Top Measures to Accelerate Local Clean Energy Programs: How to Push the Envelope on a Budget
Case Studies

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Advanced Energy Communities

- Zero net energy (ZNE) standards for built environment
- Local renewable energy, demand response, Solar Emergency Microgrids (SEM), and electric vehicle charging infrastructure (EVCI)
- Help state realize clean energy and climate change policy goals

Co-benefits

- Minimize need for new energy infrastructure
- Provide energy savings
- Provide grid reliability and resilience
- Offer easier grid integration
Solar Potential

• Southern San Mateo County has 65 MW solar potential
• Highly developed
• Dense tree canopy
Vital Community Resources

In California
- 345 hospitals
- 482 municipalities
1. Atherton Civic Center

Anticipated first Zero Net Energy civic center in the US
Library and historic City Hall
1. Atherton Civic Center

Police department and administrative services
1. Atherton Civic Center

- Proposed EUI 28.3
- Baseline EUI 74.3

**Typical Electrical Load Make-up**

**Electrical Load Profile with Thermal Storage**

- Cooling
- Pumps
- Fans
- Lighting
- BASE LOAD

- Off Peak
- Peak Demand
- Off Peak

- 6am, 12pm, 5pm
2. Stanford University Heat Exchange System

Overall Conversion Plan
2. Stanford Energy System Innovation (SESI) and Central Energy Facility
Comparison of Energy Supply Options
Key features
• Rooftop PV
• Occupancy sensors
• Building management system (BMS)
• 4 EV chargers
• Water source heat pump
• Individual heat pumps in residential units
4. Kaiser Permanente

• Healthcare industry 2nd most energy-intensive building sector in US, spends $5.3 billion on energy/year, 8% of GHG emissions
• Mission - protect and enhance both community and environmental health, ex: potential health impacts of climate change
• Goal - carbon net positive by 2025
• 20-year power purchase agreements: 153 MW NextEra Energy Resources + 75 MW solar NRG Renew and Ameresco
5. City of Palo Alto Bryant Street Garage

[Map and chart showing data for each year from 1990 to 2016, with categories for Natural Gas Distribution Leakage, Lifecycle Emissions From Annual Total Waste Placed in Landfills, Wastewater Process Emissions, Landfilling Recyclable Material, Palo Alto Landfill Fugitive Emissions, Net Brown Power Emissions (Weather adjusted), Natural Gas Use (in therms), and Road Travel into, from, and within City.]
Public-private partnership facilitated by FIT to install:
- 1.3 MW of solar PV on public garages
- 18 EV charging ports
- EVCI to support an additional 80 ports
EVCI Master Plan – low cost measures for jurisdictions
1. Create stronger code requirements for EV Level 2 charging outlets at Multi-Unit Dwellings (MUD) and workplaces -- new construction or major renovations.
2. Encourage Direct Current Fast Charging stations at transit corridors - ownership, installation and operation by third parties.
3. Encourage building owners to secure grants from public agencies and utilities for costs of installing at MUDs and workplaces.
4. Encourage public signage visible from roadways to educate and reassure non-EV owners there are plenty of places to plug in.
5. Host or encourage “EV Ride & Drives” to educate people about the benefits of EVs.
Double duty
• Back-up power
• Renewable energy storage
• Peak shaving
• Load shifting
• Power conditioning (energy supply smoothing)
• Spinning reserves

Scenario 1
87.4 kW DC solar PV + 29 kW/60 kWh energy storage for demand charge management

Scenario 2
87.4 kW DC solar PV + 29 kW/120 kWh energy storage + 10 Level 2 electric vehicle charging

Scenario 3
4 kW/135 kWh energy storage off-grid (21% of kWh baseline with no EV)

*Feed-in tariffs would incentivize SEM development at schools*

<table>
<thead>
<tr>
<th>Energy Storage System Size</th>
<th>Payback</th>
<th>Net Present Value</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 kW inverter/ 60 kWh (2 hours of energy)</td>
<td>4.2 years</td>
<td>+$242,713 (because of the savings on energy bill)</td>
<td>20.6%</td>
</tr>
<tr>
<td>29 kW inverter/ 120 kWh (doubled size of battery)</td>
<td>3.3 years</td>
<td>+$261,207</td>
<td>22.5%</td>
</tr>
</tbody>
</table>
7. Redwood City Community Microgrid

- Sobrato Broadway Plaza
  - PV
  - Battery
  - Critical Loads
  - EVCI

- Redwood City Corporate Yard
  - PV
  - Battery
  - Critical Loads

- CVS
  - PV
  - Battery
  - Critical Loads

- San Mateo County Corporate Yard
  - PV
  - Battery
  - Critical Loads

- Hoover Park
  - Critical Loads

- Hoover School
  - PV
  - Battery
  - Critical Loads
  - EVCI

- Boys & Girls Club
  - PV
  - Battery
  - Critical Loads
  - EVCI

- Stanford Medicine Outpatient Clinic
  - PV
  - Battery
  - Critical Loads

- Stanford Redwood City
  - PV
  - Battery
  - Thermal Energy Storage
  - Critical Loads
  - EVCI

Solar Emergency Microgrid
Community Microgrid
### 7. Redwood City Community Microgrid

