OCTOBER 2017

HIGH PERFORMANCE SUSTAINABLE BUILDINGS

PROGRESS & NEXT STEPS

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ARGONNE AT A GLANCE

Incorporating a unique blend of world-class facilities, science and engineering- delivering innovative research and technology

3,225

Full-time employees

$750M

Operating Budget FY17

2.3

Square mile campus

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Argonne’s Site Sustainability Program supports world class science and engineering research through infrastructure modernization and site occupant engagement, saving the laboratory money and improving operations.

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SUSTAINABILITY STRATEGIC PLAN

Integrated approach to address sustainability goals and addressing deferred maintenance

Integrating Guiding Principles for High Performance Sustainable Buildings into infrastructure projects helps address all strategic areas for Argonne's sustainability plan.

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Next Steps for Integrating HPSB Into Infrastructure Projects

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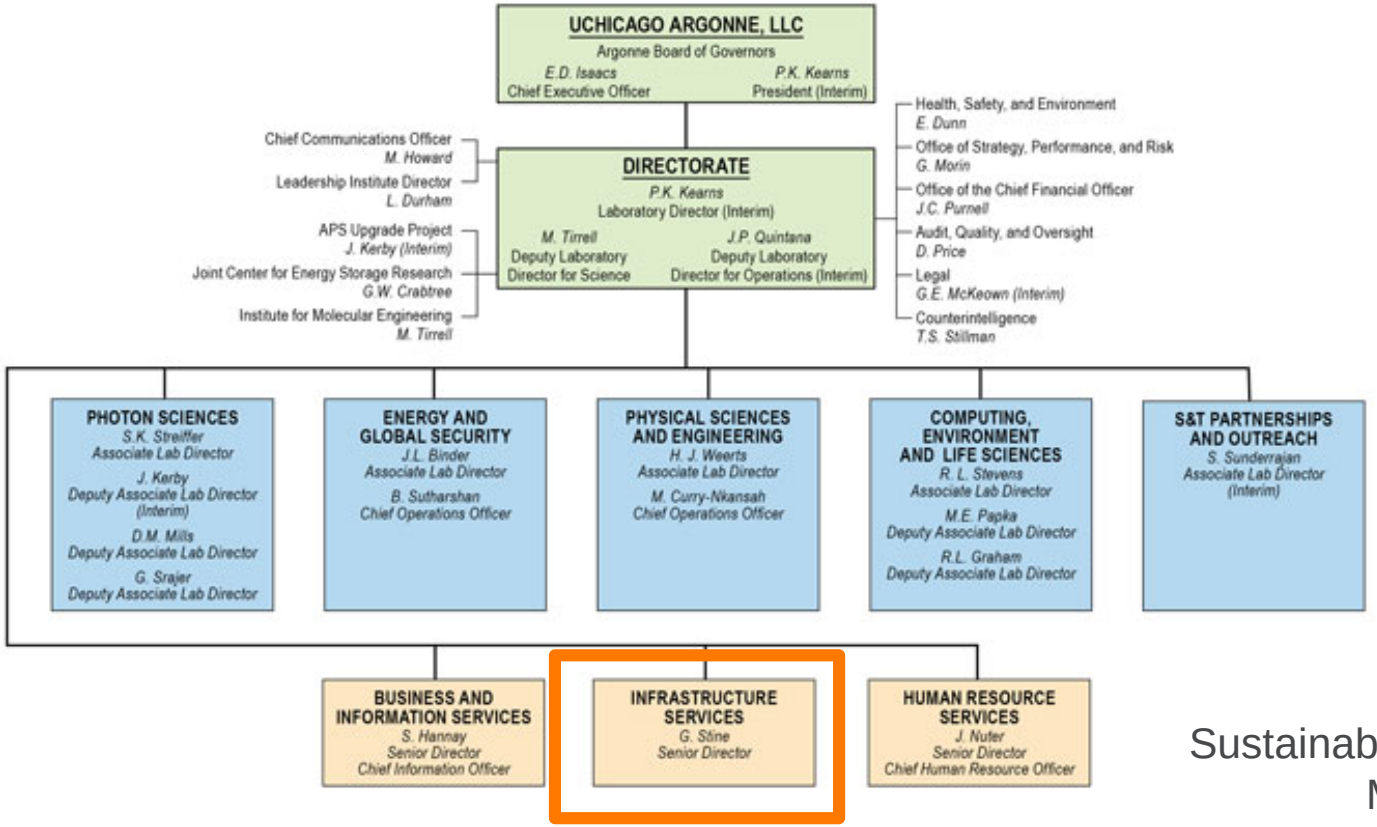
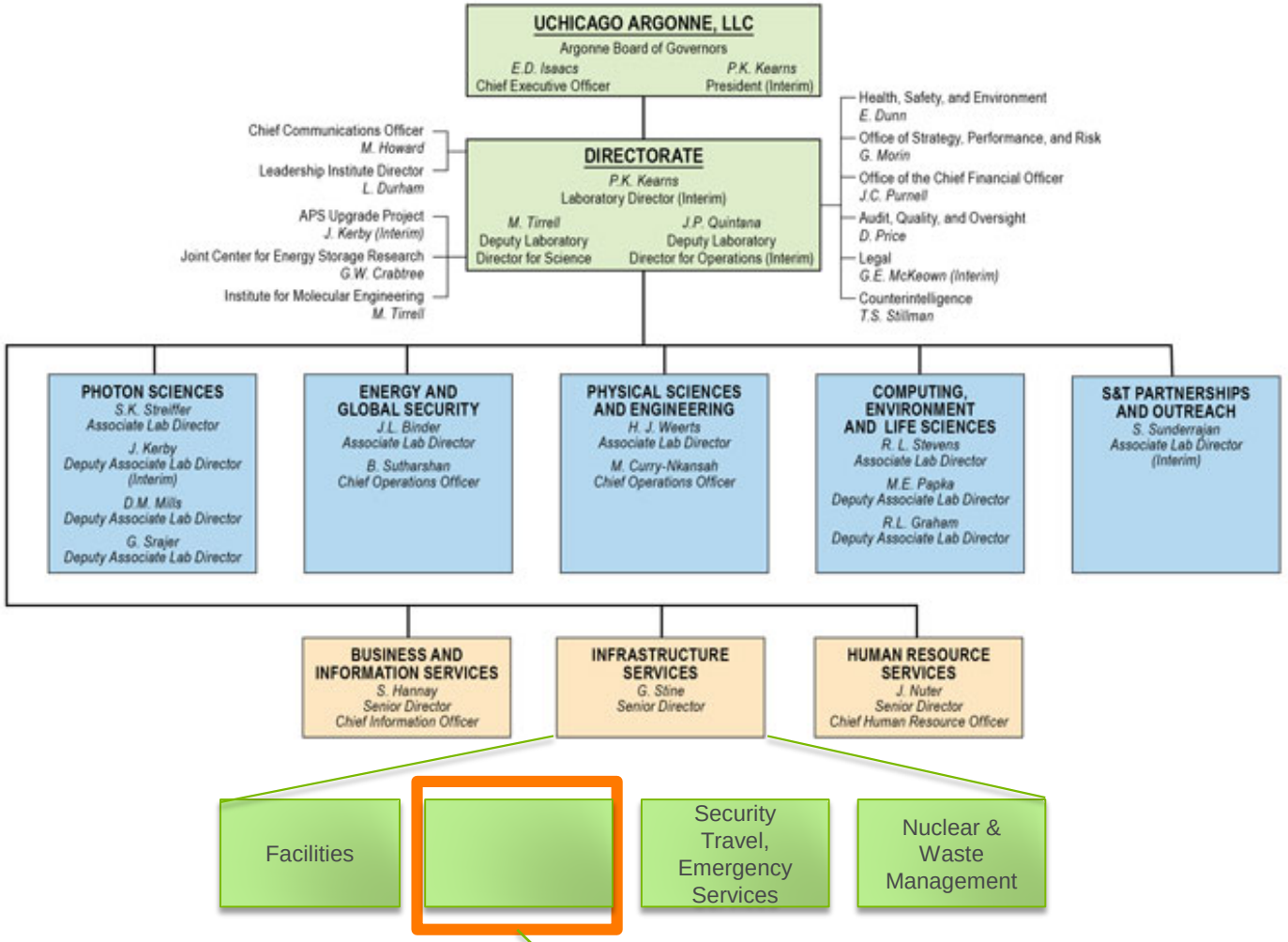
Organizational Chart



