

BORA



Energy Trust of Oregon

Allies for Efficiency

PCC Opportunity Center @ 42nd Avenue

August 22, 2023

Energy Trust of Oregon | Allies for Efficiency Webinar + Virtual Tour

Portland Community College Opportunity Center @ 42nd Avenue

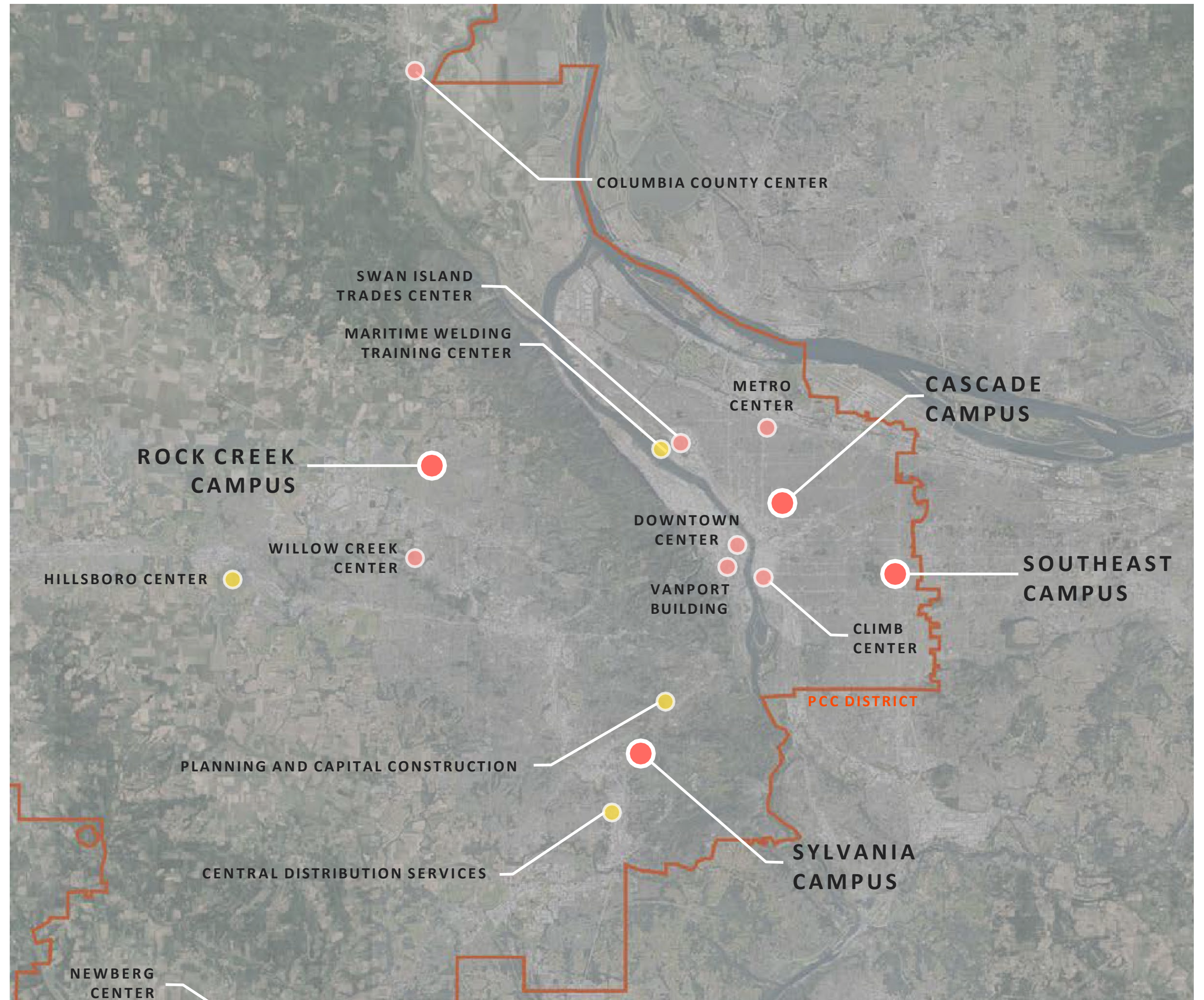
Moderated by Elin Shepard Outreach Manager, Energy Trust New Buildings

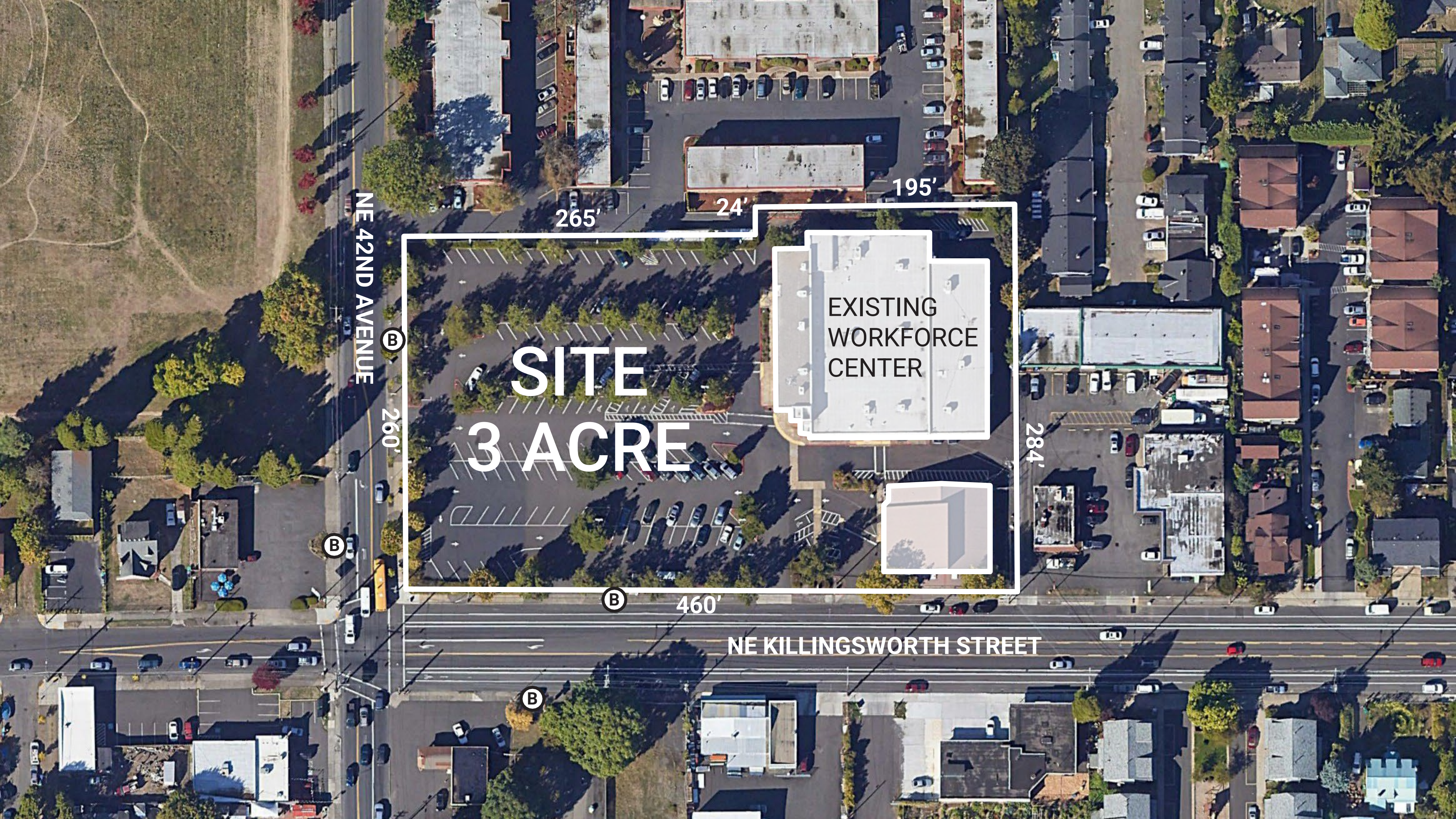
Panelist: **Rebecca Ocken** Director of Planning and Capital Construction, Portland Community College | **Jeanie Lai** Principal, Bora Architecture and Interiors | **Katrina Shum Miller** Principal, Lensa Consulting | **Andrew Craig** Principal/Owner, Arris Consulting | **Eric McDaniel** Principal, SORA Design Group | **Jared Bazar** Director of Engineering, Cherry City Electric, Energy Trust Solar Trade Ally





- Largest higher-ed institution in Oregon
- 4 campuses and multiple centers
- 60,000 full and part-time students
- Open Admission Policy
- Equitable Student Success





NE 42ND AVENUE

(B)

260'

(B)

(B)

460'

(B)

NE KILLINGSWORTH STREET

SITE
3 ACRE

EXISTING
WORKFORCE
CENTER

265'

24'

195'

284'

EXISTING METRO WORKFORCE TRAINING CENTER

Public assistance for low-income families to achieve economic mobility.
8 out of 10 clients are women. All clients have children and/ or dependents.
Staff contracts are based on program funding.



HUB OF OPPORTUNITY



PCC



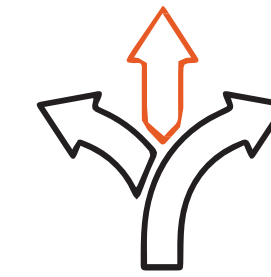
DHS



Partnerships



Career Coaching
Skills + On-Job Training Small
Business Assistance
Employment Marketplace /Job Fairs



Prepare Students
for Careers with
Economic Mobility

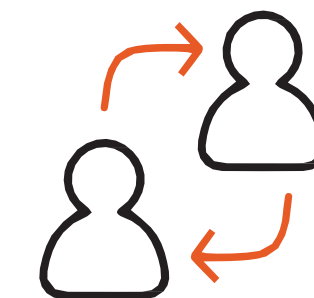
Education + Community Classes

Community + Partner Services



Collaboration
for Equitable
Student Success

Career Exploration Life Skills
Computer Classes ESL
Classes
GED Classes Job
Search
Internship Search



Connecting
Employers
+ Students

STUDENT BASIC NEEDS

A 2021 survey of PCC students found that:

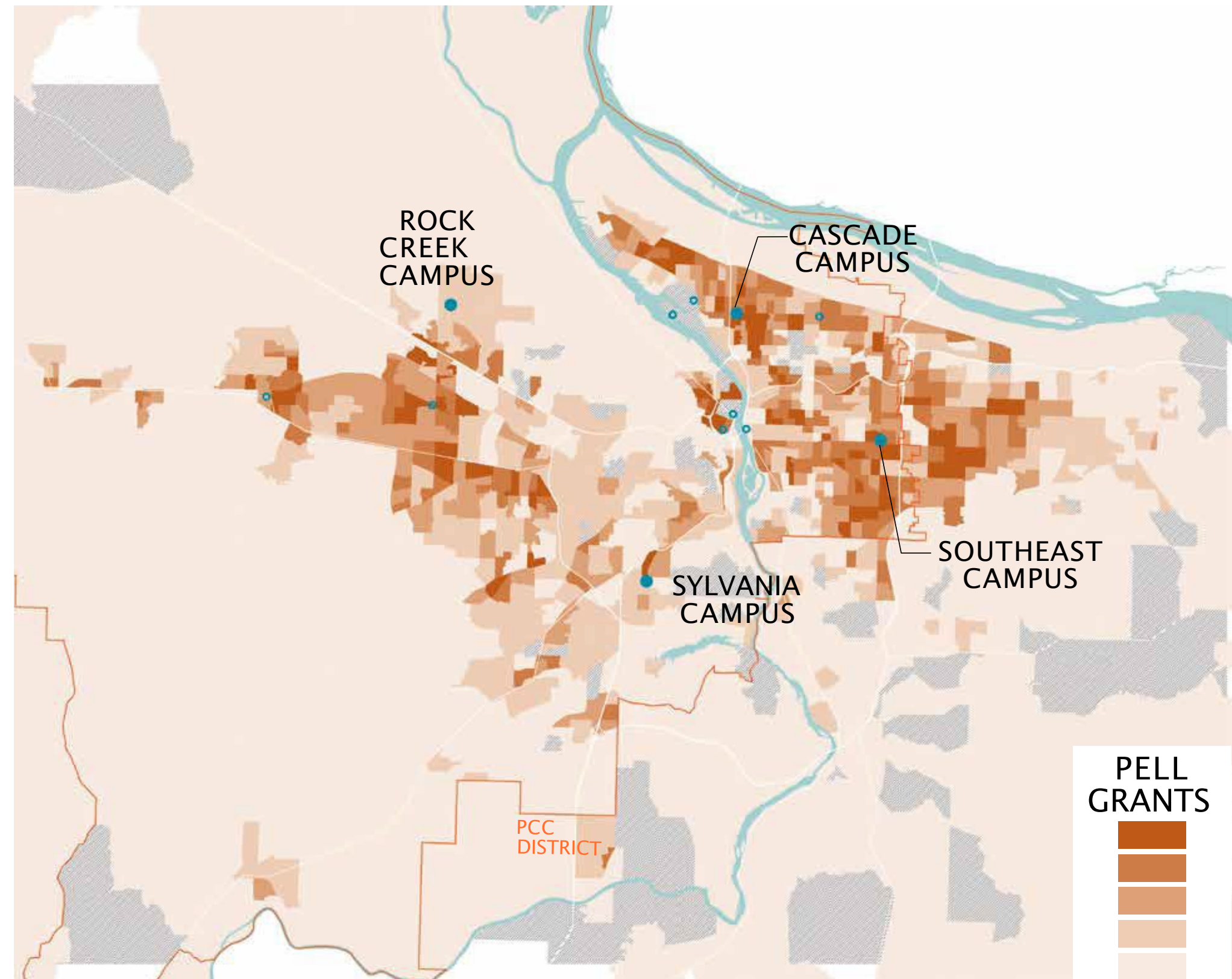
64% experienced some kind of basic needs insecurity

41% experienced food insecurity

56% experienced housing insecurity

19% experienced homelessness

5% self-identified as homeless



CULLY

Diversity
Active Community
Partnerships



CRITICAL RACE THEORY

Aim to examine how a system of domination based on race is normalized, maintained, and reproduced in day-to-day practices, institutions, systems, structures, and culture.

