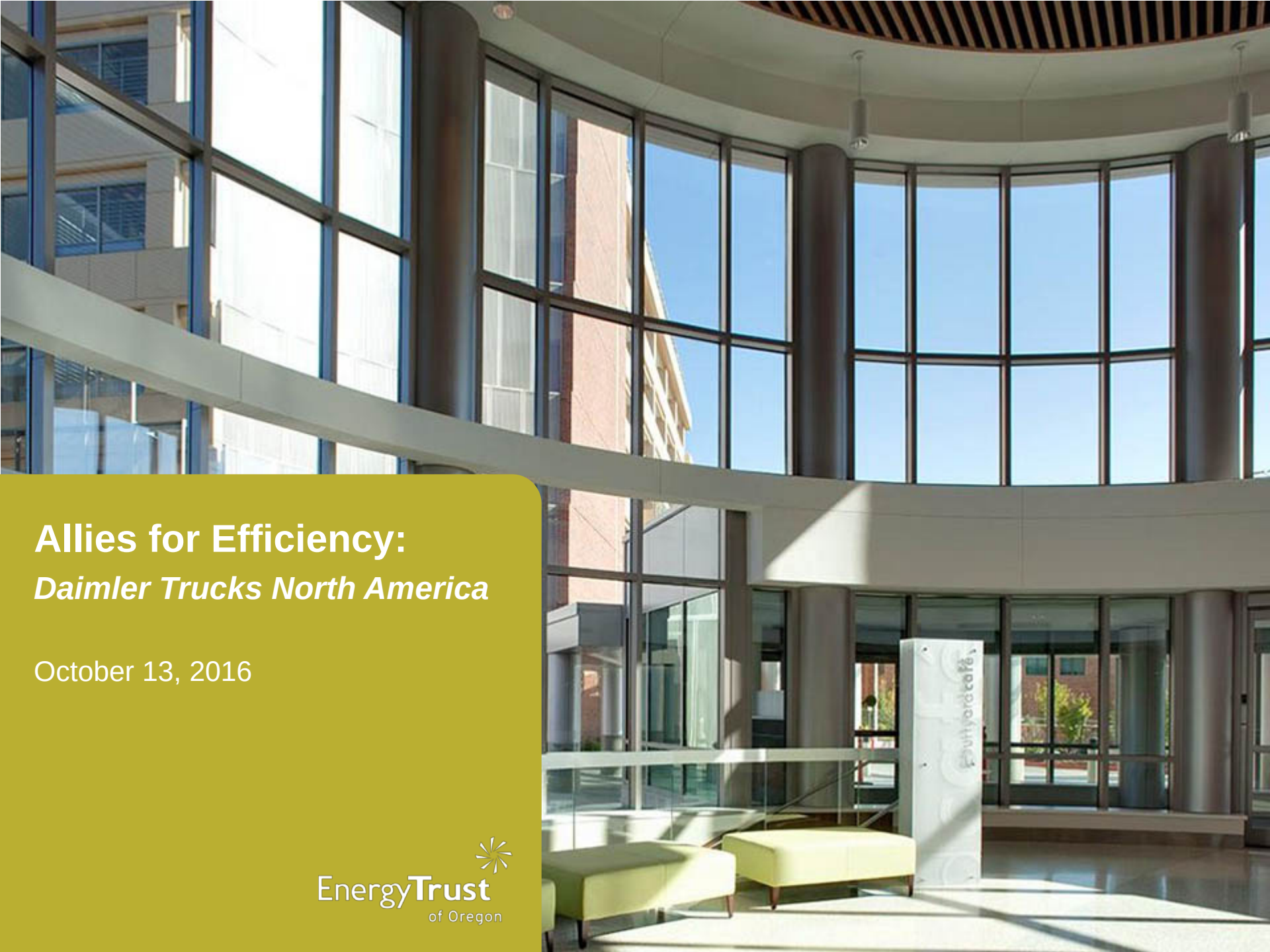


Allies for Efficiency:

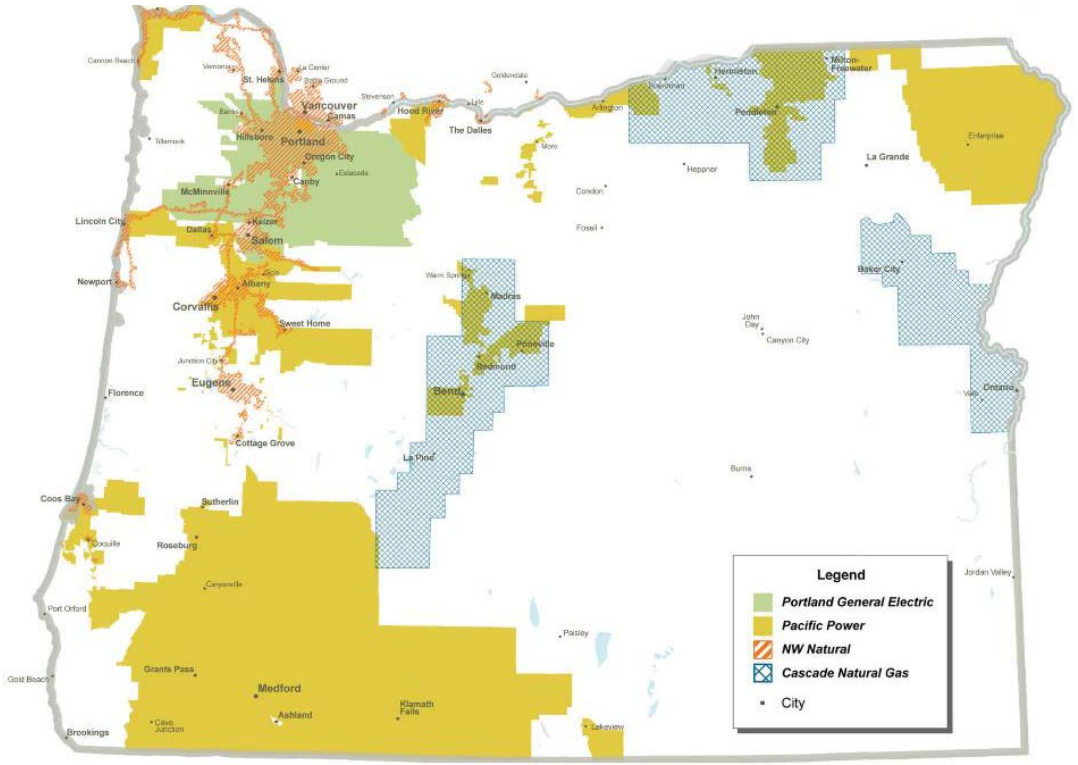
Daimler Trucks North America

October 13, 2016

EnergyTrust of Oregon

About Energy Trust

- Independent nonprofit
- Serving 1.5 million customers of Portland General Electric, Pacific Power, NW Natural and Cascade Natural Gas
- Providing access to affordable energy
- Generating homegrown, renewable power
- Building a stronger Oregon and SW Washington



New Buildings Events

Allies for Efficiency Training Series (AFE)

- Trainings on high-performance design and construction
- Takes place 3 times per year in Portland + regional events
- Registration priority for New Buildings Program Allies

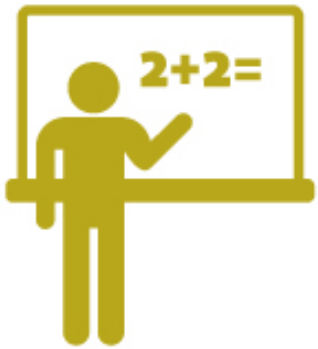
AFE 2.0

- Advanced training series for designers and architects
- Takes place 2 – 3 times per year
- Content is focused on specific techniques or technologies

Building Energy Simulation Forum (BESF)

- Advance energy modeling presentations
- Takes place every other month

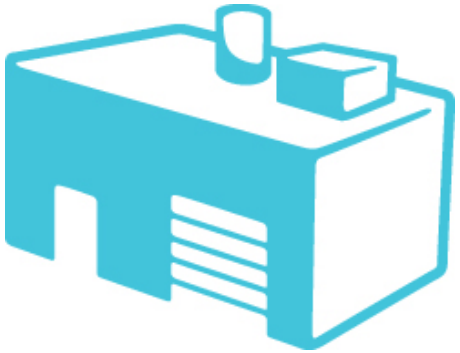
Upcoming Allies for Efficiency Trainings



December 7: Allies for Efficiency 2.0

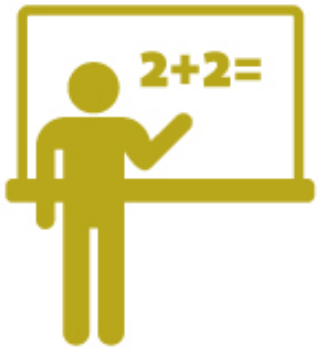
High Performance Design in Oregon

Portland, OR

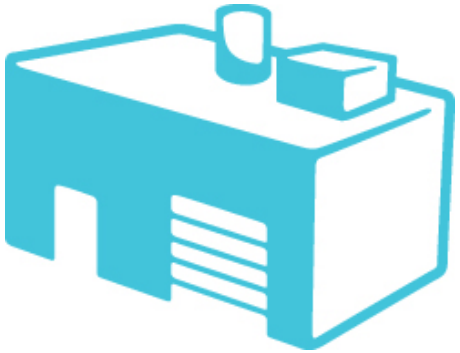


Presenting two regional case studies, energy efficiency and design at Cowhorn Vineyard and Unitarian Universalist Fellowship of Central Oregon

Upcoming Building Energy Simulation Forum Trainings



BESF takes place the third Wednesday of every other month at the Ecotrust Building at noon.



