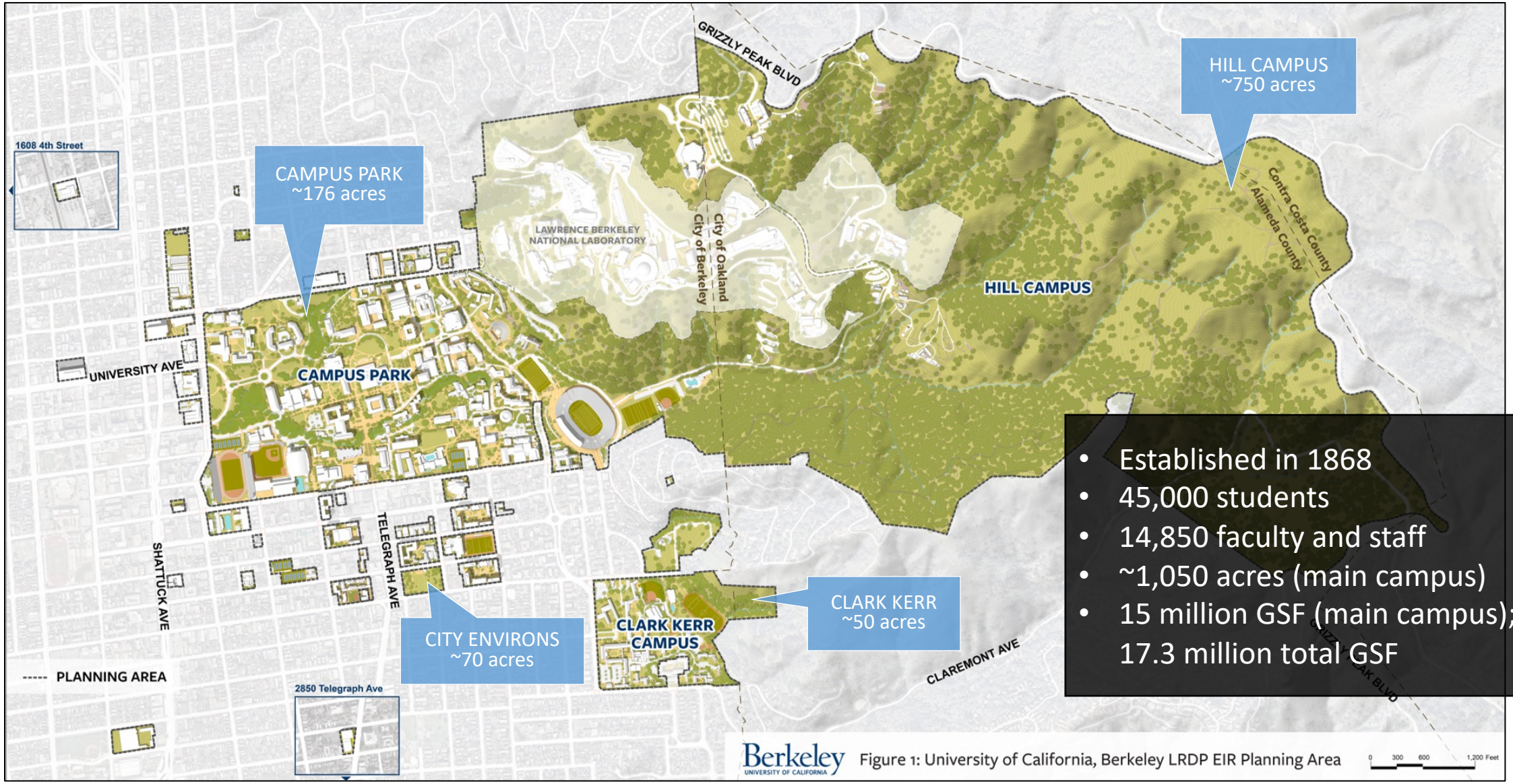
Berkeley
Clean Energy Campus

Building the Decarbonized Energy System for the Future

Fall 2022

http://cleanenergycampus.berkeley.edu

UC Berkeley Campus



- Established in 1868
- 45,000 students
- 14,850 faculty and staff
- ~1,050 acres (main campus)
- 15 million GSF (main campus); 17.3 million total GSF

Berkeley

Clean Energy Campus. Why Now?

