

Local Impact, National Influence, Global Reach

CLIMATE SOLUTIONS for UNIVERSITIES AND LOCAL COMMUNITIES

Presentation for San
Diego Super Computer

April 16, 2008



A Leader in Climate Solutions

UC San Diego has long been internationally recognized for its pioneering research in global climate change.

We feel it is imperative to have commensurate leadership in the sustainability of UCSD's operations.

As a living laboratory for climate solutions, UC San Diego will be an early adopter for real-world tools and leading-edge technologies for California and global marketplace.



Climate Solutions Work-Group

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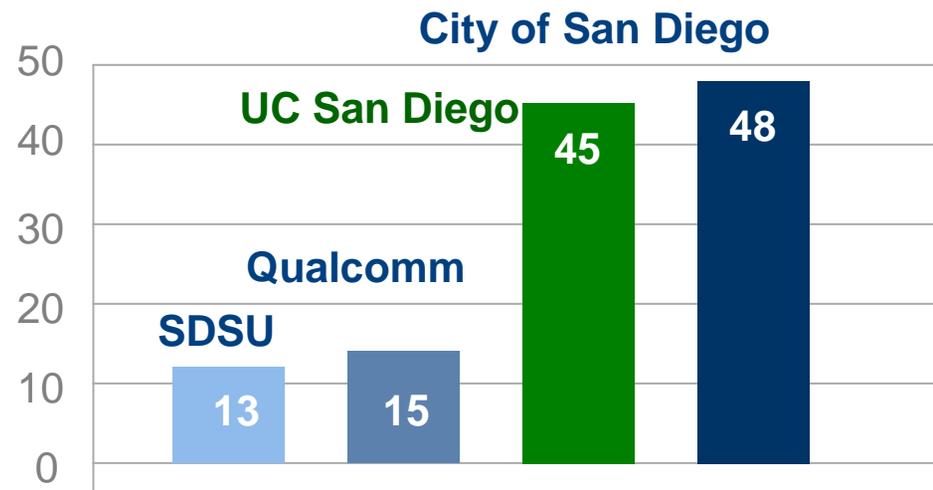
Associate Dean, Biological Sciences

Campus Quick Facts

With a daily population of over 45,000, UCSD is the size and complexity of a small city.

As a research and medical institution, we have a higher consumption of energy than comparable communities.

Electricity Peak demands (MW)

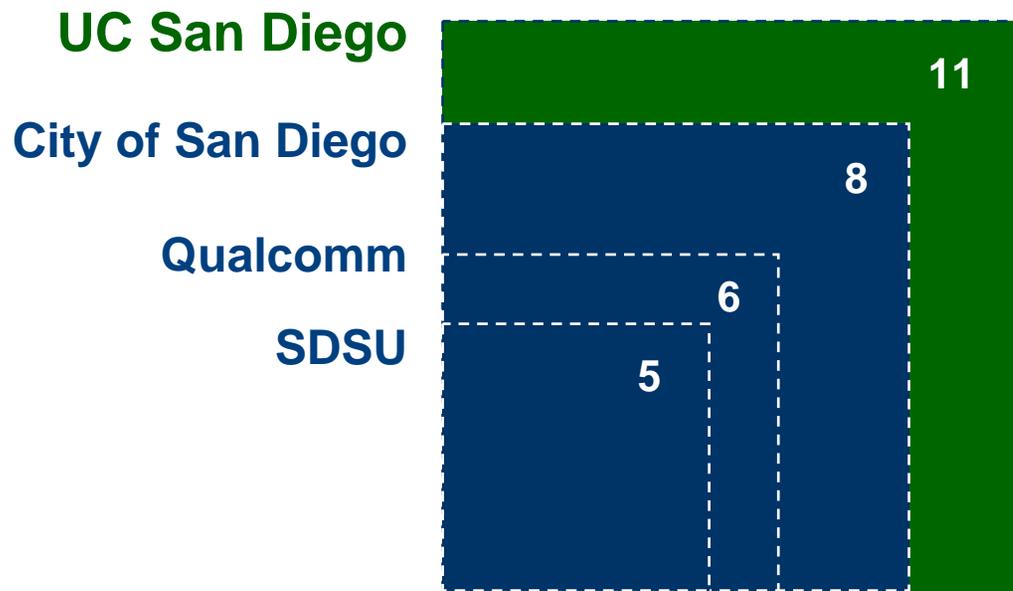


Campus Quick Facts

11 million sq. ft . of facility space, if we were a landlord, we would be the largest in San Diego

Included in the daily population of 45,000, we have over 8,000 student residents living on campus

Square Feet of Facility Space *(in millions)*

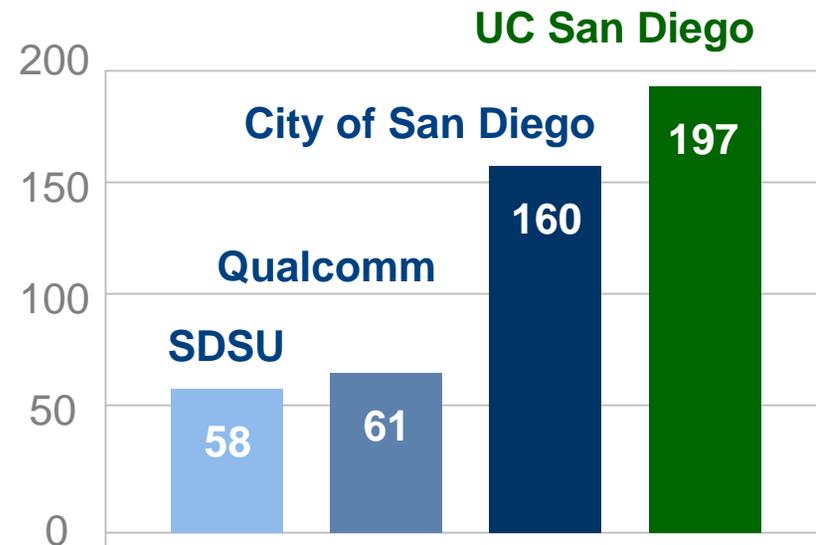


Campus Quick Facts

UCSD produces 197,000 tons of carbon dioxide each year

UCSD is a charter member of, and first university in the California Climate Action Registry

