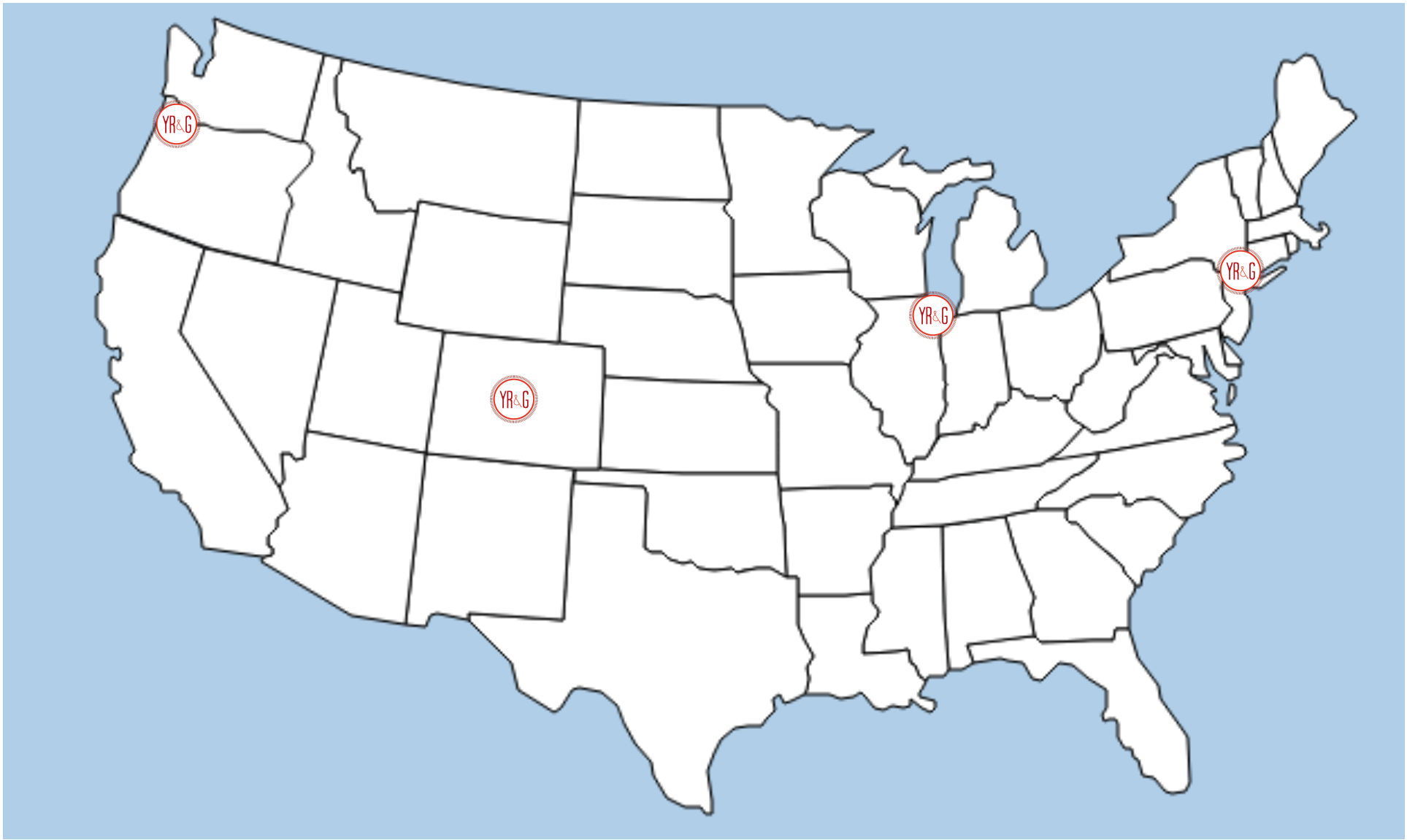

YR&G
Sustainable Procurement of Buildings: Project Design and Delivery Systems

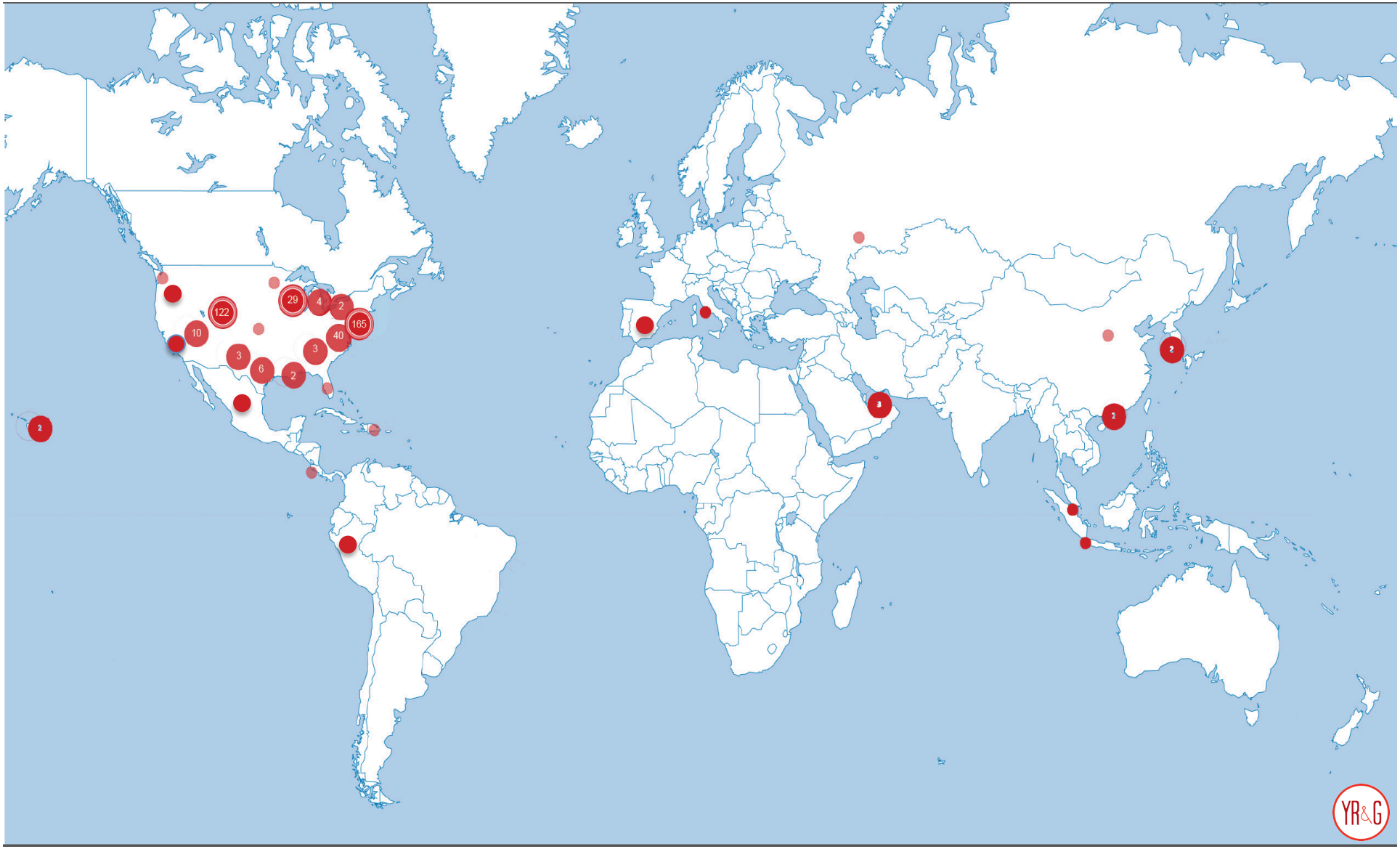
Office Locations

New York City, Chicago, Denver and Portland



Current and Past Project Locations

Across the US and Hawaii, Latin America, Europe, the Middle East, and Asia



Spectrum of Services in the Built Environment

Master Planning Support

- Goal setting and framework development
- Energy master planning
- District infrastructure analysis, onsite renewables, cogen, + storage
- Outreach and education
- Integration of natural systems, habitat and water management
- LEED-ND, SSI, and EcoDistricts certification

