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Microgrid 2018
CONFERENCE

From Planes to Preserves: Oh, the Places Microgrids Will Go!

Moderator:
H.G. Chissell, Founder and CEO, *Advanced Energy Group*

Panelists:
Don Wingate, Vice President of Sales, Utility Solutions, *Schneider Electric*
Terry Bickham, Vice President, Energy, *Faith Technologies*
Jim Zoellick, Managing Research Engineer,
Schatz Energy Research Center, *Humboldt University*

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Microgrid 2018
CONFERENCE

Microgrids and the New Energy Landscape

Energy Infrastructure Alternatives that unlock better efficiency, sustainability, and resilience

Microgrid 2018 May 7-9, 2018

Don Wingate – Schneider Electric – Vice President – Strategic Accounts and Microgrid Solutions
Don.Wingate@Schneider-electric.com

Life Is On Schneider Electric

Megatrends are provoking a rise in Energy Demand

URBANIZATION

+2.5B people in cities by 2050

Source: United Nations, DESA

DIGITIZATION

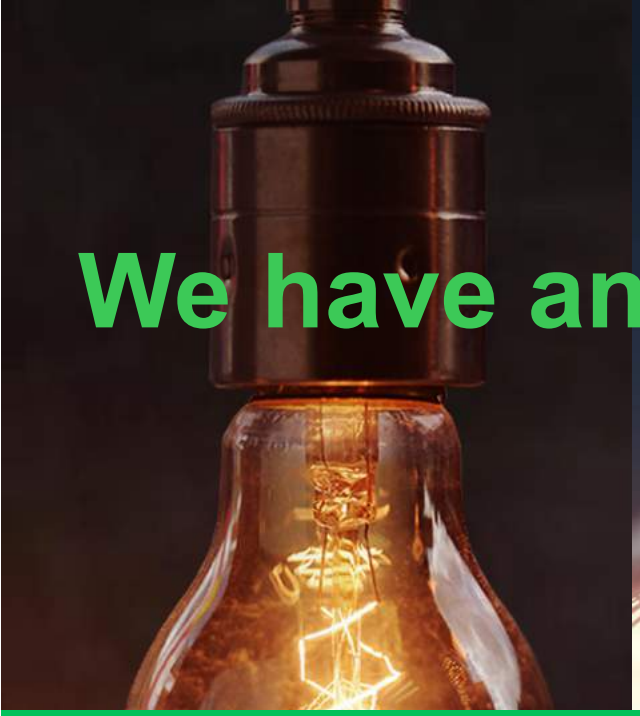
50B connected things by 2050

Source: Cisco

INDUSTRIALIZATION

+50% Energy consumption by 2050

Source: IEA




We have an opportunity to co-create the future

More ELECTRIC

2X faster growth of electricity demand compared to energy demand by 2040

Source : IEA WEO 2014

More DIGITIZED

10X more incremental connected devices than connected people by 2020

Source : Cisco, Internet World Statistics

More DECARBONIZED

82% of the economic potential of energy efficiency in buildings and more than half in industry, remains untapped

Source : World Energy Outlook 2012, Internal Analysis

More DECENTRALIZED

70% of new capacity additions will be in Renewables by 2040

Source : BNEF

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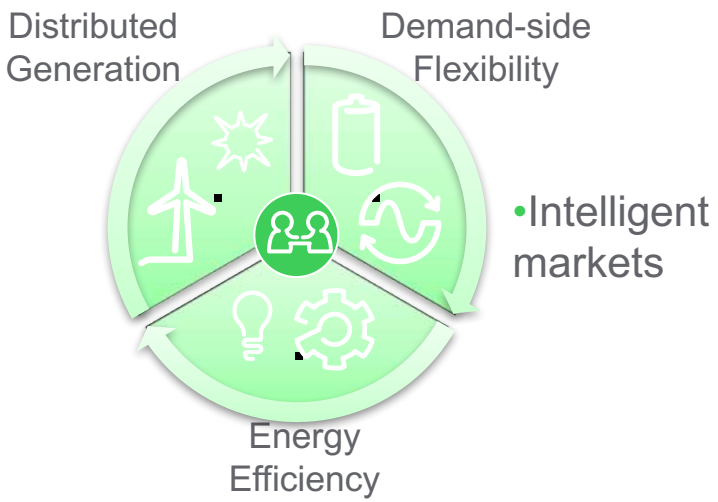
… creating unprecedented change in the power industry

By 2025 traditional centralized model will be complemented by a world of distributed energy

Pressure on the Grid

- **Tomorrow's grid integrating a multitude of DER (DG, storage and flexible loads)**



- Intelligent markets

- *Solar and storage are reaching Grid parity at zero marginal cost*

Disrupting existing business models

- **Utility-scale generation model disruption (volatile wholesale market, and emerging capacity market)**

New power grid design:

- National / Interco-regional
- Intermediate Microgrids (municipal, regional)
- Prosumers

