

Creating a Living Laboratory

CLIMATE
SOLUTIONS for
UNIVERSITIES
AND LOCAL
COMMUNITIES

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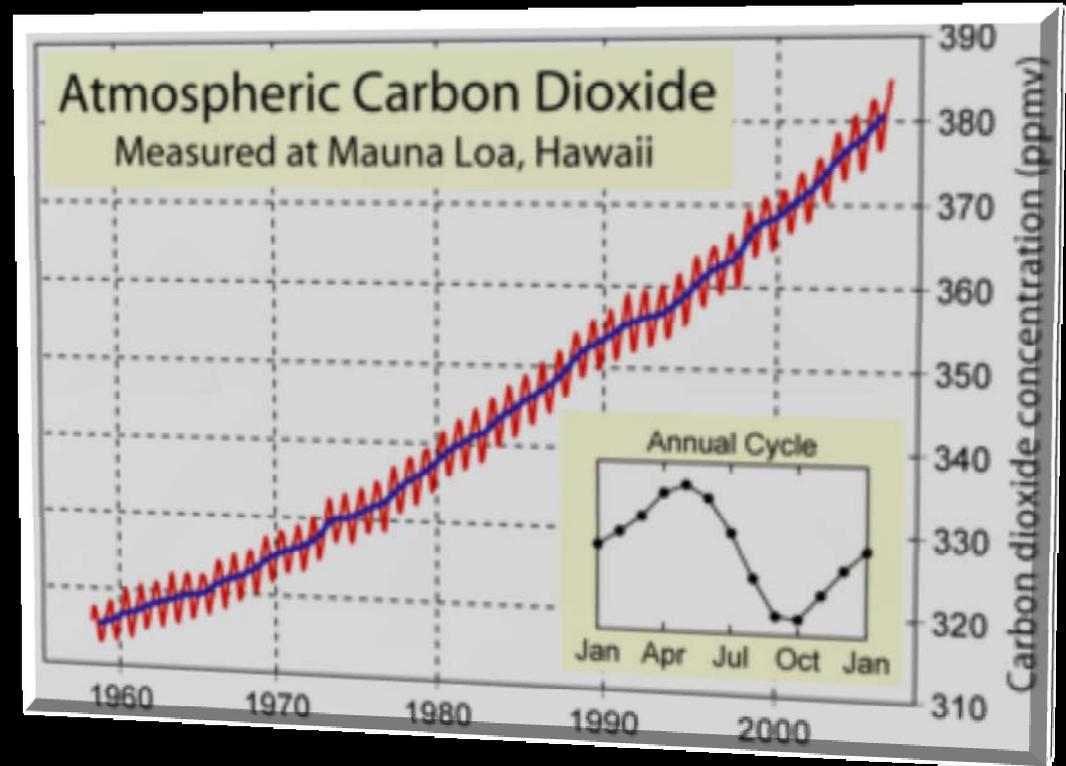


A Leader in Climate Solutions

UC San Diego and its Scripps Institution of Oceanography has long been internationally recognized for *pioneering research* in global climate change.

We feel it is imperative to have commensurate leadership in the sustainability of UC San Diego'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.

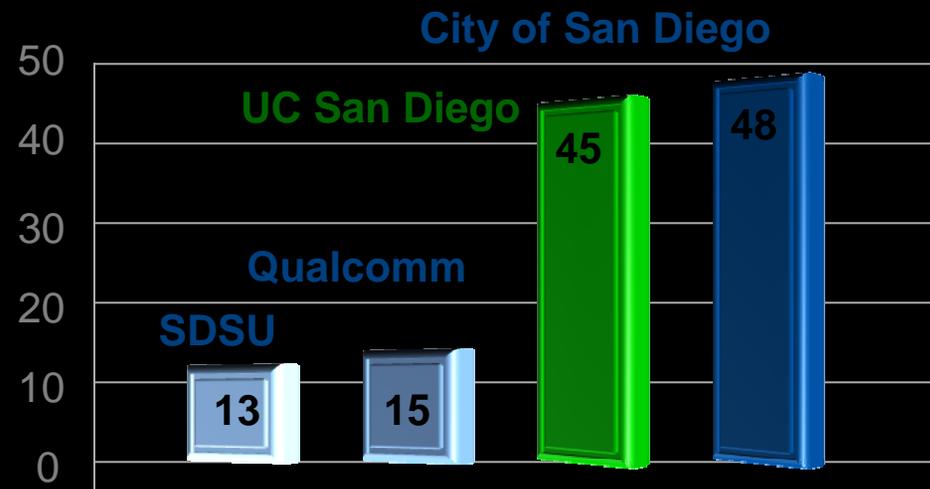


Campus Quick Facts

With a daily population of over 45,000, UC San Diego 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)