Location of Sustainability Program Management Facilitates HPSB Integration into Infrastructure Projects

Organizational Chart



Sustainability Program Management

PHASE 1 – BUSINESS CASE IDENTIFIES SUSTAINABILITY & HPSB REQUIREMENTS

- Business case developed for all projects to documented the need in CASE system
- Business case updated to capture which sustainability goal(s) the project supports
- New construction and major renovations greater than 5,000 gross square feet must meet federal high performance sustainable building (HPSB) criteria.

BUSINESS CASE PROJECT INFORMATION

PI Number: *(16-xxx)*	**Title:** *(descriptive title)*	
TEC: *($K TEC)*	**Funding:** *(funding type)*	**CAMP Score:** *(CAMP to be determined)*
Point of Contact: *(name, division, phone)*		**Location:** *(building number, site, etc.)*
Requestor: *(name, division, phone)*		**Systems Engineer:** *(name, division, phone)*

Problem Description: *(narrative giving details of the problem, history of deficiency, need or issue to be addressed by the proposed project)*

Proposed Solution: *(scope)*

Additional Scope: *(optional or additional scope)*

Justification/Risk: *(narrative describing the rational for implementing the proposed solution including the consequences if not implemented)*

Return on Investment/Energy & Water Savings: *(if applicable, expected pay back (e.g. electrical savings, labor/maintenance reductions, eliminated deferred maintenance.) Include assumptions used in calculating these items or reference Water & Energy Project worksheet.)*

Quality Level: ☐ A ☐ B ☐ C ☒ D

☐ **This work requires an Unreviewed Safety Question (USQ)?**
☐ **This work impacts a nuclear facility?**

Detailed Estimate: *(if known: include all costs to be charged to the project including ED&I and Laboratory taxes)*

Sustainability Goals: (check all goals that will be impacted by completion of this project)

☐ **Goal #1 – Greenhouse Gas Reduction**
☐ **Goal #2 – Sustainable Buildings**
☐ **Goal #3 – Fleet Management**
☐ **Goal #4 – Water Use Efficiency & Management**
☐ **Goal #5 – Pollution Prevention & Waste Reduction**
☐ **Goal #6 – Sustainable Acquisition**
☐ **Goal #7 – Electronic Stewardship & Data Centers**
☐ **Goal #8 – Renewable Energy**
☐ **Goal #9 – Climate Change Resilience**
☐ **Goal #10 – Energy Performance Contracts**

Stakeholders: *(stakeholders: names, divisions, phones)*

References: *(related CAS deficiencies and other related projects)*

Notes: *(additional notes)*

Submittal Date: *(date submitted)*	**Last Revised By:** *(revisions by: name)*	**Date Last Revised:** *(date revised)*

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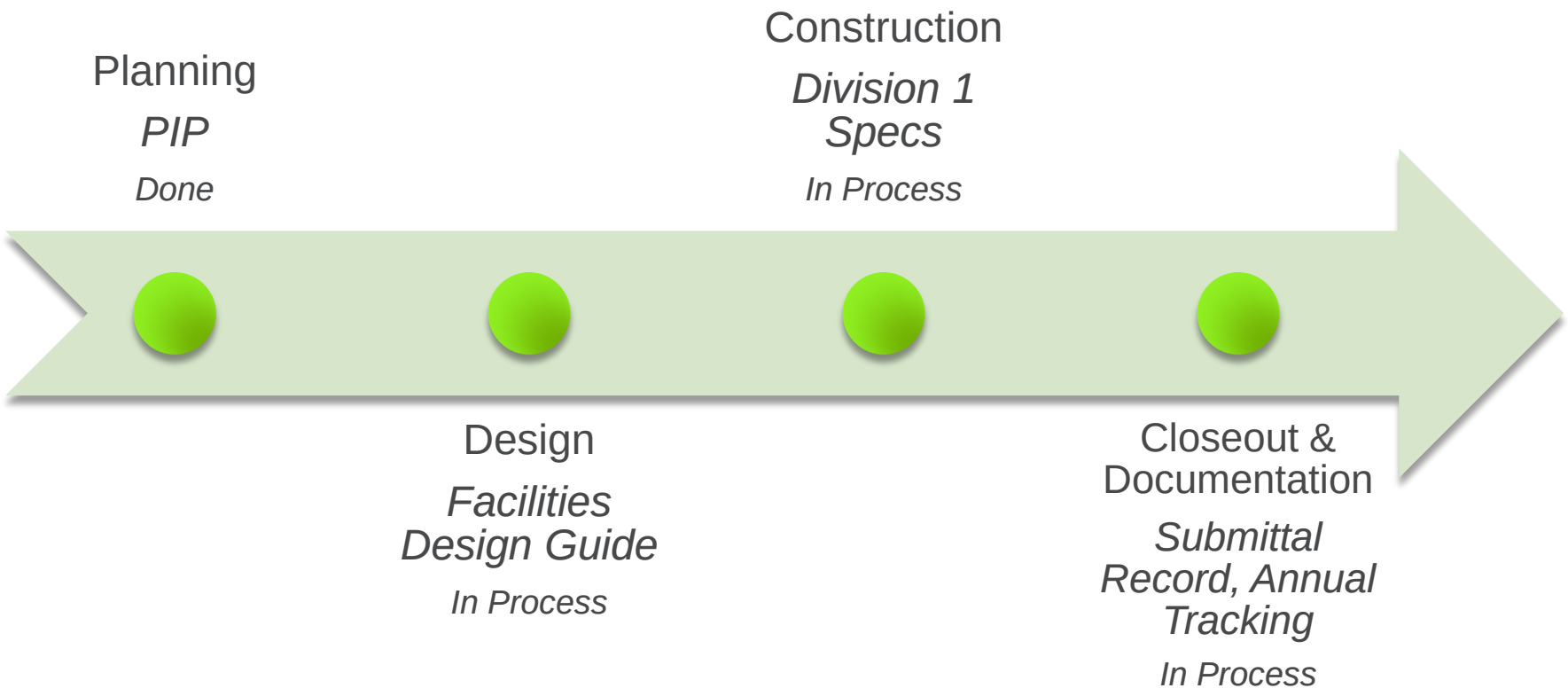
PHASE 2 – INCORPORATING HPSB INTO LIFECYCLE OF PROJECTS

