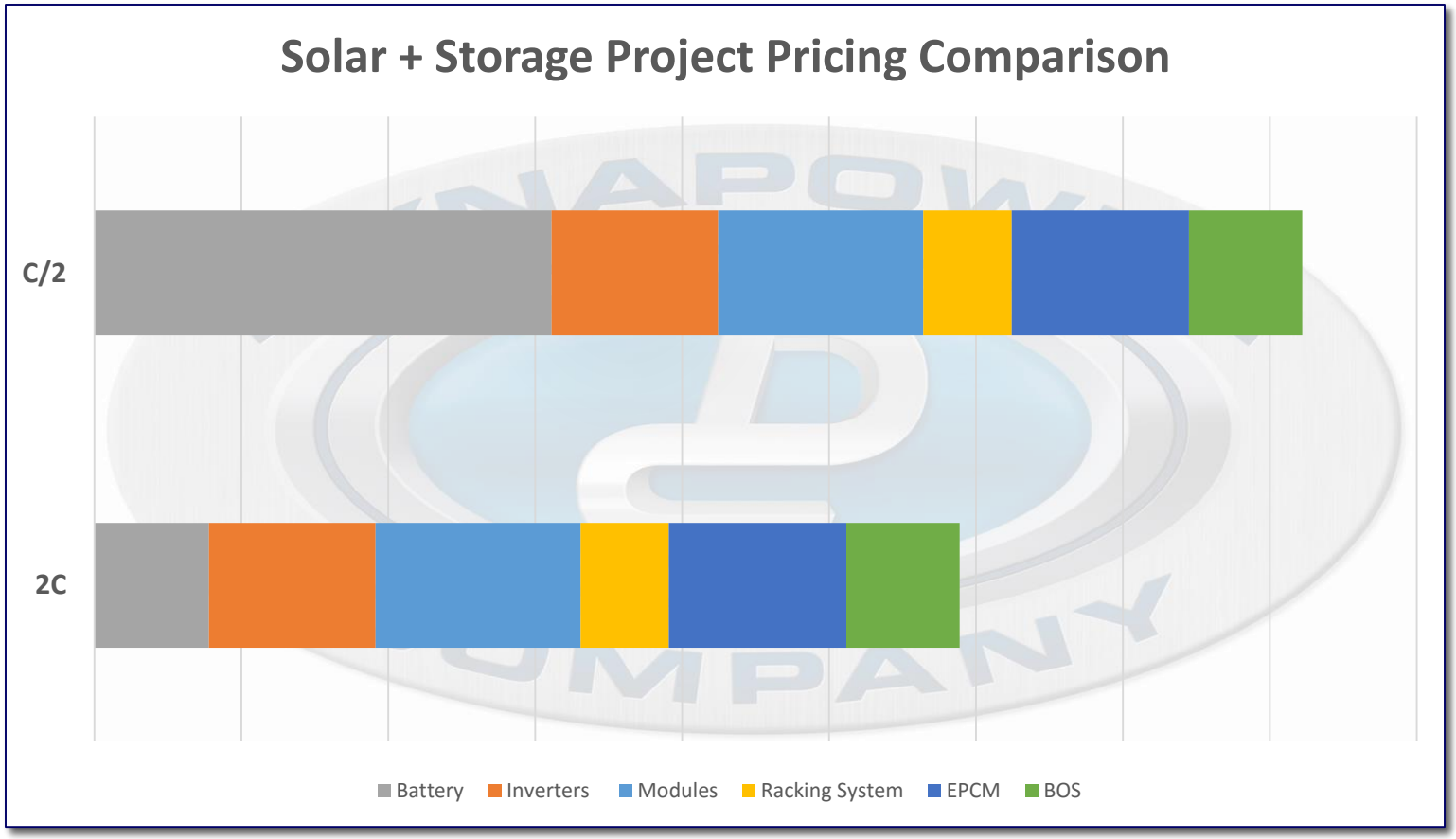


Source: GTM Research

Different Value Stream, Different Cost Drivers

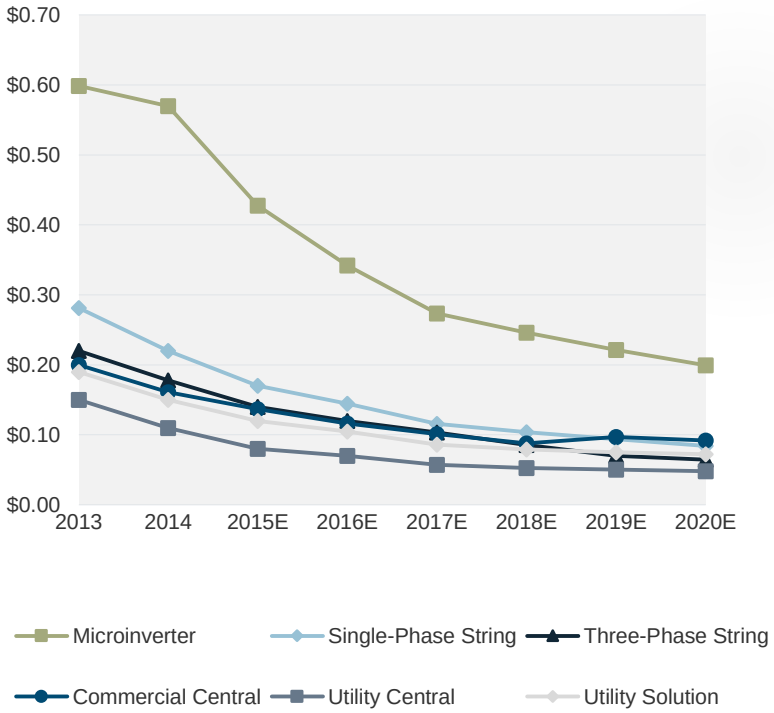
Application Drives Cost

Cost = kW_PV x $/watt + kW_ESS x $/kW_ESS + kWh battery x $/kWh