Building Design and Construction

- Energy, daylight, and comfort modeling
- Passive design analysis and optimizations
- Onsite energy generation and storage analysis
- Utility modeling provider (NYSERDA, Xcel)
- Healthy building design support
- Project financial analysis and incentive coordination
- Materials research, HPD and EPD integration
- Commissioning and M&V
- LEED-BD&C, ID&C, LBC, Well Building certification coordination

Existing Building Performance and Operations

- Sustainability management planning and goal setting
- Auditing and re-commissioning
- Performance benchmarking
- Financial and utility rate analysis, incentive coordination
- Energy management
- LEED-EBOM certification
- Portfolio-wide planning and implementation

Corporate Sustainability Services

Strategy

- Workshop Facilitation
- Stakeholder Engagement
- Goal Setting
- Boundary Setting
- Industry Research
- Peer Baselineing
- Metrics Development
- Action Plan Development

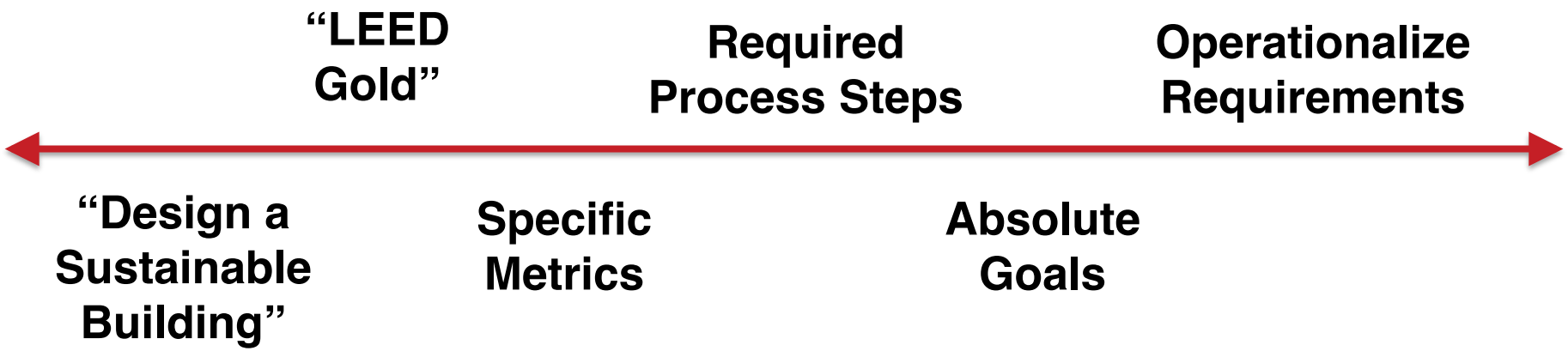
Implementation

- Initiative Management
- Staff and Stakeholder Training
- Research and Technical Support
- Market Intelligence ad Industry Trending
- Metering and Data Management
- Ongoing training

Monitoring and Reporting

- GHG accounting
- CDP Reporting
- GRI Reporting
- Metrics review

Range of Clarity



Barriers / Challenges

- Unknown Costs (rising and falling)
- Unknown Constraints (solar access, utility price signals)
- Unknown Technology (e.g. batteries)
- Varying results with varying teams
- Actual Performance versus Design Targets

Energy Performance Metrics

- **Percent Reduction Relative to Code**
  (e.g. 30% better than ASHRAE 90.1-2009)
- **Energy Use Intensity Targets**
  (kbtu/SF/yr; kWh/SM/yr)
- Net Zero Energy
- LEED Certification
- Carbon Budget

