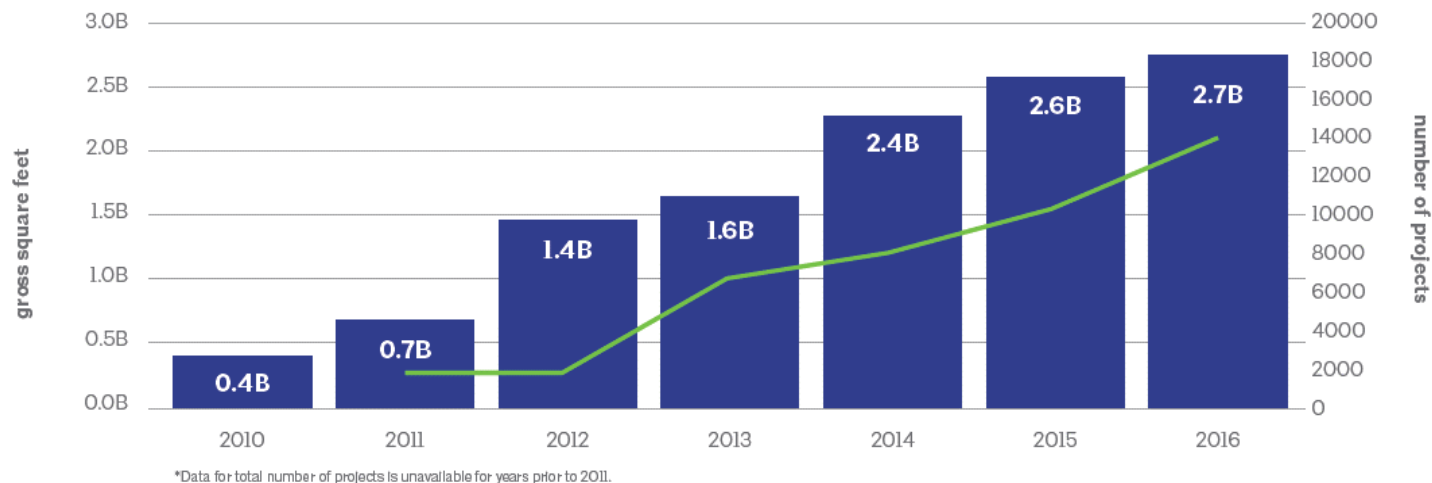


Achieving Net Zero Energy at Scale

Projected CO₂ emissions reduction in 2016 projects:
16.7 million MT CO₂e/yr



*Data for total number of projects is unavailable for years prior to 2011.



Net Zero Energy

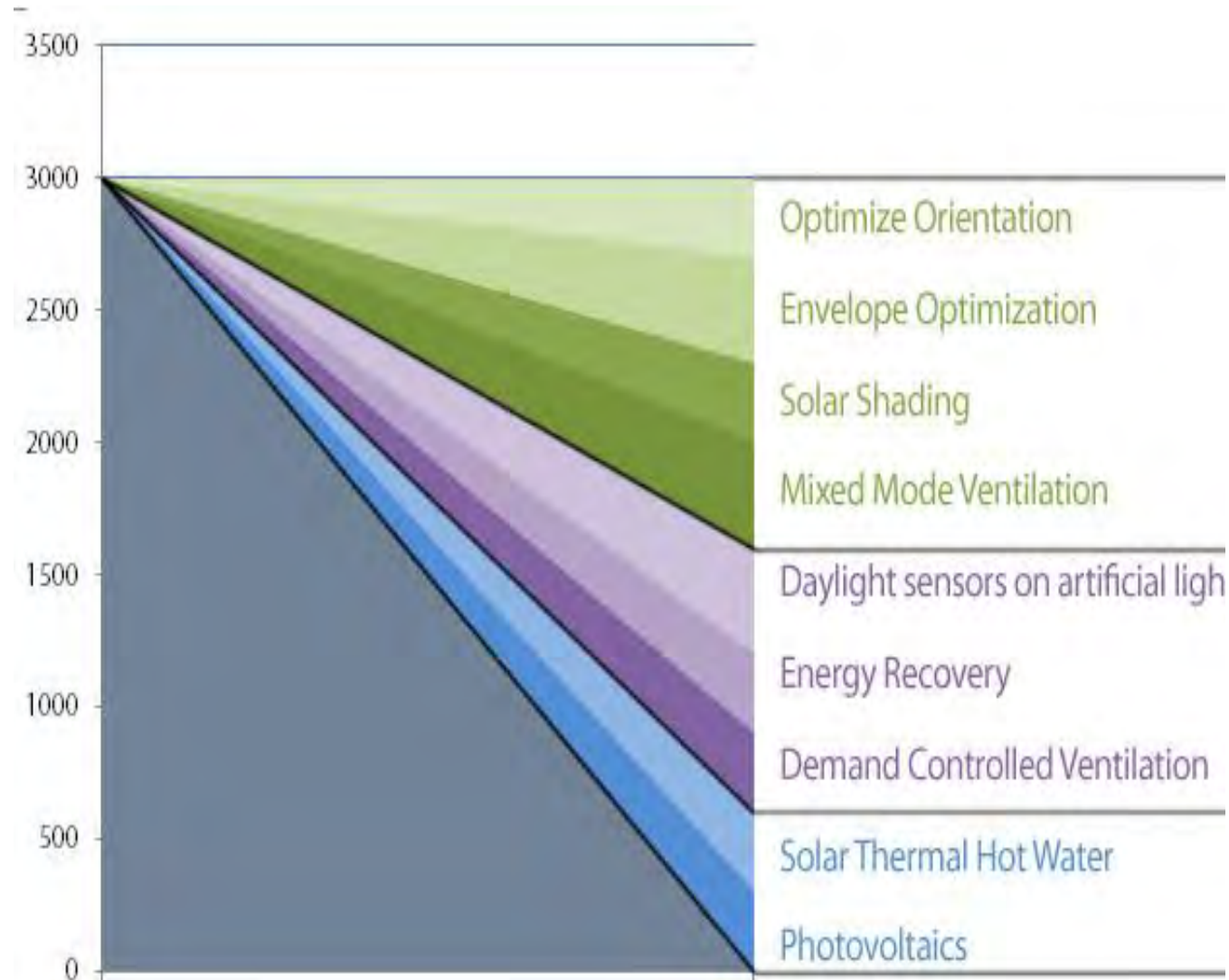


First certified NZE Building in Arizona
First certified NZE in the Mid-Atlantic
Two projects pursuing NZE certification
Two projects NZE-capable



Net Zero Energy – Approach

- Embrace passive approaches
- Conservation-focused: because PVs are expensive
- Leverage simulation and an iterative design process
- Understand use & behavior
- Manage plug loads
- Stay engaged during occupancy