- **October 19:** “Understanding Building Infrastructure and Energy Efficiency Through the Department of Energy’s Asset Score Tool”

- **December 14:** *Date Changed*
  NREL – Open Studio Presentation

Training & Education Webpage

energytrust.org/commercial/training-and-events/

Net Zero Fellowship

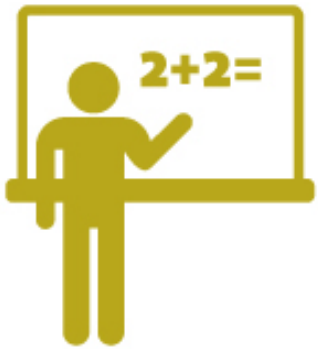
- Up to two fellowship grants, not to exceed a combined total of $50,000, to support net-zero energy research over 12 to18 months
- Funding for new research to advance design best practices, technologies and policies, and the overall net-zero community in Oregon
- Application deadline January 9, 2017
- Learn more at energytrust.org/zero

Questions?

Have questions about upcoming training and education opportunities *or* about becoming an Energy Trust New Buildings Ally?

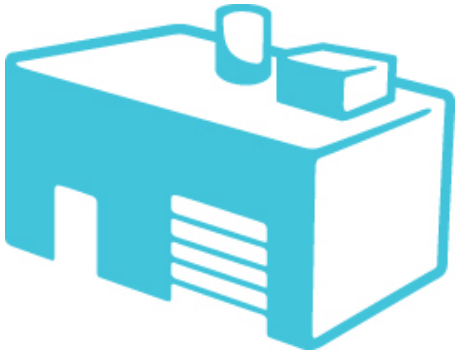
Contact Amanda.Davidowitz@clearesult.com

Allies for Efficiency: Daimler Trucks North America



Presentation 2:30-4:00 p.m.

- Matthew Markstaller, Real Estate Manager, Daimler Trucks North America
- Michael Great, Managing Principal, Connie Hotovec, Associate, and Jeff Wilder, Senior Associate - Ankrom Moisan Architects
- Mitchell Dec, Associate Principal, Glumac



Building Tour 4:00 – 5:00 p.m.

Allies for Efficiency: Daimler Trucks North America

Learning Objectives:

- Understand how the collaborative process with the design team and building owner led to effective decision-making strategies and a successful project.
- Learn how early energy analysis impacted the orientation, site placement and occupant health of the building.
- Learn how the design team created synergies between building systems to meet the RFP requirements. The course will cover how parametric analysis of envelope systems, HVAC energy consumption, thermal comfort, indoor air quality, and onsite renewable energy were utilized together.
- See how the design team and owners evaluated the building's performance during the post-occupancy measurement and verification period.
- Learn important tips for designing around dedicated outside air systems with radiant comfort systems in the occupied space.

Thank You

Amanda Davidowitz
Market Outreach Specialist
Amanda.Davidowitz@clearesult.com

EnergyTrust of Oregon

DAIMLER

Daimler Trucks North America – Corp HQ

Mercedes-Benz FUSO FREIGHTLINER WESTERN STAR Thomas BUILT BUSES

October 13, 2016

DAIMLER

A Subsidiary of Daimler AG

Trucks

Vans

Passenger cars

Daimler Trucks

DAIMLER

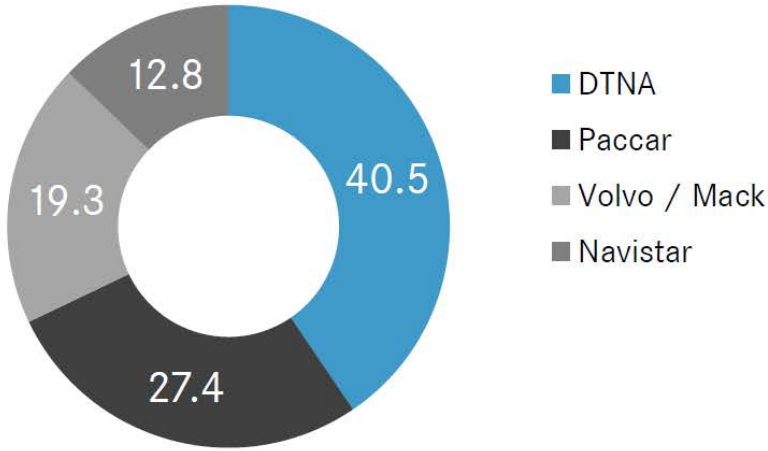
#1 Heavy and Medium Duty Truck Manufacturer in NAFTA

Energy efficiency is at the core of our business, we offer the most fuel efficient truck on the road

Freightliner Cascadia Evolution

2015 YTD Market Share, US Class 8

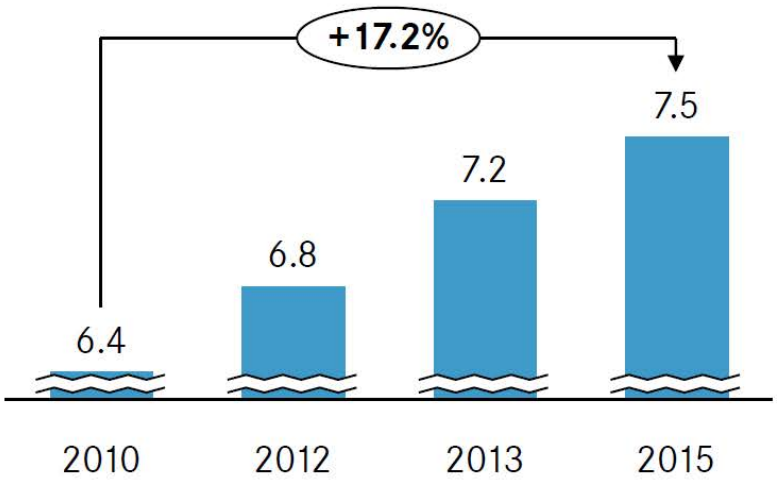
in percent



Today's Freightliner Cascadia is 17.2% more fuel efficient than in 2010, largely due to an integrated powertrain

Fuel Consumption – Portland to Pendelton route

average miles per gallon



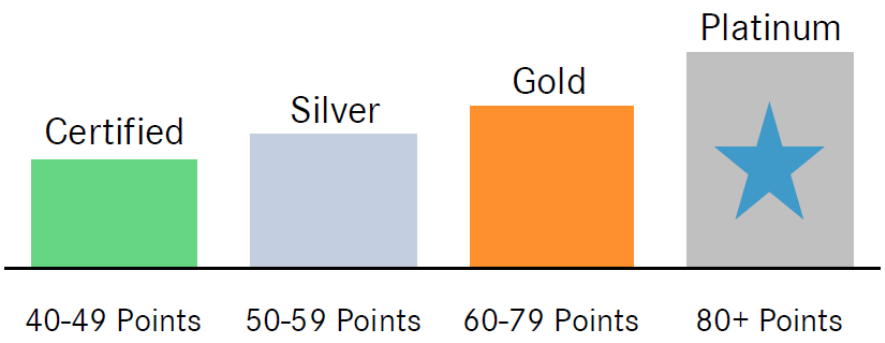
DAIMLER

Daimler Trucks North America
We bring the materials to your buildings...efficiently!

It only makes sense that our buildings are efficient and sustainable too

LEED Platinum exemplifies our commitment to waste-free, resource-optimized and CO_2-neutral production

Only 6% of LEED certified buildings have achieved Platinum



Project Achievements

- Will be in the top 1% in energy efficient office buildings nationwide
- 96% of materials during demolition kept out of landfill
- 13% of entire building energy use will be powered from onsite renewable energy

Project Aspirations

- Deliver an environmentally friendly and efficient building that aligns with DTNA's market position as the technology and fuel efficiency leader.
- Achieve LEED Platinum Certification.
- Send a strong and positive message to the public about DTNA's presence in Portland and serves as a vehicle to attract and retain top talent.
- Deliver an aesthetically exceptional and state-of-the-art building that contains workspaces and amenities that encourage and enhance employee/management productivity, collaboration and job satisfaction.