Evolution of Code Building Performance

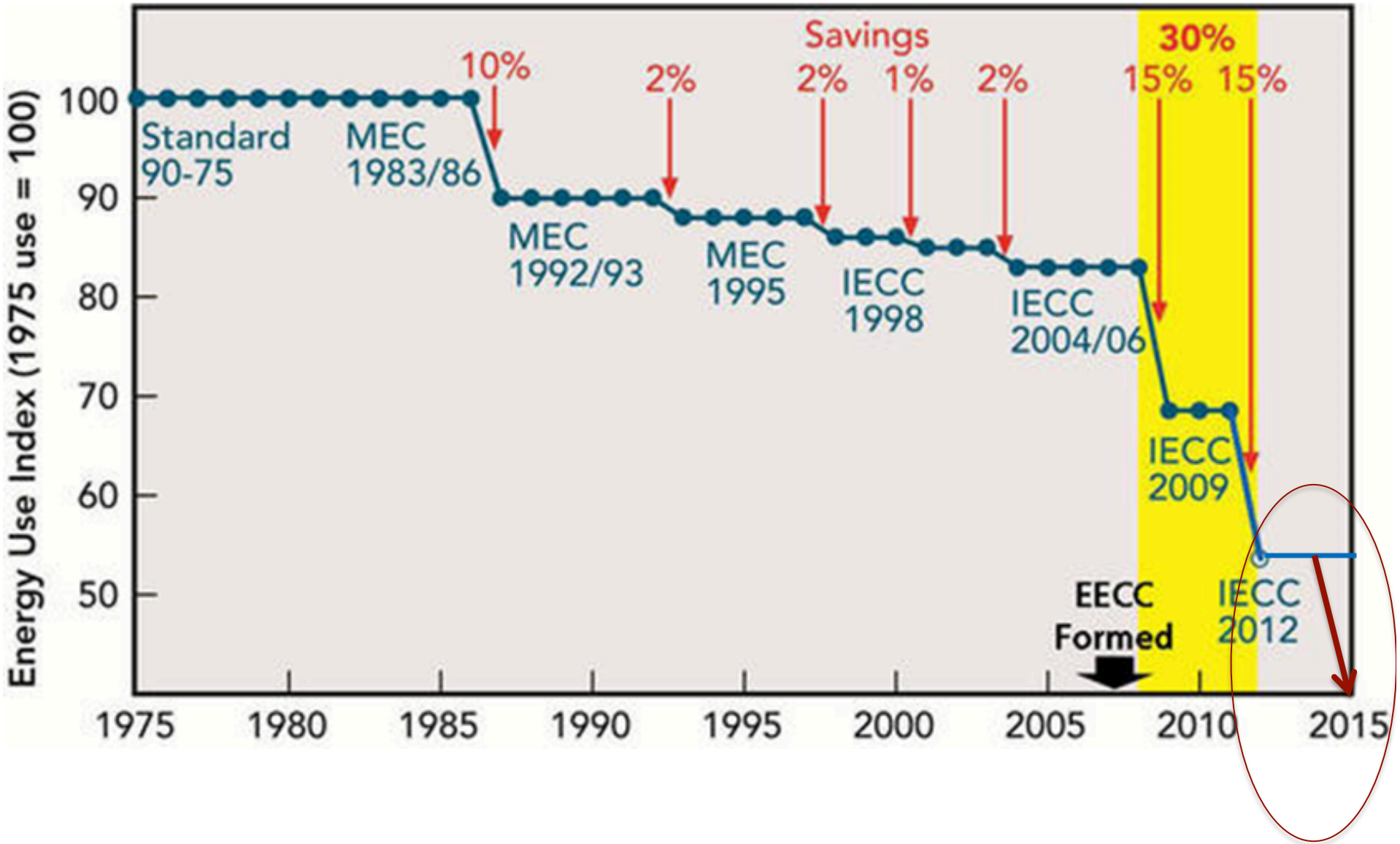
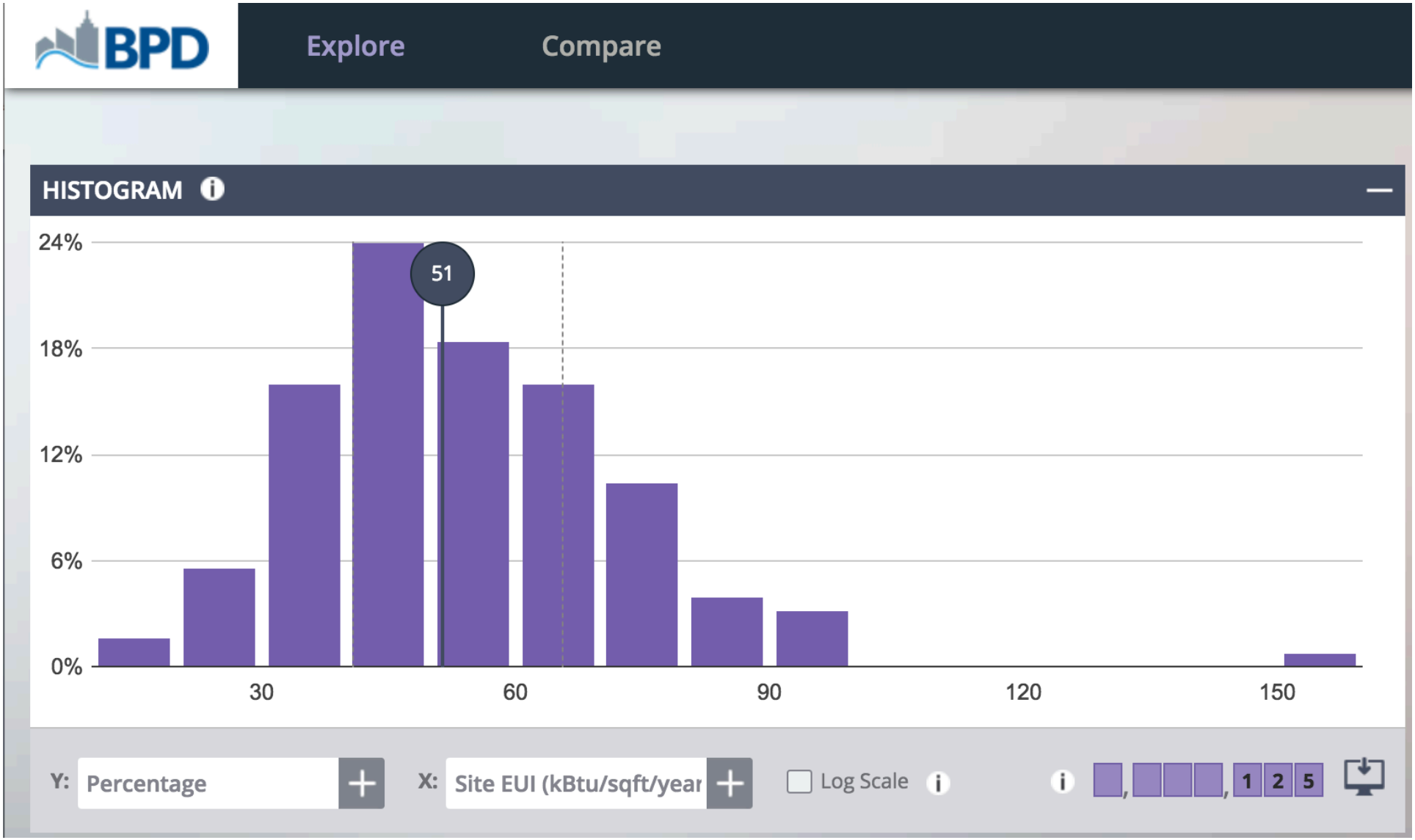