Carbon Footprint metric tons/yr CO₂ *(in thousands)*



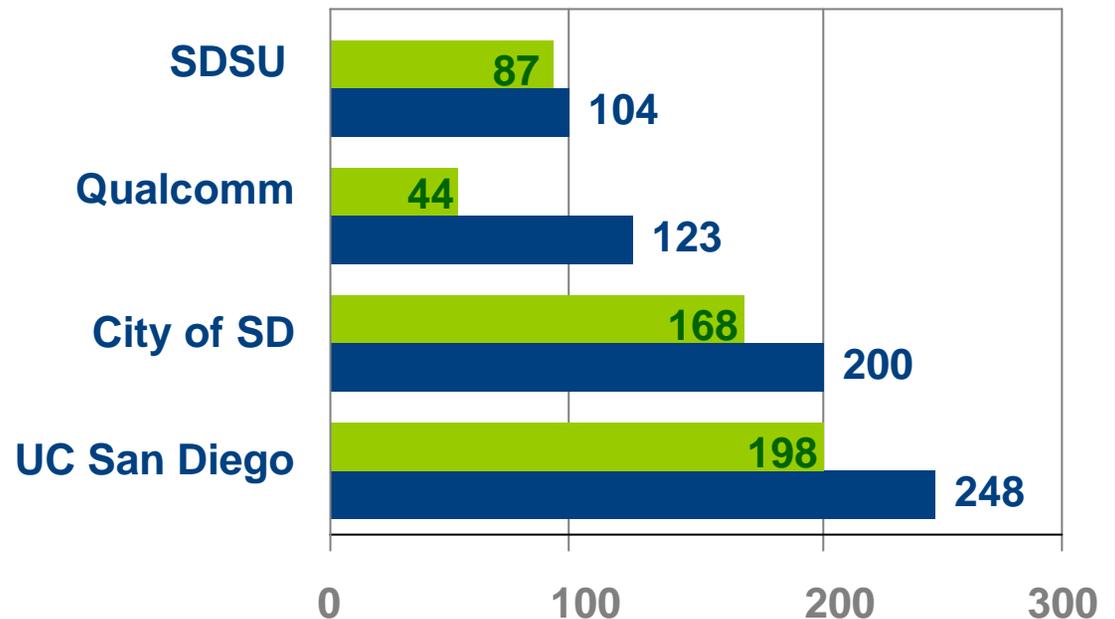
Campus Quick Facts

We self-generate 80% of our electricity demand using efficient CNG fueled cogeneration.

Even though UCSD generates the majority of its own electricity, we remain one of the top 5 customers of SDG&E

ENERGY (GW hr)

Generation ■ and Consumption ■

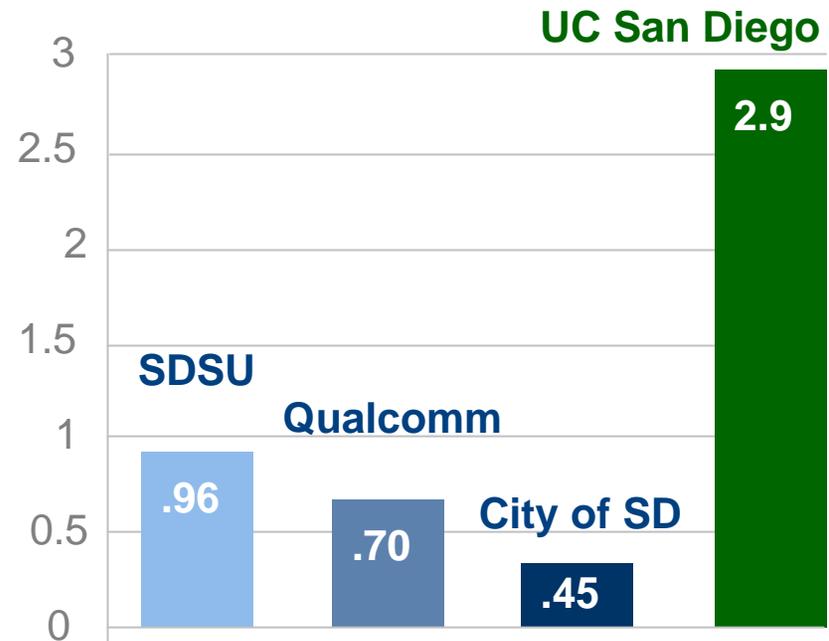


Campus Quick Facts

UCSD uses natural gas to fuel its power plant.