Engage with Project Managers to embed HPSB into workflow

- Evaluated HPSB Guiding Principles and how they are addressed through a project lifecycle
  - Identified what phase(s) of the project must consider each principle
    - Initiation, Planning, Execution, Controls, Closeout, Operations
- Developed documentation for site/laboratory wide policies, procedures and processes that support HPSB in any project
- Created templated to be used to document HPSB compliance for new construction and existing building work
- Identified existing processes or tools that HPSB could be integrated into

PHASE 2 – INCORPORATING HPSB INTO LIFECYCLE OF PROJECTS



INCORPORATE HPSB INTO INFRASTRUCTURE PROJECT PLANNING

- A project must be managed by a project implementation plan (PIP) (LMS-POL-36)
- The PIP:
  - Defines a project from the initial concept, including **scope, schedule and budget** through the project life cycle and transition to operations. The PIP is superseded by the operation manual when the transition to operations is complete.
  - Is Argonne's plan and is approved by Argonne senior and middle management.
  - Is followed by the project team as the project proceeds through its life cycle.
- Some DOE projects require a project execution plan (PEP), a DOE-owned document and a project deliverable, prior to critical decision-2 under the DOE project life cycle
- Development of the PIP is explained in the Project Management Manual (PROJECT-8), PIP Development Procedure (Appendix A) and generally follows the path recommended in ANSI/PMI 99-001-2004.

INCORPORATE HPSB INTO INFRASTRUCTURE PROJECT PLANNING

- PIP Template is maintained by the Infrastructure Program Manager (within Project Management Organization) and is used by all Project Managers in project planning
- Summer 2017, PIP was updated to specifically identify what requirements for HPSB projects must meet based on project scope.
- All PIP's are reviewed by an interdisciplinary team, including the Sustainability Program Manager.
- Benefits include:
  - Incorporating HPSB into planning phase
  - Addressing budget implications early and seeking cost effective strategies
  - Including integrated design team on wide range of projects
  - Providing clear expectations for designers and construction contract
  - Reducing operating cost and improving building infrastructure

EXCERPT FROM PIP

21. Sustainable Design

Sustainable Design Approach Selection

The project manager has consulted with the Sustainability Program Manager and has made the following determination. This project:

❑ Is a new construction project. All new construction projects must follow the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings (HPSB). See Section A.
❑ Is a major renovation within an existing building or laboratory space and it exceeds 5,000 gross square footage but cost less than $5,000,000. All major renovations must follow the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings. See Section B.
❑ Is a project that focuses on materials, furniture and finishing replacement. All projects that replace materials, furniture and finishing follow the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings. See Section C.
❑ Is less than 10,000 gross square footage gut rehab. All gut rehabs that are less than 10,000 gross square footage follow applicable Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings. See Section D.
❑ Is a building systems upgrade such as lighting and lighting controls, HVAC and HVAC controls, plumbing and acoustic systems upgrades. Projects that are building systems upgrades must follow the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings. See Section E.
❑ is none of the above and the following explanation applies:

HPSB REQUIREMENTS SPECIFIED BASED ON PROJECT TYPE

	Category A, B, D: New Construction, Major Renovation and Gut Rehab >10,000	Category C - Materials, Furniture, Finishings Replacement, Building Envelope	Category E – Building System Upgrades	Category F – All other projects
GP I: Employ integrated design principles				
Integrated design	X		X	
Commissioning	X		X	
GP II: Optimize energy performance				
Energy efficiency	X		X	
Renewable and clean energy	X			
Metering	X		X	
Benchmarking	X			
GP III: Protect and conserve water				
Indoor water use	X		X	
Outdoor water use	X			
Alternative water	X			
Stormwater management	X			
GP IV: Enhance indoor environmental quality				
Ventilation and thermal comfort	X		X	
Daylighting and lighting controls	X		X	
Indoor air quality	X	X	X	
Occupant health and wellness	X		X	
GP V: Reduce environmental impact of materials				
Material content and performance	X	X	X	X
Waste diversion and materials management	X	X	X	X
GP VI: Assess and consider climate change risks				
Mission criticality	X		X	
Risks from climate change	X		X	
Facility adaptation	X		X	