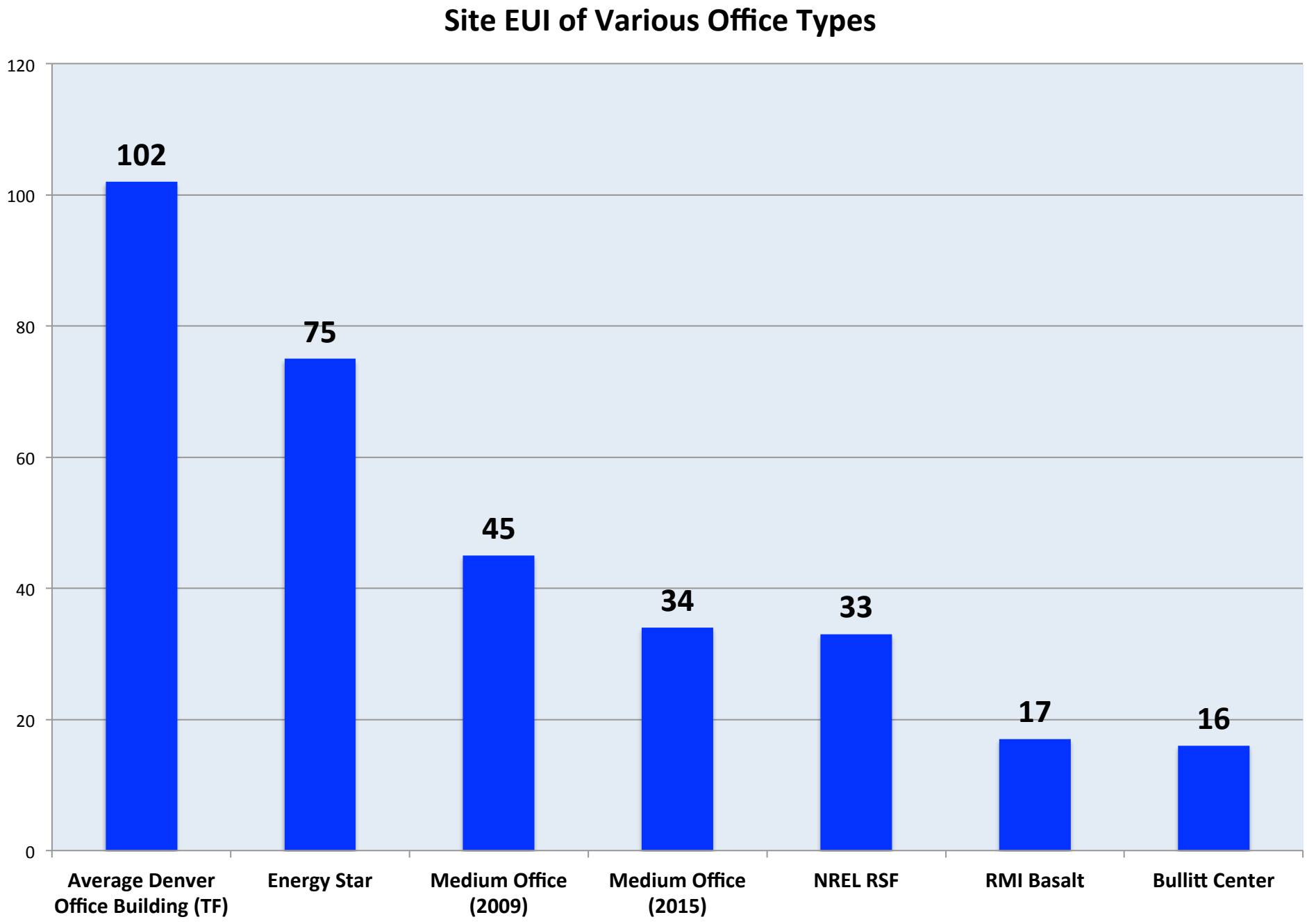
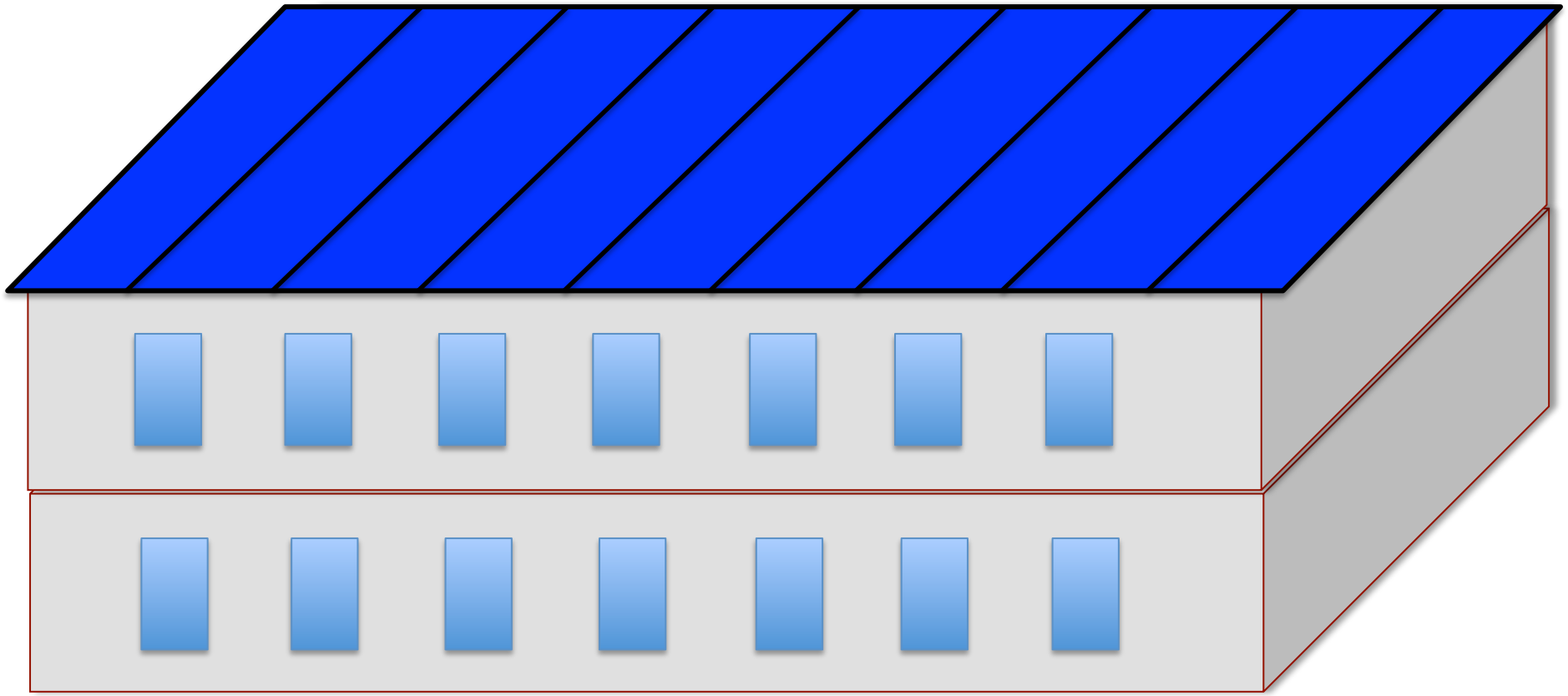


