

A wide-angle photograph of the New York City skyline at dusk, viewed from across a body of water. The sky is a deep blue, and the city lights are beginning to glow. In the foreground, the water is dark, and several rows of dark, vertical posts or pilings extend into it. The text 'A'18 AIA Conference on Architecture 2018 June 21-23, New York City' is overlaid in white, with 'A'18' being significantly larger than the rest of the text.

A'18 AIA Conference on Architecture 2018
June 21-23, New York City

Health, Net Zero and the Pursuit of Happiness

TH113

7:00-8:00 AM Thursday,
June 21, 2018

1.00 LU HSW RIBA

A'18 AIA Conference on Architecture 2018
June 21-23, New York City



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Speakers List

- Session Organizer; Marc Schneiderman, Assoc. AIA, Principal, SmithGroupJJR
- Seminar Presenter; Don Posson, Vice President, SmithGroupJJR
- Seminar Presenter; Christopher Gorthy, Leadership Team, DPR Construction

Course / Learning Objectives

- Evaluate goals among various rating systems and certifications.
- Use data to drive decision-making and identify the most advantageous and efficient mechanical system to achieve LEED CI v4 and net zero energy, health, and well-being goals.
- Leverage in-depth employee surveys and feedback to design a workplace of the future that invigorates people and encourages creative work practices.
- Explore how virtual reality and computational fluid dynamics can drive sustainable decision-making, maximizing natural and artificial light resources to reduce energy needs during daylight hours.



Why it's Important

A'18

Context

DPR Phoenix HQ



Building Envelope

BEFORE



Tenant Space

Legacy

DPR Phoenix HQ



Net Zero Energy

AFTER



Workplace of the Future



**What needs
to be
considered?**

A'18

Context



Building Entry



Tenant Space

Legacy



Building Entry



Shared Space

Project Vision

- Create an **office of the future** that invigorates our people and encourages creative and efficient work practices.
- Do the right thing by incorporating **sustainable strategies** that contribute to the health and well-being of the environment and our people.
- Make data **driven-decisions** based on cost analysis, payback decisions and team member expertise.
- Build a **living laboratory** where we showcase technologies, products and systems, along with a robust educational program.

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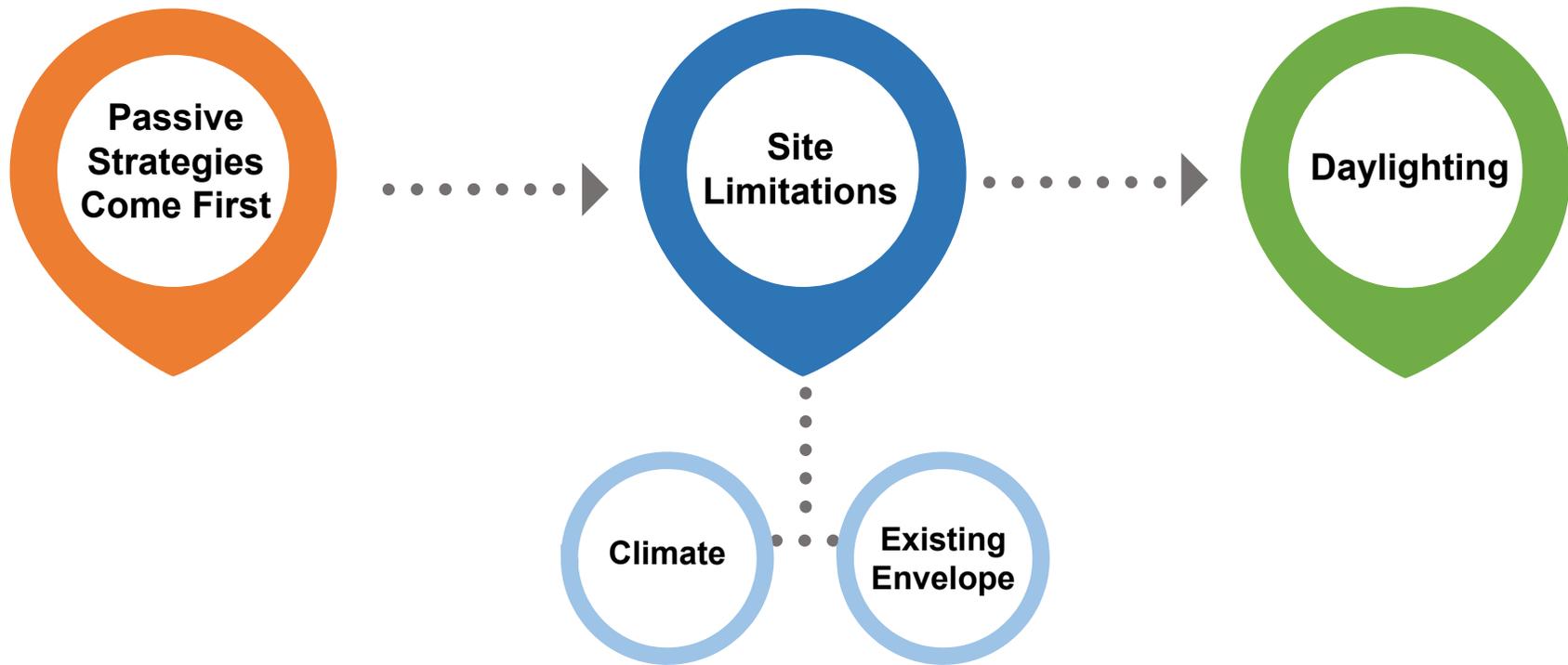
Build it here and they will come

Project Basics

- Existing Building
 - 2 Story, 40,000 SF
 - Unoccupied for 7 Yrs
- DPR Lease Entire 2nd Floor
 - 10 Year Lease
 - 20,000 SF
 - Energy by Tenant
 - Roof Access
- ½ Mile from Wiehle Metro
- 200 Yards from W&OD Trail

