SETTING THE STAGE

STEPHEN JACKSON
ASSOCIATE VICE CHANCELLOR, RESOURCE MANAGEMENT & PLANNING
WELCOME

• John Dilliott, Director, Utilities & Sustainability
• Garrett McGurk, Hydrology Engineer, Center for Western Weather and Water Extremes, Scripps Institution of Oceanography
• David Boggs, Landscape Construction & Irrigation Superintendent, Facilities Management
• Michelle Perez, Manager, Utilities & Sustainability
• Kimberly O’Connell, EH&S Environmental Affairs Division Manager
• Jen Bowser, Sustainability Engagement Manager, UC San Diego Sustainability
• Josue Canizales, UC San Diego Sustainability Green Programs Intern
• Leslie Ngo, UC San Diego Aquaholics Anonymous Intern
The UC San Diego community holds great respect for the land and the original people of the area where our campus is located. The university is built on the unceded territory of the Kumeyaay Nation. Today, the Kumeyaay people continue to maintain their political sovereignty and cultural traditions as vital members of the San Diego community. We acknowledge their tremendous contributions to our region and thank them for their stewardship.
BEFORE WE BEGIN

This webinar is being recorded.

Recordings and Q&A can be viewed on the Climate & Sustainability Town Halls webpage: https://sustain.ucsd.edu/about/town-halls.html

Strategic Energy Plan Update
QUESTIONS

• Were submitted during registration

• Can be submitted in the Zoom Q&A feature

We'll answer as many questions live as time allows.
UPDATE ON STRATEGIC ENERGY PLAN
GREEN HYDROGEN’S ROLE IN A CLEAN ENERGY FUTURE

Campus Energy Profile

- 78% complex space: Research, medical/clinical, supercomputing
- 22% non-complex space: Housing, classrooms, administrative

~65% of comfort heating and hot-water load can be served with electric heat recovery chilling technology, which represents ~40% of overall thermal load.

Green H2 can play a role.

Potential UC San Diego H2 Blending Pilot Project is key to regulatory approval in California with a potential emissions reduction equivalent to taking 1.5M cars off the road.
About Hydrogen Blending

Hydrogen 101

- **Simplest** and **most abundant** element in the universe
- **Rarely** found in its **pure form**
- **Chemical processes** are needed to extract hydrogen…
  - … from **fossil fuels**:  
    + 98%+ of the current production.
    + Releases CO₂ as a byproduct.
  - … from **water**: **Electrolysis**.
    + **Carbon-free** process if **renewable energy** is used
- **Does not release CO₂** when used as a Fuel.
Hydrogen Blending Pilots

- In 2019, the California Public Utility Commission (CPUC) mandated SDG&E and other gas utilities to define a Hydrogen Blending Standard.

- CPUC also engaged UC Riverside to conduct a study on the potential impacts of hydrogen blending in California’s natural gas system.

  - One of the key recommendations is that utilities should implement “real world” hydrogen blending pilots.

- In this context, SDG&E, SoCalGas, and Southwest Gas are proposing to conduct three hydrogen blending pilots.

  - Modeled after the successful UK HyDepl0y¹ project, demonstrating hydrogen blends of up to 20% in collaboration with a local university.

Notes:
¹ https://hydeploy.co.uk/

The pilots will provide key operational information to inform the creation of a safe hydrogen blending standard.
Safety

Safety is top priority. Efforts to be taken before, during and post-project include:

- Project equipment and design will meet all national and international safety and operational standards.
- Safety assessment will be conducted by an independent hydrogen safety consultant.
- Hydrogen safety training for relevant SDG&E and UC San Diego personnel.
- Testing protocols contemplate gradual increase in hydrogen blending percentages.
- Continuous monitoring of the project through a SCADA system.
- High frequency inspections and operational tests of all project equipment and building appliances.