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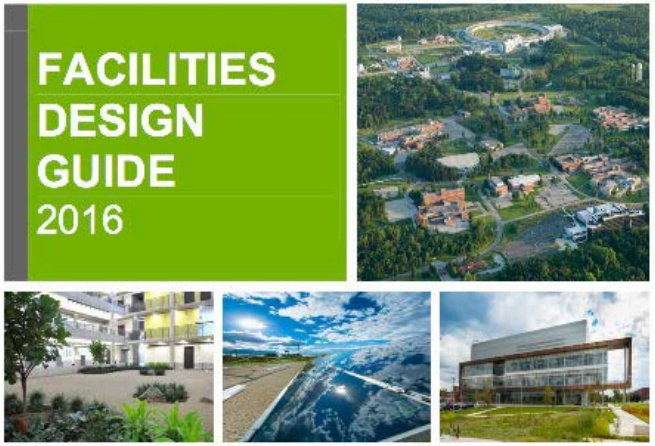
UPDATE FACILITIES DESIGN GUIDE TO INCORPORATE HPSB REQUIREMENTS

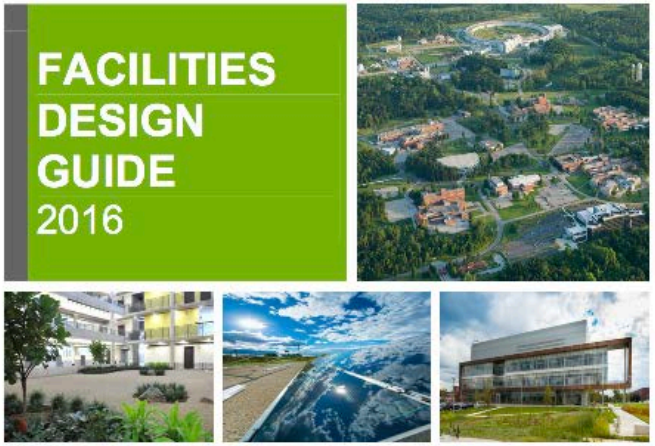
- Facilities Design guide issued in 2016 to guide Architectural / Engineering work (in-house and contracted) involving physical improvements at the lab
- Document provides the requirements for facilities-related codes, designs, and items specific to Argonne. Contents include:
  - Civil & Environmental
  - Architectural
  - Structural
  - Plumbing
  - Fire Protection
  - HVAC and Refrigeration
  - Electrical
  - Instrumentation
  - IT, Networking, Telecom, AV, Security
  - **Sustainability**
  - Non-Reactor Nuclear Facilities
  - Temporary Facilities



JSTD-128-W-T001

UPDATE FACILITIES DESIGN GUIDE TO INCORPORATE HPSB REQUIREMENTS

- Enhancing Sustainability Section to:
  - Increase scope to cover all projects with a graded approach to applicability
  - Improve definition of HPSB requirements
  - Provide cross-references to other relevant sections where specific water, energy, and other performance criteria can be summarized
  - Align with the aspects summarized from the PIP document
- Complementary Benefits:
  - Embed sustainable acquisition, electronic stewardship and organizational resilience requirements into project design
  - Improve partnership across laboratory to support sustainability goals



MODIFY SPECIFICATIONS TO ESTABLISH CONTRACTOR REQUIREMENTS

- Division 1 Specifications (Argonne Standard Boilerplate)
  - Enhancements to existing sections
    - Progress cleaning
      - Updated to specify requirements for biobased products, environmentally preferred products
    - Environmental Requirements
      - Green purchasing language addition
      - Integrated pest management addition
      - Indoor air quality management plan
  - New Sections
    - Sustainability Section
      - Providing more definition to sustainability goals, requirements
- Technical Specifications
  - Requirements embedded in each section based on established design requirements from Facilities Design Guide and project specific aspects
- Submittals
  - All sections updated to require submittals that will serve as HPSB documentation