In the future, rather than being solely dependent on natural gas, UCSD intends to secure diverse sources of renewable energy

Annual Natural Gas Consumption (Million MMBtu)



Leadership is Best Exhibited
In Times of Greatest Challenge

Our Challenges

Future Energy Costs and Emissions Regulations may Inhibit UCSD'S Growth

- ☑ Energy Intensive Research University
- ☑ \$1B of new buildings every 4 years
- ☑ Constrained State Operating Budget
- ☑ New restrictions from State and University



Energy Intensive



Campus Growth



State Budget



Unfunded Mandates

12 Key Elements of Strategy

Facilities &
Operations

E1

Transportation

E2

Building
Design

E3

Infrastructure
& Procurement

E4

Recycling &
Conservation

E5

Photovoltaic

THINK
SOLAR
ENERGY

E6

Methane &
Fuel Cells

E7

Water
Resources

E8

Wind
Energy

E9

Student
Involvement

E10

Goals &
Metrics

E11

Financing &
Partnerships

E12



Facility Operations

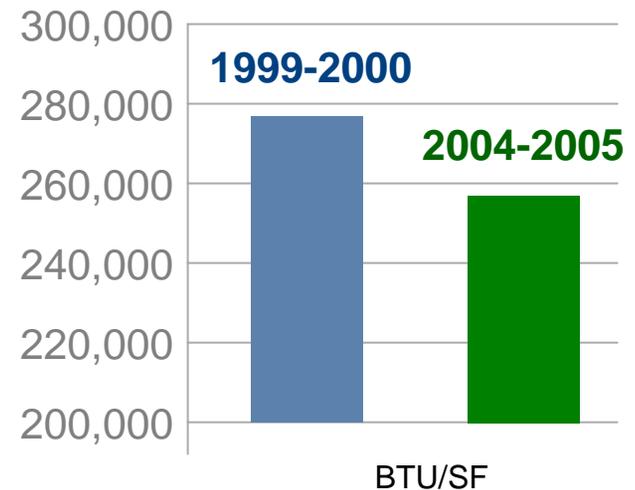
Continue to be a Leader in Resource Conservation and Energy Efficiency

Completed \$58M in energy retrofits reducing energy use by 20% or 50M kWh/yr, saving UCSD \$12M annually.

Award winning program:

- 6 Best Practice Awards
- 3 Excellence in Energy Efficiency Awards
- 2 Energy Education & Leadership Awards

Even with increased energy intensive activities and growth, facility retrofits have decreased energy consumption per sq. ft.



E1

Facility Operations: Demand Response

Continue to be a Leader in Resource Conservation and Energy Efficiency

Capacity Bidding Program:

- Contracted with Enernoc
- Day-Of Program

Central Plant Activity:

- Shut down electric chilling
- Increase generation if available

- **Capacity Bidding Program**

- **First University Member of Green Grid Collaborative**

- **Immediate shutdowns and setbacks**

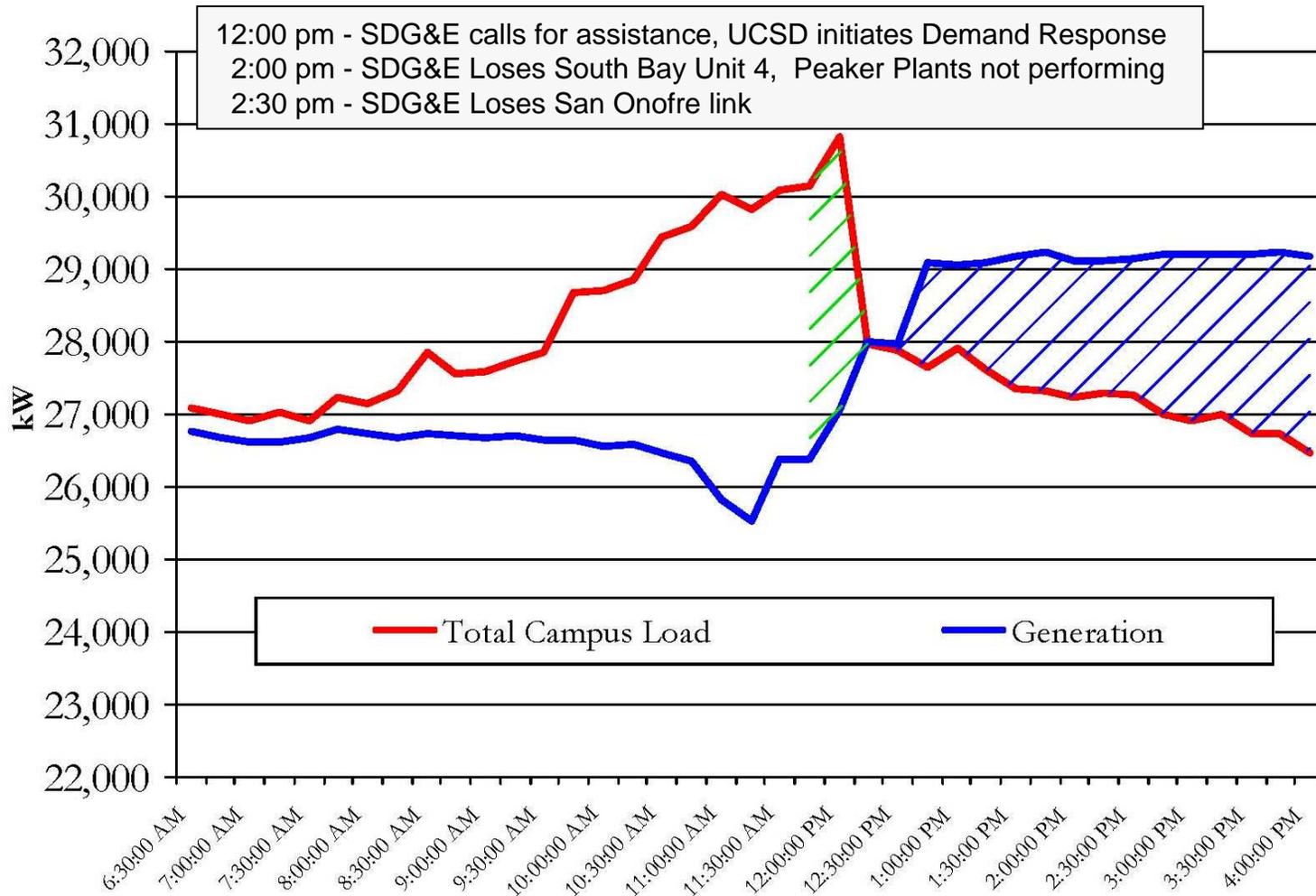
- 40% Reduction
- Wild Fire Response



E1

Facility Operations: Firestorm Response

UCSD Switches from Net *Importer* to Net *Exporter* Within Minutes



E2

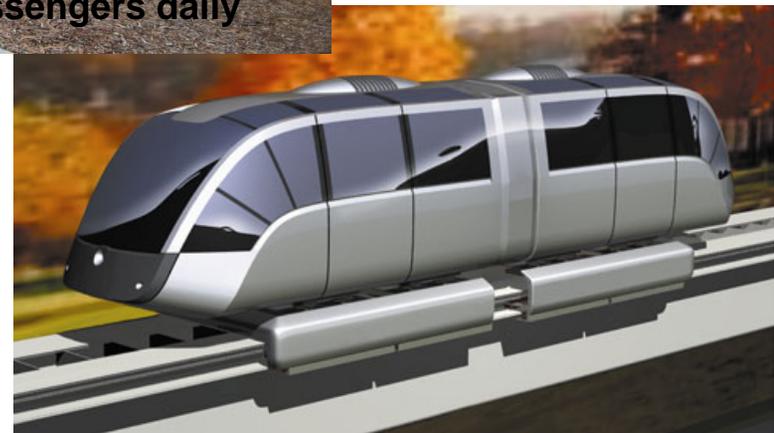
Transportation

Maximize Use of Alternative Fuels & Transportation

Replace UCSD vehicle fleet with hybrid, bio-diesel, and electric vehicles

In 10 years, reduce single-occupancy vehicle usage from 54% to 45% (4,200 person reduction)

A possible future: The General Atomics maglev concept



E3

Building Design

At a *Minimum*, Design all Future Campus Buildings to LEED Silver or Gold Standards

Leadership in Energy & Environmental Design (LEED) is the nationally recognized green building rating system

UCSD will exceed UC LEED by achieving a Silver-equivalent rating on all new buildings.

All UCSD design and project managers have now received LEED training.

Due to higher capital cost of meeting these standards, the campus will look for donor support to augment building budgets.



E4

Implementing Efficient Infrastructure

Create a State-of-the-Art Energy Infrastructure

2008