– Dr. Amara H Perez

**“Change how we work to
change what we build.”**

- Portland Community College, Metro Center RFP

DESIGN FRAMEWORK

DESIGN FOR EQUITY



Critical Race Spatial Theory



Design Justice



Trauma Informed Design

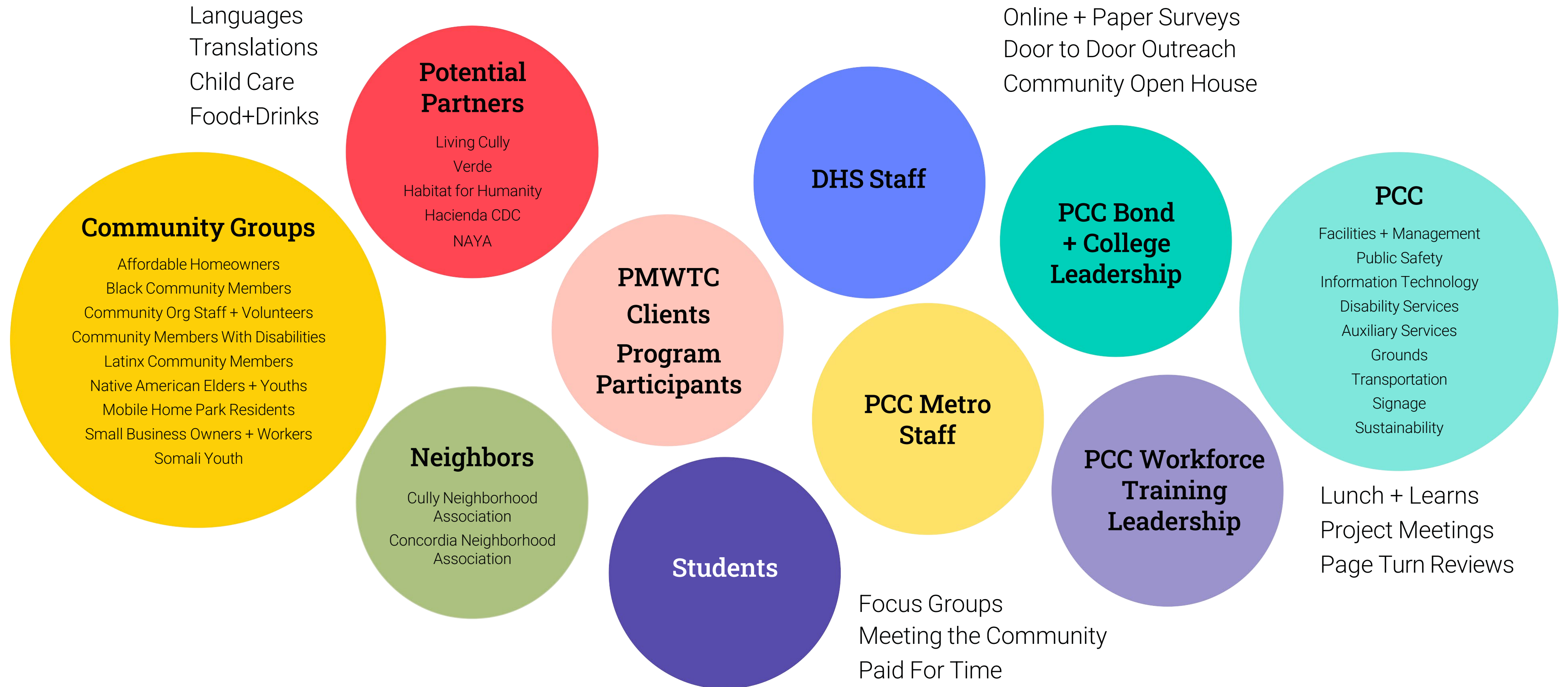
Racial equity in planning and capital projects advance equity and inclusion in education. -

Dr. Amara H Perez

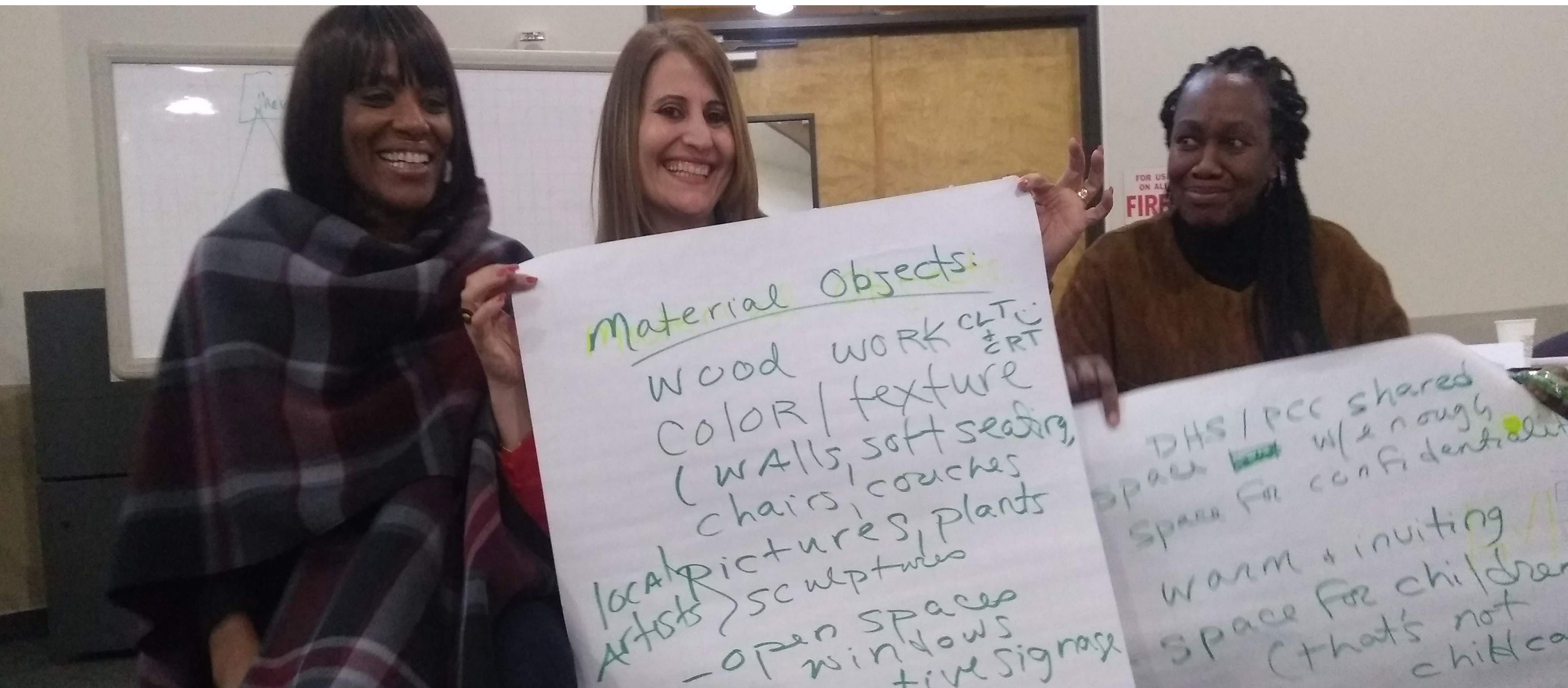


Design Team Critical Race Theory and Design Justice Training

INCLUSIVE APPROACH TO STAKEHOLDER MAPPING



SOCIO-SPATIAL INQUIRY



Material Objects:

Wood
Color / texture
Walls, soft seating,
chairs, couches
local pictures, plants
Artists
sculptures
open spaces
windows
diverse signage

WORK CLT:
CRT

DHS / PCC shared
space
w/ enough
space for confidential
warm & inviting
space for children
that's not
child co

AFFINITY GROUPS



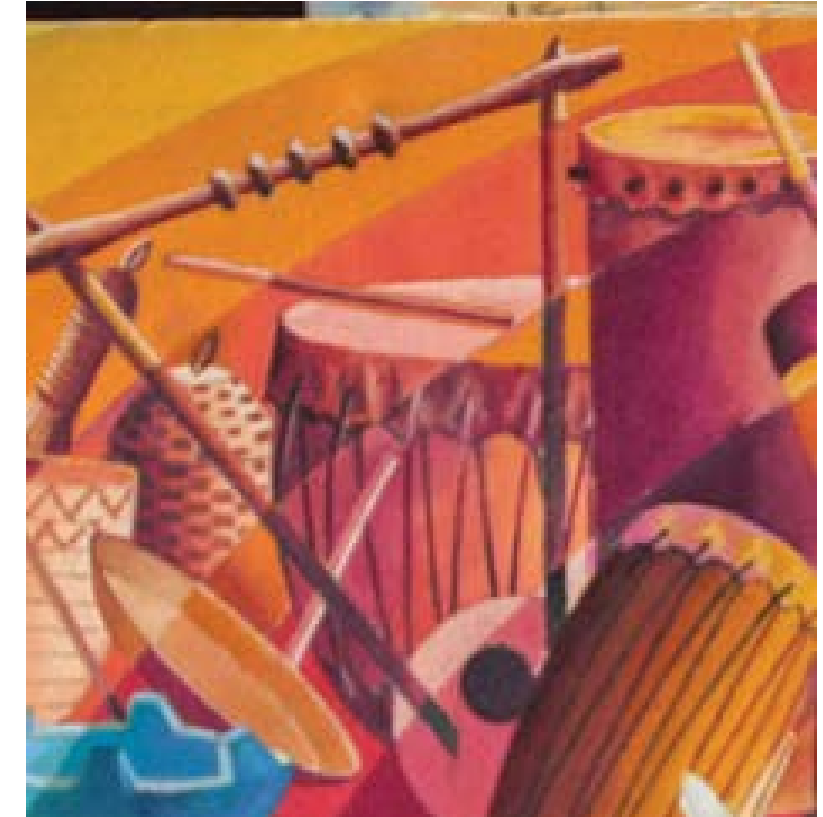
Black community members



Community-based organizations staff and volunteers



Habitat for Humanity homeowners



Latinx and Somali community members



NAYA elders and youth



People with disabilities



Residents of mobile home parks



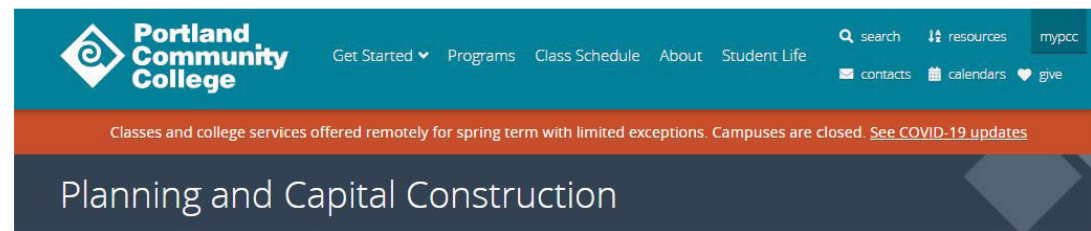
Small-business owners

PCC Opportunity Center Engagement



INFORMING COMMUNITIES

30,000 Newspapers Delivered!



PCC / Planning and Capital Construction / Current projects /

Portland Metropolitan Workforce Training Center – Capital Improvements



Staff joined community members to discuss the center.

Current projects
District-wide projects
Cascade Campus
Vanport Building
OMIC Training Center
PMWTC
Rock Creek Campus
Southeast Campus

By Spring of 2020 the design team completed the programmatic architectural meetings with the users of the building to capture their needs for space. In addition, the initial site determination was reached including location for all the elements of the site (building, housing, parking and open space). By the end of 2020, the PMWTC redevelopment finalized its design development phase. In 2021, the project is moving towards construction documentation.

- Overview
- Updates
- Timeline
- Outreach
- FAQs

+Owner Architect Contractor meetings

- Summer 2020 update – available in four languages:
 - [English \[PDF\]](#)
 - [Spanish \[PDF\]](#)
 - [Vietnamese \[PDF\]](#)
 - [Somali \[PDF\]](#)
- [Spring 2020 update \[PDF\]](#)
- [Winter 2020 update \[PDF\]](#)

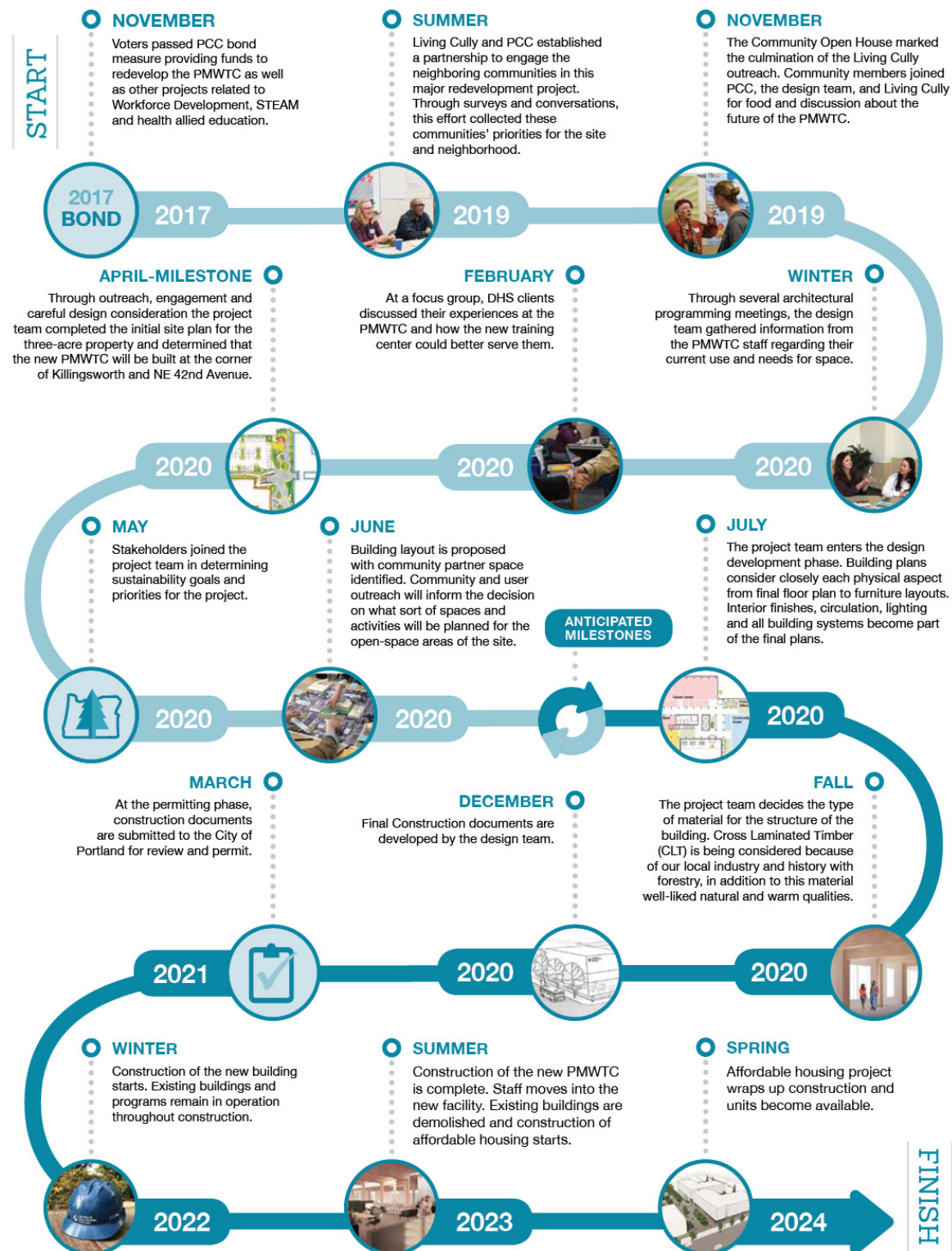
For comments on the information presented, please contact gina.valencia@pcc.edu.

