Clean Coalition

Making Clean Local Energy Accessible Now

Community Microgrid Initiative

Overview for SVLG

Greg Thomson
Director of Programs
Clean Coalition
415-845-3872 mobile
greg@clean-coalition.org

Clean Coalition Mission and Advisors

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Mission

To accelerate the transition to renewable energy and a modern grid through technical, policy, and project development expertise.

Board of Advisors

Jeff Anderson
Co-founder and Former ED, Clean Economy Network

Josh Becker
General Partner and Co-founder, New Cycle Capital

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CEO, Palo Alto Tech Group;
Councilman & Former Mayor, City of Palo Alto

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Principal, Arsenal Venture Partners

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President, Natural Capitalism Solutions

Ramamoorthy Ramesh
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Director, Colorado State University's Center for the New Energy Economy, and Former Colorado Governor

Terry Tamminen
Former Secretary of the California EPA and Special Advisor to CA Governor Arnold Schwarzenegger

Jim Weldon
Technology Executive

R. James Woolsey
Chairman, Foundation for the Defense of Democracies; Former Director of Central Intelligence (1993-1995)

Kurt Yeager
Vice Chairman, Galvin Electricity Initiative; Former CEO, Electric Power Research Institute

Clean Coalition Objectives

- From 2020 onward, all new electricity generated in the U.S. will come from at least:
  - **80% renewable sources**
  - **50% distributed sources**

- By 2020, established policies and programs will foster successful fulfillment of the above objectives

A Modern Power System

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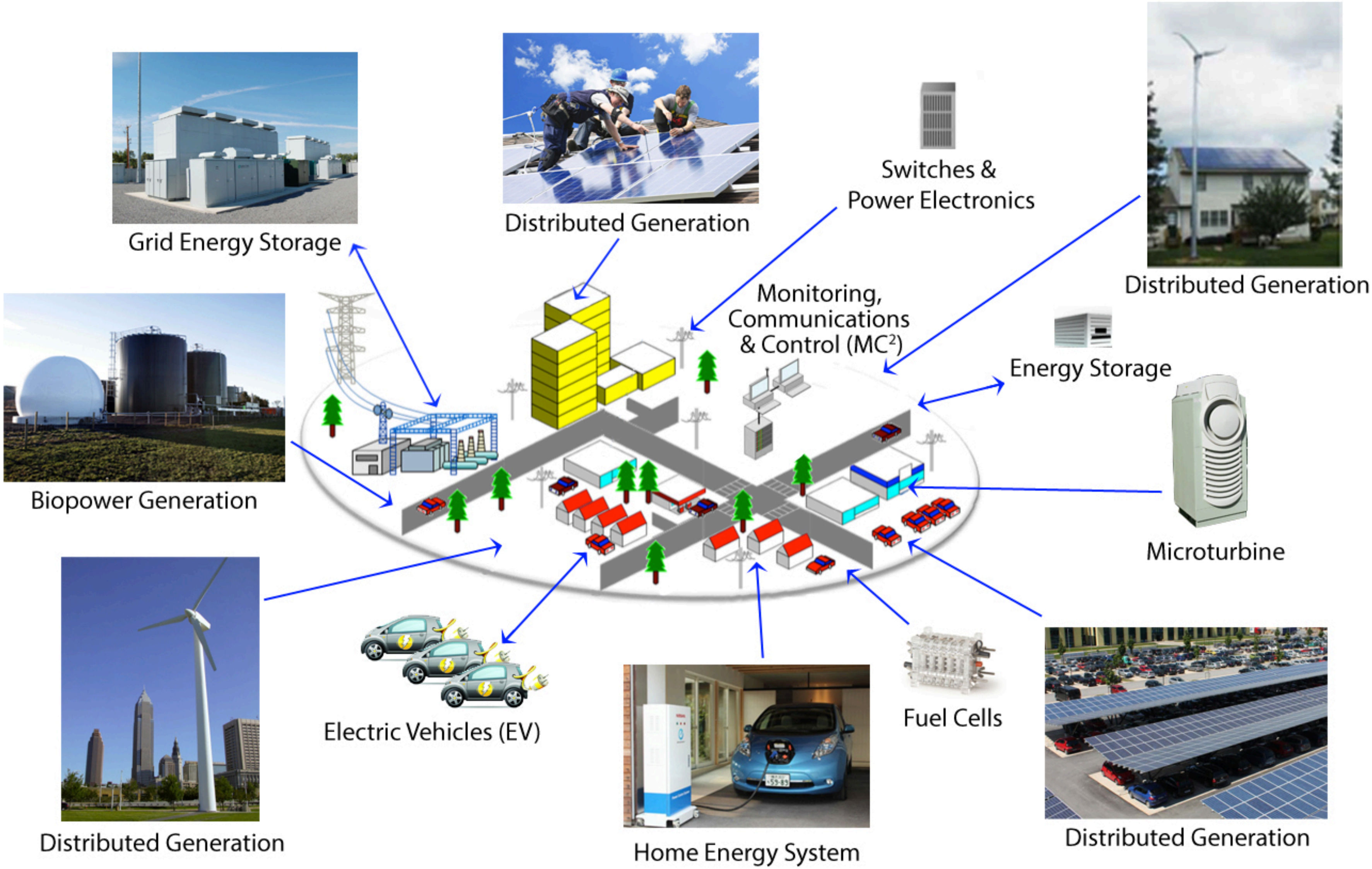

