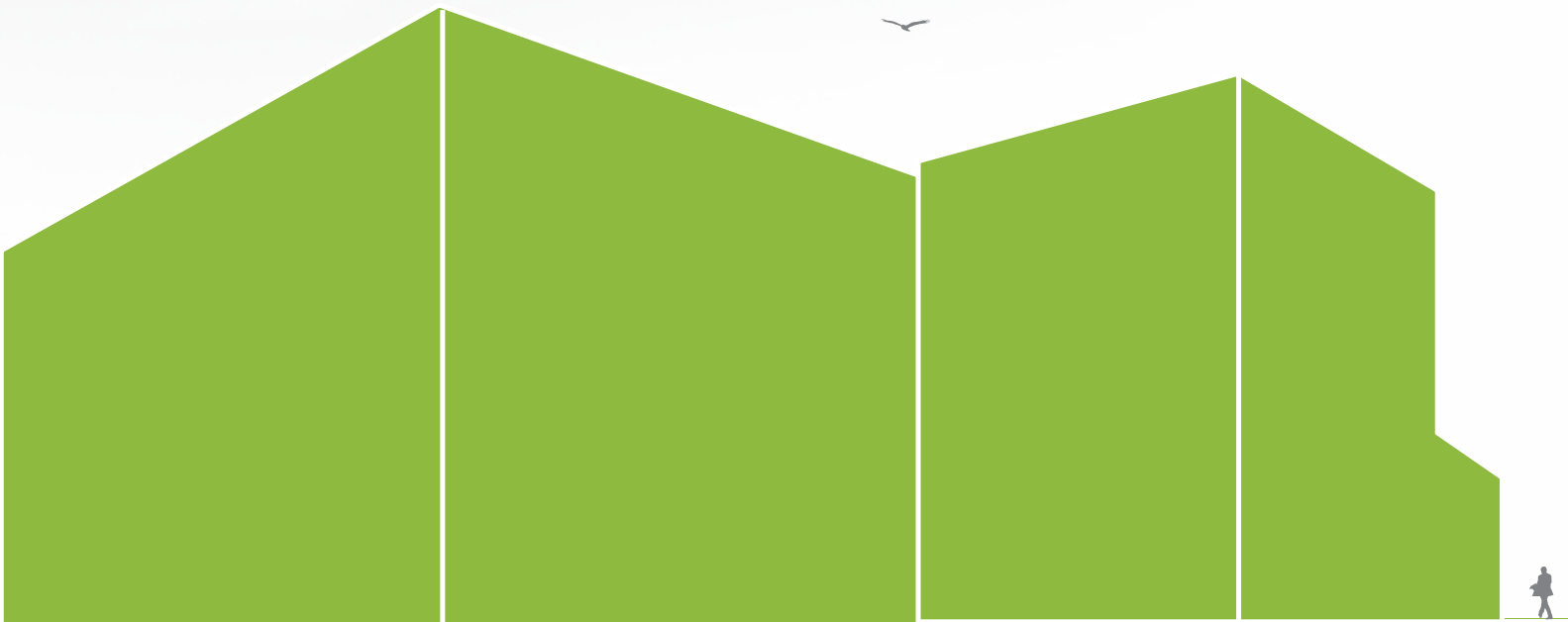


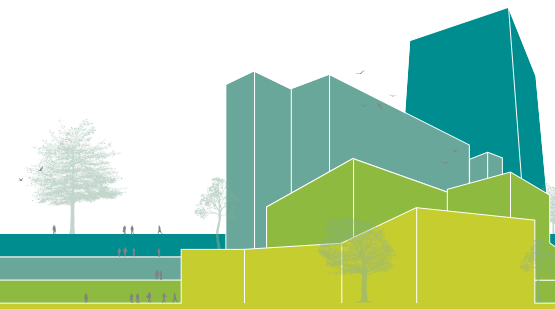


# Integrated Design Advanced Energy Retrofit ROADMAP



# Integrated Design Advanced Energy Retrofit Roadmap

*For design, construction, and management of the retrofit process.*



## Project Team Guide for Partial Retrofits

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## Disclaimer

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The Consortium for Building Energy Innovation  
Building Technologies Office, Department of Energy



*The Consortium for Building Energy Innovation is part of the United States Department of Energy's Building Technologies Office. The CBEI aims to transform the energy efficiency market for existing small- and medium-sized commercial buildings. Our vision is to be recognized as the leader in creating vibrant ecosystems to identify and apply integrative technologies and innovative practices in existing buildings.*

*The CBEI performs research to develop and integrate materials, technologies, models, and tools to optimize whole building energy performance. Research results are demonstrated in buildings and effects are measured and cycled back to refine and guide continued research for further optimization of whole building performance. The CBEI scales adoption of proven solutions by addressing business and finance, education and training, and other issues.*

*The headquarters of the CBEI is located at the Navy Yard in Philadelphia, PA. The Navy Yard and the Philadelphia region serve as the test beds from which the CBEI deploys to the nation proven energy-savings, whole building system solutions and integrated retrofit design and delivery methods.*

## Message from Principal Investigator, Franca Trubiano

The energy efficiency market currently lacks effective and scalable project management tools that offer the architecture, engineering, and construction (AEC) industry a comprehensive action process for completing advanced energy retrofits. This is particularly the case for small to medium-sized buildings. Moreover, today's commercial building market can ill afford the renovation of buildings by industry professionals who neglect to account for the building's energy consumption. In response, the ***Integrated Design Advanced Energy Retrofit (ID AER) Roadmap*** project, which our team has authored, is aimed at developing operational guidelines and protocols for ensuring building project teams can successfully complete an ID AER.

Committed to increasing the number of advanced energy retrofits completed in the United States over the next 20 years, this *Integrated Design Roadmap* assists project teams and building owners in achieving deep energy savings in the renovation of existing buildings. The ID process outlined in this *Reference Manual* and its accompanying *Project Team Guide* instructs and empowers owners, project managers, financial investors, architecture, engineering and construction professionals, as well as energy modeling and measurement professionals, with valuable information for completing an advanced energy retrofit.



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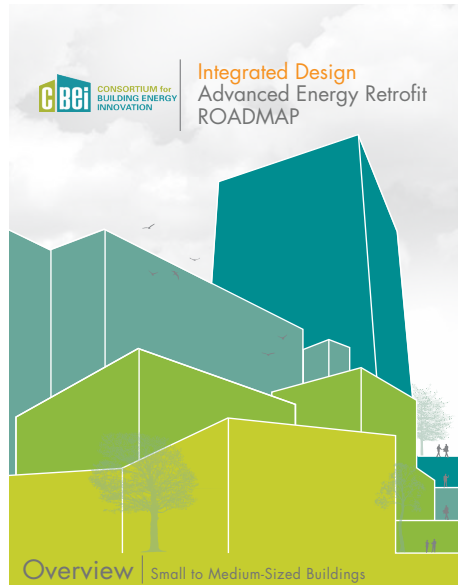
1 INTRODUCTION

- VALUE OF INTEGRATED DESIGN + ID PROTOCOLS
- PROJECT IMPLEMENTATION OF ID PROCESS

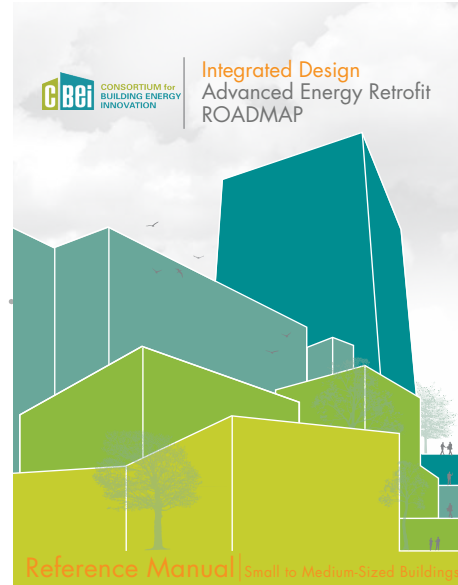
## Integrated Design (ID) Advanced Energy Retrofit (AER) Roadmap Document Suite

The Integrated Design (ID) Advanced Energy Retrofit (AER) Roadmap document suite is organized in a three-tiered structure, with each tier expanding and reinforcing the concepts introduced by the previous. The Roadmap seeks to empower building owners with the knowledge needed in order to make informed decisions leading to the completion of a successful advanced energy retrofit. The Roadmap document suite includes the following documents:

- *ID AER Roadmap Overview*
- *ID AER Roadmap Reference Manual*
- *ID AER Roadmap Project Team Guides*



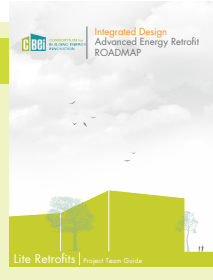
• *ID AER Roadmap Overview*  
The Overview serves as an introduction brochure to the document suite and outlines the basic concepts of Integrated Design (ID) and Advanced Energy Retrofits (AERs). A short quiz helps the reader identify what scale of retrofit may be appropriate for their project. In addition, the Overview provides info on the benefits of Integrated Design (ID) and financial resources and incentives.