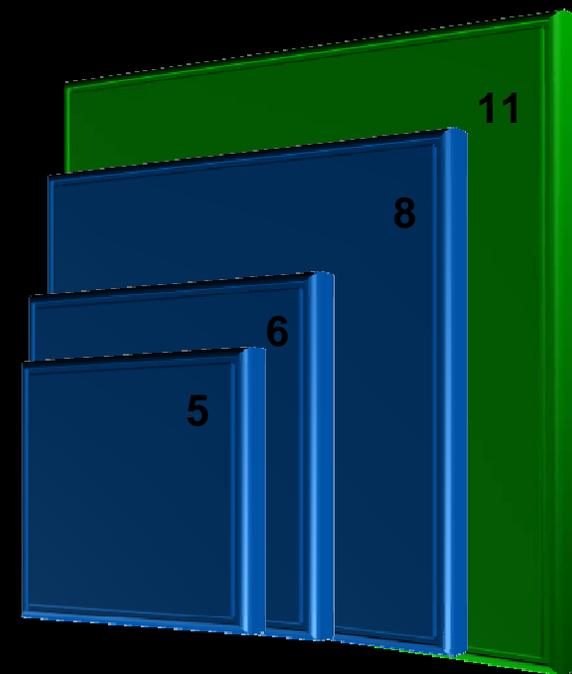
Campus Quick Facts

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)*

UC San Diego
City of San Diego
Qualcomm
SDSU



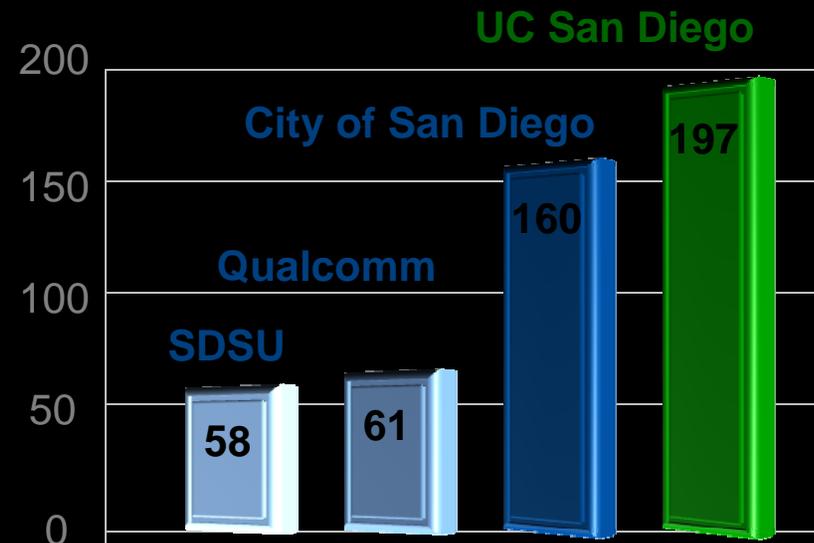
Campus Quick Facts

UC San Diego produces 197,000 tons of carbon dioxide each year

UC San Diego is a charter member of, and first university in the California Climate Action Registry

....and one of 7 university members of the Chicago Climate Exchange

Carbon Footprint metric tons/yr CO₂ (in thousands)