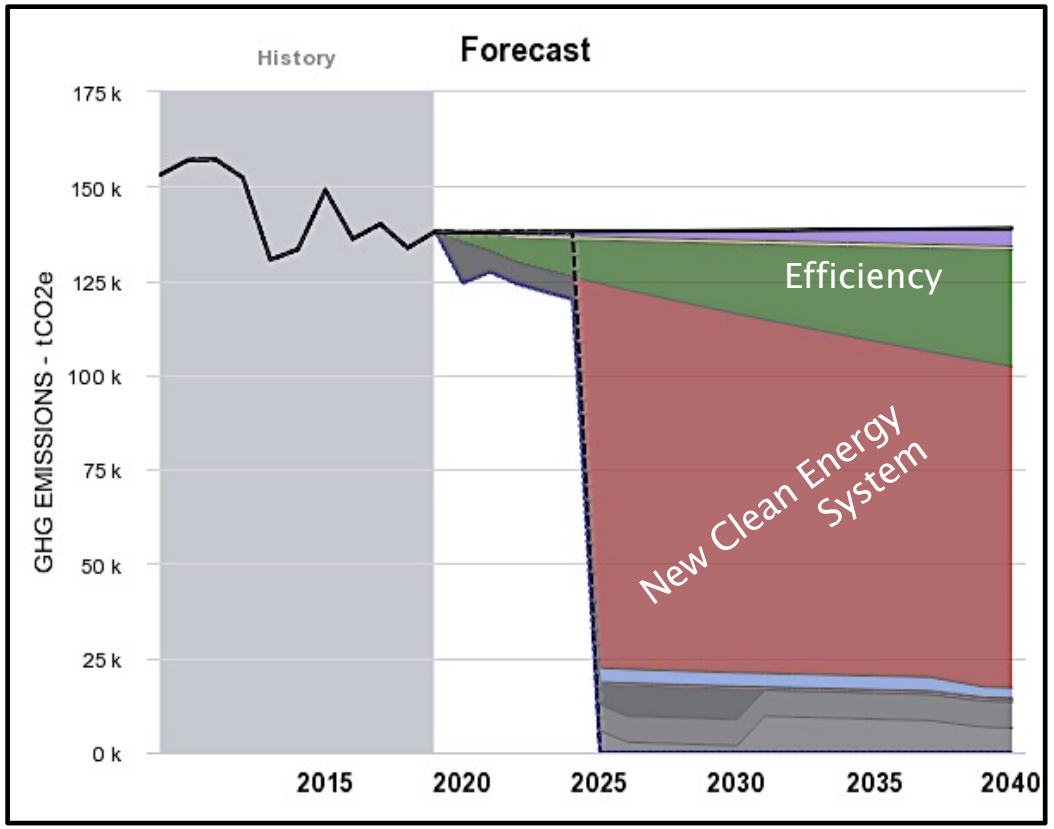
Berkeley is aiming for a clean electrified campus energy system

- 15+ years of campus climate action
- New system can be a replicable & scalable
- Leverages Berkeley's brain-trust & provides a living lab
- Aligns with State and Federal energy and carbon goals

Existing energy system reaching end of useful life

- Natural gas cogeneration plant produces 90% of the campus energy
- End of life for existing system is in 5 to 10 years, and significant investment is required
- Uneven backup capabilities in different research buildings and lack of advanced controls

Berkeley Carbon Reduction Target:



Berkeley

Thermal electrification: provide heating and cooling to the main campus with a new central plant

12+ systems studied including a BAU – the thermal heating and cooling option selected to move forward:

New Central Plant. Reduces main campus building energy use to zero carbon emissions.

Replaces cogeneration plant with a central electric heat pump plant supplying hot and chilled water for heating and cooling. The building connections to plant facility can be phased in. The thermal plant would be powered through utility and on-site solar with 100% clean electricity.