New regulatory frameworks required

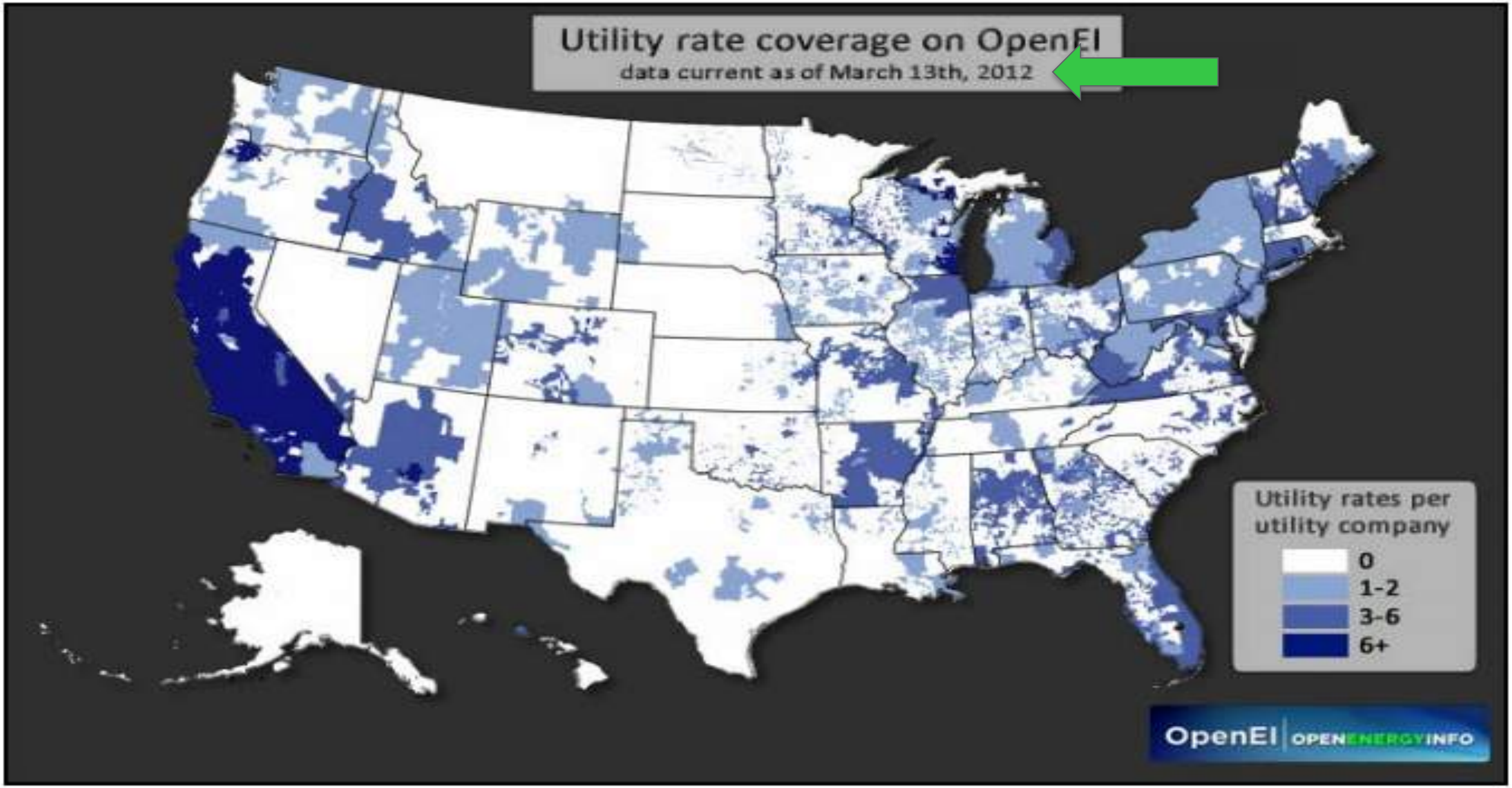
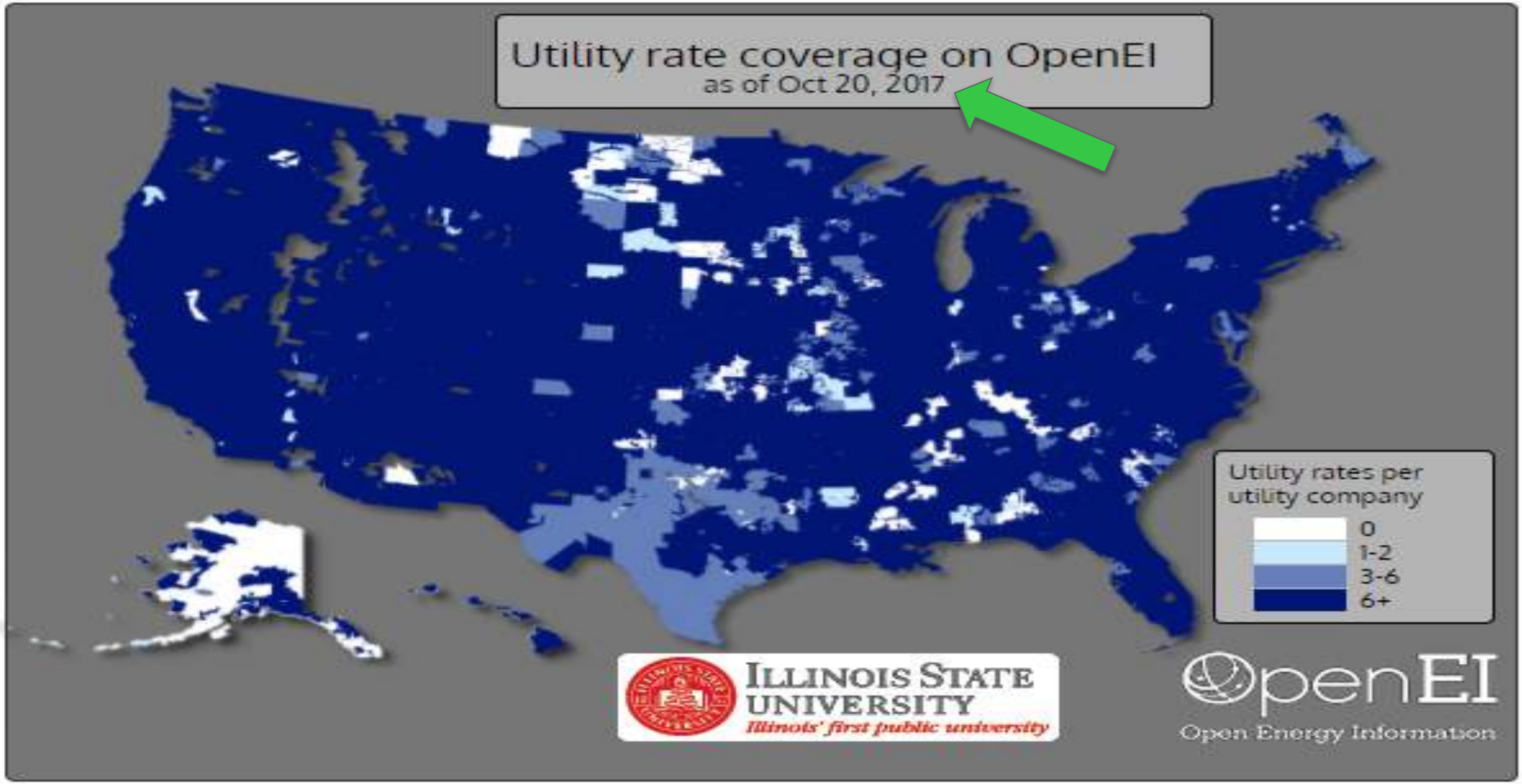


Fig. 1: This map shows utility rates entered into OpenEI as of March 13, 2012.

Utility Rate Database Visualization



…The industry is taking control of their energy spend/use

WASHINGTON BUSINESS JOURNAL

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From the Washington Business Journal:
http://www.bizjournals.com/washington/news/2017/02/10/montgomery-county-is-taking-two-large-buildings.html

Montgomery County is taking two large buildings off the energy grid

Feb 10, 2017, 1:49pm EST

Montgomery County is taking its correctional facility and public safety buildings off the grid.