• *ID AER Roadmap Reference Manual*  
The Reference Manual focuses on all information related to the execution of an Integrated Design (ID) AER project. This document is geared towards building owners, operations and maintenance teams, and tenants with limited knowledge of Integrated Design (ID), AERs, or buildings. It is also a useful companion to the Project Team Guide for team members with less experience utilizing an Integrated Design (ID) process.

- *ID AER Roadmap Project Team Guides*

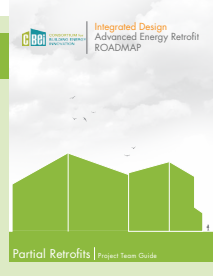
Critically important to the implementation of an Integrated Design (ID) process, the Project Team Guide outlines the activities involved in each scale of retrofit. The Project Team Guide includes four separate documents developed for use by all professionals that make up the project team.



PROJECT TEAM GUIDE: LITE

The Lite Retrofit Project Team Guide details the implementation of an Integrated Design (ID) process for a project scope that includes the Purchase, Installation and Commissioning of a minimum of one new building system and the existing building commissioning of at least one existing system.

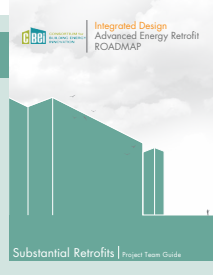
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PROJECT TEAM GUIDE: PARTIAL

The Partial Retrofit Project Team Guide details the implementation of an Integrated Design (ID) process for a project scope that includes the Purchase, Installation and Commissioning of a minimum of two building systems and one building envelope component.

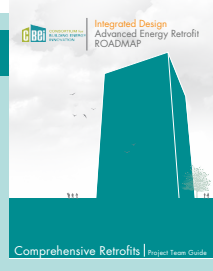
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PROJECT TEAM GUIDE: SUBSTANTIAL

The Substantial Retrofit Project Team Guide details the implementation of an Integrated Design (ID) process for a project scope that includes the Purchase, Installation and Commissioning of most building systems and building envelope components.

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PROJECT TEAM GUIDE: COMPREHENSIVE

The Comprehensive Retrofit Project Team Guide details the implementation of an Integrated Design (ID) process for a project scope that includes the Purchase, Installation and Commissioning of all building systems and building envelope components through the use of customized process protocols and benchmarks.

## What is Integrated Design (ID)?

Integrated Design (ID) is a collaborative process for identifying shared priorities and goals in an effort to build consensus amongst all members on the retrofit team. Building owners are encouraged to demonstrate commitment to the seven Integrated Design (ID) protocols, and to encourage the same level of commitment from the professional team whose members are from Architecture, Engineering, and Construction (AEC) industries.

In Collaborative Meetings (CM) all team members are in attendance to develop:

- Mission Statement + Project Priorities
- Project Budget + Restraints
- Project Values + Goals

Participating in a process such as this offers Owners the chance to have a more efficient, effective building that attains greater energy savings.

## Why is ID better than typical practice?

The use of Integrated Design (ID) in the construction industry often bypasses and mitigates many of the industry's most fragmented and inefficient activities. Regardless of project scope or scale, when professionals from the AEC industry come together and align around a project's goals, results usually include better managed and less costly projects. When using an Integrated Design (ID) approach, in which a single team works for the benefit of a shared goal, the completion of a better performing building usually results. Typical of an Integrated Design (ID) retrofit project is the:

- Team Alignment of goals
- High level collaboration + execution of project activities throughout the entire project
- Use of Predictive Modeling and Measurement + Verification (M+V) to evaluate energy savings

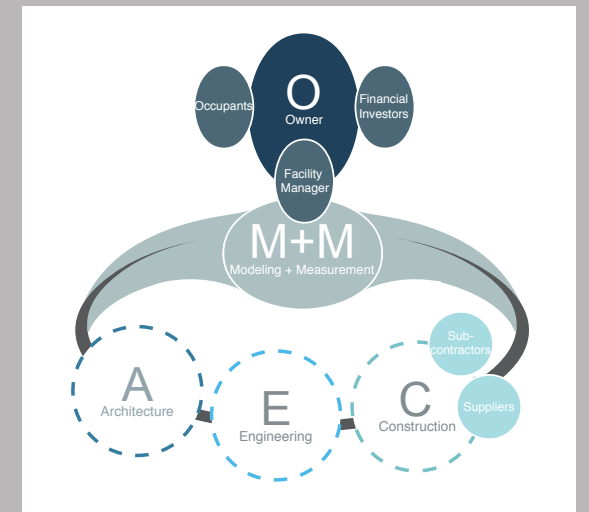
## Participants: Roles + Responsibilities

Successful retrofit projects are the result of open communication and coordination amongst all team members. The careful sequencing of required tasks to be performed by each AEC and Modeling and Measurement professional contributes to this success.

These Integrated Design (ID) protocols have been organized and sequenced to facilitate professional exchange and to increase levels of transparency of benefit to all advanced energy retrofits.

Albeit different project scales will occasion different budgets and different levels of professional engagement, all seven protocols listed here are recommended for implementation.

## PROFESSIONAL ROLES



The diagram above identifies the professionals involved in a Partial scale ID AER. Within a Partial scale ID AER, typically at least one design professional participates from the Architecture, Engineering and Construction (AEC) fields to work on the development of the project. Depending on the individual project team, an AEC professional may be able to provide Modeling + Measurement (M+M) support, or an additional consultant may be introduced to this end.

## ID PROTOCOLS

Seven Integrated Design (ID) protocols guide all advanced energy retrofits, regardless of project size, scope and budget. The protocols include:

- 1 PROJECT MISSION STATEMENTS**
  - Shared by all members of the team, they create alignment around project goals and expectations.
  - Establish values, cost priorities, people-based protocols and performance metrics.
  - Organize and guide most decisions and procedures for the entirety of the AER.
- 2 ID REQUESTS FOR PROPOSAL**
  - Sets performance based standards and financial goals for all team members.
  - Ensures all team members, including AEC professionals, Modeling + Measuring consultants, and Product and Service providers have the requisite knowledge and experience for achieving the Owner's energy savings goals.
- 3 COLLABORATIVE TEAM MEETINGS**
  - Participation in all team gatherings creates engagement among team members.
  - Fosters feelings of ownership by all team members.
  - Facilitates goal setting and project updating, as well as periodic detailed project reviews.
- 4 ENERGY FREE DESIGN SOLUTIONS**
  - Promotes and evaluates a range of passive energy solutions that encourage load reduction.
  - Contributes to minimizing the size and cost of any new HVAC and lighting systems.
  - Encourages the use of renewable energy.
- 5 WHOLE BUILDING SYSTEMS DESIGN**
  - Promotes the accrual of savings when multiple systems are retrofitted at the same time.
  - Ensures the operation of all systems (new or existing) are efficient.
  - Identifies the value of bundling retrofit measures.
- 6 PREDICTIVE MODELING**
  - Offers baseline model benchmarking for building energy consumption, pre- and post-retrofit.
  - Forecasts where other energy savings or benefits may exist.
  - Validates and tests potential design solutions for effectiveness in achieving energy target goals.
- 7 MEASUREMENT + VERIFICATION**
  - Enables the calibration of building systems post-retrofit to ensure they are operating as expected.
  - Offers measurable data to substantiate energy savings claims.
  - Demonstrates energy savings to tenants (existing and future) as well as to financing bodies.

## Project Phases in a Partial ID AER

A Partial ID AER project can be organized into five phases over the course of the project including:

- Conceptualization
- Design Development
- Implementation Documentation
- Construction & M+V
- Commissioning & Post-Occupancy

Each phase requires the collaboration of all professionals on the team.