PMWTC Redevelopment Update | 7

STAKEHOLDER INSIGHT
 “Our mission is to create education and career opportunities for people to transform their lives.”
 —PMWTC staff

PROJECT PRINCIPLE
 Highly Sustainable: The project makes the most sustainable choices, balances economic, social, and environmental targets, and aspires to exceed LEED Silver certification.

Project Timeline



4 | PMWTC Redevelopment Update

INFORMATION
 PCC entered a partnership with Home Forward for the housing agency to develop, own, and operate the first affordable housing project on college property.

STAKEHOLDER INSIGHT
 “We need to avoid overcrowding of the site and make sure that the flow of the space allows for calming areas.”
 —PMWTC staff

Design drives redevelopment plans

Project team works to deliver space for diverse users

By PCC's P&CC and Bora staff

P

CC's Office of Planning & Capital Construction contracted with Bora Architecture & Interiors to design the new workforce development center. Bora accepted the challenge, as a means to better understand the college and community vision. The project team delivered an inclusive process and design that empowers staff, clients and students, and enhances the nearby NE Portland communities. The project is now in the construction documentation phase, which will continue into the summer of 2021. Construction soon follows, beginning in early 2022, with the center slated to open in spring of 2023.

In addition to the considerations featured in the diagram (below), the project team is proud to create a building that includes the following design elements:

- ◆ The distinctive exterior treatment complements the neighborhood and is scaled to better suit Cully's characteristically large blocks. By introducing curves into the otherwise rectangular building form, the design of the PCC building offers a warm welcome and enlivens pedestrians' experience.
- ◆ The new PMWTC building defines and adds character to the western edge of the NE 42nd Avenue and Killingsworth Street intersection. The plans expand the pedestrian experience with widened sidewalks. Pedestrians will be able to safely approach the site, access and wait for public transit and enjoy the landscape and amenities along the building.
- ◆ Natural light defines important elements of the project design. The orientation is optimal given that the majority of the building will face either north or south. In addition to orientation, a consistent rhythm of windows brings well-balanced daylight throughout the building.
- ◆ The design of the new PMWTC building invites interaction. In addition to large storefronts creating views and transparency of activities inside the building, the exterior canopies and benches encourage passing pedestrians and visitors to gather. Seating areas located around the building offer the opportunity for community members to connect with one another. If possible, some of the seating may include such amenities as a free "little library" and space for art. Meanwhile, the building canopies also offer shelter from the rain and shade from the sun.
- ◆ The outdoor courtyard has varied and flexible spaces to invite different scales of events. The layering of spaces includes a covered porch by the community room, a linear paved plaza, stadium seats, and a variety of green and playful areas. The paved plaza area can accommodate food trucks during event days, as well as event tents.
- ◆ With a focus on well-being, the design allows for an abundance of indoor and outdoor connections. Plants and trees provide building occupants with a strong connection to nature and respite from traffic noise. The landscape design will enhance the areas for building occupants, residents and neighbors across the site year-round.

Site plan provided by PLACE Landscape Architecture, Colloqate, Hacker Architects and Bora Architecture & Interiors



DESIGN JUSTICE DRAWINGS

DESIGN JUSTICE SYMBOL LEGEND

AA00

First 2 letters indicate type of implication:
 PC - Process implication
 PG - Programming implication
 SP - Spatial implication

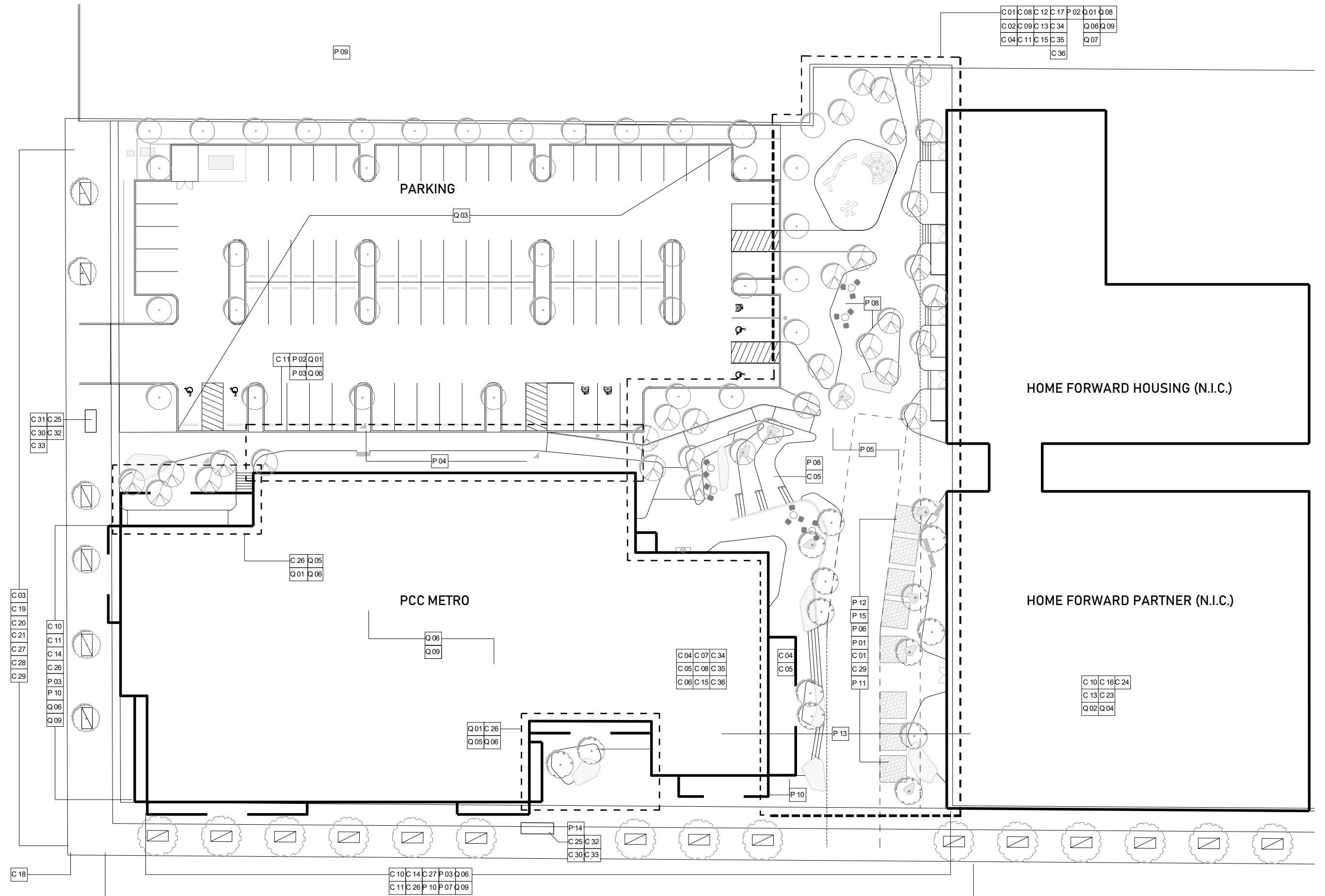
AA00

Last 2 numbers indicate keynote item number

- Indicates an implication that has been incorporated into the design
- Indicates an implication that is in progress, in a later design/construction phase, or that the design team is determining feasibility and is pending
- Indicates an implication that will not be incorporated into the design or that is outside of the scope of this work

Design Justice Keynotes

PC01	Survey Respondents: Accomodate expanded hours for activities and markets. Consider that with housing on site, it broadens the time window (day/night) for activity
PC03	Survey Respondents: Effectively eliminate the barriers to access at any time. Clarity about the access to public and community spaces. Ensure that public access is integral to the life of the building and that access is maintained long term. Assess how to provide access or expand the programmatic efforts to the public spaces around the building
PC08	Survey Respondents: Many respondents noted speeding and congestion. Modifications to the right of ways and curb cuts should be appropriate for traffic and follow DOT guidelines. Additional design measures should be considered to provide an emotional respite from the presence of cars.
PC09	Survey Respondents: PCC has partnered with Home Forward for an affordable housing project on the site and more amenities should be incorporated into the public space in order to provide safe spaces. Continuously referencing CRT training will help emphasize PCC's ability to engage marginalized communities. Work with Home Forward and Hacker to define their final program to see what the dialogue between program.
PC10	Survey Respondents: Maximize publicly accessible space. What spaces can be decoupled from the space as it is designed? What spaces can extend the active footprint of the space to provide a external opportunities to participate in the experience of the metro center regardless of user status
PC13	Survey Respondents: Integrate health and food partner organizations i.e. food trucks, garden operators, air quality, toxic sites. A groundsetting with partners will be beneficial in providing flexible but foundational values that all contribute to the end goal. The design team and partners should be mindful throughout that process about systematic ways that marginalized communities have been excluded from access to wellness resources and aim to reduce barriers to access.
PC14	Survey Respondents: Recreational activities should be age-inclusive and ability inclusive. The space should remain flexible for multiple uses.
PC17	Accessibility focus group: Consider that accessibility is not just suggested, but essential. If not implemented would make participants less likely or impossible to use certain parts of the building. Folks said buildings with usable amenities are places they return to over and over.
PG01	Survey Respondents: Support walking/biking to support neighborhood businesses. Example: Reoccurring marketplace with local pop-ups
PG02	Survey Respondents: Gathering spaces, bulletin boards, and book exchanges to support neighborhood's history of community activism and organizing to improve their quality of life
PG03	Survey Respondents: Diversity is often a reflection of representation. Reflect the visuals and languages that define the metro center and its users, i.e. wayfinding
PG06	Survey Respondents: Consider making civic spaces green and publicly accessible. Interesting community green spaces throughout civic space, not just in one location.
PG07	Survey Respondents: Provide infrastructure for flexible programmatic events like pop up markets, food trucks, festivals
PG08	Survey Respondents: Public exterior restrooms open to public
PG11	Survey Respondents: Food Market spaces that can be incorporated into the fabric of the site.



DESIGN OVERVIEW

PCC OPPORTUNITY CENTER @ 42nd Avenue

Design for Climate, Health and Equity



NE 42nd Ave.



PCC OPPORTUNITY CENTER @ 42nd Avenue 50,000 SF

PARKING

Community Plaza



homeforward
AFFORDABLE HOUSING



DESIGN TEAM:

BORA
HACKER
PLACE

COLLOQUATE

OPPORUNTUNITY CENTER BUILDING PROGRAM



Work
Open Workspace
Office
Meeting Space



Lobby
Waiting Play
Area Front
Office Open
Stair



Learn
Career Center
Classrooms
Computer Labs
Counseling



Community Partnership
10,000sf Health Clinic



Community
1,800sf of Flexible
Community Space



Community
Outdoor Plaza +
Green Spaces

FROM EQUITY PROCESS TO DESIGN OUTCOMES

CLIMATE

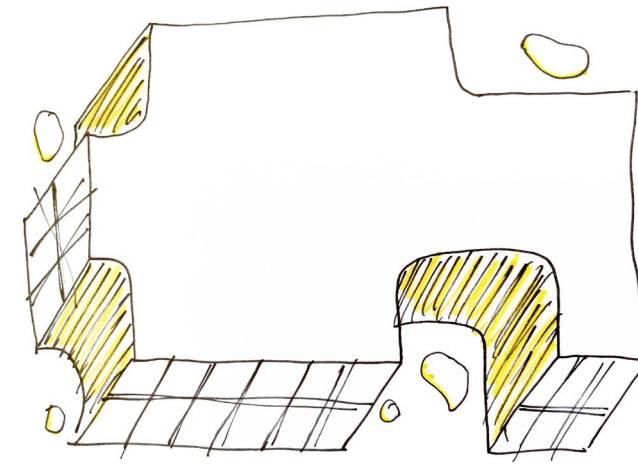
- Mass Timber Project – first project for PCC
- FSC Certified Wood
- All Electric Building
- High Performance Building Enclosure
- PV Array
- EV Charging

HEALTH

- 100% Outside Air
- Low-Emitting Materials
- Daylight + Views
- Outdoor Spaces
- Trees + Native Plantings

EQUITY

- Affordable Housing On Site
- Community Use Programming
- Partnership Programming
- Community Placemaking + Belonging
- Universal Design



WELCOMING AND BELONGING



Warmth
Mass Timber
Structure



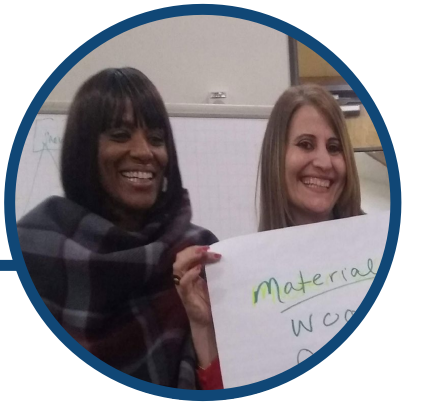
Biophilic
Visibility + Daylight
Natural Materials