The county has entered into a public-private partnership with **Schneider Electric** and **Duke Energy Renewables** to construct microgrid systems at the 300,000-square-foot jail in Clarksburg and the nearly 50-year-old, 408,000-square-foot police and fire headquarters in Gaithersburg.

It's a first-of-its-kind move for the county, bringing environmental and other benefits and protecting the county from power outages, said Eric Coffman, chief of the county's office of energy and sustainability. The microgrids will generate clean power using solar energy systems and natural gas generators. The public safety buildings will operate independent of the electrical grid, which will enable the county to replace aging equipment, install stiffer security measures and ensure uninterrupted service, Coffman said.

"This is the first advanced microgrid in this part of the state, to my knowledge," said Coffman. "Mont
big power outages, and our facilities need to operate."

The buildings are expected to be on the microgrid by mid-2018, the county said. While the contract
county will only pay for the energy it uses, which is expected to cost 12-13 cents a kilowatt hour —
Pepco for its power now. The project emerged from a request for proposals issued by the county in
dozen firms responded.

Ohio State's Endowment Gets $1 Billion With Campus Energy Deal

by **Janet Lorin** and **Brian Eckhouse**

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UTILITIES

How MGM Prepared Itself to Leave Nevada's Biggest Utility

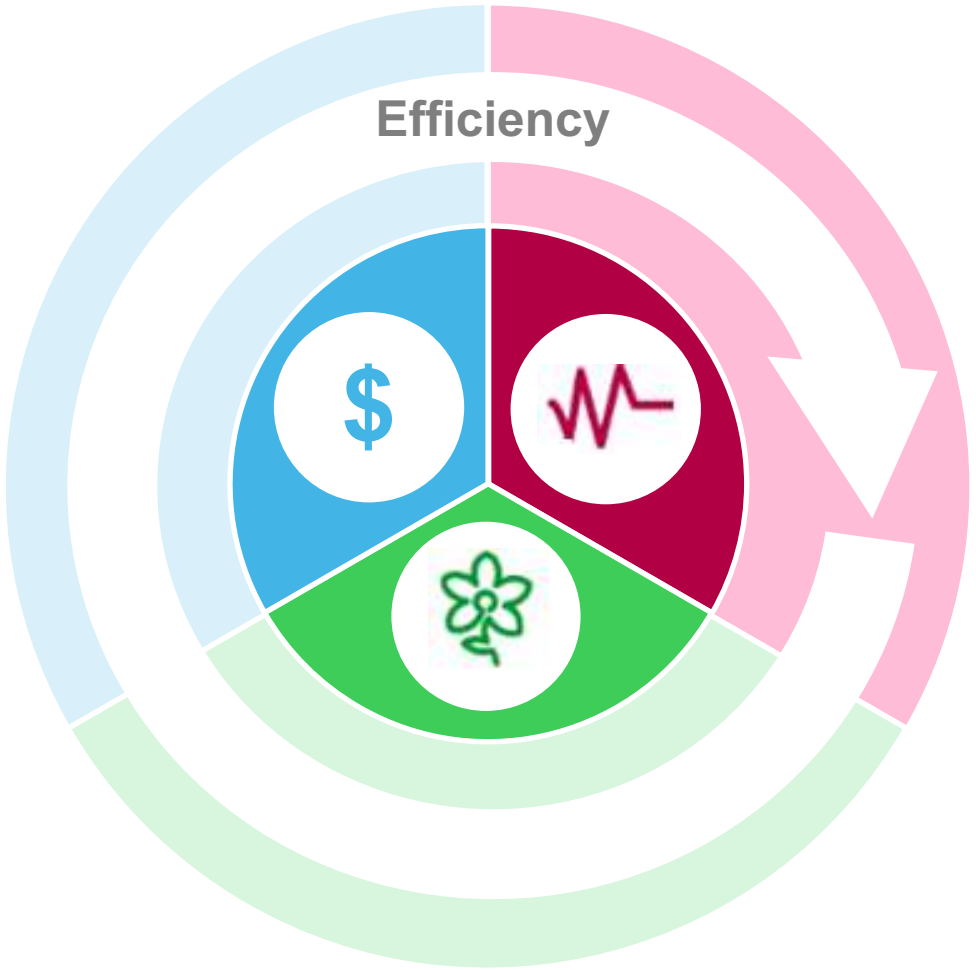
Photo Credit: NRG Energy

The casino conglomerate expects to double its use of renewable energy and earn payback within 7 years.

by Julian Spector
September 16, 2016

Integrated Energy Outcomes – Acquisition and Use

Historically Passive Consumers are Thinking About Energy in a New Way



Cost

- Lower / More Predictable Energy Costs
- Energy / Fuel Source Arbitrage
- Flexibility drives savings / incremental revenue

