Deployment and Integration of Renewables at UC Irvine

ADVANCED POWER & ENERGY PROGRAM
UNIVERSITY of CALIFORNIA • IRVINE

Energizing California's Communities with Renewables:
A Southern California Urban Perspective
Sept 30, 2015

UCI Microgrid

- Comprehensive Research University
- $330 Million Sponsored Research
- Top Public U.S. University 50 Years Old or Younger
- 20+ LEED Buildings
- 7.5 Million Square Feet
- 8–24 MW Load

- **Major Goal: Net zero carbon by 2025**

UCI Microgrid

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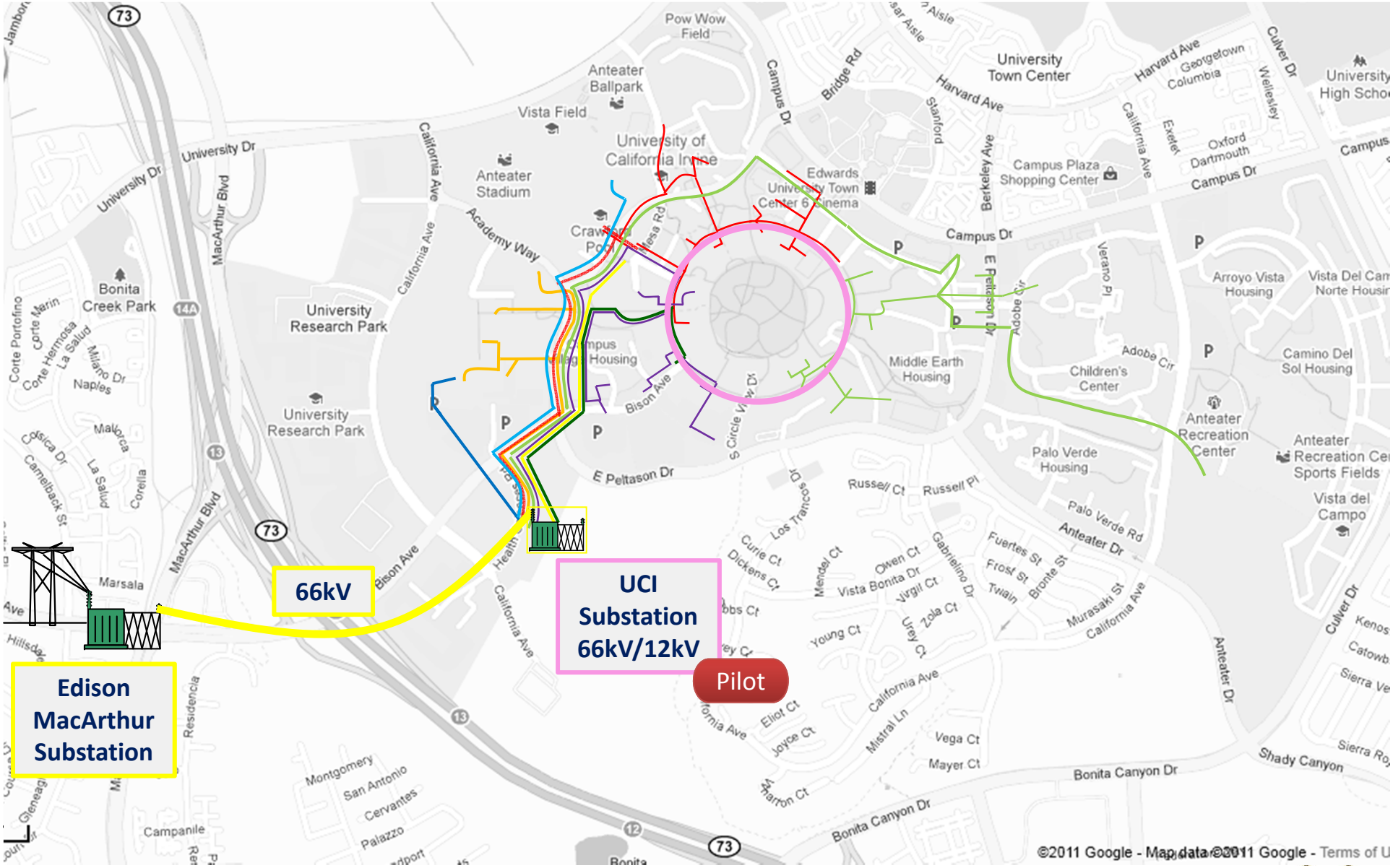
UCI Microgrid