### • Conceptualization

The Conceptualization phase includes the Pre-Project Resource Gathering (RG) stage and the first process oriented Collaborative Meeting (CM) stage. During the Pre-Project RG stage, the preliminary project details are identified. The first CM is intended to give the team an opportunity to understand the ID process and its protocols, develop project goals, and work towards alignment.

### • Design Development

The Design Development phase includes a RG stage and the second CM stage. During the RG stage, design solutions and a predictive energy model are developed and the team participates in Sub-Team Meetings to review options. During the CM stage, all team members participate to review the final design options and ensure continued alignment with the project's Mission Statement.

### • Implementation Documentation

The Implementation Documentation phase includes a RG stage and the third process oriented CM stage. During the RG stage, implementation documents are developed and the predictive energy model is calibrated. Additionally, the project's phasing, purchase orders, and construction schedule are developed and reviewed. During the CM stage, the Mission Statement is reviewed to ensure team members remain aligned.

### • Construction & M+V

The Construction & M+V phase includes only a RG stage. This RG stage includes the construction of the project using Lean Project Delivery methods and the identification of the project's M+V goals. In addition, a plan for commissioning, operations and maintenance (O+M), and On-going Performance Evaluation are identified and reviewed.

### • Commissioning & Post-Occupancy

The Commissioning & Post-Occupancy phase includes the final CM, and the final RG stage, called On-going Performance Evaluation. At the CM, the Commissioning plan, the O+M plan, and the On-going Performance Evaluation plan are confirmed and approved. During On-going Performance Evaluation, M+V and commissioning is overseen by designated members of the project team.

## Resource Gathering (RG)

The ID process includes two types of activities defined as Resource Gathering (RG) stages and Collaborative Meeting (CM) stages. RG stages include information gathering activities assigned to each professional team member based on their competencies. Typically, team members work independently in gathering the required information. During RG stages, the Owner and/or Project Manager may have Sub-Team meetings with various team members to review the development of these activities and ensure alignment of the project with the Mission Statement.

During a Partial scale retrofit, there are typically five RG stages. The first is defined as the Pre-Project RG stage during the Conceptualization phase. This RG stage involves the participation of the Owner and/or Project Manager, and a Modeling + Measurement (M+M) professional. The subsequent three RG phases involve all of the professionals involved with the project team, and they occur in the Design Development, Implementation Documentation, and Construction & M+V phases. The final RG stage is defined as On-going Performance Evaluation, and occurs in the Commissioning & Post-Occupancy phase. The On-going Performance Evaluation RG stage typically includes the Owner and/or Project Manager, and the team member responsible for the continued M+V of the project.

## Collaborative Meetings (CM)

As part of a Partial scale ID AER, four Collaborative Meeting (CM) stages take place. CM stages include all team members in order to achieve project alignment and provide for the integrated development of the project. The following outlines the CM stages within a Partial scale ID AER:

### • Alignment and Goal Setting Meeting:

The first CM occurs during the Conceptualization phase and focuses on introducing and developing an understanding of all ID process protocols by team members.

### • Final Design Decisions Meeting:

The second CM occurs during the Design Development phase and focuses on the review and approval of the final design solutions by the project team.

### • Construction Planning Meeting:

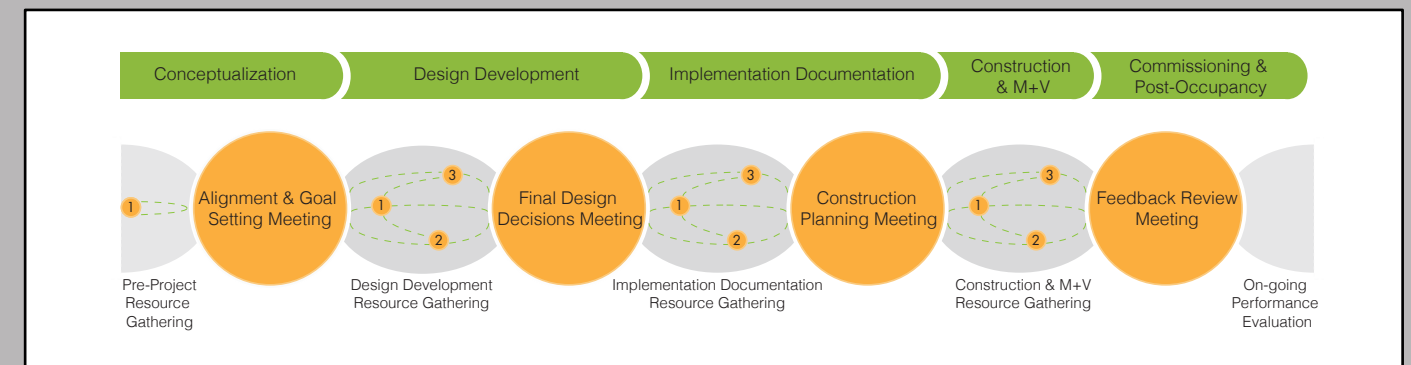
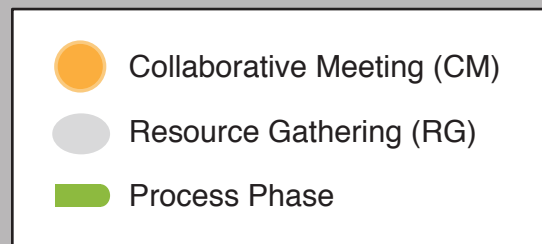
The third CM occurs during the Implementation Documentation phase and focuses on the review and approval of the construction schedule, budget, and implementation documents.

### • Feedback Review Meeting:

The fourth CM occurs during the Commissioning & Post-Occupancy phase and focuses on approval of plans for on-going performance evaluation.