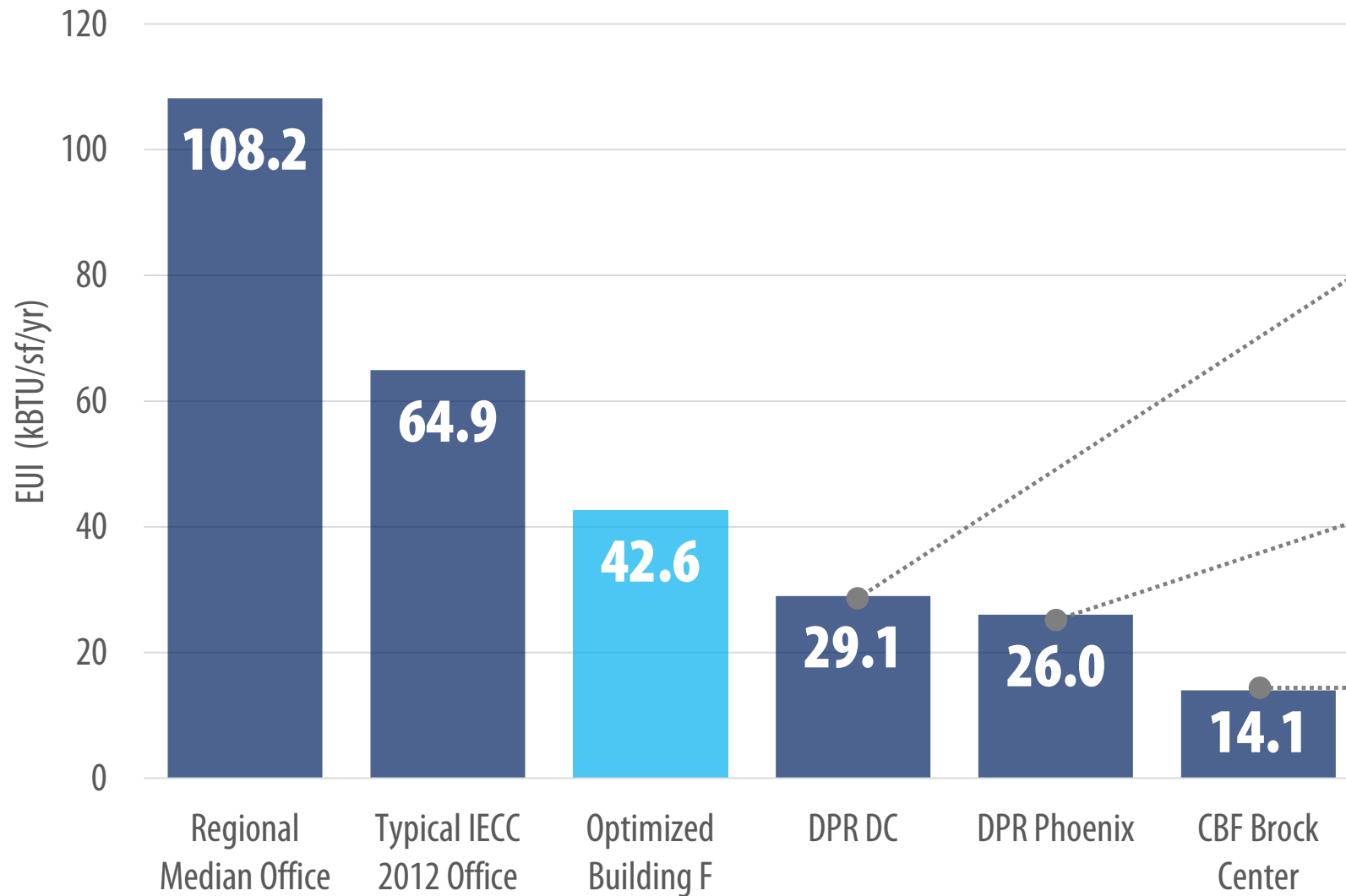


Passive Design:
Reduces energy demand using free resources

Active Design:
Meet remaining demand w/ high-efficiency equip

Renewables:

Net Zero Energy – Conservation: because PVs are expensive



DPR and Net Zero



Phoenix

San Diego

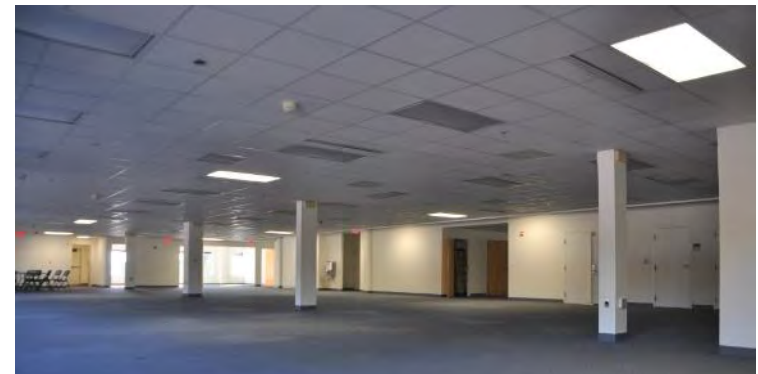
San Francisco

DC



Project Basics - 11109 Sunset Hills Dr.