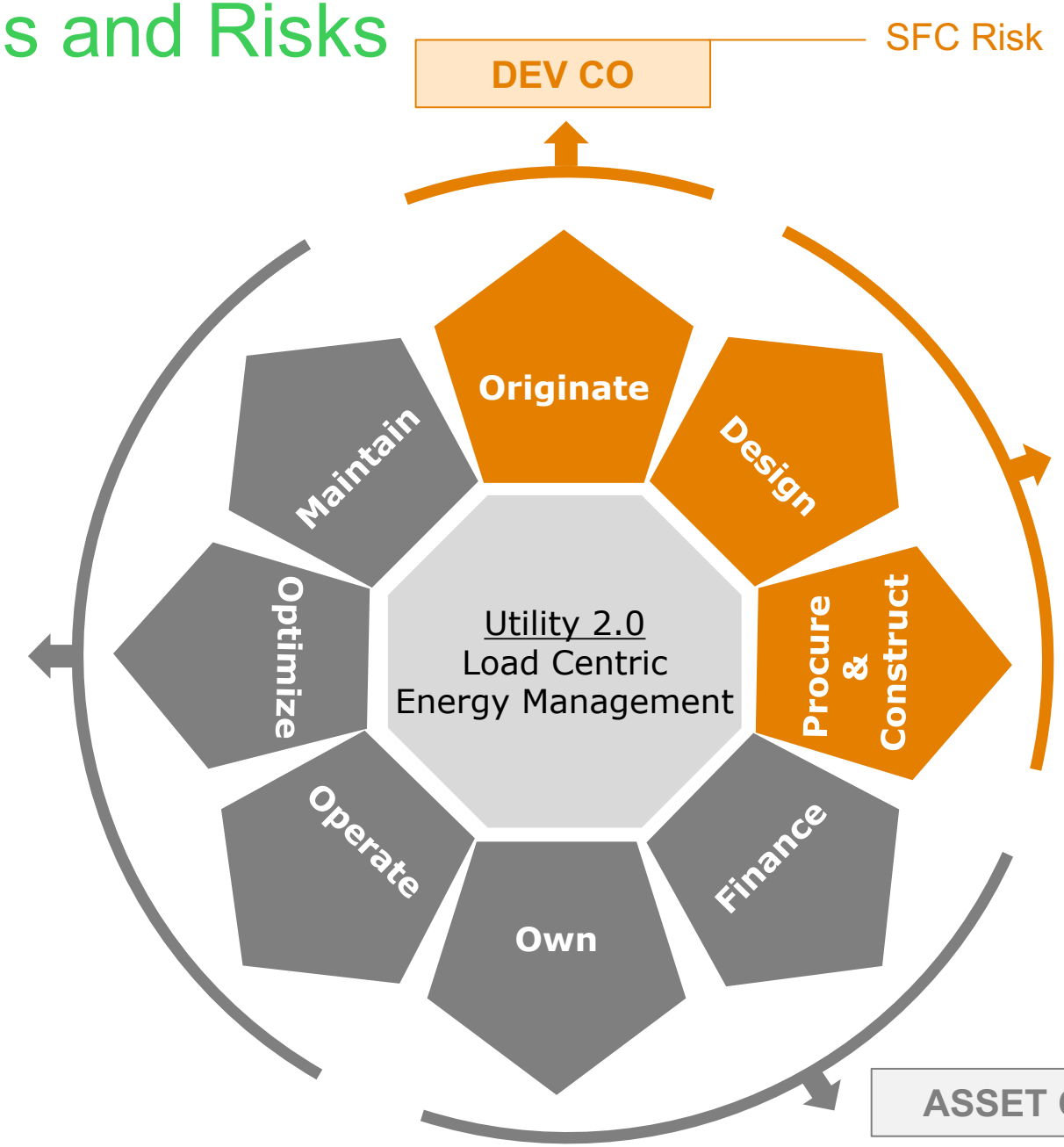
Resilience

- Serve loads during times of grid stability
- Oasis for employees / customers – shelter in place
- Protect power sensitive / critical assets from poor power quality

Sustainability

- Reduce carbon footprint
- Improve brand image
- Attract / Service carbon sensitive customers

Responsibilities and Risks



DEV CO

SFC Risk

EPC

Design Risk

Construction Risk

Warranty Risk

OP CO

Performance Risk

ASSET CO

Credit Risk

Regulatory Risk

Energy finance and service models evolve are a new opportunity

Traditional DER PPA model paves way for “Energy-as-a-Service”

Traditional Approach - CAPEX Business Model

EPC Develop and build | Customer own, operate, & maintain

Microgrid Construction | **Microgrid Operation** | **Energy Prosumer**

- Capital Required
- Infrastructure Improvements Required
- ROI Considerations
- Higher reliability
- Better sustainability
- Self Service

Microgrid-as-a-Service - OPEX Business Model

Schneider Electric & Investment Partner Develop, Own & Operate | PPA/Lease with Customer | SE & Partner O&M

Microgrid Construction | **Microgrid Operation** | **Energy Consumer**

- No Upfront Capital
- Infrastructure Improvements
- More predictable energy costs
- Higher reliability
- Better sustainability
- PPP Business Model

Life Is On Schneider Electric

Gordon Bubolz Nature Preserve: How a Microgrid in the Woods Supports Business Objectives and Our Future Workforce

Presenters:

Don Wingate, Vice President of Sales, Utility Solutions, *Schneider Electric*

Terry Bickham, Vice President, Energy, *Faith Technologies*

Gordon Bubolz Nature Preserve

Microgrid Design and Utilization

"More than the Sum of Its Parts"

EDUCATION RECREATION CONSERVATION

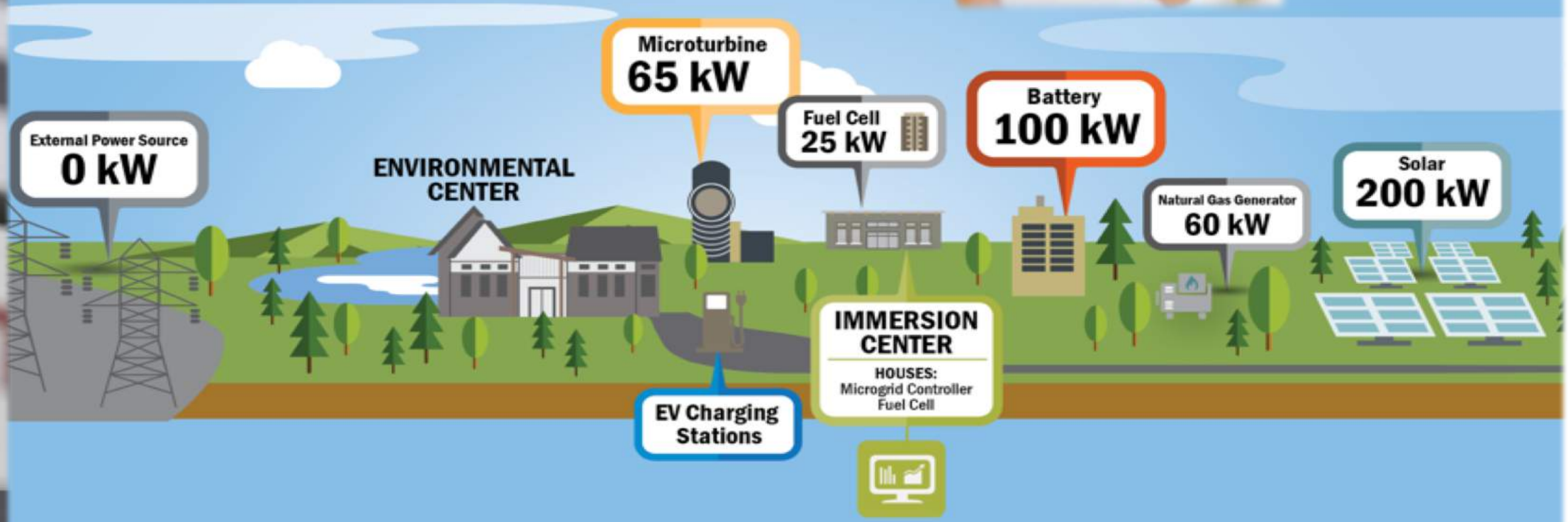
GORDON BUBOLZ
NATURE PRESERVE

It Begins with “Why”