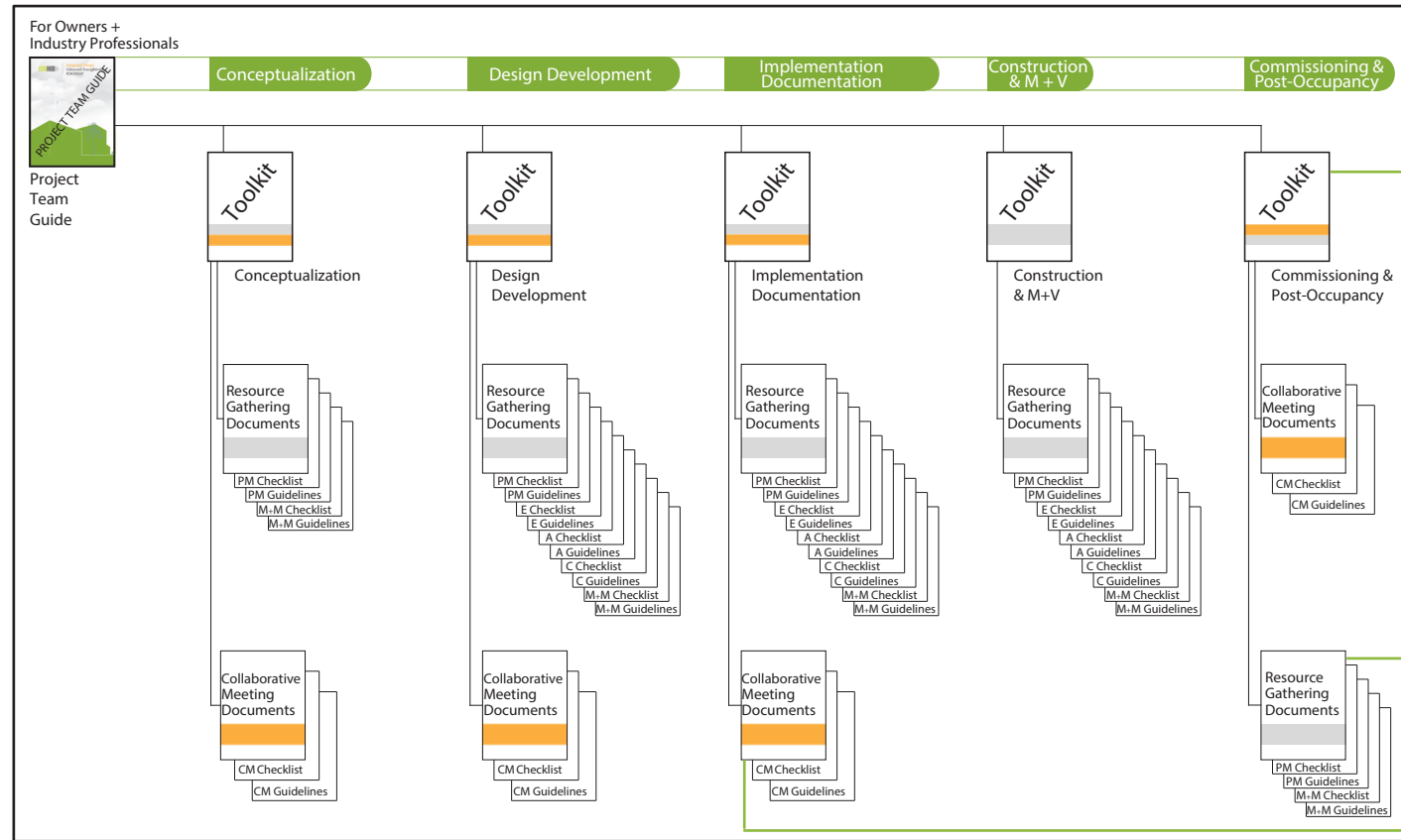
## INTEGRATED DESIGN PROCESS DIAGRAM

This Integrated Design (ID) Process Diagram identifies the phases of a typical Partial scale ID AER project. The diagram identifies the components involved within each phase including Resource Gathering (RG) and Collaborative Meeting (CM) stages. Detailed activity Checklists and Guidelines for all of the RG and CM stages can be found within this document. Throughout this process, team members collaborate for maximum alignment around project goals and intended outcomes.





## Project Team Guide Documents Map



### Project Phase Toolkits

The Project Team Guide is organized into toolkits used during each phase of an integrated design (ID) AER project. Each toolkit includes the documents that are necessary for that particular phase, which typically involves Resource Gathering documents and Collaborative Meeting documents.

### Resource Gathering Documents

The Resource Gathering (RG) documents include Checklists and Guidelines associated with each of the professional competencies needed on the project, and at each of the RG stages.

### Collaborative Meeting Documents

The Collaborative Meeting (CM) documents include shared Checklist and Guidelines documents that outline activities to be completed by all team members within each of the CM stages.

## Using the Project Team Guide to Complete a Partial ID AER

The Project Team Guide outlines all activities involved in each phase of a Partial ID AER project. This comprehensive toolkit has been developed for use by all professionals on a project team. Since a typical Partial scale ID AER project may have a limited number of AEC professionals on the team, the documents within the guide are organized according to the professional competencies required on a particular team, which include the following:

- Project Management
- Architectural
- Engineering
- Construction
- Modeling + Measurement (M+M)

During a Partial scale retrofit, team members may be required to explore tasks that are not typically offered as part of their services but for which they are qualified. For example, a project may have an Architect, but not an M+M professional. In this case, the Architect could be asked to complete the M+M activities necessary in a Partial ID AER project. Designated project team roles are explored according to the specifics of a project, and assigned by the Owner and/or Project Manager at the start of the project.

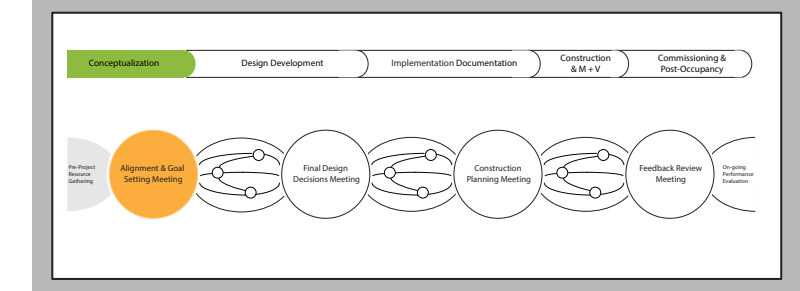
## CONCEPTUALIZATION PHASE CONTENTS

DESIGN DEVELOPMENT PHASE		
CONTENTS		
<b>RESOURCE GATHERING (RG) DOCUMENTS</b>		
DD.RG.PM	PROJECT MANAGEMENT (PM)	42
DD.RG.PM.1	PM CHECKLIST	
DD.RG.PM.GUIDELINES	PM GUIDELINES	
DD.RG.A	ARCHITECTURE (A)	48
DD.RG.A.1	ARCHITECTURE CHECKLIST	
DD.RG.A.GUIDELINES	ARCHITECTURE GUIDELINES	
DD.RG.E	ENGINEERING (E)	54
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DD.RG.E.GUIDELINES	ENGINEERING GUIDELINES	
DD.RG.C	CONSTRUCTION (C)	62
DD.RG.C.1	CONSTRUCTION CHECKLIST	
DD.RG.C.GUIDELINES	CONSTRUCTION GUIDELINES	
DD.RG.MM	MODELING & MEASUREMENT (M+M)	66
DD.RG.MM.1	M+M CHECKLIST	
DD.RG.MM.2	M+M CHECKLIST	
DD.RG.MM.GUIDELINES	M+M GUIDELINES	
<b>ID COLLABORATIVE MEETING (CM) DOCUMENTS</b>		
DD.CM.1	FINAL DESIGN DECISIONS MEETING CHECKLIST	
DD.CM.GUIDELINES	FINAL DESIGN DECISIONS MEETING GUIDELINES	

**PHASE LEGEND**

**Design Development Phase Table of Contents**

## CONCEPTUALIZATION PHASE LEGEND



## EXAMPLE CHECKLIST DOCUMENT

**CONCEPTUALIZATION (CONC.) PHASE** CONC. PM, 1

PRE-PROJECT RESOURCE GATHERING (RG) DOCUMENT

PROJECT MANAGEMENT (PM) GENERAL ACTIVITIES

**CHECKLIST**

- 1 Identify who will FACILITATE the Integrated Design (ID) process  
Team Member Name: \_\_\_\_\_  
Contact Information: \_\_\_\_\_
- 2 Identify building performance and utility DATA for M+M consultant  
DELIVERABLE: Submit Utility Bills for the most recent 1-2 years on record (Electric, Gas, Water)  
DELIVERABLE: Submit Energy Audits, if available  
DELIVERABLE: Submit Building Automation System info or report(s), if available
- 3 Identify and review retrofit SCALE using the ID AER Roadmap evaluation tools  
DELIVERABLE: Submit completed Retrofit Scale Quiz
- 4 Identify and review preliminary project SCOPE and SCHEDULE  
DELIVERABLE: Submit summary outlining preliminary project scope  
DELIVERABLE: Submit preliminary project schedule
- 5 Identify and review project CONSTRAINTS  
DELIVERABLE: Submit summary outlining project constraints
- 6 Identify and review preliminary project PERFORMANCE TARGETS and Metrics with M+M  
DELIVERABLE: Submit summary outlining the preliminary project performance targets and metrics
- 7 Identify and review the preliminary project ENERGY CERTIFICATION/ACCREDITATION goals  
DELIVERABLE: Submit summary outlining the preliminary project energy certification/accréditation goals
- 8 Identify and review an Owner's TEAM ORGANIZATION MAP for communication  
DELIVERABLE: Submit Owner's team Organization Map
- 9 Schedule and lead the collaborative Conceptualization SUB-TEAM MEETING to review Pre-Project Resource Gathering activities including building data, documents, and financial resources  
DELIVERABLE: Submit report outlining the results of the Sub-Team Meeting
- 10 SCHEDULE first Collaborative Meeting, Alignment and Goal Setting, and draft list of owner's project priorities  
DELIVERABLE: Submit draft list of owner's project priorities  
DELIVERABLE: Schedule the Alignment and Goal Setting Meeting and notify all project team members

ASSIGNED TO: \_\_\_\_\_ CONTACT INFO: \_\_\_\_\_ DATE COMPLETED: \_\_\_\_\_

**CBEi** ID AER ROADMAP PARTIAL PROJECT TEAM GUIDE 18

Conceptualization Phase Resource Gathering Document

## Project Team Checklists

Within the Project Team Guide, each Resource Gathering (RG) and Collaborative Meeting (CM) stage includes Checklists that outline the integrated design (ID) and advanced energy retrofit (AER) activities required during a Partial scale retrofit.

### • Resource Gathering (RG) Checklists:

During RG stages, Checklists are used to outline the professional competencies needed on the project to complete all required activities.