Campus Quick Facts

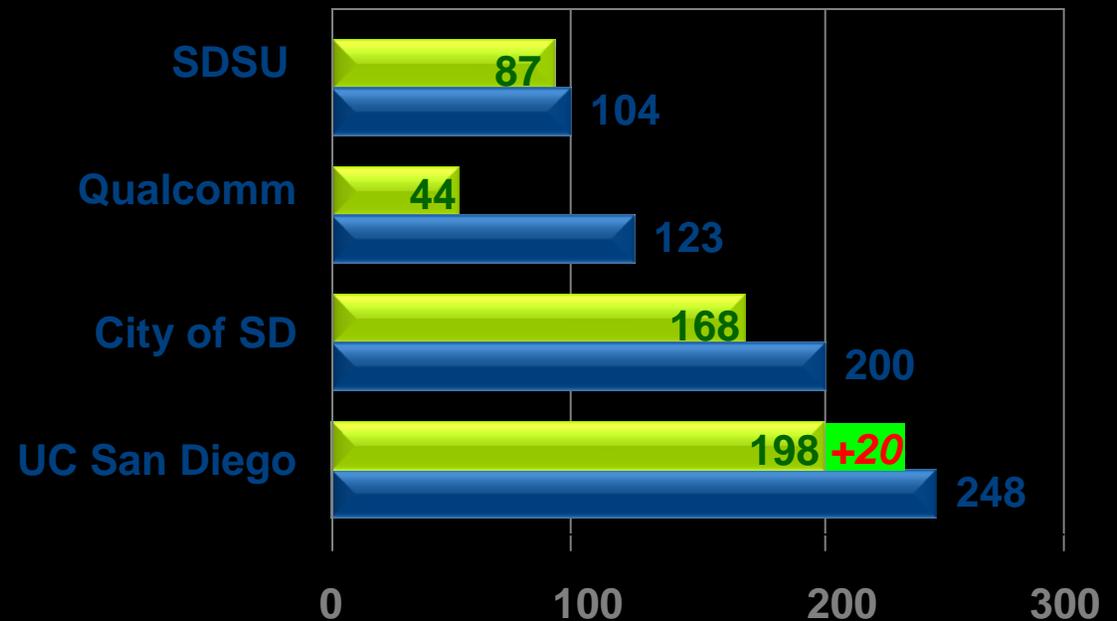
We self-generate 80% of our electricity demand using efficient CNG fueled cogeneration.

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

ENERGY (GWhr) PER YEAR

Generation ■ Consumption ■

Renewable Generation ■

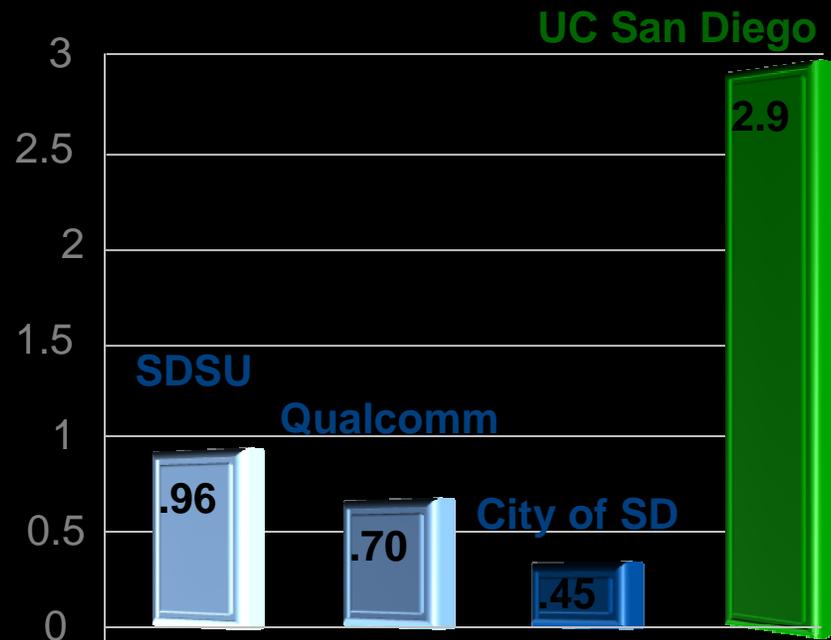


Campus Quick Facts

UC San Diego uses natural gas to fuel its power plant.

