TISHMAN SPEYER DESIGN AND CONSTRCUTION

Strategically Incorporating Sustainability, Resilience, and Footprint Consolidation in Portfolio Planning

FFC Workshop

September 2015

TISHMAN SPEYER

GUARDIANS OF THE PAST

TISHMAN SPEYER

The Chrysler Building, New York City

- Recently received LEED Gold and Energy Star certifications for the Chrysler Building, the oldest skyscraper in New York City to have achieved both

GUARDIANS OF THE PAST

TISHMAN SPEYER

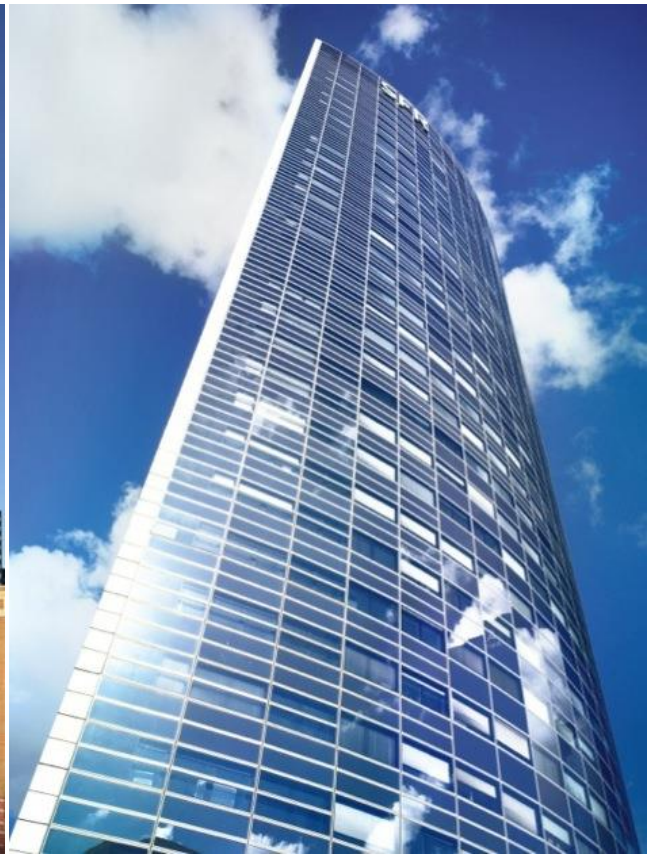
Rockefeller Center, New York City

- Installed a 21-tank, 80,000-ton ice chiller in Rockefeller Center that reduced the carbon footprint by approximately 400 tons
- Installed a 363-panel solar array that provides renewable sources of energy and allows generated power to be returned to the municipal grid
- In the process of installing a co-generation plant to further reduce energy demand by 2MW

PIONEERS OF THE FUTURE – FIRST ACHIEVEMENTS

TISHMAN SPEYER

- Achieved first LEED Gold for New Construction in New York at the Hearst Tower, and later helped achieve LEED-EB Platinum
- Tishman Speyer owns the only triple-certified (LEED, BREEAM and HQE) property in the world: Tour Esplanade in Paris
- Achieved first LEED Gold for Existing Buildings in New York at 375 Hudson Street

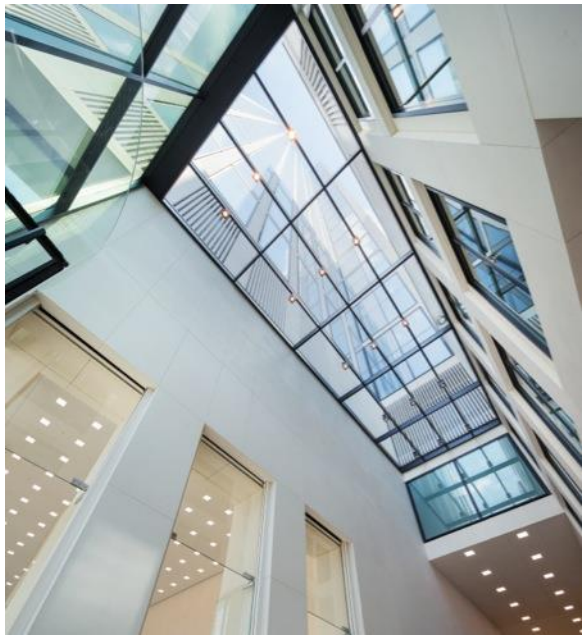


PIONEERS OF THE FUTURE – FIRST ACHIEVEMENTS

TISHMAN SPEYER

TaunusTurm, Frankfurt

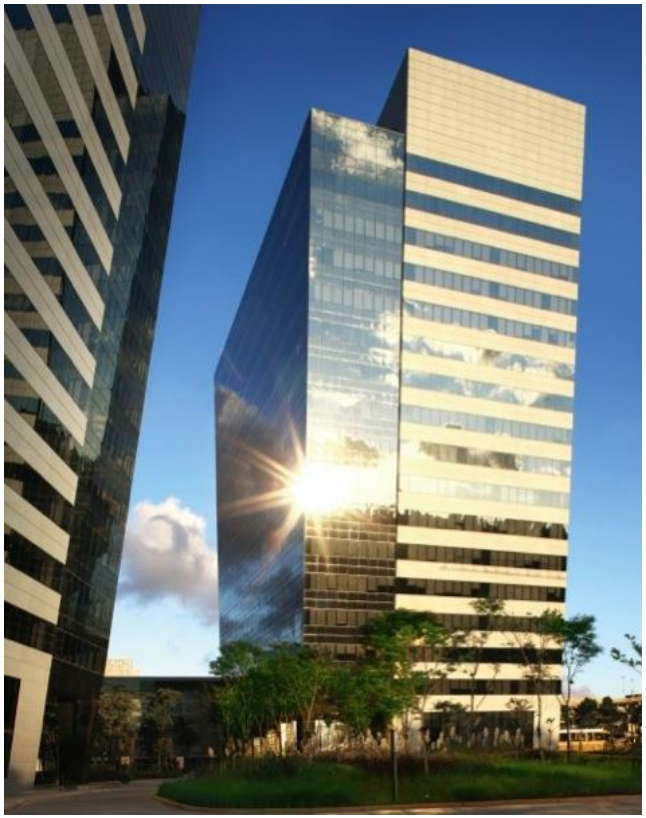
- Recently completed new development setting the global standard
- Currently pending LEED Platinum certification — will represent the first building certified at this level in Frankfurt
- 35% estimated energy savings compared to buildings of similar size
- 90% of construction waste diverted from landfills
- 100% LED lighting throughout, resulting in annual reduction in energy costs of approximately 20%
- Efficiently insulated building lowers the need for heating in winter and cost of cooling in summer



PIONEERS OF THE FUTURE – EMERGING MARKETS

TISHMAN SPEYER

- Currently developing a new 836,000 sqm mixed-use campus in Shanghai, to be certified LEED Gold for New Construction — The Springs
- First LEED Gold for New Construction in South America — Rochaverá Corporate Towers
- Completed a 232,000 sqm office park in Hyderabad, certified LEED Gold for New Construction in India — WaveRock

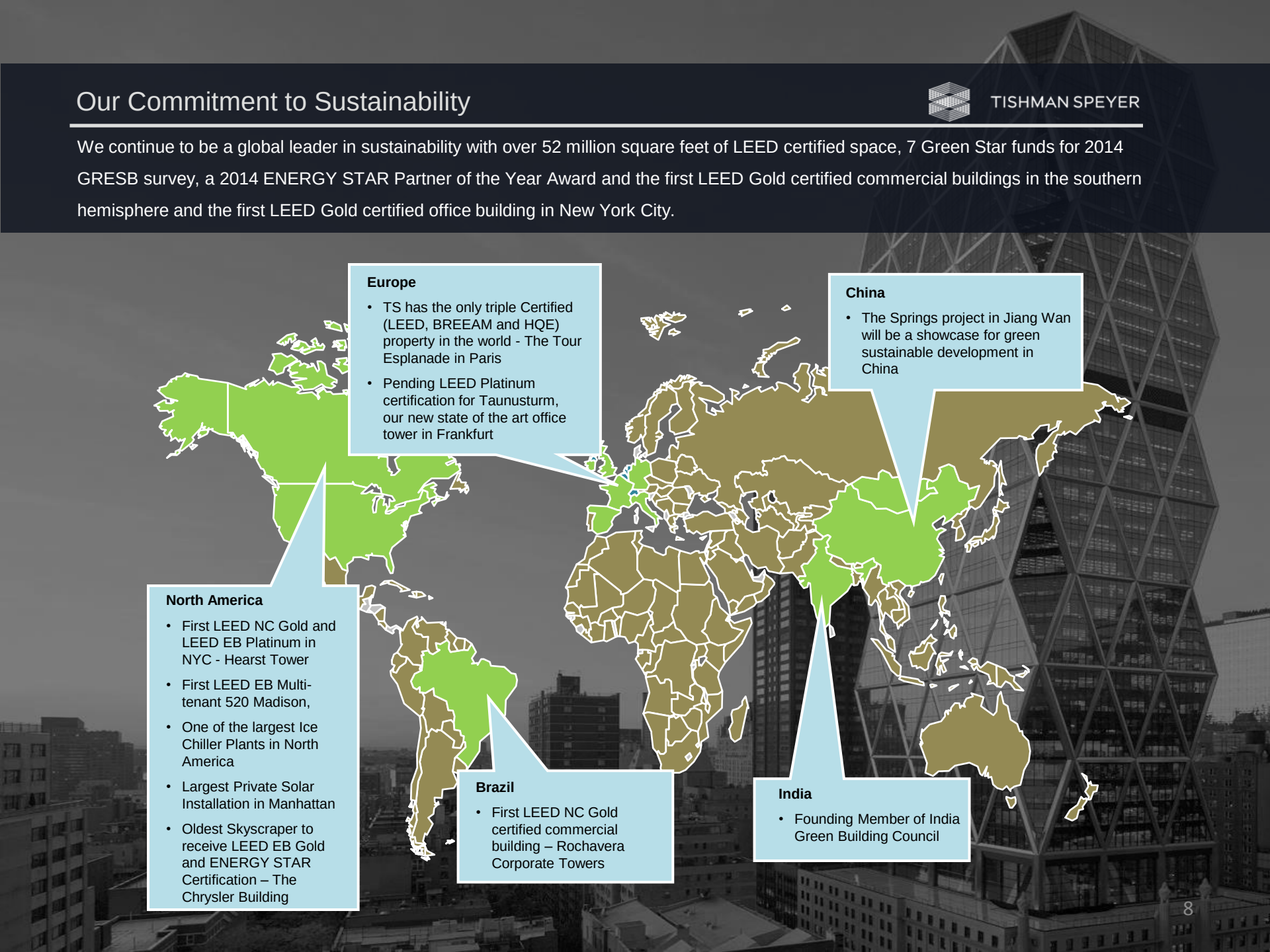


TISHMAN SPEYER SUSTAINABILITY

Our Commitment to Sustainability

TISHMAN SPEYER

We continue to be a global leader in sustainability with over 52 million square feet of LEED certified space, 7 Green Star funds for 2014 GRESB survey, a 2014 ENERGY STAR Partner of the Year Award and the first LEED Gold certified commercial buildings in the southern hemisphere and the first LEED Gold certified office building in New York City.



Europe

- TS has the only triple Certified (LEED, BREEAM and HQE) property in the world - The Tour Esplanade in Paris
- Pending LEED Platinum certification for Taunusturm, our new state of the art office tower in Frankfurt

China

- The Springs project in Jiang Wan will be a showcase for green sustainable development in China

North America

- First LEED NC Gold and LEED EB Platinum in NYC - Hearst Tower
- First LEED EB Multi-tenant 520 Madison,
- One of the largest Ice Chiller Plants in North America
- Largest Private Solar Installation in Manhattan
- Oldest Skyscraper to receive LEED EB Gold and ENERGY STAR Certification – The Chrysler Building

Brazil

- First LEED NC Gold certified commercial building – Rochavera Corporate Towers

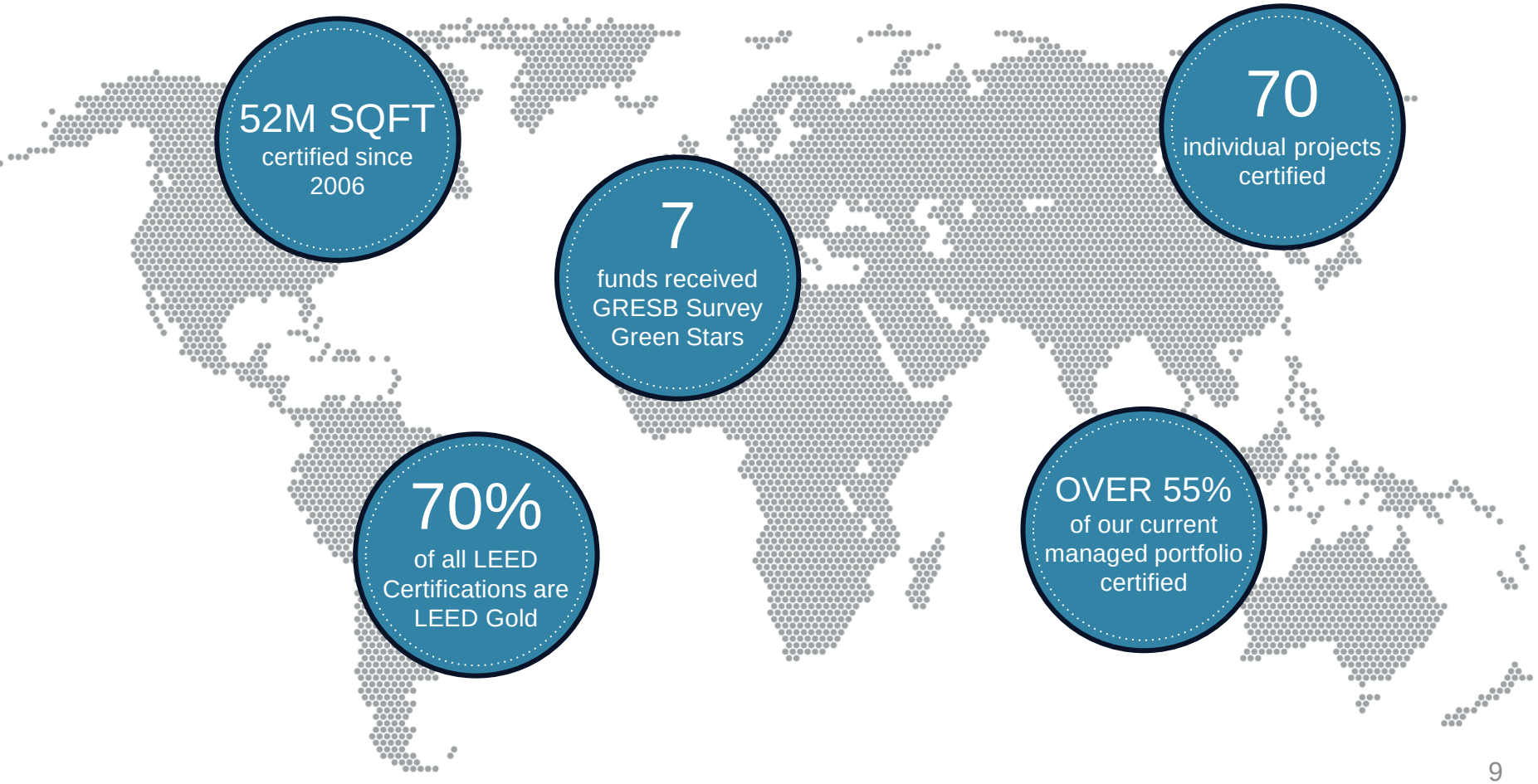
India

- Founding Member of India Green Building Council

OUR GLOBAL IMPACT

TISHMAN SPEYER

These include assets in Brazil, the United States, Europe and India. Certification schemes are also under construction in China.



IDENTIFICATION OF CONSULTANTS

Leverage relationships with some of the world's best design and engineering firms while maintaining competitive fee structures.

INITIAL CONCEPT DESIGN

Evaluate design concepts with regard to constructability and budget constraints, and closely manage the architect so that feasibility is built in from the very beginning.

DESIGN PHASE PREPARATION

Now the Local Codes and Market Trends. Supervise all planning and approvals and site investigations required for the preparation of construction.

MANAGE THE PROCESS

Manage the entire design process from schematic to completed construction documents.

PLAN REVIEW, VE AND BUDGETING

Analyze all systems and components with an eye on the current construction market for labor and materials.

PROCUREMENT

Stay involved in the selection of materials and equipment.