### • Collaborative Meeting (CM) Checklists:

During CM stages, one shared Checklist outlines the activities to be completed by all team members at each process oriented Collaborative Meeting.

## Project Team Guidelines

Within the Project Team Guide, each Resource Gathering (RG) and Collaborative Meeting (CM) stage includes a Guidelines section for every Checklist. These Guidelines provide resources and additional information to assist the project team in completing the activities that are outlined in the corresponding Checklist.

### • Resource Gathering (RG) Guidelines:

During RG stages, the Guidelines are organized according to the professional competencies required for designated activities.

### • Collaborative Meeting (CM) Guidelines:

Of use during CM stages, there is one Guidelines section used by the project team. These Guidelines help direct Integrated Design activities and contribute to team alignment around a project's goals and outcomes.

## EXAMPLE GUIDELINES DOCUMENT

**GUIDELINES**

**CONCEPTUALIZATION (CONC.) PHASE** CONC. PM, GUIDELINES

PRE-PROJECT RESOURCE GATHERING (RG) DOCUMENT

PROJECT MANAGEMENT (PM) GUIDELINES

**10 IDENTIFYING AN INTEGRATED DESIGN FACILITATOR**  
The Project Manager identifies the team member who will facilitate the Integrated Design (ID) process. This ID facilitator can be the Project Manager, and/or any other member of the project team who is skilled and committed to the goals of integrated design. This facilitator will ensure that the team is on track to complete the Checklists required for each phase. At the beginning of each phase, the facilitator will be responsible for assigning the Checklists within that particular phase to a team member. A completion date for each Checklist is also assigned by the facilitator. In addition, it is important that the facilitator keeps the project and the team members aligned throughout the ID process. See the Roadmap Reference Manual for additional information (pages 15-18).

**11 PROJECT CONSTRAINTS**  
The Project Manager reviews possible project constraints associated with the existing building conditions, occupant and tenant requirements, as well as the scope, budget, and schedule. Identifying these issues early in the project will help to eliminate problems later on in the ID AER.

**12 IDENTIFYING PERFORMANCE & UTILITY DATA**  
The Project Manager gathers all building performance and utility data. Building performance data includes utility bills, recent energy audits and building automation system reports, if applicable. Utility bills should include historic electric, water, and gas bills from the past one to two years showing monthly usage for the building. The Project Manager shares this information with the project's M+M professional for their use and review. See the Roadmap Reference Manual for additional information (page 29).

**13 IDENTIFYING RETROFIT SCALE**  
The Project Manager reviews the retrofit scale evaluation tools to ensure the project is correctly classified as a Partial retrofit. See the Roadmap Reference Manual (pages 70-78) for additional information and the scale of retrofit evaluation tools.

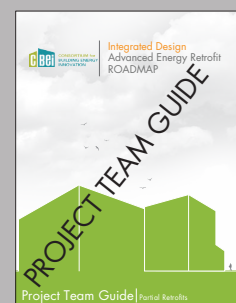
**14 IDENTIFYING PROJECT SCOPE & SCHEDULE**  
The Project Manager identifies and reviews the preliminary project scope and planned energy efficient measures, as well as the schedule. This includes identifying the ID process timeline for Resource Gathering and Collaborative Meetings stages.

**15 PERFORMANCE TARGETS**  
The Project Manager identifies preliminary performance targets and metrics, relating to pre- and post-retrofit benchmarks and energy use intensity (EUI), for the ID AER. This can include identifying the percentage of energy savings targeted for the advanced energy retrofit project. This will ensure the project achieves a greater amount of energy savings. Additional information about benchmarking can be found in the Roadmap Reference Manual (pages 29-30).

**CBEi** ID AER ROADMAP PARTIAL PROJECT TEAM GUIDE 24

Conceptualization Phase Resource Gathering Document

## NEXT STEPS: USING THE PARTIAL ID AER PROJECT TEAM GUIDE



The documents within this guide outline all of the activities involved in a Partial ID AER project. Initially, the Owner and/or Project Manager will begin the project by launching the Conceptualization phase. Initial steps include some of the following activities during the Pre-Project Resource Gathering stage:

### FINANCIAL RESOURCES REVIEW

The Owner and/or Project Manager will review the financial resources available for the project, and any associated constraints. This will include a review of all available incentives in order to develop a preliminary project budget.

### ID REQUEST FOR PROPOSALS

The Owner and/or the Project Manager will identify the required consulting competencies. Integrated Design (ID) Request for Proposals (RFPs) help identify professionals who are familiar with ID and who share the goals of advanced energy retrofits.

### CONTRACTING THE TEAM

The Owner and/or the Project Manager will review and respond to the ID RFPs for professionals. Once completed, professionals are contracted and invited to the first Collaborative Meeting (CM). All team members need to be contracted prior to the CM.

### COLLABORATIVE MEETING

At the Alignment & Goal Setting Meeting, the team will review the ID process and protocols. The intent of this first meeting is to understand the ID process and develop goals for the project relating to the ID protocols, in order to align team members towards achieving the intended outcomes.

# CONCEPTUALIZATION (CONC.) PHASE

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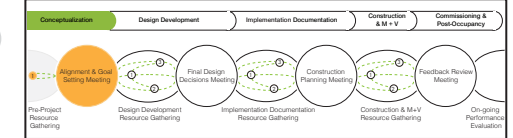
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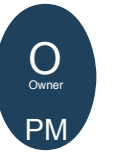
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### PHASE LEGEND





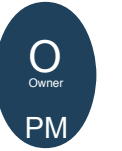


CHECKLIST

- 1a Identify who will FACILITATE the Integrated Design (ID) process
  - Team Member Name: \_\_\_\_\_
  - Contact Information: \_\_\_\_\_
- 1b Identify building performance and utility DATA for M+M consultant
  - DELIVERABLE: Submit Utility Bills for the most recent 1-2 years on record (Electric, Gas, Water)
  - DELIVERABLE: Submit Energy Audits, if available
  - DELIVERABLE: Submit Building Automation System info or report(s), if available
- 1c Identify and review retrofit SCALE using the ID AER Roadmap evaluation tools
  - DELIVERABLE: Submit completed Retrofit Scale Quiz
- 1d Identify and review preliminary project SCOPE and SCHEDULE
  - DELIVERABLE: Submit summary outlining preliminary project scope
  - DELIVERABLE: Submit preliminary project schedule
- 1e Identify and review project CONSTRAINTS
  - DELIVERABLE: Submit summary outlining project constraints
- 1f Identify and review preliminary project PERFORMANCE TARGETS and Metrics with M+M
  - DELIVERABLE: Submit summary outlining the preliminary project performance targets and metrics
- 1g Identify and review the preliminary project ENERGY CERTIFICATION/ACCREDITATION goals
  - DELIVERABLE: Submit summary outlining the preliminary project energy certification/accreditation goals
- 1h Identify and review an Owner's TEAM ORGANIZATION MAP for communication
  - DELIVERABLE: Submit Owner's team Organization Map
- 1i Schedule and lead the collaborative Conceptualization SUB-TEAM MEETING to review Pre-Project Resource Gathering activities including building data, documents, and financial resources
  - DELIVERABLE: Submit report outlining the results of the Sub-Team Meeting
- 1k SCHEDULE first Collaborative Meeting, Alignment and Goal Setting, and draft list of owner's project priorities
  - DELIVERABLE: Submit draft list of owner's project priorities
  - DELIVERABLE: Schedule the Alignment and Goal Setting Meeting and notify all project team members

ASSIGNED TO: \_\_\_\_\_ CONTACT INFO: \_\_\_\_\_ DATE COMPLETED: \_\_\_\_\_





# CHECKLIST

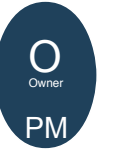
- 2a) Identify and review FINANCIAL RESOURCES for project
  - DELIVERABLE: Submit summary of financial resources for the project
- 2b) Identify and review INCENTIVES for project:
  - Identify and review possible UTILITY company agreements (ESCO, ESA, On-Bill)
  - Identify and review possible product equipment REBATES
  - Identify and review possible ENERGY INCENTIVES
  - Identify and review possible energy upgrade TAX INCENTIVES
  - DELIVERABLE: Submit summary of selected incentives for the project
- 2c) Identify and review preliminary BUDGET for project
  - DELIVERABLE: Submit preliminary budget for project
- 2d) Identify and review possible GREEN LEASES and negotiate leases, if applicable
  - DELIVERABLE: Submit summary outlining the review of green leases, if applicable
  - DELIVERABLE: Submit negotiated leases, if applicable
- 2e) Identify and review RISK CAPACITY and intended return on investment (ROI)
  - DELIVERABLE: Submit summary outlining the review of risk capacity and the intended ROI