Efficiency **Sustainability** **Resilience**

- Nature center mission
- Redefining what’s possible
  - Making a microgrid, sustainability “real”
  - Visibility – physical presence, data, screens, immersion center, signage, tours
- Many purposes (and microgrids) in one
  - Efficiency, resilience, sustainability (by physical, education, example)
  - Multiple DER’s in different combinations

The Microgrid



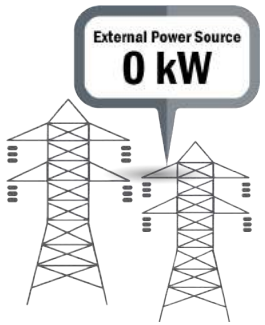
VISION 2020 [2.0]

CORE VALUES

2 | Build **TRUST** in everything we do.

FAITH TECHNOLOGIES

Not Simple



Sunshine

Time of Day

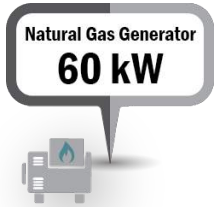
BAS

Loads

Events

Maintenance

Weather forecast



Hydrolizer

Meter Data

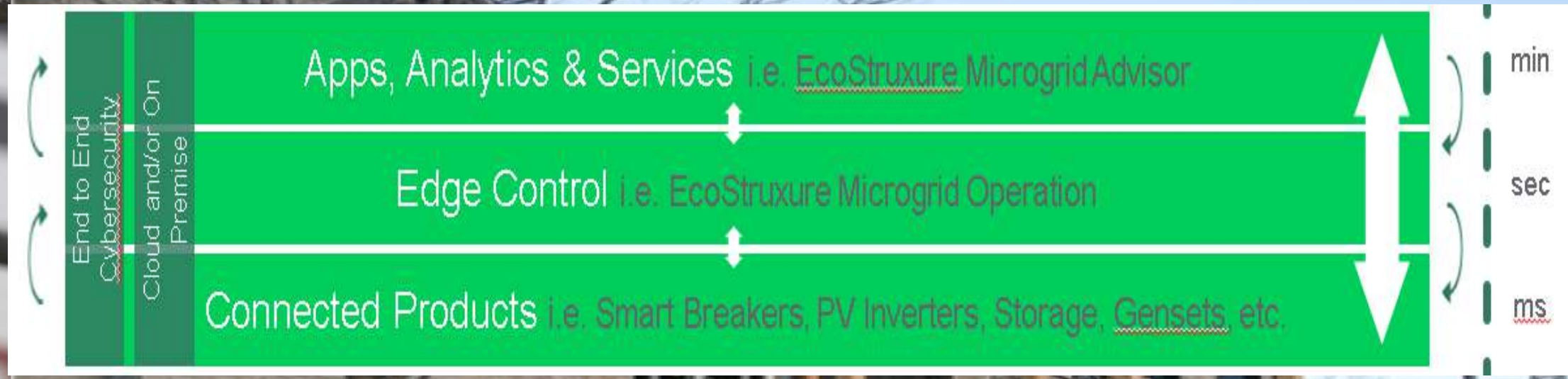
Gas rates

Heat Loads

Electricity rates

Control and Integration

- Three layers of control
- Integration with load

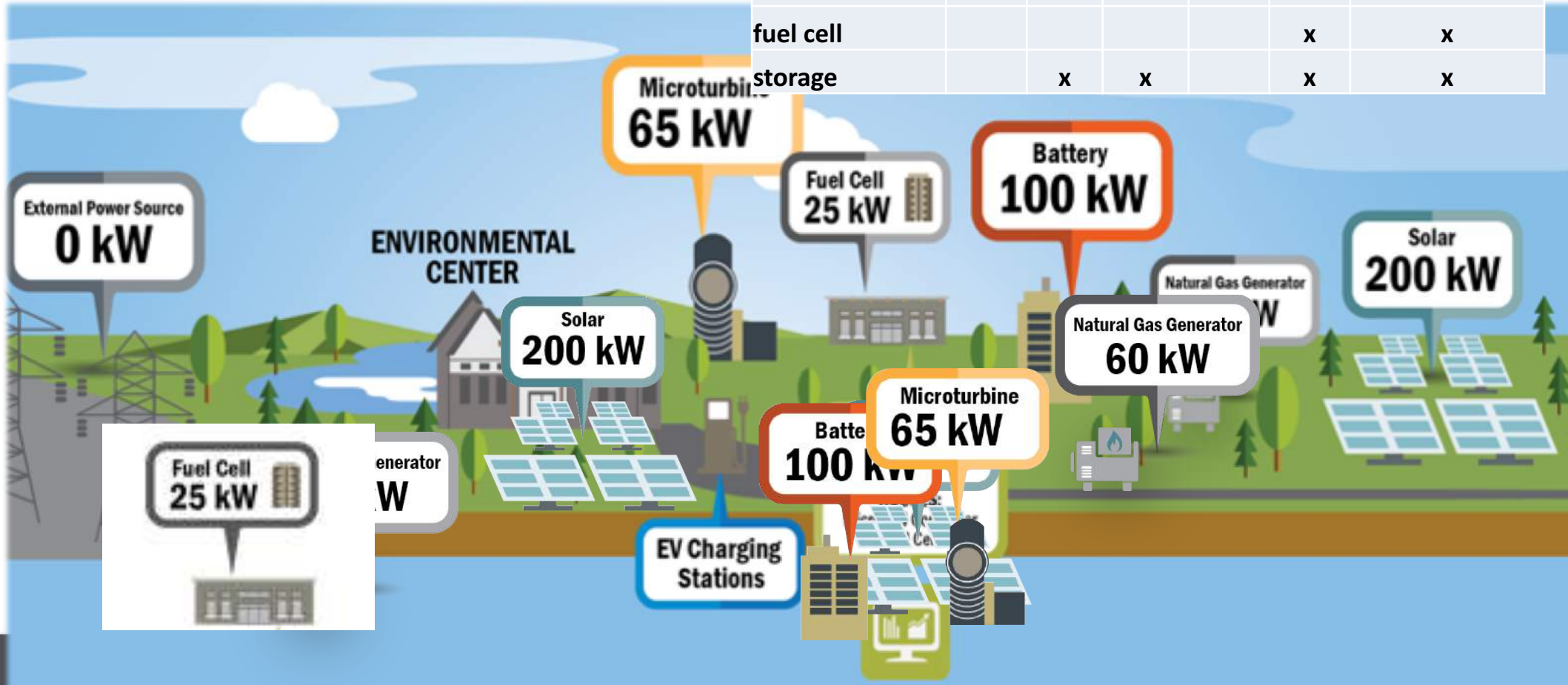


Integration with load control – ability to "trim" to fit

Many Microgrids in One

DER	1	2	3	4	5	Normal Ops
genset	x		x			x
PV	x	x	x	x	x	x
CHP				x		x
fuel cell					x	x
storage		x	x		x	x

Normal operations



A Different Approach

- A microgrid that fits the mission
- We don't have to poach the future

- Modular construction
- Built with connectivity for "next"

VISION 2020 [2.0]

VISION 2020 [2.0]

CORE VALUES

2 | Build **TRUST** in everything we do.