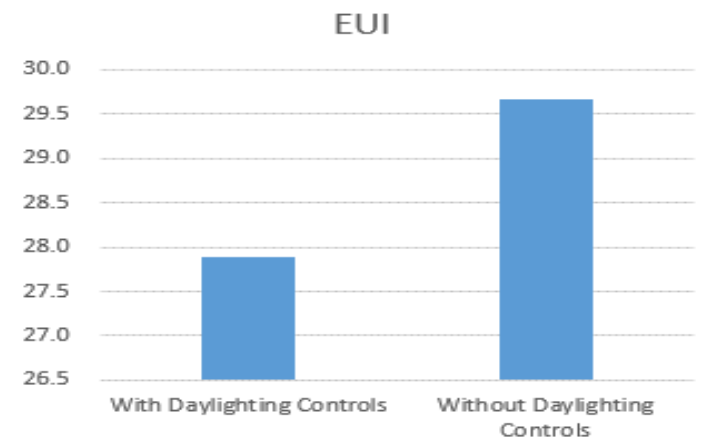
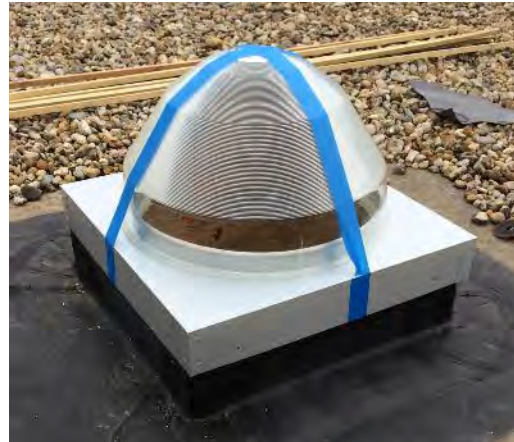
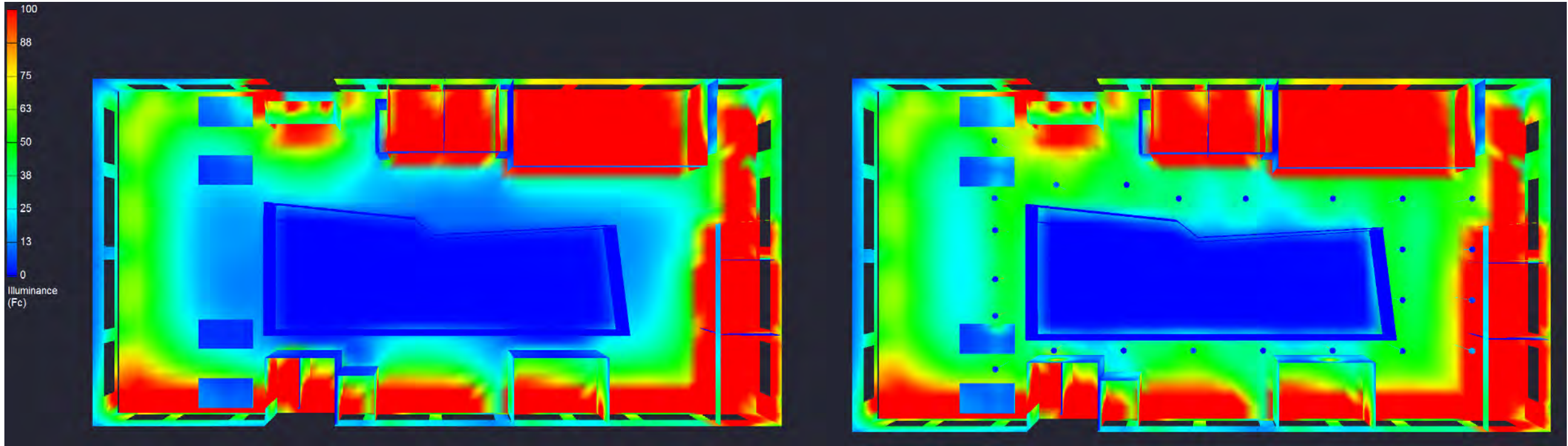
- Existing Bldg
 - Two Stories
 - 40,000 SF
 - Unoccupied for 7 Yrs
- DPR Lease Entire 2nd Floor
 - 10 Year Lease
 - 20,000 SF
 - Energy by Tenant
 - Roof Access
- ½ Mile from Wiehle Metro
- 200 Yards from W&OD Trail



