Plenary Session

Grid 2.0
Grid Modernization for Local Energy Resources

Gerry Braun
Statewide Energy Efficiency Collaborative Forum
Fresno, California
June 15, 2017
Outline

Decentralization
Local investment in local energy supply

Democratization
Local accountability for local energy resources and infrastructure

Decarbonization
Local resiliency and energy price stability outcomes

Demonopolization
Local energy markets open to transformative new technologies

Linear version of a virtuous clean local energy circle
Decentralization: Integrative Clean Energy

Solar & Wind Power

Power to/from H2 Storage

Grids & Batteries

Integrated Resources Network
Decentralization is a Local Choice

Grid Modernization Pathways: Follow the Money

In California, how much “grid modernization” money is forecast to follow Wall Street pathway vs. pathways within communities?
Decentralization is a Local Choice

Grid Modernization Pathways: Follow the Money

“The company (PG&E) expects to spend $5.6 billion this year, including $2 billion on distribution, $1.2 billion on transmission and $700 million on generation, with annual investments ranging from $5.4 billion to $6.4 billion over the next three years.”

PG&E’s forecast for “behind-the-meter” generation additions in the next three years of roughly 1GW/year*. Related local investment will be in the range of $3B/year or considerably higher if some PV additions include energy storage.

*DRP DER Growth Scenarios Workshop, May 3, 2017
Decentralization: Example of Demand Profile Differences – City (blue) vs. County (red)

Source: TEA
Democratization: Two Visions of Community Choice

Old – Imported Energy
- Natural Gas Power Plants
- Utility Scale Renewables

Future – Local Energy +
- Utility Scale Renewables and Storage
- Community Solar & Wind
- On site Solar
- Zero Carbon Vehicles
Decarbonization: Buildings Sector GHG Emissions Profile for Davis, California

Source: PG&E
Decarbonization: 1970s Vintage Home Net Zero Retrofit Energy Usage Reductions (Davis, CA)
Decarbonization: GHG Emission Reduction in Three Scenarios for Davis, California

IOU = Business as Usual
CCE15 = Community Choice Energy (CCE)
CCE25 = CCE with Local Energy Resource and Fuel Substitution Emphasis

Source: IRESN
Demonopolization: System Architecture for Local Clean Energy Resources

*Community Choice Energy
**Independent Local System Operator
Demonopolization: Solar Micro-grid Concept

- Power Plants
- HV Wires
- LV Wires
- Substation
- LV Wires
- Meters
- Smart Inverters and/or energy mgmt. systems
- Smart Appliances
- Building Circuits
- Solar PV and/or Storage

Integrated Resources Network
Recap - 1

• Energy/transportation technology tipping points make energy decentralization inevitable.
• Importing energy means exporting dollars. Now how much to import is becoming a local choice.
• Community choice enables community solar and also urban/rural energy exchange.
• Timely local decarbonization hinges on mass marketing of smart energy retrofits.
Recap - 2

- Community Choice is a natural partner in clean local energy resource (CLER) deployment, not a substitute for active city/county engagement.
- Economically optimum CLER deployment may require the creation of local independent system operators.
- Solar micro-grids provide resiliency benefits and enable more economically efficient mixed portfolios of residential and community solar.
Let’s help one another remember:
We are at a point in human history where, if it isn’t happening, it’s because we aren’t doing it!

Thank You!

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Electrified Transportation; We Need to Plan How to Plug In

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How We Are Used to Fueling our Vehicles
How Electric Vehicles are Fueled
EVs Come in All Sizes and Functions
Electric Vehicles Will Need to Integrate into Existing Structures

Energy/Water Efficient Homes and Businesses…

Will support Zero Emission Electric Vehicles!
Electrical Loads for ZEV Fleets

*Figure 14: Peak loads for various electric vehicle fleets (without mitigating grid impacts)*

Assumptions: the Chevy Volt charging rate is 3.3 kW, the medium-duty E-Truck charging rate is 15 kW and the E-Bus charging rate is 60 kW. The peak load for the Transamerica Pyramid building is from [26].
This Requires Planning

- We must move to planning holistic integrated community scale deployments of renewable energy, advanced energy storage, transit oriented development, and supporting infrastructure for advanced electrified transportation.
- These developments should incorporate renovation and efficiency upgrades of existing buildings with new construction while blending onsite energy production with energy-efficient equipment and energy storage.
What Will These Communities Look Like? It Could Be Something Like This...
Questions?

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Grid 2.0 & Local Governments & Sustainable Energy & Growing Up
when I grow up I want to be...
What we wanted...

- Increase PV & DER
- Increase EVs
- Save MONEY
- Reduce GHG
What we got...

- Avoid blackouts
- Peak demand & duck curve
- Increase reliability
- Fight for NEM
- Rolling Portfolio
- Too much solar is a bad thing?
- Do it EQUITABLY
SM ADVANCED ENERGY DISTRICT

- Utilize CCA to procure, interconnect and provide low-cost clean energy to non-city entities.
- Expand microgrid by leveraging commercial development through community benefits agreement.
- Take advantage of contiguous city-owned properties.
- Site majority of microgrid resources within redeveloped city yards.
- Provide interactive education through learning center.
# Capability Maturity Model Model

<table>
<thead>
<tr>
<th>Initial GRID 1.0</th>
<th>Basic</th>
<th>Intermediate</th>
<th>Optimized</th>
<th>Innovative GRID 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Centralized</td>
<td>- Transitioning to mixed model</td>
<td>- Decentralized</td>
<td>- Local, green</td>
<td>- Integrated control</td>
</tr>
<tr>
<td>- Unidirectional</td>
<td>- Increased DER, responsive but not coordinated</td>
<td>- Optimized for GHG &amp; cost</td>
<td></td>
<td></td>
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<tr>
<td>- Fossil fuel based</td>
<td>- Integrated control</td>
<td>- Deploying DER</td>
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<tr>
<td>- Low level of control</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
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<tr>
<td>GOVT</td>
<td></td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
</tr>
<tr>
<td></td>
<td>- Low level of control &amp; influence</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
</tr>
<tr>
<td></td>
<td>- Recipient of programs &amp; funds</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
</tr>
<tr>
<td>COMM</td>
<td>- Early adopters of solar, EE &amp; EV</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
</tr>
<tr>
<td></td>
<td>- No integration of DER</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
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<tr>
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<td>- Low level of DR participation</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
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<tr>
<td></td>
<td>- Energy storage for DR &amp; resilience</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
</tr>
<tr>
<td></td>
<td>- Dabbling with Internet of Energy</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
</tr>
<tr>
<td></td>
<td>- Connected homes &amp; biz</td>
<td>- Deploying DER</td>
<td>- Aggregating benefits</td>
<td>- Active grid management &amp; planning</td>
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<tr>
<td></td>
<td>- Optimize usage for GHG &amp; cost</td>
<td>- Deploying DER</td>
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</table>
• Coalition of CA local governments and non-profits

• Advocate for greater role in sustainable energy infrastructure, programs and policies

• Participate in regulatory proceedings
  • Investments, program design, funding, administration, EM&V
  • Rate design, NBCs
  • Pilot programs – RENs
Plenary Session

Grid 2.0

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Gerry Braun | The IRES Network
Joseph Oldham | CALSTART
Garrett Wong | City of Santa Monica