Wholesale DG is the Critical & Missing Segment

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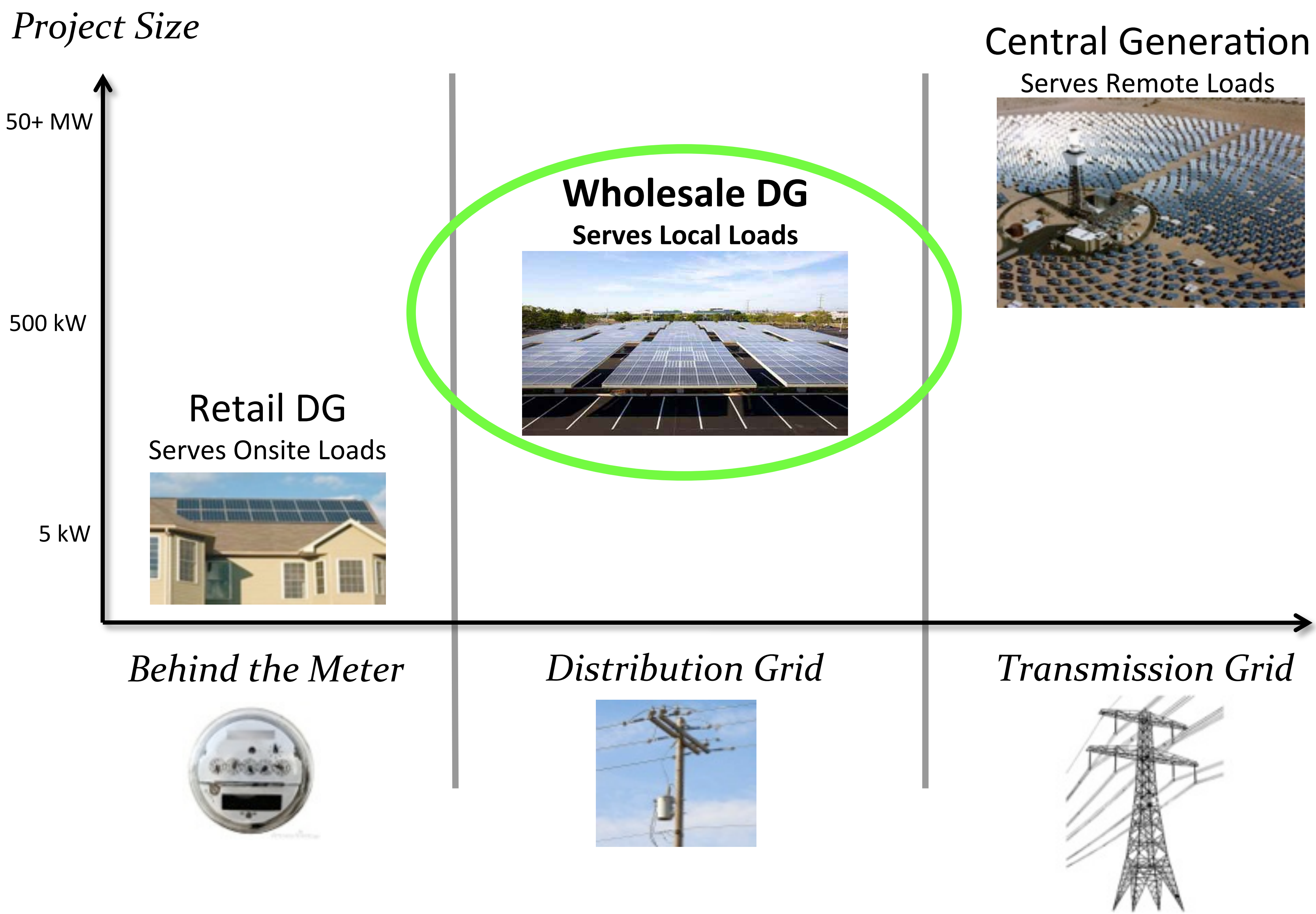