LESSONS LEARNED

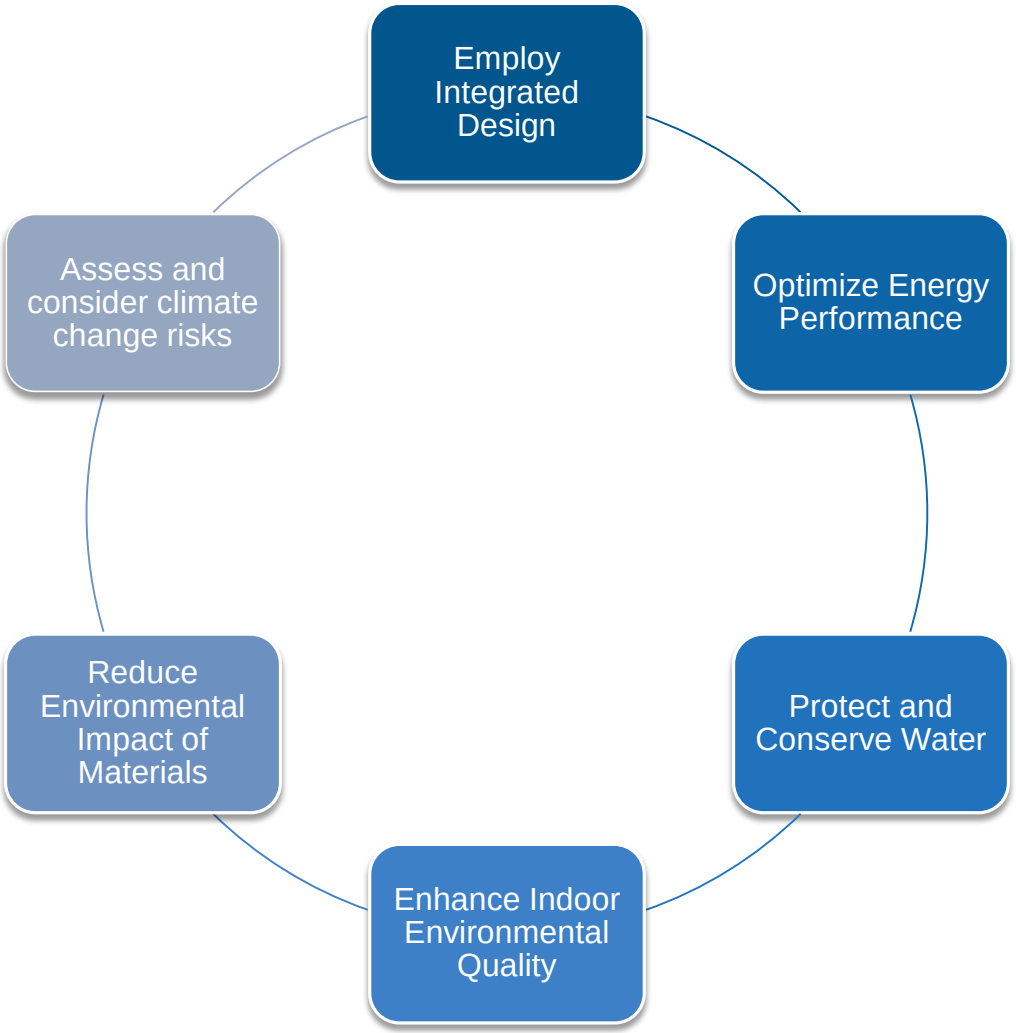
Sustainability is a journey that challenges us to continue improving

- Strong finish sets up next project for success
  - Use closeout process to document lessons learned and help improve efficiency for the next project
    - LOM's and ESB each had lessons learned that could have saved time (and money) on the next project
- People support tend to support what they create
  - PMO Project Managers leveraged to update PIP, Specs and project implementation strategies
- Graded approach limits cost burden and maximizes benefit
  - Guidance documents make requirements clear and template process and tools make it easy to implement
- It takes a village
  - Aligning Sustainability Team, Project Managers, Facilities Staff, Procurement, Consultants and Contractors takes time but will be well worth the effort

GUIDING PRINCIPLES FOR HIGH PERFORMANCE SUSTAINABLE BUILDINGS (HPSB)