Softness
Movable Seating
Soft Lighting



Subtle Contrast
Absorptive Acoustics
Simple Material Palette



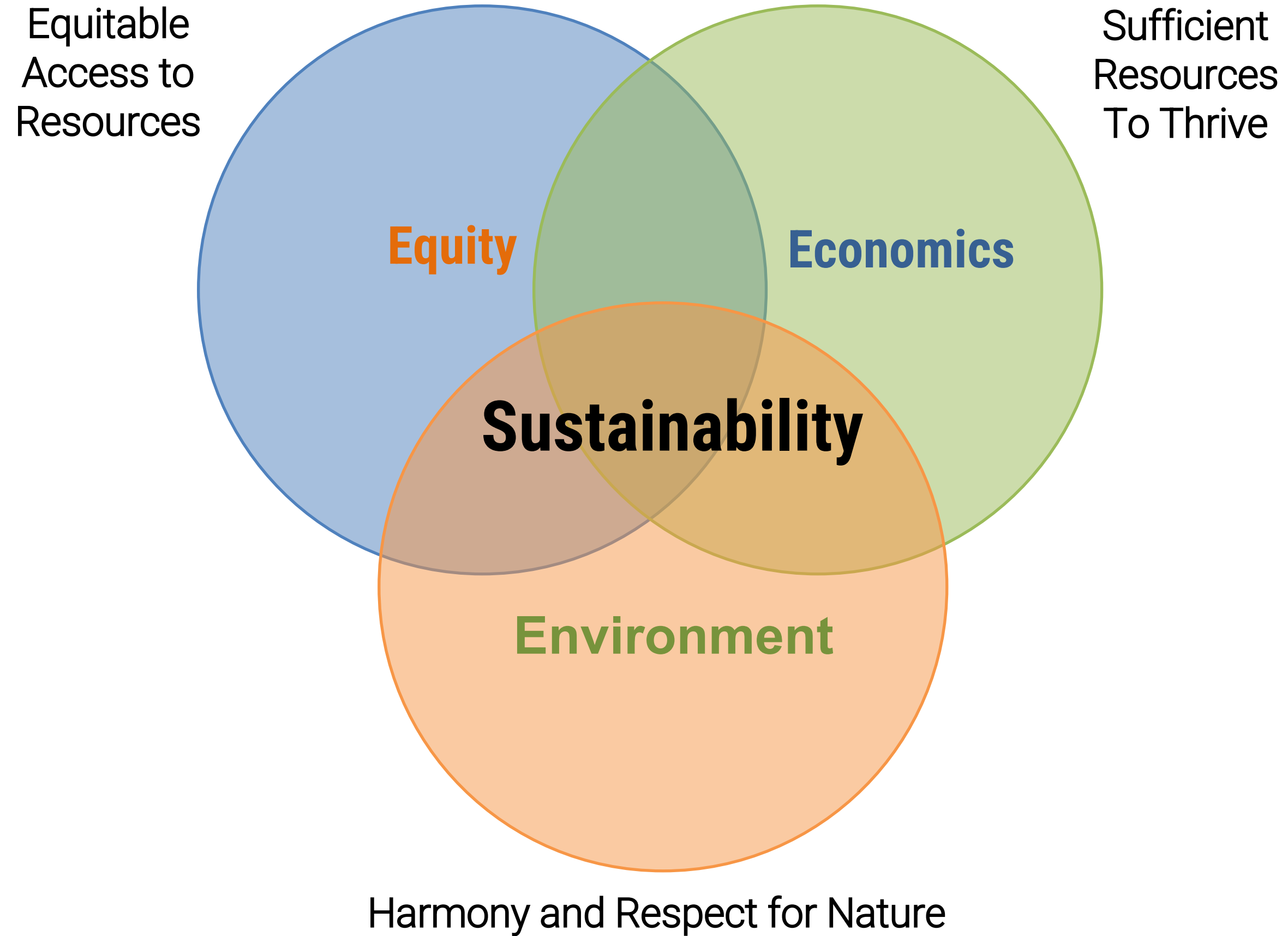
Joy + Delight
Community Art Mural



Ease
Open Mass
Timber Stair

SUSTAINABILITY PROCESS

A HOLISTIC APPROACH TO SUSTAINABILITY



PCC AND SUSTAINABILITY

Mission, Goals, and Requirements

- Board Policy BP-3551:

Portland Community College is committed to becoming a leader in academic programs and operational practices that model the sustainable use of resources, so that the needs of current generations are met without impairing the ability of future generations to meet their own needs.

- Second Nature's Carbon Commitment

(formerly American Colleges and University Presidents' Climate Commitment)

- Climate Action Plan

- AASHE's Sustainability Tracking, Assessment, & Rating System (STARS) – Silver (2021)

- LEED requirements – Silver for new construction

- Design Standards and Specifications

- OR Green Energy Technology requirements

**PCC'S 2021 CLIMATE ACTION PLAN:
RESILIENCY, EQUITY AND EDUCATION FOR A JUST TRANSITION**

Icons: People, Solar panels, Recycle, Gear, Hand, Lightbulb, Bicycle

pcc.edu/climateaction

Portland Community College

PCC SUSTAINABILITY UPDATE - FEBRUARY 2023
pcc.edu/sustain

GHG SAVINGS Since 2006, PCC has reduced its Scope I and Scope II emissions by 37%. Learn more about PCC's commitment to climate action at pcc.edu/climateaction .	ENERGY MANAGEMENT PCC has decreased its building energy use by over 35% per square foot since 2006, despite significant growth, thanks to energy efficiency and conservation efforts like our Strategic Energy Management program.	EVENTS Each year the PCC Sustainability Office partners with students, staff, and faculty to host the Ecochallenge, Sustainability Symposium, EcoSocial Justice Day, PCC Earth Week and more.	GREEN BUILDING PCC's efforts include: 13 LEED projects with a path to net zero building, advanced storm water systems and a green roof. New projects are incorporating mass timber and supporting community needs.	ECOSOCIAL JUSTICE GRANT Students have funded over \$1.1 million dollars into sustainability projects, including learning gardens and bike rental programs, through the EcoSocial Justice Grant.	SUSTAINABLE TRANSPORTATION PCC supports: inter-campus shuttles, access to frequent service bus routes, subsidized transit passes for students, bike rental & repair shops, carpool programs, and electric vehicle charging stations.	STARS RANKING PCC is ranked #1 for community colleges in the United States under the Sustainability, Tracking, Assessment & Rating System and currently has a STARS Silver rating.
ELECTRIFICATION PCC is switching its handheld landscaping equipment from gasoline to electric power, and is beginning to transition its fleet vehicles to electric, which will result in cleaner air.	ECOLOGICAL STEWARDSHIP PCC has a combined 14,048 trees in the urban forest and the Rock Creek Environmental Studies Center, which sequesters carbon and avoids over 26 million gallons of stormwater runoff annually.	LEARNING GARDENS PCC has five learning gardens, which provide food for the college's food pantries, hands-on learning and community engagement.	RENEWABLE ENERGY PCC's on-site PV arrays produced ~800,000 kWh of solar energy, and the college purchased 7,056,000 kWh of renewable energy credits, replacing ~27% of PCC's grid electricity with renewable energy.	WASTE MANAGEMENT PCC has composted nearly 1.3 million lbs and recycled 10.8 million lbs since 2012. This is due in part to our many specialty recycling programs, e.g. for plastic film, electronic waste, pens and markers and batteries.	SUSTAINABILITY EDUCATION PCC offers over 71 sustainability-focused courses with another 154 that include sustainability across 44 departments.	RESILIENCY PCC incorporated our ecological health and wellness, equity, Bee Campus and Tree Campus USA efforts into the 2021 Climate Action Plan through resiliency.

LEED CERTIFICATION PURSUIT

Framework for sustainable strategies, leveraging industry standards

- Site development, location and transit
- Energy and water resources
- Healthy, low-emitting products and product disclosures
- Construction practices
- Commissioning – energy systems and building envelope
- Equitable development and community outreach
- Integrative process



KEY DECISIONS AND PROCESS

- Early design engagement and guiding principles
- Sustainability Workshop – May 2020
- Early Design Assistance Meeting – June 2020
 - Online meetings only
 - AIA Framework for Design Excellence
 - Architecture 2030
 - Path to Net Zero established as goal for the project
- Ongoing sustainability development
 - Informed design decisions – analysis
 - Tracking and validating strategies



ENERGY, ECONOMY & CHANGE

1. Achieve a reduction in GHG emissions - 40% below 2006 levels by 2030, and 80% below 2006 levels by 2050.
2. Achieve a minimum of 30% energy use reduction compared to code requirements for new buildings.
3. Require renewable energy for large construction projects.
4. Plan for the college to be PV-ready and/or net-zero ready.
5. Integrate a “total cost of ownership” approach to new construction and renovations.

GROUP 3
 Mike Manzi, Bora
 Paula Barreto, PLACE
 Rebecca Ocken, PCC
 John Maclean, PCC
 Oriana Magnera, Verde
 Caleb Aring, Elevate
 Jade, PCC

MEASURE: DESIGN FOR ENERGY & ECONOMY

OBJECTIVE:	TARGET		
	Good (minimum)	Better	Best (stretch)
Improve building envelope performance	ceiling fans	operable windows	night flush cooling
Optimize the use of materials	Consider ongoing maintenance	longlasting materials	repurposing materials
Embodied carbon of materials	Electric equipment (during construction)	Use low-carbon materials	using efficient equipment
	Resiliency (Verde)	Solar plus storage	Community solar plus storage

GROUP 2
 Amy Donohue, Bora
 Brian Butler, Arris
 Katrina S.M., Lensa
 Mark Godfrey, O-LLC
 Stephania Fregosi, PCC
 Donna Bezio, PCC

MEASURE: DESIGN FOR WATER & RESOURCES

OBJECTIVE:	TARGET		
	Good (minimum)	Better	Best (stretch)
Provide clean water to users	outdoor drinking fountains	bottle filler stations with filters	periodic testing of water quality on site
Reduce operational water use	low-flow plumbing fixtures	smart irrigation	rainwater harvesting system for non-potable uses
Longevity of materials	long-lasting exterior panels and long-term coated, sealed	recycled content in interior finishes	solid mineral testing materials, including with warm
	durability vs. chemicals, must balance	vetted red list free materials	cast from piping in lieu of plastic/PVC

GROUP 4
 Emily Hayden, Bora
 Bryan Lee, Colloqate
 Eric McDaniel, Sora
 Linda Degman, PCC
 Sherry Durfey, PCC

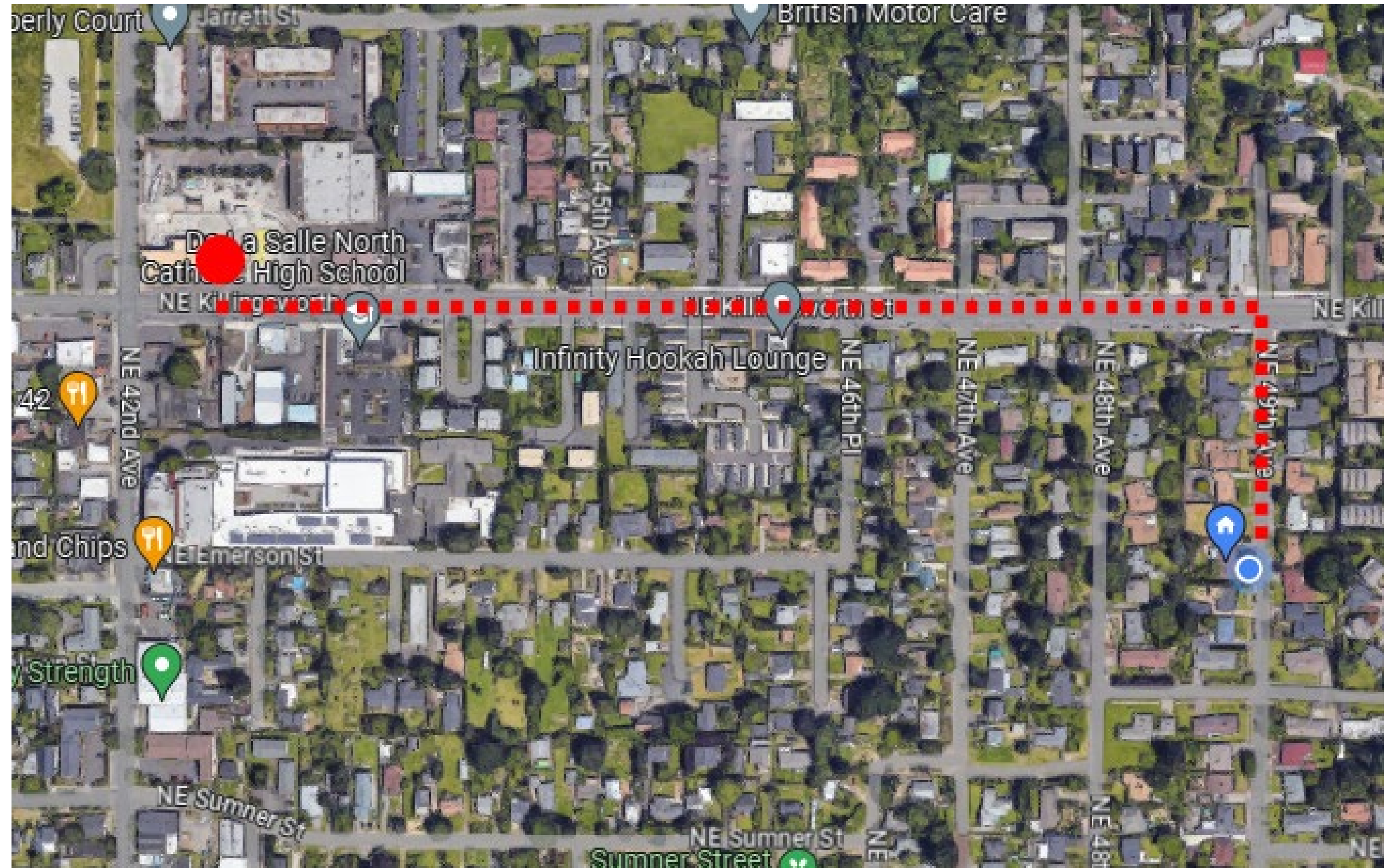
MEASURE: DESIGN FOR WELLNESS

OBJECTIVE:	TARGET		
	Good (minimum)	Better	Best (stretch)
Provide exemplary indoor air quality	Healthy materials (VOCs, off-gassing, etc)	Test air quality (dependent on goals set)	20% improvement relative to code (CO2, radon, etc)
Experience biophilia	Natural daylight / managed glare	80% occupants view to nature	100% occupants view to nature
Comfort zone mapping	Thermal comfort zones	Control equipment (fans, shades, etc) to balance with occupant	Keep outdoor spaces sheltered from sun/rain