DPR – DC Metro



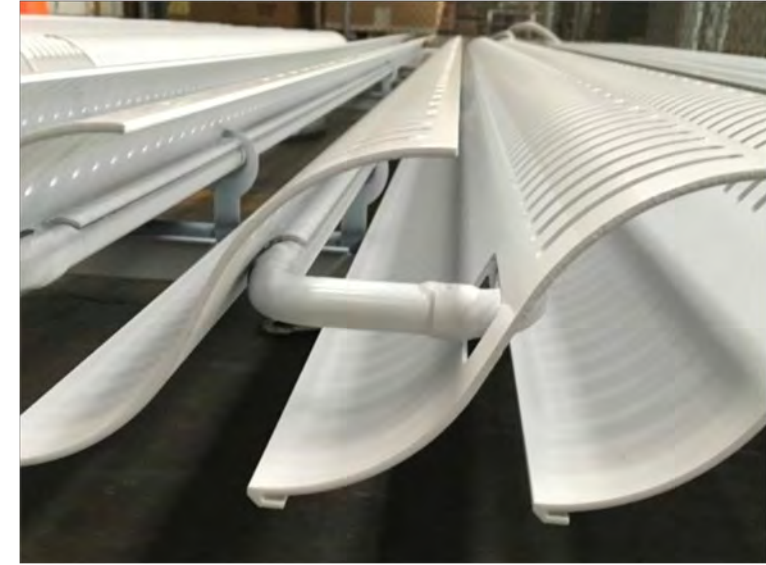
Daylighting



HVAC Systems

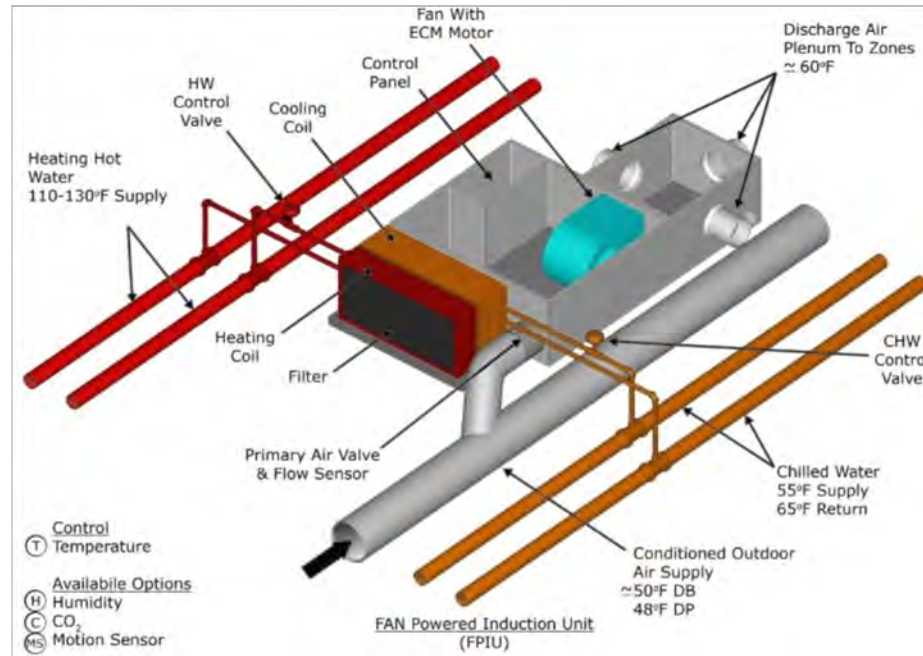
Multiple Systems Evaluated

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



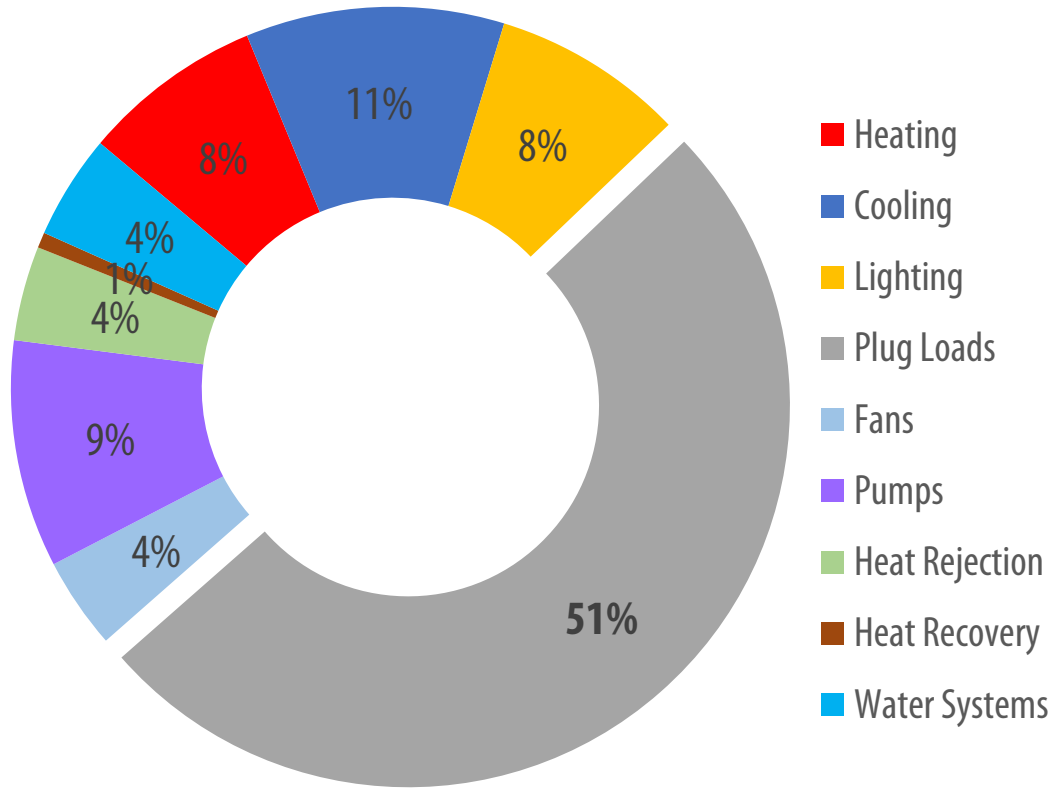
What mattered to DPR?

- EUIB
- Cost
- Comfort & Controllability
- Flexibility

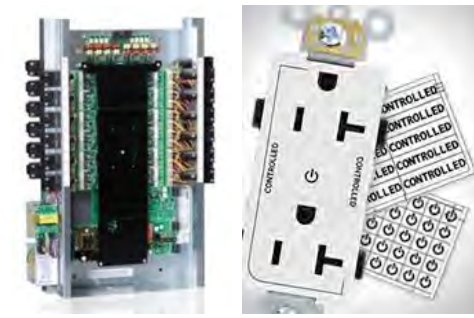
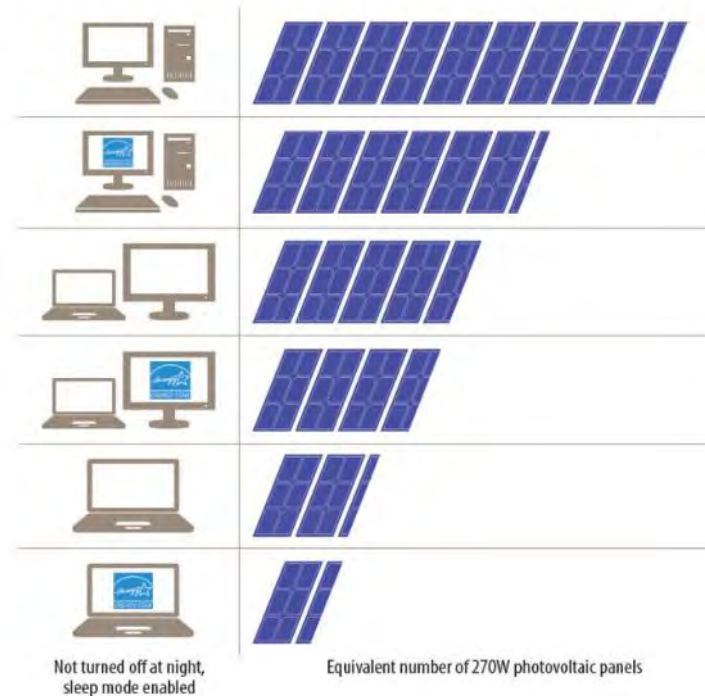
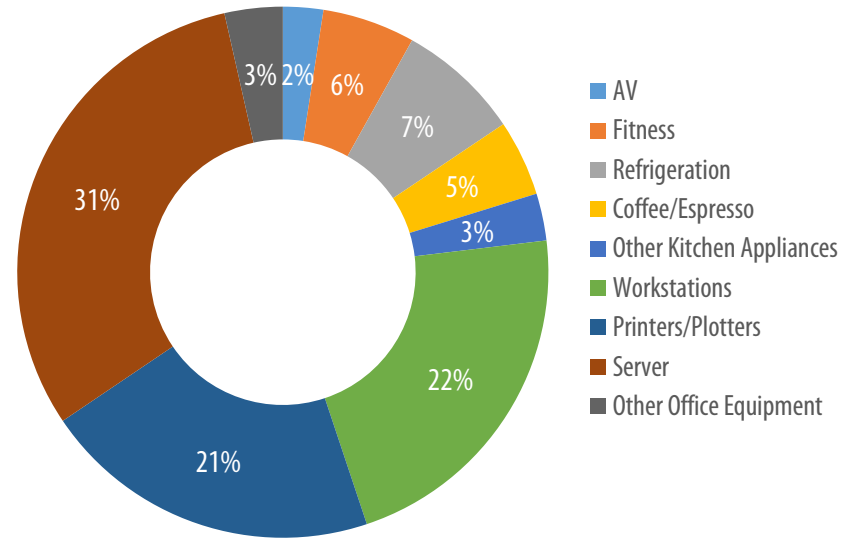