Going green is a good investment

Efficient Technologies Used:

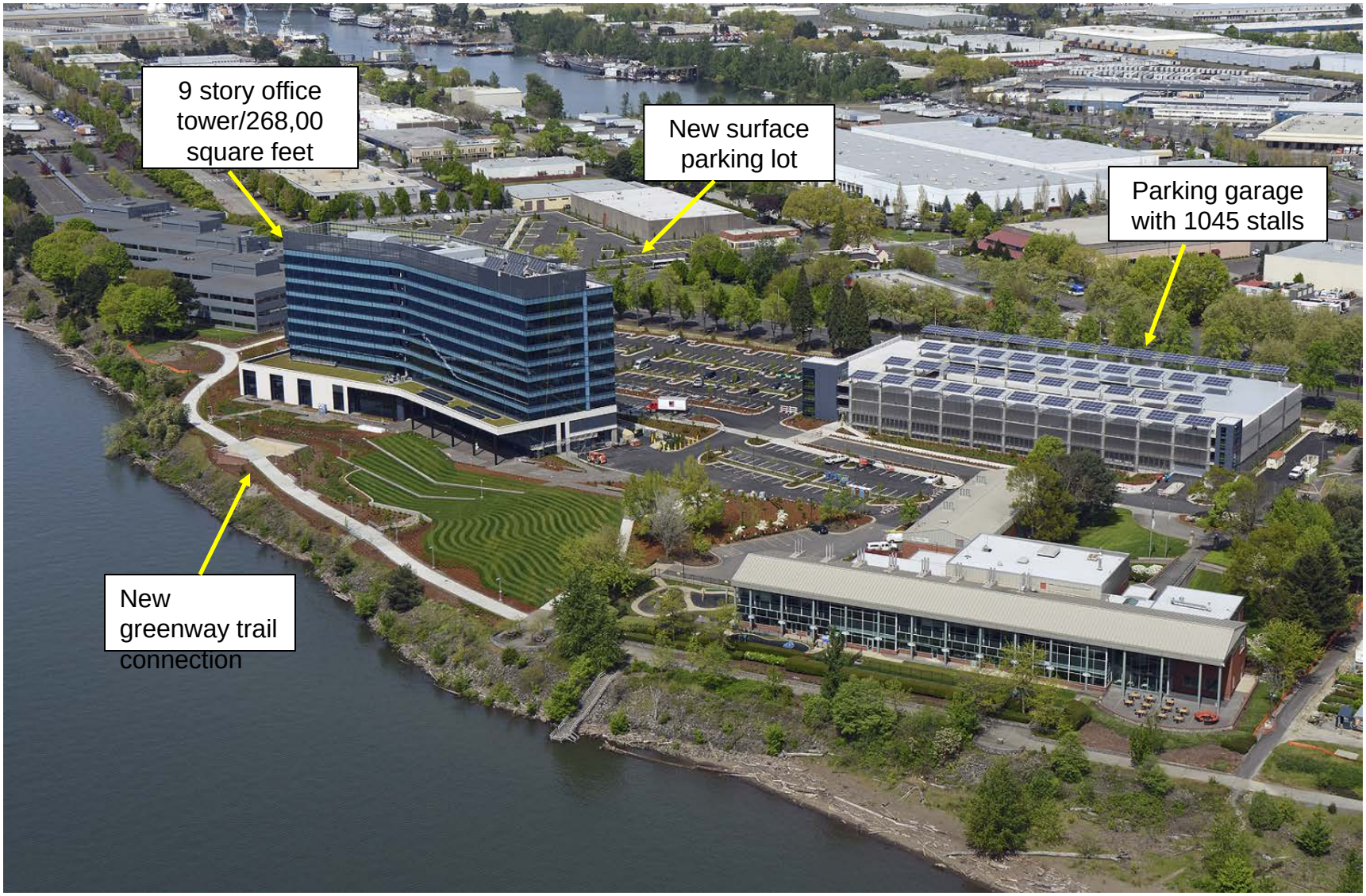
- Highly efficient HVAC with dedicated outside air system
- Alternative energy such as solar hot water and solar panels
- Low water use fixtures
- LED lighting and daylight controls
- Radiant slab floor
- Green roof to reduce heat generation and manage storm water
- Green building and finish materials

Impact: $200,000 per year in savings relative to a new building under today's code, and substantial savings relative to existing headquarter building

Features and attributes that contribute to employees' health, satisfaction and productivity:

- Ample natural light and access to outdoor spaces
- Smart HVAC systems to heat and cool discrete spaces (not a one size fits all approach)
- Low VOC emitting paint, carpet and furniture
- A multitude of different types of spaces where employees can work ("your workspace is no longer just your desk")
- Cubicle areas in small "pods" or "communities" – limited to 16-18 people
- Comfortable and ergonomic furniture, including sit to stand desks
- Intelligent outdoor air delivery
- Fitness room & interior bike storage