MECHANICAL SYSTEM DESIGN

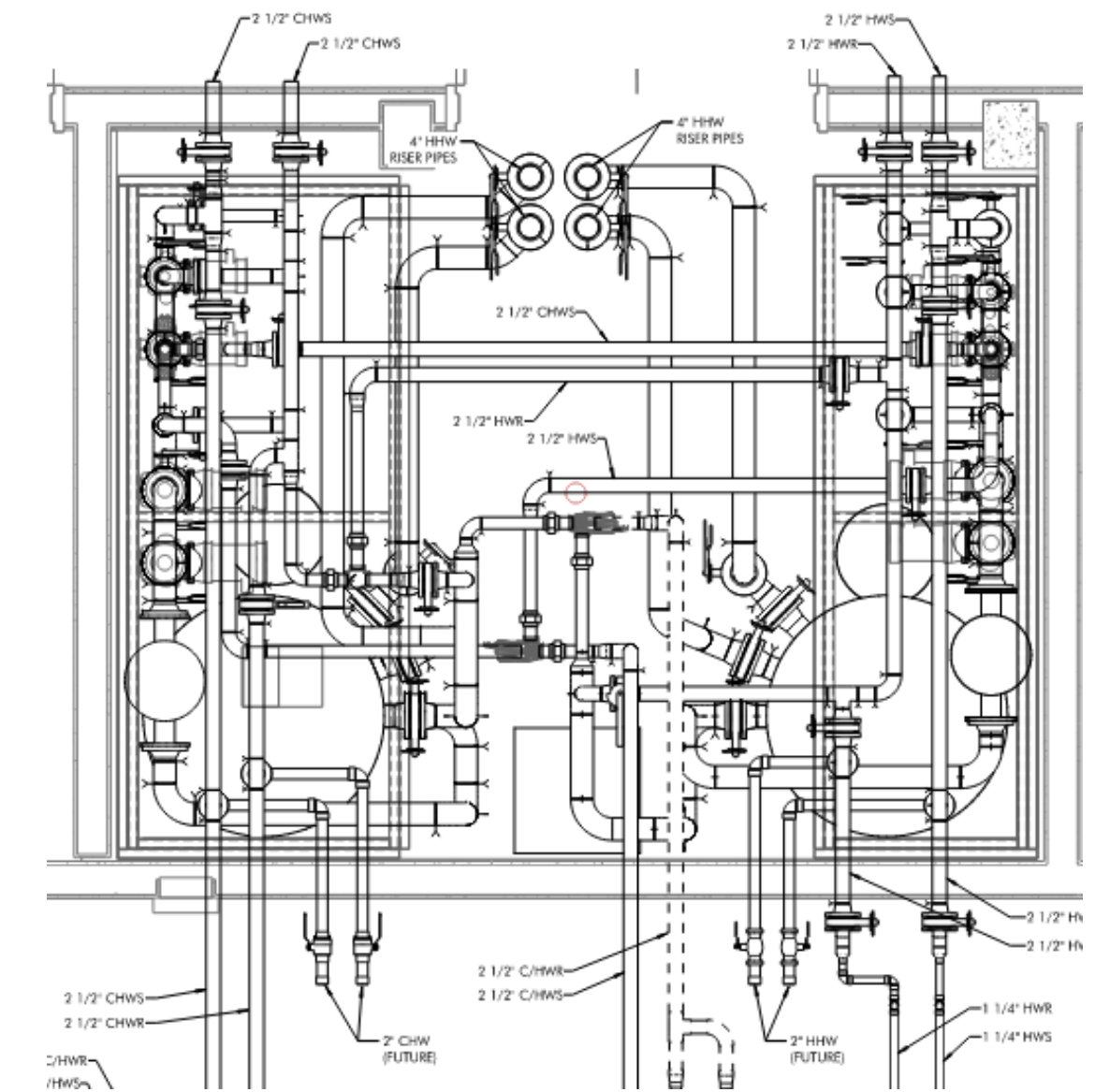
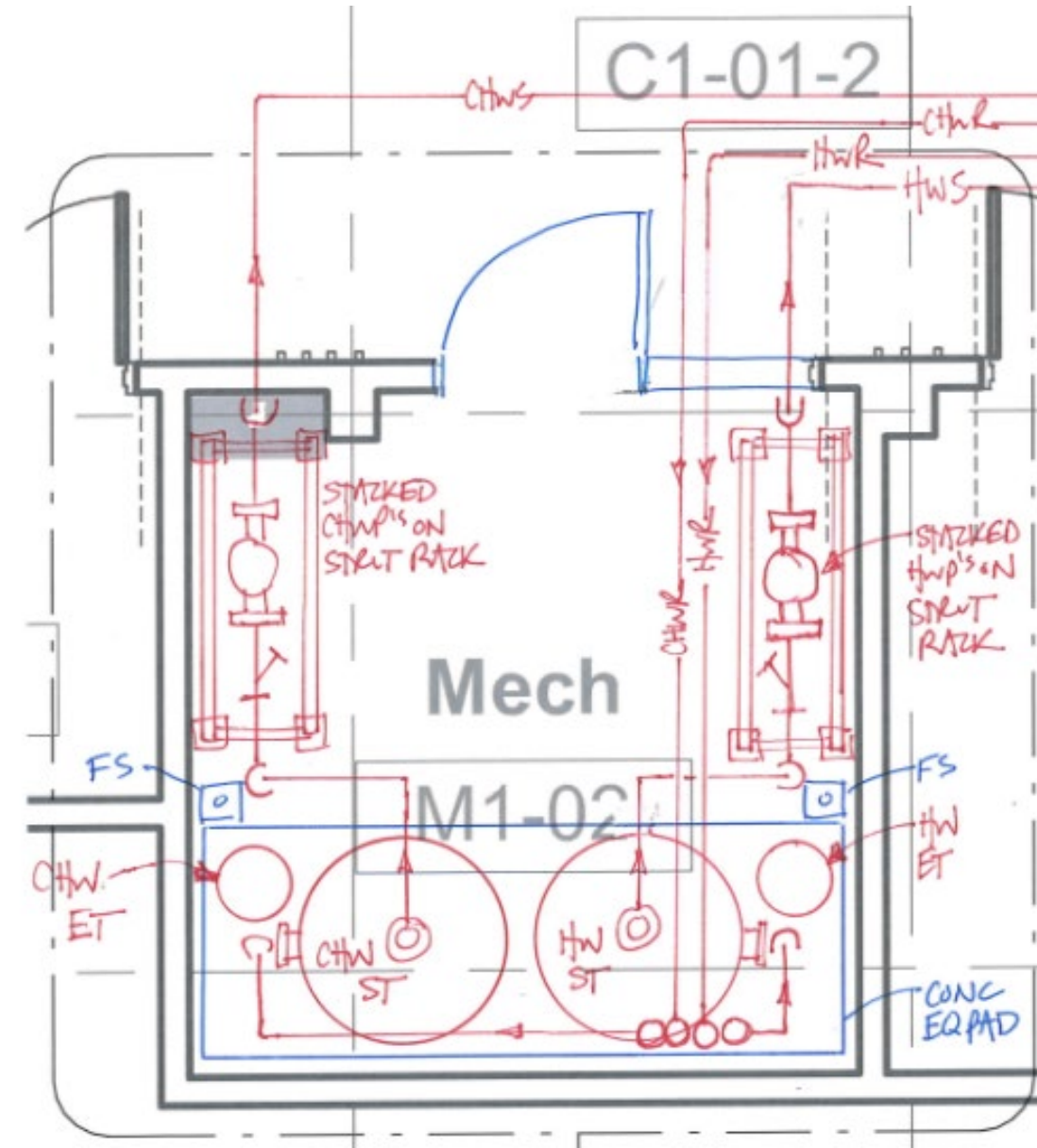
MWESB DESIGN CONSULTANT TEAM

- Arris Consulting founded in 2019 just 10 blocks from the PCC Metro project site.
- MWESB certified firms under Bora included Samata Engineers, Reyes Engineering, Vega Civil Engineering, Place Studio and more.
- Goal to design and construct a mechanical system that is efficient, reliable, healthy and resilient



COLLABORATIVE MECHANICAL SYSTEM DESIGN

- Mechanical subcontractors interviewed after SD
- Created a collaborative design/build team with Total who were essential for providing years of experience
- Able to optimize the system while maintaining the original project goals and even adding further controllability and resiliency to the system





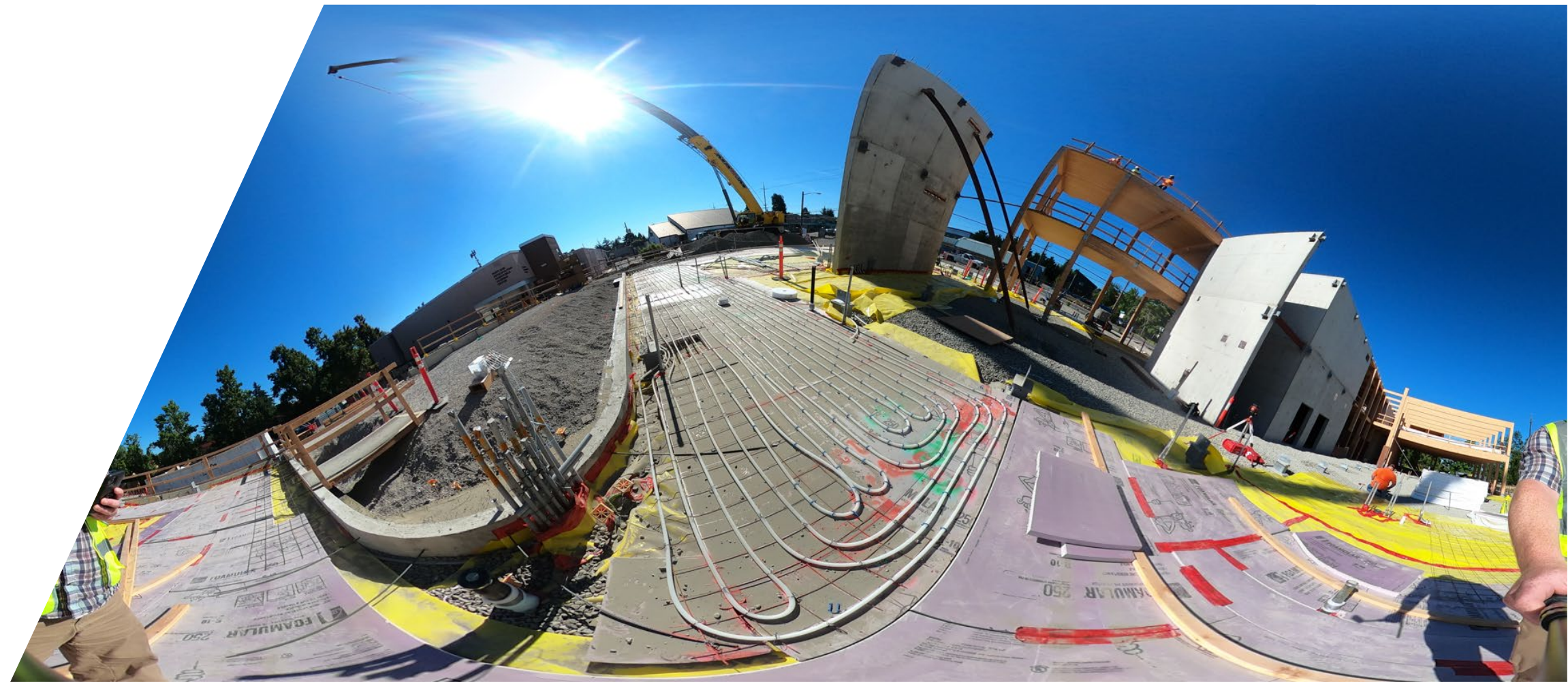
- Heating and chilled water system served by three rooftop air-source heat pump chillers
- System feeds two large storage tanks in mechanical room

- Chilled or heating water pumped to various terminal devices through inline pumps on variable speed drives.
- Separate hydronic loops serve sensible-cooling fan terminal units, perimeter radiant slab and rooftop heat recovery ventilators (HRVs).





- Envelope heat loss is overcome by a radiant heated slab at the perimeter of the building.
- Rooftop HRVs provide filtered and conditioned ventilation air via sensible cooling fan terminal units
- Active radon system and 100% outside air for safe and clean ventilation

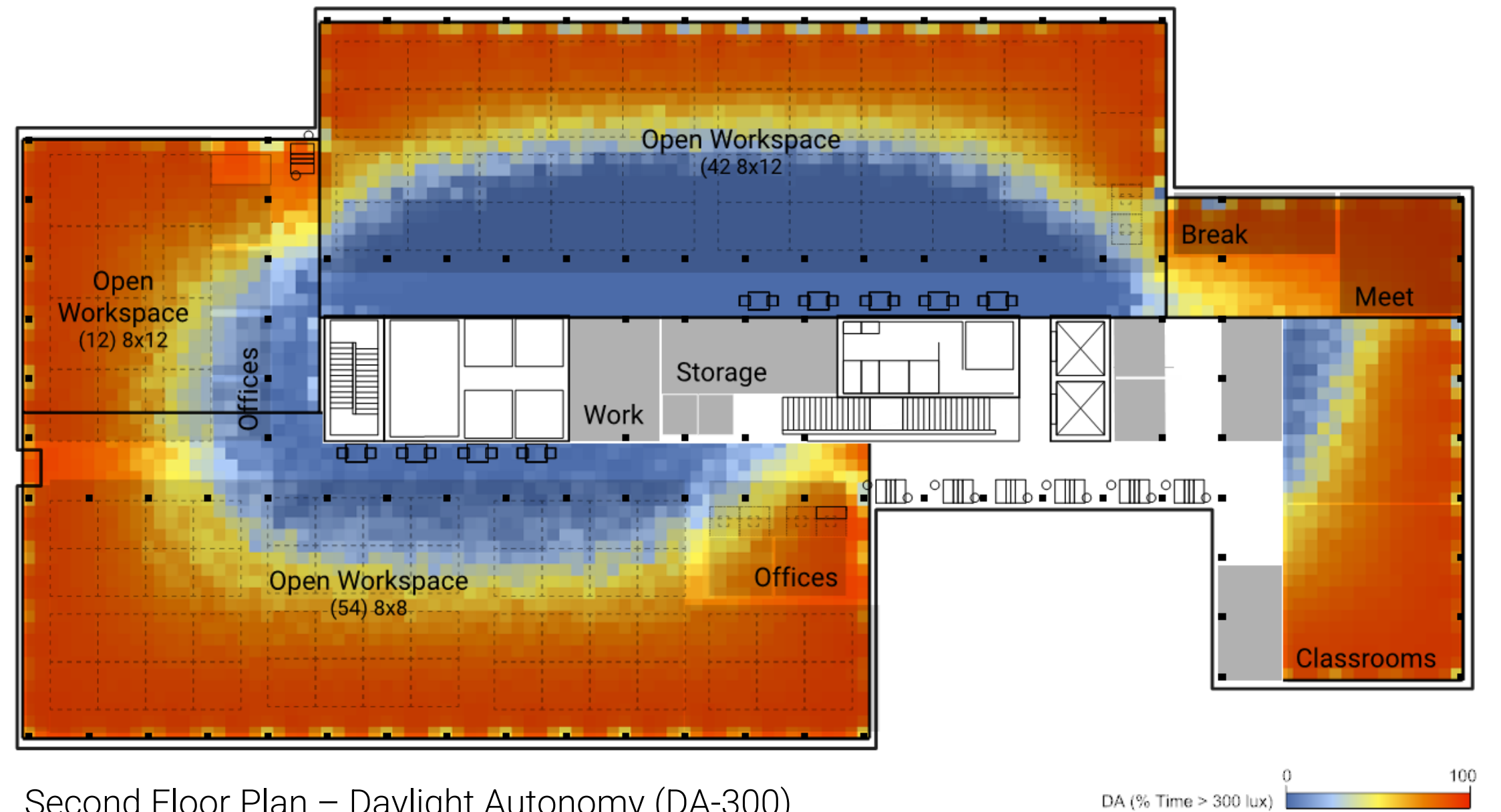


ENERGY + DESIGN

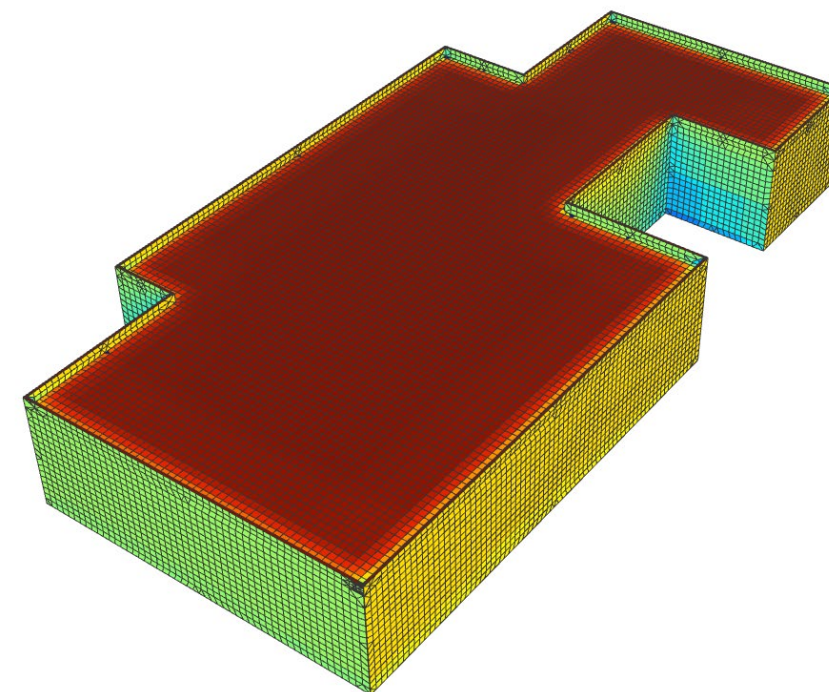
ENERGY + DESIGN

Key Objectives + Goals:

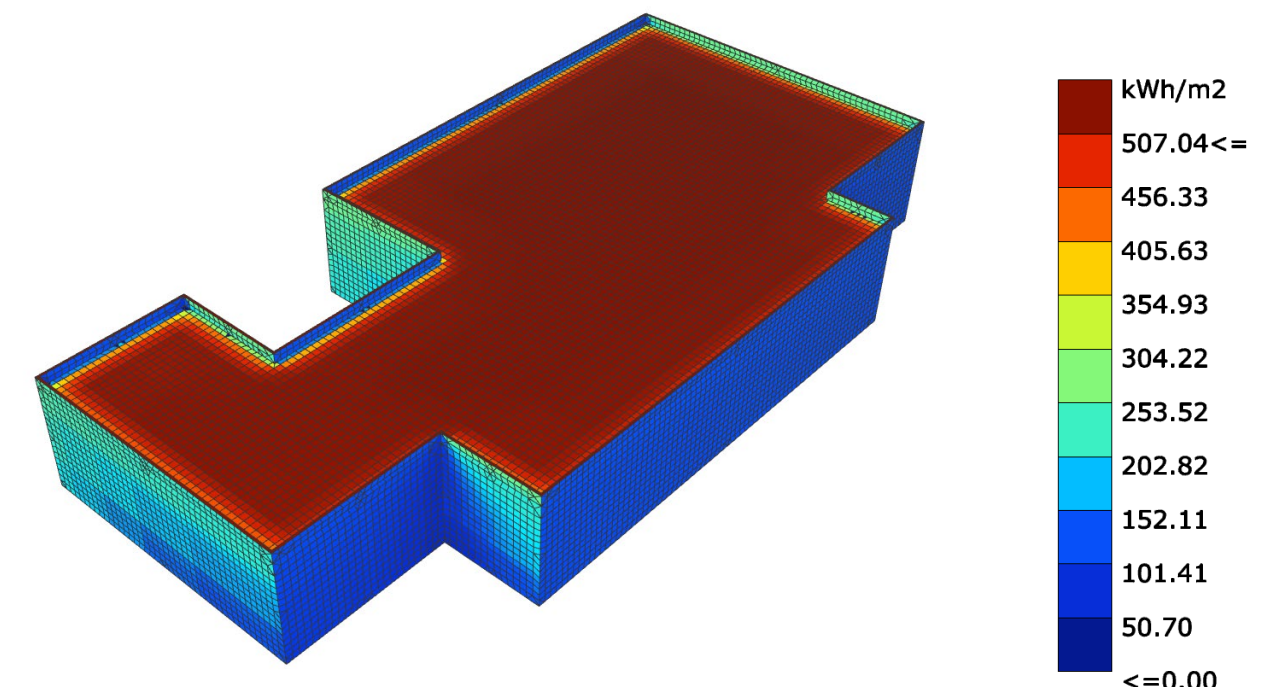
- Meet PCC's GHG Emission Targets
- Meet 2030 Challenge EUI of 16
- 100% Electricity Use Facility
- Select cost-effective/ efficient systems
- Utilize carbon first thinking:
 - Operational Carbon
 - Embodied Carbon



Second Floor Plan – Daylight Autonomy (DA-300)



Axon – South & West Facades- NTS



Axon – East & North Facades- NTS

ENERGY + DESIGN

Studies Performed:

Early Design Analysis:

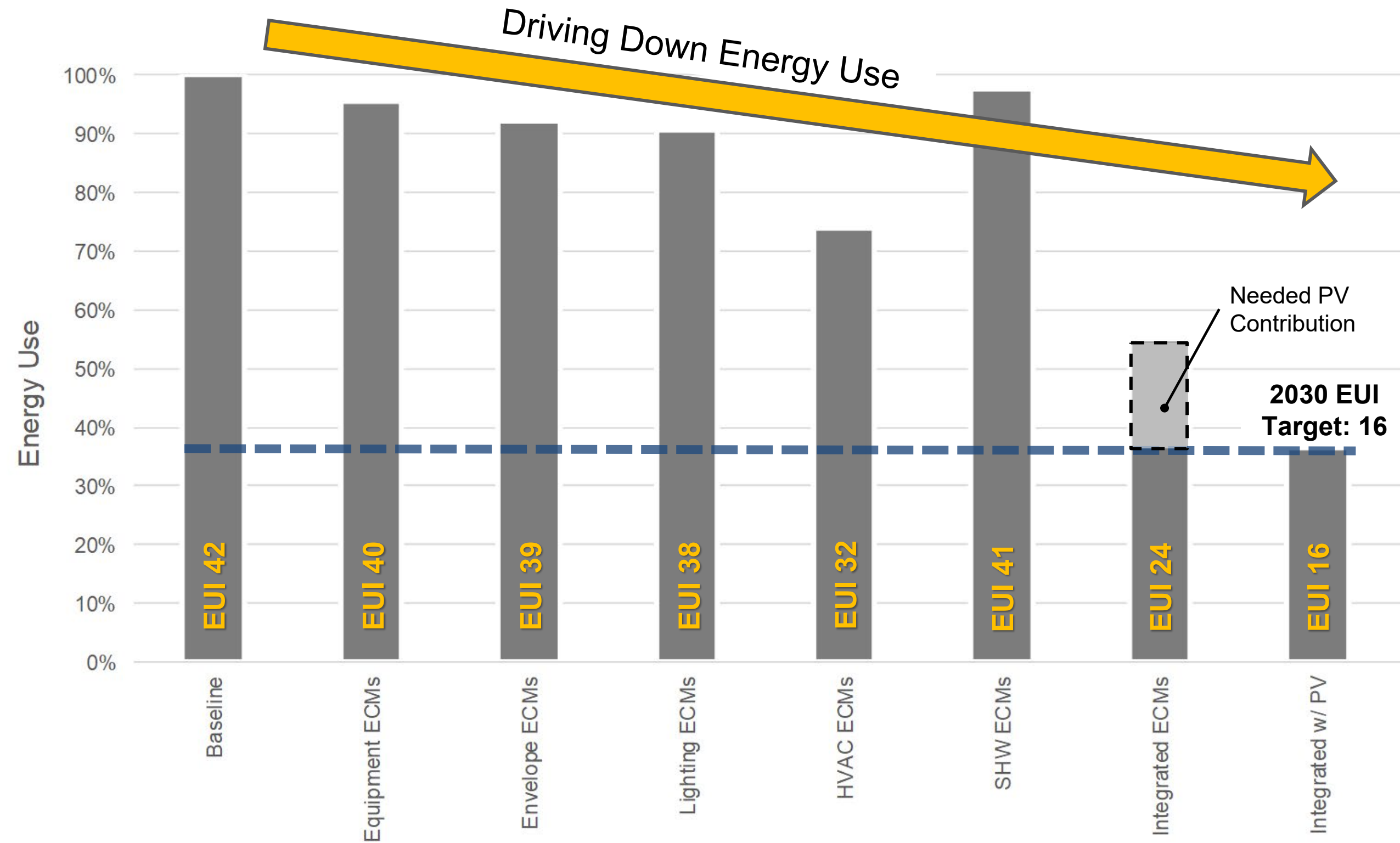
- Climatic Analysis
- Preliminary Daylight Modeling
- SD Energy Modeling + Sensitivity

Embodied Carbon Modeling

Whole Building Energy Analysis

- ETO PTNZ
- LEED v4 BD+C

Early Design Sensitivity Analysis

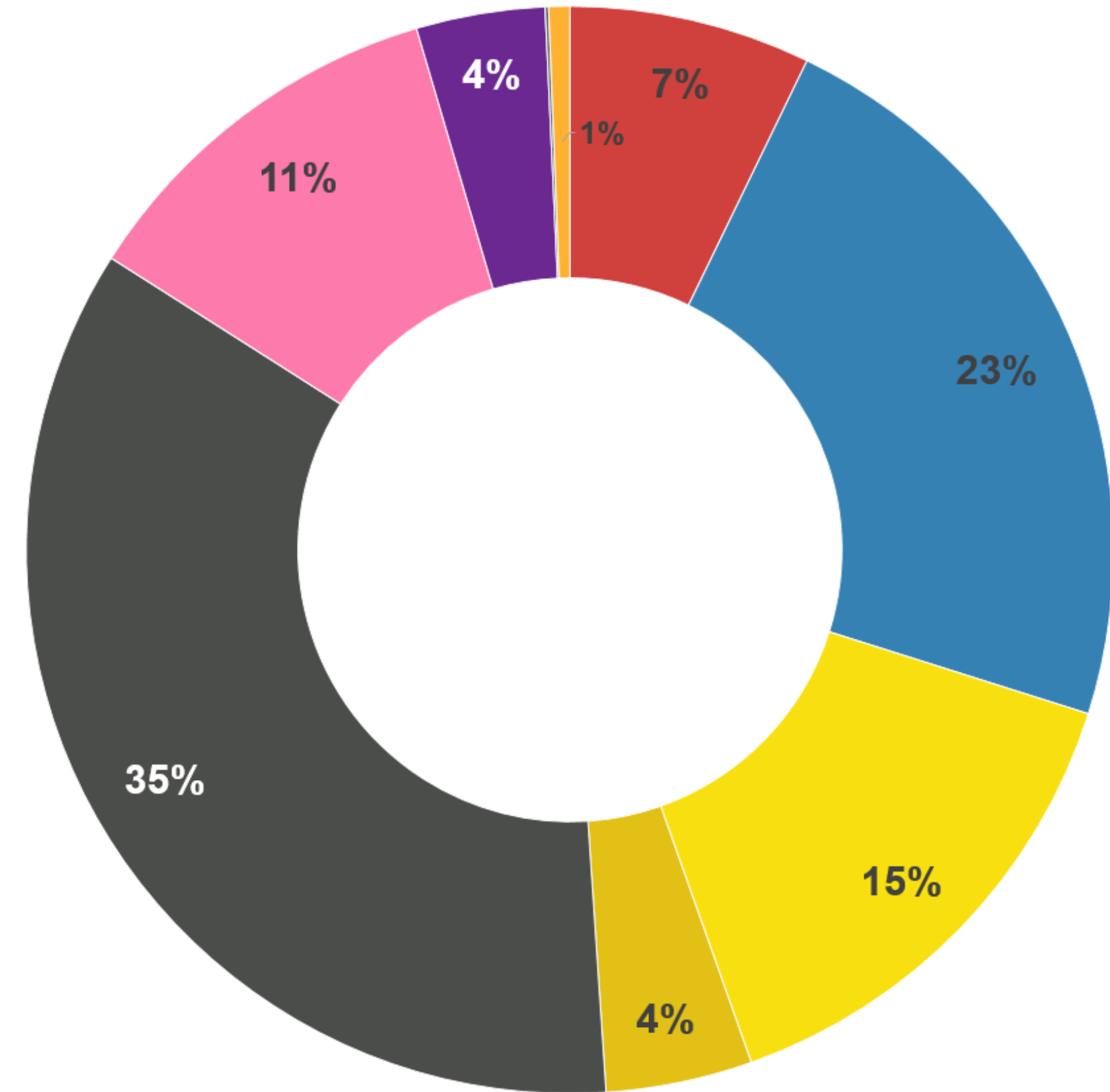


ENERGY + DESIGN

Energy End Use – 100% CD

Strategies:

- High-Performance Fenestration
- Enhanced Building Air Tightness
- Daylight Harvesting
- 100% LED Lighting Systems
- HR Heat Pump Chillers
- Heat Recovery Ventilators
- Energy Star Equipment
- Implementing Tenant Guidelines
- 91.7 kW PV Array



■ Heating ■ Cooling ■ Interior Lighting ■ Exterior Lighting ■ Interior Equipment ■ Exterior Equipment ■ Fans ■ Pumps ■ Heat Rejection ■ Water Systems

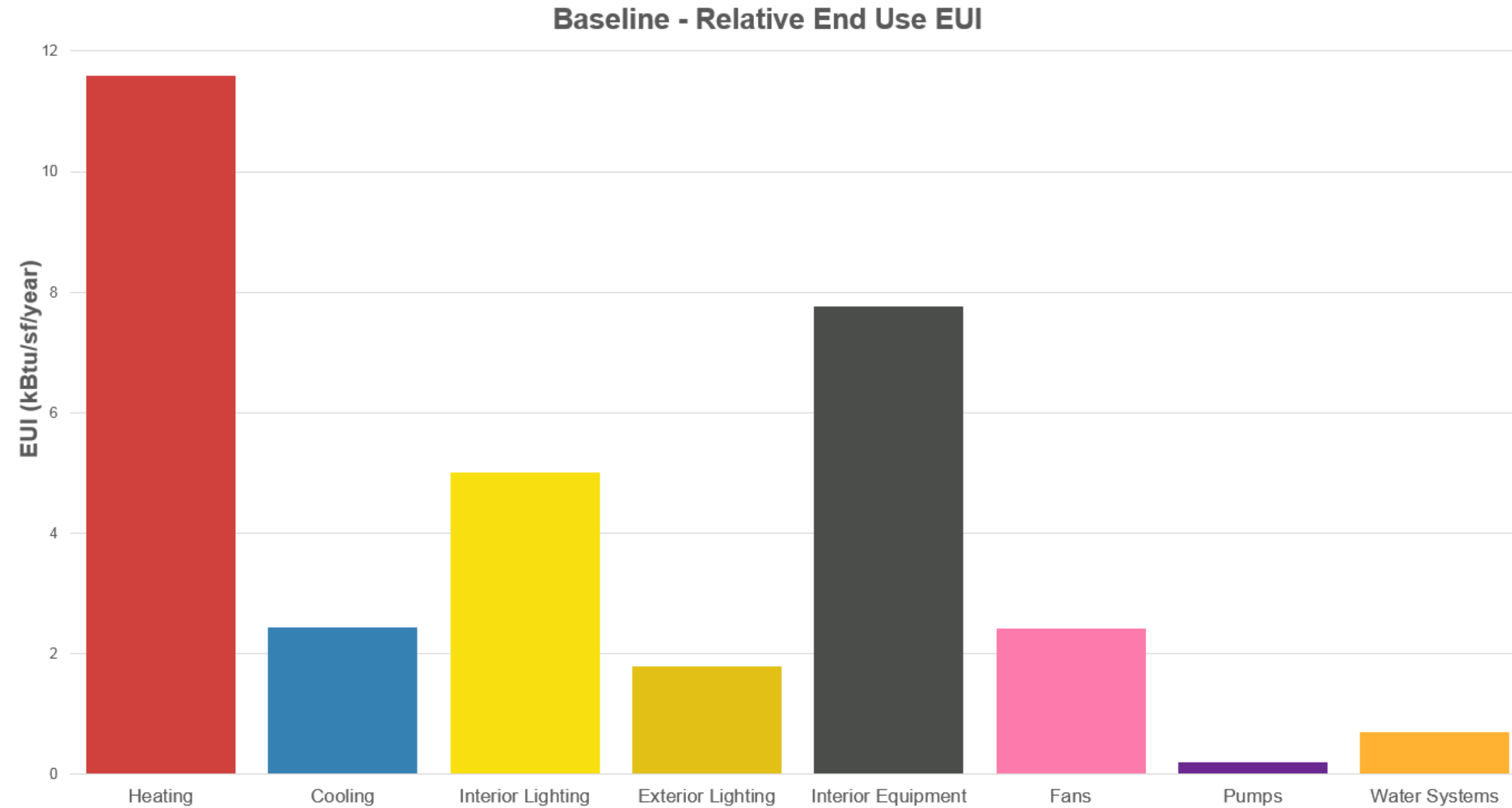
ENERGY + DESIGN

Challenges:

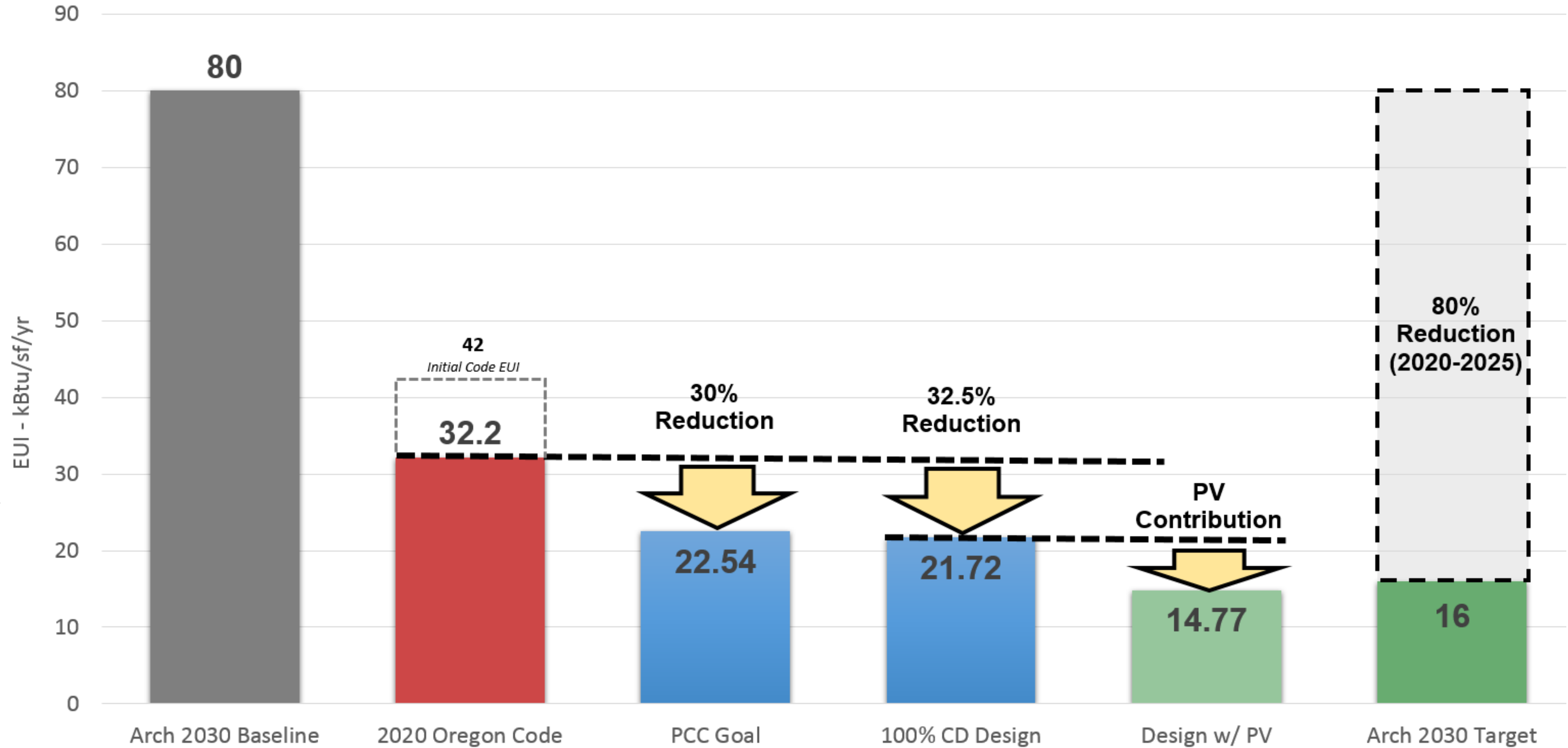
- New Energy Code (OEESC 2019)
- Aggressive EUI Target
- System Changes - VE
- Unknown tenant
- New ETO Modeling Guidelines

Successes:

- Leverage teamwork + I.D.
- 54% Utility Savings
- Projected 6,700+ MT CO2e reduction over building-life
- 37% Embodied Carbon Savings



Energy Performance Comparison

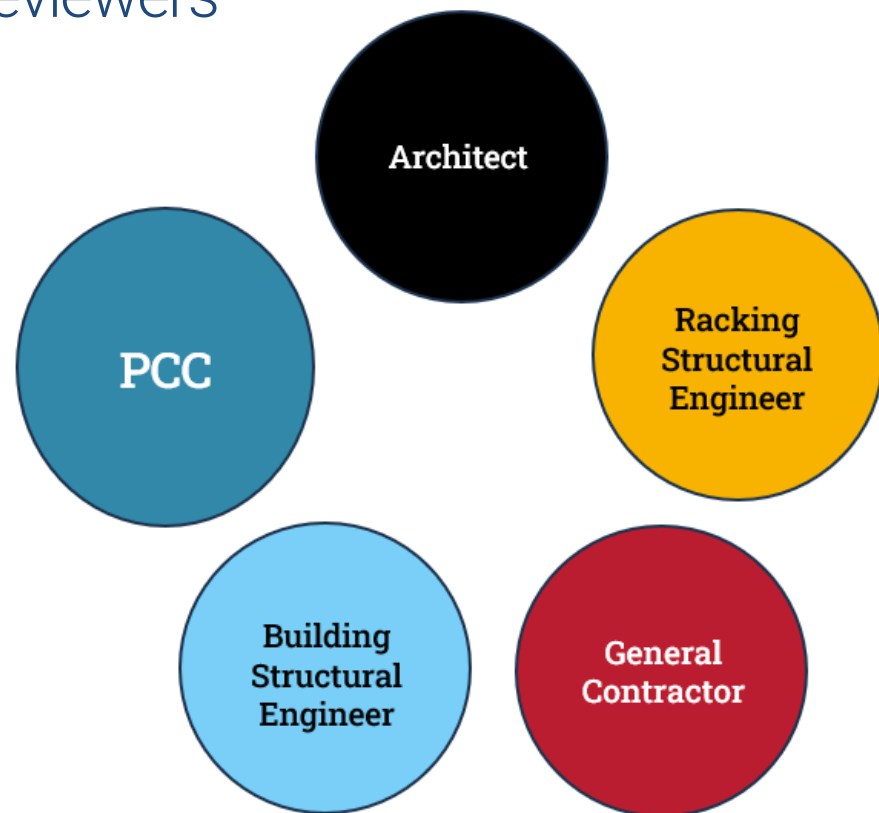


PV ARRAY

PRELIMINARY DESIGN

- Possible system size
- Estimated production
- Components requiring space allocation in Electrical Room
- Initial options for Racking, Panels & MLSD

- Stakeholders
- Design Team
- Reviewers



Annual Production Report produced by Jared Bazar

Design 1 PCC Metro Center, 5600 NE 42nd Ave, Portland, OR 97218

Report	
Project Name	PCC Metro Center
Project Address	5600 NE 42nd Ave, Portland, OR 97218
Prepared By	Jared Bazar jbazar@morrow-meadows.com

System Metrics	
Design	Design 1
Module DC Nameplate	105.9 kW
Inverter AC Nameplate	100.0 kW Load Ratio: 1.06
Annual Production	116.9 MWh
Performance Ratio	79.9%
kWh/kWp	1,104.1
Weather Dataset	TMY, 10km grid (45.55,-122.65), NREL (prospector)
Simulator Version	b8fa6b56c8-2605871ca9-018051495e-c10d33f4e5

Monthly Production			
Jan	Feb	Mar	Apr
May	Jun	Jul	Aug
Sep	Oct	Nov	Dec

Annual Production			
Irradiance (kWh/m²)	Description	Output	% Delta
	Annual Global Horizontal Irradiance	1,284.6	
	POA Irradiance	1,382.4	7.6%
	Shaded Irradiance	1,316.0	-4.8%
	Irradiance after Reflection	1,273.6	-3.2%
Energy (kWh)	Irradiance after Soiling	1,185.0	-7.0%
	Total Collector Irradiance	1,184.7	0.0%
	Nameplate	125,470.8	
	Output at Irradiance Levels	124,030.4	-1.1%
	Output at Cell Temperature Derate	122,057.6	-1.6%
	Output After Mismatch	121,951.6	-0.1%
	Optimizer Output	120,233.9	-1.4%
	Optimal DC Output	119,884.1	-0.3%
	Constrained DC Output	119,805.9	-0.1%
	Inverter Output	118,008.8	-1.5%
Energy to Grid	116,933.7	-0.9%	

Condition Set												
Description	Condition Set 1											
Weather Dataset	TMY, 10km grid (45.55,-122.65), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	4	9	14	16	8	4	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By	Characterization									
	Q,PEAK DUO XL-G9.3 445 (Hanwha Q CELLS)	Folsom Labs	Spec Sheet Characterization, PAN									
Component Characterizations	Device	Uploaded By	Characterization									

Annual Production Report produced by Jared Bazar

Components		
Component	Name	Count
Inverters	SE100K (SolarEdge)	1 (100.0 kW)
AC Home Runs	3/0 AWG (Copper)	1 (1,618.4 ft)
Strings	10 AWG (Copper)	8 (904.7 ft)
Optimizers	P960 NA (SolarEdge)	120 (115.2 kW)
Module	Hanwha Q CELLS, Q,PEAK DUO XL-G9.3 445 (445W)	238 (105.9 kW)