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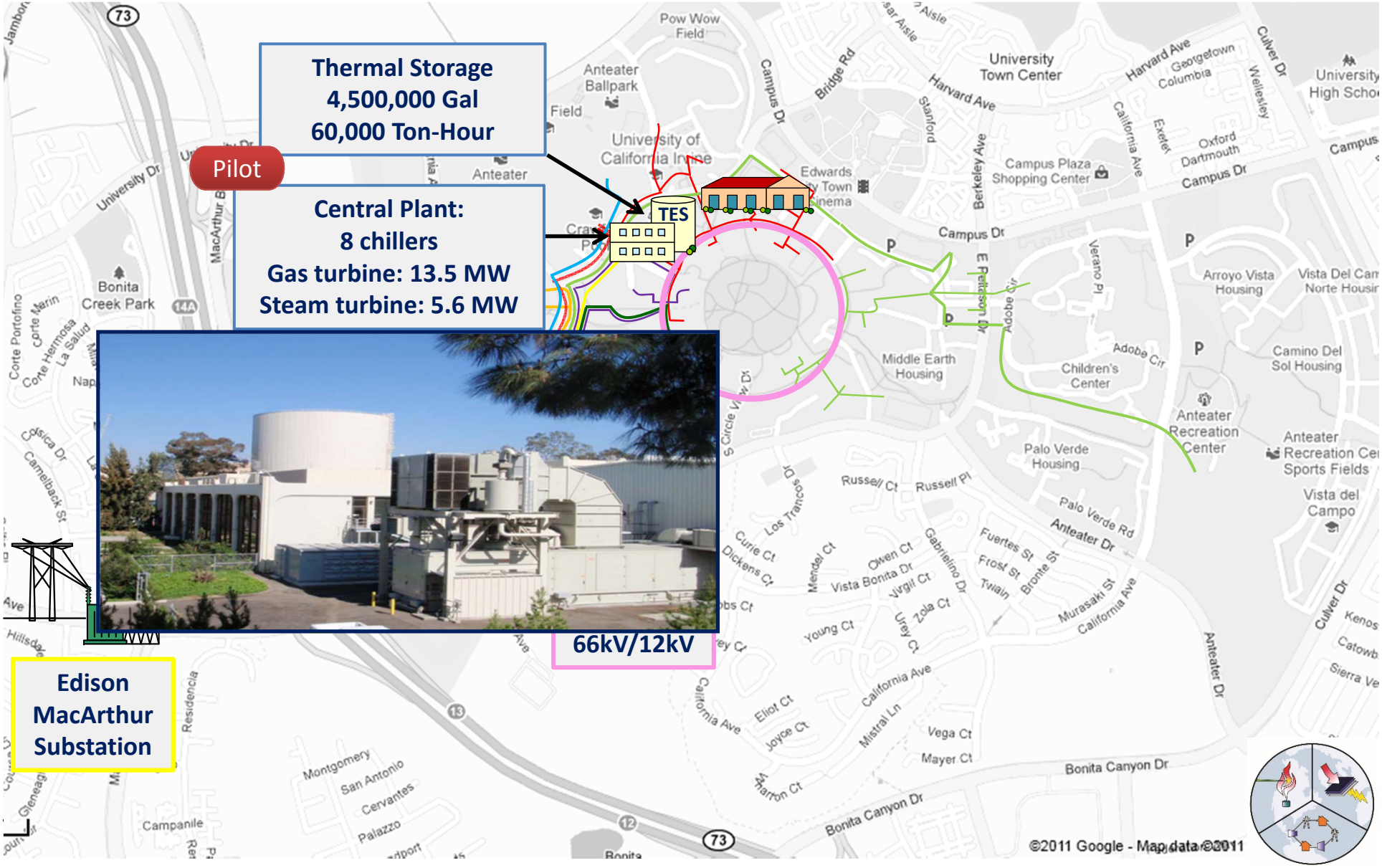

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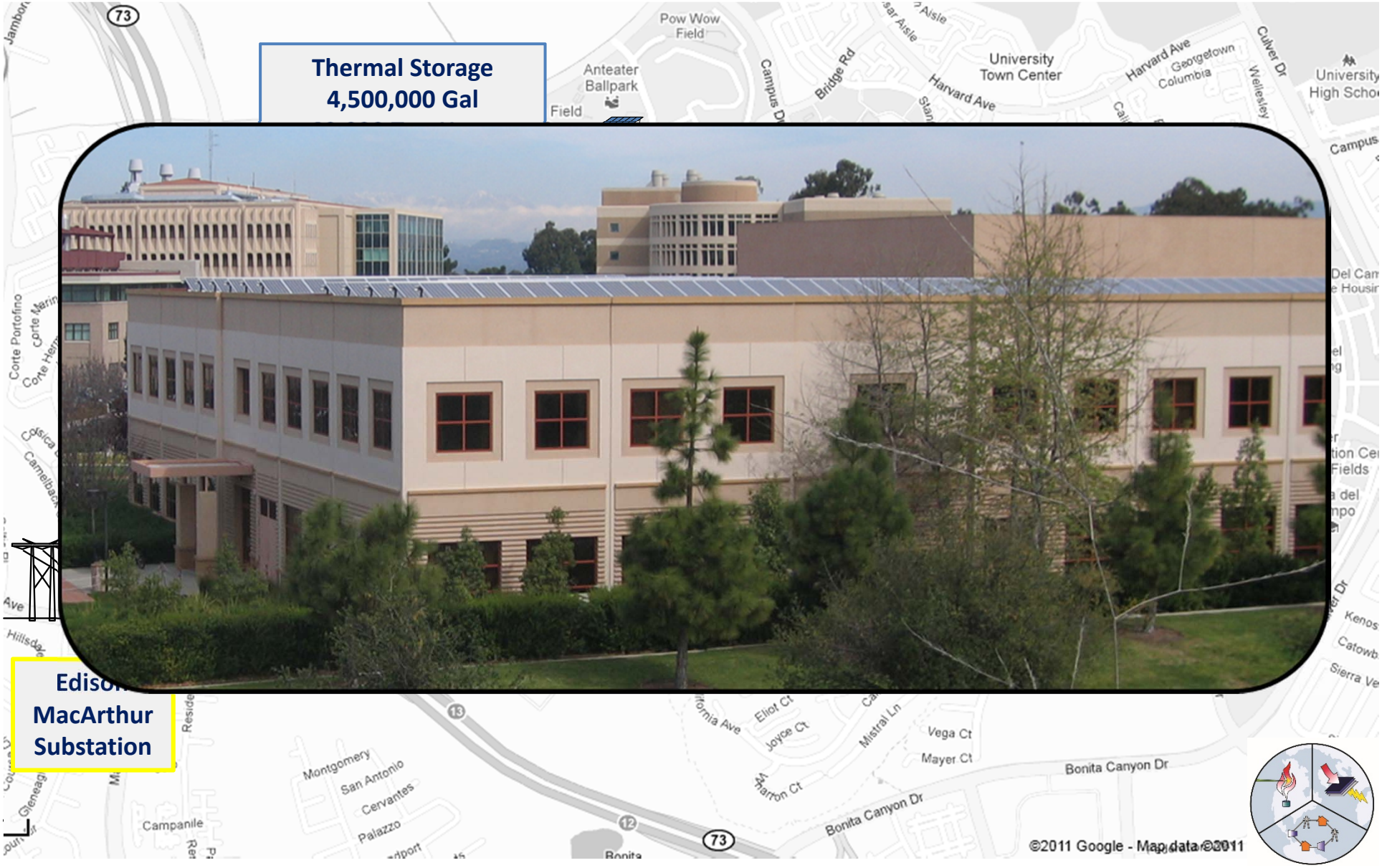