Project Nova




DAIMLER
DAIMLER

DAIMLER TRUCKS NORTH AMERICA

ALLIES FOR EFFICIENCY PRESENTATION

GLUMAC engineers for a sustainable future™

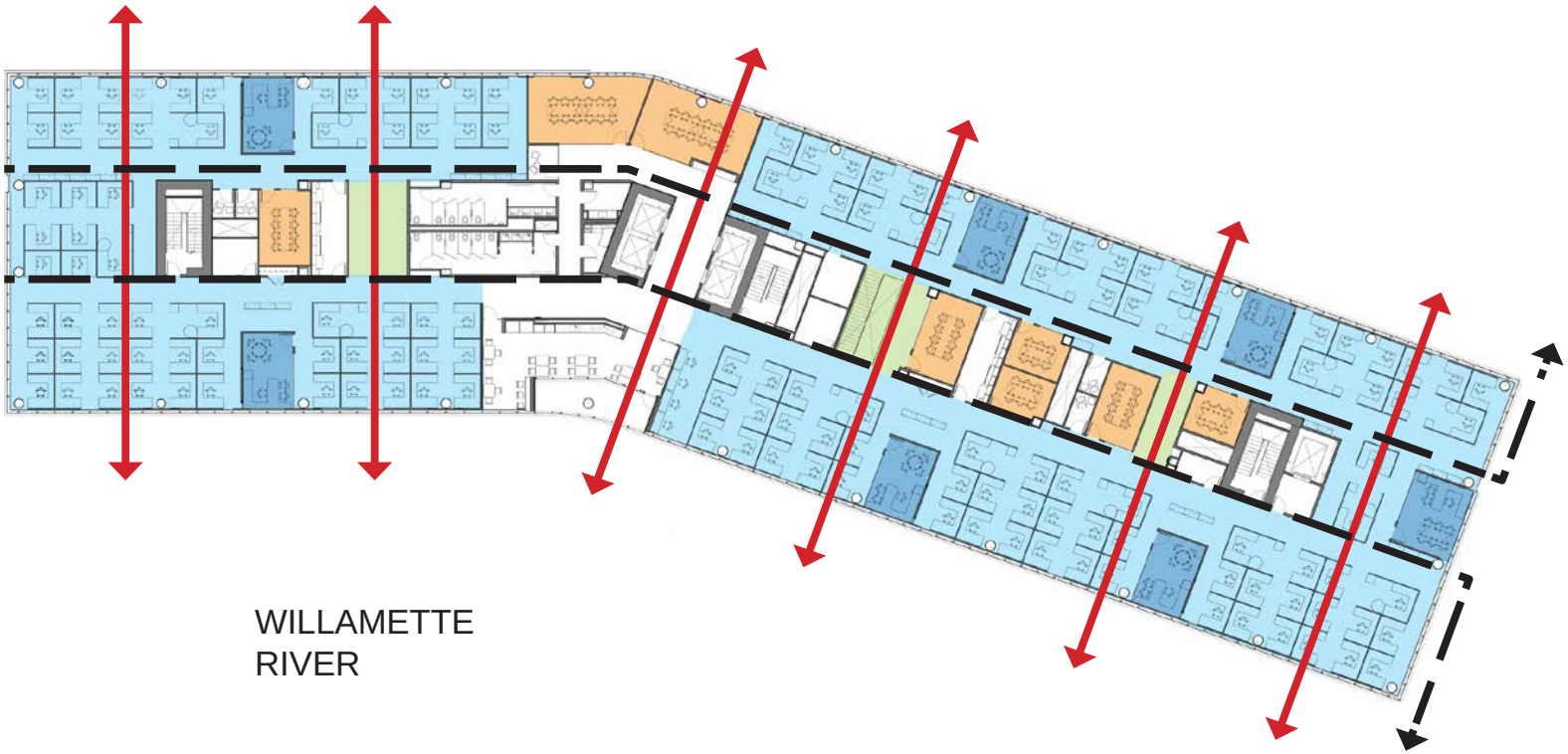
Ankrom Moisan

SITE ANALYSIS

Ankrom Moisan

SITE PLAN

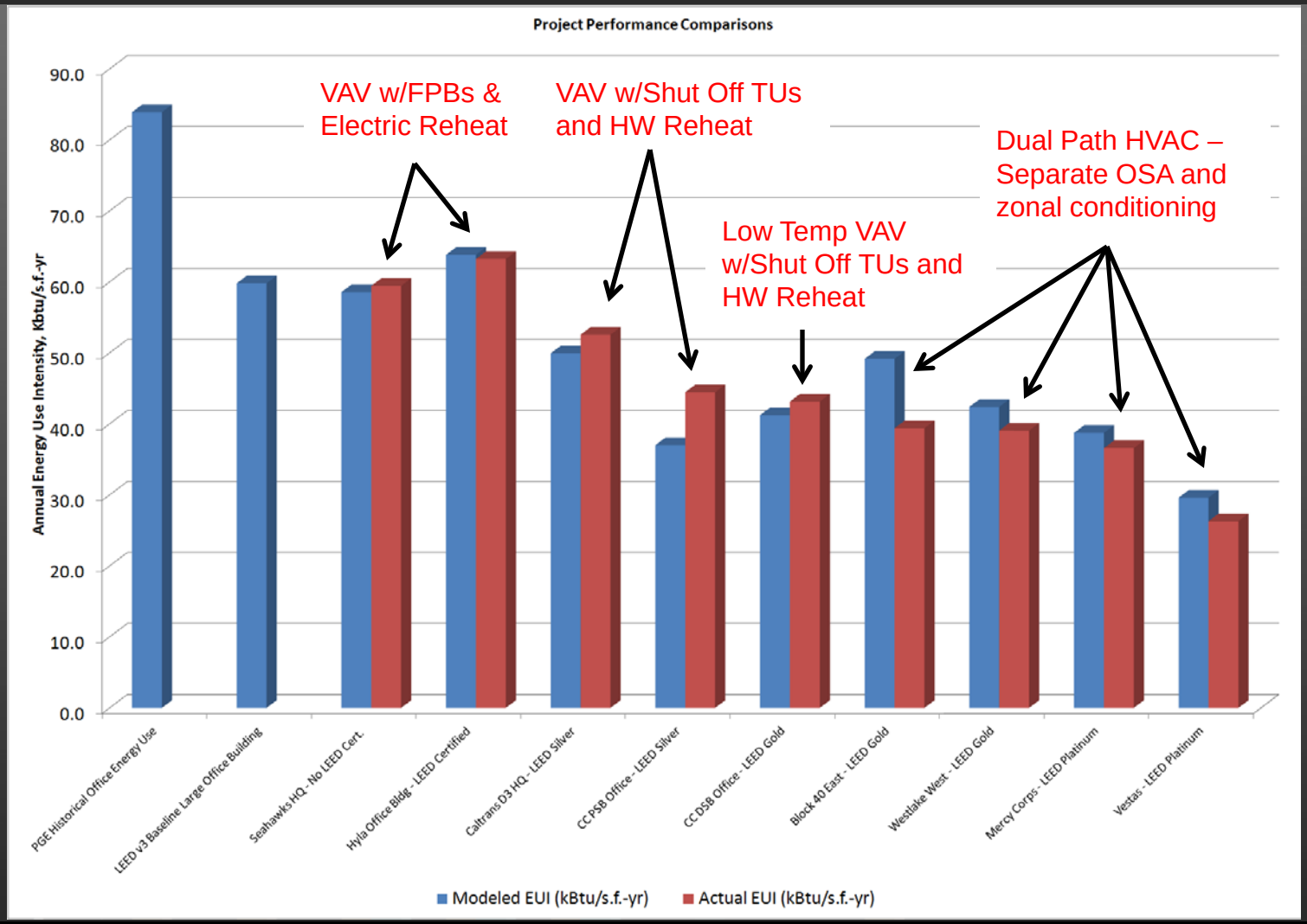
Ankrom Moisan



TYPICAL TOWER FLOORPLAN

Ankrom Moisan

Modeled vs. Actual Office Building Performance



ASHRAE 90.1 Baseline System Definition

TABLE G3.1.1A Baseline HVAC System Types

Building Type	Fossil Fuel, Fossil/Electric Hybrid, and Purchased Heat	Electric and Other
Residential	System 1—PTAC	System 2—PTHP
Nonresidential and 3 Floors or Less and <25,000 ft^2	System 3—PSZ-AC	System 4—PSZ-HP
Nonresidential and 4 or 5 Floors and <25,000 ft^2 or 5 Floors or Less and 25,000 ft^2 to 150,000 ft^2	System 5—Packaged VAV with Reheat	System 6—Packaged VAV with PFP Boxes
Nonresidential and More than 5 Floors or >150,000 ft^2	System 7—VAV with Reheat	System 8—VAV with PFP Boxes

Notes:

Residential building types include dormitory, hotel, motel, and multifamily. Residential space types include guest rooms, living quarters, private living space, and sleeping quarters. Other building and space types are considered nonresidential.

Where no heating system is to be provided or no heating energy source is specified, use the "Electric and Other" heating source classification.

Where attributes make a building eligible for more than one *baseline* system type, use the predominant condition to determine the system type for the entire building.

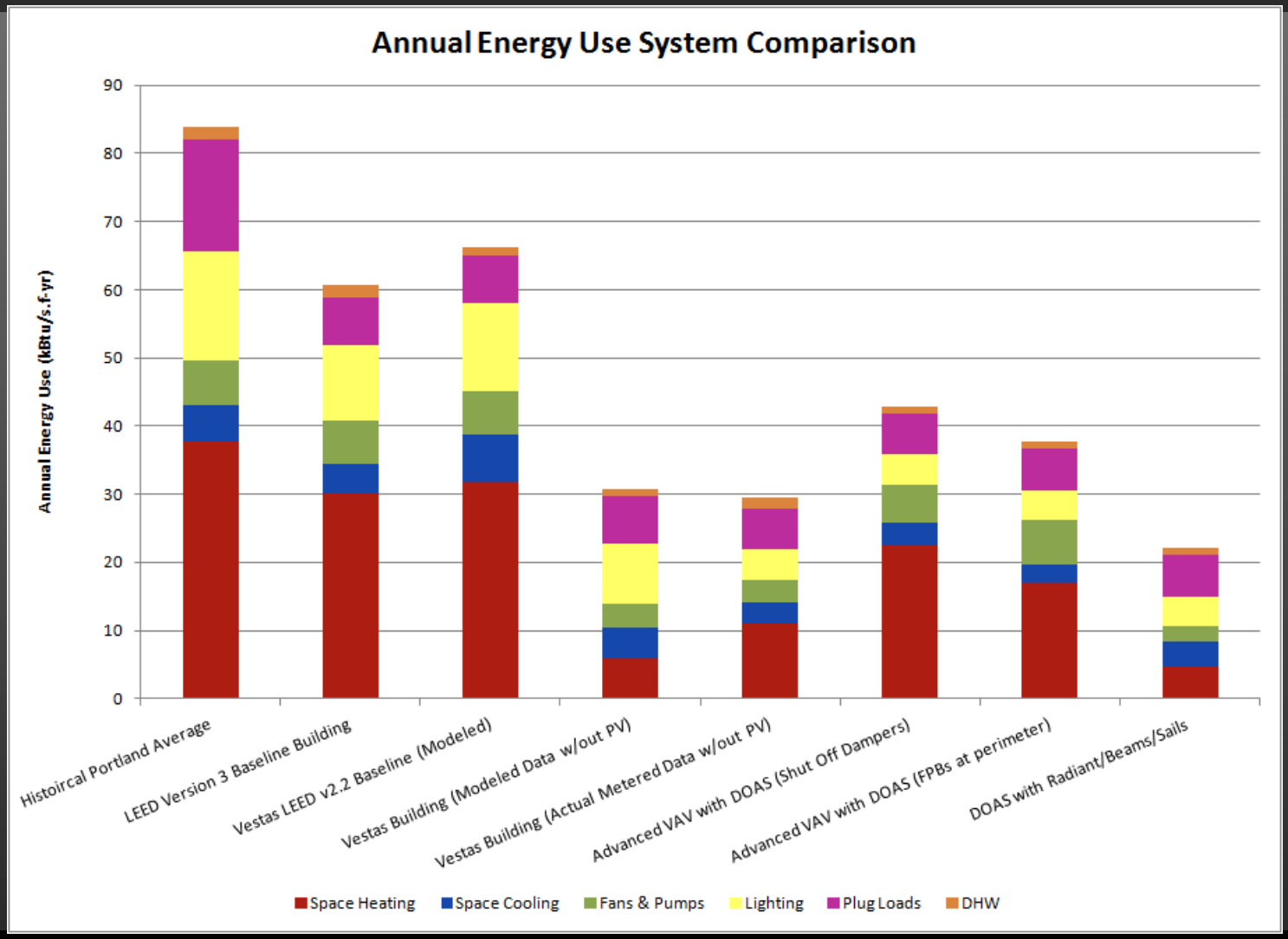
For laboratory spaces with a minimum of 5000 cfm of exhaust, use system type 5 or 7 and reduce the exhaust and makeup air volume to 50% of design values during unoccupied periods. For all-electric buildings, the heating shall be electric resistance.