FAITH TECHNOLOGIES

Immersion Center by Design

VISION 2020 [2.0]

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2 | Build **TRUST** in everything we do.

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FAITH TECHNOLOGIES

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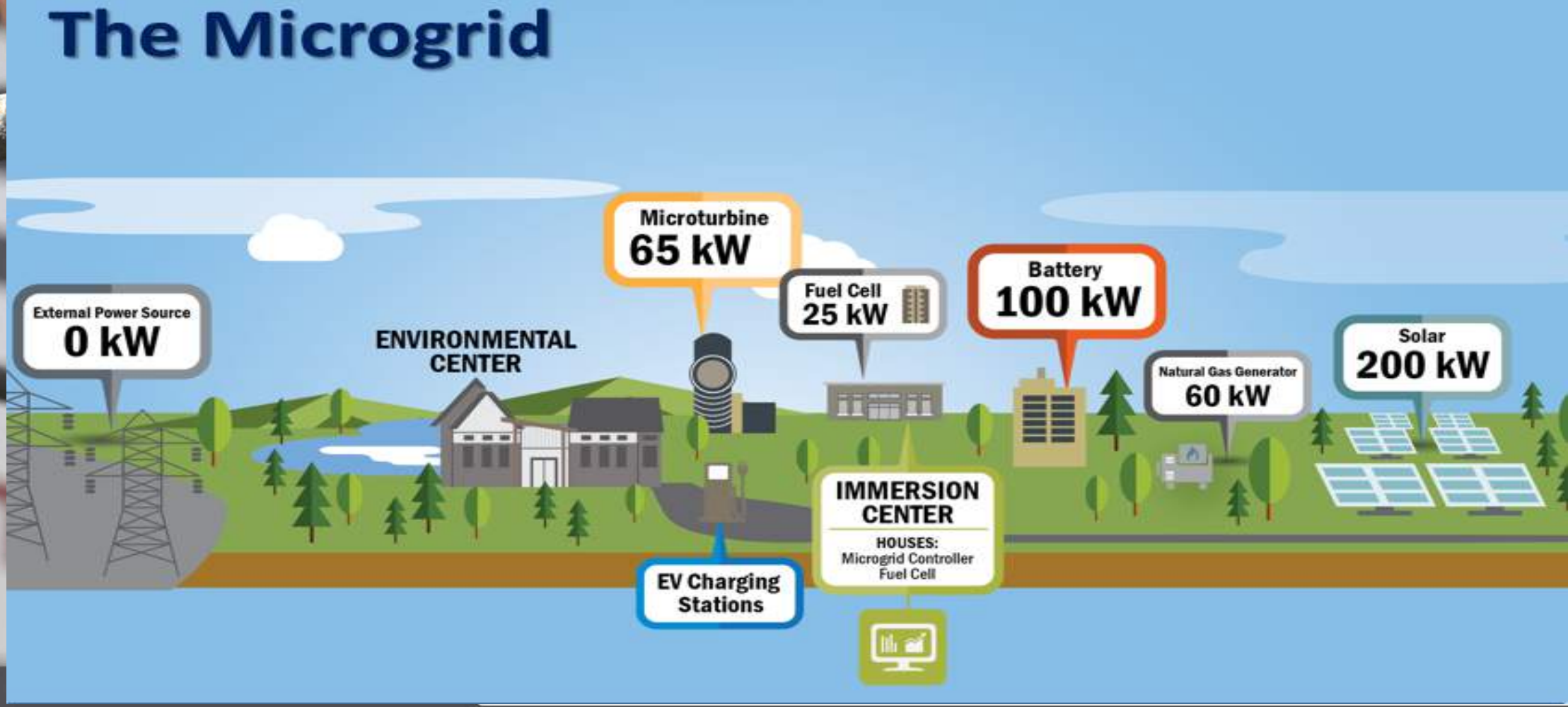
Question? Comments?



Redwood Coast Airport Renewable Microgrid – Demonstrating a Viable Business Case

Presenter:
Jim Zoellick, Managing Research Engineer,
Schatz Energy Research Center, *Humboldt University*

ACV Airport Microgrid Project:

A Viable Business Case

- *Greater resiliency in times of disaster*
- *Energy cost savings*
- *Local jobs*
- *Local renewable energy*
- *Lower GHG emissions*

Jim Zoellick, Managing Research Engineer
Schatz Energy Research Center, Humboldt State University