Equipment

Energy End Use Breakdown

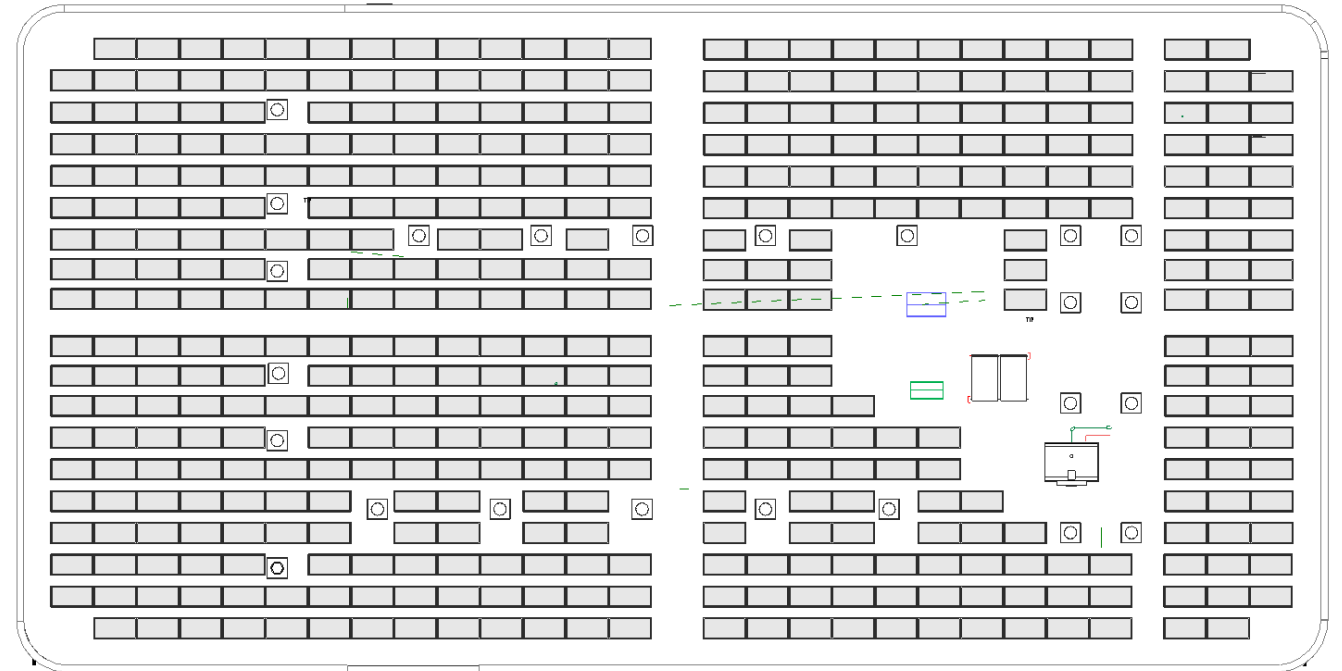


Plug Load Breakdown



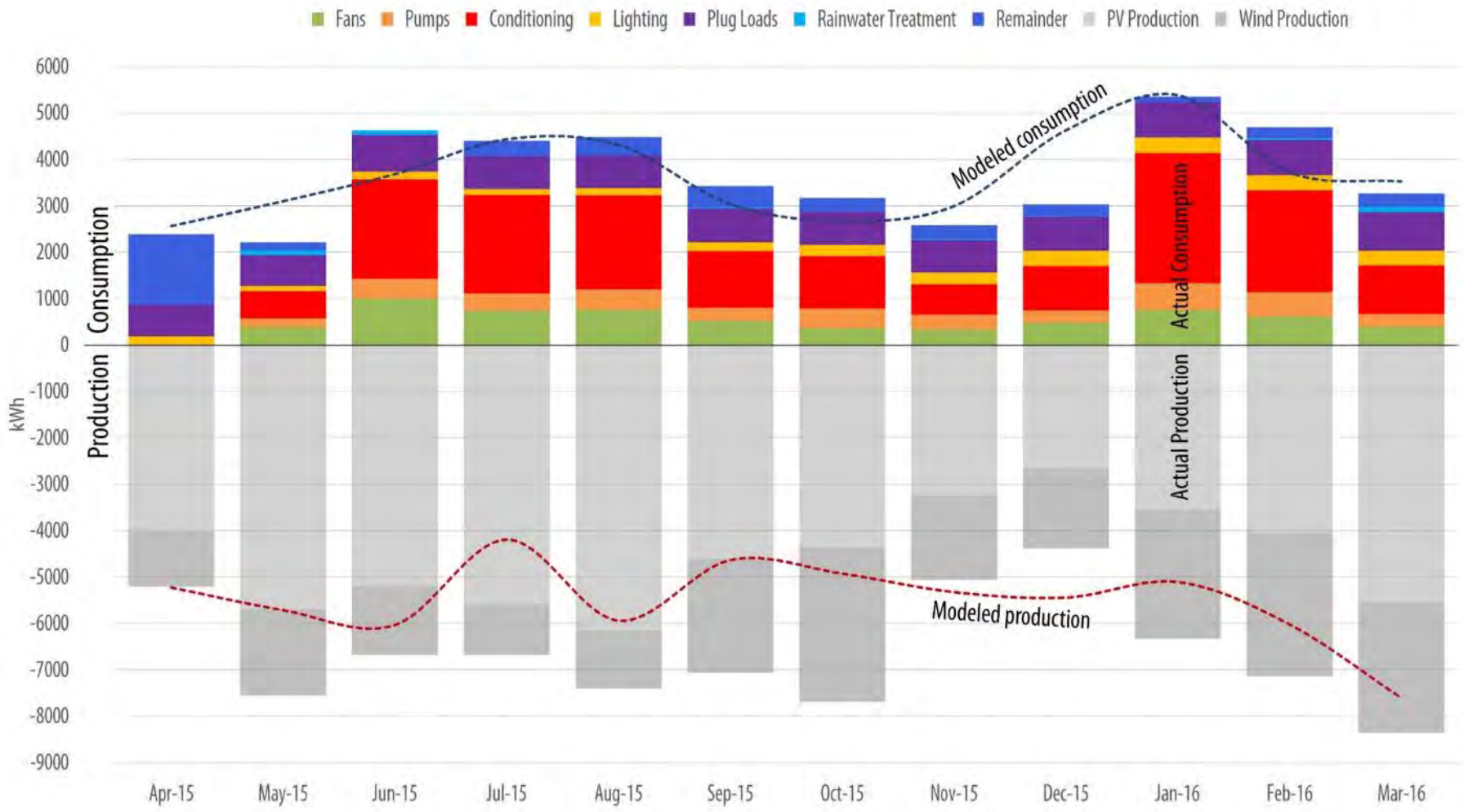
Photovoltaic Roofs

- 141kW PV System
- 20.3% Efficient Modules
- Roof-mounted Microinverters



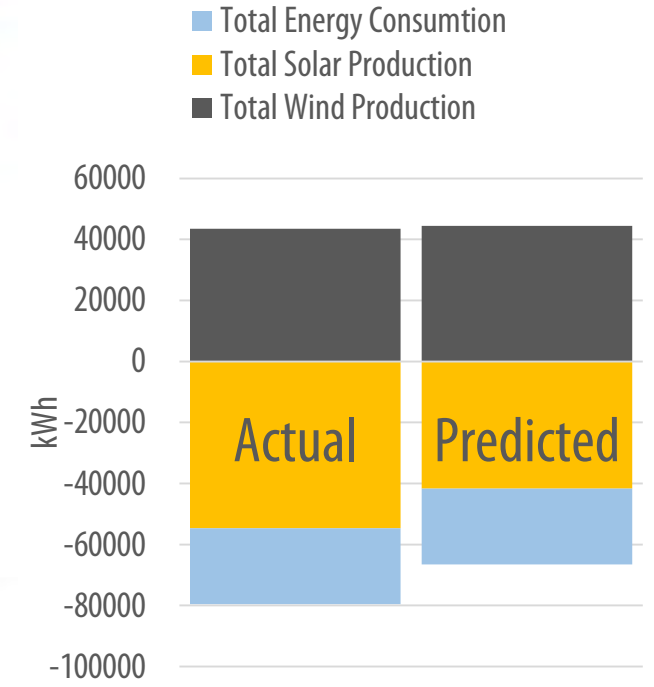
Net Zero Energy – Staying engaged

Actual Energy Consumption/Production compared to Predicted Values



Brock produced 1.83x more energy than it consumed.

ENERGY SUPPLY & DEMAND



Old Town North Small Area Plan ECODISTRICT



ENVIRONMENTAL ACTION PLAN TARGETS

By 2010, the City will purchase 5% of electricity needs through green certificates.

By 2012, reduce Business As Usual (BAU) emissions by 10% below 2012 level.

By 2015, reduce the per capita energy use in Alexandria by 15%.

By 2015, track energy use of 30% of multi-family residence units.