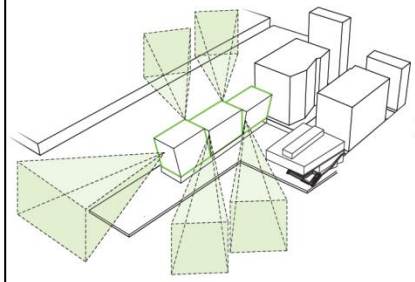
SCHEDULES AND RESOURCES

From approvals to bidding and through to construction, maintain momentum to stay on time and on budget.

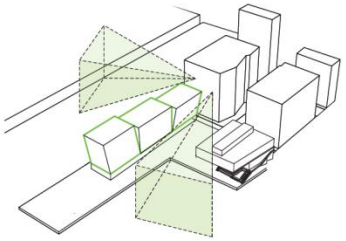
COMMISSIONING AND DELIVERABLES

Follow through in the process of validating operational performance and the proper training of facility management personnel.

OPTION 2 // VIEW CORRIDORS



PHASE 3 VIEWS



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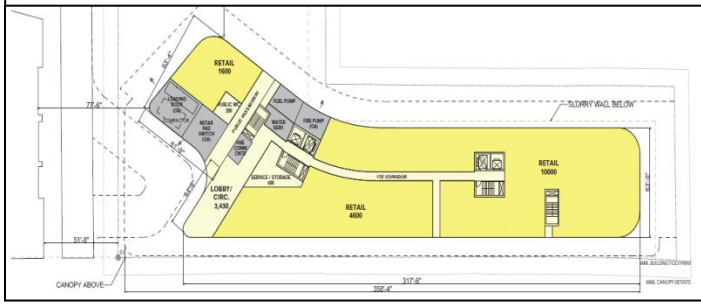

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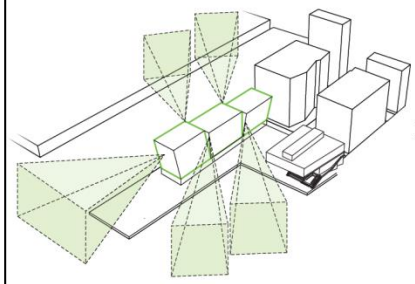

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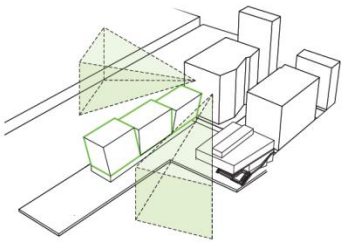

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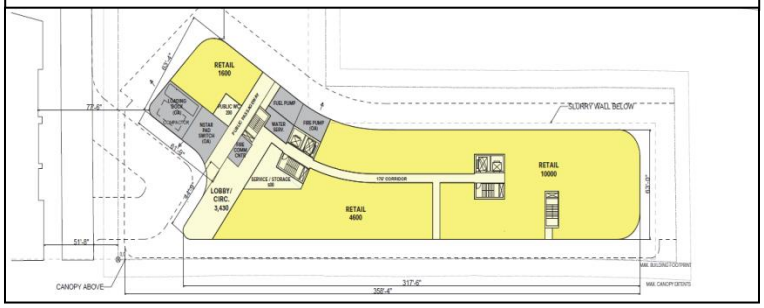
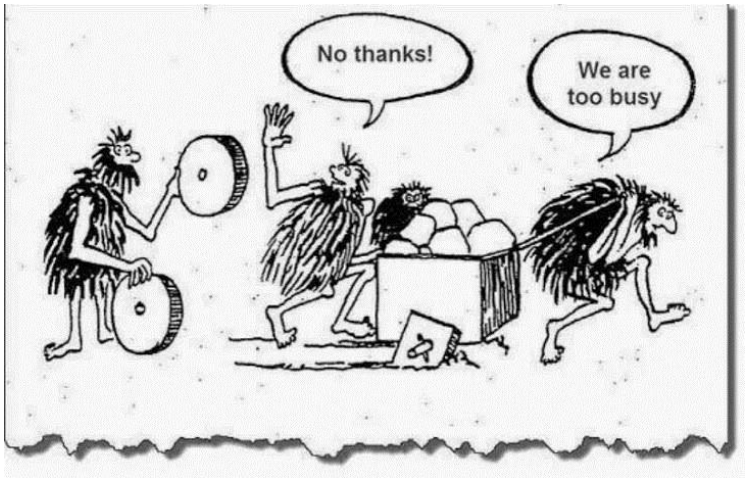


ENGAGE EARLY



DEFINE SPACE, USE AND FUNCTIONS

ESTABLISH BASIS OF DESIGN

BLOCK LOADS
ENERGY MODEL
SYSTEMS

ARCHITECTURE
GLASS & WWR

LEED SCORECARD & EEMs

N + ?

DIVERSITY

SET LEVEL OF SUSTAINABILITY

RESILIENCEY & CRITICAL SYSTEMS


load
outside
Load
Base
require
budget
Parasitic
ASHRAE
ECMs
kBtu
data
HVAC
service
functional
measured
consumption
EUI
Operational
footage
within
Exterior
Facility
facility
landlord
building's
square
Retro-Commissioning
investment
testing
Analyze
performance
building
consumed
comparison
implemented
Conservation
Improvements
observations
Transportation
gross
requirements
following
Whole-building
analysis
walk-through
use
efficiency
Energy
located
impact
lighting
tenant
Systems
Vertical
recommend
systems
Building
Measures
building's
Equipment
real-time
physically
conducting
Audit
Intensity
Use
Identify
measures
Interior
modeling
equipment
capital
associated
divided
reduce
utility
Historic
Total Level
and/or
annual
current
base

MECHANICAL/ELECTRICAL DESIGN CRITERA

I. HEATING, VENTILATING AND AIR CONDITIONING

Baseline Design Criteria

The Baseline Design Criteria is NOT a cookbook or a limit on the Engineer's creativity.

It is simply an attempt to define critical issues of technical systems design that are important to Tishman Speyer Properties' ability to deliver high quality, yet flexible and cost efficient, mechanical and electrical systems for our properties.

It is imperative to keep in mind that technical system design solutions differ from market to market, country to country, and Engineer to Engineer. What is appropriate for New York may not be appropriate for Los Angeles and may be looked upon with horrified eyes by a European Consultant.

These Standards, while a worthwhile tool as a checklist or punch list as to what to cover with the Engineer/Consultant, is intended primarily for the use of the MEP Project Manager/Engineer who is best qualified to control the MEP design and construction process and make the necessary judgments as to when to deviate from these Standards and Criteria.

The MEP Project Manager/Engineer needs to keep in mind "best practice" in the use of these "criteria" in guiding the Engineer/Consultant through the design process.

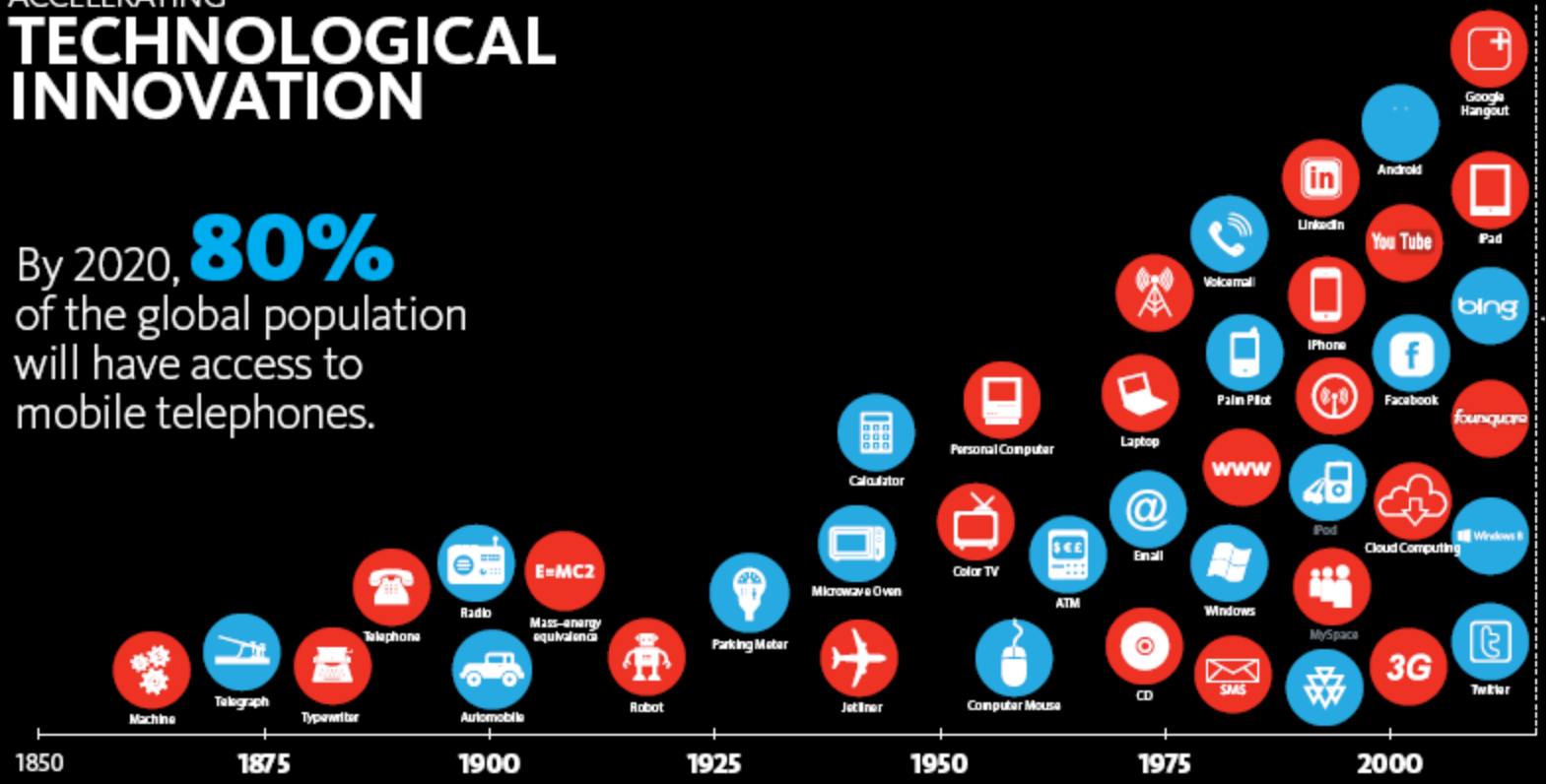
LOOK INTO THE FUTURE

Provide a flexible and agile workspace catering for the following:
-Informal reception/meeting space for 3 seats
-Large Meeting Room for 12 pp
-Small Meeting/Focus room for 6pp
-Breakout/Kitchen area for 14
-One small office or quiet meeting room for 4pp
-4 different types of work points consisting of:
-6 electrically height adjustable desks that can be unplugged and moved around the tenancy
-4 focus / private or quiet work points
-8 open plan workstations that allow for collaborative working

ACCELERATING

TECHNOLOGICAL INNOVATION

By 2020, **80%** of the global population will have access to mobile telephones.

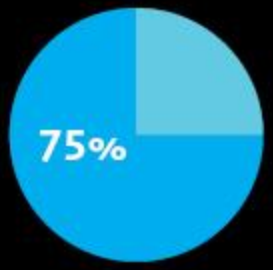


Source: Institute for the Future + Rockefeller Foundation 2020 Forecast: The Future of Cities, Information and Inclusion 2011

A DRAMATICALLY

SHIFTING WORKFORCE

2030



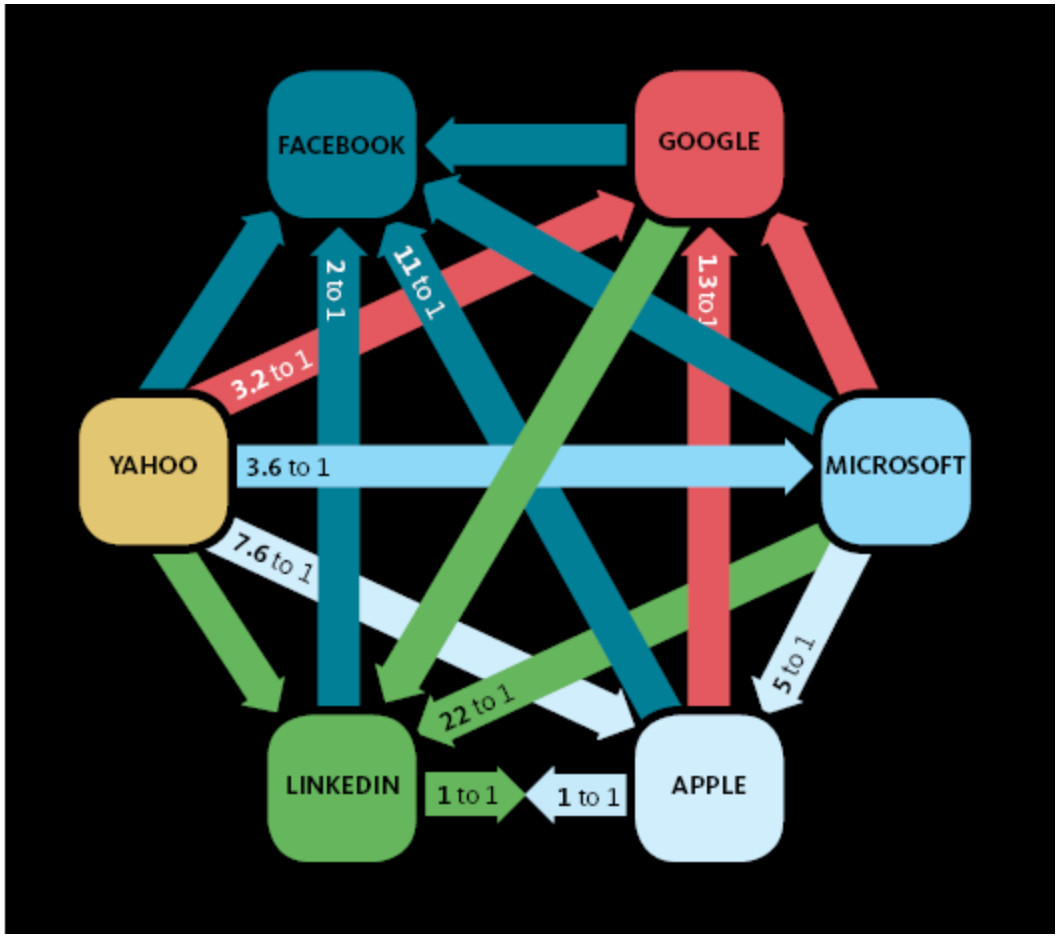
Millennials in Global Workforce

Source: Forbes, Three Reasons You Need to Adopt a Millennial Mindset Regardless of Your Age, Oct. 2012; Forbes, Why You Should Be Hiring Millennials, July 2012

THE RISE OF THE
FREE AGENT

War for talent driving workplace innovation.

"Fewer Harvard MBA's going to work on Wall Street" - The Washington Post, September 2013



THE PUSH FOR

HEALTH & WELLNESS

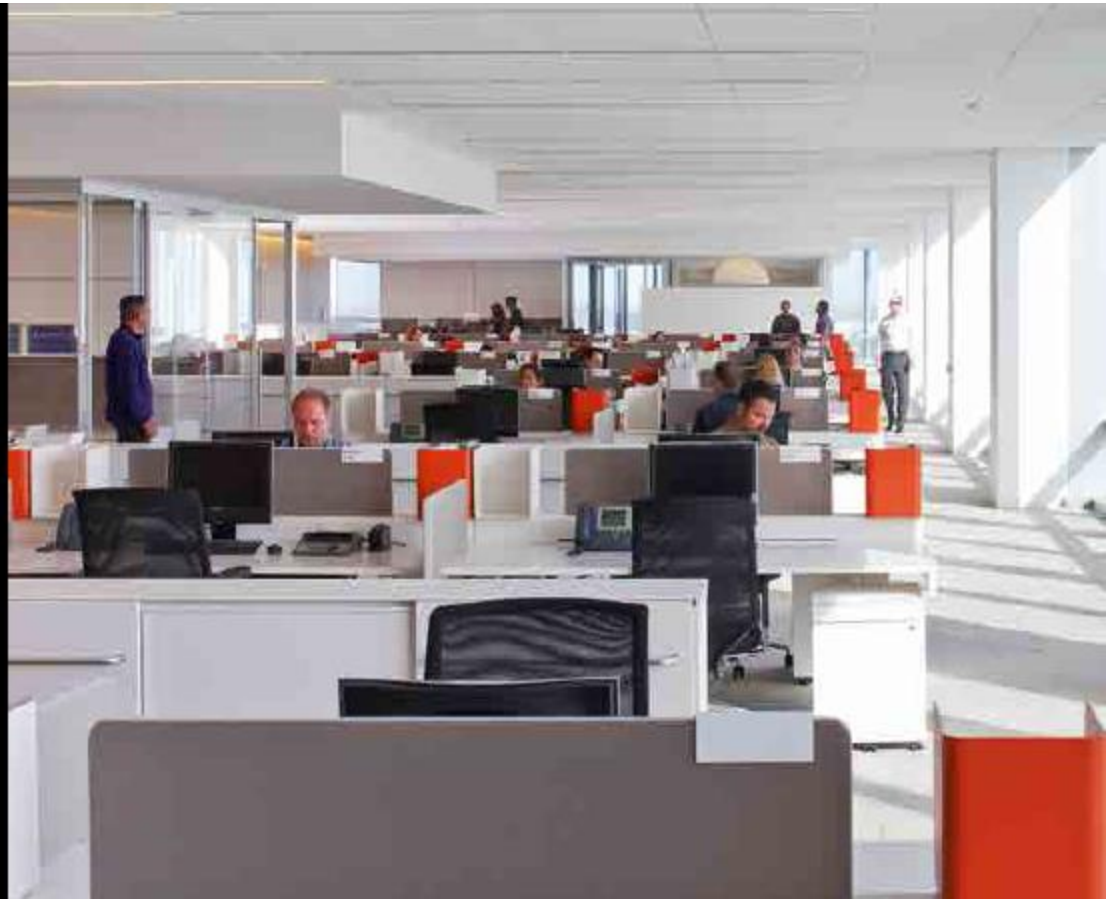
To meet employee demand and **ensure retention**, global firms are infusing fitness spaces, health programs and living art displays into their workplace designs.