Table E.2. Estimated Energy Use Intensity by Building Type – Standard 90.1-2013

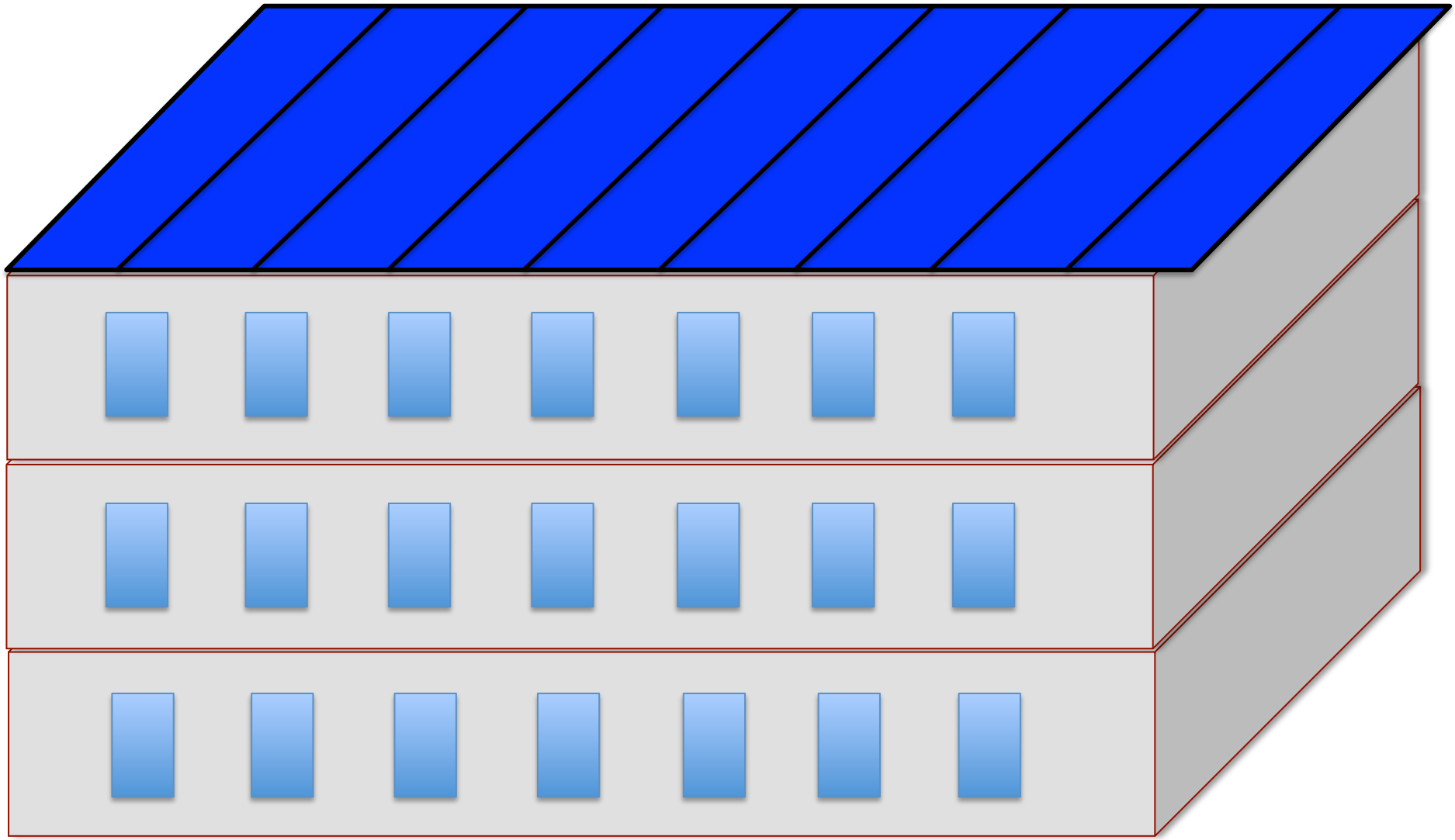
Building Type	Prototype building	Building Type Floor Area Weight (%)	Whole Building EUI Data for Building Population		
			Site EUI (kBtu/ft^2-yr)	Source EUI (kBtu/ft^2-yr)	ECI ($/ft^2-yr)
Office	Small Office	5.61	29.4	89.3	$0.88
	Medium Office	6.05	34.1	97.9	$0.95
	Large Office	3.33	70.8	205.8	$2.01
Retail	Stand-Alone Retail	15.25	45.9	124.6	$1.20
	Strip Mall	5.67	55.1	147.3	$1.42
Education	Primary School	4.99	54.2	134.4	$1.28
	Secondary School	10.36	41.7	111.9	$1.08
Healthcare	Outpatient Health Care	4.37	115.8	311.8	$3.00
	Hospital	3.45	123.7	300.7	$2.85
Lodging	Small Hotel	1.72	60.0	137.6	$1.29
	Large Hotel	4.95	89.0	195.4	$1.81
Warehouse	Non-Refrigerated Warehouse	16.72	17.1	40.6	$0.38
Food Service	Fast-Food Restaurant	0.59	576.4	1001.9	$8.78
	Sit-Down Restaurant	0.66	372.5	713.5	$6.41
Apartment	Mid-Rise Apartment	7.32	43.9	124.8	$1.21
	High-Rise Apartment	8.97	46.9	114.4	$1.08
National		**100**	**54.1**	**136.2**	**$1.30**


BPD
Explore
Compare
HISTOGRAM
24%
18%
12%
6%
0%
51
30
60
90
120
150
Y:
Percentage
X:
Site EUI (kBtu/sqft/year
Log Scale
1 2 5


Site EUI of Various Office Types
120
100
80
60
40
20
0
102
75
45
34
33
17
16
Average Denver Office Building (TF)
Energy Star
Medium Office (2009)
Medium Office (2015)
NREL RSF
RMI Basalt
Bullitt Center



2 STORY IECC 2015 CODE BUILDING
-- NEED A 4.4% REDUCTION FROM CODE; EUI OF 32.5



3 STORY IECC 2015 CODE BUILDING
-- NEED A 37% REDUCTION FROM CODE; EUI OF 21.5

TECHNICAL FEATURE

University of Chicago Campus North Residence Hall and Dining Commons.

Studio Gang Architects

Procurement Path for Energy-Efficient Buildings

BY ADAM MCMILLEN, P.E.; PAUL TORCELLINI, PH.D., P.E., MEMBER ASHRAE; SUMIT RAY, P.E.; AND KEVIN RODGERS, MEMBER ASHRAE

In a perfect world, a building owner tells everyone what sort of building should be built. Talented design and contractor teams come together to design and build it. Twelve months later, the building performs to expectations, and the tenants are all happy. Utility bills match the design energy analysis. Simple, right?

Aligning Program Metrics With the Energy Goal

The set of program metrics and performance criteria should be unique to each project. The program metrics for the National Renewable Energy Lab's RSF facility were as follows:[1]

Mission Critical

1. Attain safe work performance and safe design practices
2. LEED Platinum rating
3. Energy Star appliances, unless other system outperforms

Highly Desirable

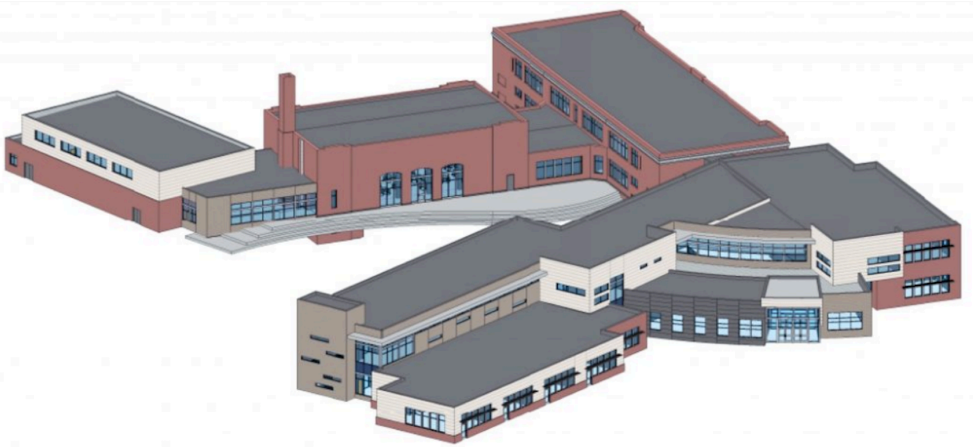
4. 800 staff capacity (later adjusted to 822)
5. 25 kBtu/ft^2 including NREL's data center
6. Architectural integrity
7. Honor future staff needs
8. Measurable 50% plus energy savings versus ASHRAE Standard 90.1-2004
9. Support culture and amenities
10. Expandable building
11. Ergonomics
12. Flexible workspace
13. Support future technologies
14. Documentation to produce a How To manual
15. PR campaign implemented in real time for benefit of DOE/NREL and DB (design/build team)
16. Allow secure collaboration with outsiders
17. Building information modeling
18. Substantial completion by June 2010