Expand cogeneration capacity by 50% (15 MW) will yield \$2.4M annually in savings and reduce emissions.

\$2M state grant will continue energy efficiency retrofits with a goal of 1 million sq ft of facilities by 2010

2008

Deployment of green cyber-infrastructure will consolidate computer servers in energy-efficient mobile facilities.



SDSC
SAN DIEGO SUPERCOMPUTER CENTER

UCSD is increasing computing capacity and efficiency with server consolidation and maximum use of “Super Computing” capability

Computing Capacity = High-Tech growth

E5

Conservation & Recycling

Demonstrate Best Practices in Recycling

The campus will achieve
50% waste diversion by June
2008, and 75% by 2012.

By 2020, UCSD's goal is to
be a zero-waste campus.

UC San Diego recycles nearly 40% of its
waste, or 2,000 tons each year.





Renewable Solar Energy

**Become the
Leading University
Site in the World
for Photovoltaic
Energy (PV)**

**We have secured CSI
incentives to develop
1MW of PV energy**

2006: PV Installation at School of Engineering

2007: PV Installation at Rady School

**Mar 2008: Signed agreements with local PV
Energy Provider**

May 2008: Start PV installation

**Dec 2008: 1 MW in production using latest, hi-
efficiency (16%+) PV modules**

Identified sites for another 1MW of PV





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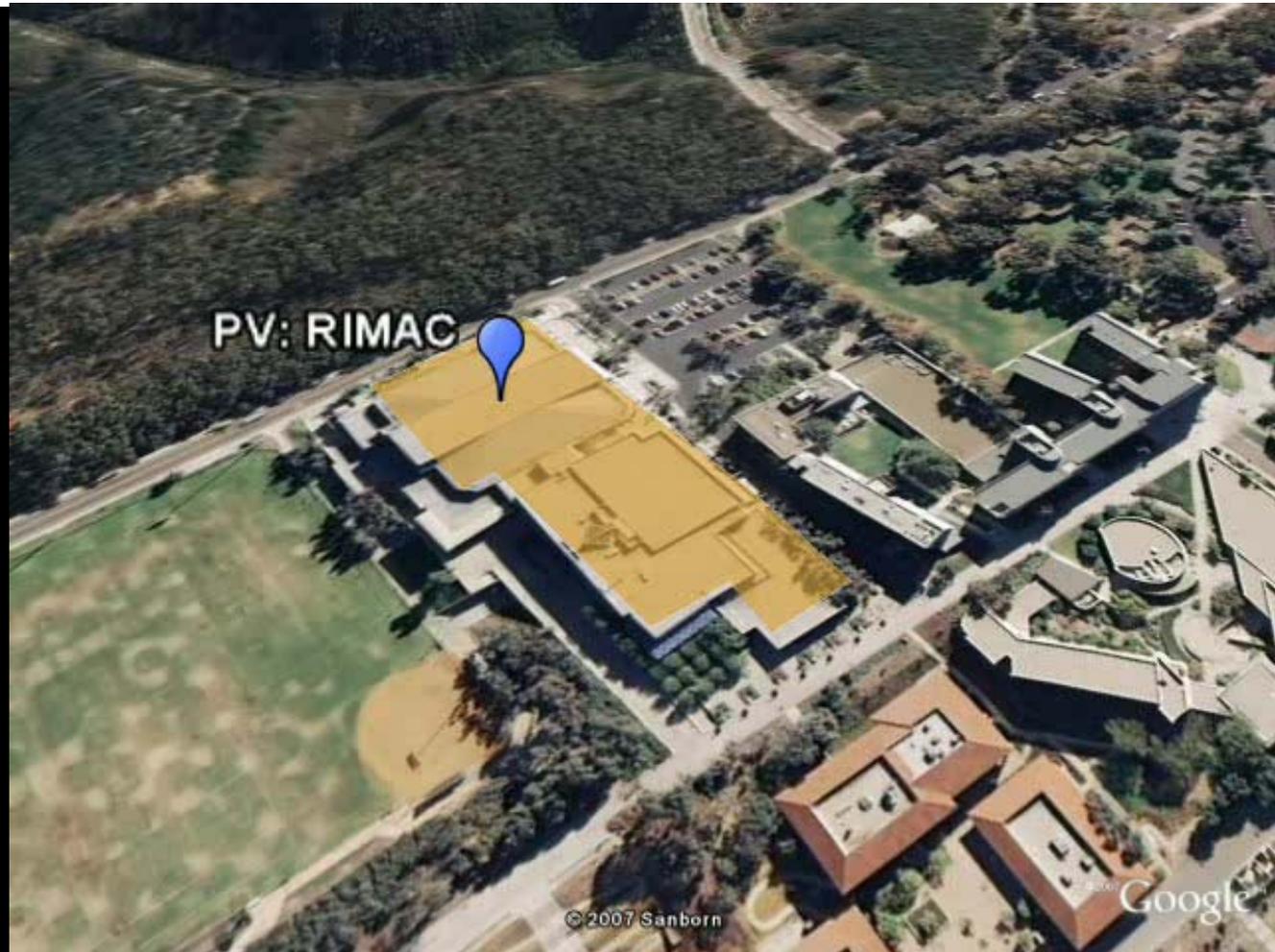