Relevant considerations:
- Hydrogen is a well-known commodity that has been used for decades in many industrial applications.
- Successful international projects set strong precedent for safe hydrogen blending up to 20% (e.g., UK HyDeploy, Hawai‘i, Hong Kong, Singapore).
**H₂ Blending Project Development**

Project plans were developed on a wealth of data and lessons learned from research, demonstration and larger-scale projects worldwide.

- Implements recommendations set forth by UC Riverside on behalf of the CPUC to conduct “real world” demonstrations utilizing the actual natural gas infrastructure with 5-20% H₂ gas blends over extended periods.

- Modeled after the successful UK **HyDeploy** project, demonstrating **H₂ blends of up to 20% can be safely delivered to and used by customers without changes to the gas system or end use equipment**.

### Real world H₂ blending demonstrations occurring around the globe.

<table>
<thead>
<tr>
<th>Project</th>
<th>Country</th>
<th>Year</th>
<th>Blending Vol%</th>
<th>Trial/Project Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>HyDeploy</td>
<td>UK</td>
<td>2019</td>
<td>20</td>
<td>1500 residential</td>
</tr>
<tr>
<td>East Neuk Power</td>
<td>UK</td>
<td>2020</td>
<td>20</td>
<td>15 GWh energy annually</td>
</tr>
<tr>
<td>Aberdeen Vision</td>
<td>UK</td>
<td>2020</td>
<td>2-20</td>
<td>300 residential</td>
</tr>
<tr>
<td>HyNet Northwest</td>
<td>UK</td>
<td>2021</td>
<td>100</td>
<td>30 TWh energy annually</td>
</tr>
<tr>
<td>HyNTS Hydrogen Flow Loop</td>
<td>UK</td>
<td>2021</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>H2I</td>
<td>UK</td>
<td>2018</td>
<td>100</td>
<td>6.4 TWh energy annually</td>
</tr>
<tr>
<td>HY4Heat</td>
<td>UK</td>
<td>2018</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>HySpirit</td>
<td>UK</td>
<td>2019</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Zero 2050 South Wales</td>
<td>UK</td>
<td>2020</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Decarbonisation Pathway</td>
<td>UK</td>
<td>2020</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>GROUPE</td>
<td>France</td>
<td>2014</td>
<td>20</td>
<td>200 residential and 100 residential</td>
</tr>
<tr>
<td>THeGA</td>
<td>EU</td>
<td>2019</td>
<td>10-100</td>
<td>200 residential and 100 residential</td>
</tr>
<tr>
<td>WindGas Falkenberg</td>
<td>Germany</td>
<td>2013</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>WindGas Hamburg</td>
<td>Germany</td>
<td>2015</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>HyP SA</td>
<td>Australia</td>
<td>2021</td>
<td>5</td>
<td>700 residential</td>
</tr>
<tr>
<td>HyP Gladstone</td>
<td>Australia</td>
<td></td>
<td></td>
<td>500 residential and industrials</td>
</tr>
<tr>
<td>HyP Murry Valley</td>
<td>Australia</td>
<td>2021</td>
<td>10</td>
<td>40,000 residential</td>
</tr>
<tr>
<td>Jennessa West Sydney</td>
<td>Australia</td>
<td>2018</td>
<td>2</td>
<td>259 residential</td>
</tr>
<tr>
<td>Fort Saskatchewan</td>
<td>Canada</td>
<td>2020</td>
<td>5</td>
<td>2000 residential</td>
</tr>
<tr>
<td>Cummins-Enbridge</td>
<td>Canada</td>
<td>2018</td>
<td>2</td>
<td>3600 residential</td>
</tr>
</tbody>
</table>

H₂ is already included in natural gas mixes in some parts of the world. Local demonstration is required to evaluate California natural gas infrastructure.
ATMOSPHERIC RIVERS AND FORECAST INFORMED RESERVOIR OPERATIONS
Mission
Provide 21st Century water cycle science, technology, education, and outreach to support effective policies and practices that address the impacts of extreme weather and water events on the environment, people, and economy of Western North America.
BACKGROUND ON ATMOSPHERIC RIVERS
A lack of ARs can lead to drought
ATMOSPHERIC RIVER RECONNAISSANCE
Filling Gaps in Pacific Weather Observations