In order to reduce our dependence on natural gas, we are in the process of securing diverse sources of renewable energy

Annual Natural Gas Consumption (Million MMBtu)



Our Challenges

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

- ☑ Energy Intensive Research University
- ☑ \$1B of new buildings every 5 years
- ☑ Reduced State Operating Budget
- ☑ Restrictions from State and University



12 Key Elements of Strategy

Facilities &
Operations

E1

Transportation

E2

Building
Design

E3

Smart Grid
Infrastructure

E4

Recycling &
Conservation

E5

Advanced
Energy Storage

E6

Photovoltaic
**THINK
SOLAR
ENERGY**

E7

Methane &
Fuel Cells

E8

Water
Resources
and Wind
Energy

E9

Faculty
Leadership

E10

Strategic
Partnerships

E11

Student
Involvement

E12

E1

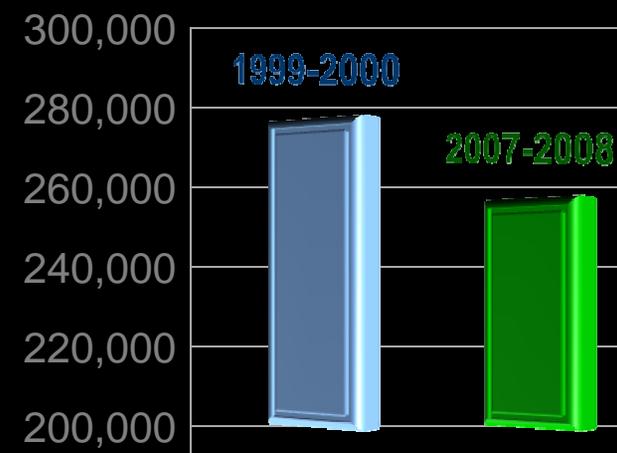
Retrofitting Campus Buildings

Continue to be a Leader in **Carbon Reduction and Energy Efficiency**

Completed \$60M 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



E2

Moving to Alternative Transportation

**Maximize Use of
Alternative Fuels
& Transportation**

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

- Increase number of PZEV / ZEV vehicles 20% by 2010
- Convert campus fleet to 50% non-carbon based fuel by 2010



**CNG Shuttles &
Light Duty Vehicles**



**34 Prius & 11 Escape
Hybrids**



E2

Moving to Alternative Transportation



Alternative Fuel Station

- Will provide CNG and hydrogen fuel
- Diesel to CNG / CNG hybrid fleet
- Capture waste heat from fuel cell for electrolysis & Hythane production



E3

Efficient Building Design

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

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

\$9M of state rebates will continue energy efficiency retrofits with a goal of 1 million sq ft of facilities by 2010

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



E4

Developing a Micro Smart Grid

Create a State-of-the-Art **Energy Infrastructure**

Calit2's Project GreenLight will investigate new ways of measuring energy efficiency of computers