Fuel Cell Energy

Become Leading University Site in the World for *Ultra Clean Fuel Cells*

Methane is transported daily to campus from Point Loma waste treatment plant.

Campus plans to install 2.4 megawatts of methane powered Fuel Cells.



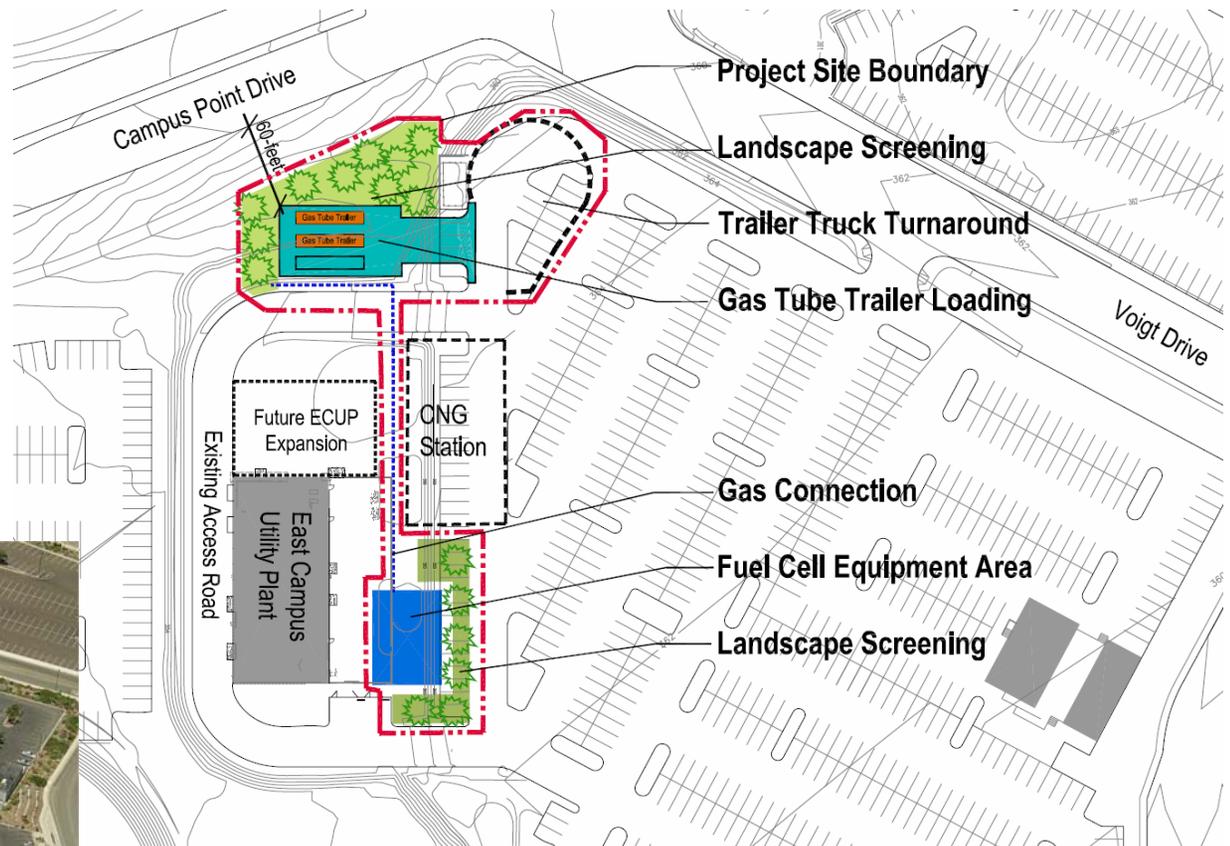


Fuel Cell Energy

Become Leading University Site in the World for *Ultra Clean Fuel Cells*

Opportunity to turn waste heat into power

Largest renewable powered University Fuel Cell





Water Resources

UCSD is helping California solve the water dilemma

Scripps researchers predict that Lake Mead could be dry by 2021

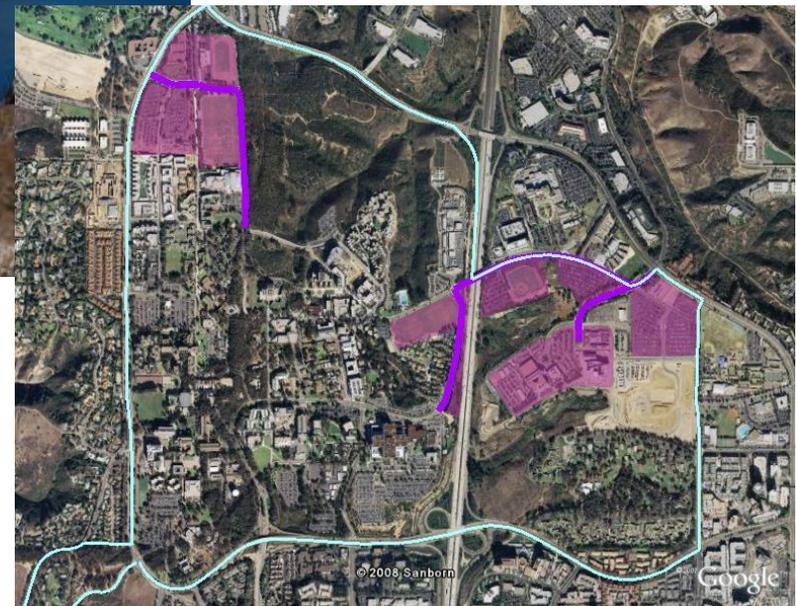
UCSD is reducing water use:

- Reclaimed water for irrigation
- Planting natural vegetation
- Wx monitoring/soil moisture controlled watering
- Low flow fixtures
- Condenser water capture



Lake Mead

UCSD Reclaimed Water System

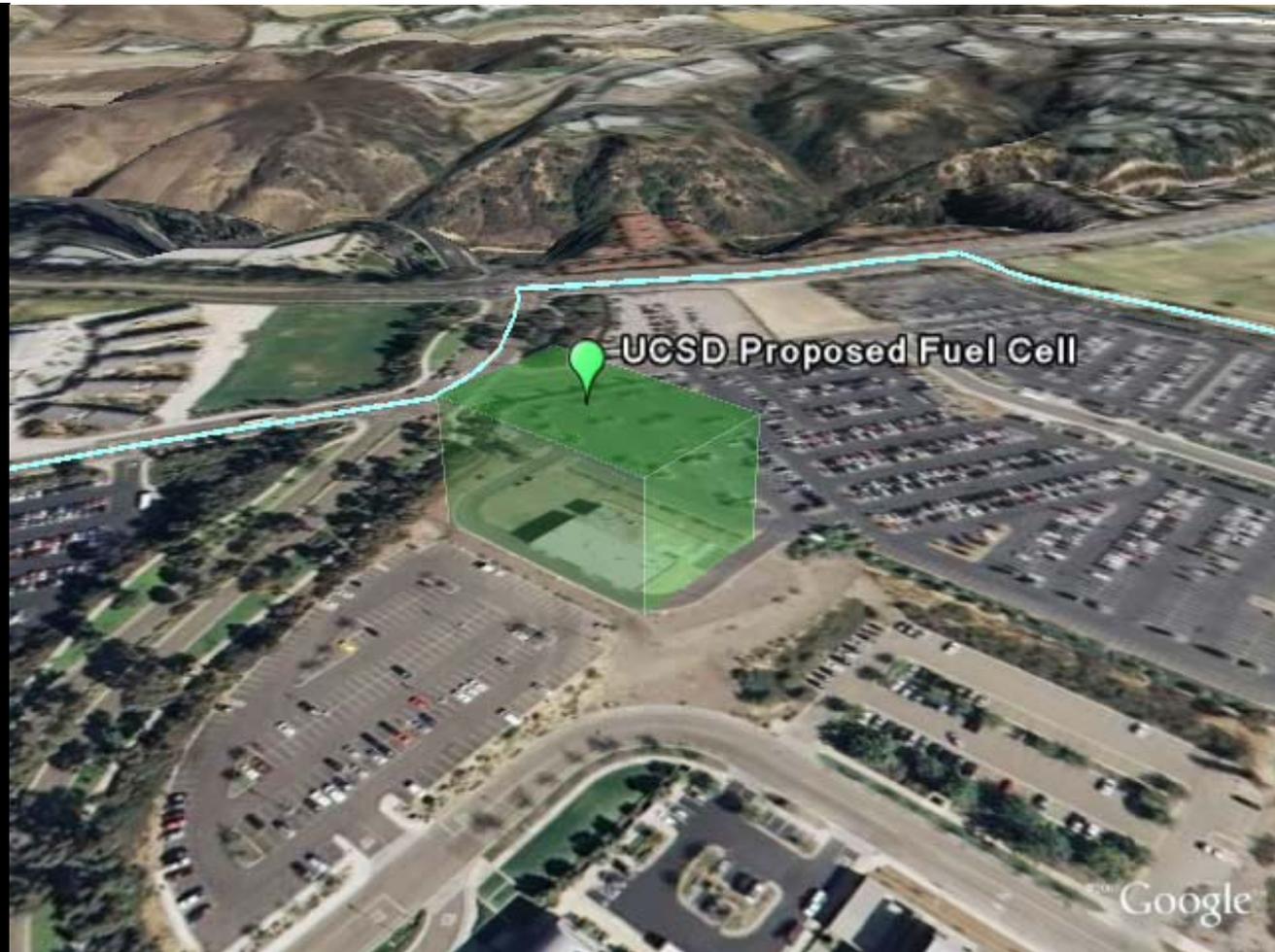




Using Sea Water

Become a Global Demonstration Project for Sea Water Cooling

UCSD is uniquely located to use cold seawater from one of only 40 deep shoreline sites in the world. It can supply cold water essential for air conditioning laboratories