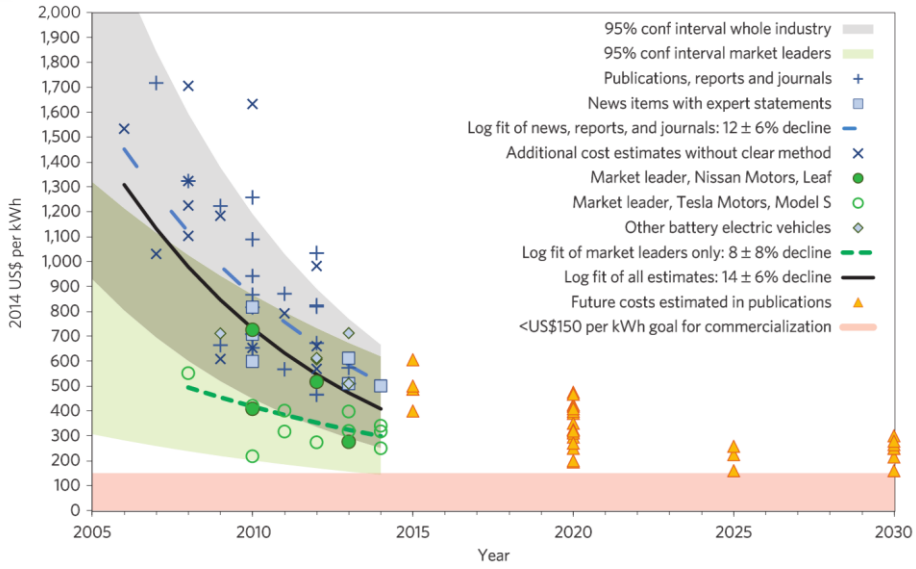
Enabling New Markets

INVERTER PRICE $/WATT AC

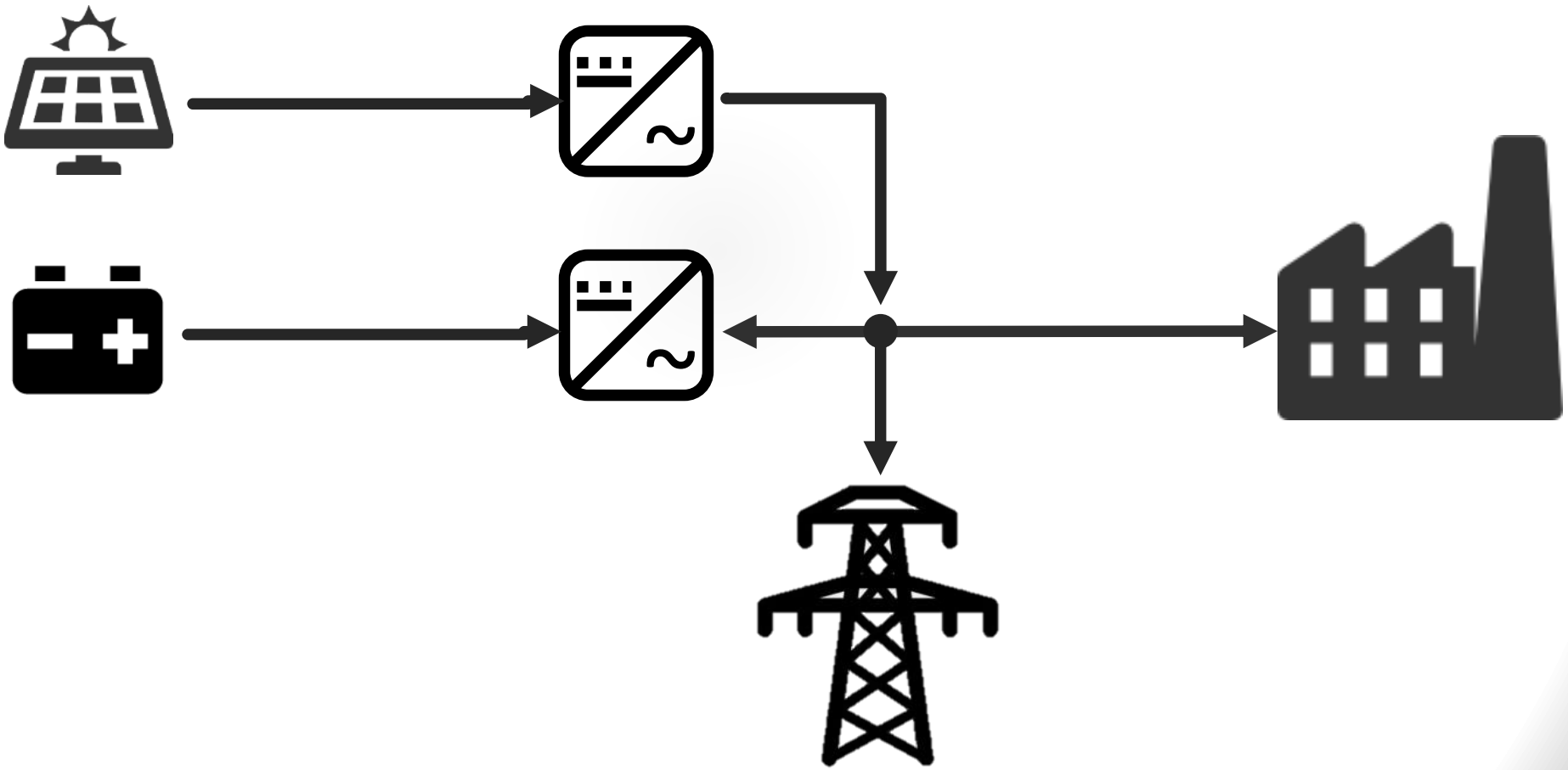


Source: GTM Research

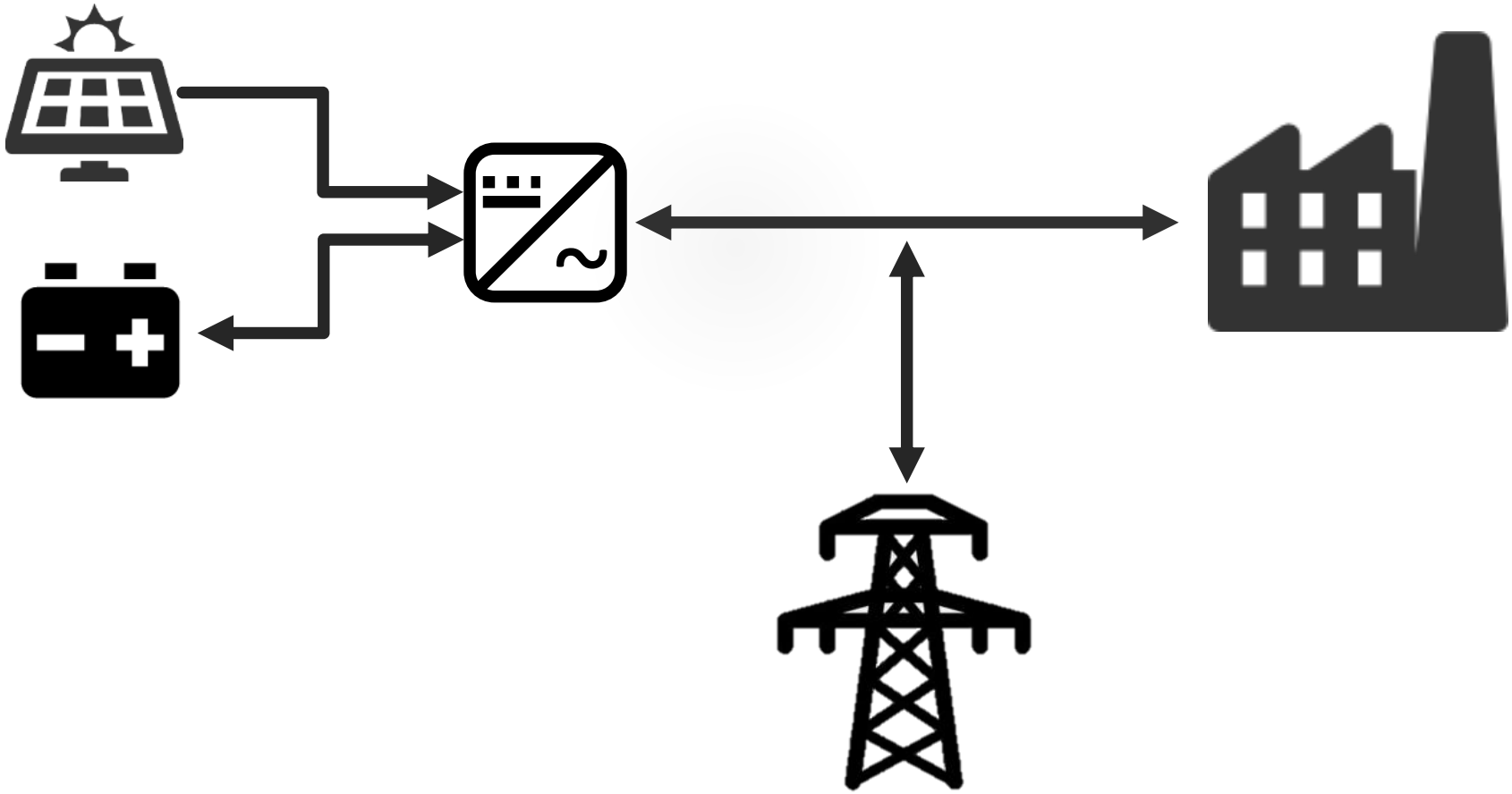
BATTERY PRICING



Solar + Storage Option 1



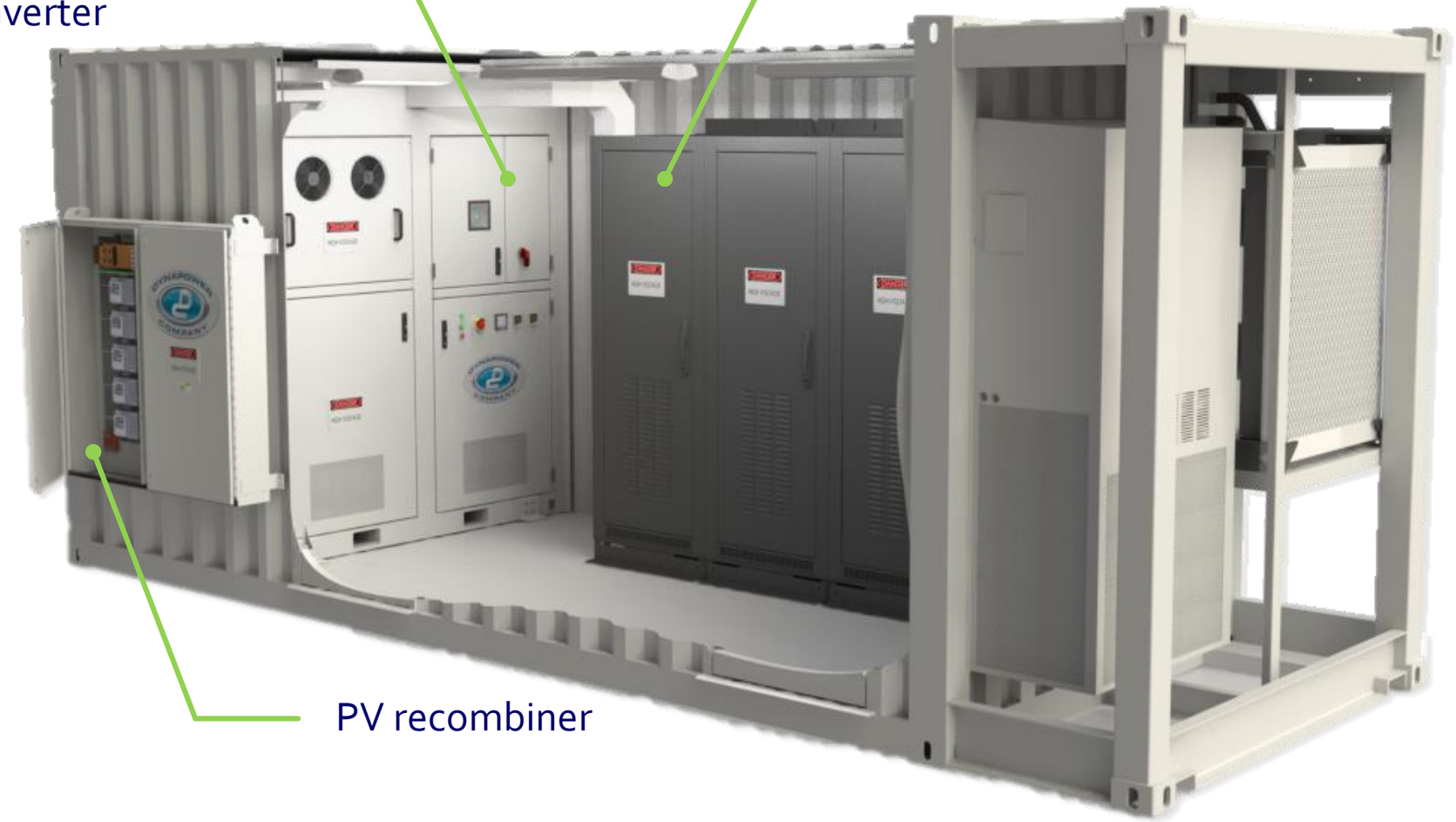
Solar + Storage Option 2



Rough costs

- Assume 250kW with 250kWh
  - Option 1: $0.90 – $1.10
    - Existing PV inverter - remains in use
    - New storage inverter - battery only
    - Controls integration
    - Batteries Li-ion 1C
    - Upstream islanding breaker
  - Option 2: $1.00 – $1.20
    - Existing PV inverter – removed
    - New storage inverter - battery and PV
    - Batteries Li-ion 1C
    - Upstream islanding breaker (maybe)

Option 2 example:
Integrated Solar + Storage System



Example: 2 MW Solar + Storage
Stafford Hill – Rutland, VT

- 4 x IPS-500
- Hybrid Storage System
  - 2,000 kW / 1,000 kWh Li
  - 2,000 kW/ 2,000 kWh VRLA
- Dynapower Controller
- Value Streams
  - Resiliency
  - Frequency Regulation
  - Demand Response

RETROFITS FOR RESILIENCY:

HOW TO MAKE AN EXISTING SOLAR PV SYSTEM INTO AN ISLANDABLE RESILIENT POWER SYSTEM

Presented By: Dan Cohee, Vice President

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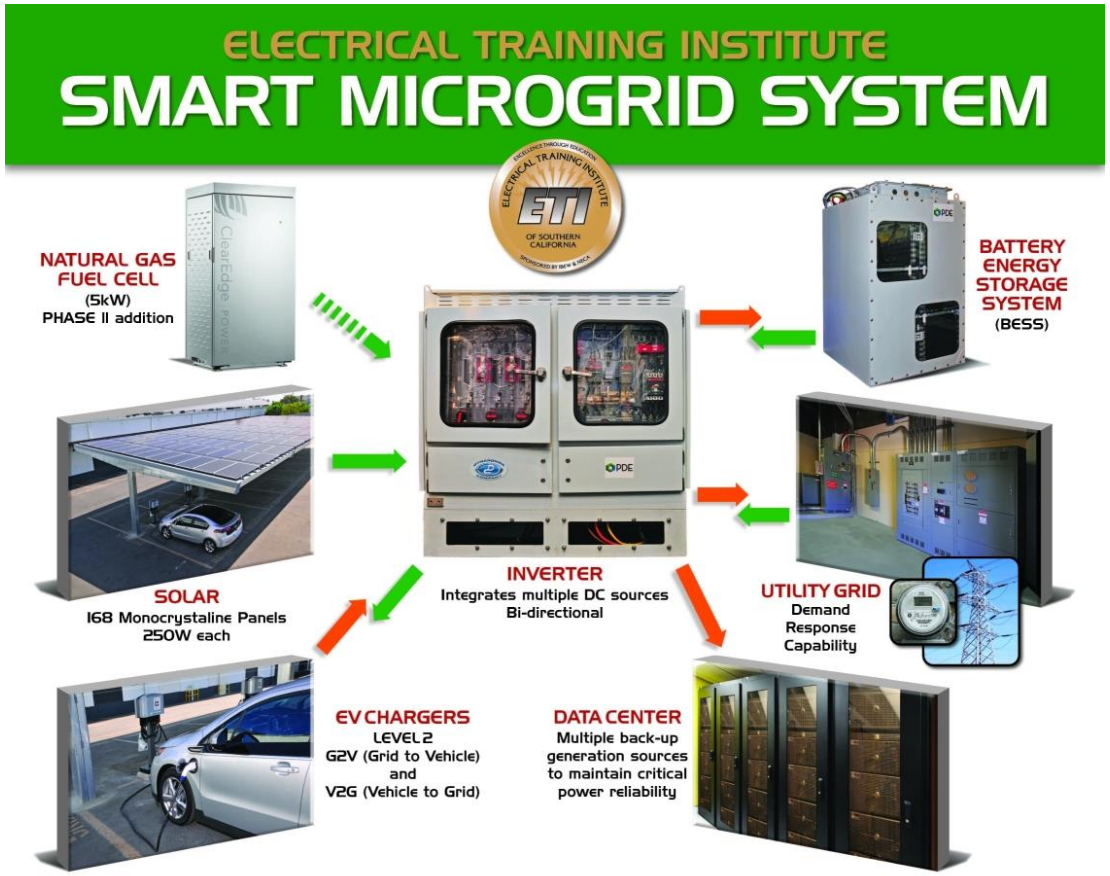
PDE Representative Projects
ETI Smart Microgrid

- Combines Energy Storage, Solar Generation, Electrical Vehicle Charging and building load management
- Can be operated both grid-connected and island-mode with full bumpless transfer
- Functionality includes renewable smoothing, peak shaving, VAR control and EV charge leveling



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Forbes

12/31/2011 William Pentland, Contributor

12 Energy Projects to Watch in 2012

#6 - PDE Total Energy Solutions: Sodium-Metal-Halide Battery Energy Storage for DoD Installations

Partners: GE Global Research/GE Energy Storage; Dynapower Corporation
Demonstration Site: 29 Palms, CA

This project is testing a Battery Energy Storage System (BESS) that incorporates utility grade power electronics, a step-up cast coil transformer, AC and DC switchgear, and sodium-metal-halide battery energy storage and is designed to integrate seamlessly to an existing microgrid. The project will demonstrate how a robust BESS will alleviate renewable energy intermittency, improve island-mode operations, and reduce demand charges and peak load stress on the main transformers and other grid equipment.