By 2020, reduce emissions by 20% below 2005 levels.

By 2020, 25% of the City's energy portfolio will consist of clean, renewable energy sources.

By 2020, all new buildings will achieve LEED Gold certification.

By 2020, 60% of all existing buildings will achieve a 20% energy consumption reduction

By 2025, track energy use of 60% of multi-family residence units.

By 2025, existing City buildings in the aggregate are 25% more energy efficient.

By 2025, all new buildings will achieve LEED Platinum standards.

By 2030, 50% of the City's energy portfolio will consist of clean, renewable energy sources.

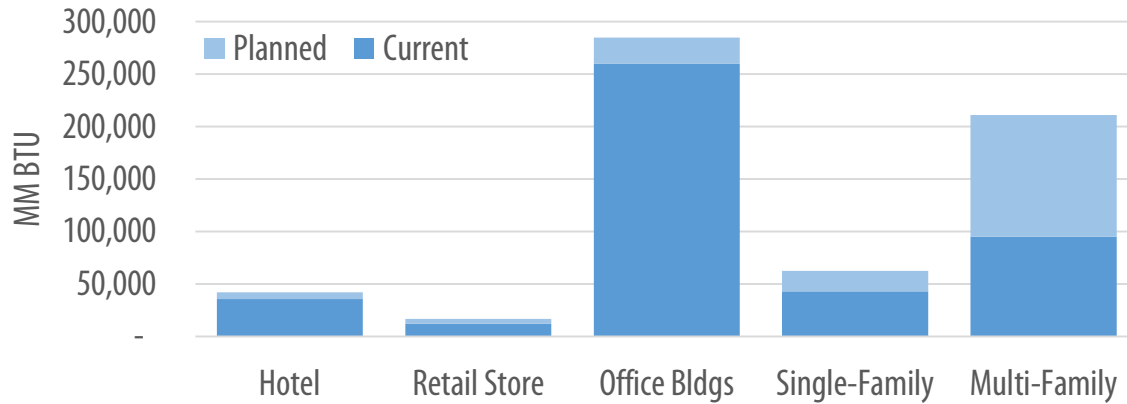
By 2030, track energy use of 100% of multi-family residence units.

By 2030, all new buildings will be carbon neutral

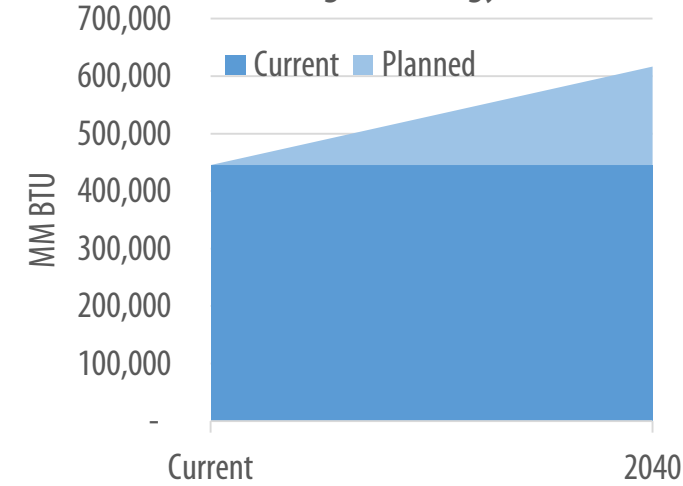
By 2050 at least an 80% reduction in emissions from 2005 levels.