Community Microgrid Objectives

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1

Accelerate clean energy & sustainability

- Achieve 25% or more of the <u>total energy</u> consumed in a community from local renewables

2

Improve grid reliability & resilience

- Leverage dynamic grid solutions: advanced inverters, demand response, energy storage, and local reserves (e.g. CHP)

3

Optimize for cost-effectiveness

- Across DG, dynamic grid solutions, and physical locations, leading to financially viable deployments

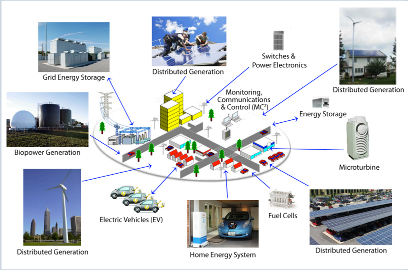
4

Capture local economic benefits

- Secure predictable energy prices, reduce transmission-related costs & inefficiencies, and increase local investment & jobs

<u>Modern Distribution Grid</u>

- More clean energy now
- Improved grid performance
- Stronger long-term economics



Example: A Dynamic Distribution Grid

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1. 6AM:
   - No PV impact
2. Noon:
   - 20MW PV causes overvoltage
3. Noon:
   - Advanced inverters set at 0.9 power factor stabilizes voltage