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:





# CHECKLIST

- 3a) Identify required project TEAM COMPETENCIES (Architecture, Engineering, Construction) and proficiencies
  - DELIVERABLE: Submit list of required team competencies and proficiencies
- 3b) Identify a list of CONSULTANTS based on required project team competencies with shared goals and priorities
  - DELIVERABLE: Submit list of consultants
- 3c) Issue Integrated Design Request for Proposals (RFPs) to list of consultants
  - DELIVERABLE: Submit copy of issued ID RFPs
- 3d) CONTRACT project team members and invite to Alignment & Goals Setting Meeting
  - DELIVERABLE: Submit copy of project team contracts

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### 1a) Identifying an Integrated Design Facilitator

The Project Manager identifies the team member who will facilitate the Integrated Design (ID) process. This ID facilitator can be the Project Manager, and/or any other member of the project team who is skilled and committed to the goals of integrated design. This facilitator will ensure that the team is on track to complete the Checklists required for each phase. At the beginning of each phase, the facilitator will be responsible for assigning the Checklists within that particular phase to a team member. A completion date for each Checklist is also assigned by the facilitator. In addition, it is important that the facilitator keeps the project and the team members aligned throughout the ID process. See the *Roadmap Reference Manual* for additional information (pages 15-18).

### 1b) Identifying Performance & Utility Data

The Project Manager gathers all building performance and utility data. Building performance data includes utility bills, recent energy audits and building automation system reports, if applicable. Utility bills should include historic electric, water, and gas bills from the past one to two years showing monthly usage for the building. The Project Manager shares this information with the project's M+M professional for their use and review. See the *Roadmap Reference Manual* for additional information (page 29).

### 1c) Identifying Retrofit Scale

The Project Manager reviews the retrofit scale evaluation tools to ensure the project is correctly classified as a Partial retrofit. See the *Roadmap Reference Manual* (pages 70-78) for additional information and the scale of retrofit evaluation tools.

### 1d) Identifying Project Scope & Schedule

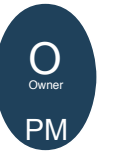
The Project Manager identifies and reviews the preliminary project scope and planned energy efficient measures, as well as the schedule. This includes identifying the ID process timeline for Resource Gathering and Collaborative Meetings stages.

### 1e) PROJECT CONSTRAINTS

The Project Manager reviews possible project constraints associated with the existing building conditions, occupant and tenant requirements, as well as the scope, budget, and schedule. Identifying these issues early in the project will help to eliminate problems later on in the ID AER.

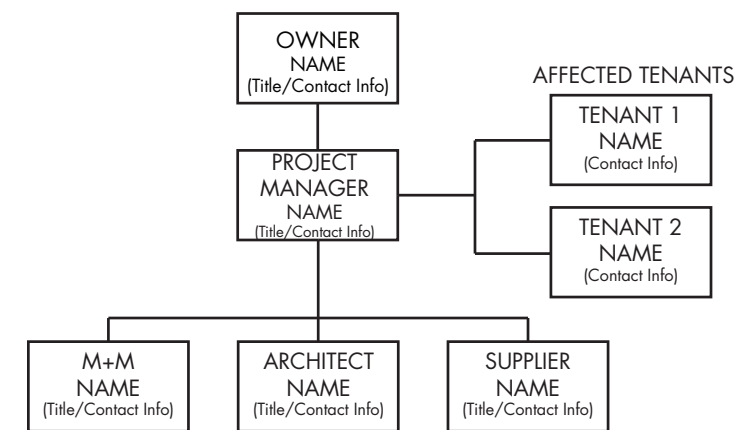
### 1f) PERFORMANCE TARGETS

The Project Manager identifies preliminary performance targets and metrics, relating to pre- and post-retrofit benchmarks and energy use intensity (EUI), for the ID AER. This can include identifying the percentage of energy savings targeted for the advanced energy retrofit project. This will ensure the project achieves a greater amount of energy savings. Additional information about benchmarking can be found in the *Roadmap Reference Manual* (pages 29-30).



### 1h) Identifying an Owner's Team Organization Map for Team Communication

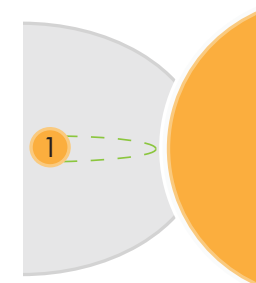
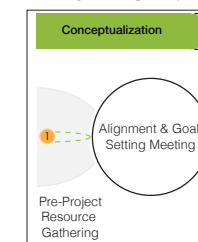
The Project Manager creates the Team Organization Map which will be used during the retrofit project and shared with all team members. The Map outlines the decision making process for facilitating communication amongst all project team members. All team members involved in the ID AER project are identified with contact information. This Team Organization Map encourages project transparency. The diagram below provides a basic example of an Owner's **Team Organization Map**.



### 1i) Conceptualization Sub-Team Meeting

The Project Manager schedules and leads the Pre-Alignment Sub-Team Meeting to review the progress made throughout the Pre-Project Resource Gathering stage. This includes a meeting with the M+M to review existing building data, questions, preliminary energy efficient measures (EEMs), and remaining Checklist activities that need to be completed prior to the first Collaborative Meeting.

#### PHASE LEGEND



**1. PRE-ALIGNMENT SUB-TEAM MEETING** to review building data, Pre-Project RG activities and documents, as well as financial resources.

### 1g) ENERGY CERTIFICATION PROCESS

The Project Manager identifies the level of energy certification/accreditation that will be pursued for the project. Certification can provide a number of benefits including the ability to attract more tenants than buildings that are not certified, as well as an increase in the building's value, while also reducing energy use. Additional information about available energy certification/accreditation programs can be found in the *Roadmap Reference Manual* (pages 35-36).

### 1k) COLLABORATIVE MEETING PREP

The first Collaborative Meeting which is the Alignment and Goal Setting Meeting is scheduled during the Pre-project Resource Gathering (RG) stage, and all team members are present at this meeting. All Pre-project RG activities need to be completed prior to the meeting, including the issuing of ID RFPs in order to contract the professional team members. In addition, in preparation for the meeting the Project Manager develops an agenda for the meeting and drafts a preliminary Mission Statement for the project. The Mission Statement will include project values, project cost priorities, people based priorities, and performance targets for the project.



**2b) STATE INCENTIVES RESOURCES**

State based energy saving incentives are found in the Database of State Incentives for Renewables and Efficiency:

<http://www.dsireusa.org>

With its interactive map, property owners and their representatives have access to a full list of financial programs designed to facilitate the completion of advanced energy retrofits.

**2b) CBEI RESOURCES**

Local utilities often provide incentives for commercial building energy efficiency and retrofit projects; it is worth determining if there are applicable incentives as part of the process of planning your building retrofit.

The CBEI's *Incentive Program Guide* is a tool for identifying incentive programs for energy efficient retrofits offered by state agencies and utility companies in the ten-county CBEI region. For additional information on market incentives, consult our *Incentive Program Guide* online at:

[http://cbei.psu.edu/portals/cbei/Resources/RegionIncentiveProgramGuide/EEB\\_Hub\\_Region\\_Incentive\\_Program\\_Guide.pdf](http://cbei.psu.edu/portals/cbei/Resources/RegionIncentiveProgramGuide/EEB_Hub_Region_Incentive_Program_Guide.pdf)

**2a) Identifying Financial Resources**

The Owner and/or Project Manager reviews the financial resources available for the project. Financial resources have an impact on project scope and possible design solutions. A full financial review will determine the amount of financing needed for the project, and if additional incentives need to be pursued.