Ralph et al. 2019 BAMS
Zheng et al. 2021 BAMS
Stone et al. 2020 MWR
Reynolds et al. 2019 MWR
Lavers et al. 2018 GRL
Lavers et al. 2020 Wea Fore
Lavers et al. 2020 Nature Comms
Zhang and Ralph 2021 MWR
Prince et al. 2021 GRL
Haase et al. 2021 JGR
CW3E LAND-BASED OBSERVATIONS

Soil Moisture Station

Surface Meteorology Station

Weather Balloon Launch
Hypothetical estimate of extra water retained unless an atmospheric river storm is predicted to hit the watershed; requires reliable AR prediction at 5-day lead time.

Co-Chairs, Lake Mendocino FIRO: F. Martin Ralph, Jay Jasperse
FIRO Prototype Demonstrated

FIRO Planning Underway

Major deviation to be requested

**FIRO PROJECT LOCATIONS**

- Howard Hanson Dam – 106 TAF
  Green River, Seattle District USACE

- Oroville Dam – 3500 TAF
  Feather River, CA Dept. of Water Resources

- New Bullards Bar Dam – 996 TAF
  Yuba River, Yuba Water Agency

- Lake Mendocino Dam – 111 TAF
  East Fork Russian River, San Francisco District USACE

- Prado Dam – 170 TAF
  Santa Ana River, Los Angeles District USACE

Credit: UGGS.GOV
FIRO allowed additional water to be retained in Lake Mendocino based on forecasts where improvements were facilitated in part by AR Recon.

21 April 2021 – Gov. Newsom declares a drought emergency from Lake Mendocino, and notes that the reservoir holds 50% more water than it would have without FIRO.

~19% increase in water supply as of April 1

Co-Chairs, Lake Mendocino FIRO: F. Martin Ralph Jay Jasperse
RESEARCH AND OPERATIONS PARTNERSHIPS

Atmospheric River Reconnaissance
NCEP/NWS, ECMWF, NRL, NCAR, CU Boulder, Plymouth State Univ., SUNY Albany, NWS Western Region, NOAA AOC, Air Force, Northern Ill. Univ.

AR Forecasting (West-WRF & AR-AFS)
NCEP/NWS, San Diego Super Computing

Forecast Informed Reservoir Operations (FIRO)
USACE, USACE-ERDC, NOAA/NWS, Local Water Agencies, California Department of Water Resources, Environmental Agencies (RAOP is determined via the Steering Committees)

Advance Quantitative Precipitation Information (AQPI)
NOAA, Sonoma Water, CA Department of Water Resources, Colorado State Univ, local participating agencies (LPAC)

cw3e.ucsd.edu
mralph@ucsd.edu
F. Martin (Marty) Ralph
gmcgurk@ucsd.edu
Garrett McGurk
OVERVIEW OF WATER USE
A SMALL CITY – LA JOLLA CAMPUS

• Campus population over 50,000…and growing
• Research, clinical and residential spaces—two-to-three times water density of commercial office buildings
• 1,200 acres, over 15 million square feet of buildings
WATER GOALS AND PLANNING

WATER IS A PRECIOUS RESOURCE
San Diegans Conserve by

- washing only full loads of dishes and laundry
- using native plants
- utilizing rebates and resources
- reducing their use of disposable items
- supporting conservation legislation

The water we use every day in San Diego traveled a long way to get here. Let’s use it wisely.

WATER ACTION PLAN
University of California, San Diego
December 20, 2013
Updated December 2017
• Nearly all campus irrigation and building connections are metered.