Community Microgrid: Hunters Point Project

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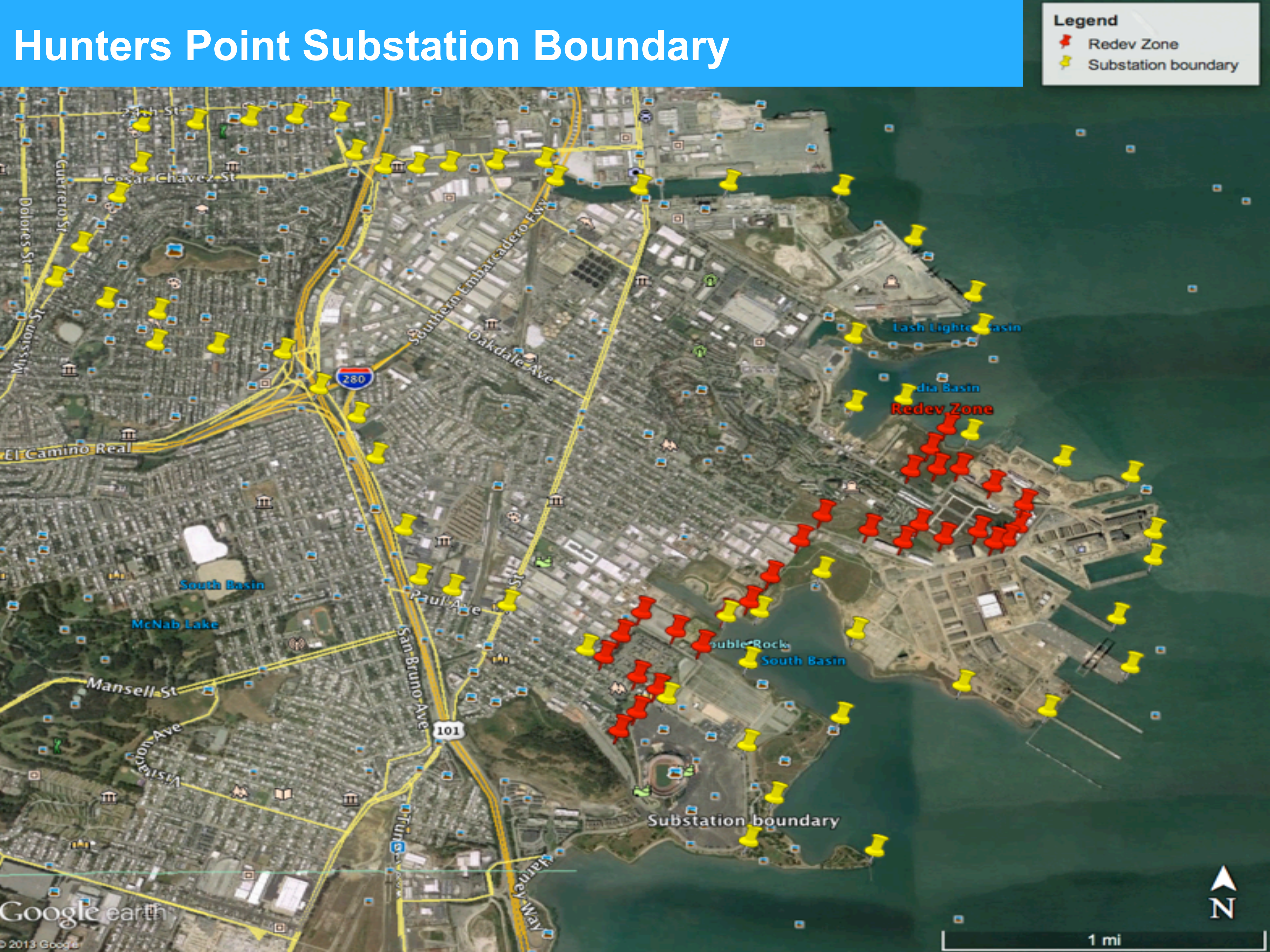
Overview

- Innovative project in the Bayview-Hunters Point area of San Francisco, in collaboration with Pacific Gas & Electric
- Model for achieving 25% of the total energy consumed in the area from local renewables, while maintaining or improving grid reliability and power quality using dynamic grid solutions
- The Hunters Point substation serves ~20,000 customers (about 90% residential, 10% commercial/industrial)