ASHRAE 90.1 Baseline System Definition

TABLE G3.1.1B Baseline System Descriptions

System No.	System Type	Fan Control	Cooling Type	Heating Type
1. PTAC	Packaged terminal air conditioner	Constant volume	Direct expansion	Hot-water fossil fuel boiler
2. PTHP	Packaged terminal heat pump	Constant volume	Direct expansion	Electric heat pump
3. PSZ-AC	Packaged rooftop air conditioner	Constant volume	Direct expansion	Fossil fuel furnace
4. PSZ-HP	Packaged rooftop heat pump	Constant volume	Direct expansion	Electric heat pump
5. Packaged VAV with Reheat	Packaged rooftop VAV with reheat	VAV	Direct expansion	Hot-water fossil fuel boiler
6. Packaged VAV with PFP Boxes	Packaged rooftop VAV with reheat	VAV	Direct expansion	Electric resistance
7. VAV with Reheat	Packaged rooftop VAV with reheat	VAV	Chilled water	Hot-water fossil fuel boiler
8. VAV with PFP Boxes	VAV with reheat	VAV	Chilled water	Electric resistance

Energy Use Comparisons



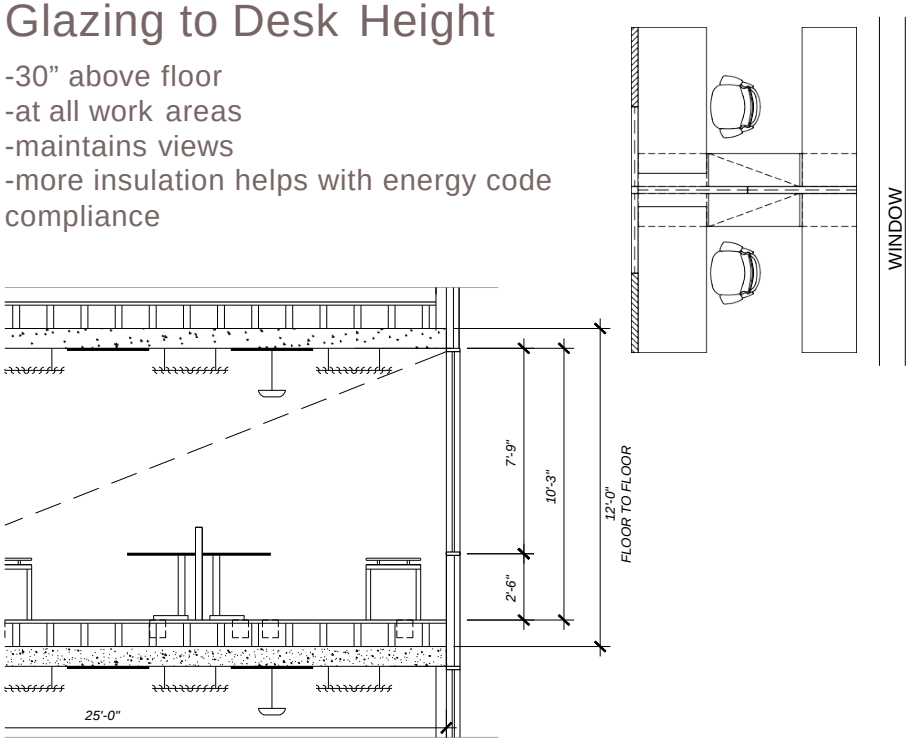
Energy Efficiency Measures – Decision Making

EEM #	Individual Energy Efficiency Measure	Location	See Note #	Additional Electricity Savings[6] (kWh/yr)	Additional Natural Gas Savings[6] (therms/yr)	Additional Energy Cost Savings	Additional Energy Cost Percent Savings[7]
Energy Efficiency Measures for Consideration							
1A	Increase wall insulation to achieve an overall U-value of 0.048. Construction would utilize 2.5" of XPS exterior of steel studs and R-13 batt insulation within the steel stud.	Exterior Wall		13,967	3,785	$5,490	1.6%
1B	Increase wall insulation to achieve an overall U-value of 0.040. Construction would utilize 2.5" of polystyrene exterior of steel studs and R-13 batt insulation within the steel stud.	Exterior Wall		16,761	5,442	$7,578	2.2%
1C	Increase wall insulation to achieve an overall U-value of 0.029. Construction would utilize 1" of Dow Corning Vacuum Insulated Panel (VIP) insulation within curtainwall assembly.	Exterior Wall		19,582	7,267	$9,854	2.8%
2A	Increase roof insulation to R-30 continuous insulation over roof deck.	Roof		8,062	1,947	$2,908	0.8%
2B	Increase roof insulation to R-40 continuous insulation over roof deck.	Roof		9,678	2,337	$3,490	1.0%
2C	Increase roof insulation to R-50 continuous insulation over roof deck.	Roof		11,103	2,597	$3,911	1.1%
3A	Reduce window U-value from 0.45 to 0.38 using fully thermal breaks in double pane curtain wall system and intercept spacer. Consider products such as EFCO 5500X curtainwall assembly.	Windows		20,532	3,266	$5,543	1.6%
3B	Reduce window U-value from 0.45 to 0.32 using advanced stick built curtainwall system with elimination of all thermal bridging in aluminum frame. Consider products such as Schucco curtainwall assembly.	Windows		37,131	6,065	$10,199	2.9%
3C	Reduce window U-value from 0.45 to 0.22 using either a fiberglass frame or using triple pane glass within a high perfromance aluminum frame like the EFCO 5500X, or equivalent, curtainwall system..	Windows		59,716	10,731	$17,477	5.0%
4A	Reduce SHGC from 0.39 (PPG Solarban 60 equivalent) to 0.27 (PPG Solarban 70XL equivalent).	Windows		73,996	-1,662	$5,201	1.5%
4B	Reduce SHGC from 0.39 (PPG Solarban 60 equivalent) to 0.23 (PPG Solarban R100 equivalent).	Windows		98,661	-2,216	$6,935	2.0%
5A	Reduce overhead lighting power density to 0.7 W/SF average for offices.	Lighting		220,447	-4,115	$16,416	4.7%
5B	Reduce overhead lighting power density to 0.5 W/SF average for offices.	Lighting		335,421	-6,738	$24,453	7.0%
6	Implement daylight dimming controls for the first 20 for all perimeter spaces.	Lighting		123,531	-512	$11,172	3.2%
7	Utilize vacancy sensors for all office areas - manual on, automatic off controlls.	Lighting		39,936	-341	$3,419	1.0%
8	Work station plug load reduction - set monitors to 50% brightness and install occupancy controlled plug strip to shut off non-critical plug loads when employees are away from their desk.	Plug Loads		102,211	-1,744	$7,792	2.2%
9	Refrigeration/Freezer Energy Use Reduction - use drybulb reset on condenser temperature, use VFDs on compressors/condensers/air units, and reject waste heat to a heat exchanger for kitchen domestic hot water preheating.	Kitchen		180,000	2,782	$20,160	5.8%
10A	Advanced VAV with DOAS.	Office HVAC		346,347	18,763	$53,542	15.3%
10B	DOAS with Chilled Sails or Radiant Panels, DOAS served through overhead air distribution.	Office HVAC		787,135	29,896	$107,663	30.7%
10C	DOAS with Chilled Sails or Radiant Panels, DOAS served through underfloor air distribution.	Office HVAC		908,736	34,368	$124,135	35.4%
11	Condensing Boilers	Contral Plant			8,962	$9,858	2.8%
12	Premium Efficiency Chiller, targeting average efficiency around 0.4-0.45 kW/ton.	Central Plant		86,452		$8,213	2.3%
13	Cooling tower with VFDs and reduced approach..	Central Plant		23,212		$2,205	0.6%
14A	170-kW PV Array (target 10% for EAc2)	Onsite Renewables		178,500		$16,958	4.8%
14B	340-kW PV Array (target 20% for EAc2)	Onsite Renewables		357,000		$33,915	9.7%
15	400-kW Fuel Cell from ClearEdge Power	Onsite Generation		3,153,600	-33,985	$262,209	74.8%
16	Ground source heat pump loop to connect central plant heating and cooling.	Central Plant		-79,000	12,000	$5,695	1.6%
17	Solar Hot Water - 40 panel array	Onsite Renewables			6,500	$7,150	2.0%
18	Sewer Heat Recovery	Central Plant			2,894	$3,183	0.9%
19	Condensing Domestic Hot Water Heaters	DHW			1,960	$2,156	0.6%
20	Low Flow Plumbing Fixtures (0.5 gpm lav sinks, 1.5 gpm showers for bike commuters)	DHW			2,492	$2,741	0.8%
Interactive combinations in the design							
A	EEMs 1A, 2A, 3A, 4A, 5B, 6, 7, 8, 9 10A, 11, 12, 13	-		1,150,617	28,016	$140,126	40.0%
B	Package A but replace 10A with 10B	-		1,525,287	37,479	$186,129	53.1%
C	Package A but replace 10A with 10C	-		1,628,648	41,280	$200,130	57.1%
D	Package B + 14A	-		1,703,787	37,479	$203,087	57.9%
E	Package B + 14B	-		1,882,287	37,479	$220,044	62.8%