If Possible

19. Net zero design approach
20. Most energy-efficient building in the world
21. LEED Platinum Plus rating
22. Exceed 50% savings over ASHRAE baseline
23. Visual displays of current energy efficiency
24. Support public tours
25. Achieve national and global recognition and awards
26. Support personnel turnover

NREL RSF*, EUI = 33

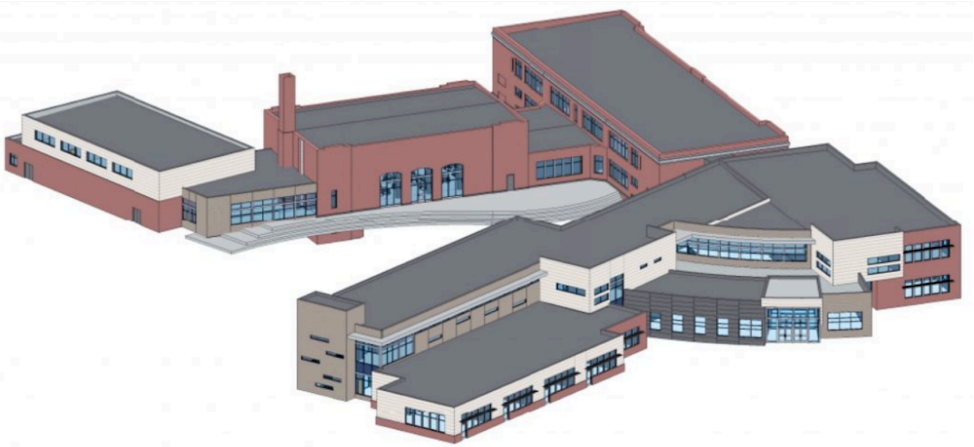
SUSTAINABILITY AND HIGH PERFORMANCE



New School Benchmarks

- Design to meet CO-CHPS or 2014 LEED v4 for Building Design and Construction, targeting the equivalent of Silver Certification level.
- Design to meet these site energy consumption criteria or Energy Use Intensity (EUI):
    - o High Schools – 40 kBtu/sf/yr
    - o Middle Schools – 35 kBtu/sf/yr
    - o Elementary – 30 kBtu/sf/yr
- Design to meet approximately 35-40% reduction in energy cost when compared to an ASHRAE 90.1-2010 standard baseline.
- Target a Lighting Power Density (LPD) of 0.65 Watts/SF.
- Install advanced metering systems
- Prepare all new schools to be "solar ready," or defined as taking into account the future possibility and identification of solar elements on the roof and site. The design team will perform solar analysis to ensure that roofs are optimized for the installation of solar. The electrical engineer will route conduits to the roof and leave appropriate space in the design and infrastructure to accommodate the future installation with minimal disruption.

SUSTAINABILITY AND HIGH PERFORMANCE



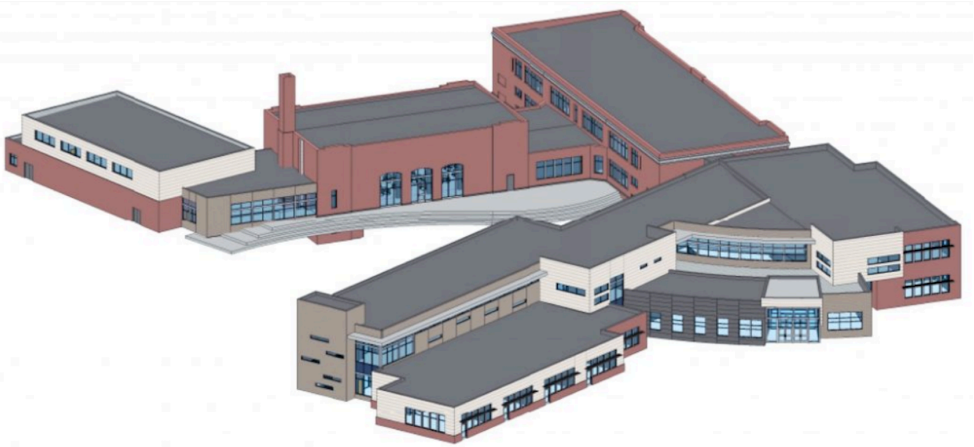
Daylighting - Provide quality daylighting design for all regularly occupied spaces and consider:

- How much of a space receives sufficient daylight, and target a Spatial Daylight Autonomy (sDA) of 50 or more.
- How much of space receives too much direct sunlight, which can cause visual discomfort (glare) or increase cooling loads, and target an Annual Sun Exposure (ASE) less than 10.

Waste and Recycling - Divert a minimum of 75% construction waste from the landfill.

Water efficiency - Plan for water efficient landscaping and reduce water consumption 40% when compared to a 2008 baseline.

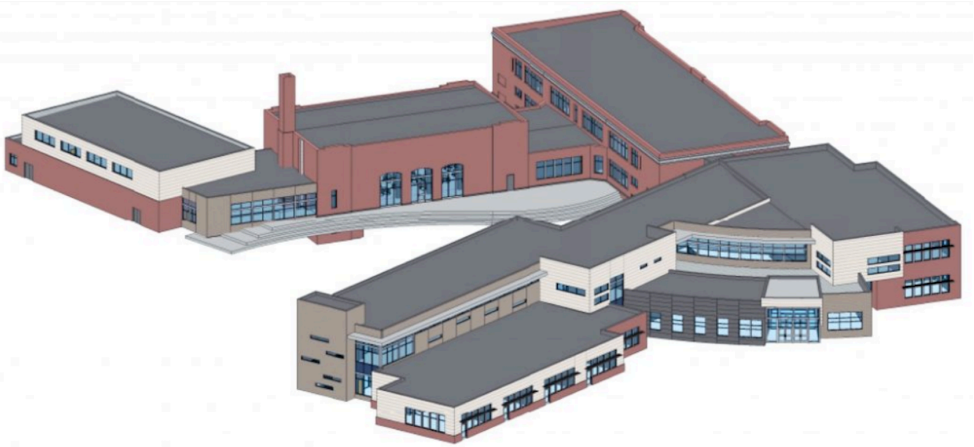
SUSTAINABILITY AND HIGH PERFORMANCE



Materials - Use materials in construction that are durable, repairable, and reusable or recyclable. All materials shall be low on toxins and indoor air pollutants in order to support good indoor air quality. Consider:

- Long-term durability and maintenance costs
- Use of rapidly renewable materials.
- Use of materials to emphasize a connection to nature, or biophilic design.
- Compliance with Green Seal standards, which are life cycle-based sustainability standards and use of certified products.
- Selection of GREENGUARD Certified products, which have low chemical emissions.
- Use of Carpet and Rug Institute (CRI) Green Label products.
- Review of proposed building products with a Health Product Declaration (HPD), which reports content and associated health information for building materials, or Environmental Product Declaration (EPD) which is based on a Life Cycle Assessment (LCA).