• Real-time usage data is sent to a central interface
  - Register leaks, allowing UC San Diego Meter Shop to report issues
  - Track usage that can be compared to historic and baseline water use
  - Allow UC San Diego to target high-use areas for efficiency projects
TRACKING OVERALL WATER CONSUMPTION

- Potable Total: 74%
- Recycled: 26%
TRACKING POTABLE WATER CONSUMPTION

The bar chart and pie chart show the potable water usage and campus square footage over fiscal years 10 to 22. The pie chart breaks down the water usage into categories: Housing 24%, Industrial 21%, Irrigation 12%, Lab 22%, Thornton 3%, Office 5%, Restaurant 5%, Clinic 7%, Gym 1%. The bar chart indicates a steady increase in water usage over time, with a sharp rise in the last fiscal year.
TRACKING RECYCLED WATER CONSUMPTION

- Industrial: 73%
- Irrigation: 27%
DESIGN STANDARDS

LEED – Leadership in Energy and Environmental Design

• Awards points for reducing water use with drought-tolerant plants

MWELO – Model Water Efficiency Landscape Ordinance (California)

• Sets water-use limitations achieved by using drought-tolerant plants and efficient irrigation
• Allows some accommodations for turf use in recreational areas
LOW-INPUT LANDSCAPES

Climate appropriate plants – Mediterranean climate

Designed for:

- Aesthetics
- Recreation
- Relaxation
- Physical and mental health (more on that later!)
RECYCLED WATER

• 45% of total landscape water usage — Anticipated to exceed potable irrigation use within the next year
• Includes:
  o Athletic fields
  o La Jolla Medical Center
  o New and renovated landscapes
• Areas irrigated by recycled water are not subject to drought restrictions but have a separate set of regulations.
RECYCLED WATER VS. POTABLE WATER IRRIGATION MAP
RECYCLED WATER EXPANSION

Redevelopment projects:

• Theater District Living and Learning Neighborhood
• Pepper Canyon West
• Triton Center
• Ridge Walk

Retrofit projects:

• Geisel Library
• School Of Medicine

Implementation and city inspections require building water shut off. No city infrastructure at Scripps.
ARTIFICIAL TURF
New CA drought restrictions:

- Campus has implemented most of the restrictions previously.
- City of San Diego captures most of these restrictions.
- Restrictions include no irrigation of "non-functional" turf.
- UCSD has been removing turf areas that are considered "non-functional" for several years and is evaluating additional areas.
EFFICIENT IRRIGATION TECHNOLOGY

- Central Control System
  - Weather-based irrigation
  - Flow monitoring
  - Leak detection and elimination
- Low-volume rotary nozzles
- Drip irrigation
Landscape Services Mission Statement:

To maintain an aesthetically pleasing campus landscape conducive to learning and working.

**Studies have shown green spaces lead to:**

- Improved physical fitness
- Reduction in depression
- Social interaction
- Stress reduction
- Improved memory, attention and creativity
- Reduced mental fatigue
Experienced team of irrigation professionals manages:

- 300 controllers
- 6,000 valves
- Over 100,000 sprinklers
- Miles of pipe and drip lines
- Over 1,200 acres

Numerous industry certifications:

- QWEL
- Rain Bird Factory Trained
WATER QUALITY AND PROTECTION
RECYCLED WATER IN PLANT COOLING TOWERS
Air-handling unit condensate collection and reuse

Plumbing retrofits for research buildings to collect water for reuse:

- Air-handling unit condensate
- Reverse-osmosis treatment systems reject water
- Water softener reject water

<table>
<thead>
<tr>
<th>Year</th>
<th>Water Collected for Reuse from 4 Buildings</th>
</tr>
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<tbody>
<tr>
<td>2019</td>
<td>1,842,606 gallons</td>
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<tr>
<td>2020</td>
<td>1,721,148 gallons</td>
</tr>
<tr>
<td>2021</td>
<td>2,704,561 gallons</td>
</tr>
<tr>
<td>2022</td>
<td>2,252,976 gallons</td>
</tr>
</tbody>
</table>
The Ridge Walk Rain Garden is designed to conserve water resources, improve water quality, attract wildlife, and promote watersheds stewardship. The Ridge Walk Rain Garden features low-impact development (LID) practices that work with nature to manage stormwater by incorporating landscaping techniques to retain and slow runoff from adjacent sites. This helps improve water quality and runoff to the ocean. The eco-friendly landscaping conserves water by using native and drought-resistant plants.
RIDGE WALK RAIN GARDEN: BEFORE
RIDGE WALK RAIN GARDEN: AFTER
RIDGE WALK RAIN GARDEN: BEFORE
RIDGE WALK RAIN GARDEN: AFTER
The campus replaced an asphalt road used for parking and a turf area with a stormwater treatment detention basin and drought-tolerant landscaping.
GROVE SITE BEFORE AND AFTER
The Historic Grove was originally planted as a lumber source. Today it's a campus habitat rich with biodiversity and rustic character.