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Meters or Buildings</th>
<th>Critical Loads</th>
<th>NEM Solar kW AC</th>
<th>FIT Solar kW AC</th>
<th>Total Solar kW AC</th>
<th>Battery kW</th>
<th>Battery kWh</th>
<th>EVCI [Level-2 charging port count]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanford Redwood City Phase 1</td>
<td>P1, B1-B4</td>
<td>Campus emergency response</td>
<td>886</td>
<td>0</td>
<td>886</td>
<td>251</td>
<td>2,100</td>
<td>52</td>
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<tr>
<td>Hoover Cluster</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoover School</td>
<td></td>
<td>Shelter &amp; food service</td>
<td>73</td>
<td>203</td>
<td>276</td>
<td>29</td>
<td>150</td>
<td>20</td>
</tr>
<tr>
<td>Boys &amp; Girls Club</td>
<td></td>
<td>Shelter &amp; food service</td>
<td>11</td>
<td>90</td>
<td>101</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Hoover Park</td>
<td></td>
<td>Equipment staging</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Redwood City Corporate Yard</td>
<td>Redwood City Corporate Yard</td>
<td>Road and public facility maintenance and repair</td>
<td>136</td>
<td>352</td>
<td>488</td>
<td>58</td>
<td>360</td>
<td>*4</td>
</tr>
<tr>
<td>San Mateo County Corporate Yard</td>
<td>San Mateo County Corporate Yard</td>
<td>Road and public facility maintenance and repair</td>
<td>100</td>
<td>173</td>
<td>273</td>
<td>TBD</td>
<td>TBD</td>
<td>*4</td>
</tr>
<tr>
<td>Sobrato Broadway Plaza</td>
<td>Sobrato Broadway Plaza (multiple meters)</td>
<td>Low income housing</td>
<td>0</td>
<td>1,197</td>
<td>1,197</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
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<tr>
<td>Sobrato CVS</td>
<td>Sobrato CVS</td>
<td>Pharmacy &amp; grocery</td>
<td>0</td>
<td>83</td>
<td>83</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>New Deployments TOTAL</td>
<td></td>
<td></td>
<td>1,206</td>
<td>2,098</td>
<td>3,304</td>
<td></td>
<td>2,610</td>
<td>82</td>
</tr>
</tbody>
</table>

- NEM: only 1.2 MW of solar PV (1/3 of total solar PV capacity)
- FIT: an **additional 2.1 MW** of local, renewable generation could be deployed
# 7. Redwood City Community Microgrid

Summary of benefits from the Stanford RWC community microgrid

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Annual per MW deployed</th>
<th>20 year cumulative per MW</th>
<th>Annual 90 MW addition system-wide</th>
<th>System-wide annual total at year 20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formula</strong></td>
<td>Base value</td>
<td>BV x 20</td>
<td>BV x 90</td>
<td>BV x 1800</td>
</tr>
<tr>
<td><strong>Peak Capacity Savings</strong></td>
<td>$24,000 @ 20% ECC</td>
<td>$480,000</td>
<td>$2,160,000</td>
<td>$43,200,000</td>
</tr>
<tr>
<td><strong>T&amp;D Line Loss Savings</strong></td>
<td>$11,835</td>
<td>$236,700</td>
<td>$1,065,150</td>
<td>$21,303,000</td>
</tr>
<tr>
<td><strong>New Transmission Capacity Savings</strong></td>
<td>$30,500</td>
<td>$610,000</td>
<td>$2,745,000</td>
<td>$54,900,000</td>
</tr>
<tr>
<td><strong>Energy Purchase Reduction</strong></td>
<td>1,550 MWh</td>
<td>31,000 MWh</td>
<td>139,500 MWh</td>
<td>2,790,000 MWh</td>
</tr>
<tr>
<td><strong>Energy Cost Savings</strong></td>
<td>$71,920</td>
<td>$1,438,400*</td>
<td>$6,472,800</td>
<td>$129,456,000</td>
</tr>
<tr>
<td><strong>Reliability Value</strong></td>
<td>$1,766</td>
<td>$35,320</td>
<td>$158,900</td>
<td>$3,178,800</td>
</tr>
<tr>
<td><strong>CO2 Reduction</strong></td>
<td>513 MT</td>
<td>10,260 MT</td>
<td>46,170 MT</td>
<td>923,400 MT</td>
</tr>
<tr>
<td><strong>NOx Reduction</strong></td>
<td>1.39 MT</td>
<td>27.85 MT</td>
<td>125 MT</td>
<td>2,506 MT</td>
</tr>
<tr>
<td><strong>Water Savings</strong></td>
<td>0.03 M gal</td>
<td>0.6 M gal</td>
<td>2.7 M gal</td>
<td>54 M gal</td>
</tr>
</tbody>
</table>
Project Benefits

Quantitative:
- $2,000 savings per commercial application
- $116 million in total added economic output
- $35 million in local wages from construction and installation
- Energy consumers will save $27 million
- 20% lower prices for clean local energy

Qualitative:
- Help meet clean energy policy goals and reduce GHG emissions
- Enhance grid resilience and security
- Provide emergency power
- Obviate expense of new power plants
- Support grid modernization
- Increase percentage of renewables for RPS
- Improve interconnection policies
- Create green jobs
Questions?

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The Great Pivot: Creating Meaningful Work to Build a Sustainable Future
thegreatpivot.org