PDE's Twentynine Palms Project

- Environmental Security Technology Certification Program (ESTCP)
  - DoD's installation energy test bed
  - Nearly 600 pre-proposals submitted
  - 27 projects selected
  - PDE team includes with Dynapower and GE Energy Storage
- Twentynine Palms
  - World's largest Marine Corps base
  - US Military's largest Type 2B Microgrid
  - Project tests GE's newly developed battery energy storage system (BESS)

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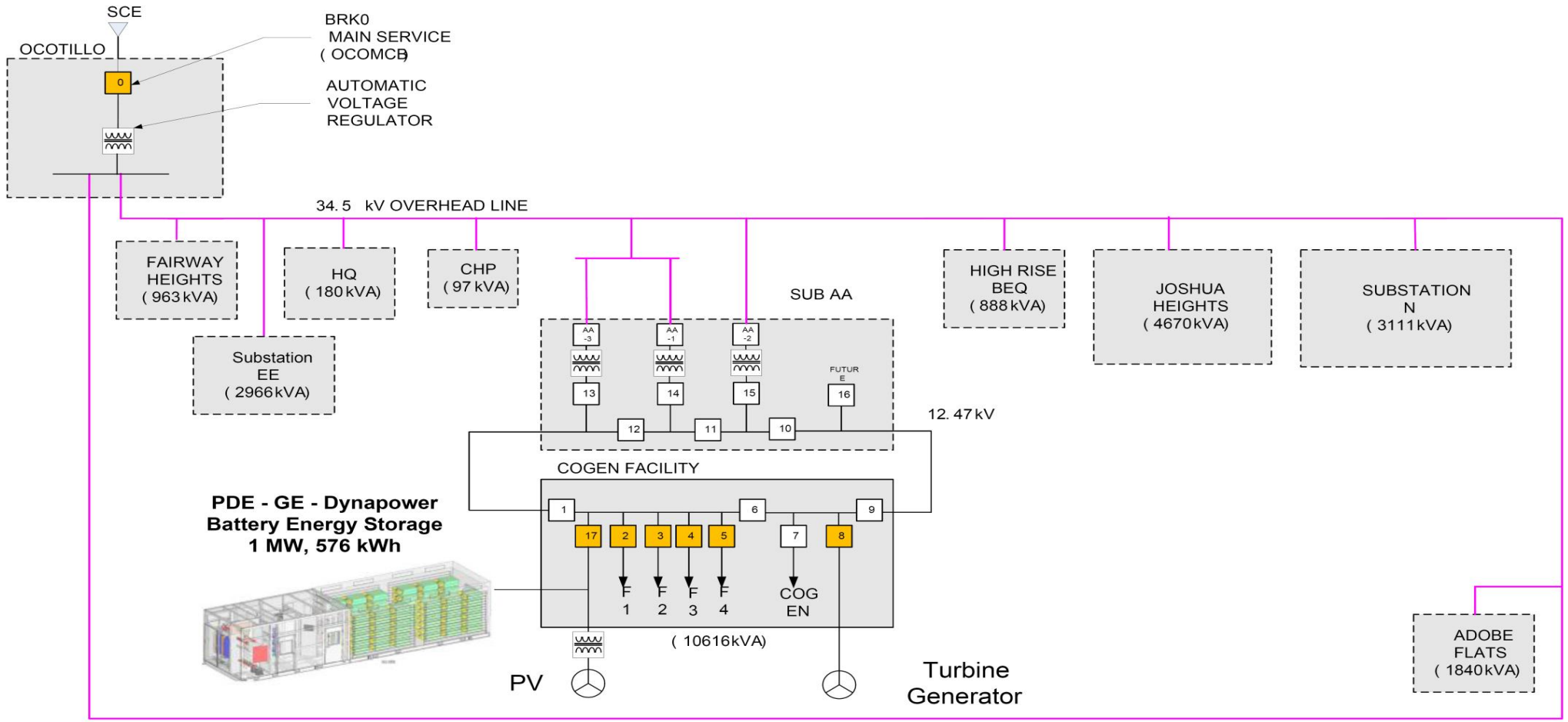
ESTCP

Twentynine Palms Grid



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NetZero Plus
Advancing Tomorrow's Energy Solutions Today™

NECA
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IBEW LOCAL 11 AND LA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

NZP ETI

Uniting energy-efficiency practices, new clean-energy technologies, improved grid resiliency, and career development at the newly expanded NZP ETI. PDE is providing Construction Management for the project and Design-Build for the microgrid/solar system.