08.20.2013

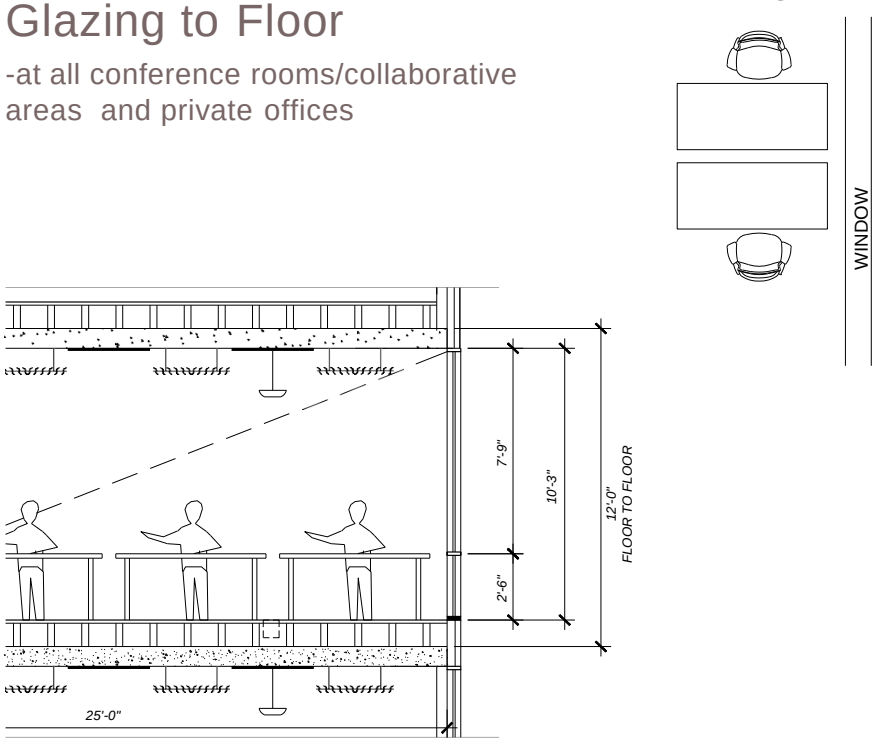
Glazing to Desk Height

-30” above floor
-at all work areas
-maintains views
-more insulation helps with energy code compliance

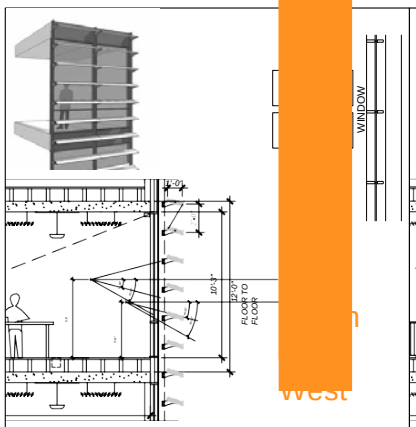


Glazing to Floor

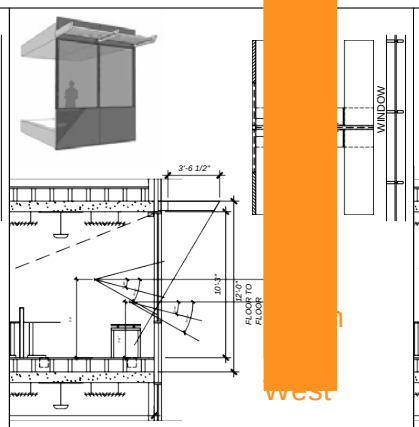
-at all conference rooms/collaborative areas and private offices



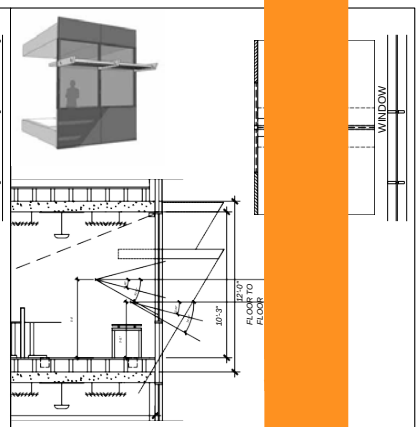
Sunshading - Studies



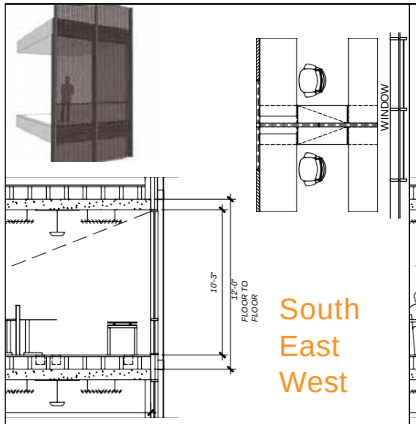
Horizontal Sunshades - 18-20" vertically



Horizontal Sunshade at window head

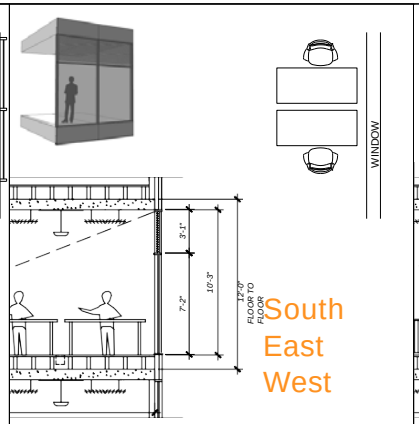


Horizontal Sunshades w/ ligh



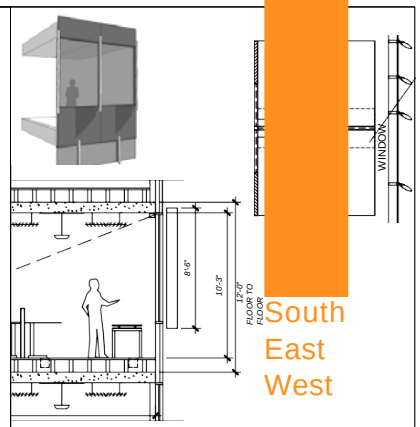
South
East
West

Exterior Screen



South
East
West

Integrated Solution - Sage/Pythagoras



South
East
West

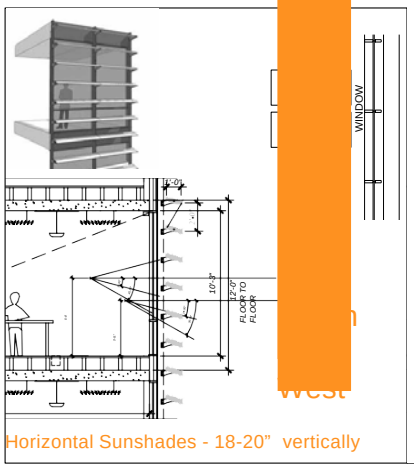
Vertical Sunshades (angled)

Considerations

- River Glare
- Views
- Solar heat gain pertaining to heating/cooling system
- Thermal comfort (employees seated near windows)
- Cost
- Aesthetic (how does it fit the Daimler story)
- Window cleaning
- Birds/Maintenance