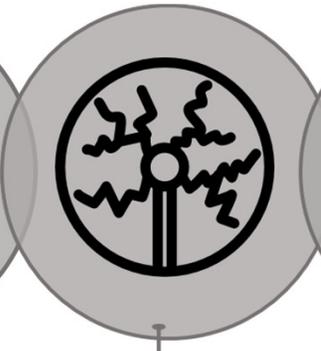


Sustainable Pathways

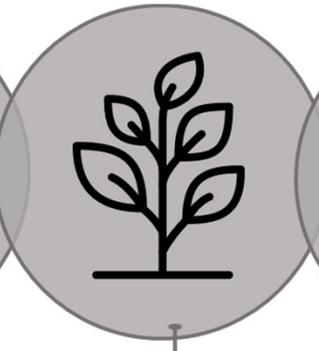




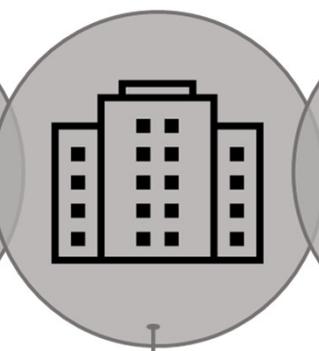
of Design Awards



Targeting NetZero



Targeting WELL



Top 4% of workplaces in Leesman Survey



Return On Investment





The Supporting Evidence

A'18

Proof



Reception



Main Pantry

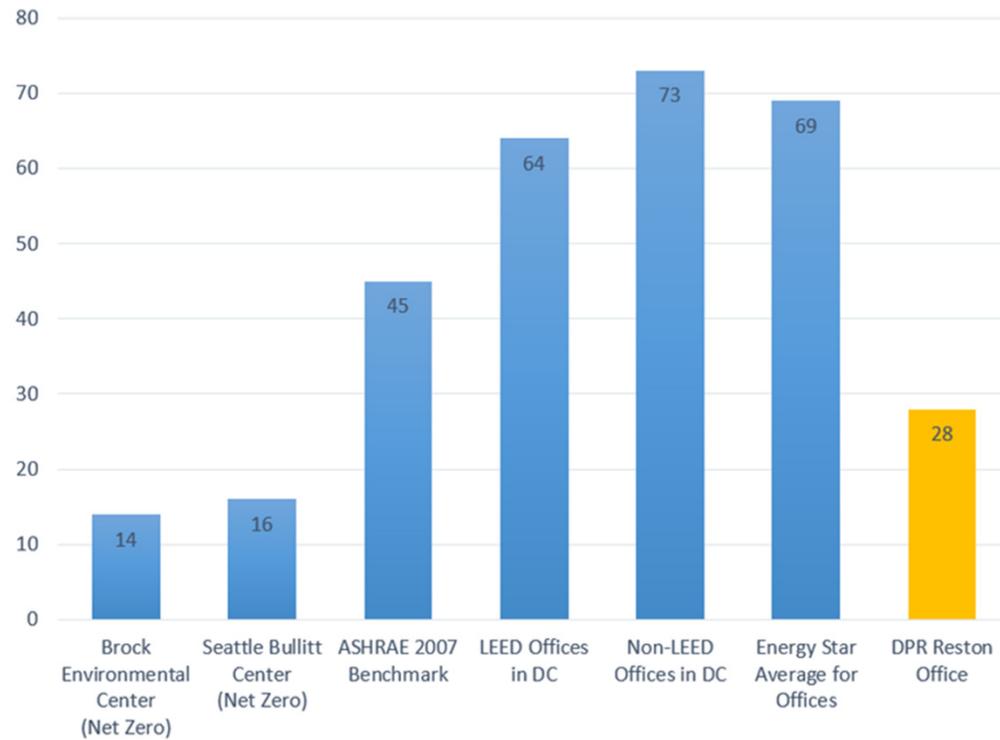
LEED CI v4 Scorecard

Y	?	N		
2			Credit	Integrative Process
				2
11	0	7		Location and Transportation
			Credit	LEED for Neighborhood Development Location
				18
5		3	Credit	Surrounding Density and Diverse Uses
				8
3		4	Credit	Access to Quality Transit
				7
1			Credit	Bicycle Facilities
				1
2			Credit	Reduced Parking Footprint
				2
6	0	6		Water Efficiency
				12
Y			Prereq	Indoor Water Use Reduction
				Required
6		6	Credit	Indoor Water Use Reduction
				12
37	0	1		Energy and Atmosphere
				38
Y			Prereq	Fundamental Commissioning and Verification
				Required
Y			Prereq	Minimum Energy Performance
				Required
Y			Prereq	Fundamental Refrigerant Management
				Required
4		1	Credit	Enhanced Commissioning
				5
25			Credit	Optimize Energy Performance
				25
2			Credit	Advanced Energy Metering
				2
3			Credit	Renewable Energy Production
				3
1			Credit	Enhanced Refrigerant Management
				1
2			Credit	Green Power and Carbon Offsets
				2
7	0	6		Materials and Resources
				13
Y			Prereq	Storage and Collection of Recyclables
				Required
Y			Prereq	Construction and Demolition Waste Management Planning
				Required
1			Credit	Long-Term Commitment
				1
2		2	Credit	Interiors Life-Cycle Impact Reduction
				4
1		1	Credit	Building Product Disclosure and Optimization - Environmental Product Declarations
				2
		2	Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials
				2
1		1	Credit	Building Product Disclosure and Optimization - Material Ingredients
				2
2			Credit	Construction and Demolition Waste Management
				2

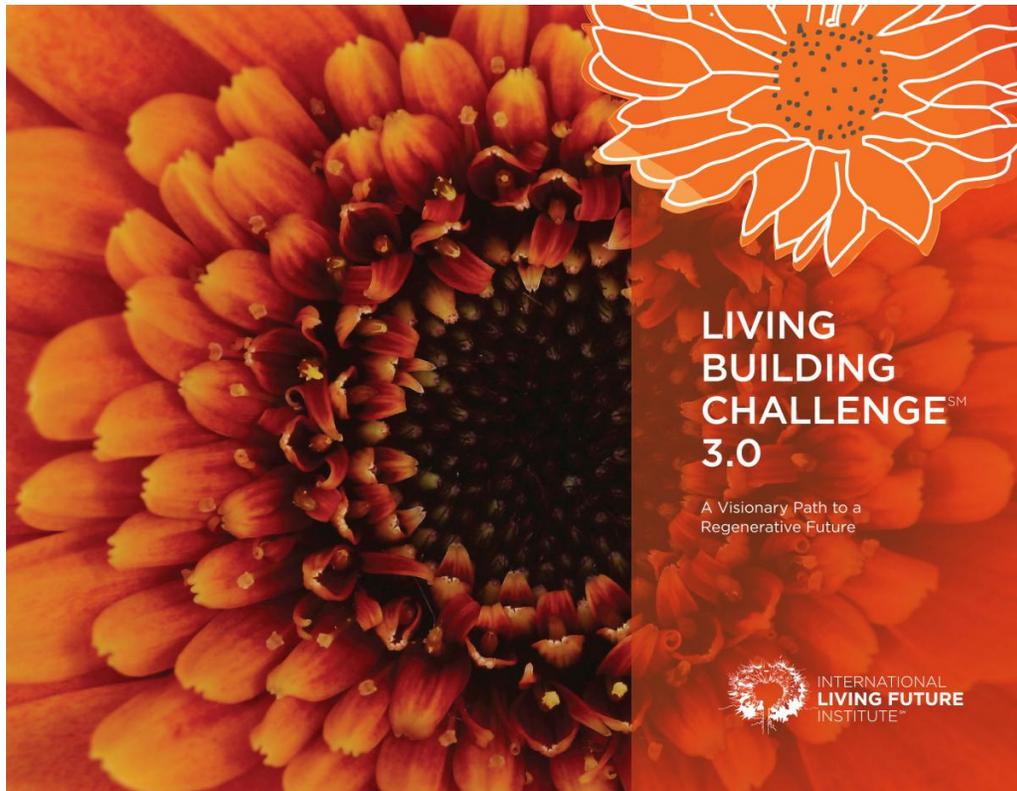
Y	?	N		
9	2	6		Indoor Environmental Quality
				17
Y			Prereq	Minimum Indoor Air Quality Performance
				Required
Y			Prereq	Environmental Tobacco Smoke Control
				Required
2			Credit	Enhanced Indoor Air Quality Strategies
				2
2		1	Credit	Low-Emitting Materials
				3
1			Credit	Construction Indoor Air Quality Management Plan
				1
1		1	Credit	Indoor Air Quality Assessment
				2
		1	Credit	Thermal Comfort
				1
1		1	Credit	Interior Lighting
				2
1		2	Credit	Daylight
				3
1			Credit	Quality Views
				1
2			Credit	Acoustic Performance
				2
6	0	0		Innovation
				6
5			Credit	Innovation
				5
1			Credit	LEED Accredited Professional
				1
2	1	1		Regional Priority
				4
1			Credit	Regional Priority: Specific Credit
				1
1			Credit	Regional Priority: Specific Credit
				1
		1	Credit	Regional Priority: Specific Credit
				1
		1	Credit	Regional Priority: Specific Credit
				1
80	3	27		TOTALS
				Possible Points: 110

Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80+

EUI Benchmarking



ILFI



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IMPERATIVE		Preliminary Audit	Final Audit
01	Limits to Growth	x	
02	Urban Agriculture		x
03	Habitat Exchange	x	
04	Human Powered Living	x	
05	Net Positive Water		x
06	Net Positive Energy		x
07	Civilized Environment	x	
08	Healthy Interior Environment		x
09	Biophilic Environment	x	
10	Red List	x	
11	Embodied Carbon Footprint	x	
12	Responsible Industry	x	
13	Living Economy Sourcing	x	
14	Net Positive Waste		x
15	Human Scale + Humane Places		x
16	Universal Access to Nature and Place	x	
17	Equitable Investment		x
18	JUST Organizations	x	
19	Beauty + Spirit		x
20	Inspiration + Education	x	

Well Building Institute



AIR				
Y	?	N		
Y			P	01 Air Quality Standards*
Y			P	02 Smoking Ban*
Y			P	03 Ventilation Effectiveness
Y			P	04 VOC Reduction
Y			P	05 Air Filtration*
Y			P	06 Microbe And Mold Control*
Y			P	07 Construction Pollution Management
Y			O	08 Healthy Entrance*
Y			P	09 Cleaning Protocol
			n/a	10 Pesticide Management
Y			P	11 Fundamental Material Safety
			n/a	12 Moisture Management
Y			O	13 Air Flush
Y			O	14 Air Infiltration Management
			N	15 Increased Ventilation
			N	16 Humidity Control*
			N	17 Direct Source Ventilation*
Y			O	18 Air Quality Monitoring And Feedback*
			N	19 Operable Windows*
Y			O	20 Outdoor Air Systems
			N	21 Displacement Ventilation
			N	22 Pest Control*
			O	23 Advanced Air Purification*
			O	24 Combustion Minimization*
			N	25 Toxic Material Reduction
Y			O	26 Enhanced Material Safety
			N	27 Antimicrobial Activity for Surfaces
			N	28 Cleanable Environment*
Y			O	29 Cleaning Equipment*
16	0	9		TOTAL

WATER				
Y	?	N		
Y			P	30 Fundamental Water Quality*
Y			P	31 Inorganic Contaminants*
Y			P	32 Organic Contaminants*
Y			P	33 Agricultural Contaminants*
Y			P	34 Public Water Additives*
Y			O	35 Periodic Water Quality Testing
			N	36 Water Treatment*
Y			O	37 Drinking Water Promotion*
7	0	1		TOTAL

NOURISHMENT				
Y	?	N		
Y			P	38 Fruits And Vegetables*
Y			P	39 Processed Foods*
Y			P	40 Food Allergies*
Y			P	41 Hand Washing*
n/a			P	42 Food Contamination*
Y			P	43 Artificial Ingredients*
Y			P	44 Nutritional Information*
Y			P	45 Food Advertising*
			N	46 Safe Food Preparation Materials*
Y			O	47 Serving Sizes*
Y			O	48 Special Diets
			N	49 Responsible Food Production
Y			O	50 Food Storage*
			N	51 Food Production*
Y			O	52 Mindful Eating
12	0	3		TOTAL

LIGHT				
Y	?	N		
Y			P	53 Visual Lighting Design*
Y			P	54 Circadian Lighting Design*
Y			P	55 Electric Light Glare Control
Y			P	56 Solar Glare Control*
Y			O	57 Low-Glare Workstation Design*
Y			O	58 Color Quality
			N	59 Surface Design
			N	60 Automated Shading And Dimming Control
Y			O	61 Right To Light*
			N	62 Daylight Modeling
			N	63 Daylighting Fenestration*
7	0	4		TOTAL

FITNESS				
Y	?	N		
			N	64 Interior Fitness Circulation*
Y			P	65 Activity Incentive Programs
			N	66 Structured Fitness Opportunities
Y			O	67 Exterior Active Design*
Y			O	68 Physical Activity Spaces
Y			O	69 Active Transportation Support*
Y			O	70 Fitness Equipment*
			O	71 Active Furnishings*
5	0	2		TOTAL

COMFORT				
Y	?	N		
Y			P	72 Accessible Design
Y			P	73 Ergonomics: Visual And Physical*
Y			O	74 Exterior Noise Intrusion*
Y			P	75 Internally Generated Noise*
Y			P	76 Thermal Comfort*
			N	77 Olfactory Comfort*
Y			O	78 Reverberation Time*
			N	79 Sound Masking*
			N	80 Sound Reducing Surfaces
			N	81 Sound Barriers
Y			O	82 Individual Thermal Control*
			N	83 Radiant Thermal Comfort
7	0	5		TOTAL

MIND				
Y	?	N		
Y			P	84 Health And Wellness Awareness*
Y			P	85 Integrative Design
Y			P	86 Post-Occupancy Surveys
Y			P	87 Beauty And Design I*
Y			P	88 Biophilia I - Qualitative*
Y			O	89 Adaptable Spaces*
			N	90 Healthy Sleep Policy
			N	91 Business Travel
Y			O	92 Building Health Policy
Y			O	93 Workplace Family Support
Y			O	94 Self-Monitoring
Y			O	95 Stress And Addiction Treatment
Y			O	96 Altruism
Y			O	97 Material Transparency*
	?		O	98 Organizational Transparency*
	?		O	99 Beauty And Design II*
			N	100 Biophilia II - Quantitative*
Y			O	101 Innovation Feature I
			N	102 Innovation Feature II
			O	103 Innovation Feature III
			O	104 Innovation Feature IV
			O	105 Innovation Feature V
13	2	4		TOTAL

SUMMARY				
Y	?	N		
36	0	0	Preconditions (36 possible)	
31	2	28	Optimizations (32 possible + 5 Innovations)	

Requirements		Results	
Preconditions	Must meet all preconditions.	All preconditions satisfied.	
Optimizations	0 needed for Silver, 25 for gold, 50 for platinum	Current status: Gold	

* Pending onsite post-occupancy Performance Verification testing.