PNC Place | Pittsburg, PA

WORKPLACE TRENDS FOR THE FINANCIAL SERVICES SECTOR

ADOPTING GLOBAL MODELS

Now, more than ever, companies are adopting global standards across their entire portfolio.



WORKPLACE TRENDS FOR THE FINANCIAL SERVICES SECTOR

VISIBILITY & TRANSPARENCY

Exhibit transparency and openness in design, while acknowledging compliance requirements.

WORKPLACE TRENDS FOR THE FINANCIAL SERVICES SECTOR

ONSITE & OFFSITE MOBILITY

50%

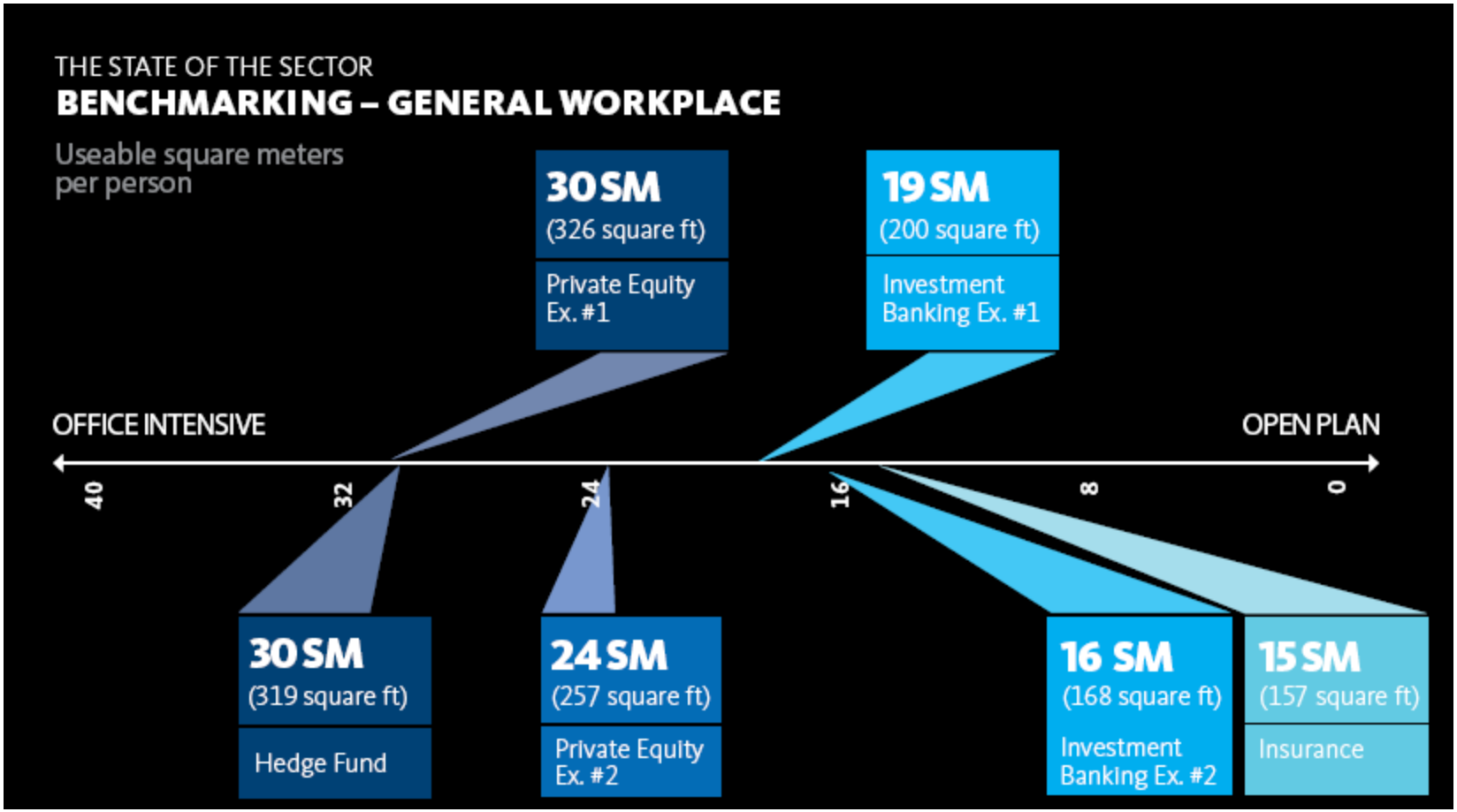
of firms surveyed have already developed an unassigned seating/ mobility program.

This study looked at companies such as: Morgan Stanley, HSBC, Deutsche, JPMC, Credit Suisse, UBS, Wells Fargo, Bank of America, TDBank, Goldman Sachs, PNC, and Capital One

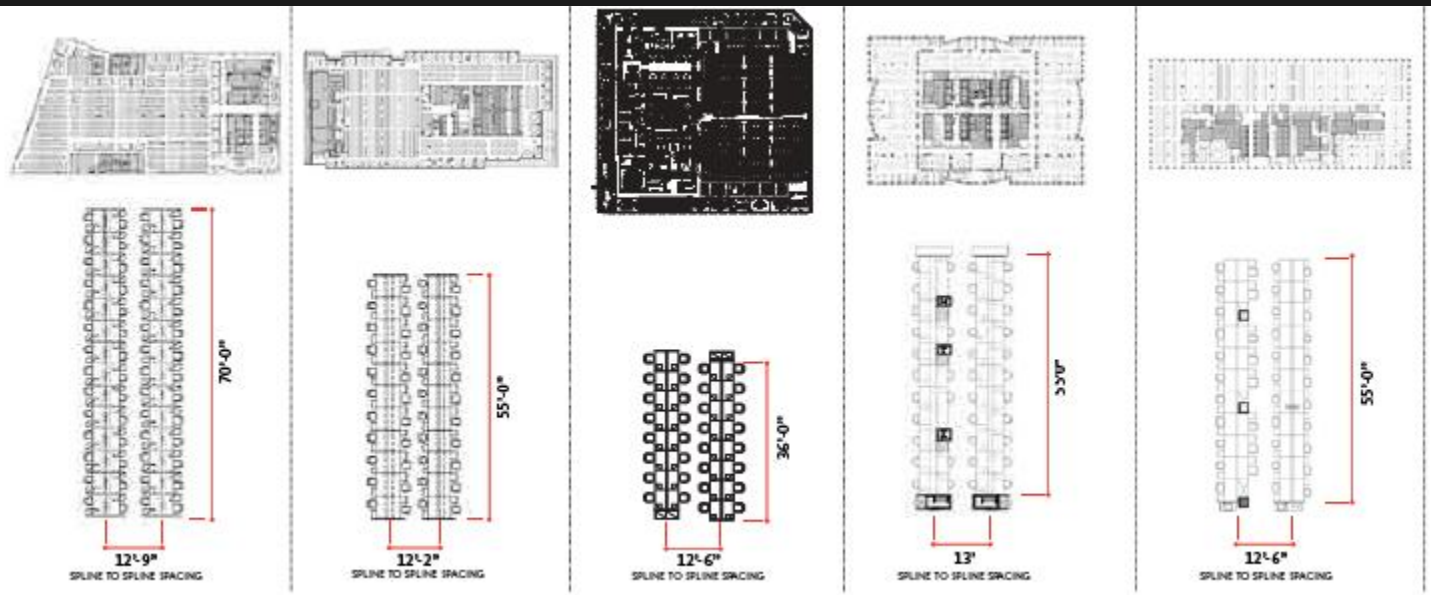
WORKPLACE TRENDS FOR THE FINANCIAL SERVICES SECTOR

EMPLOYEE ATTRACTION AND RETENTION

Currently only **one in four** financial services employees works in a top-performing workplace.


THE STATE OF THE SECTOR
BENCHMARKING – GENERAL WORKPLACE
Useable square meters per person
30 SM
(326 square ft)
Private Equity Ex. #1
19 SM
(200 square ft)
Investment Banking Ex. #1
OFFICE INTENSIVE
OPEN PLAN
40
32
24
16
8
0
30 SM
(319 square ft)
Hedge Fund
24 SM
(257 square ft)
Private Equity Ex. #2
16 SM
(168 square ft)
Investment Banking Ex. #2
15 SM
(157 square ft)
Insurance

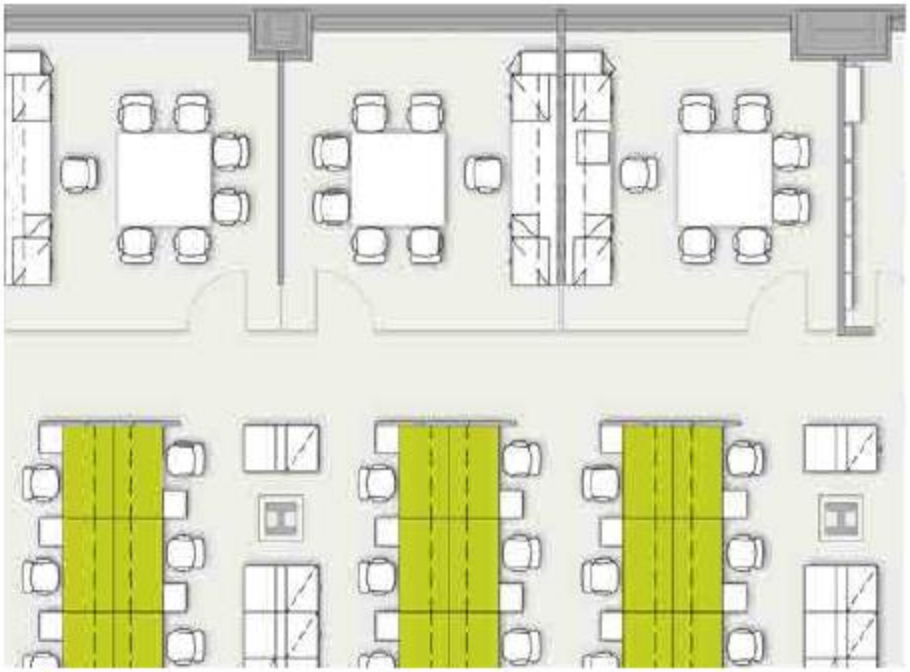
APPROACHES TO DESK LAYOUT



REMOTING OF PC'S

COLLABORATION / AMENITY SPACES

TEAM ROOM / OFFICE



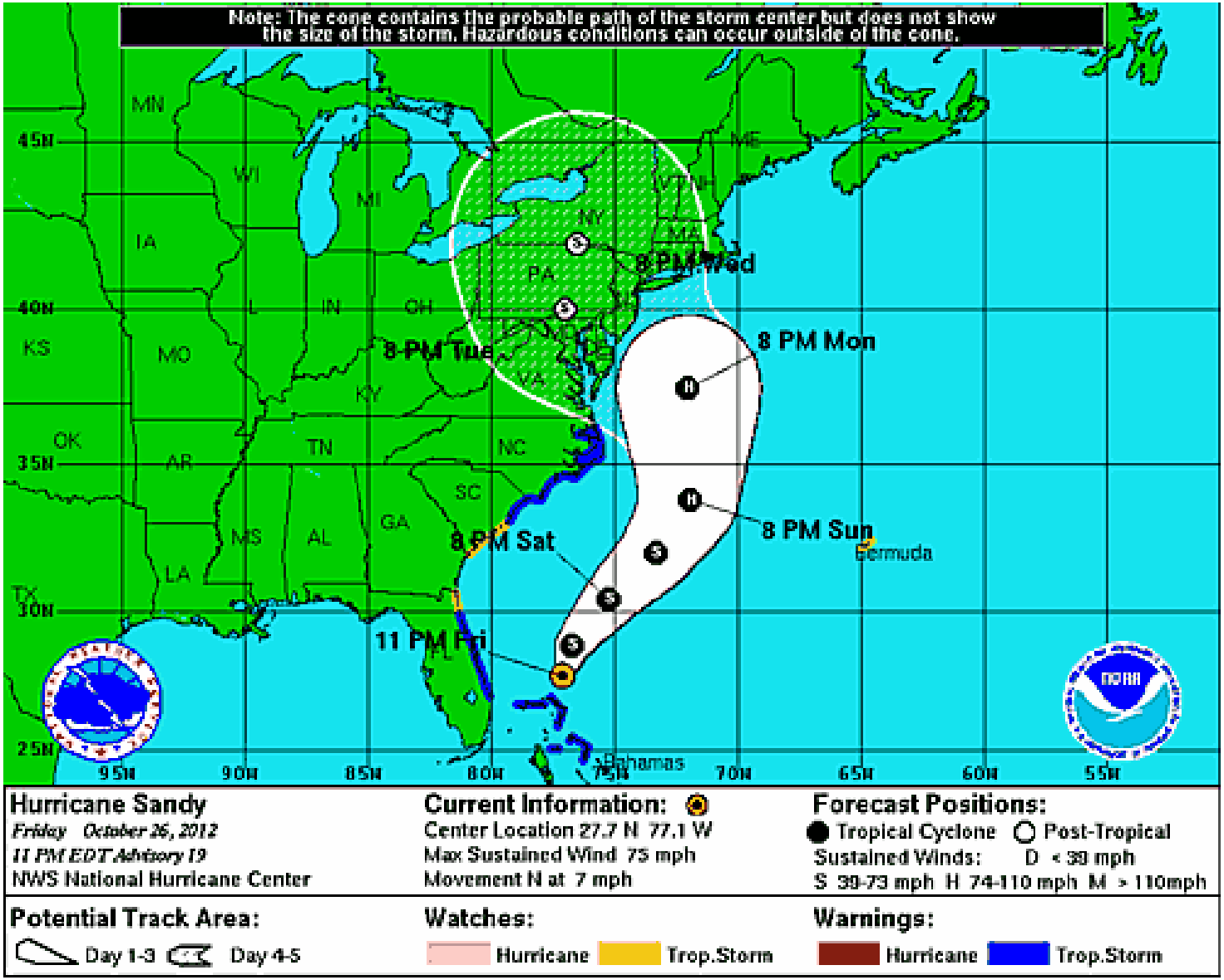
ENHANCED PROXIMITY

- "Morning Meeting Rooms"
- Traders' pantry
- Core restrooms
- Collaboration spaces
- Alternative work spaces