**2b) Identifying Financial Incentives**

The Project Manager identifies and reviews all possible financial incentives including the following:

- **Utility Company Agreements:**
  - *On-Bill Financing (OBF)*  
OBF "refers to a financial product that is serviced by, or in partnership with, a utility company for energy efficiency improvements in a building, and repaid by the building owner on his or her monthly utility bill". \*ACEEE: [http://www.puc.state.pa.us/Electric/pdf/Act129/OBF-ACEEE\\_OBF\\_EE\\_Improvements.pdf#sthash.whH4wh0e.dpuf](http://www.puc.state.pa.us/Electric/pdf/Act129/OBF-ACEEE_OBF_EE_Improvements.pdf#sthash.whH4wh0e.dpuf)
  - *Energy Service Companies (ESCOs)*  
ESCOs are businesses that provide a range of services including consulting, designing and implementing building efficiency projects for guaranteed energy and financial savings. \*Pacific Northwest National Laboratory, PEI, Department of Energy, 2011: *Advanced Energy Retrofit Guide for Office Buildings*
- **Product Rebates:**  
Product rebates for qualified energy efficient products may be applicable to your project.
- **Energy Incentives**
- **Tax Incentives:**  
Local, state, and federal tax incentives for energy efficient upgrades such as the *179D Federal Tax Deduction*.  
\*Department of Energy, 2012: *179D DOE Calculator*

**2c) Identifying a Preliminary Project Budget**

The Project Manager identifies a preliminary project budget, taking into account the financial resources available, potential incentives, as well as the preliminary project scope.

**2d) Identifying & Negotiating Green Leases**

The Project Manager reviews resources associated with available green leases. Green leases are tools that help address possible financial asymmetries between building owners and tenants who wish to go 'green'. The *Green Lease Library* is a centralized resource that provides guidance for building owners and tenants on the signing commercial green leases. For additional information on identifying and negotiating green leases, consult the website: <http://www.greenleaselibrary.com/>.  
\*EEB Hub, 2013: <http://www.eebhub.org/research-digest/>

**2e) Identifying Risk Capacity & ROI**

The Owner and/or Project Manager identifies the project's intended return on investment (ROI) and the project's risk capacity. These both will have an impact on the project scope, and it is important to identify both at the beginning of the project.

**3a) Identifying Team Competencies**

Since a typical Partial scale ID AER project may have a limited number of AEC professionals on the team, the Owner and/or Project Manager identifies the necessary project team competencies and who will complete them (see *Reference Manual*, pages 21-24 for additional info). Within a Partial scale retrofit, team members may be required to explore tasks that are within their abilities, but not typically offered as part of their services. In all instances, the professional competencies that the team will be required to have include the following:

- Project Management
- Engineering
- Architectural
- Construction
- Modeling + Measurement (M+M)

**3b) Identifying Team Consultants**

Once the required team competencies have been identified, the Project Manager identifies consultants who will meet these requirements. Professional consultants with past experience in integrated design should be sought. Once team consultants are identified, Integrated Design (ID) Request for Proposals (RFPs) are issued for bids (see *Reference Manual* for additional info, page 17).

**3c) ISSUING INTEGRATED DESIGN RFPs**

A Request for Proposal (RFP) is a solicited opportunity for professionals in the industry to submit bids for completing defined project needs. Often, an RFP will include a description of the project, products and/or services needed, business requirements, the submitter's experience and background, an RFP due date, standards for selection, and a time frame. Integrated Design (ID) RFPs can also set performance based standards, including energy use intensity (EUI) and financial goals, for consultants with shared energy goals. An ID RFP outlines clear ID methods that the project plans to undertake, as well as the intended ID goals.

**3d) CONTRACTING TEAM MEMBERS**

Selecting the professionals for the project is one of the most important steps leading to an exceptional project. When all bids are in, the Owner and/or Project Manager evaluates all project bids and identifies the best choice for the project. Project goals and priorities are taken into consideration, and the candidate(s) who best supports these goals should be selected. In addition, it is important to select professionals who are committed to participating in the ID process and to establish expectations and responsibilities at both the individual and group level. Once contracts are finalized, all team members are invited to the first Collaborative Meeting.

## PRE-PROJECT RESOURCE GATHERING (RG) DOCUMENT

### MODELING + MEASUREMENT (M+M) ACTIVITIES



CHECKLIST

CONCEPTUALIZATION

RESOURCE GATHERING

- 1a) Review building performance and utility DATA (from PM/Owner)
  - Consider the completion of a UTILITY CONSUMPTION ANALYSIS
    - YES, a utility consumption analysis has been completed (submit documentation)
    - A utility consumption analysis has NOT been completed (explain below):  
\_\_\_\_\_  
\_\_\_\_\_
  - DELIVERABLE: Submit a Site Assessment summary report that outlines building centered information, performance data, and any issues that have been identified
- 1b) Identify and review preliminary project PERFORMANCE TARGETS and Metrics with PM/Owner
  - DELIVERABLE: Submit summary outlining preliminary project Performance Targets and Metrics
- 1c) Identify a preliminary PREDICTIVE MODEL strategy for the project; if possible, create the model
  - DELIVERABLE: Submit a summary outlining the preliminary Predictive Model strategy
  - DELIVERABLE: Submit results of the preliminary Predictive Model (if applicable)
- 1d) Identify and review a preliminary MEASUREMENT + VERIFICATION (M+V) PLAN for the project pre- and post-retrofit
  - Consider the INSTALLATION of an M+V system pre-retrofit
    - YES, an M+V system was installed on the project pre-retrofit (submit documentation)
    - An M+V system was NOT installed on the project pre-retrofit (explain below):  
\_\_\_\_\_  
\_\_\_\_\_
  - Consider designing an M+V Plan with the capacity for POST-RETROFIT INSTALLATION
    - YES, an M+V Plan includes the capacity for post-retrofit installation (submit documentation)
    - M+V Plan does NOT include the capacity for post-retrofit installation (explain below):  
\_\_\_\_\_  
\_\_\_\_\_
  - DELIVERABLE: Submit summary outlining the preliminary M+V Plan for the project

ASSIGNED TO: \_\_\_\_\_ CONTACT INFO: \_\_\_\_\_ DATE COMPLETED: \_\_\_\_\_



## PRE-PROJECT RESOURCE GATHERING (RG) DOCUMENT

### MODELING + MEASUREMENT (M+M) ACTIVITIES



- 2a) Consider the completion of an ASHRAE Level II AUDIT
  - YES, an ASHRAE Level II Audit was completed (submit documentation)
  - An ASHRAE Level II Audit was NOT completed (explain below):  
\_\_\_\_\_  
\_\_\_\_\_
  
- 2b) Consider establishing pre-retrofit BENCHMARKS using Portfolio Manager (or similar)
  - YES, pre-retrofit benchmarks have been established (submit documentation)
  - Pre-retrofit benchmarks have NOT been established (explain below):  
\_\_\_\_\_  
\_\_\_\_\_
  
- 3c) Participate in the collaborative Conceptualization SUB-TEAM MEETING to review Pre-Project Resource Gathering activities including building data, documents, and financial resources

CHECKLIST

CONCEPTUALIZATION

RESOURCE GATHERING

ASSIGNED TO: \_\_\_\_\_ CONTACT INFO: \_\_\_\_\_ DATE COMPLETED: \_\_\_\_\_





### ①a) Reviewing Performance & Utility Data

The M+M team member reviews the existing building's performance and utility data. This includes a full review of historic electrical, gas, and water usage, and any available energy audits, if applicable. Using this data, the building's energy use can be determined and any energy use related issues can be identified.

### ①a) Completing a Utility Consumption Analysis

Utility Consumption Analysis investigates present energy consumption against a building's past usage, examining where, when, and how much energy is being consumed. As an important component of this analysis, monthly energy use data along with utility interval data offers an assessment of trends in energy usage, offering clues as well as identifying which systems are poorly performing. It can also help to establish pre-retrofit benchmarks. See the *Roadmap Reference Manual* for additional information (page 29).

### ①b) Identifying Performance Targets

The M+M team member helps the Project Manager to identify performance targets for the AER project. This includes setting target energy use reduction goals, and whether to pursue energy certification programs such as Energy Star or LEED.

### ①c) Identifying a Predictive Model Strategy

The M+M team member identifies the preliminary Predictive Energy Model strategy and goals for the project. For a Partial scale ID AER, this may include inverse modeling of some form, as well as the possible use of additional whole building energy modeling platforms such as BIM models (i.e. OpenStudio) or Design Builder. Goals relating to benchmarking and forecasts of potential energy savings or benefits can also be reviewed by the M+M team member. See the *Roadmap Reference Manual* for additional information (pages 45-46). If possible, the M+M team member also begins to build the model for the project using the collected building data.