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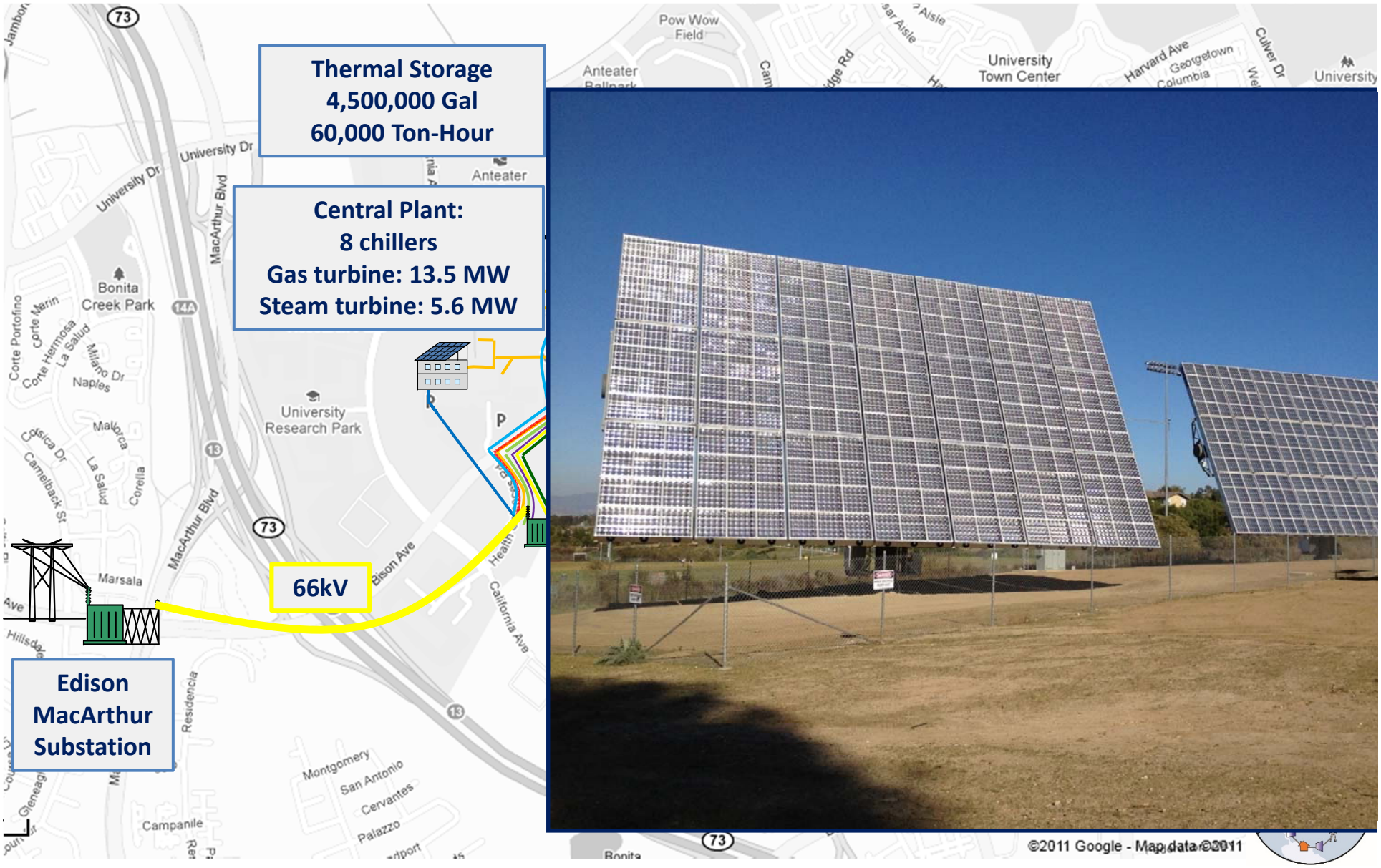