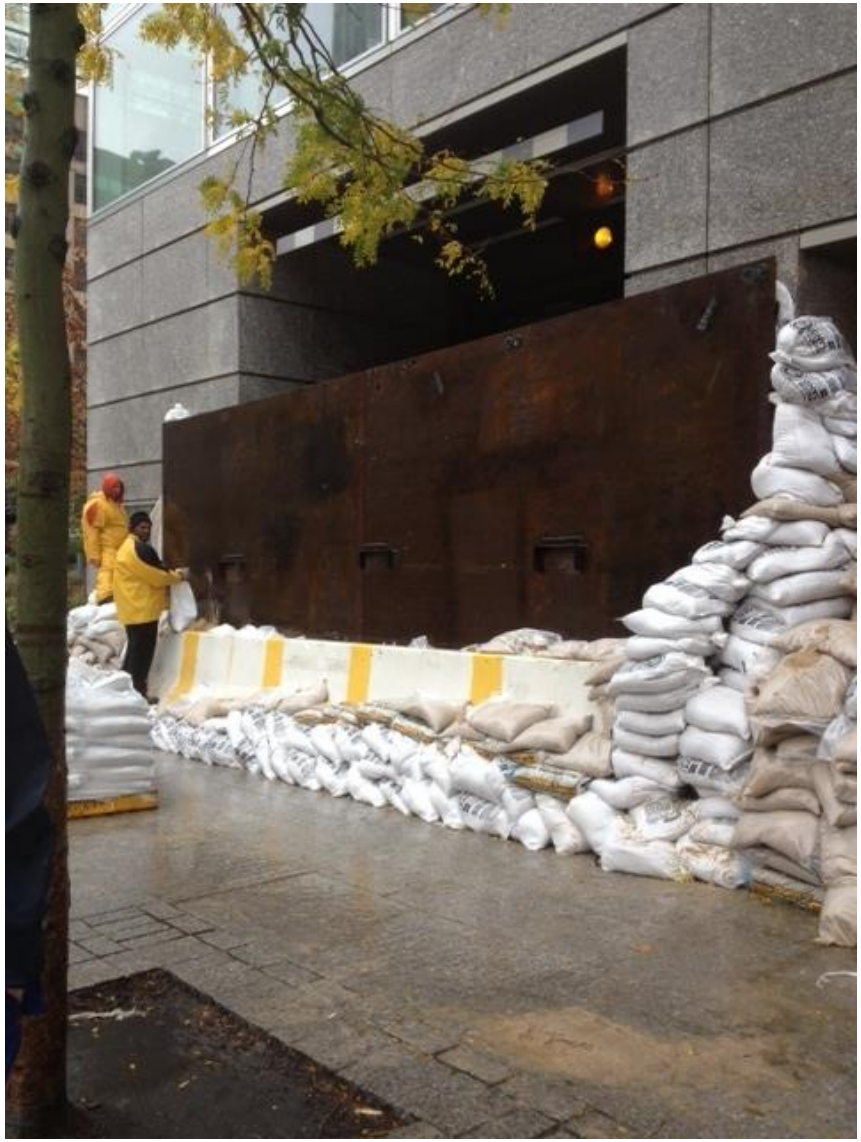
LIGHTING

- Lighting design
- Lighting systems and compliance walls
- Ceiling functions as a compass
- Tickers and newsfeeds

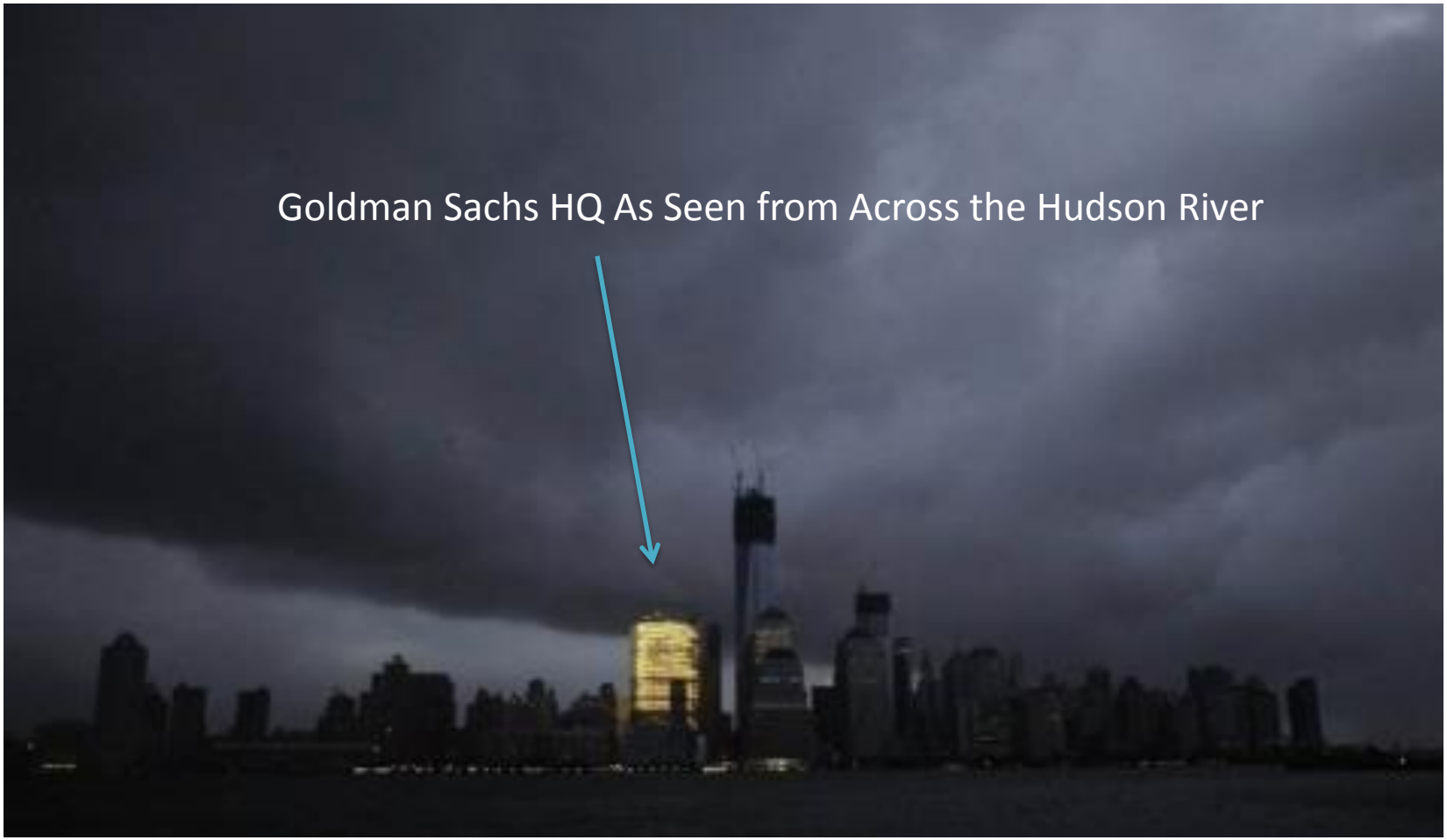
EVOLVING TECHNOLOGIES


Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.
MN
WI
MI
IA
IL
IN
OH
KS
MO
KY
OK
AR
TN
NC
SC
MS
AL
GA
LA
TX
PA
NY
VT
NH
ME
MA
45N
40N
35N
30N
25N
95W
90W
85W
80W
75W
70W
65W
60W
55W
8 PM Wed
8 PM Mon
8 PM Tue
8 PM Sun
8 PM Sat
11 PM Fri
Bermuda
Bahamas
Hurricane Sandy
Friday October 26, 2012
11 PM EDT Advisory 19
NWS National Hurricane Center
Current Information:
Center Location 27.7 N 77.1 W
Max Sustained Wind 75 mph
Movement N at 7 mph
Forecast Positions:
Tropical Cyclone
Post-Tropical
Sustained Winds: D < 39 mph
S 39-73 mph H 74-110 mph M > 110mph
Potential Track Area:
Day 1-3
Day 4-5
Watches:
Hurricane
Trop.Storm
Warnings:
Hurricane
Trop.Storm

15,000 Sandbags
350 Jersey Barriers
1 Massive Steel Plate (custom fabricated)
125 Laborers



After the Storm



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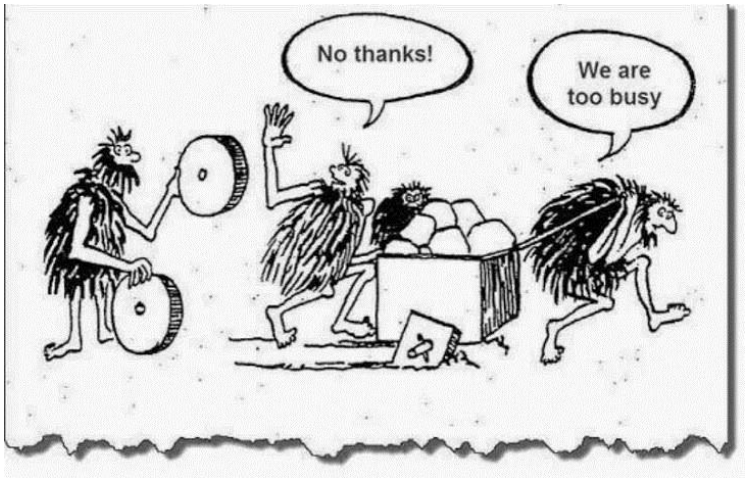
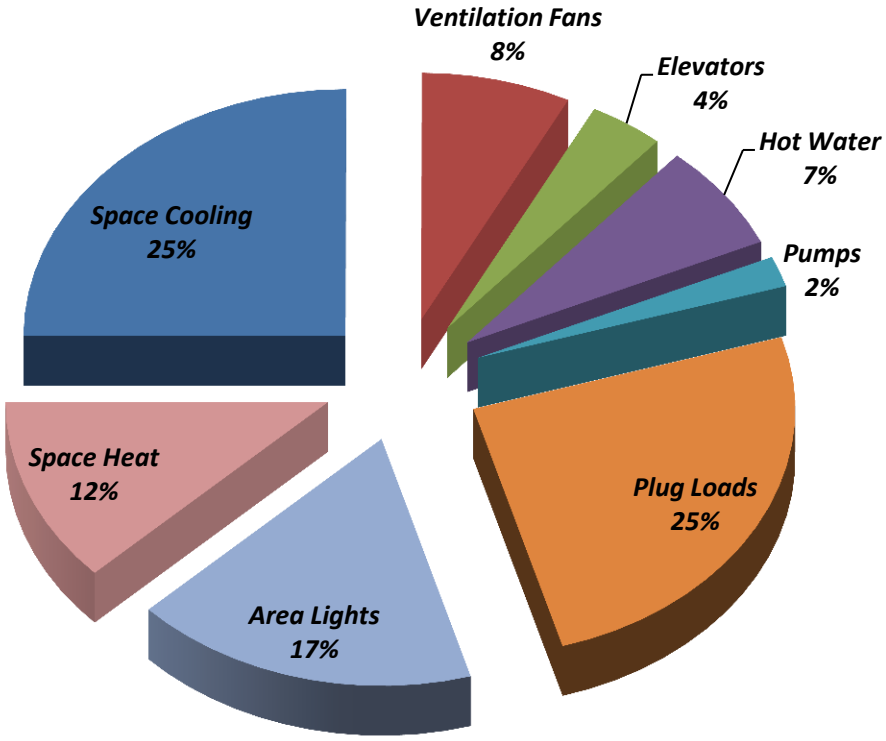



Ventilation Fans
8%
Elevators
4%
Hot Water
7%
Pumps
2%
Plug Loads
25%
Area Lights
17%
Space Heat
12%
Space Cooling
25%

3. ASHRAE 90.1-2007 Appendix G

3.1 General Description

ASHRAE Standard 90.1-2007 provides minimum energy-efficiency requirements for the design and construction of new buildings and their systems, building additions and their systems, new systems, and equipment in existing buildings.

The Appendix G of the ASHRAE 90.1-2007 standard uses the Performance Rating Method to evaluate the energy performance of building designs. All energy costs within and associated with the building project have to be considered. Additionally, the design has to meet all the requirements of ASHRAE 90.1-2007 as described in sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4, as well as all mandatory provisions.

Appendix G sets the modeling requirements for calculating the design and the baseline building performances. These requirements apply to:

1. Building Envelope
2. Additions and Alterations
3. Space Use Classifications
4. Schedules
5. Lighting
6. Thermal Blocks – HVAC Zones
7. HVAC Systems
8. Service Hot Water Systems
9. Receptacle and other Loads
10. Modeling Limitations to the Simulation Program

In this approach the proposed design is compared against a baseline case as outlined by ASHRAE Standard 90.1-2007 in terms of energy cost savings. This percentage determines the number of points achievable under LEED rating system for EA Credit 1.

VI. Model Input Summary: ASHRAE 90.1 2007 Baseline and Base ECM's

PIER-IV Development : DD Model Input Summary		
Exterior Envelope		
	ASHRAE 90.1 2007 Baseline	BASE ECM's
Roof	R-20 insulation entirely above deck. Assembly U-value 0.048	R-20 insulation entirely above deck. Assembly U-value 0.048
Curtain Wall Glazing Properties:	Metal Framing (curtain wall/ storefront) Assembly U-Value: 0.45 SHGC: 0.40 VT%: 90%	Curtain Wall: GL-1 c.o.g U-value: 0.26 Assembly U-Value: 0.36 SHGC: 0.33 VT%: 53% Storefront: GL-4 (Viracon VE 24-85 low-e air filled) c.o.g U-value: 0.31 winter/ 0.29 summer Assembly U-Value: 0.4 SHGC: 0.61 VT%: 80%
Vision Glass (WWR %)	40%	70%
Opaque Surface/ Spandrel	Steel Framed with R-13 cavity anD R-7.5 continuous insulation. Assembly U-value: 0.064	Shadow Box: Double low-e glass + air gap + 3" semi-rigid mineral fiber insulation. Estimated Assembly U Value: 0.13
Interior Loads		
	ASHRAE 90.1 2007 Baseline	BASE ECM's
Lighting	1.0 Watts/SF	1.0 Watts/SF
Equipment	3 Watts/SF (with diversity)	3 Watts/SF (with diversity)
Sensible Heat Gain	250 Btu/h-person	250 Btu/h-person
Latent Heat Gain	200 Btu/h-person	200 Btu/h-person
Occupant Density	200 SF/Person	200 SF/Person
HVAC : Air Side		
	ASHRAE 90.1 2007 Baseline	BASE ECM's
System Description - Primary	ASHRAE 90.1 2007 System #7: VAV with Reheat Cooling Type: Chilled Water Heating Type: Hot Water	Floor by floor VAV AHU's with HW and CHW coils. Series fan powered terminal units. Roof top ERV for ventilation.
Other HVAC Systems	ASHRAE 90.1-2007, Section G3.1.1 Exception (b); Additional system type for non-predominant conditions: Spaces with occupancy/ process loads/schedules that differ significantly from rest of the building. Retail 1-3, fitness, conference center: System #3 - Packaged Single Zone (PSZ) with Furnace	Retail 1-3: Capped HW and CW connections to retail spaces. Water cooled packaged air handlers with hot water heating coils with default ASHRAE 90.1 2007 efficiencies modeled in these spaces. Fitness and Conference Center: Water cooled packaged air handlers with hot water heating coils.
Summer T-Stat	75F	75F
Winter T-Stat	72F	72F

Ventilation	50,000 CFM 0.3 CFM/SF Modeled for future retail spaces	50,000 CFM 0.3 CFM/SF Modeled for future retail spaces
Energy Recovery Unit		
ERV Unit Description	NA	Roof top ERV Unit with no cooling coil. Energy Recovery Wheel to preheat ventilation air. The ERV unit will be provided with a gas furnace for emergency condition and will not operate under normal conditions (not included in energy model).
ERV Unit OA CFM Capacity	-	50,000 CFM
OA AHU EER	-	NA
ERV Fan Power (Supply/Exhaust)		0.001 kW/CFM Supply/ 0.009 kW/CFM Exhaust
Energy Recovery Control Parameters	-	ERV modeled to operate when the HVAC fans are on, and the enthalpy differential between the outside air and the exhaust is at least 1 Btu/lb.
Energy Recovery Control Effectiveness	-	Enthalpy Wheel ERV; Total recovery effectiveness ~72%
Floor VAV AHU's		
Fan Power on VAV AHU	Per ASHRAE 90.1 2007 Section G3.1.2.9 0.001315 kW/CFM. Pressure Drop Adjustment: fully ducted exhaust; MERV 13 Filters	0.0008 kW/cfm As/design 25,000 Supply Air / Floor 4000 CFM OA/Floor
VAV Min Flow Set-points	0.4 CFM/SF	0.3 Min Ratio
Zone Terminal Type	Standard VAV with HW reheat	Series FPB w HW heating in perimeter and core spaces
Zone Total Fan Power	NA	0.0003 kW/CFM
Cooling SAT	55 F	55 F
Heating SAT	95F	95F
Supply Air Temperature Reset	Supply air temperature reset of 5°F under minimum cooling load conditions per G3.1.3.12	Modeled same as Baseline
HVAC : Water Side		
	ASHRAE 90.1 2007 Baseline	BASE ECM's
Chiller Type	Water-cooled centrifugal chillers	Water-cooled centrifugal chillers
Chiller Qty	2	3
Chiller Capacity	Auto-sized: 750 tons each	350 Tons each
Chiller Efficiency (Full load/part load) performance	Centrifugal Chiller >300 Tons Peak Load: 6.1 COP/0.576 kW/Ton	Centrifugal Chiller >300 Tons Peak Load: 0.576 kW/Ton IPLV: 0.345 kW/Ton
CHWS Temp/ Loop dT	44F/ 10F dT	44F/ 10F dT
CHWR Temp	54F	54F