Data Driven Decisions



Data Driven Decisions / Sustainable Path

Comparison Matrix of Sustainable Pathways

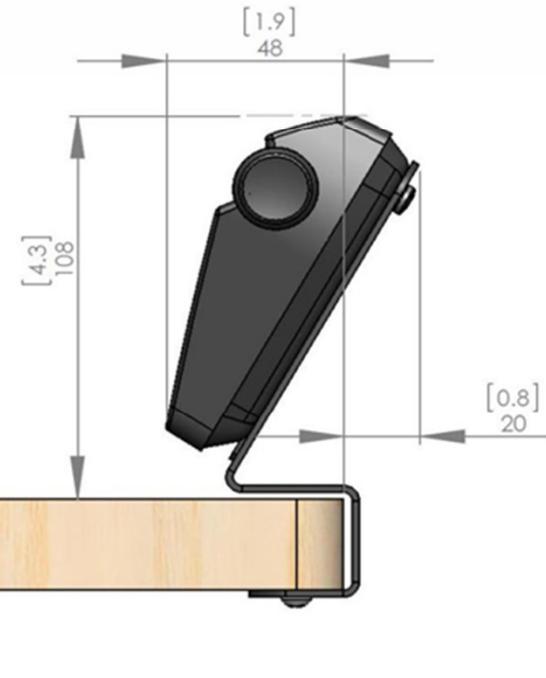
	Washington DC		San Diego, CA		Phoenix, AZ		Newport Beach, CA		San Francisco, CA	
	Renovation of 1980's Existing Building LEED CI Platinum & Net Zero		Renovation of - 1984 Existing Building LEED NC Platinum & Net Zero Energy		Renovation of 1972 - Existing Building LEED NC Platinum & NZE Certified 2013		Tenant Improvement 1982 - Leased Space LEED CI Gold 2013		Renovation of 1956 Existing Building Pursuing LEED EB Platinum & NZE	
	Core and Shell	20,400	Core and Shell	33,572	Core and Shell	16,533	Core and Shell	16,270	Core and Shell	24,000
	Tenant Improvement	20,400	Tenant Improvement	31,712	Tenant Improvement	16,533	Tenant Improvement	16,270	Tenant Improvement	20,000
	Cost	\$ / SF	Cost	\$ / SF	Cost	\$ / SF	Cost	\$ / SF	Cost	\$ / SF
SUBTOTAL: Shell and Core	\$ 1,775,464	\$ 87.03	\$ 1,488,231	\$ 44.33	\$ 1,075,828	\$ 65.07	\$ 230,220	\$ 14.15	668,336	\$ 27.85
SUBTOTAL: Tenant Improvements	\$ 2,682,977	\$ 131.52	\$ 3,082,003	\$ 97.19	\$ 2,487,621	\$ 150.46	\$ 2,517,383	\$ 154.73	2,990,851	\$ 149.54
SUBTOTAL: Renewable Energy System	\$ 602,250	\$ 29.52	\$ 233,389	\$ 6.95	\$ 318,277	\$ 19.25	\$ (13,352)	\$ (0.82)	538,804	\$ 22.45
SUBTOTAL: Indirects	\$ 1,160,145	\$ 56.87	\$ 1,070,232	\$ 31.88	\$ 1,095,581	\$ 66.27	\$ 893,745	\$ 54.93	957,218	\$ 39.88
TOTAL:	\$ 6,220,836	\$ 305	\$ 5,873,855	\$ 175	\$ 4,977,308	\$ 301	\$ 3,627,996	\$ 223	\$ 5,155,209	\$ 215
\$/Office Seat	\$ 77,760	80	\$ 78,318	75	\$ 95,717	52	\$ 60,467	60	\$ 88,883	58

Technology Infrastructure

ClickShare – Components



ENMETRIC EDGE MOUNT



Button

Controller



ClickShare Tray

Building Dashboard

buildingOS_

Reston Office

- 11109 Sunset Hill Road 20190
- Office
- 1 floor
- 0 occupants

Reston Summary / Last 12 months

- Total Electricity Use: 255,075 kWh
- Total Photovoltaic Production: 14,953 kWh
- Total Water Use: 1.85M gal
- Total Solar Thermal Production: 8,974 kBtu

Rather than building new, DPR chose to renovate this 20,000-sq.-ft. space, which had previously been vacant for more than seven years. This decision, which emphasizes DPR's commitment to environmental responsibility and to moving the industry forward, showcases how a Class-C office space with an average skin system can become a net-zero, Class-A office in the Mid-Atlantic climate. DPR's Reston office is the fourth DPR office to target net-zero energy and the first of its kind in the D.C.-metro region.

Navigation: Welcome, BAS Electricity, Enmetric Receptacles, Water, Solar, Sustainability Goals, Green Features

Lessons Learned



Plug load assumptions from Phoenix proved close to metered use at Reston



Layout and coordination of critical rooftop elements; PV's, solar tubes and solar hot water heater was significant challenge