Hunters Point Substation Boundary



Hunters Point <u>Reasonable</u> DG Potential = 58 MW, Over 25% Total Energy

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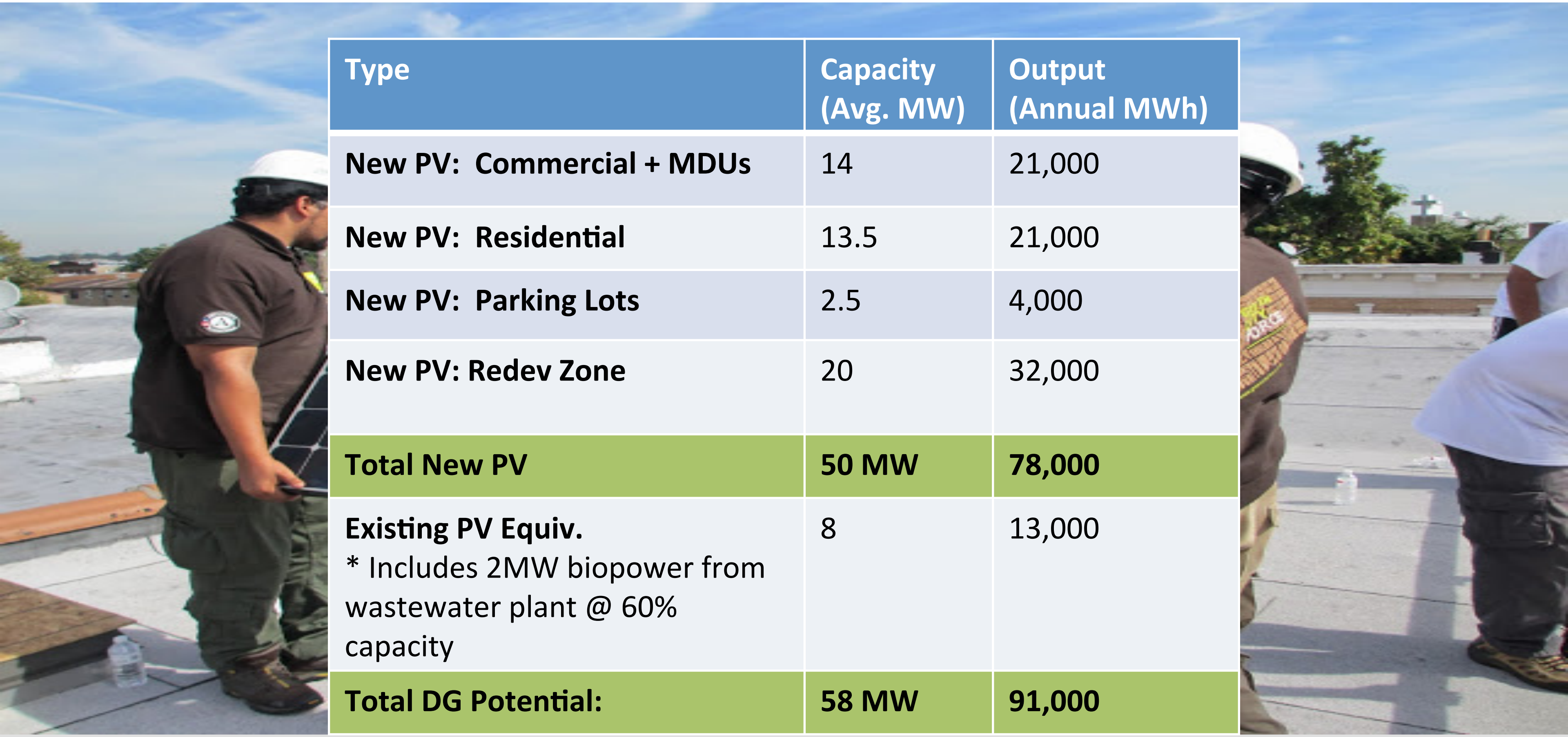
<u>DG Potential</u>: **Over 25% of Total Load (320,000 MWh)**

- **New PV in Bayview** = 30 MW, or 46,000 MWh
- **New PV in HP Redev Zone** = 20 MW, or 32,000 MWh
- **Existing DG** = 8 MW (PV equivalent), or 13,000 MWh



Type	Capacity (Avg. MW)	Output (Annual MWh)
New PV: Commercial + MDUs	14	21,000
New PV: Residential	13.5	21,000
New PV: Parking Lots	2.5	4,000
New PV: Redev Zone	20	32,000
Total New PV	**50 MW**	**78,000**
Existing PV Equiv. * Includes 2MW biopower from wastewater plant @ 60% capacity	8	13,000
Total DG Potential:	**58 MW**	**91,000**

Hunters Point Reasonable DG Potential: Commercial + MDUs

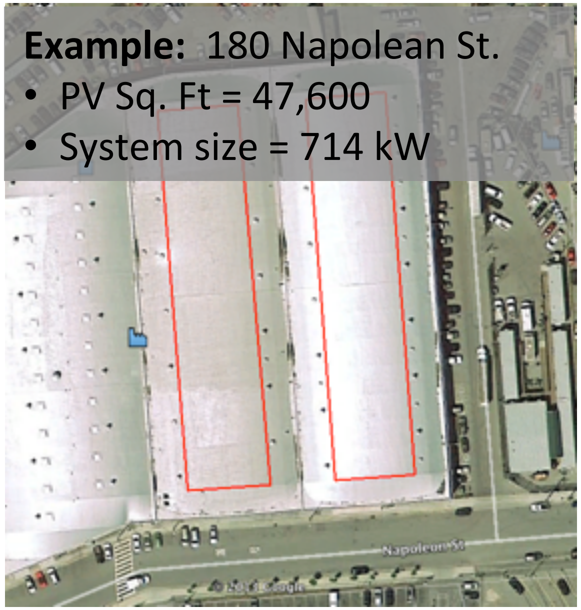
Potential PV: Commercial Rooftops + MDUs