Federal Government's Green Building Goals and Requirements

By 2015: Document 17% of existing buildings as compliant with HPSB



Beyond 2015: Work toward documenting 100% buildings as compliant with HPSB

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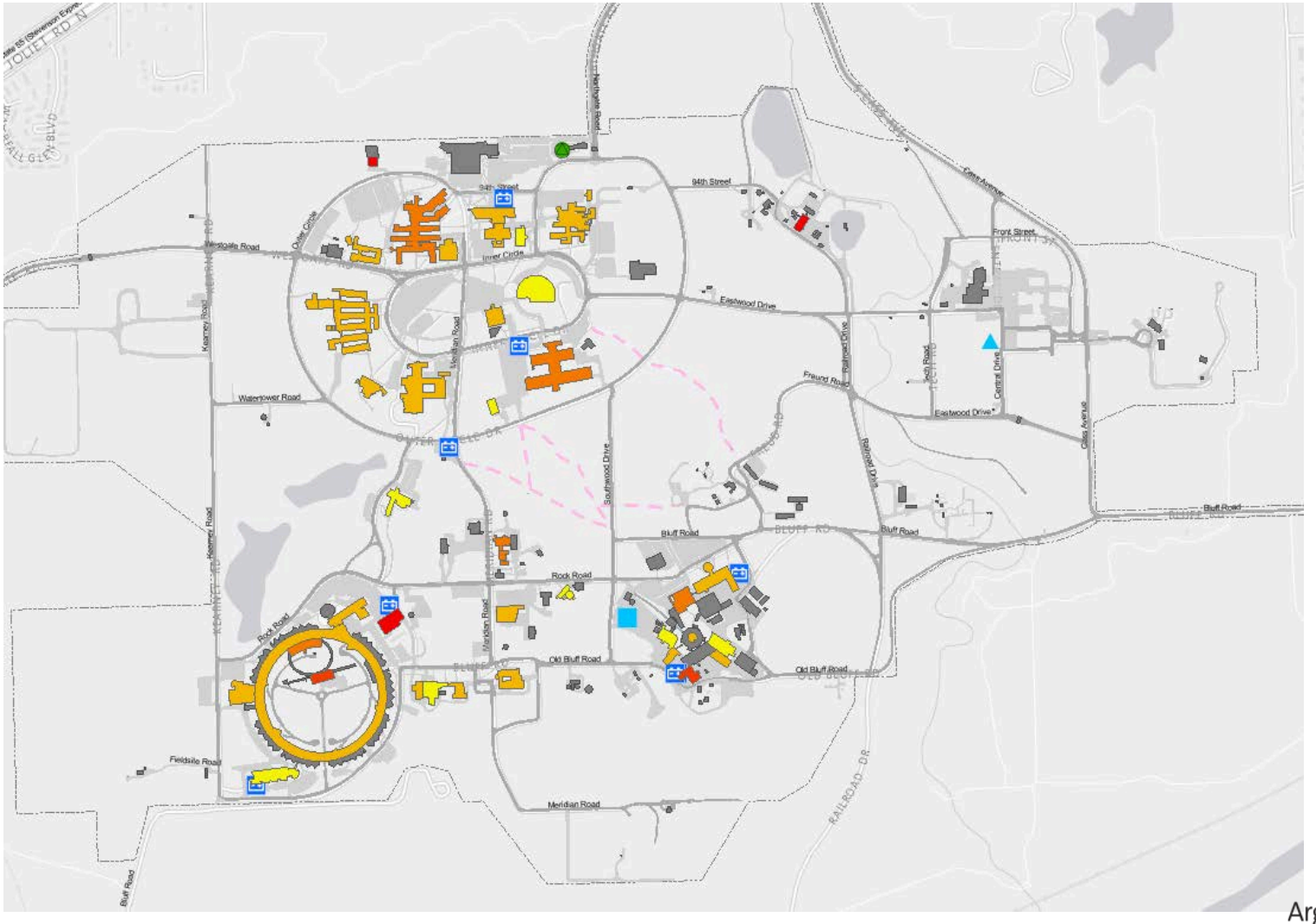
ARGONNE BUILDINGS OVERVIEW

Diverse and aging building stock provides challenges for addressing sustainable building goals

Goal Subject Buildings	98 / 162 campus buildings are GSB
	3.1M / 5.3M ft^2 GSB
Average Age	Mean 43 yrs
	Median 50 yrs
	45 built before 1960
Construction	Mostly standard post-war brick government construction
EUI (of largest GSB energy consumers)	Average: 250
	Low: 51 (Utility / Office)
	High: 550 (Laboratory / Office)

ARGONNE BUILDINGS OVERVIEW

Heat Map of Energy Intensity for Argonne Buildings



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OVERVIEW OF ARGONNE APPROACH TO HPSB GOALS

16 Buildings Total

- 11 Guiding Principles
- 5 LEED

Existing Buildings

- 10 Guiding Principles
  - Self-certified
  - Documentation of Energy STAR Portfolio Manager
- 1 LEED for Existing Buildings

New Buildings

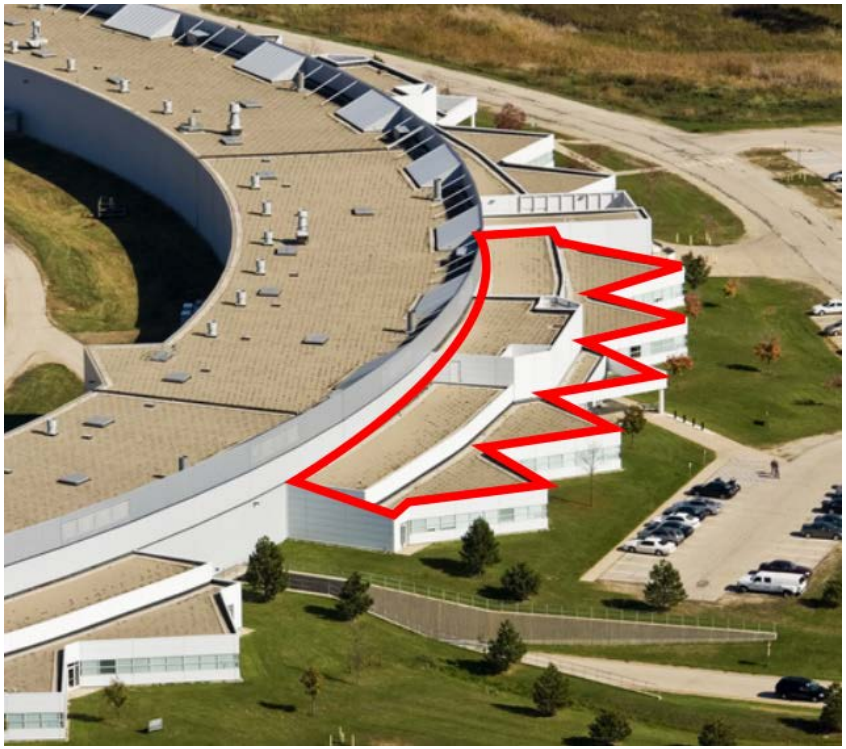
- Self documentation using Energy STAR Portfolio Manager
  - Enterprise Data Center
- LEED for New Buildings when appropriate
  - 216, APCF, ESB, and MDL (future)