Select and maintain PV manufacturer during design



Maintenance impacts of hybrid HVAC selected for Living Lab



Needed a robust lighting control system



Publicize "Living Lab" so to manage staff expectations



Provide adequate time in the schedule for commissioning & troubleshooting



Provide an education plan to occupants



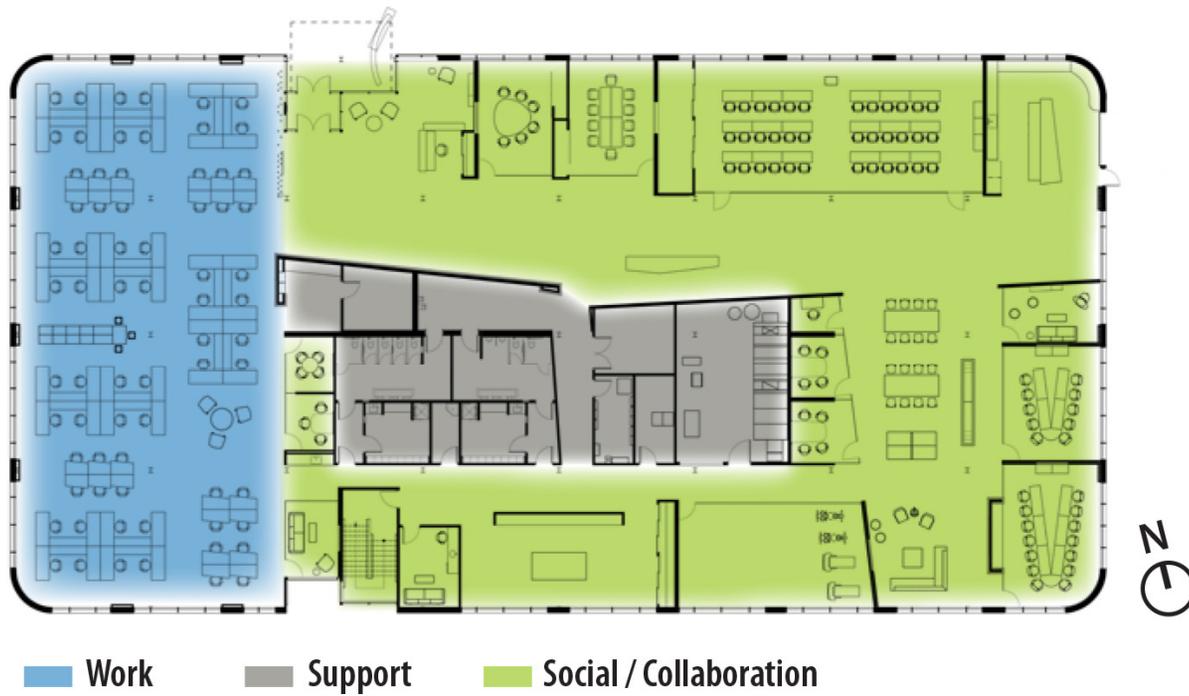
Workplace Change

A'18

Place Lab Insight & Exploration



Program Elements



Living Lab

Landscape Quality

Essential qualities toward a Living Office

Coherence



Identity



Attraction



Convergence



11.5
out of 20

● Pre

Space Allocation

Settings in support of work

Variety of Group Spaces

- Cove ●
- Meeting Space ●
- Landing ●
- Workshop ●
- Forum ●
- Plaza ●

Group Spaces : Workpoints **1:8**

● Pre

Change Management

Activities to manage the workplace change

Level of Agreement

Leadership/management communicates changes



85%
agreement

Communication is effective



The business reasons for the workplace change are understood

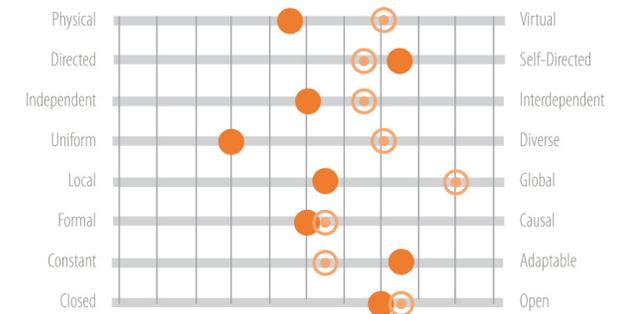


● Pre

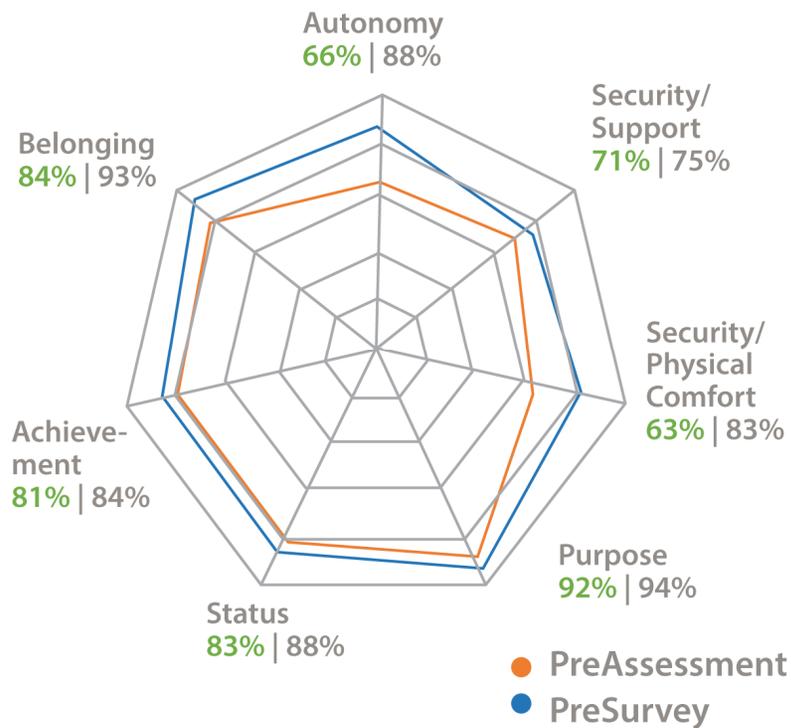


Character of Organization

How your workplace reflects attributes of character



The Leesman Index



58.7

of 100 Leesman Index (Lmi)

16.7 - 100

Lowest Score Highest Score

60.4

Global Benchmark (Lmi)