Highlights:

- Number of visually-sited highest value "A" sites = **74**
  - Total PV-potential rooftop square feet = **1.6M**
    - Total participating sq. ft. @ 50% = **891K**
- Total average generation, participating rooftops = **14 MW**

Hunters Point Rooftops - Commercial + MDUs

Assumptions	
Watts/sq. ft.	15
PV hrs./yr.	1570
Participation Factor	50%
Results	
Total Sq. Ft.	1,627,605
Total Sq. Ft. Participating	891,605
Total Watts Participating	13,374,068
Total PV in MW	14
Total PV in Annual MWhr	21,333
Average kW per site	357



Hunters Point Reasonable DG Potential: Parking Lots

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Potential PV: Parking Lots

Highlights:

- Number of visually-sited highest value "A" sites = **13**
- Total PV-potential parking lot square feet = **348K**
- Total participating sq. ft. @ 50% = **174K**
- Total average generation, participating parking lots = **2.5 MW**

Hunters Point Parking Lots

Assumptions	
Watts/sq. ft.	15
PV hrs./yr.	1,570
Participation Factor	50%
Results	
Total Sq. Ft.	348,400
Total Sq. Ft Participating	174,200
Total Watts Participating	2,613,000
Total PV in MW	2.5
Total PV in Annaul MWh	4,102
Average kW per site	402

Hunters Point Reasonable DG Potential: Residential

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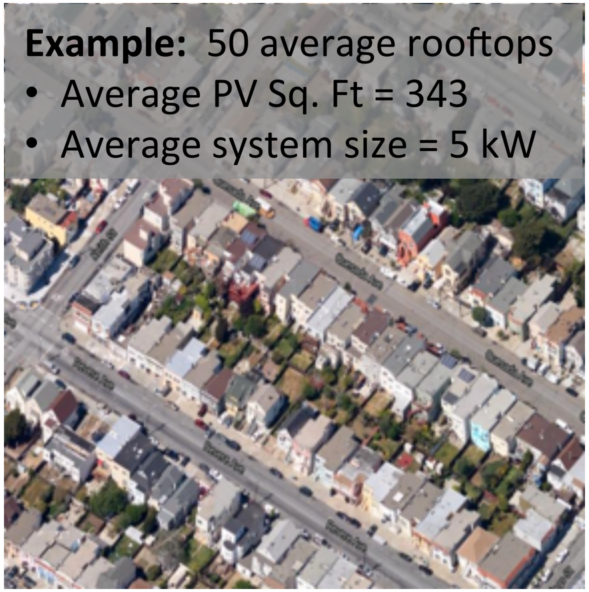
Potential PV: Residential Rooftops

Highlights:

- Total residential sites = 14,000
- Average PV-viable square feet per residence (from 50 sites) = **343**
- Total PV-potential residential square feet = **3.6M**
- Total participating sq. ft. @ 25% = **900K**
- Total average generation, participating rooftops = **13.5 MW**

Hunters Point Rooftops - Residential

Assumptions	
Watts/sq. ft.	15
PV hrs./yr.	1570
Participation Factor	25%
Results	
Total HH	14,000
Average PV-viable sq. ft. per HH	257
Total PV-viable Sq. Ft.	3,601,920
Total PV-viable Sq. Ft. Participating	900,480
Total PV in Watts	13,507,200
Total PV in MW	13.5
Total PV in Annual MWh	21,206
Average PV system size per HH, kW	4