Microgrid 2018 – Chicago – May 7, 2018

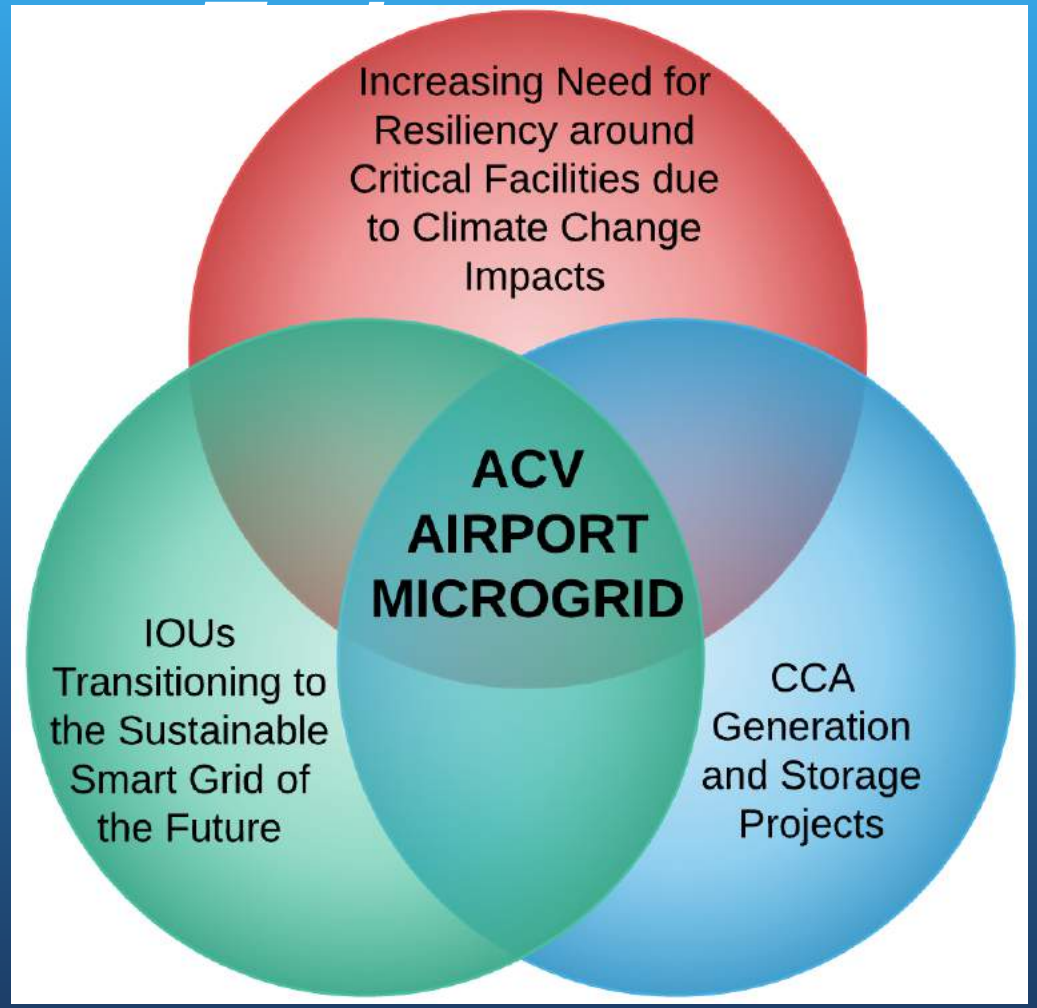
Schatz Energy Research Center
SERC

Humboldt County, CA

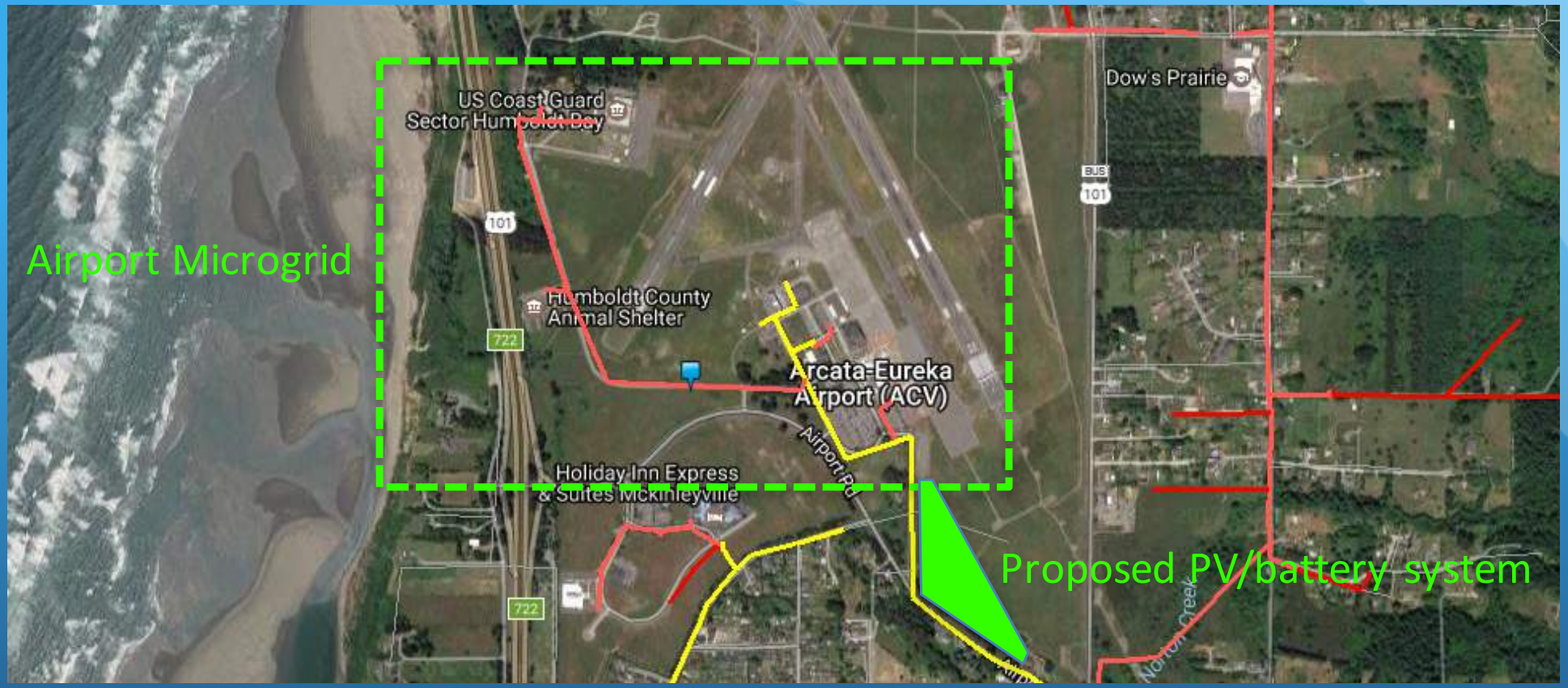
- Rural, remote
- An energy peninsula
- Transmission constrained
- Prone to earthquakes, tsunamis and other natural disasters

- Award winning Blue Lake Rancheria Microgrid
- SERC was prime contractor, system integrator & owner's engineer

ACV Airport Microgrid –
A Viable Business Model



US Coast Guard aerial rescue dispatched from ACV airport.



Adapted from PG&E PVRAM map.