● Pre

Living Lab



Individual Work Settings



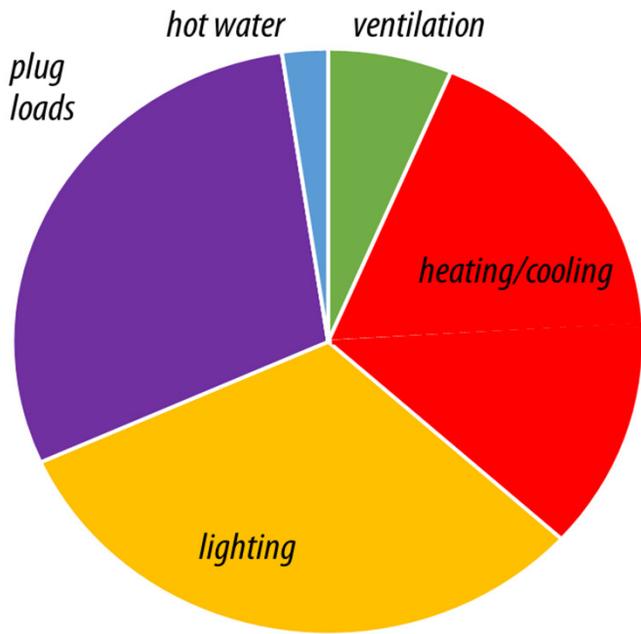
Huddle Rooms



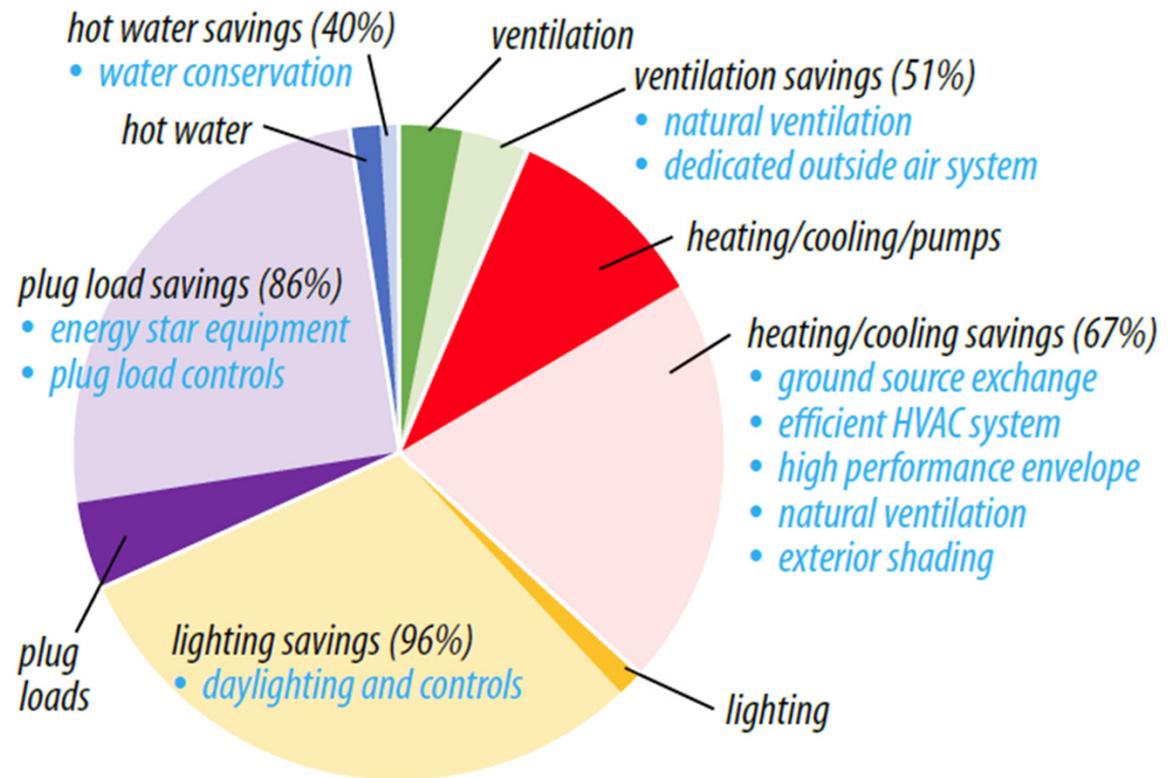
How do we
get there?

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NZE Goals & Definitions



Average building: EUI: 69.82



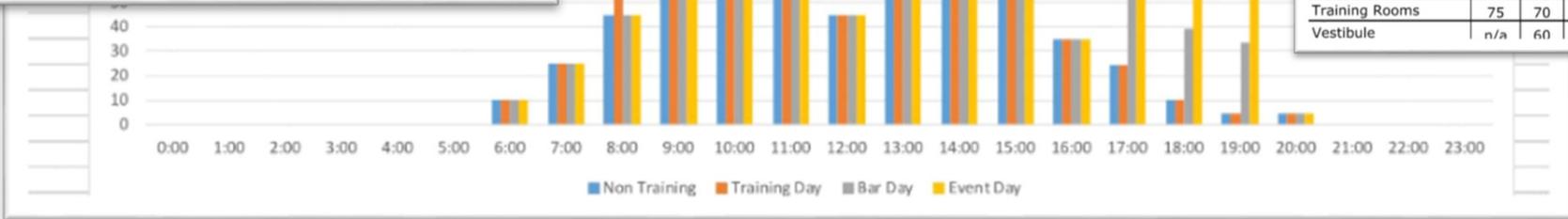
Brock

EUI: 14.12 (80% savings)

Energy Modeling

DESIGN DAY CONDITIONS

Weather Data Location	Washington DC Dulles International Airport
Altitude (Above Sea Level)	325 Feet
Latitude	38.94°N
Longitude	77.45°W
Summer Design Conditions (0.4%)	Dry Bulb and Coincident Wet Bulb: 93.38°F DB / 75.02°F WB Evaporation for Heat Rejection: 77.72°F WB / 88.88°F MCDB
Winter Design Conditions (99.6%)	12.1°F DB