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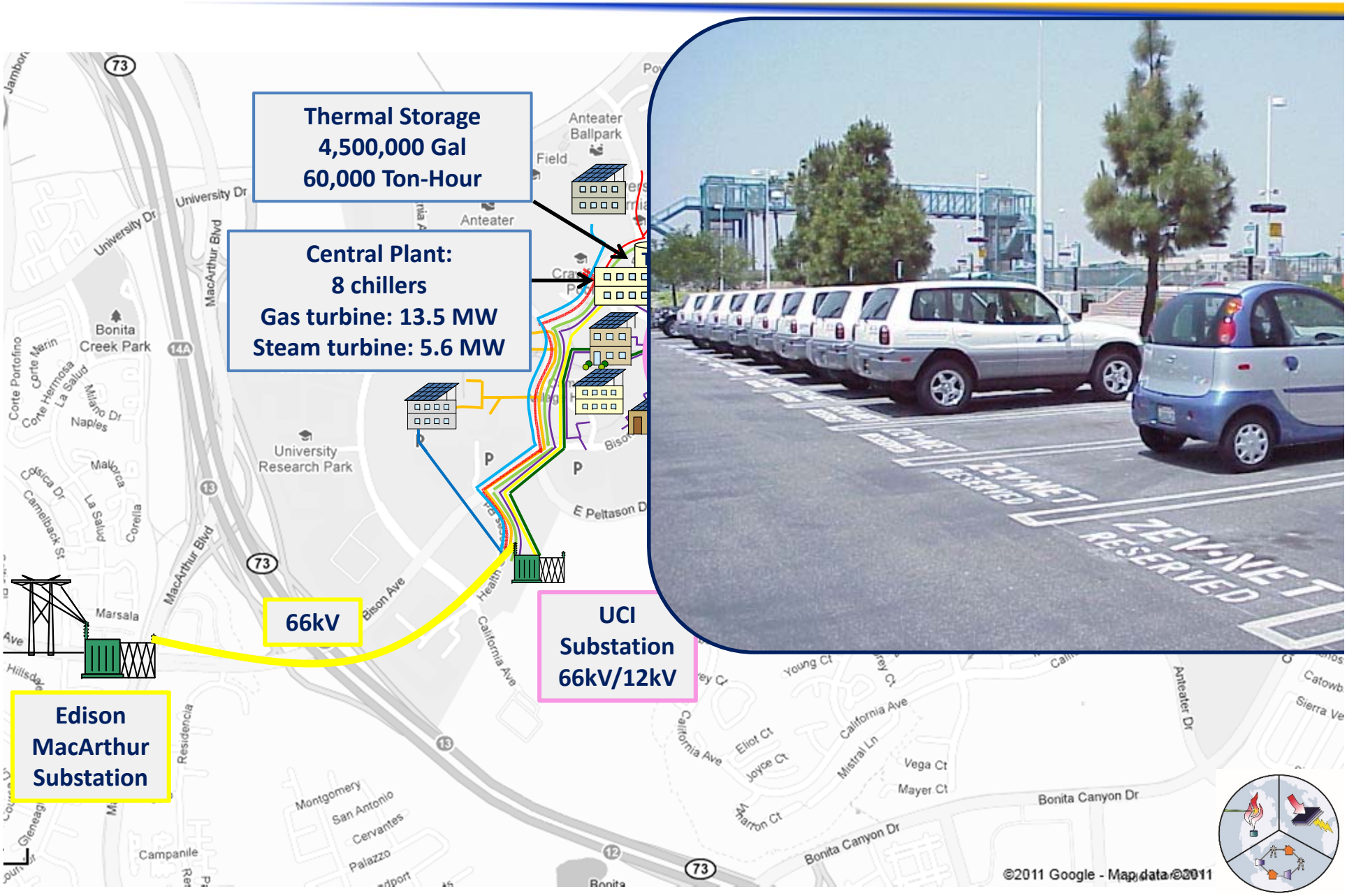