Project Description

- End of Janes Creek 1103 feeder (PG&E distribution system)
- Will serve 18 retail electric accounts
- Distribution owned, operated, and maintained by PG&E
- Solar, battery, and MG controls owned and operated by RCEA
- Generators at ACV and USCG provide back-up of last resort

2.25 MW PV Array (7 acres)

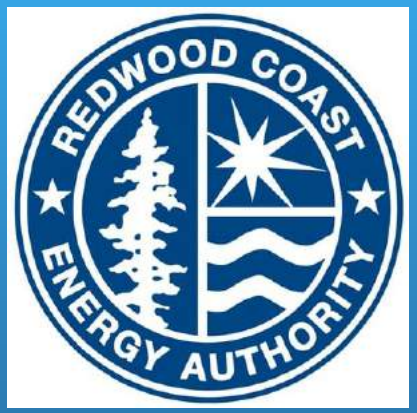
2 MW / 8 MWh battery energy storage
(DC-coupled)

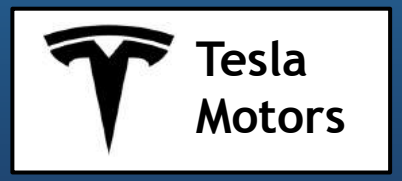
Key Project Partners

Schatz Energy Research Center

SERC

HUMBOLDT STATE UNIVERSITY



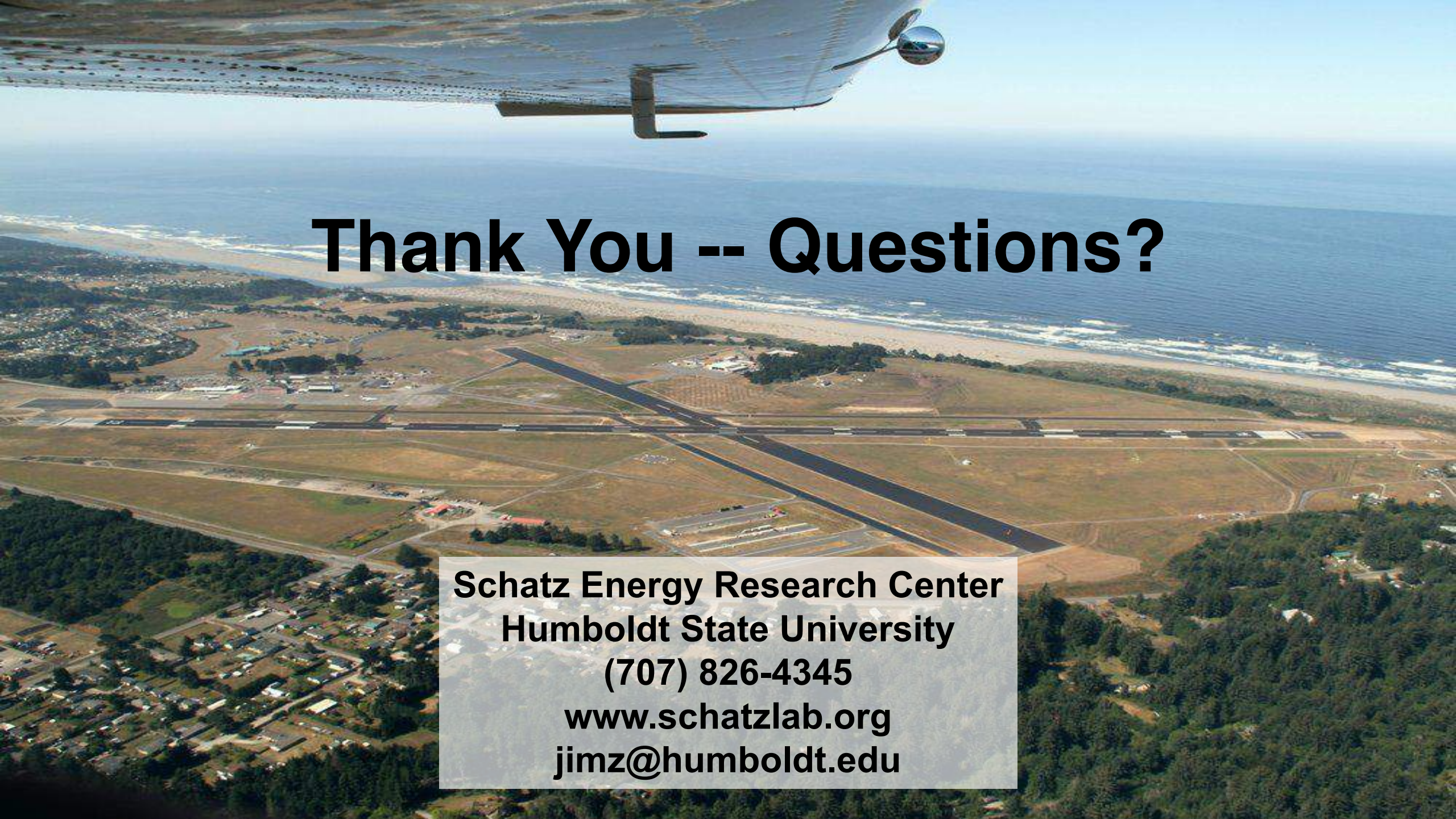


Business Model

Entity	Ownership Stake	Contribution	Benefits
Redwood Coast Energy Authority	PV array, BESS, MG controller	$6.3 M	Dispatchable PV power, local renewable generation, storage asset
Pacific Gas & Electric Co.	Distribution system	Expertise, distribution system host	A field test of microgrid distribution control
County of Humboldt	NEM PV array	Site host	Lower electric costs, energy resilience
U.S. Coast Guard	N/A	Participation	Energy resilience
California Energy Commission	N/A	$5M	Demonstration, model agreements, replicability, technology advancement

Key Outcomes

- A safe, functional microgrid operational by the end of 2020
- A viable, replicable business model
- PG&E's first multi-customer microgrid
- Technical advancements: DC coupling of the PV & BESS, remote control via PG&E's distribution control center
- A field test of PG&E's microgrid distribution control system
- Model tariffs and agreements → a replicable regulatory model
- Market research and stakeholder outreach leading to replication (key markets: CCA's, airports, critical facilities, utility microgrids)



Thank You -- Questions?

Schatz Energy Research Center
Humboldt State University
(707) 826-4345
www.schatzlab.org
jimz@humboldt.edu

Three important questions about the business case for microgrids:

1. How will microgrid benefits, like resilience and grid services, be valued and compensated?
2. What sort of microgrid business/regulatory models will evolve that are fair to all stakeholders (rate payers, site hosts, IOUs and their shareholders, CCA's, etc.) in terms of shared costs and benefits?
3. How will the distribution system costs of multi-customer microgrids be handled (upgrades/reconfigurations, reclosers, protection, controls)?