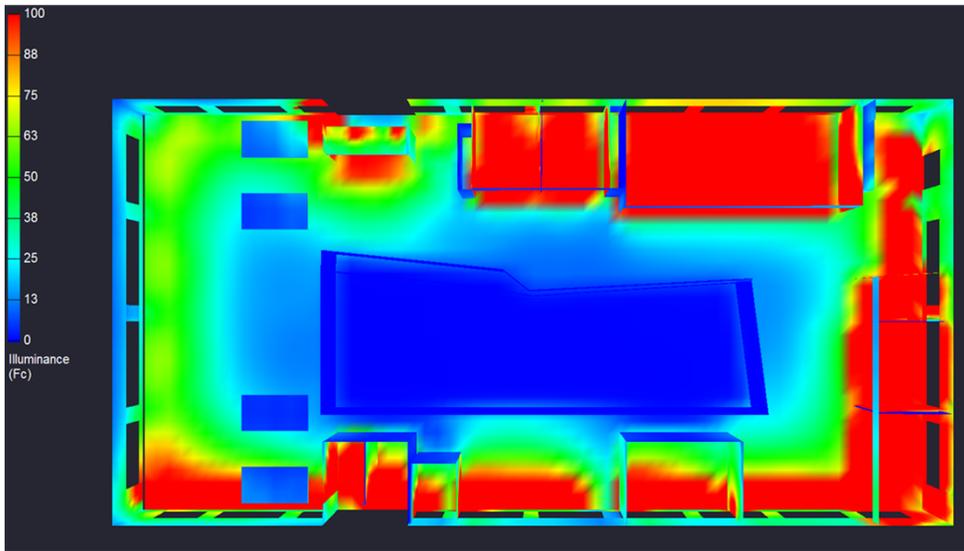


SPACE SETPOINTS

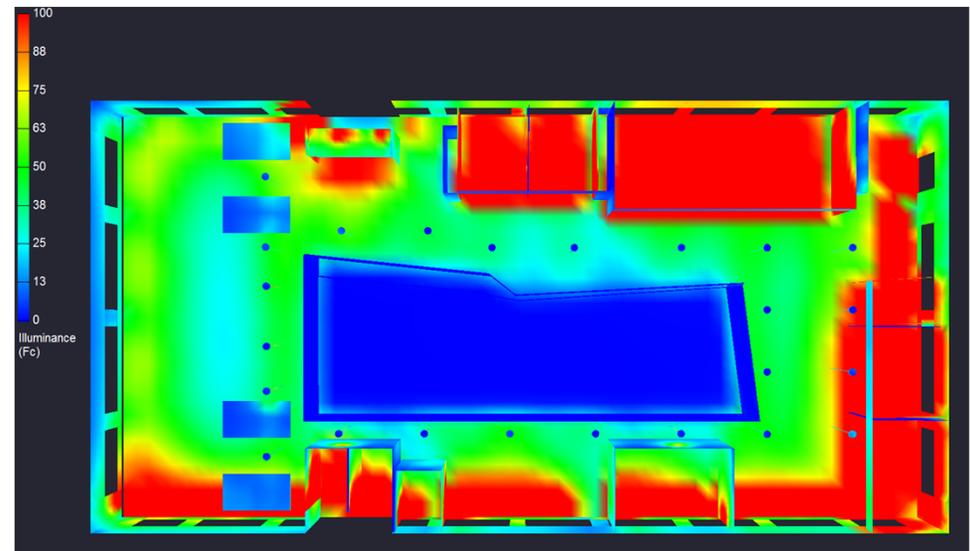
Space	Design Temp (°F)		Relative Humidity	Room Pressure
	Clg	Htg		
Break Rooms	75	70	50%	----
Conference Rooms	75	70	50%	----
Copy/Printing Rooms	75	70	50%	NEG
Corridors	75	70	50%	----
Electrical/ Telecom Rooms	75	n/a	50%	----
Fitness Room	75	70	50%	----
Janitor Closets	85	55	50%	NEG
Library/Reading Area	75	70	50%	----
Locker Room	78	70	50%	NEG
Main Entry Lobby	75	70	50%	----
Mechanical	85	55	50%	----
Office - Open	75	70	50%	----
Office - Private	75	70	50%	----
Storage (General)	85	55	50%	----
Toilet Rooms	75	70	50%	NEG
Training Rooms	75	70	50%	----
Vestibule	n/a	60	50%	POS

Daylighting

Existing



Proposed



Photovoltaic Selection



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Active Strategies

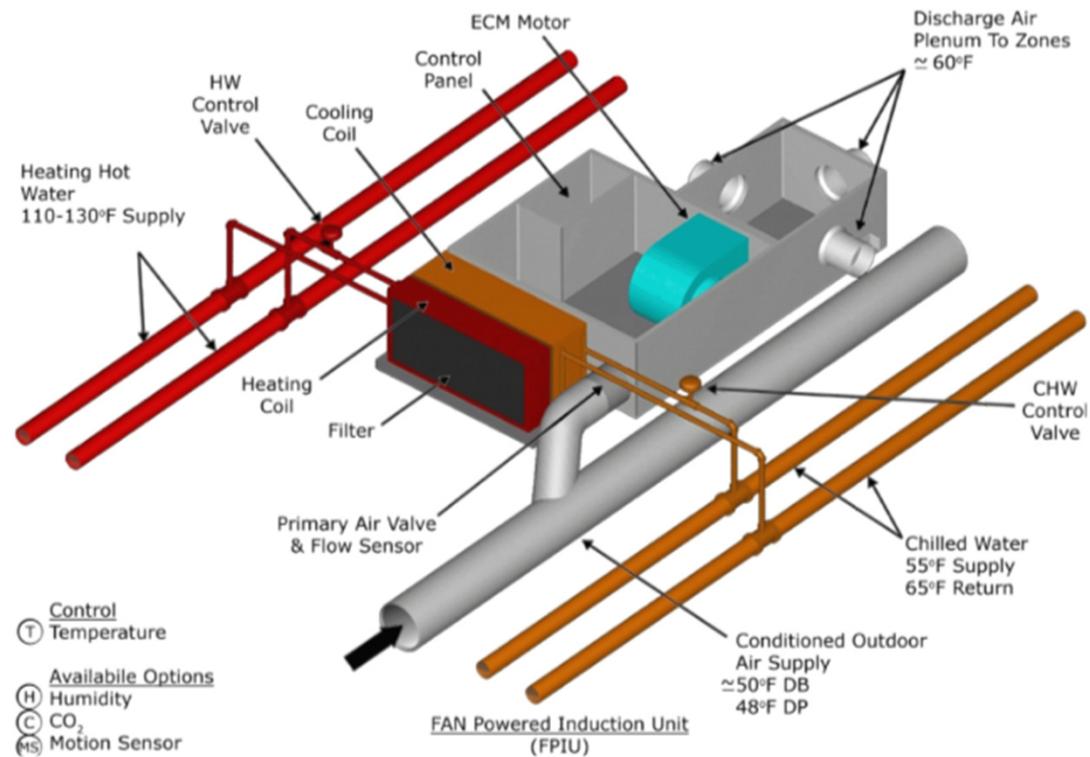
- DOAS & VRF w/ Water-cooled condensers
- Air-cooled DOAS & Air-cooled VRF
- DOAS & Heat Recovery Chiller (Sails and FPTU)