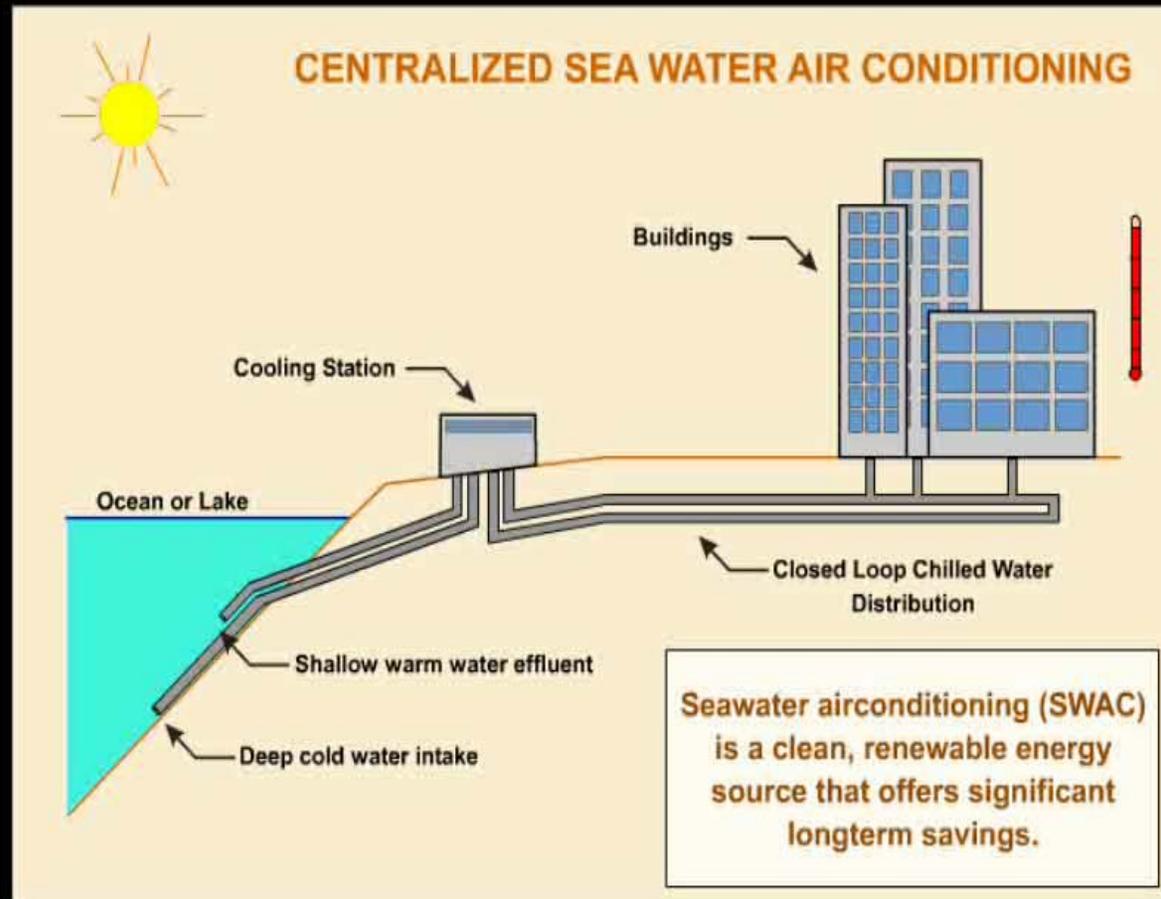




Renewable Energy

Initial study of La Jolla underwater trench suggests a seawater cooling system could produce savings of \$4M/yr and 100 million gallons of fresh water per year.

Campus is exploring private party build, own, operate approach.



E9

Renewable Wind Energy

Become a Pioneer
in the Utilization
of Off-Peak Wind
Energy

Off-Peak
Wind
Generation



Throttle
Down
Power Plant



Biofuels: A New Approach

Advanced Biofuel Feedstocks Program: grasses and algae

Miscanthus

Perennial grass

Fast growing

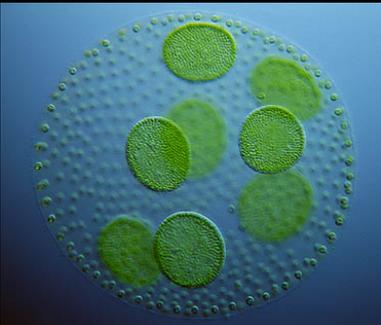
Low inputs

Micro-algae

High density

No food competition

Saltwater / wastewater



Steve Kay, researcher



E10

Research and Student Involvement

Create Leading Sustainability Program with Focus on Student and Community Involvement