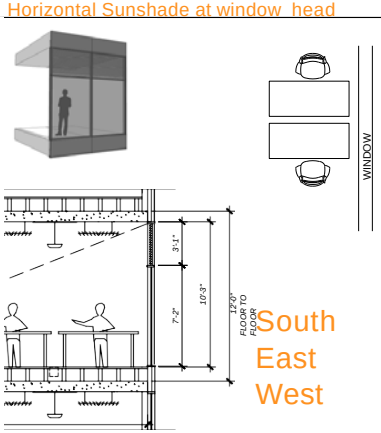
08.20.2013

Sunshading - Recommended

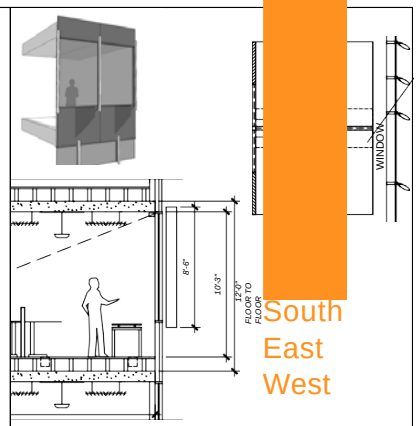


Horizontal Sunshades - 18-20" vertically

Horizontal Sunshade at window head



Integrated Solution - Sage/Pythagoras

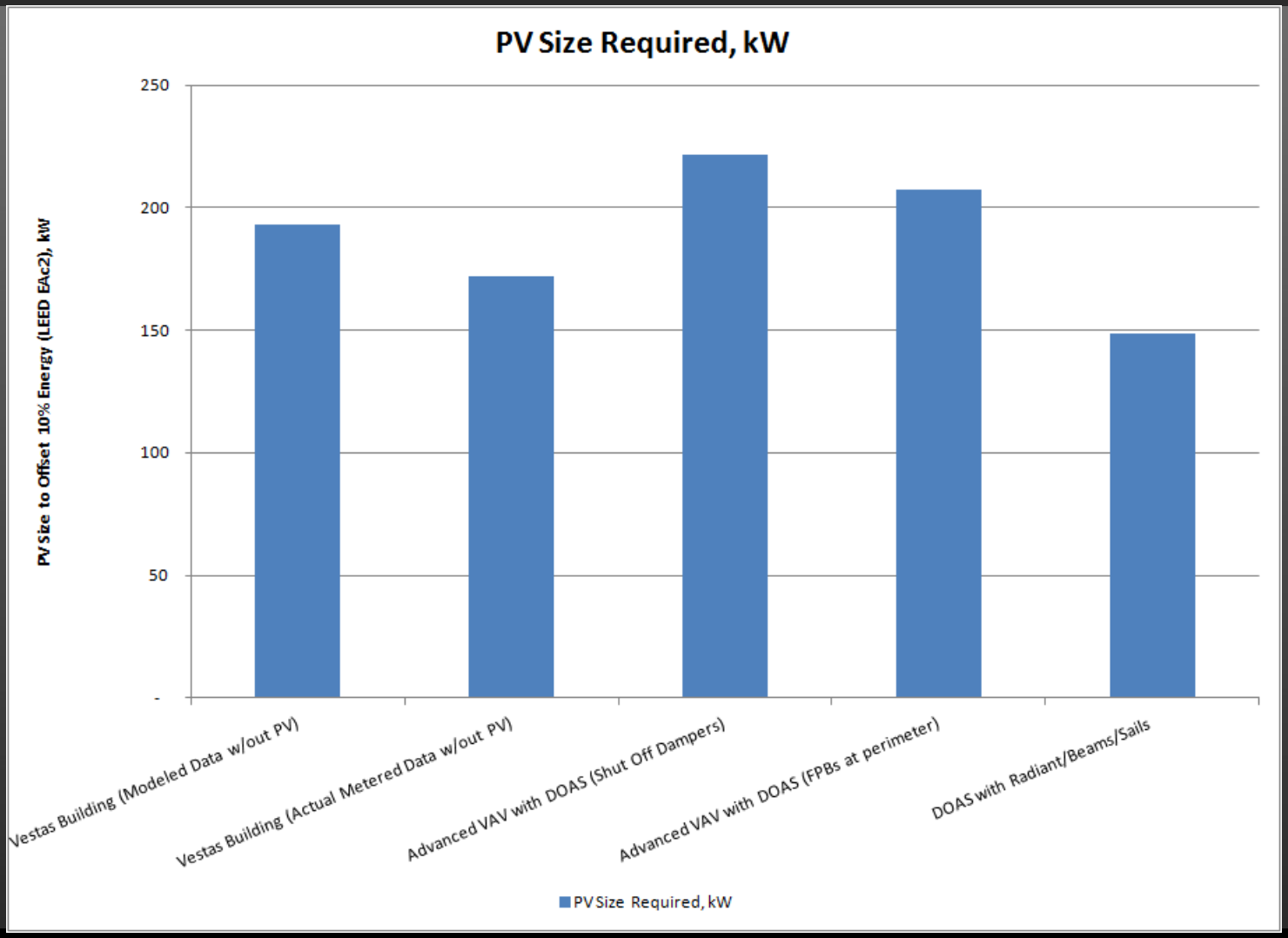


Vertical Sunshades (angled)

Considerations

- River Glare
- Views
- Solar heat gain pertaining to heating/cooling system
- Thermal comfort (employees seated near windows)
- Cost
- Aesthetic (how does it fit the Daimler story)
- Window cleaning
- Birds/Maintenance

PV Sizing for 10% Onsite Renewable



LEED Point Contribution By System

End Use	Historical Portland Office Building (mix of VAV, Multizone, and Double Duct)	LEED Version 3 Baseline Building	Vestas Building (Modeled Data w/out PV)	Vestas Building (Actual Metered Data w/out PV)	Advanced VAV with DOAS (Shut Off Dampers)	Advanced VAV with DOAS (FPBs at perimeter)	DOAS with Radiant/Beams/Sails
Space Heating	37.7	30.2	5.8	11.1	22.6	17.0	4.7
Space Cooling	5.3	4.2	4.6	3.0	3.2	2.7	3.6
Fans & Pumps	6.7	6.4	3.5	3.4	5.6	6.6	2.3
Lighting	16	11.2	8.8	4.4	4.4	4.4	4.4
Plug Loads	16.4	7.0	7.0	6.0	6.0	6.0	6.0
DHW	1.8	1.8	1.1	1.5	1.1	1.1	1.1
Total w/out PV	83.9	60.7	30.7	29.4	42.9	37.7	22.1
Annual Operating Cost, per sq. ft.	$ 1.76	$ 1.17	$ 0.69	$ 0.61	$ 0.79	$ 0.74	$ 0.53
LEED, EAc1 Percent Savings	n/a	n/a	41%	48%	32%	37%	55%
10% PV Offset Contribution - Assuming 265,000 SF Building							
Site Annual Energy Cost			$ 182,623	$ 162,559	$ 209,350	$ 196,100	$ 140,450
Annual Electricity Offset Required, kWh			202,915	180,621	232,611	217,889	156,056
PV Size Required, kW			193	172	222	208	149
PV Area Required, sq. ft.			12,883	11,468	14,769	13,834	9,908
Site Area Required, sq. ft.			25,767	22,936	29,538	27,668	19,817
Estimated Cost of PV Array			$ 1,014,574	$ 903,103	$ 1,329,206	$ 1,245,079	$ 780,278