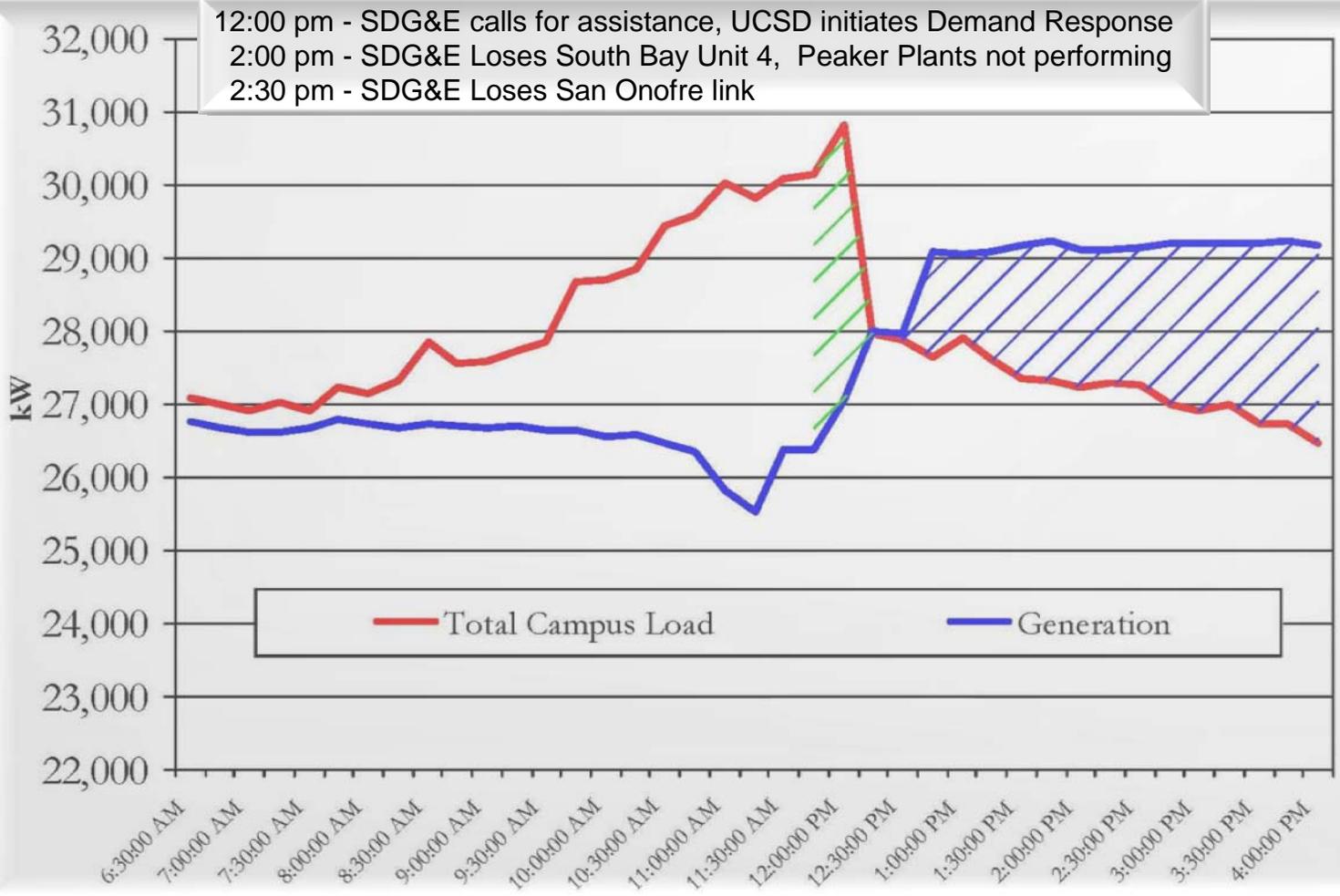
\$2M of State rebates will continue energy efficiency retrofits with a goal of 1 million sq ft of facilities by 2010

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



E4

The Smart Grid: 2007 Wild Fires



E4

Smart Grid: Climate Monitoring

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



E5

Conservation & Recycling

**Demonstrate
Best Practices
in Recycling**

**The campus will achieve
75% waste diversion by 2012.**

**Will complete conversion to
compostable utensils in
restaurants by Jan 2009**

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

**UC San Diego diverts 67% of its waste, or
13,000 tons each year.**



E6

Advanced Energy Storage

Energy Storage is the “enabler” for intermittent renewable energy

UCSD’s goal is to shift 20% of its load from off-peak to on-peak periods by 2011

A 3.8M gallon Thermal Energy Storage already shifts 14% of our load daily

A \$3.4M CPUC rebate will permit the installation of 12 MWh of Electricity Energy Storage of UCSD’s renewable energy production



E7

Moving to Solar Power

Become one of the
Leading University
Sites in the World
for **Photovoltaic
Energy (PV)**

We have used CSI
incentives to develop
1MW of PV energy



Image NASA



E8

Creating Fuel Cell Energy

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

Campus plans to install **2.8 megawatts** of methane powered Fuel Cells.

Methane transported to campus provides an economic, renewable energy resource with a net CO₂ reduction.