SUSTAINABILITY AND HIGH PERFORMANCE

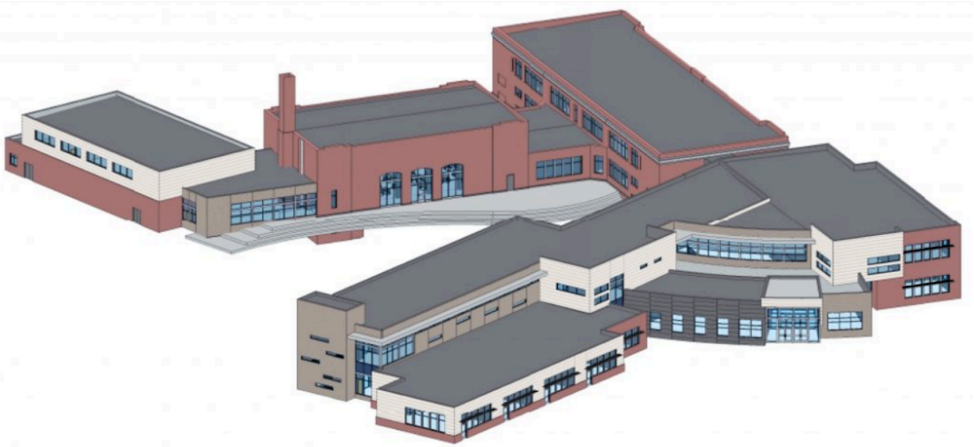


Process

- The integrated design team shall be led by professionals experienced in the process and include RFSD educational, operations and maintenance staff, as well as the general contractor, key subcontractors, the commissioning agent, et. al.
- An EcoCharette shall be held early in the design process including all key members of the integrated design team.
- Building Performance Simulation (modeling) for energy, daylight, and thermal comfort should be performed from the beginning of the project.

Heating, Ventilation, and Air Conditioning (HVAC) - Perform system comparison early in the design process to enable careful analysis and selection with the Owner.

SUSTAINABILITY AND HIGH PERFORMANCE



Indoor air quality is critical to a high performance educational facility, so:

- Design new construction and renovations to meet ASHRAE 62.1 as a minimum standard for ventilation with outside air.
- Use of mixed-mode ventilation strategies are encouraged, which means use of fresh air through automatic or user-controlled window openings. Demand control ventilation is appropriate in select areas (cafeteria, gyms, auditoriums, etc.). Consideration should be given to on-going maintenance and calibration requirements before incorporating demand control ventilation throughout all spaces.
- Consider systems that provide higher levels of ventilation effectiveness where appropriate, such as displacement ventilation.

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- Goal of LEED for New Construction (LEED-NC) Gold, and certify Enterprise Green Communities Criteria.
- Consider, analyze, energy model and evaluate five different net zero strategies.
- 80% of the roof areas shall be covered with photovoltaics with a minimum efficiency of 14%.
- Achieve 50% energy cost savings relative to ASHRAE 90.1-2007 through energy efficiency strategies; AND achieve a level of carbon emissions related to building energy use of 8 lbs CO2/ SF per year or lower, where SF is the conditioned floor area in the building (using 1.71 lbs CO2/ kWh and 11.76 lbs CO2 per therm natural gas).
- Net Zero energy systems and design for the building(s). Recognizing the definition variation available for net zero (site, source, cost and carbon), please interpret 'net zero' to mean a net zero carbon impact to the environment. Offsets, either on site or off site, are acceptable for consideration.
- Provide an energy monitoring system capable of displaying building energy use metrics that will allow for continuous oversight/monitoring of the energy systems. Electricity use in all residential units shall be sub-metered; also consider metering natural gas and hot water use. Present ideas on how such systems will effect tenant behavior and reduce tenant utility consumption.

NEW YORK CITY

GREEN SCHOOLS GUIDE

2017

NYC Department of Education

DRAFT FOR REVIEW - OCTOBER 14, 2016

SCA NYC School Construction Authority

NEW YORK CITY
GREEN SCHOOLS GUIDE
2017

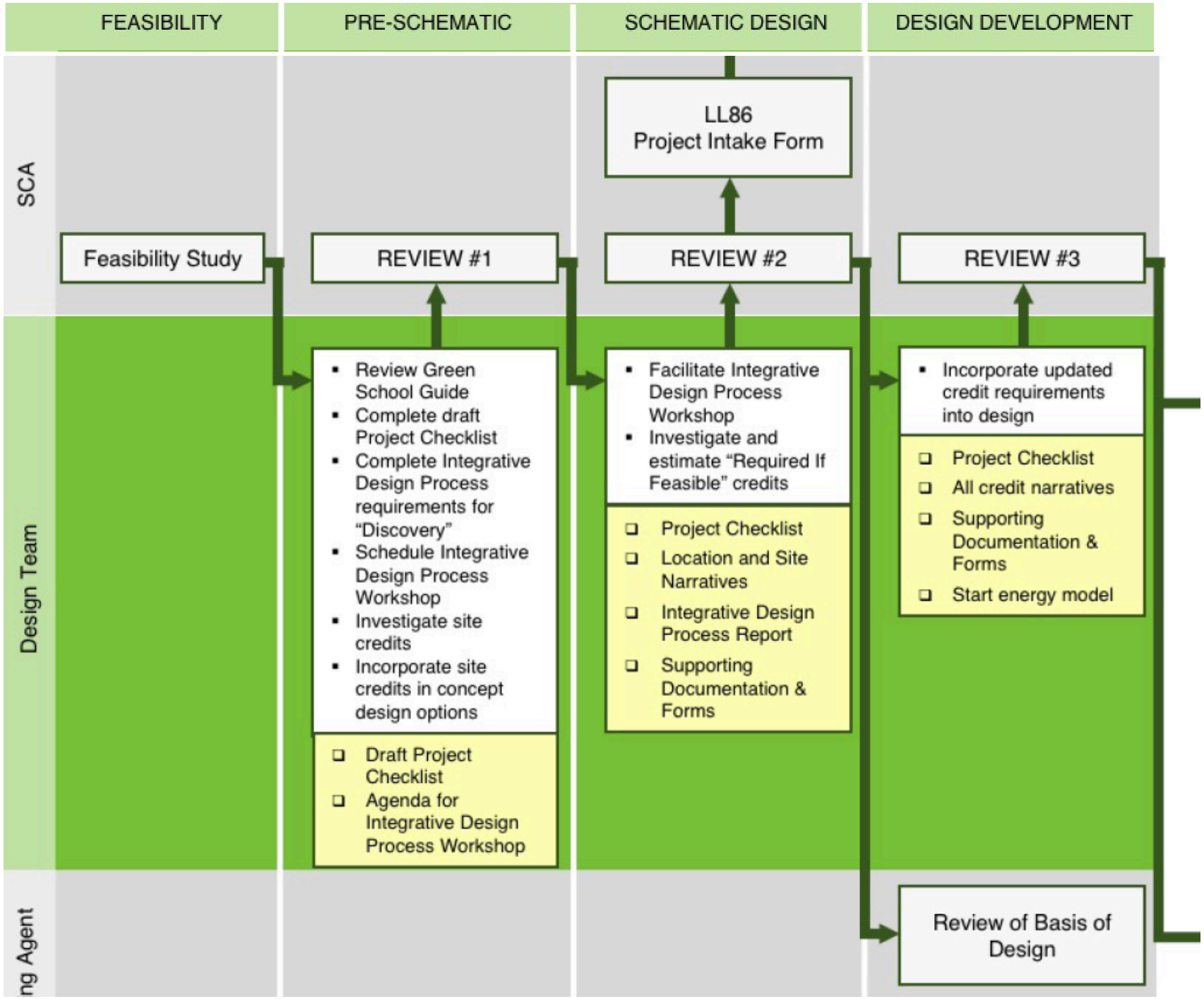
The NYC GSG makes a distinction between several types of required credits:

- "Required for all" credits must be achieved by all applicable projects. This category includes 20 LEED-based credits. There may be an occasional project unable to comply with a "Required for All" credit.
- "Required if feasible" credits must be achieved by all projects if possible, unless site constraints, programmatic requirements or extraordinary costs do not permit compliance. If credit compliance is not possible, the Design Team must provide an acceptable explanation of why that credit cannot be achieved for review and approval by the SCA. This category includes 23 LEED-based credits. An example of a "required if feasible" credit is High-Priority Site Selection. This credit would be pursued by any projects located on a site that meets the LEED definitions for High Priority.
- "Additional" credits are credits that may not be achievable for typical SCA project types and scope and/or are not addressed by SCA standards. This category includes 34 LEED-based credits. SCA approval must be granted to pursue Additional credits.
- All projects are required to achieve at least 40 points of the LEED-based credits included in the NYC Green Schools Rating System to achieve LEED Certified equivalency per LL32/16.

RATING SYSTEM SUMMARY

	BD&C Reference LEED for Schools v4	CHPS Reference	NYC GSG 2017	Credit Description and Relevant Information and Drop-Down Menus	Credits with No Points Required For all Projects	Credit with Points Required For all Projects	Required if Feasible [1]	Additional Credits [2]	Regional Priority4
Integrative Design Process (P)									**1 Point**
	IP 1		P 1.1R	**Integrative Design Process**		1			
				IDP Category Sub-Total:	**0NP**	1	0	0	0
Location (L)									**16 Points**
Site Selection	LT 2		L 1.1R	**Sensitive Land Protection**		1			
	LT 3		L 1.2	**High Priority Site**			2		1
	LT 4		L 1.3	**Surrounding Density**			3		
	LT 4		L 1.4R	**Diverse Uses**		2			
Transportation	LT 5		L 2.1	**Access to Quality Transit**		2	2		
	LT 6		L 2.2	**Bicycle Facilities**			1		
	LT 7		L 2.3R	**Reduced Parking Footprint**		1			
	LT 8		L 2.4A	**Green Vehicles**				1	
				Location Category Sub-Total:	**0NP**	6	8	1	1

	BD&C Reference LEED for Schools v4	CHPS Reference	NYC GSG 2017	Credit Description and Relevant Information and Drop-Down Menus	Credits with No Points Required For all Projects	Credit with Points Required For all Projects	Required if Feasible [1]	Additional Credits [2]	Regional Priority4
Water (W)									**10 Points**
Outdoor Systems	WE Pr 1		W 1.1P	**Outdoor Water Use Reduction**, Reduce by 30%	**NP**				
	WE 1		W 1.2R	**Outdoor Water Use Reduction,** Reduce by 50%		**1**			
	WE 1		W 1.3R	**Outdoor Water Use Reduction**, Reduce by 100%		**1**			
Indoor Systems	WE Pr 1		W 2.1P	**Indoor Water Use Reduction**, 20% Reduction	**NP**				
	WE 3		W 2.2	**Indoor Water Use Reduction**, 25% Reduction		**1**			
	WE 3		W 2.3	**Indoor Water Use Reduction**, 30% Reduction			**1**		
	WE 3		W 2.4	**Indoor Water Use Reduction**, 35% Reduction			**1**		
	WE 3		W 2.5A	**Indoor Water Use Reduction**, 40-45% Reduction				**2**	
Metering	WE Pr 3		W 3.1P	**Building Level Water Metering**	**NP**				
	WE 4		W 3.2R	**Enhanced Water Metering**		**1**			
Cooling Tower	WEc3		W 4.1	**Cooling Tower Water Use** (only for projects with cooling tower)				**2**	
				Water Category Sub-Total:	**3NP**	**4**	**2**	**4**	**0**
Energy (E)									**30 Points**
Commissioning	EA Pr 1		E 1.1P	**Fundamental Commissioning**	**NP**				
	EA c1		E 1.2A	**Enhanced & Monitoring-Based Commissioning**				**3**	
	EA c1		E 1.3A	**Envelope Commissioning**				**2**	
Refrigerant Management	EA Pr 4		E 2.1P	**Fundamental Refrigerant Management**	**NP**				
	EA 4		E 2.2	**Enhanced Refrigerant Management**			**1**		
Energy Efficiency	EA Pr 2		E 3.1P	**Minimum Energy Performance**	**NP**				
	EA 2		E 3.2R	**Optimize Energy Performance**[5]		**3**		**13**	
		3.1.2	E 3.3R	**HVAC System Sizing,** Avoid Oversizing	**NP**				
Energy Management			E 4.1R	**Energy Management System Controls,** HVAC & H. W. Systems	**NP**				
	EA 4		E 4.2A	**Demand Response**				**1**	
Metering	EA Pr 3	3.3.5	E 5.1P	**Building Level Energy Metering**	**NP**				
	EA 3		E 5.2R	**Advnaced Metering**		**2**			
Power	EA 5		E 6.1A	**Renewable Energy Production**				**4**	
	EA 7		E 6.2R	**Green Power & Carbon Offsets**		**1**		**1**	
				Energy Category Sub-Total:	**6NP**	**6**	**1**	**24**	**0**


FEASIBILITY
PRE-SCHEMATIC
SCHEMATIC DESIGN
DESIGN DEVELOPMENT
SCA
Design Team
ng Agent
LL86
Project Intake Form
Feasibility Study
REVIEW #1
REVIEW #2
REVIEW #3
Review Green School Guide
Complete draft Project Checklist
Complete Integrative Design Process requirements for "Discovery"
Schedule Integrative Design Process Workshop
Investigate site credits
Incorporate site credits in concept design options
Draft Project Checklist
Agenda for Integrative Design Process Workshop
Facilitate Integrative Design Process Workshop
Investigate and estimate "Required If Feasible" credits
Project Checklist
Location and Site Narratives
Integrative Design Process Report
Supporting Documentation & Forms
Incorporate updated credit requirements into design
Project Checklist
All credit narratives
Supporting Documentation & Forms
Start energy model
Review of Basis of Design

Takeaways

- Balance simplicity with the nuance of project delivery (there's something really easy about an annotated LEED scorecard)
- Be specific about performance metrics
- Build in as much as you can to address performance and operational issues. i.e. Set the project up for success beyond the D&C process.
- Include detailed process items so you don't short circuit necessary evaluation in the design process
- Include the sustainability team in the interview.
- Consider incentives for performance.

Thank you.

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