Involve students in photovoltaics, weather station network, biofuels

Provide incentives for multidisciplinary student collaboration



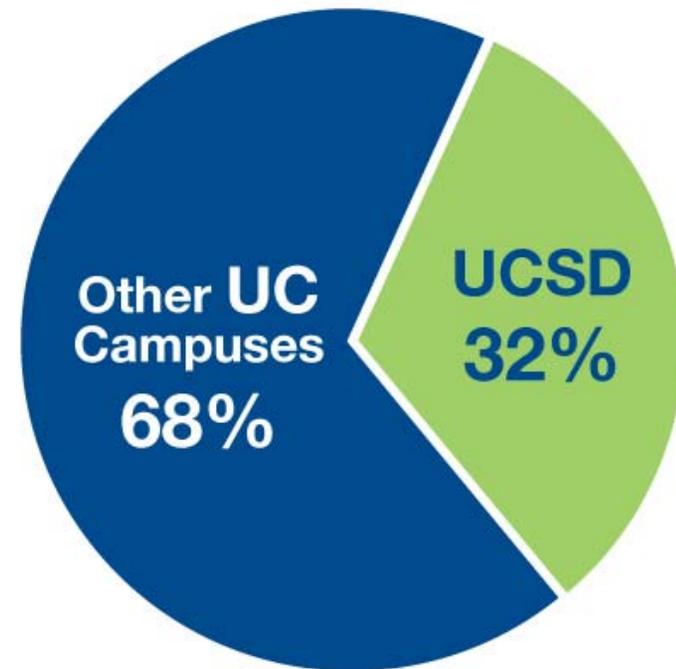
E11

Defined Metrics in Meeting Near Term Goals

In 2008,
on-campus renewable
production = 1/3 of UC's
2010 system-wide goal.

Renewable energy grid
purchases to rise to 24%
of total, exceeding UC
2010 goal of 20%

Recycle 50% of our
waste and 75% by 2012



E12

Partnerships

- ✓ Maximizes existing subsidies
- ✓ Minimizes capital outlays
- ✓ Reduces exposure to future fossil-fuel price escalation
- ✓ Re-vectors the carbon intensity of inherently energy-intensive research and medical institutions

A Focused Approach to Sustainability Financing & Partnerships

UC San Diego has developed a leveraged financing plan with the private sector that attempts to achieve all of the goals and objectives at or below prevailing energy market prices



Next Steps

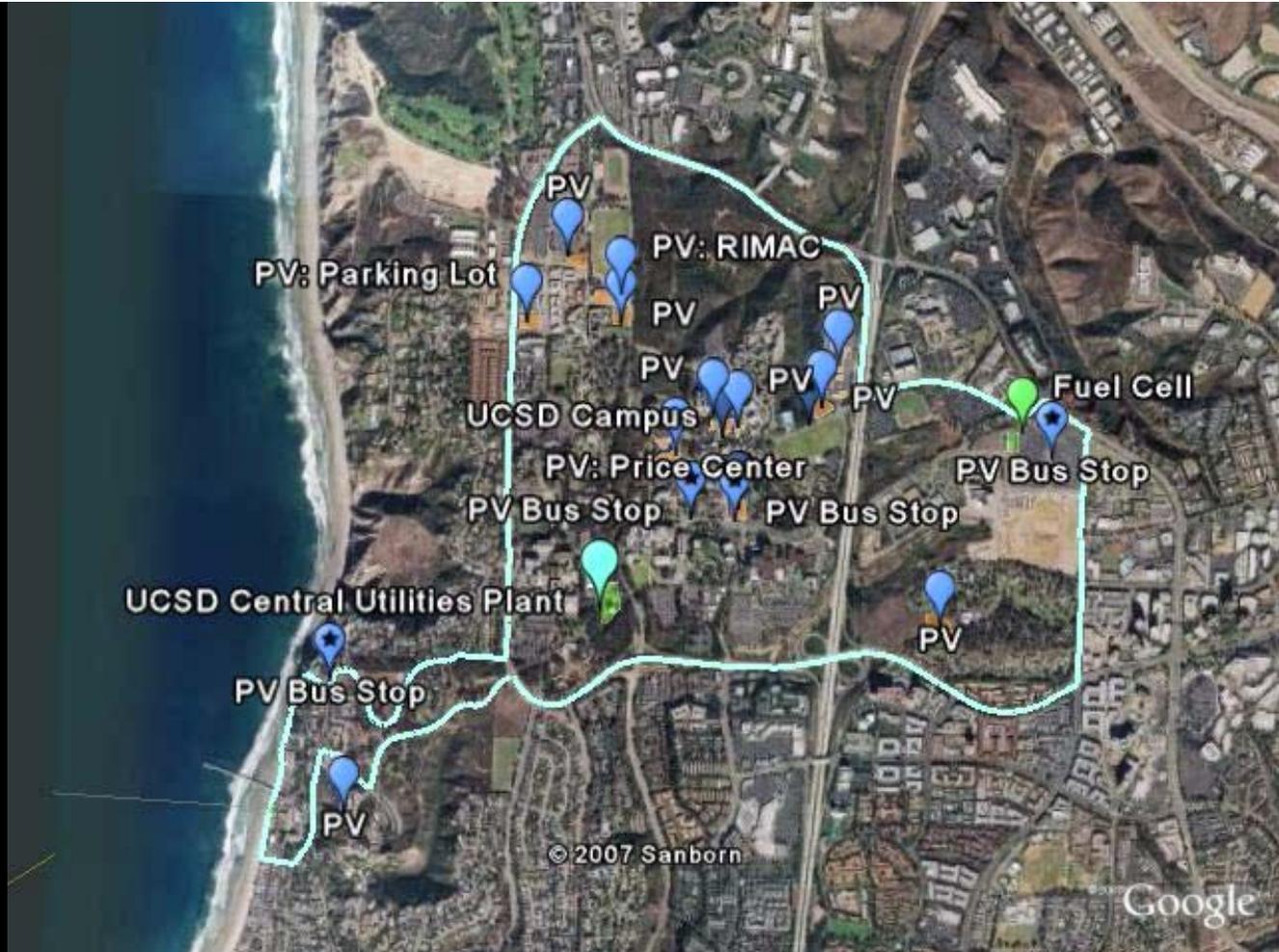
We are not constrained by opportunity, capability, or our demand.

2007

Thus far, we have harvested the low-hanging fruit represented by available incentives.

2008

We need to plan a 1:4 leveraging requirement to remain ahead of the "Green Tsunami."



Thank You

UC San Diego has the potential for becoming a global model of sustainability for universities and communities alike.