E9

Protecting Water Resources

UC San Diego is helping California solve the water dilemma

Scripps researchers predict that Lake Mead could be dry by 2021

Water use is reduced by:

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



Lake Mead

**UC San Diego
Reclaimed Water
System**

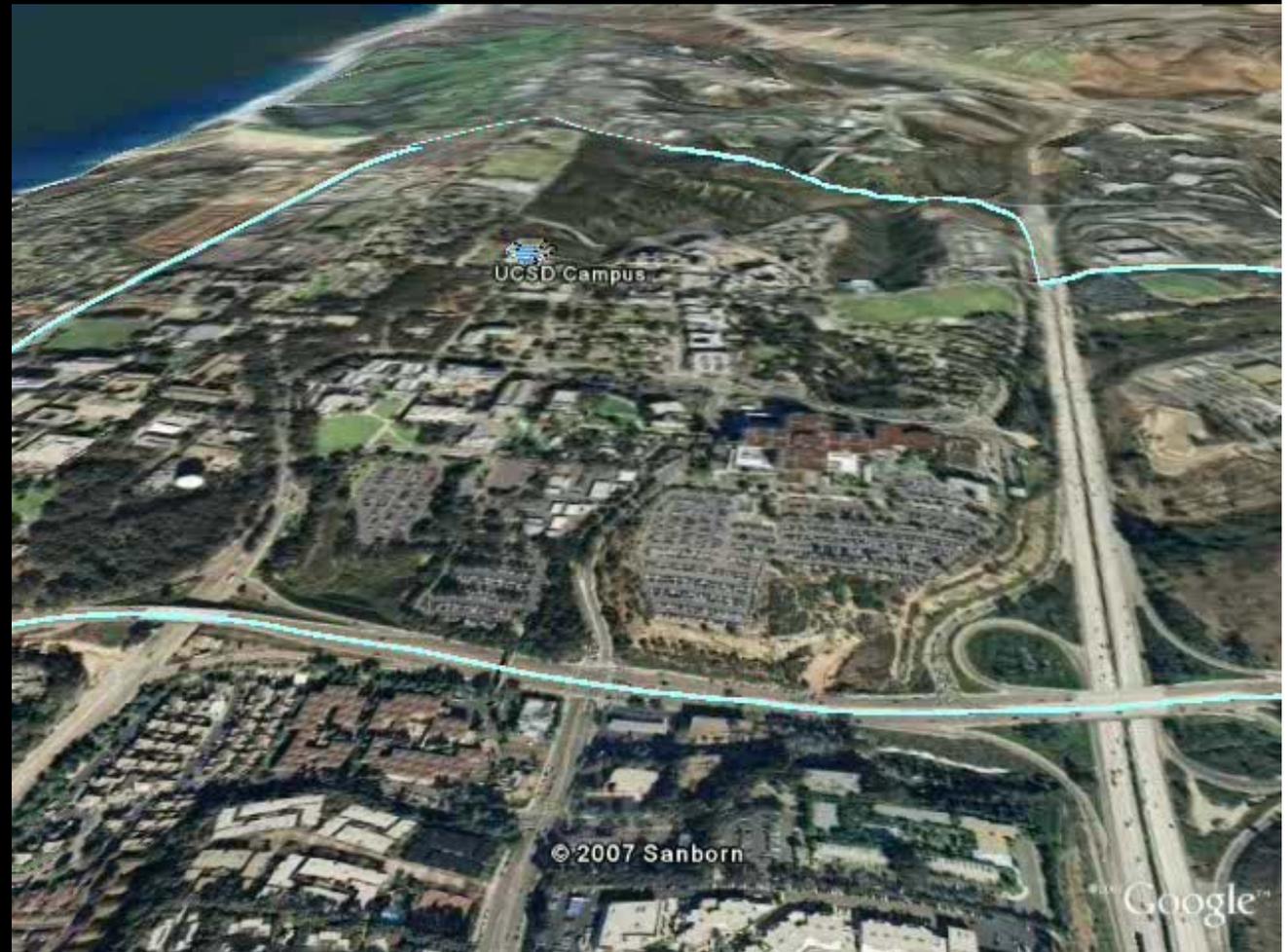
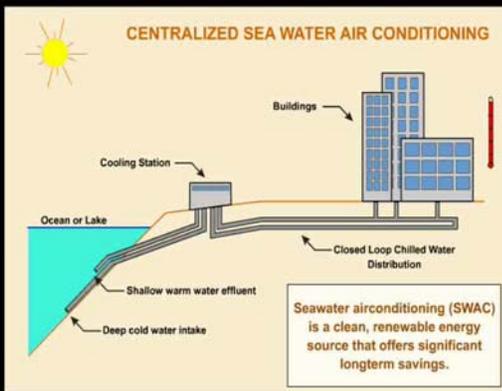


E9

Sea Water Cooling

Become a Global Demonstration Project for Sea Water Cooling

Seawater Cooling could save \$4M/yr in energy and 100M gallons of water per year.