Energy Use and GHG Emissions

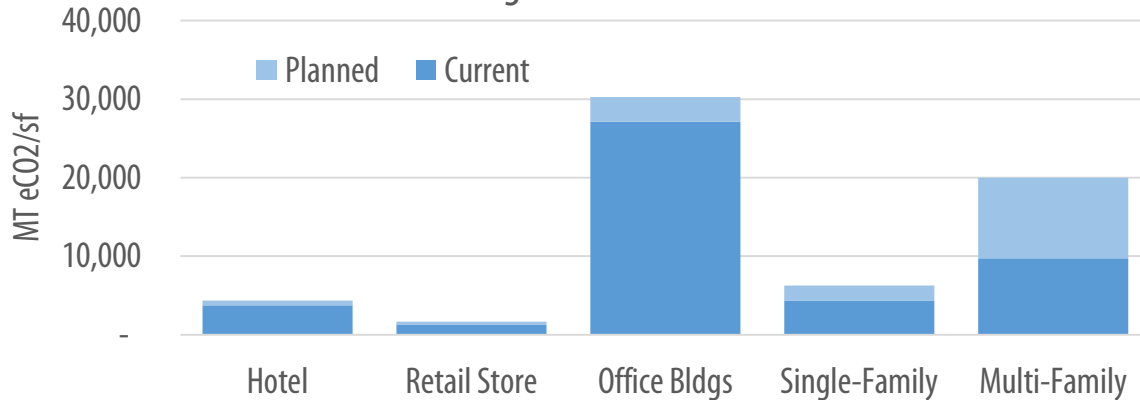
2040 Building Stock - Total Energy Use



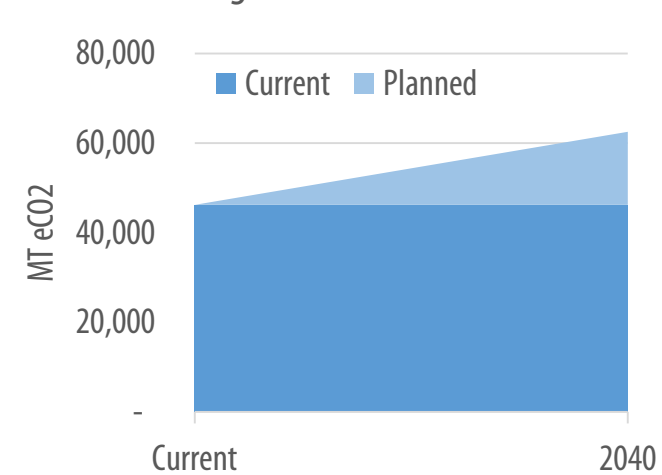
Change in Energy Use



2040 Building Stock - Total GHG Emissions



Change in GHG Emissions



Energy Reduction Strategies

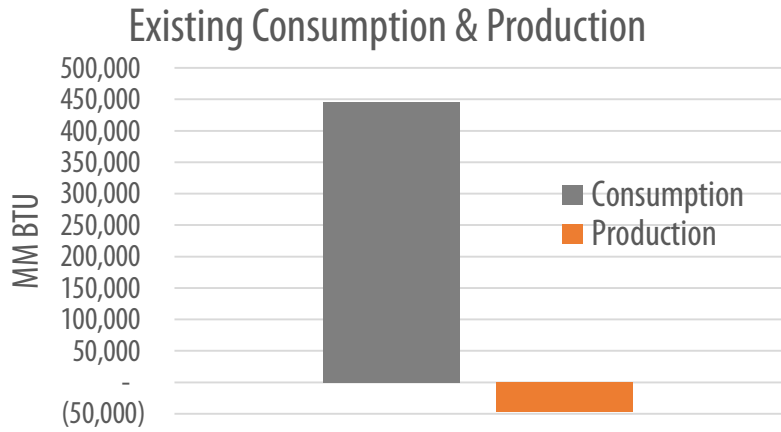
ENERGY STRATEGIES FOR EXISTING BUILDINGS

LOW	MEDIUM	HIGH
Lamp replacements	Items from "Low Column" +	Items from "Medium Column" +
Energy Audits	Weatherization, insulation upgrades, storm windows	Window replacements
Appliance/office equipment replacements	Light fixture and ballast replacements	HVAC equipment upgrades
Showerhead replacements	BMS/EMS Controls and Metering/Sub-metering	
Programmable Thermostats		

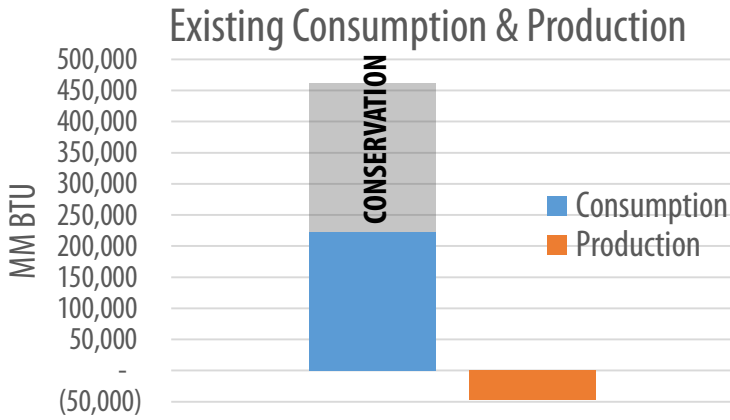
ENERGY STRATEGIES FOR PROJECTED FUTURE BUILDINGS

LOW	MEDIUM	HIGH
Exterior sun-shading	Items from "Low Column" +	Items from "Medium Column" +
Optimized window-to-wall ratio	Thermally-improved glazing	Radiant Conditioning with Dedicated Outdoor Air System DOAS
Infiltration barriers and envelope commissioning	Optimized wall insulation	Natural Ventilation
Optimized roof insulation	Daylighting controls on lighting	Solar Domestic Hot Water
High-performance lighting	Plug-load controls	Photovoltaics
Energy Star equipment	Total Energy Recovery	HVAC upgrades
Demand Controlled Ventilation	Drain Heat Recovery	Ground Source Heat Pumps
Hot Water Demand Reduction	Co-generation / District Energy	