EAc1: 19 points

HVAC accounts for 14 points

EAc1: 11 points

HVAC accounts for 8 points

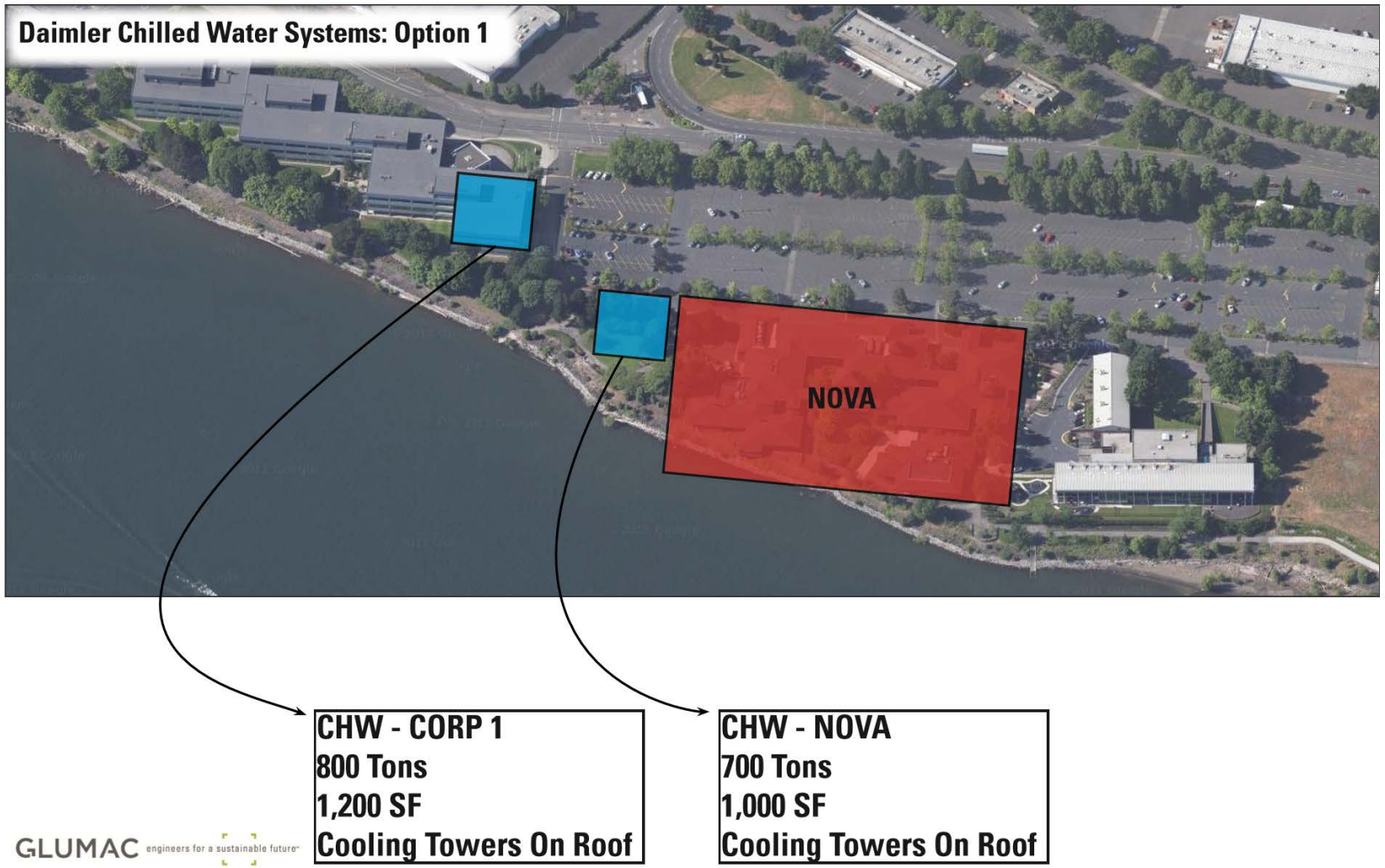
EAc1: 13 points

HVAC accounts for 10 points

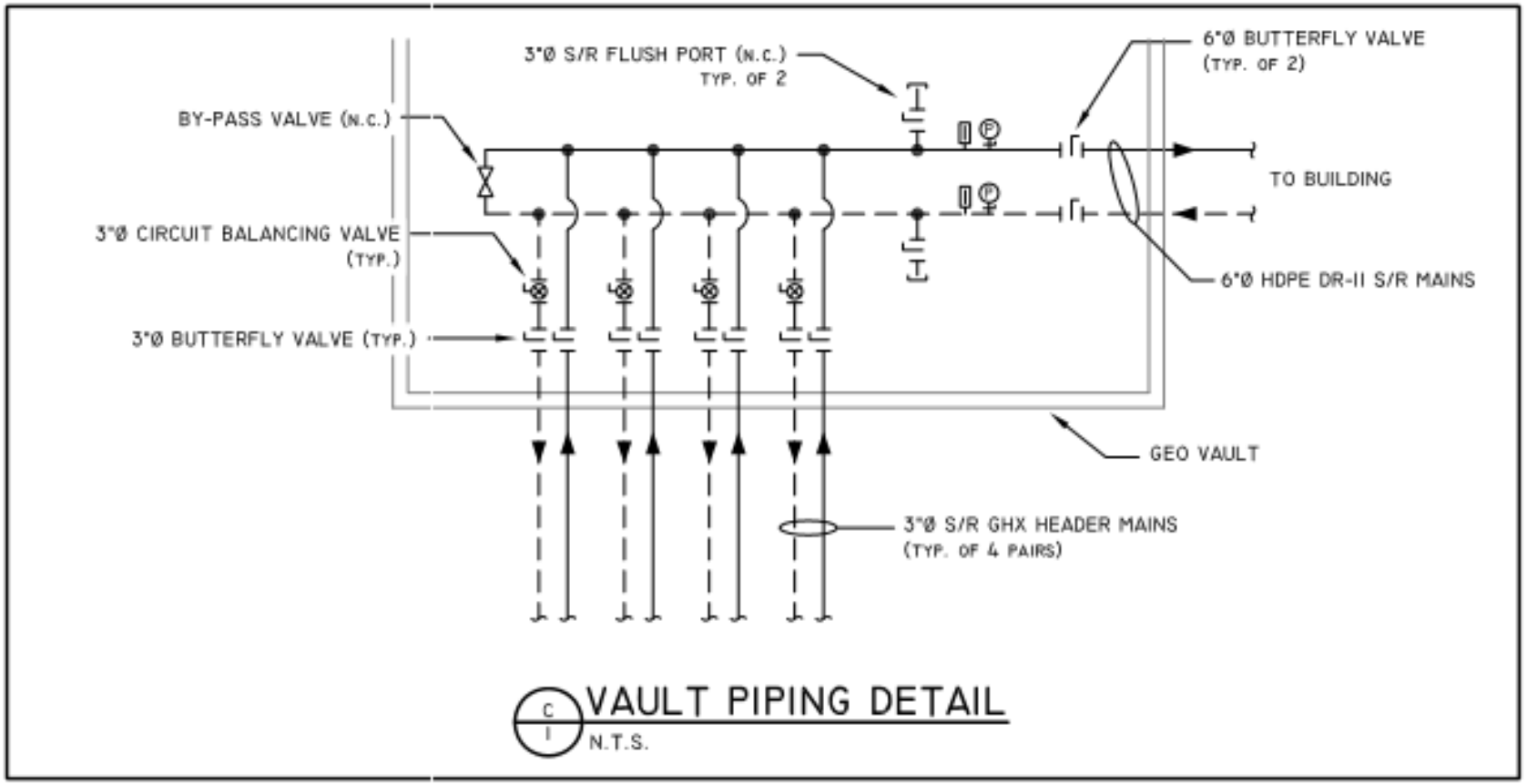
EAc1: 19 points

HVAC accounts for 15 points

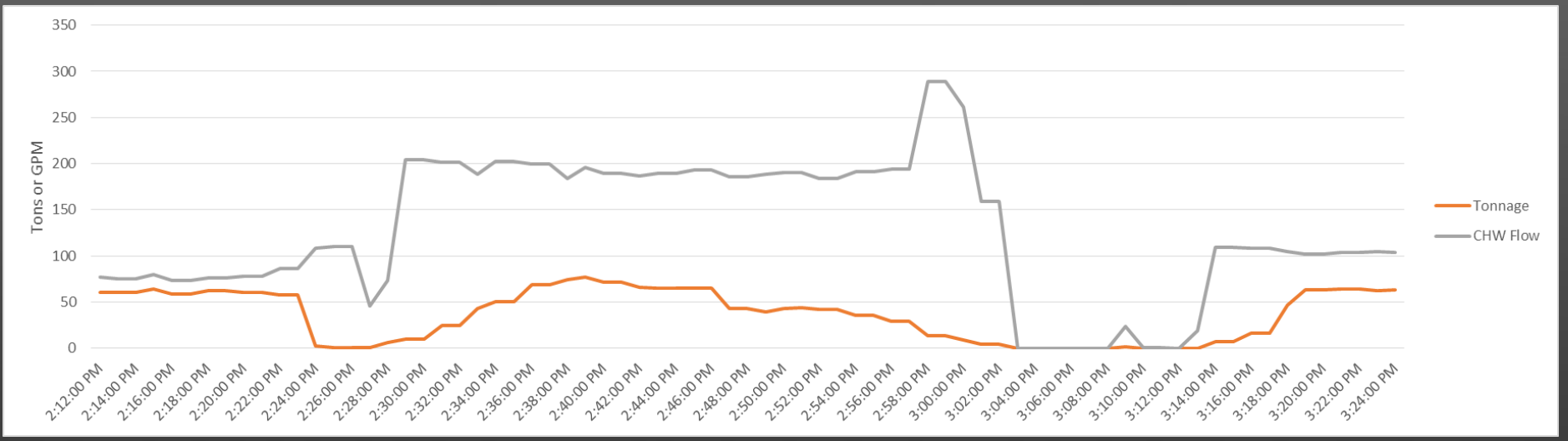
Design Challenges & Lessons Learned



Design Challenges & Lessons Learned



Design Challenges & Lessons Learned



LESSONS LEARNED

- MANAGING OCCUPANT EXPECTATIONS

- SYSTEM COMPLEXITY

QUESTIONS?