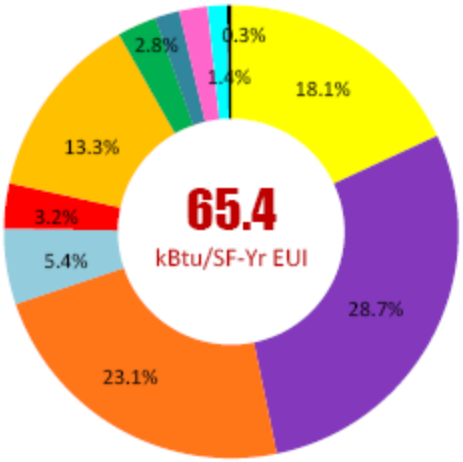
CHWS Temperature Reset Parameters	44F at 80F and above, 54F at 60F and below, and ramped linearly between 44F and 54F at temperatures between 80F and 60F.	Fixed Set-point
Water Side Economizer	NA	Yes
Hot Water		
Boiler Type/ Number	Gas Fired Condensing	Gas Fired Condensing
Boiler Qty.	2	4
Boiler Capacity	Auto-sized: 4775 KBTU/Hr each	3720 KBTU/Hr each
HW Loop Temperature	180F	140F
HW Loop Delta	50F	20F
Boiler Efficiency	82% Combustion / 77% Thermal Efficiency	93% Thermal Efficiency
HWS Temperature Reset Parameters	180°F at outdoor temps 20°F and below, 150°F at outdoor temps 50°F and above, and ramped linearly between 180°F and 150°F at outdoor temps between 20°F and 50°F	Fixed Set point
Heat Rejection : Cooling Tower and Condenser Water		
Number of Cooling Towers	2	3
Cooling Tower Capacity	Auto-sized: 875 tons each	430 tons each
Cooling Tower Fan Control	Two speed	Two speed
CW Temp & Loop Delta-T	85F/ 10F	85F/ 10F
CT Fan Power	Minimum 38.2 gpm/hp (maximum 0.0262 hp/gpm or 19.5 W/gpm) per Table 6.8.1G	Same as Baseline
Pumps		
CW Pumps	2 @ 19 Watts/GPM; Auto-sized loop flow	3/720 GPM each - 20HP (P 7-8-9)
Chiller Pumps	2 @ 22Watts/GPM; Auto-sized loop flow	3/ 600 GPM each - 20HP (P 4-5-6)
CHW Loop Pump	1 @ 22Watts/GPM; Auto-sized loop flow	3/ 1050 GPM each - 75HP (P 1-2-3)
HW Pumps	1 @ 19 Watts/GPM; Auto-sized loop flow	3/ 450 GPM each -15HP (P 11-12-13)
Domestic Hot Water		
SHW Storage Tank Capacity	Same as proposed	1000 Gallons total(estimate)
SHW DHW Flow		1.5 GPM Reduced Domestic hot water consumption due to use of low flow fixtures modeled as an ECM.
Equipment Efficiency		80% Thermal Efficiency (Et)
Temperature Controls		140F; 80F Delta, 50F inlet water temperature

Table 1. LEED Points based on cost savings

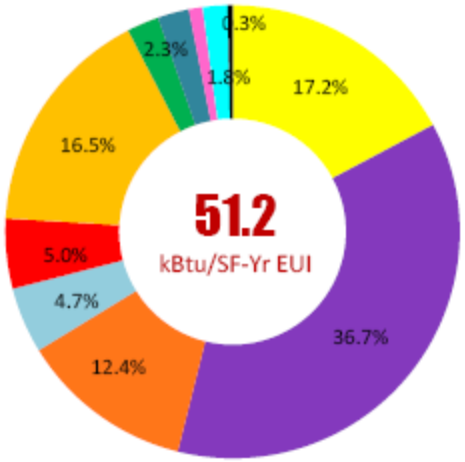
Energy Cost Savings	Points (CS)
12%	3
14%	4
16%	5
18%	6
20%	7
22%	8
24%	9
26%	10
28%	11
30%	12
32%	13
34%	14
36%	15
38%	16
40%	17
42%	18
44%	19
46%	20
48%	21

ENERGY SAVINGS APPROACH			
#	Measure Description	Scenario-1	Scenario-2
	Base ECM's	X	X
1	Glass Alt-1 (U 0.35, SHGC 0.28, VLT 43%)	X	X
2	Increased Roof Insulation R-30	X	X
3	*Interior Lighting - 20% Lighting Reduction	X	-
4	**Interior Lighting - 30% Lighting Reduction	-	X
5	Centrifugal Chiller with VFD	X	-
6	Magnetic Bearing Chiller with VFD	-	X
7	Condensing Boiler Efficiency-95%	X	X
8	Cooling Towers - Fan VFD	X	X
9	CHW Loop Reset	X	X
10	HW Loop Reset	-	-
11	Supply Air Temp Reset - 65F	X	X
12	*Day Light Dimming	X	X
13	Garage CO Monitoring	X	X
14	DHW Savings	X	X
15	*Occ Sensors (enclosed spaces: private offices, restrooms, storage, copy rooms,etc.)	X	-
16	**Occ Sensors (enclosed spaces + large open office areas)	-	X
17	*DCV Zone Sensor	X	X
	% Energy Use Savings	21.7%	23.4%
	% Energy Cost Savings	14%	16.3%
LEED Points (As per LEED CS Alternative Compliance Path (ACP), point threshold based on the Percent of Energy Cost influenced or directly controlled by CS owner/developer)		4	5
*Required ECM's within Tenant Scope to meet Massachusetts Stretch Energy Code requirement of 20% energy use reduction.			
**Optional ECM's within Tenant Scope for additional savings.			

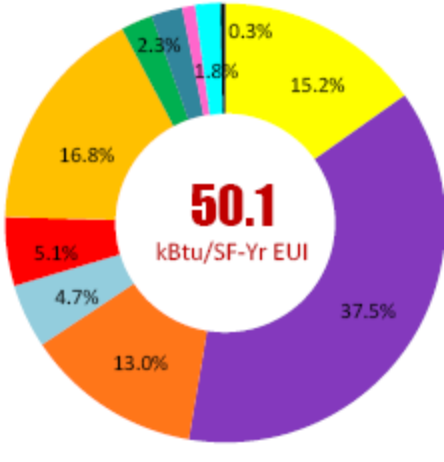
Table-1: Potential Design Scenarios



ASHRAE BASELINE



SCENARIO -1

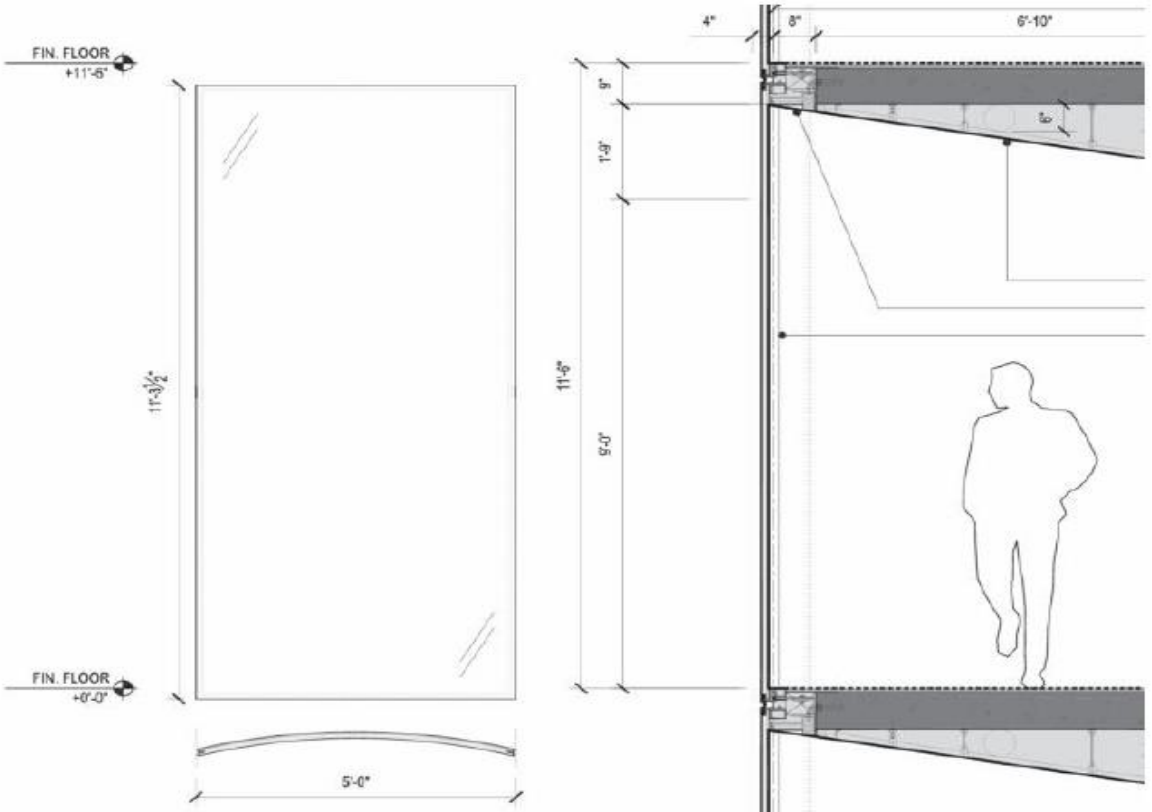


SCENARIO-2

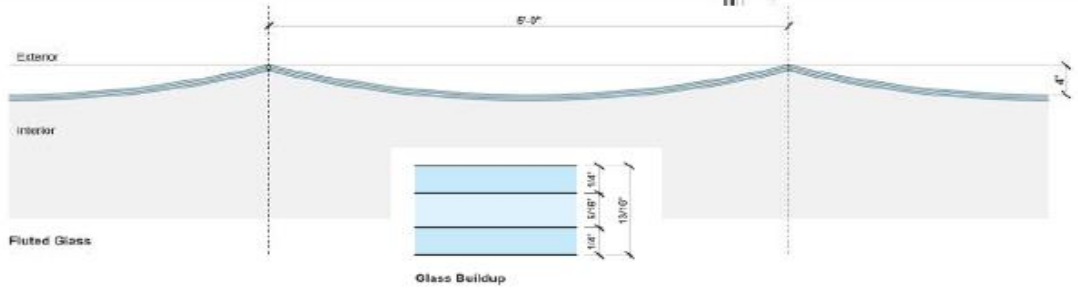
SITE ENERGY CONSUMPTION BY END-USE

Energy Use Savings (MMBtu/Yr)											
Description	Lights	Misc Equip	Space Heating	Space Cooling	Pumps & Aux	Vent Fans	DHW	Elevator Loads	Garage Exhaust	Ext Lighting	H Rej
90.1 BASELINE	4685	7455	5983	1397	841	3459	725	452	523	358	
Scenario-1	3495	7455	2516	953	1015	3345	464	452	199	358	
Scenario-2	3014	7455	2587	937	1009	3343	464	452	199	358	

Energy Use and Cost Summary				
Description		90.1 BASELINE	Scenario-1	Scenario-2
Annual Energy Consumption				
Electricity	kWh	5,637,789	5,081,089	4,932,186
Natural Gas	Therm	67,070	29,796	30,508
Total Enery use	MMBtu	25,948.6	68.9	66.7
Annual Energy Costs				
Electricity	$0.1436	$809,586.5	$729,644.4	$708,261.9
Natural Gas	$1.20	$80,484.0	$35,755.2	$36,609.6
Total Energy Cost	$	**$890,070**	**$765,400**	**$744,872**
			14.0%	16.3%



CURVED GLASS PANEL / WALL SECTION



- Fluted Glazing

2020/2030 M Street for Tishman Speyer
Architects: REX / Kendall Heaton Associates

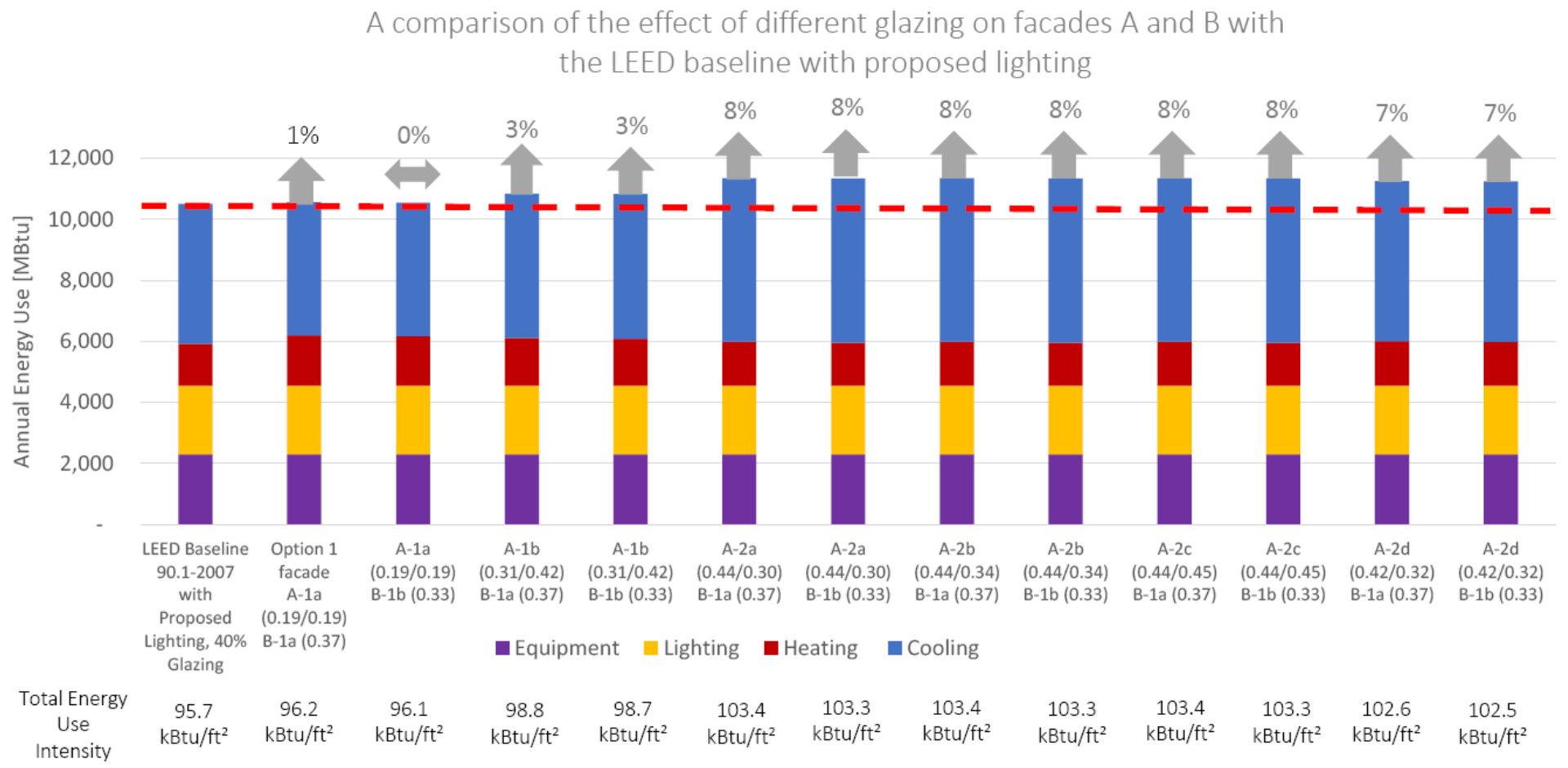
Exterior Glazing Performance Data
PRELIMINARY