Soil and Habitat
The soil in the rain garden filters pollutants out of the stormwater runoff, thereby improving the water quality of runoff and providing essential nutrients to support plant growth. The resilient landscaping supports water conservation and encourages a healthy ecosystem.

Plants and Water Conservation
The turf in the garden has been replaced with a variety of hardy, drought tolerant and native plants that require significantly less water. Unlike turf, the plants in the garden require little maintenance and no fertilizers or pesticides. These plants assist with the removal of pollutants in stormwater runoff.
SCHOLARS LANE SITE BEFORE AND AFTER
SCHOLARS LANE SITE AFTER
WATER CONSERVATION

JOSUE CANIZALES
GREEN PROGRAMS INTERN

LESLIE NGO
AQUAHOLICS ANONYMOUS CHAIR
DID YOU KNOW?

Bathroom water use accounts for up to 70% of indoor residential water consumption.
DID YOU KNOW?

Flushing the toilet multiple times a day uses **more water** than showering **OR** washing your clothes.
DID YOU KNOW?

Older toilet models can use up to 6 gallons per flush.

Replace your toilet with a low-flow model, or consider purchasing a Toilet Tank Bank to displace the water or DIY it with a plastic water bottle filled with water.
WHAT YOU CAN DO

Taking a **six-minute shower seven days a week** uses roughly **4,500 gallons** of water per year.

A **five-minute shower** reduces annual water use up to approximately **3,800 gallons**, **saving up to about 750 gallons**.
WHAT YOU CAN DO

You can also reduce your water consumption by:

- turning off the tap when brushing teeth and when lathering your hands and body
- collecting cold water as the faucet or shower heats up to water plants
Dishwashers manufactured after May 2013 cannot exceed five gallons of water use per cycle as regulated by the Department of Energy.

Handwashing dishes could use up to 27 gallons of water.
WHAT YOU CAN DO

Save water when dishwashing by:

- scraping off food instead of pre-rinsing
- running the dishwasher at full capacity
- using the two-basin method when hand washing dishes
- using the normal cycle setting instead of using the heavy cycle setting
WHAT YOU CAN DO

Report water leaks to
Facilities Management Customer Relations
(858) 534-2930 or email wsc@ucsd.edu.
WATER CONSERVATION EDUCATION AND OUTREACH

AQUAHOLICS ANONYMOUS

We encourage water conservation through education and outreach and are resource for networking and collaboration between different areas of campus that are working on water conservation.

GET INVOLVED

AQUAHOLICS Anonymous

conserve water, sustain life at UCSD

Take the Pledge! Help us save water!

UC San Diego is one of the largest water users in San Diego. With over 80 percent of San Diego County’s water imported, you can help conserve our precious resource by making every drop count.

Please indicate which of the following activities you will add to your daily routine to conserve water:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Weekly Water Savings</th>
<th>Pledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soak pots and pans instead of having the water run while scraping</td>
<td>2 gal/min</td>
<td></td>
</tr>
</tbody>
</table>
NEXT STEPS:
YOUR CHANCE TO GET INVOLVED

JEN BOWSER
SUSTAINABILITY ENGAGEMENT MANAGER
Feedback

• We aim to get representation from our diverse campus community.

• You can express your comments, ideas and questions via survey that we will send after the town hall.

Future Town Halls Covering Various Sustainability Topics
UC San Diego