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The Microgrid

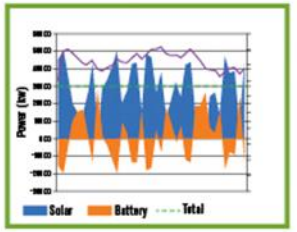
SOLAR
168 Monocrystaline
Panels 250 watts each

INVERTER
Integrates multiple DC Sources
Bi-directional

EV CHARGERS

BATTERY ENERGY STORAGE SYSTEM

UTILITY GRID
Demand
Response
Capability



DATA CENTER
Multiple back-up
generation sources
to maintain critical
power reliability

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- Living Laboratory – Local Workforce Training
- Demonstration Center
- Utility Scale Smart Microgrids
- Advanced Electronics
- Battery Storage, Solar
- Advanced Lighting Controls
- EV Charging Stations
- High Efficiency Chilled Water Mechanical System

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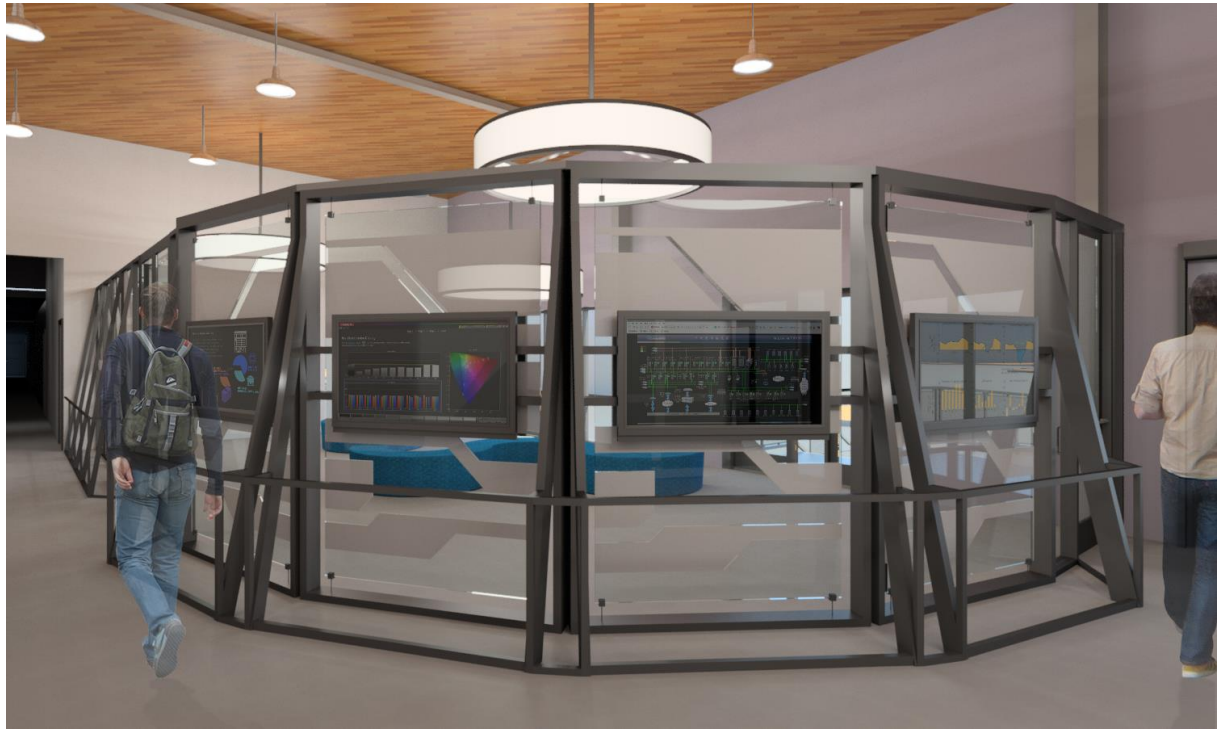
Building Design Features

- Plug Load Strategies
- Data Management
- Operable and Dimmable Skylights
- Highly Efficient Industrial Fans
- New Roof and Wall Insulation
- LED Lighting
- Exterior Solar Shading Device – Reducing Solar Heat Gains
- High Solar Reflective Index (SRI) Roofing Material
- Electrochromic Glass



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QUESTIONS