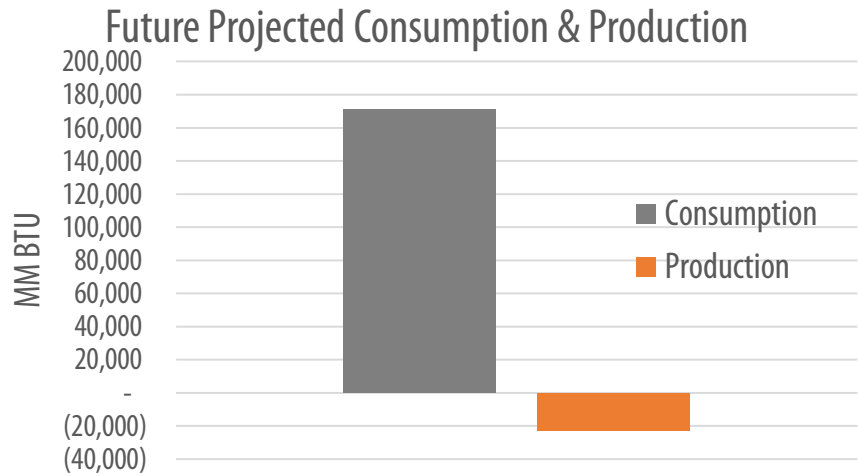
Renewable (Solar) Analysis



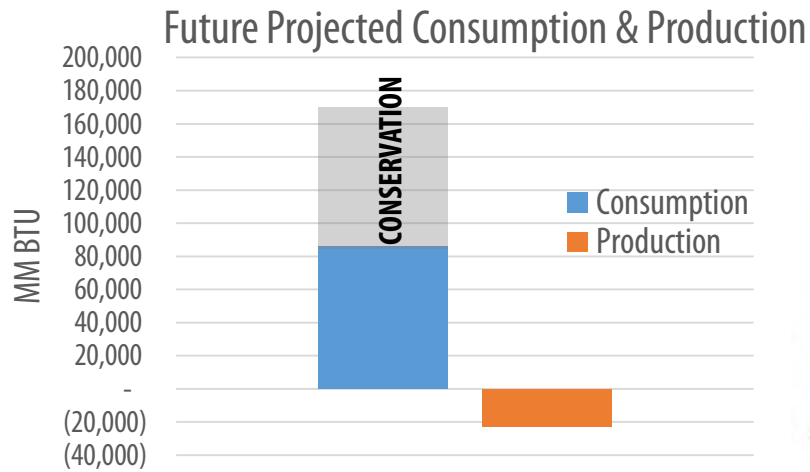
PVs can supply **10.6%** of demand



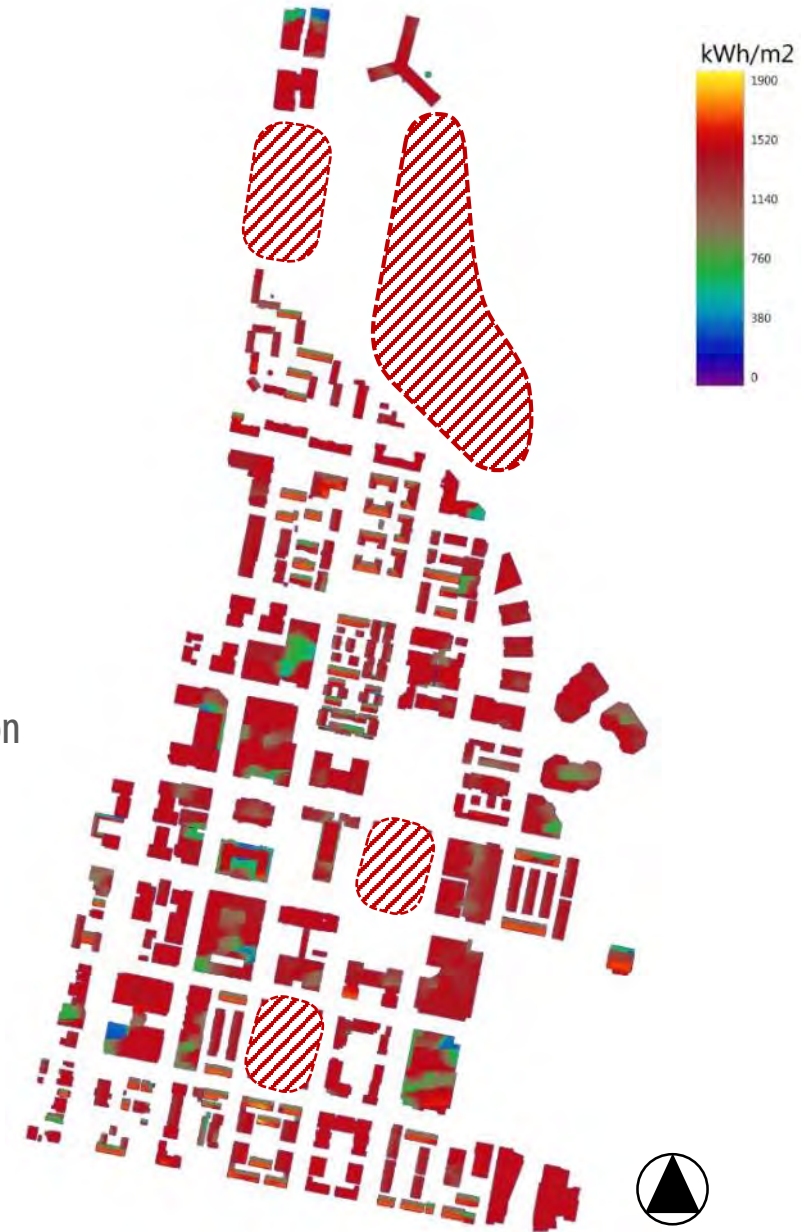
PVs can supply **21.1%** of demand



PVs can supply **13.2%** of demand



PVs can supply **26.4%** of demand



Energy Targets

ENERGY TARGETS FOR EXISTING BUILDINGS			
	LOW (ROI 0-5 YEARS)	MEDIUM (ROI 5-10 YEARS)	HIGH (ROI 10-20 YEARS)
1	Provide incentives to encourage existing building owners to improve the energy consumption of their properties by 20% .	By 2020, all existing commercial properties to disclose their energy use publicly. By 2030, provide incentives for commercial property owners to voluntarily reduce their energy use by 30% over 2020 levels.	By 2020, all existing commercial properties to disclose their energy use publicly. By 2030, provide incentives for commercial property owners to reduce their energy use by 50% over 2020 levels.
2	Provide incentives to allow existing buildings when they change hands, to be renovated to current code, subject to an energy audit.	Require that all existing buildings when they change hands, are renovated to exceed current energy code by 20% .	Require that all existing buildings when they undergo major renovations, are renovated to exceed current energy code by 50% .
3	Provide incentives to property owners, when seeking to replace existing roofs, to promote that each rooftop maximize its productive space.	Provide a City-Wide Solar Co-Op that existing home owners can take advantage of.	Require that all existing roofs when buildings undergo major renovations, incorporate photovoltaics.
ENERGY TARGETS FOR PROJECTED FUTURE BUILDINGS			
	LOW (ROI 0-5 YEARS)	MEDIUM (ROI 5-10 YEARS)	HIGH (ROI 10-20 YEARS)
4	Between now and 2025, all new projects and major renovations achieve an energy consumption that is 20% better than current code (assumed IECC 2015).	Between now and 2025, all new projects and major renovations achieve an energy consumption that is 35% better than current code (assumed IECC 2015).	Between now and 2025, all new projects and major renovations achieve an energy consumption that is 50% better than current code (assumed IECC 2015).
5	Planned development and major renovations constructed after 2025 achieve an energy consumption that is 80% better than CBECs 2003 Average.	Planned development and major renovations constructed after 2025 achieve an energy consumption that is 90% better than CBECs 2003 Average.	Planned development and major renovations constructed after 2025 are carbon neutral .
6	All planned development must ensure that each rooftop is designed to accommodate photovoltaics, and provide 20% of available roof with photovoltaics.	All future development must ensure that each rooftop is designed to accommodate photovoltaics, and provide 50% of available roof with photovoltaics.	Planned development to provide 100% of available roof with photovoltaics
7	All planned development must purchase Green Power to provide 25% of total energy use.	All planned development must purchase Green Power to provide 50% of total energy use.	All planned development must purchase Green Power to provide 100% of total energy use.

Cumulative Impacts

Existing Buildings			Future Buildings			
1	2	3	4	5	6	7