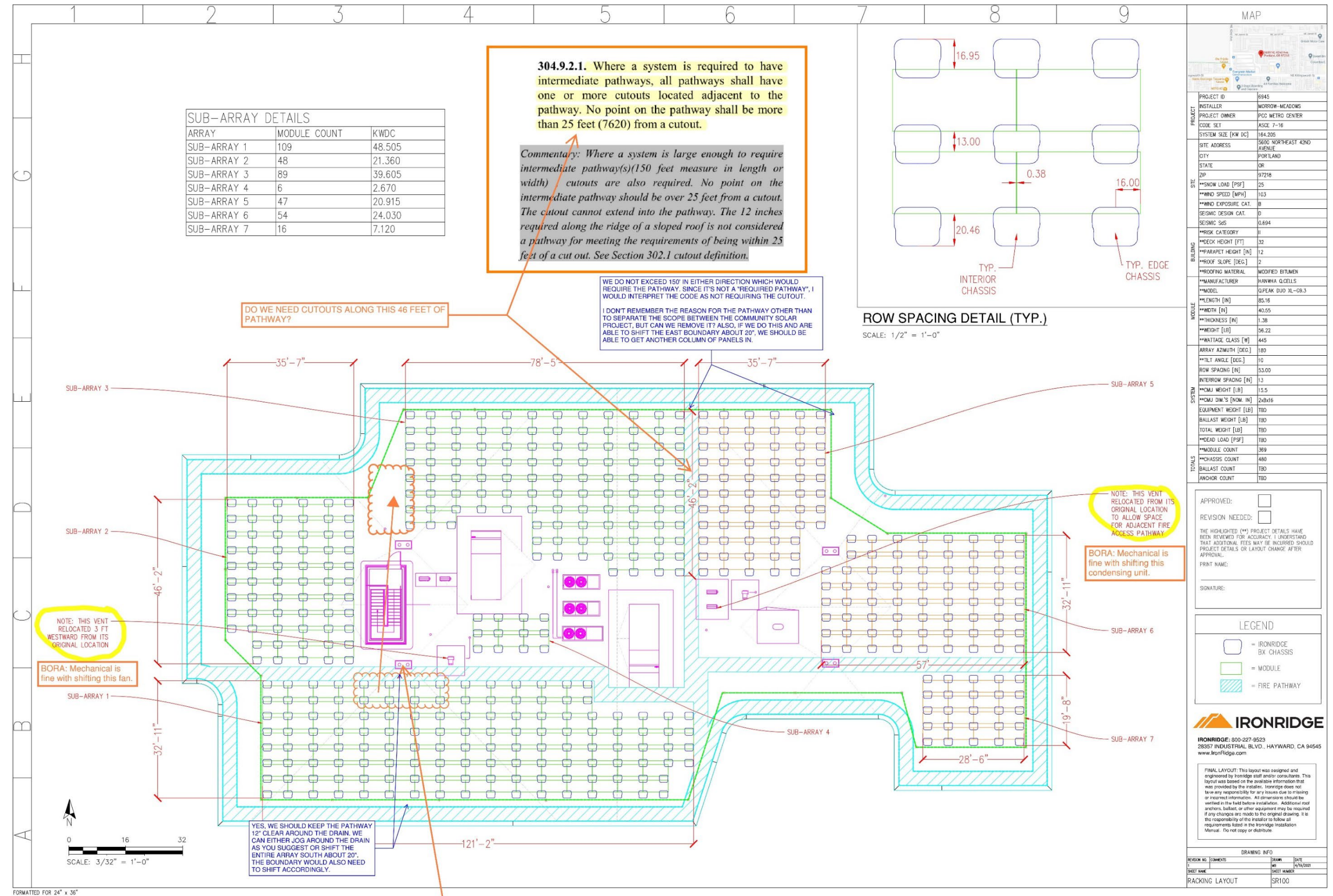
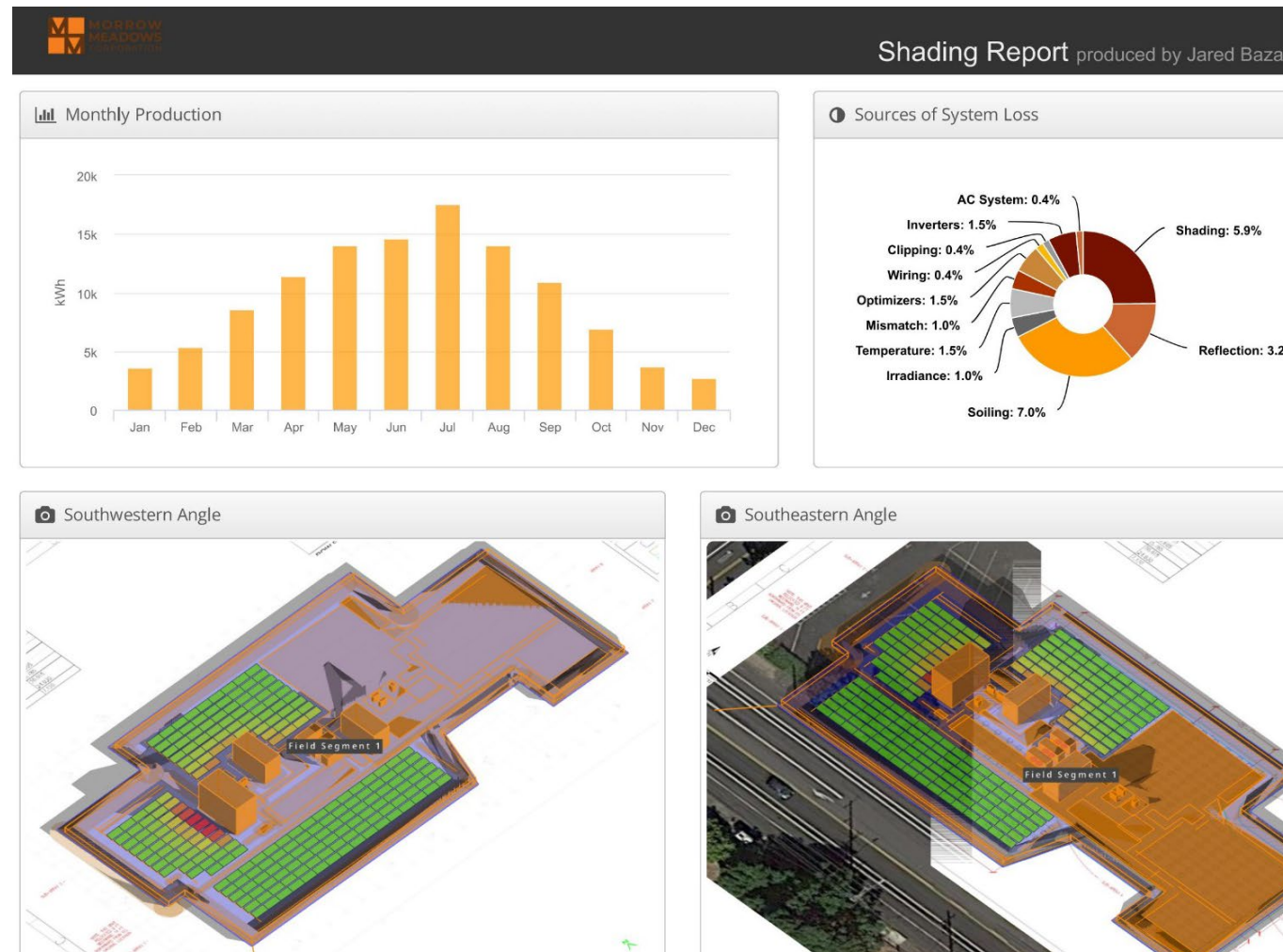
Wiring Zones			
Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	13-32	Along Racking

Field Segments							
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	180°	1.1 ft	1x1	238
							238
							105.9 kW

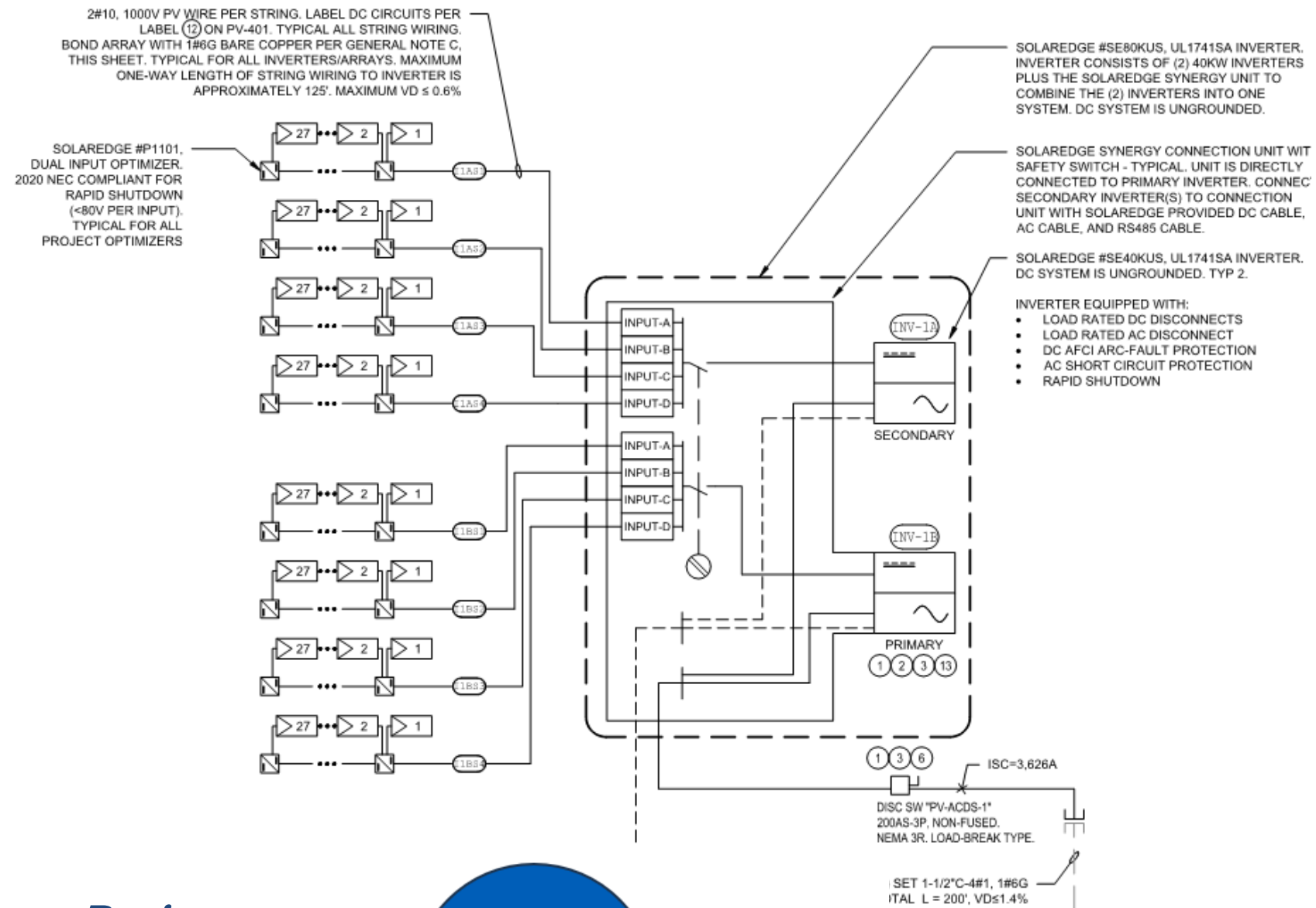
MORROW MEADOWS CORPORATION

LAYOUT & DESIGN CHALLENGES

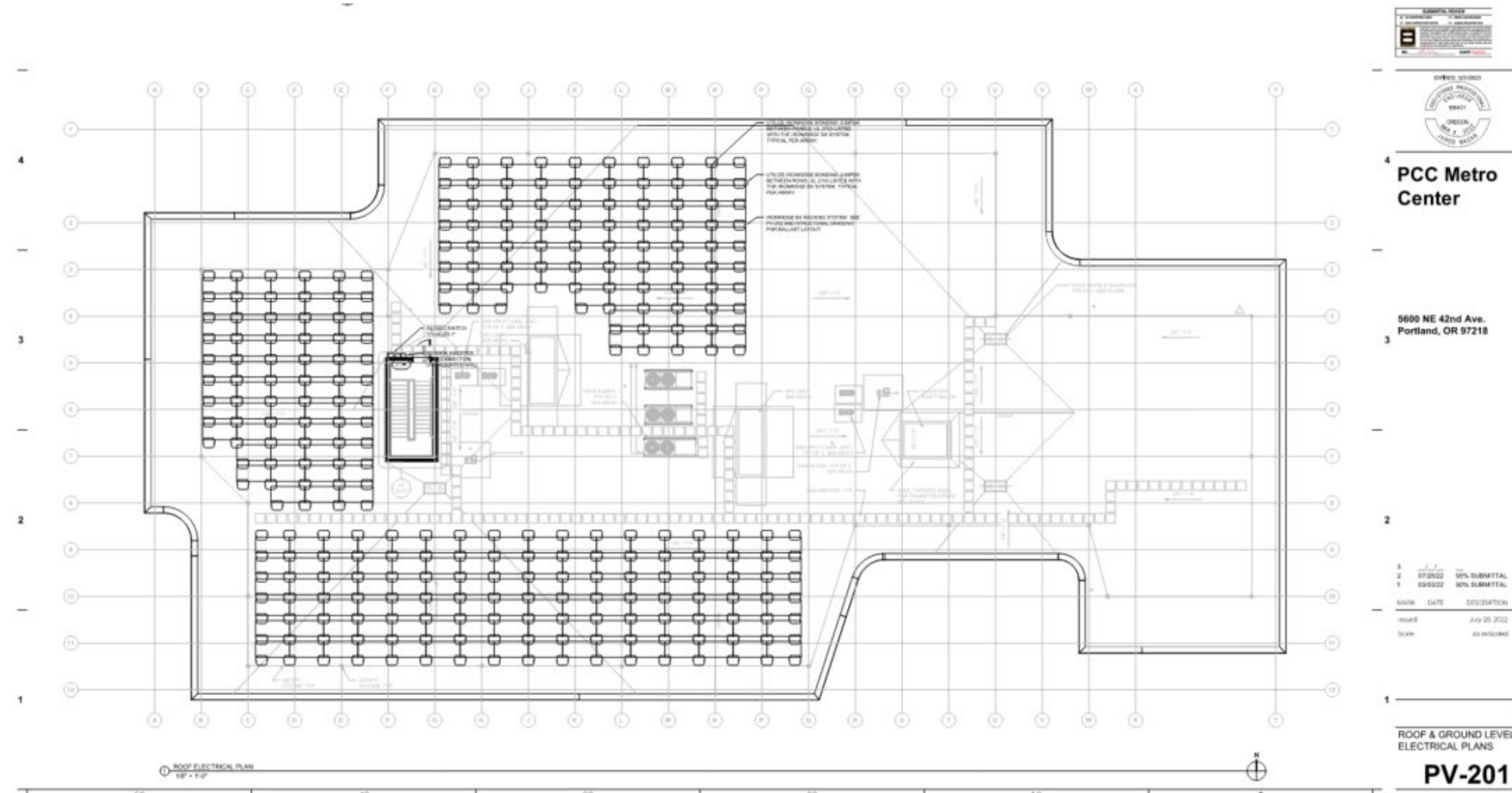
- Budget
- Fire Code setbacks
- Building pathway clearances
- Changing roof & HVAC design
- Structural PSF limitations
- No roof penetrations
- Limited shading



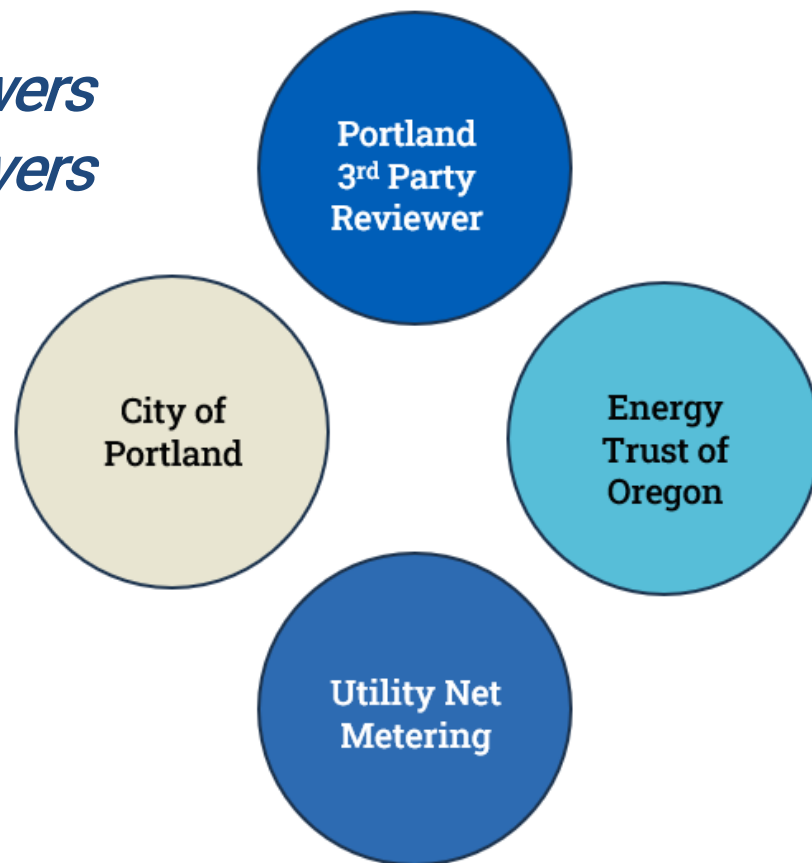
Develop Final Construction Documents for Approval



BDS This letter is to confirm that the calculations and ballast plan conform to the design principles described in the wind tunnel test and peer review reports for the determination of the required ballast for the installation.



- Reviewers
- Approvers



City Of Portland
REVIEWED FOR CODE COMPLIANCE
 Date: 10/28/22
 Permit #: 21-056105-DFS-07-CO

CITY OF PORTLAND BDS INSPECTION REPORT

IVR number: 4772697 **Permit Number:** 22-111839-000-00-ET
Location : 4299 NE KILLINGSWORTH ST PORTLAND OR 97218 USA **Applicant Name:** CHERRY CITY ELECTRIC *TRACE THOMPSON*
Permit Type: Electrical Permit
Work Description : Electrical work for new two-story office building
Inspection Code: 160 Renewable Energy Solar/Wind
Inspection Results: Approved

CONSTRUCTION



Thank You!