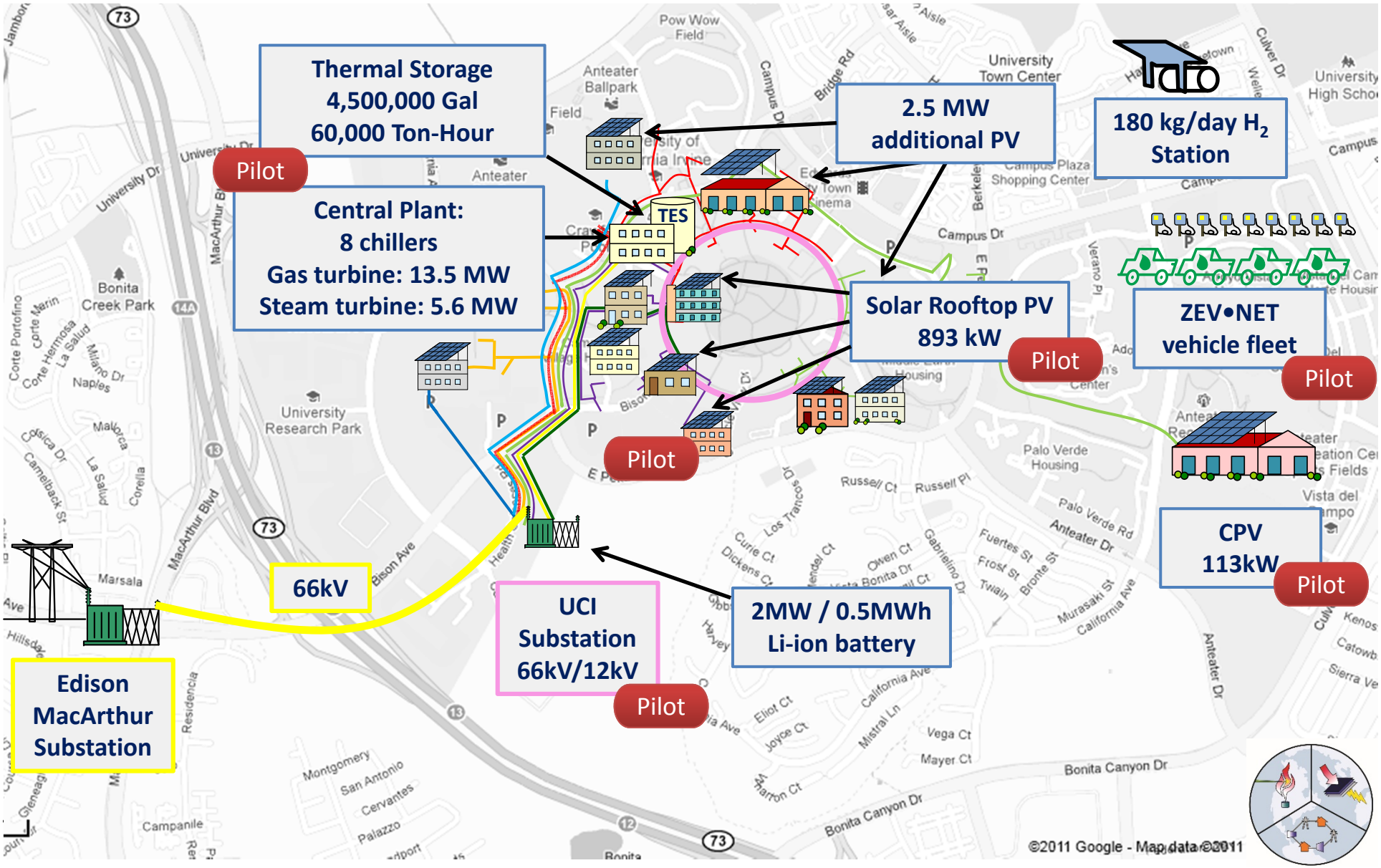
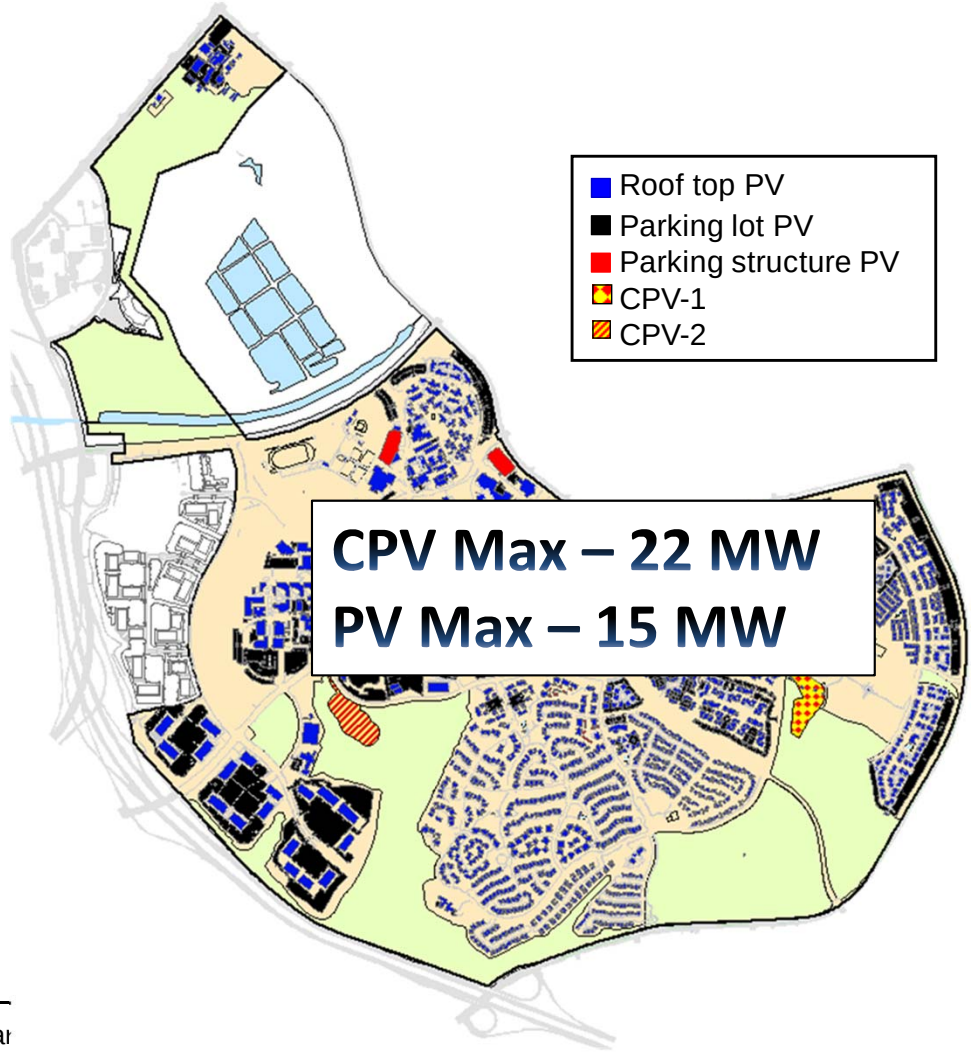