July 14, 2015
Prepared by Front Inc

Location	IGU Coatings		Center U	Center SHGC	Center VLT	Reflectance Outer	Reflectance Inner	Edge U	Frame U	% Area Center	% Area Edge	% Area Frame	Assembly U	Assembly SHGC	Assembly VLT	VLT to SHGC Ratio
FAÇADE A "CURVED GLASS CURTAIN WALL"	Option 1a	AGC Stopsol Grey #2 + Guardian SN68 #3	0.29	0.22	0.22	0.34	0.11	0.45	0.85	77%	11%	12%	0.38	0.19	0.19	1.00
	Option 1b	AGC Stopsol Clear #2 + Guardian SN68 #3	0.29	0.35	0.48	0.36	0.25	0.45	0.85	77%	11%	12%	0.38	0.31	0.42	1.37
	Option 2a	Guardian HP Silver 35 on #3	0.30	0.50	0.34	0.24	0.41	0.45	0.85	77%	11%	12%	0.38	0.44	0.30	0.68
	Option 2b	Guardian HP Silver 40 on #3	0.30	0.50	0.39	0.18	0.13	0.45	0.85	77%	11%	12%	0.38	0.44	0.34	0.78
	Option 2c	Guardian AG 50 on Clear #3	0.30	0.50	0.51	0.18	0.27	0.45	0.85	77%	11%	12%	0.38	0.44	0.45	1.02
	Option 2d	Guardian AG 50 on Crystal Grey #3	0.30	0.48	0.37	0.18	0.16	0.45	0.85	77%	11%	12%	0.38	0.42	0.32	0.77
FAÇADE B1 "PUNCHED WINDOWS" AT PRE-CAST PANEL WALL	Option 1a	Guardian SN68 on #2, Air	0.30	0.27	0.43	0.07	0.12	0.42	1.00	81%	10%	9%	0.37	0.25	0.39	1.59
	Option 1b	Guardian SN68 on #2, Argon	0.25	0.27	0.43	0.07	0.12	0.42	1.00	81%	10%	9%	0.33	0.25	0.39	1.59

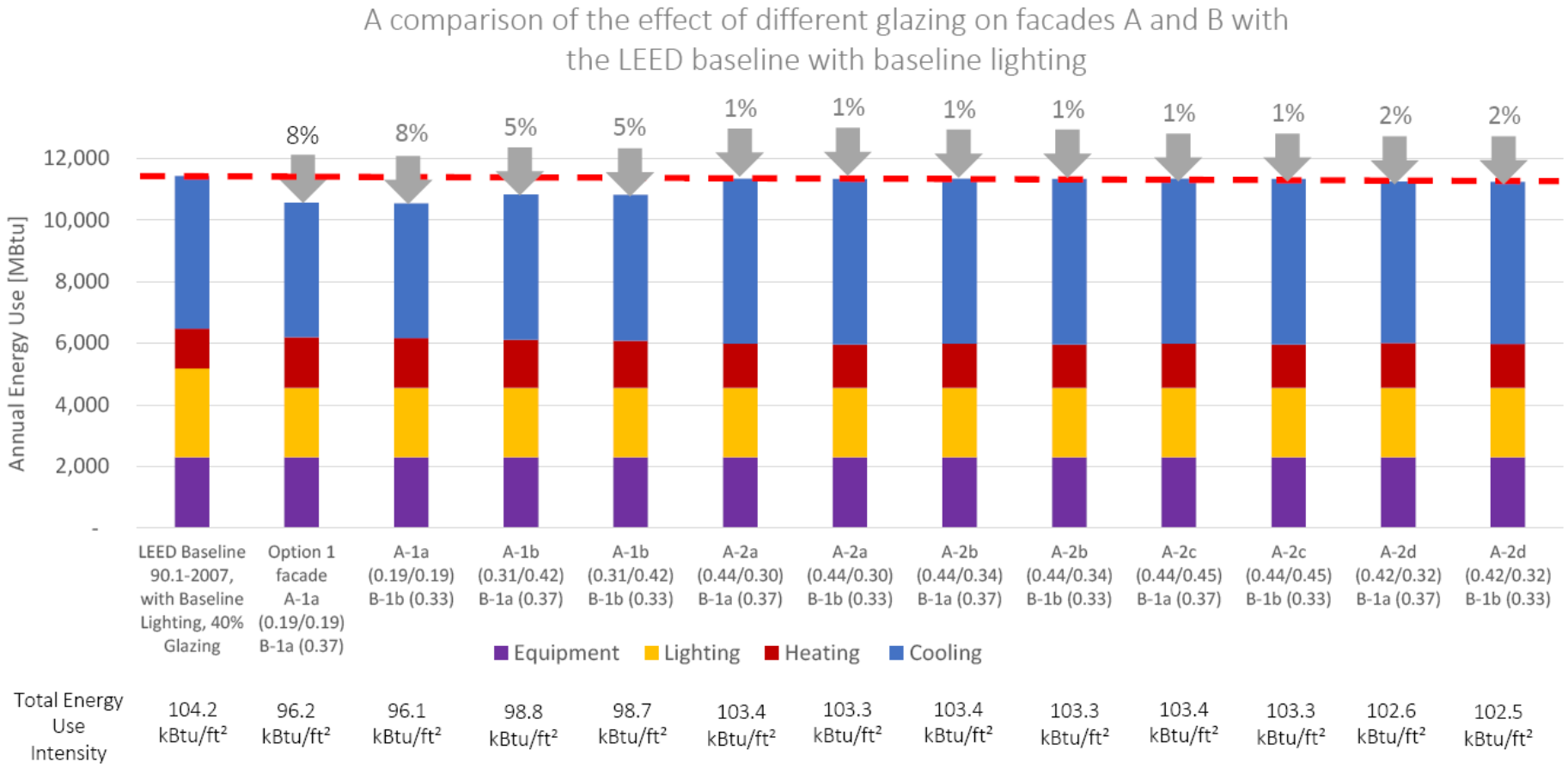
Zones	Proposed Lighting		Baseline Lighting		Schedule	Occupancy		Equipment		Schedule
	W/ft²	Total (W)	W/ft²	Total (W)		Per Room	Total	W/ft²	Total (W)	
Building Average	0.8 W/ft²		1.0 W/ft²			Occupancy	160 ft²/per	Equipment	1.2 W/ft²	
Open Office	0.9	265,825	1.1	324,898	Office Lighting	150 ft² / People	1,969	1.5 W/ft²	443,043	Office Occ and Equip
Lobby	0.5	1,961	1.3	4,721	Lobby Lighting	1 Person	337	-	-	Lobby Occ and Equip
Corridor	0.7	409	0.5	305	Office Lighting	-	-	-	-	Office Occ and Equip
Stair	0.7	2,552	0.6	2,285	Office Lighting	-	-	-	-	Office Occ and Equip
Elevator	0.7	3,480	0.5	2,597	Office Lighting	-	-	5,000 W	5,000	Office Occ and Equip
Restroom	1.1	11,407	0.9	9,333	Office Lighting	-	-	-	-	Office Occ and Equip
Parking	0.2	6,799	0.2	7,998	Parking Lighting	-	-	-	-	Parking Occ and Equip
Mechanical Rooms	0.5	4,016	1.5	12,550	Mechanical Lighting	-	-	-	-	Mechanical Occ and Equip
CBS Building	0.9	19,456	1.1	23,779	Office Lighting	150 ft² / People	144	1.5 W/ft²	32,426	Office Occ and Equip
CBS Core	0.7	820	0.5	613	Office Lighting	-	-	-	-	Office Occ and Equip

Study matrix	Façade A – Fluted Glazing			Façade B – Punched Glazing			Window to wall percentage	Lighting Levels [W/ft²]
	Assembly U-Value [Btu/h.ft².F]	Assembly SHGC	Assembly VLT	Assembly U-Value [Btu/h.ft².F]	Assembly SHGC	Assembly VLT		
LEED baseline w/baseline lighting	0.55	0.4	0.72	0.55	0.4	0.72	40%	1.1



Total Energy Use Intensity	95.7 kBtu/ft²	96.2 kBtu/ft²	96.1 kBtu/ft²	98.8 kBtu/ft²	98.7 kBtu/ft²	103.4 kBtu/ft²	103.3 kBtu/ft²	103.4 kBtu/ft²	103.3 kBtu/ft²	103.4 kBtu/ft²	103.3 kBtu/ft²	102.6 kBtu/ft²	102.5 kBtu/ft²

Study matrix	Façade A – Fluted Glazing			Façade B – Punched Glazing			Window to wall percentage	Lighting Levels [W/ft²]
	Assembly U-Value [Btu/h.ft².F]	Assembly SHGC	Assembly VLT	Assembly U-Value [Btu/h.ft².F]	Assembly SHGC	Assembly VLT		
LEED baseline w/proposed lighting	0.55	0.4	0.72	0.55	0.4	0.72	40%	0.9



Total Energy Use Intensity	104.2 kBtu/ft²	96.2 kBtu/ft²	96.1 kBtu/ft²	98.8 kBtu/ft²	98.7 kBtu/ft²	103.4 kBtu/ft²	103.3 kBtu/ft²	103.4 kBtu/ft²	103.3 kBtu/ft²	103.4 kBtu/ft²	103.3 kBtu/ft²	102.6 kBtu/ft²	102.5 kBtu/ft²

VII. Energy Conservation Strategies

The following Table summarizes the analysis results for each ECM. Note that the each strategy was analy against the ASHRAE 90.1 2007 Baseline and includes savings from the Base ECM's.

#	Measure	Measure Description	Savings above ASHRAE Baseline			Incremental sa	
			$ Savings	Energy Use (%)	Energy Cost (%)	$ Savings	Ene
	Base ECM's	Base Measures included within the Core and Shell scope - Refer Model Input Summary	$9,876	8.3%	1.1%	-	
1	Glass Alt-1 (U 0.35, SHGC 0.28, VLT 43%)	Spandrel U=0.15 (assembly) Glazing (GL-1): Assembly U-value: 0.35 (c.o.g u-0.25) SHGC: 0.28 VLT: 43%	$15,501	8.6%	1.7%	$5,624	
2	Increased Roof Insulation R-30	R-30 c.i. Assembly U-Value: 0.032	$10,442	8.4%	1.2%	$566	
3	*Interior Lighting - 20% Lighting Reduction	20% below ASHRAE 90.1 2007 allowance Office: 0.8 W/SF Parking: 0.24 W/SF Mech Penthouse: 1.12 W/SF	$48,421	11.4%	5.4%	$38,545	
4	**Interior Lighting - 30% Lighting Reduction	30% below ASHRAE 90.1 2007 allowance Office: 0.7 W/SF Parking: 0.21 W/SF Mech Penthouse: 0.98 W/SF	$67,506	12.9%	7.6%	$57,629	
5	Centrifugal Chiller with VFD	Chiller utilizes a variable-speed drive	$20,223	9.3%	2.3%	$10,346	
6	Magnetic Bearing Chiller with VFD		$23,046	9.5%	2.6%	$13,169	
7	Condensing Boiler Efficiency-95%	95% Thermal Efficiency (Et)	$10,725	8.6%	1.2%	$848	
8	Cooling Towers - Fan VFD	Variable Speed Drive on CT Fans	$11,904	8.5%	1.3%	$2,028	
		44F at 80F and above, 54F at 60F and below,					

IDENTIFICATION OF CONSULTANTS

Leverage relationships with some of the world's best design and engineering firms while maintaining competitive fee structures.

INITIAL CONCEPT DESIGN

Evaluate design concepts with regard to constructability and budget constraints, and closely manage the architect so that feasibility is built in from the very beginning.

DESIGN PHASE PREPARATION

Now the Local Codes and Market Trends. Supervise all planning and approvals and site investigations required for the preparation of construction.

MANAGE THE PROCESS

Manage the entire design process from schematic to completed construction documents.

PLAN REVIEW, VE AND BUDGETING

Analyze all systems and components with an eye on the current construction market for labor and materials.

PROCUREMENT

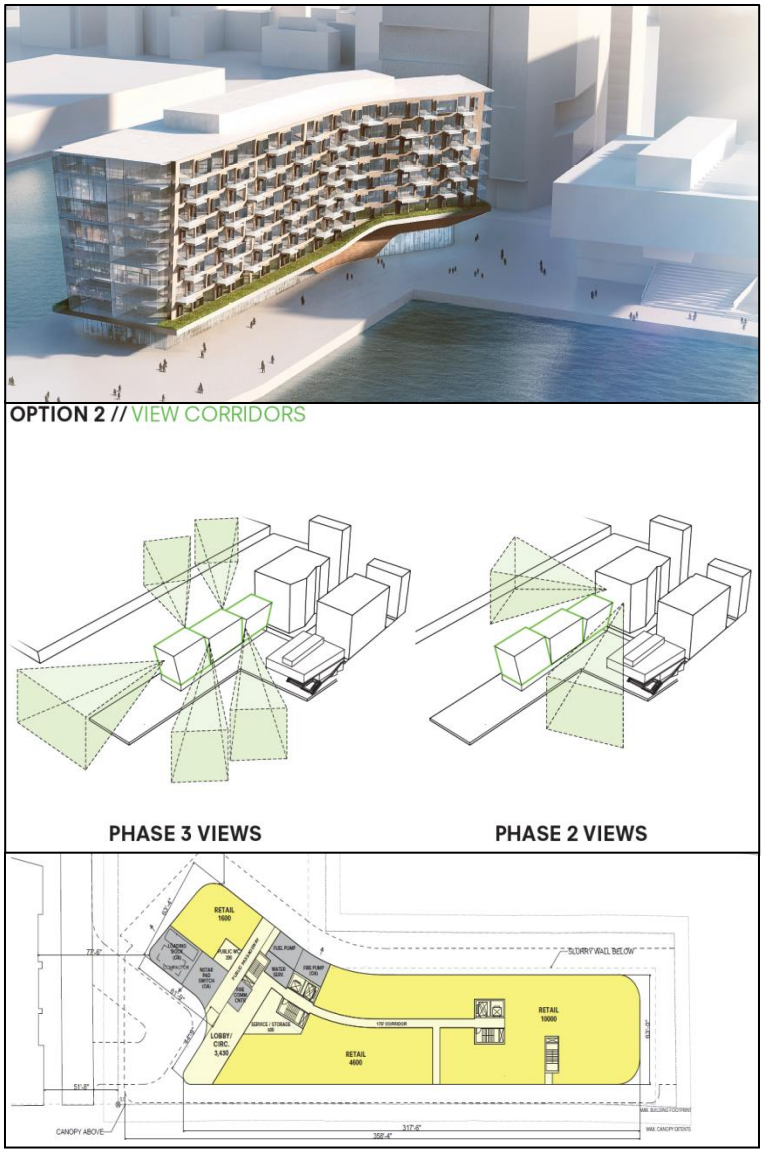
Stay involved in the selection of materials and equipment.

SCHEDULES AND RESOURCES

From approvals to bidding and through to construction, maintain momentum to stay on time and on budget.

COMMISSIONING AND DELIVERABLES

Follow through in the process of validating operational performance and the proper training of facility management personnel.



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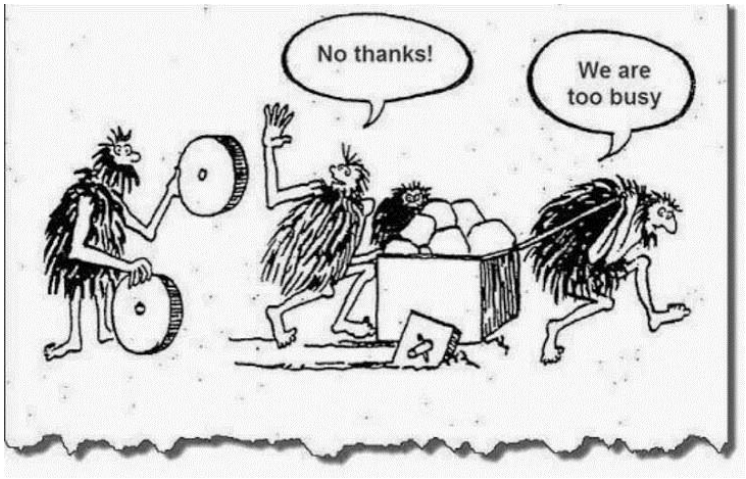


Procurement Methods for pre-purchase or direct purchase items, items which Citi wishes to have quality control over and items of a large quantity to limit parts and service issues resulting from multiple suppliers:

Method 1. Specifications name multiple manufacturers. Contractors may choose any one they wish to use. The manufacturer is not known until the submittal stage. Any deviation from the listed names, require they follow procedures for substitutions.

Fans
Amenities AHU
Pumps
Heat Exchangers
Valves
BOH light fixtures
Motors
Electrical Panels
Transformers (General)
Load Bank
Unit Heaters
UFAD Supply Fan upgrades
Window Washing
Registers, Diffusers and Linear Grills
Grass Seed

Method 2*. Tishman or Turner issues an RFP for an equipment package. Once a Vendor is selected, the package is assigned in total to one or more specific installing contractors.