HPSB GOAL STATUS

Building	New/Existing	Certification	FY
46: Shipping and Receiving	Existing	LEED Silver	<2011
216: Sub-Angstrom Microscopy	New	LEED Gold	<2011
214: Facilities Management	Existing	HPSB	2012
302: Security	Existing	HPSB	2012
438: APS LOM	Existing	HPSB	2012
440: Center for Nanoscale Materials	New	LEED Silver	2012
435: APS LOM	Existing	HPSB	2013
241: Energy Sciences Building	New	LEED Gold	2015
446: Advanced Protein Characterization Facility	New	LEED Gold	2015
436: APS LOM	Existing	HPSB	2015
224: Visitor Reception Center	Existing	HPSB	2015
434: APS LOM	Existing	HPSB	2016
431: APS LOM	Existing	HPSB	2017
432: APS LOM	Existing	HPSB	2017
433: APS LOM	Existing	HPSB	2017
386: Enterprise Data Center	New	HPSB	2017
242: Materials Design Laboratory	Future	LEED Gold	2018+

HPSB UPGRADES FOR LAB/OFFICE MODULE FOR AT ADVANCED PHOTON SOURCE

- 8 Lab / Office Modules (7 fully occupied)
  - 7 Certified as HPSB
  - Convenient access to APS Light Source
  - Additional Laboratories for research
  - Average 30 MWh / month



HPSB UPGRADES FOR LAB/OFFICE MODULE FOR AT ADVANCED PHOTON SOURCE

Replicate upgrades to achieve compliance with HPSB for existing buildings

- Approach to using LOM's for HPSB compliance
  - Same sized buildings with similar building loads
  - Designed internally based on previous LOM implementation study
  - Lighting Upgrades
- Implementation Approach
  - First 4 LOMs done as one-off projects
    - Existing pre-negotiated BOA contract
    - Managed through internal engineering team
  - Last group of 3 done as a large project
    - Competitively bid as a package
    - Managed by Infrastructure Project Management Org.
- Lessons Learned
  - Full design by A/E would help eliminate change orders
  - Better documentation needed to prevent repeating mistakes when team changes
  - Missed scope item for recycling of light fixtures

LEED AS PATH FOR HPSB COMPLIANCE AT NEW BUILDINGS

Energy Sciences Building (ESB)

Multi-division laboratory office building

LEED Gold

- Low flow fixtures
- Zero landscape irrigation
- LED lighting with daylighting and centralized control
- High efficiency fans
- High-performance, low velocity hoods
- Exhaust air heat recovery
- EV charging station
- Seasonal bike share program

LEED AS PATH FOR HPSB COMPLIANCE AT NEW BUILDINGS

Material Design Lab (MDL)

- Designed as LEED Gold
- Anticipating 61 LEED points
- Innovative lab design and policies
- Includes waste heat recovery

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HPSB FOR NEW CONSTRUCTION ENTERPRISE DATA CENTER (EDC)

Project Overview and Objectives

Purpose

- Replace existing inadequate facility
- Provide high up-time environment for business applications and storage
- Provide high efficiency space to encourage consolidation of smaller data centers

Schedule

- Several spaces considered in last 5 years
- Decision to build new FY16
- Design and construction completed FY17
- Operations begin FY18

Procurement

- Design build
- HPSB/GP included in bridging documents
- PUE 1.4 included in bridging documents
- Sustainability involved in all design reviews

HPSB FOR NEW CONSTRUCTION ENTERPRISE DATA CENTER

HPSB Process

- Adhering to Guiding Principles and 1.4 PUE requirement communicated to bidders from the beginning
- Energy efficiency a selection criteria during procurement
- Difficulties in applying Guiding Principles
  - No ASHRAE 90.1 standard for data centers
  - Consulted with other research labs and industry experts to determine baseline energy standard
  - No windows = No daylighting
  - Design build contractors not familiar with guiding principles, only LEED

HPSB FOR NEW CONSTRUCTION ENTERPRISE DATA CENTER

Results

- Project completed on-time
- Full load PUE testing to still be completed; contractor contractually bound to make changes should energy targets not be met
- Met 92% of Guiding Principles for HPSB
- IT moving in Q1-FY18
- Hoping to consolidate smaller data centers once all business applications and storage are moved, further increasing campus efficiency

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