UCI Microgrid



On-site Renewables

- **Fixed PV**
  - Building rooftops (20%), ground level parking lots - car shade (15%), and parking structure terraces (70%)
  - 15 Watts/m^2
- **Dual-axis CPV**
  - Exposed ground
  - 40 Watts/m^2



CPV Max – 22 MW

PV Max – 15 MW

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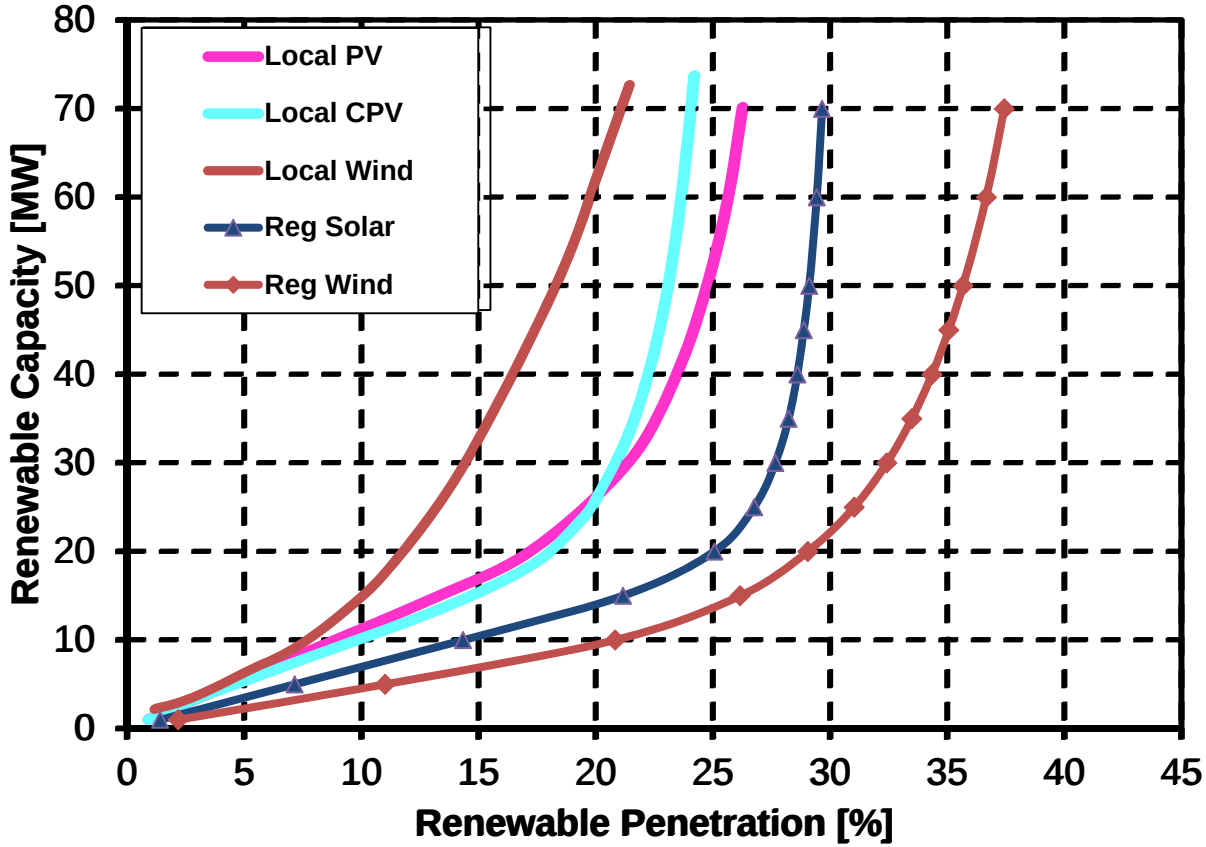
HiGRID Community Scale

- Renewable Deployment on the UCI Microgrid



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Ener-Core

EC250 Package

Nominal Electrical Output*: 250 KW
Voltage: 480/400VAC
Frequency: 60Hz/ 50Hz
System Weight: less than 50,000 lbs
Efficiency: 26% (+/-2)
Achievable NOx Emissions: <1 ppm @15% O2

Gas Turbine (Flex Energy)
- Power: 250kW

Power Oxidizer (Ener-Core)
- Pressure vessel and pipes
- Fuel Operating Range (Direct Injection): 350-2,600 Btu/scf (13-97 MJH/NM^3)

Generator Braking Resistor: 330 kW (max load)

* Does not include fuel delivery parasitics

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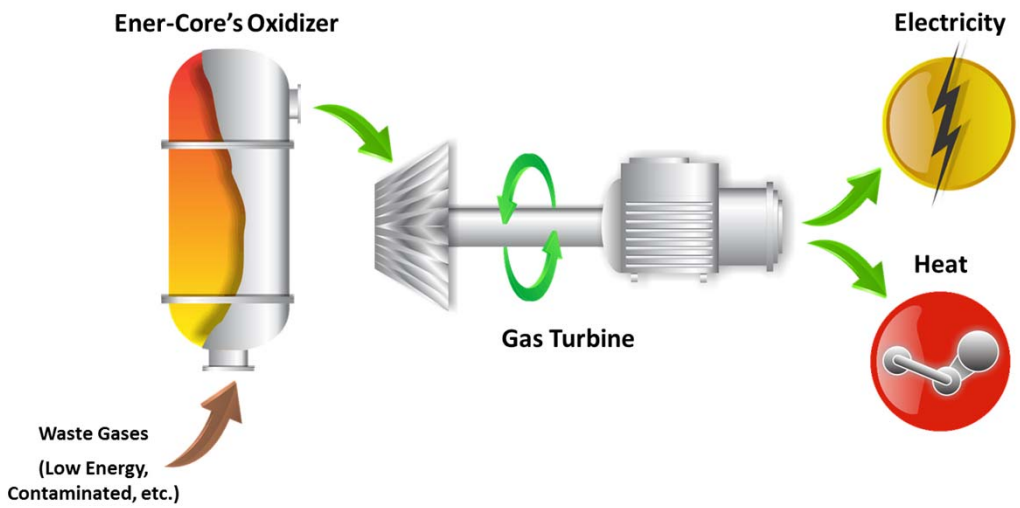
Ener-Core

Ener-Core's Oxidizer technology replaces the combustor in a traditional gas turbine.