- **Chillers**
- **DOAS Boxes for Corp Center**
- **CRAH Units (Turner)**
- **UFAD / Air Columns (Turner)**
- **Generators**
- **Utility and Distribution Switchboards, Panel Boards and Transformers[1]**
- **UPS[2] / CDPs[1]**
- **RPP / PDUs[2] (Turner)**
- **Paralleling Switchgear[1] / ATS Switches**
- **Electrical Power Monitoring System (EPMS)**

1 Breakers to be broken out with alternate prices for Citi to select manufacturer
2 Alternate manufacturers to be broken out for Citi to select manufacturer

Method 3*. Tishman or Turner issues an RFP for a labor and material package. Citi interviews the bidders and selects one. Tishman or Turner issues them a contract for labor, material and service contract. Tishman will establish unit prices that Turner will use.

Elevators
BMS
Fire Alarm
First Responder – Design-Build (HP writes performance specs)

Method 4*. Tishman or Turner issues an RFP for unit prices. Once a vendor is selected, contractors deal directly with the vendor or their representative to procure the item.

Lighting Control
Lighting Fixtures
DOAS Boxes for Typical Floors
VFD
Ceiling System (Turner)
Access Flooring (Turner)
Window Treatment (Turner)

Method 5. Tishman or Turner issues an RFP for a bid package for material and labor. The contractors are given multiple manufacturers to choose from on a specific item. The contractor names which manufacturer he has based his bid on. The contractor has to state the price difference for alternate manufacturers. Citi will interview the vendors and/or select a preferred supplier.

Ice Storage
Boilers

Method 6. Once an award is made to a contractor, that contractor receives bids from multiple manufacturers and presents the cost differences. Citi selects the manufacturer. The contractors purchase the items which are part of their scope. From the manufacturer, prices are guaranteed to other contractors purchasing identical items at the established unit prices.

Typical Floor 100% OA Units
VAV Boxes
Fan Powered Boxes
Power and Data outlets in Raised Floor
Toilet Faucets
Sinks
Water closets
Urinals
Flushometers
Bathroom Partitions
Toilet Accessories
Fire Extinguisher Cabinets
Pantry Refrigerators
Pantry Water and Ice Dispensers
Pantry Microwaves
Drinking Fountains
Door Hardware and Locksets

Method 7. Tishman or Turner instructs in their Riders that the bidding installers contact Citi approved distributors who will furnish the material at pre-negotiated contract prices with Citi. The BOM will be as per the plans and spec and no substitutions will be accepted.

CAT 6 and CAT 6A Structured Cabling
IT Racks and Cable Management Hardware
IT Rack PDUs/Power Strips
IT Grounding Products
BMS Fiber Riser

Method 8. Tishman and Turner will issue a pre-approved list of sub-contractors. Contractors will qualify in their BAFO which contractor they will use.

T&B Contractor (no list of approved sub-contractors)
Vibration Analysis

Method 9. Citi directly selects a manufacturer or supplier and Tishman or Turner issues a contract to that vendor as well as assigning labor to an installing contractor.

Method 10. Citi directly selects a manufacturer and Tishman or Turner instructs in their Riders that only that manufacturer is acceptable.

Siemens Onicon insertion electromagnetic meter (in 390 Chiller Plant)

Carpet

Method 11. Citi will select a vendor and directly issue a purchase order for material and labor. Tishman and Turner will coordinate with that vendor.

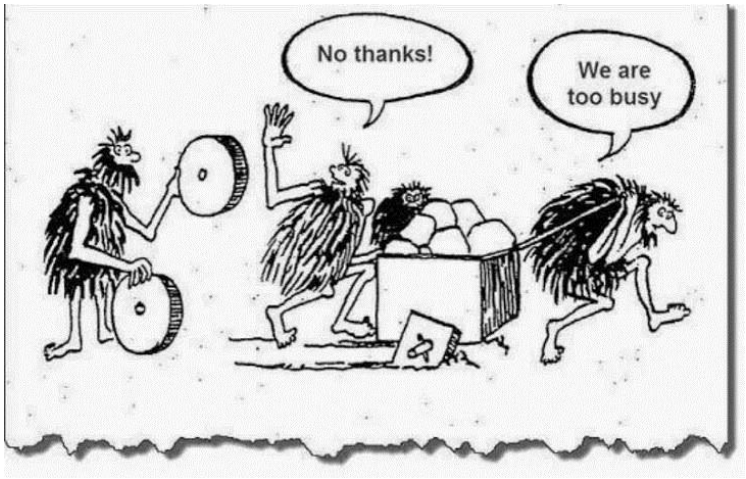
Office Furniture
Ancillary Furniture
Office Fronts

Method 12. Citi will select a vendor and directly issue a purchase order. Tishman and/or Turner will include the wiring plus antennae in a bid package.

DAS Integrator
Security Integrator

***Require bid packages from SOM or Gensler**

ENGAGE EARLY



LOOK FOR THE LITTLE THINGS (THEY ADD UP)

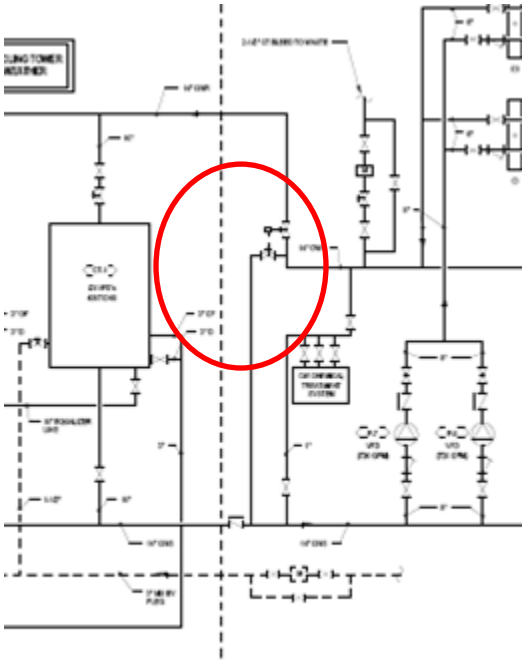
- ECM Variable speed
- Balance with VFDs
- Fan Wall Discharge Dampers
- Maximize BMS
- Optimization is a Standard
- What is a Smart Building?
- Go to Benchmarking and Trust your Instincts
- What is 6 watts per square foot?
- Rentable or Usable (80%)
- Understand Resiliency N+1
- Pump Through
- Thermal Storage
- Detention vs Retention

When compared to similarly sized PSC motors, constant torque motors reduce power consumption, using approximately 413 watts in cooling mode and only 200 watts in continuous fan mode - compared to 552 watts and 515 watts, respectively, for PSC models.

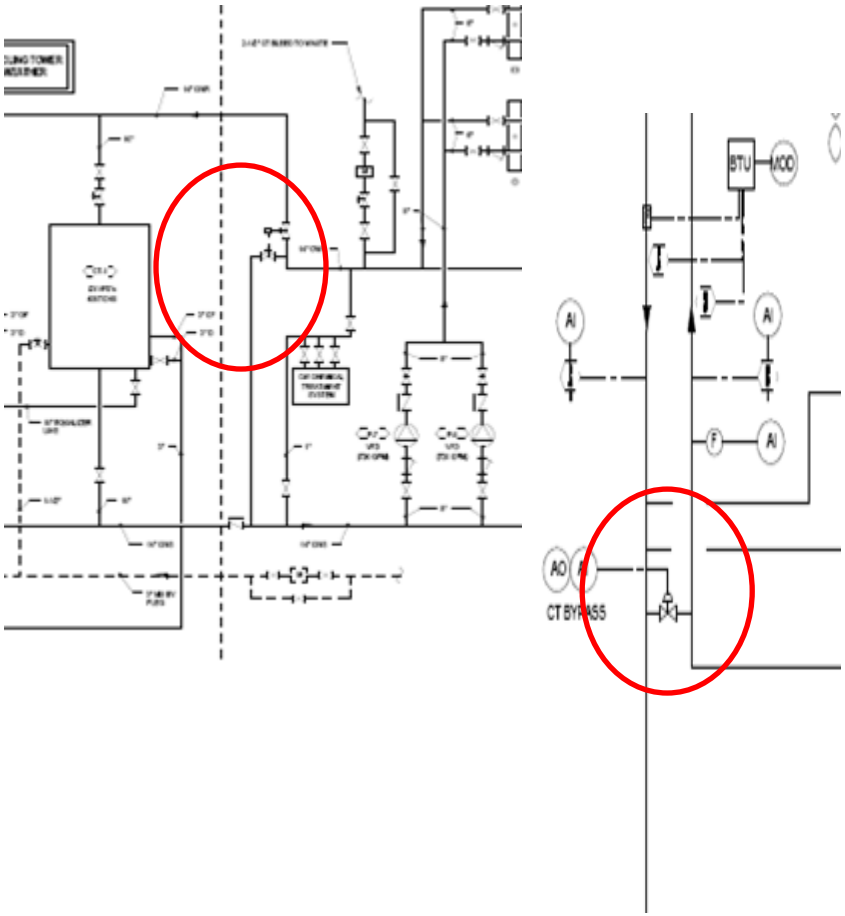
ECM motor technology provides the ability to program and deliver constant airflow over a wide range of ESP, typically up to 1.0 inches water column.
This feature automatically compensates for any added pressure drop introduced to the system. For example, if a duct system layout has an increased static pressure due to a dirty filter, the presence of a media filter or simply because of poor design, the motor will automatically ramp up to ensure that the programmed amount of airflow is delivered. This is accomplished without the use of any additional components.


ECblue

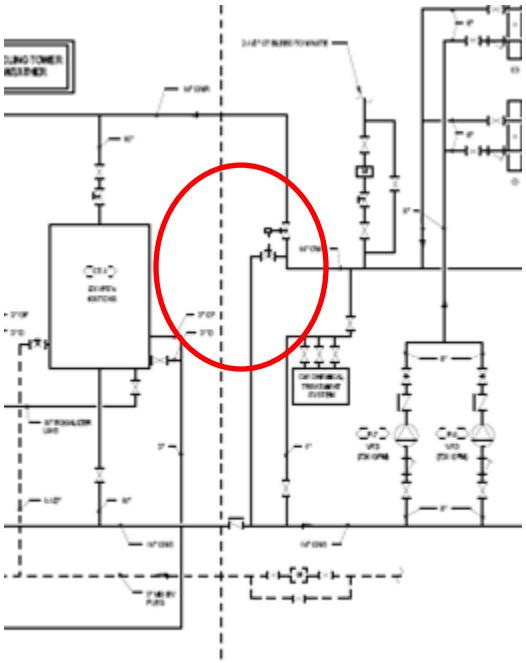
Tower Bypass with 3-way valve, constant speed CW pumps

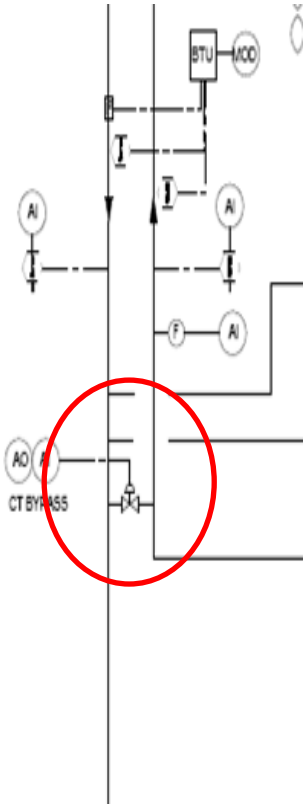


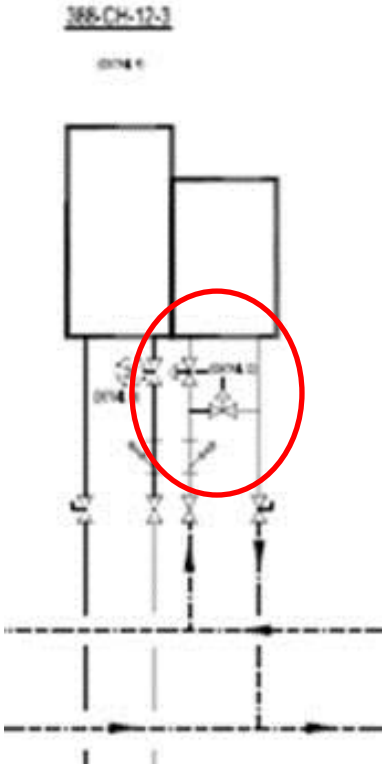
Tower Bypass with 2-way valve, constant speed CW pumps