Hunters Point Project Deliverables

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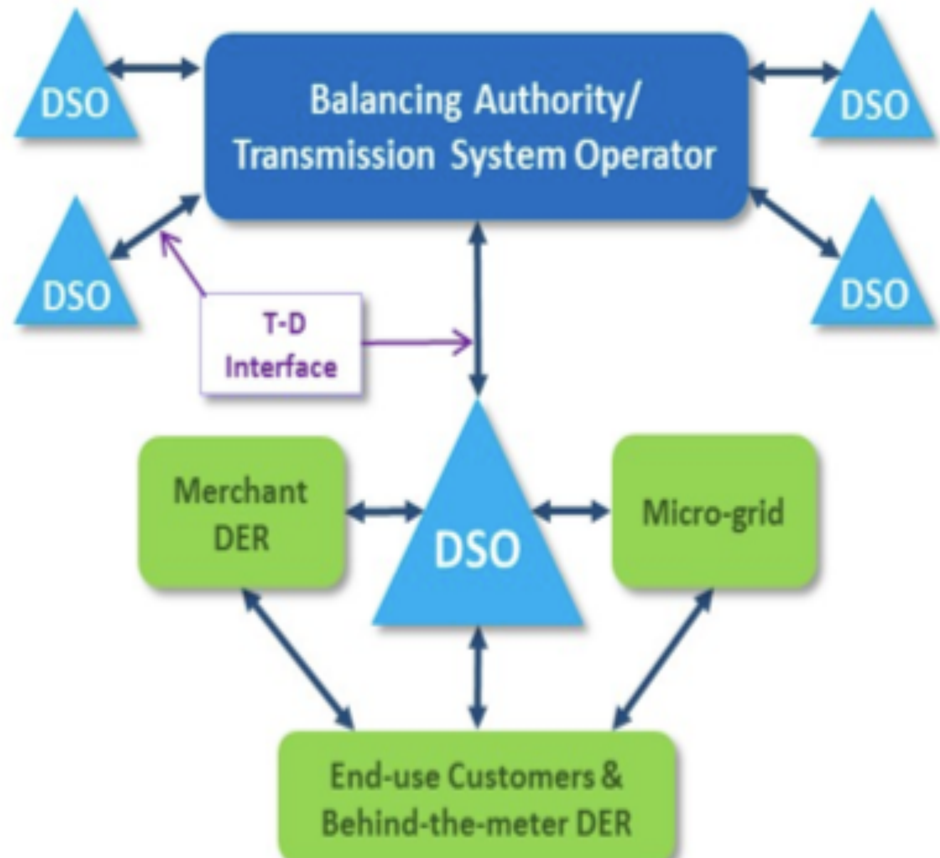
Deliverable	Details	Status
DG Survey	• Identified 50 MW of new PV potential: commercial, residential, parking lots • Existing DG includes 2 MW wastewater biopower (6.5 MW PV equiv.)	✔
Benefits Analysis	• DG Economic: $200M in local stimulus, $100M going to local wages • DG Environmental: 78M lbs. of GHG eliminated per year, 15M gallons of water saved per year, 375 acres of land preserved	✔
Baseline Model	• Required data sets and circuit model from PG&E • Model of existing powerflow, validated by PG&E	2Q 2014
Optimized Scenarios	• Optimal mix of DG, dynamic grid solutions, and physical locations • Cost-optimized scenarios	3Q 2014
Results	• Standardized reports, modeling, and methodologies, setting the stage for implementation (Phase 2) and industry-wide scalability • Streamlined & scalable procurement & interconnection	4Q 2014

Utility of the Future? "Distribution System Operator"

The Distribution System Operator (DSO) will:

- In real time, reliably operate the local distribution system, optimizing all Distributed Energy Resources (DER): micro-grids, diverse small-scale generation, self-optimizing customers, energy storage, power flow control devices, demand response, etc.
- Create a more stable and predictable interchange with the Transmission System Operator (TSO) that relies on more local balancing of resources

Future "Integrated Distributed" Electricity System
(High-DER, Multi-directional energy flows & Multi-level optimizations)



Source: 21st Century Electric Distribution System Operations, May 2014

Peek at the Future of Bayview-Hunters Point

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Ecoplexus project at the Valencia Gardens Apartments in SF. ~800 kW serving ~80% of the total annual load.