Contaminated fuels *(Siloxanes, Hydrogen, etc.)* By using oxidation rather than combustion, the technology can handle fuels with higher levels of contaminates. Specifically, tolerances to hydrogen and Siloxanes are higher than for combustion based power generation solutions.

Pollution Destruction *(99% destruction efficiency)* The technology can be used in lieu of a traditional thermal abatement technology (flares, scrubbers, etc.) to destroy gases emitted by industry while simultaneously producing electrical and thermal energy.

Low Emissions *(<1 ppm NOx & CO)* Using an oxidizer in place of a combustor allows for lower emissions than traditional power generation equipment. Typically, to achieve these emission levels power producers use post-combustion technologies (SCR, CO Catalyst, etc.)

Low Energy Fuels *(25 to 2,600 btu/scf)* The Ener-Core Power stations can operate on lower energy density fuels than traditional power gen technologies. This technology can operate (without supplemental fuel) on gases with energy densities as low as 15 btu/scf.

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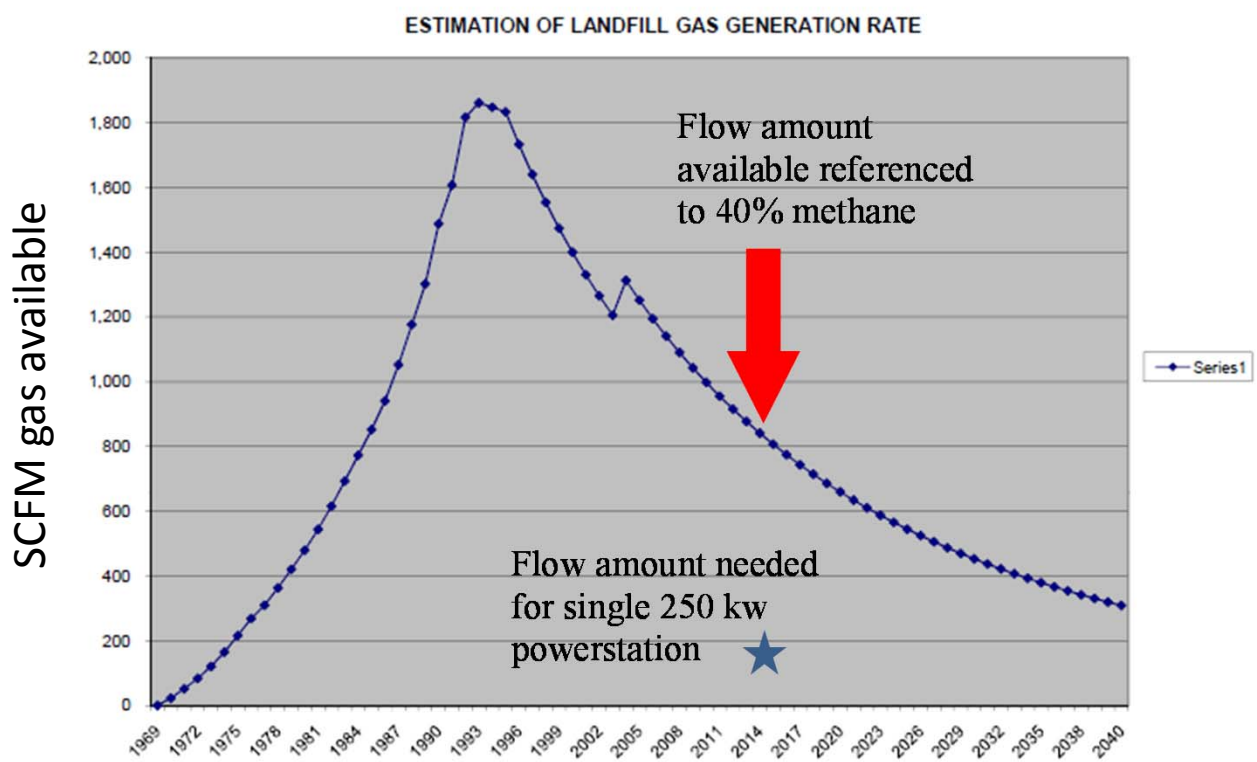
Santiago Canyon Landfill

- Landfills generate biogas from decomposing material
  - The quality and flow of gas varies with time
  - Santiago Canyon Characteristics (EPA Landgem Model)
    - Reduced Flow and reduced methane content