E9

Renewable Wind Energy

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

Off-Peak
Wind
Generation



Throttle
Down
Power Plant



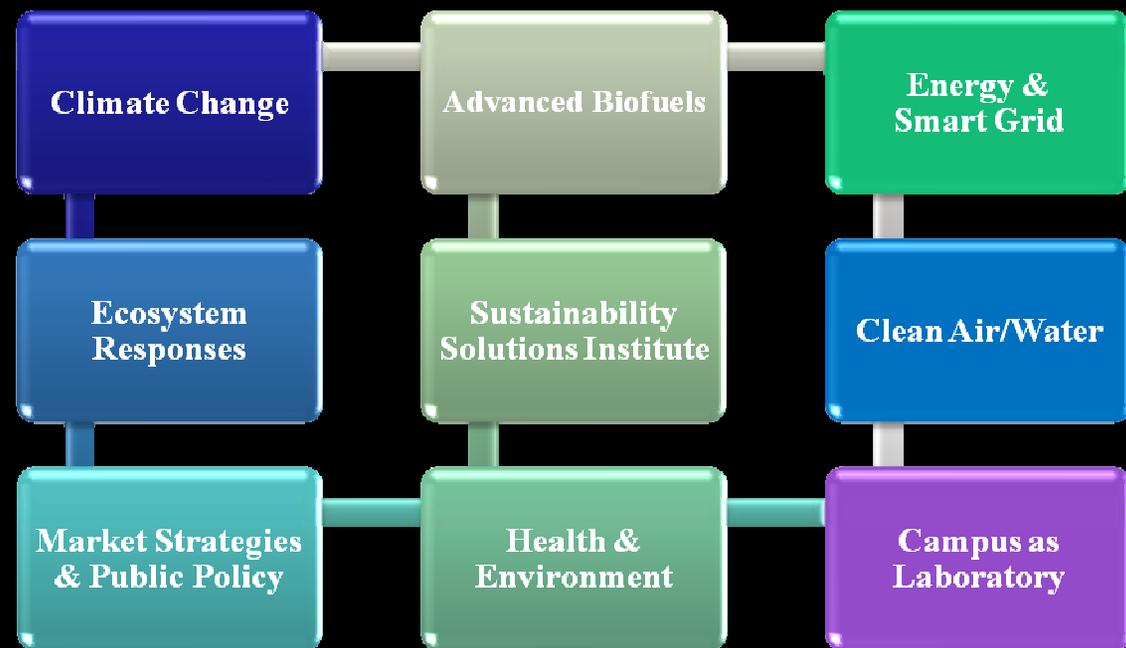
E10

Faculty Leadership

A Leading Sustainability Research Program with Focus on Basic Research, Applied Research, and Prototyping

Existing faculty experts are being augmented with new positions

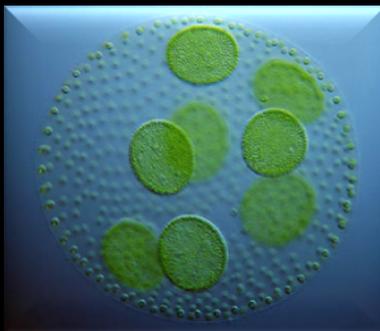
Providing an environment for multidisciplinary academic collaboration



E10

Focus on Research: Biofuels

Advanced Biofuel
Program: Algae



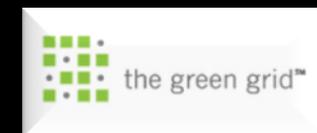
Micro-algae
High density
No food competition
Saltwater / wastewater



E11

Partnerships: We Can't Do It Alone

- ✓ Maximizes existing subsidies
- ✓ Minimizes capital outlays
- ✓ Reduces exposure to future fossil-fuel price escalation
- ✓ Leverages private sector partnerships



MONTREUX ENERGY

E12

Student Leadership

Create a Leading Sustainability Program with Focus on Student and Community Involvement

Involve students in photovoltaics, weather station network, biofuels

Provide incentives for multidisciplinary student collaboration

Thank You

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



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