**Multiple
Systems
Evaluated**

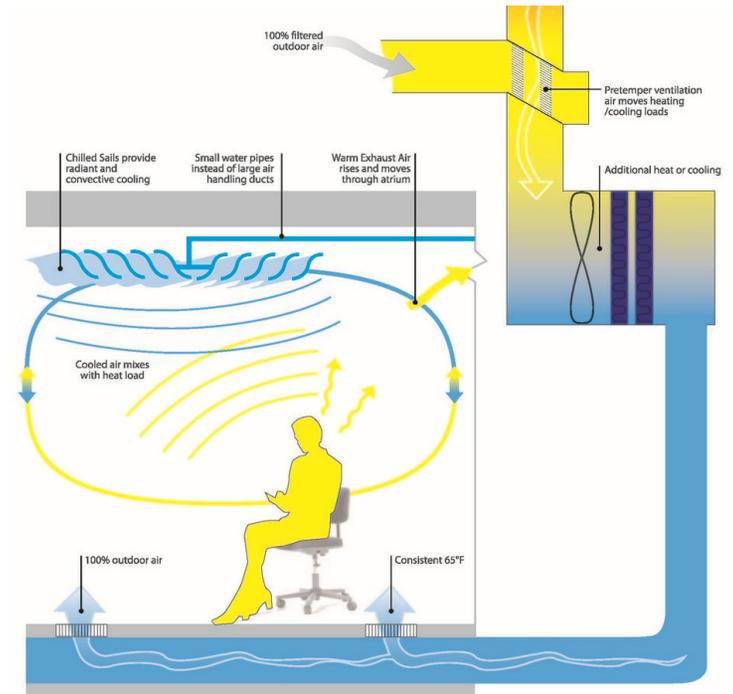
**What
Mattered to
DPR?**

- EUI
- Cost
- Temperature and Humidity Controls
- Flexibility

DOAS Mechanical System



Active Strategies



NZE Goals & Definitions



Mechanical Room



Solar Hot Water, Solatubes & PV Array

Net Zero Strategies



DPR
Phoenix

DPR
Washington DC

DPR
Sacramento

Daylighting	Rooftop solar tube fixtures (Solatubes)	●	●	●
	Rooftop daylight harvesting light wells	●		
	Daylight and Views Strategy, Utilizing Glass Fronts for all Conference Rooms		●	●
	Raven Window Glass, Minimize Glare, and Radiant Heat from Direct Sunlight		●	?
	White countertop surfaces, and acoustical ceiling clouds to extend daylight further into space		●	?
Energy	High efficiency and LED fixtures	●	●	●
	Low Energy or Energy Star Equipment		●	●
	Single Extra Wide Monitors ILO Dual Monitors at Workstations		●	?

Net Zero Strategies



DPR
Phoenix



DPR
Washington DC



DPR
Sacramento

Energy Consumption Awareness	Energy End-Use Measurement Submeters	●	●	?
	Building Energy Use Dashboard Display (Lucid Designs)	●	●	●
	Occupant Plug Load Management & Measurement System – EnMetric		●	?
Onsite Renewable Energy Generation	Rooftop Photovoltaic (PV) Solar Array	●	●	●
	Rooftop Solar Water Heating Array		●	
	Shaded Parking Photovoltaic (PV) Solar Array	●		
Design	Extensive energy Modeling		●	●
	3rd Party HVAC/Electrical Consultant		●	●

Net Zero Strategies



DPR
Phoenix



DPR
Washington DC



DPR
Sacramento

Controls and Building Management	Passive Infra-Red Occupancy Controls	●	●	●
	Time Controls and Shut-Offs	●	●	●
	Integrated Building Management System	●	●	●
	Non-Occupied Energy Circuit Shut-Off – Phantom Load Management Switch	●	●	●
HVAC	Dedicated Outdoor Air System w/ Water Source Heat Pump/Heat Recovery Chiller & Fan Powered Terminal Units served by a four pipe system.		●	●
	Utilization of Several Energy Efficient Heating/Cooling Radiant Sails		●	
	Set Points Established on Dew-point, Not Just Temp.		●	?
	Simultaneous Energy Recovery from Hot and Cold Water Loops Design - Collaborative Process		●	?

Net Zero Strategies



DPR
Phoenix



DPR
Washington DC



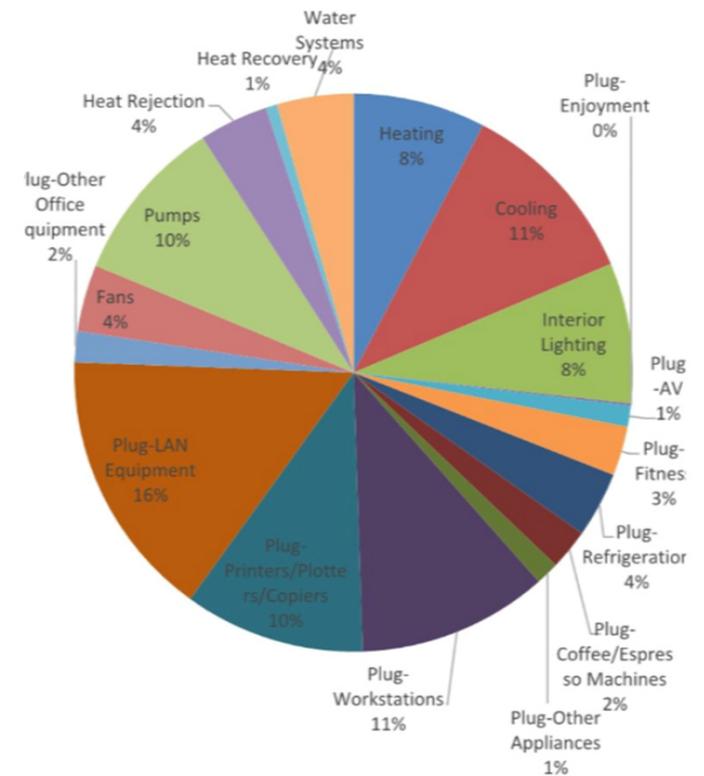
DPR
Sacramento

HVAC	Expanded Occupancy Thermal Comfort			●
	Enhanced air circulation – High Volume, Low velocity ceiling fans (Big Ass Fans)			●
	Passive ventilation			●
	Evaporative Cooling – Shower Towers	●		●
	Natural Ventilations – Operable Windows and Rooftop Monitors – Solar Chimney	●		
	Exterior Window Shading / Treatments – Green Screens	●	●	●
	Indoor Landscaping	●	●	●

Determining Predicted EUI

Annual Energy Use (kBtu/yr)	
End Use	Proposed Design
Heating	42,200
Cooling	60,321
Interior Lighting	44,846
Plug-Enjoyment	557
Plug-AV	6,829
Plug-Fitness	15,721
Plug-Refrigeration	20,880
Plug-Coffee/Esspresso Machines	12,907
Plug-Other Appliances	7,430
Plug-Workstations	60,688
Plug-Printers/Plotters/Copiers	57,570
Plug-LAN Equipment	86,137
Plug-Other Office Equipment	9,848
Fans	21,318
Pumps	53,087
Heat Rejection	22,051
Heat Recovery	3,618
Water Systems	24,378
Total	550,386
Net Energy Use (kW-hrs)	161,302
Equip PV Modules (Qty)	372
Equip PV kW Rating (kW)	128
EUI (kBtu/sf/yr)	27.9

- Better simulation tools available now than in 2012
- Modeling included orientation, envelope, daylighting, lighting, ventilation, mechanical systems, renewables





Collaborative Efforts

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Gutierrez Studios





Learning Environment

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Community Outreach







Honors & Awards



FAIRFAX COUNTY

A'18 AIA Conference on Architecture 2018
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Questions & Concerns

New Technologies

Energy Model Assumptions

Issues with Complex Systems

Reinforcing Decision making with Facts

Consensus Mechanical System Selection

High Performance Building w/out Impacting Users

Questions & Concerns

Early Participation by Commissioning Agent

Required by LEED V

Drawing review included in Fundamental
Commissioning Task

Net Zero – Not Easy

Other tenants

Real time monitoring

End-use metering / analysis

PV availability (Monthly, seasonally)

Contact Information

[Optional slide]



Thank you!

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June 21-23, New York City