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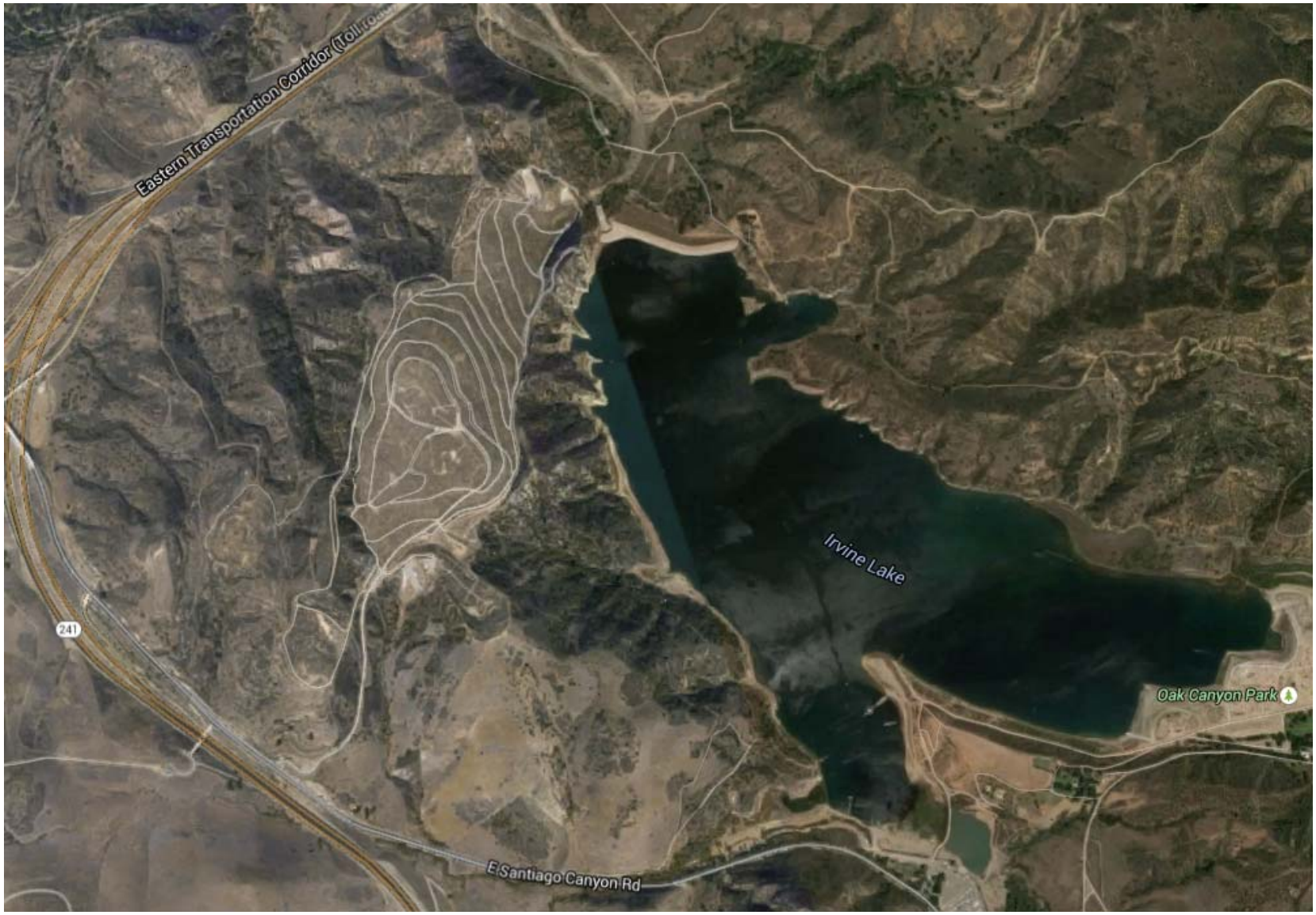
Santiago Canyon Landfill



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Santiago Canyon Landfill

View to South

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Cost-Benefit Analysis

- Derived Value

		Cost Benefit Based on Avoided Electricity Cost without Incentives 2015 - 2024		Cost Benefit Ratio Based on Avoided Electricity Cost	
Scenario	MW operating in closed Landfills	Using Avoided Commercial Rates	Using Avoided Industrial Rates	High Cost Benefit Ratio	Low Cost Benefit Ratio
1%	3.8	$20,745,336	$4,563,939	10.4	2.3
5%	19.2	$103,726,680	$22,819,693	51.9	11.4
10%	38.3	$207,453,360	$45,639,386	103.7	22.8
20%	76.6	$414,906,720	$91,278,772	207.5	45.6
30%	114.9	$622,360,080	$136,918,158	311.2	68.5
50%	191.5	$1,037,266,799	$228,196,930	518.6	114.1
75%	287.3	$1,555,900,199	$342,295,395	778.0	171.1
100%	383.0	$2,074,533,599	$456,393,860	1037.3	228.2

- The Santiago Canyon landfill project will demonstrate the following:
  - Continuous baseload renewable electricity from landfill gas which it being flaring because the gas quality is too low to be used in reciprocating engines.
  - CARB 2013 Waste Gas standards the target of NOx below 0.07 lb/MWh, CO below 0.10 lb/MWh, and VOC/NMOC below 0.02 lb/MWh.
  - The cost benefit with a project total budget of under $2 million
- The value derived from this project is
  - Avoided cost of electricity based on either Commercial ($147/MWh) or Industrial ($99.81/MWh) rates minus the system's LCOE. (see attachment 12)
  - Emissions reductions with the assigned value of $72,000 per ton based on the published emissions reduction credits in SCAQMD.
  - CO2e reduction with the assigned value based on the avoided CO2e g/kWh of 218.8. The value of the CO2e reduction was set at $11.34/ton from the GHG auction.

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THANK YOU

Questions?

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