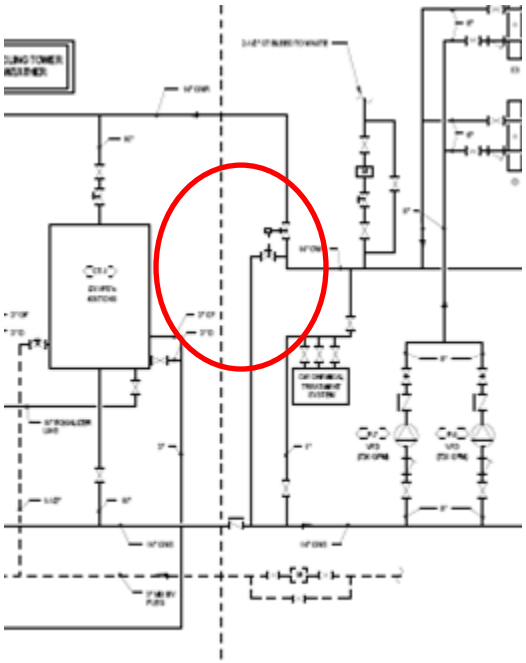
Bypass at Chiller, VFD on CW pumps

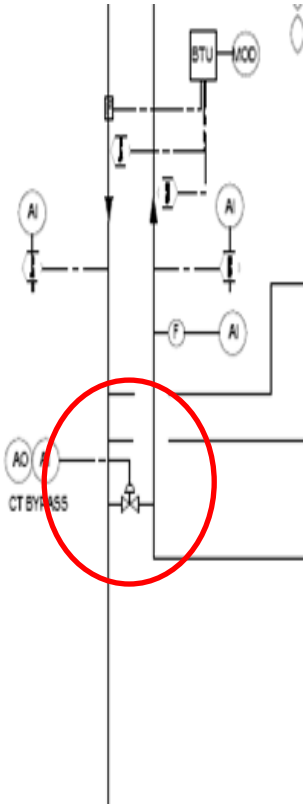


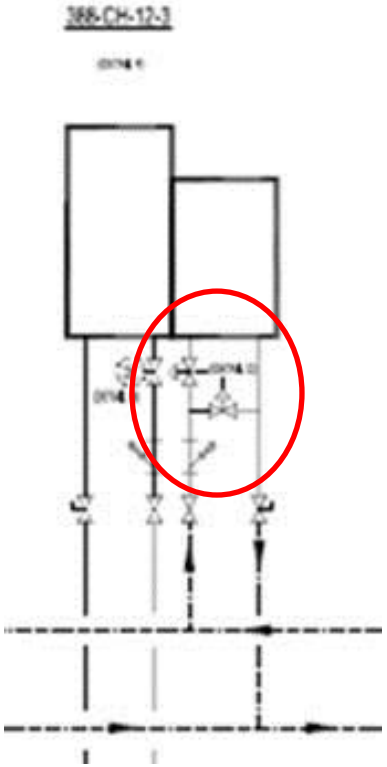


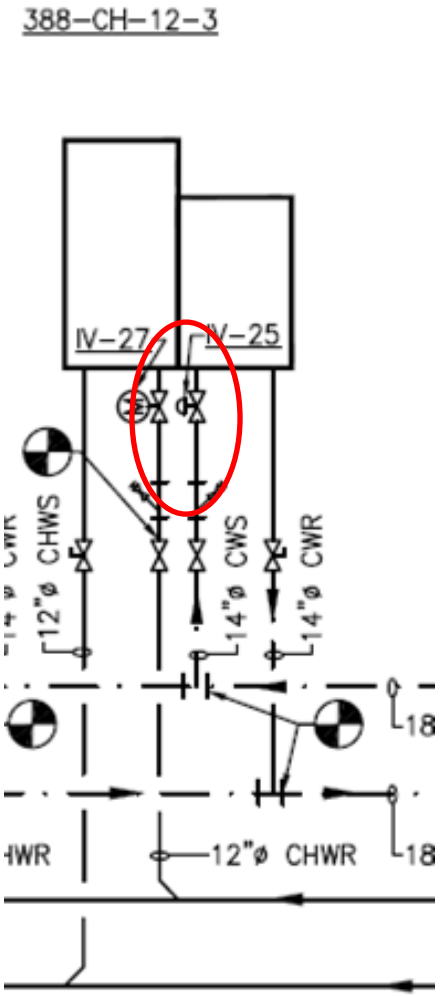


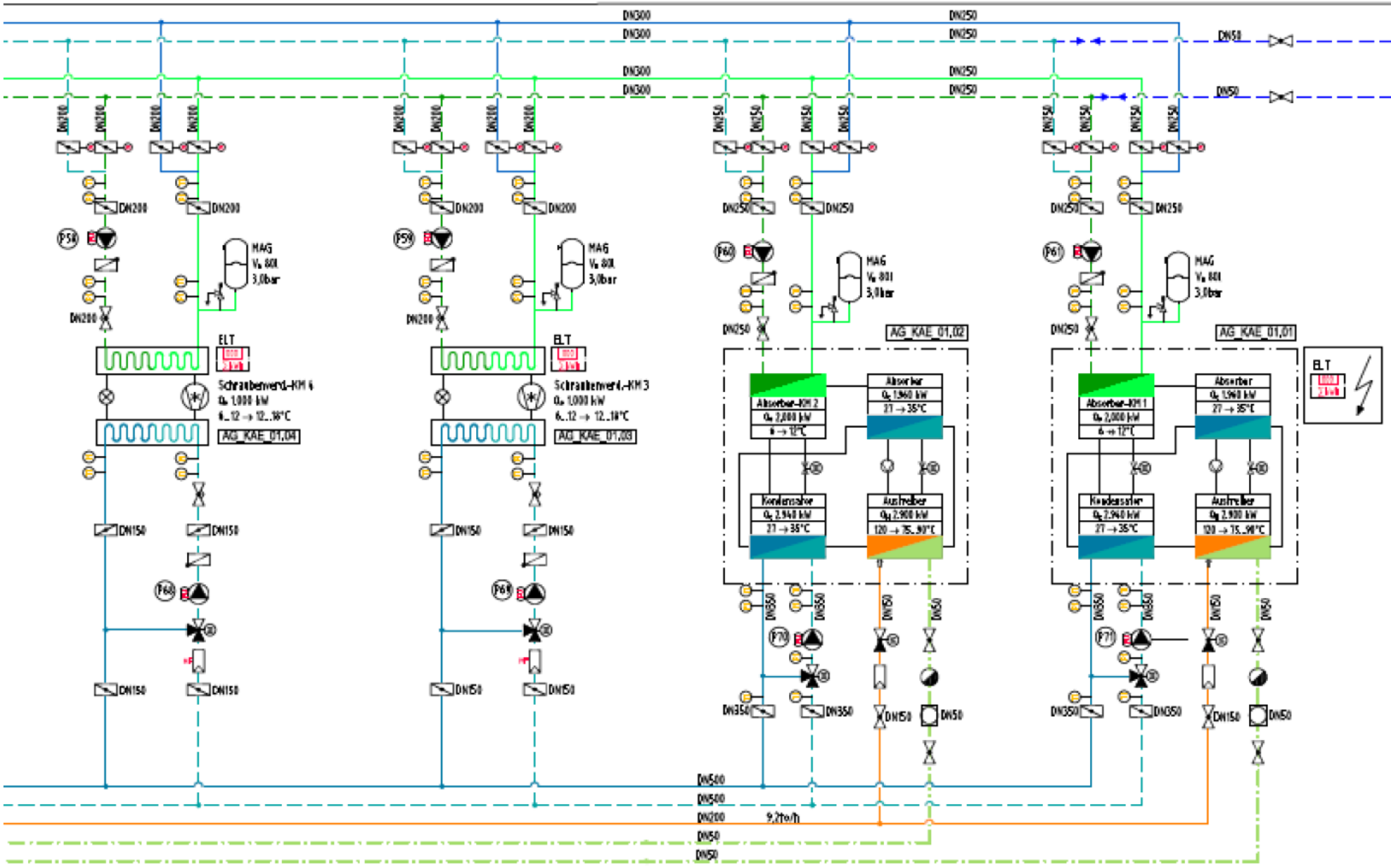
Two-way modulation at Condenser, VFDs on CW pumps

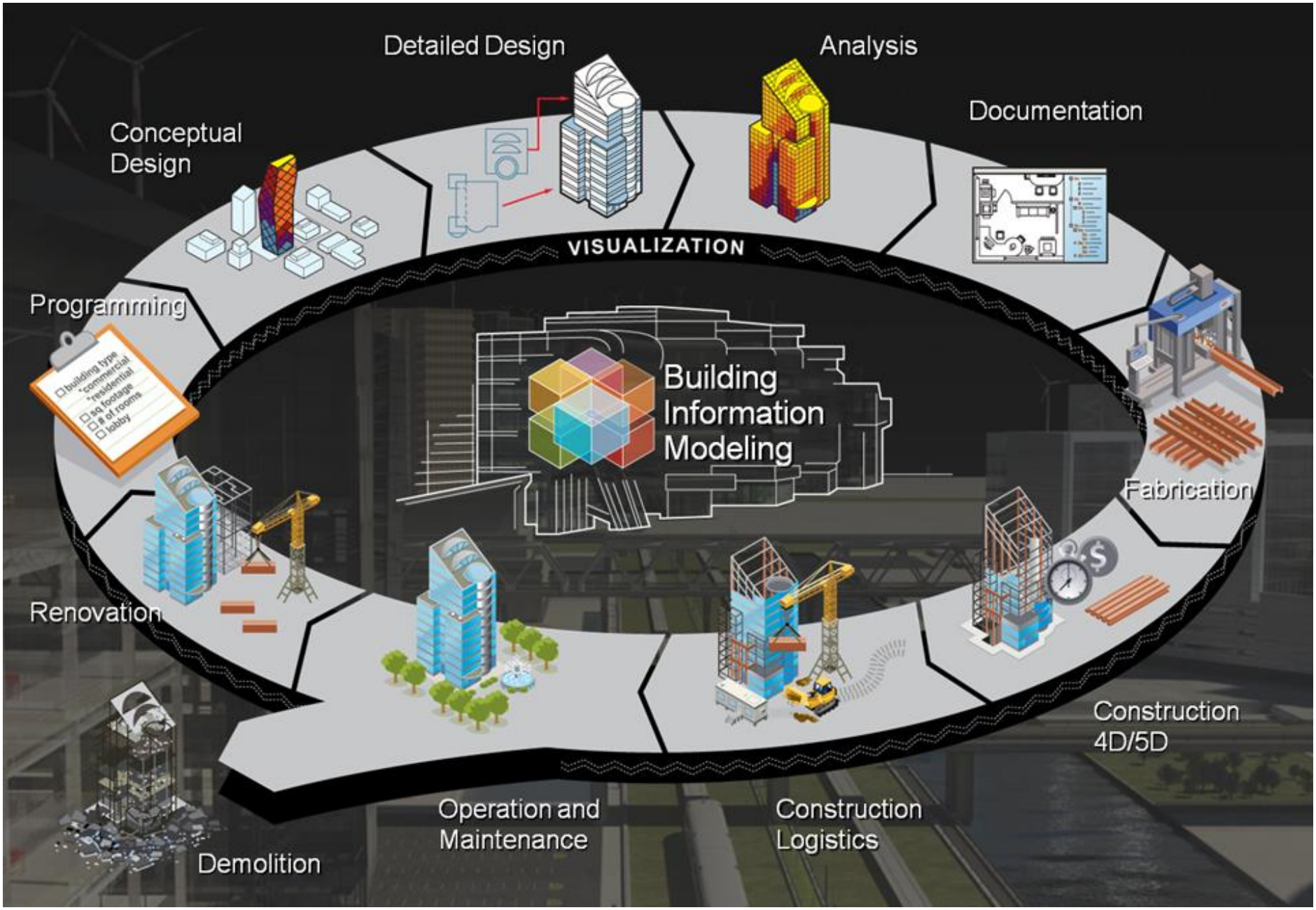


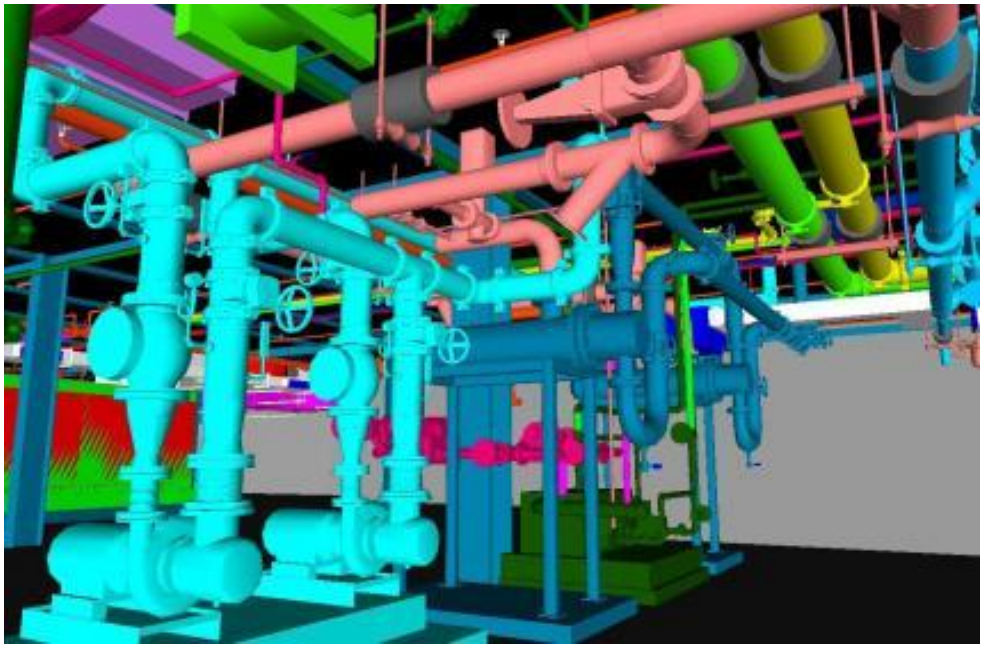






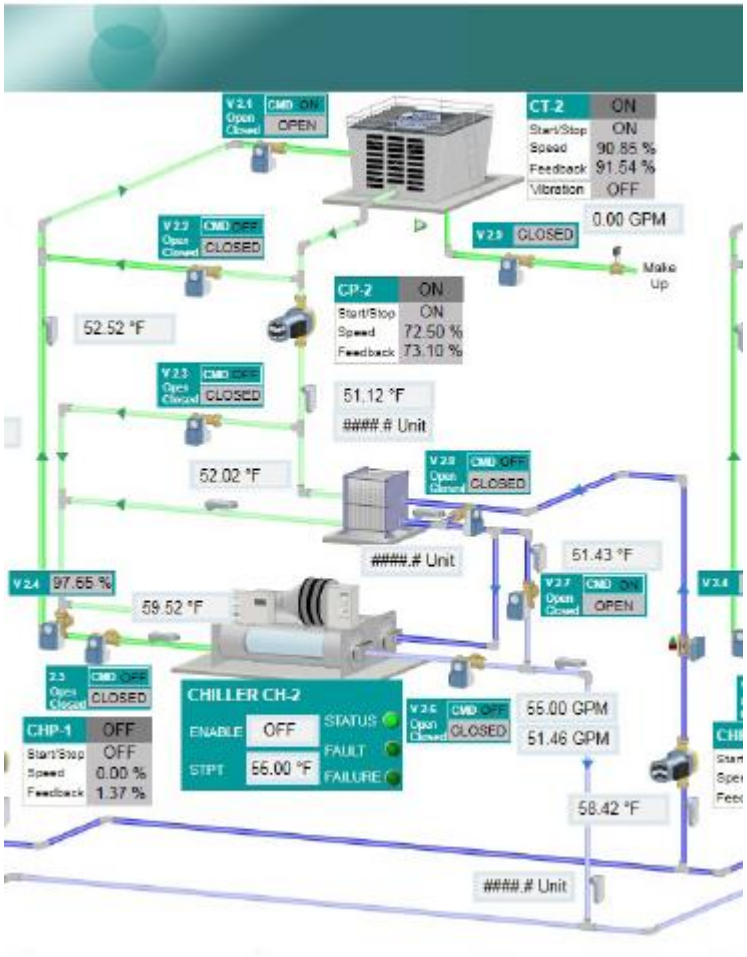

DN300
DN250
DN50
DN200
DN150
DN350
DN500
P58
P59
P60
P61
P68
P69
P70
P71
MAG
V₀ 80l
3,0bar
ELT
Schraubenverd.-KM 4
Schraubenverd.-KM 3
AG_KAE_01,04
AG_KAE_01,03
AG_KAE_01,02
AG_KAE_01,01
Absorber-KM 2
Absorber-KM 1
Absorber
Kondensator
Austreiber
9,2to/h


Detailed Design
Analysis
Conceptual Design
Documentation
VISUALIZATION
Programming
Building Information Modeling
Fabrication
Renovation
Construction 4D/5D
Operation and Maintenance
Construction Logistics
Demolition

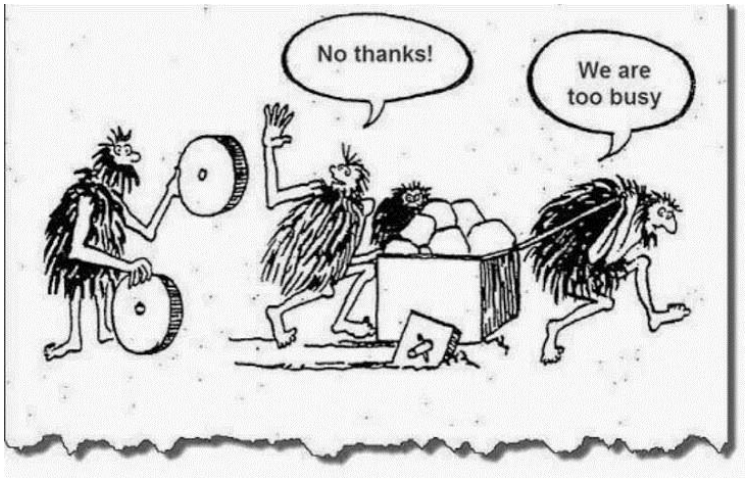


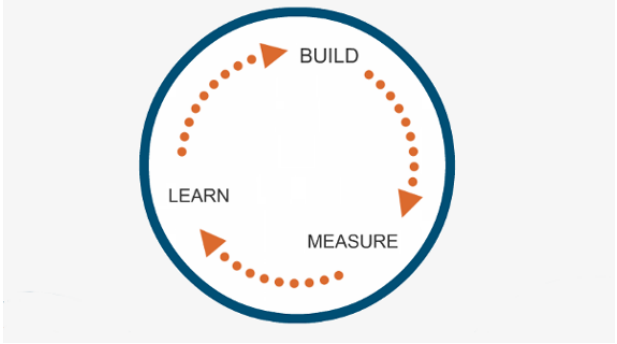
BIM -
Static
LOD-500

BMS -
Dynamic
Drop Down Menus
w/ Links to
Deliverables



ENGAGE EARLY





Outside Temperature

Chiller

	Status	Temp
CH-1		68.5°
CH-2		68.5°
CH-3		68.5°
CH-4		68.5°
CH-5		68.5°

Tower

	Status	Temp
Tower 1		68.5°
Tower 2		68.5°
Tower 3		68.5°
Tower 4		97.5°
Tower 5		68.5°

Boiler

	Status	Temp
Boiler 1		102.5°
Boiler 2		102.5°
Boiler 3		104.5°

Crac Unit POD 1

	Status	Temp
CRAC-1		48.5°
CRAC-2		48.5°
CRAC-3		48.5°
CRAC-4		48.5°
CRAC-5		48.5°

Crac Unit POD 2

	Status	Temp
CRAC-6		48.5°
CRAC-7		48.5°
CRAC-8		48.5°
CRAC-9		48.5°
CRAC-10		48.5°

Pod 1 Server Racks

	Row 1	Row 2	Row 3	Row 4
POD A	Temp 68.5° Status	Temp 68.5° Status	Temp 68.5° Status	Temp 68.5° Status
POD B	Temp 68.5° Status	Temp 68.5° Status	Temp 68.5° Status	Temp 68.5° Status
POD C	Temp 68.5° Status	Temp 68.5° Status	Temp 68.5° Status	Temp 68.5° Status
POD D	Temp 68.5° Status	Temp 68.5° Status	Temp 68.5° Status	Temp 68.5° Status

Pod 2 Server Rack

	Row 1	Row 2	Row 3
POD A	Temp 68.5° Status	Temp 68.5° Status	Tem Stat
POD B	Temp 68.5° Status	Temp 68.5° Status	Tem Stat
POD C	Temp 68.5° Status	Temp 68.5° Status	Tem Stat
POD D	Temp 68.5° Status	Temp 68.5° Status	Tem Stat

BUILDING EQUIPMENT DASHBOARD

Quick snapshot of critical points of all equipment building

ENERGY DASHBOARD

Energy usage overview.

THANK YOU

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