Energy resiliency still under study and to be provided through on-site solar, battery, fuel cells and/or generator farm. Reconfigured cogeneration facility to be assessed as short term resiliency option. Gas use to be fully phased out as more on site renewables are added for resilience and the plant is fully connected to campus buildings.

Plant Description- Options to Develop	Phase	Heating layout	Heating distribution	Heating generation	Cooling	Electricity
New central electric heat recovery chillers and heat pump heating	In full operation All buildings connected	■	💧	♻	■	⚡
A Phasing Scenario Example	Phase 1, 60% of buildings connected to plant and some resiliency options in place	■	💧	♻	■	⚡
		■	♨	♨	▒	♨

Layout & Heat/ Cooling distribution

Central ■ ■

Building ▒

Heat (cooling) Generation

Water 💧

Steam ♨

Electricity

PG&E + Solar ⚡

Cogen ♨

Berkeley

Clean Energy Campus
Energy, Carbon & Resiliency Goals and Objectives

Develop an efficient, electrified campus heating and cooling system and an 85% reduction in campus carbon emissions by end of 2030.

Achieve zero carbon building energy use and manage the campus as a fully electrified and renewable energy microgrid by 2035 or sooner.

Leadership in microgrids - Model a large-scale public-sector renewable energy microgrid in an urban setting capable of integrating advanced efficiency controls and novel technologies like geothermal, large-scale solar and storage, and green hydrogen systems.

Resiliency and independence – Provide the campus with clean onsite generated renewable energy and utility-distributed clean electricity suitable to support growth, peak energy demand, emergency shutdowns and outages.

Contributory benefits– Install a new underground energy distribution network that will be a generational opportunity for campus-wide renovation of walkways and landscape and inclusion of non-potable water piping for a new onsite water reuse plant. Site thermal plant and storage tanks to adapt and revitalize a central campus location.

Berkeley

Clean Energy Campus
Resiliency with renewable technologies

Moving from a natural gas & potable water microgrid system to a renewable energy & water microgrid is key to **operational resiliency**

On-site for clean energy & storage for resiliency:

- Solar photovoltaics + Battery storage
- Geothermal heat exchange for efficiency
- Advanced Utility + Building Controls
- Fuel cells, Green Hydrogen and More

Recycled water:

- New non-potable water source for the new energy system cooling towers is under study.

Berkeley

Clean Energy Campus
People, Learning & Research Opportunities

A catalytic project for people:

Retain full-time jobs, generate hundreds of regional construction jobs and stimulate tens of millions of dollars into the California economy.

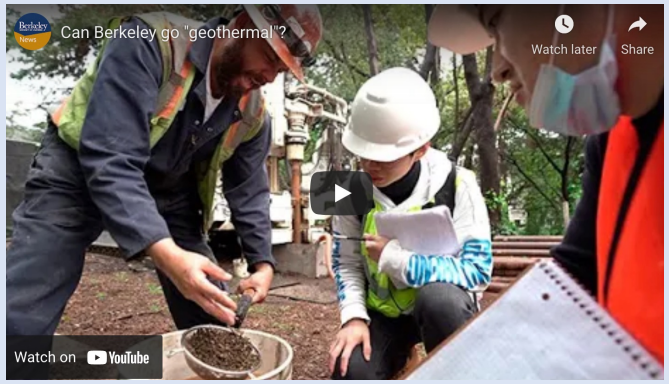
Improve public health by removing a gas powered plant and a source of local air pollution.

Enhance campus as a community emergency resiliency center.

Engagement – Involve many stakeholders to ensure transparency and accountability throughout project development and on-going operations.

Learning – Teach with concrete examples and train future climate solution engineers, social science, business and policy leaders.

Research – Activate and integrate UC Berkeley's brain-trust in living labs and deploy lessons learned to the public.



March 30, 2022: UC Berkeley researcher drills 400-foot borehole to explore geothermal heating and the viability of using a geothermal heat pump system to help heat and cool campus buildings more efficiently.