#### M+M TOOLS

There are a variety of tools available for benchmarking data before an ID AER including:

- Energy Audits
- Energy Modeling
- Utility Consumption Analysis
- Climate Analysis
- Installation of M+V Instrumentation

Additional details on M+M can be found in the *Roadmap Reference Manual* (pages 45-46).

#### BENEFITS OF USING M+M

Using M+M can provide several benefits including the following:

- More efficient and comprehensive energy management.
- Increased energy savings both monthly, and through the monitoring and adjustment of systems over time.
- Encourages a comprehensive integration of engineering systems within the development of the project and its specific targets to be met.
- Potential to change occupant behavior by making post-monitoring results available, resulting in lower user-driven energy demand.

Additional details can be found in the *Reference Manual* (pages 45-46 and 31-32).

### 1d) Identifying an M+V Plan

The M+M professional identifies a preliminary Measurement + Verification (M+V) Plan for the project pre- and post-retrofit. Additionally, the Plan outlines project goals relating to commissioning and existing building commissioning (EBCx) of systems in order to ensure systems are operating efficiently, the amount of M+V instrumentation on the project, possible consideration of third party annual energy use reporting, the issuing of post-occupancy surveys to occupants and tenants, and the training of Operation and Maintenance personnel. See the *Roadmap Reference Manual* for additional information on M+V (pages 31-32) and existing building commissioning (pages 43-44).

### 2a) Completing an ASHRAE Level II Audit

An ASHRAE "Level II Audit includes a full review of all building systems' energy use to develop pre-retrofit benchmarks as well as to inspect and recommend improvements for a building's energy usage."<sup>1</sup> See the *Roadmap Reference Manual* (pages 29-30) for additional information and resources for completing a Level II Audit.

<sup>1</sup>Pacific Northwest National Laboratory, PECL, Department of Energy, 2011: *Advanced Energy Retrofit Guide for Office Buildings*

### 2b) Identifying Pre-retrofit Benchmarks

The first step in the committing to an M+V Plan is to identify pre-retrofit benchmarks for the building. Benchmarking is the act of comparing energy consumption of a building to either its previous years consumption or other buildings of a similar profile (its peer group). To accurately evaluate the efficiency or inefficiency of a building, it is crucial to benchmark consistently over time using the same unit of measure. This process helps identify potential areas of savings. See the *Roadmap Reference Manual* (pages 29-30) for additional information and resources for developing pre-retrofit benchmarks.

### 1d) INSTALLING AN M+V SYSTEM

A measurement + verification (M+V) system can include the installation of HVAC, lighting, CO<sub>2</sub>, and occupancy sensors to collect the most recent data from the building in order to evaluate its performance levels pre- and post-retrofit. An M+V system can also include sub-metering and a building automation system (BAS) to collect data and optimize the systems within the building. The M+M team member encourages the use of an M+V system within the ID AER. See the *Roadmap Reference Manual* for additional information (pages 31-32).

### 2c) SUB-TEAM MEETING

The M+M team member participates in the collaborative Pre-Alignment Sub-Team Meeting to review the progress made during the Pre-Project Resource Gathering stage with the Project Manager. This meeting focuses on a review of existing building data and analysis, questions, preliminary energy efficient measures (EEMs), and remaining Checklist activities that need to be completed prior to the first Collaborative Meeting. For additional information, see page 26 within this *Project Team Guide* document.

## CONCEPTUALIZATION (CONC.) PHASE

CONC.CM.1

### ID COLLABORATIVE MEETING (CM) DOCUMENT

#### ALIGNMENT & GOAL SETTING MEETING ACTIVITIES

① Identify who will FACILITATE the Alignment & Goal Setting Meeting

Team Member Name: \_\_\_\_\_

Contact Information: \_\_\_\_\_

② Review Integrated Design PROTOCOLS and PROCESS

③ Identify and align around project VALUES

④ Identify and align around project COST PRIORITIES

⑤ Identify and align around PEOPLE BASED PRIORITIES

⑥ Review and align around project PERFORMANCE TARGETS, Metrics, and Accreditation

⑦ Identify project MISSION STATEMENT

⑧ Identify goals for ENERGY FREE DESIGN

⑨ Identify goals for WHOLE BUILDING SYSTEMS

⑩ Identify goals for PREDICTIVE MODELING

⑪ Identify goals for MEASUREMENT + VERIFICATION (M+V)

⑫ Review and align around preliminary project SCOPE

⑬ Review and align around preliminary project BUDGET

⑭ Review and align around preliminary project SCHEDULE

⑮ Identify team roles and assign Design Development ACTIVITIES to team members

⑯ Identify the number of collaborative SUB-TEAM MEETINGS during the Design

Development Resource Gathering stage

REPORTING:

PROJECT MGMT.

PROJECT MGMT.

PROJECT MGMT.

PROJECT MGMT.

PROJECT MGMT.

M+M

PROJECT MGMT.

ARCHITECTURE

ENGINEERING

M+M

M+M

PROJECT MGMT.

PROJECT MGMT.

PROJECT MGMT.

PROJECT MGMT.

PROJECT MGMT.

#### REPORTING GUIDELINES:

##### ACTIVITY REPORTER:

Based on the Reporting Chart, the assigned Activity Reporter serves as the point person to create an Activity Report of decisions and outcomes made at the Collaborative Meeting for each identified activity. Once the Activity Report is completed, the final document should be given to the Summary Reporter on an agreed to date after the Collaborative Meeting.

##### SUMMARY REPORTER:

The Summary Reporter serves as the point person to collate the Activity Reports from the Collaborative Meeting for the creation of a Summary Report. Once the Summary Report is completed, the final document should be distributed to the entire team on an agreed to date after the Collaborative Meeting.



## ID COLLABORATIVE MEETING (CM) DOCUMENT

## ALIGNMENT &amp; GOAL SETTING MEETING ACTIVITIES

**1** Identifying a Meeting Facilitator

The Project Manager identifies the team member who will facilitate the process oriented Collaborative Meeting (CM) and coordinate the project team. At the CM, coordinating the project team involves the alignment of all team members towards the same goals and performance targets. In addition, the CM facilitator will be responsible for ensuring the team will complete the Checklist activities required for the CM. In order to complete the agenda, the CM facilitator manages the time in order to keep the team on schedule.

**2** Reviewing Integrated Design Protocols

During the CM, ID protocols and the ID process are reviewed to ensure understanding by all team members. The aim, goals, outcomes, and value of ID are outlined and clarified. This will contribute to the alignment of team members, key for the success of an ID AER.

At the first CM, goals for each of the ID protocols, regardless of project size, scope and budget, are identified. The following list outlines the seven ID protocols:

1. Project Mission Statement
2. Participation in Integrated Design RFPs
3. Participation in Process Oriented Collaborative Meetings
4. Commitment to "Energy Free" Design Solutions
5. Commitment to Whole Building Systems Design
6. Commitment to Predictive Modeling
7. Commitment to Measurement + Verification

The success of ID protocols is predicated on the project's capacity to identify shared beliefs before it engages in Design, Engineering (implementation) and Instrumentation. See the *Roadmap Reference Manual* for additional information (pages 15-20).

**2** PROCESS FOR TEAM ALIGNMENT

Commitment to the seven ID protocols includes the process for team alignment at CM meetings, where all team members are in attendance to discuss priorities, budget restraints, goals, and intended outcomes for the ID AER project. Attendance is a key factor for ensuring team alignment and a spirit of cooperation when working on a construction project. This gives all team members an equal opportunity to voice opinions while encouraging a sense of ownership and camaraderie amongst the team. Communication and coordination amongst the project team members is essential within the ID process, and working towards team alignment at the first CM will set a good foundation for the entire project.

**2** VALUE OF ID PROTOCOLS

Integrated design is greatly facilitated when team members demonstrate commitment to the seven ID protocols. Participating in a process such as this has the potential to result in a more efficient building that achieves greater energy savings, and increases occupancy rates, tenant satisfaction, and overall value. In addition, by allowing equal participation of professionals from the AEC industry, it affords opportunities for innovate design that otherwise may not occur.



## CONCEPTUALIZATION (CONC.) PHASE

CONC. CM. GUIDELINES

## ID COLLABORATIVE MEETING (CM) DOCUMENT

## ALIGNMENT &amp; GOAL SETTING MEETING ACTIVITIES

## 7 VALUE OF MISSION STATEMENT

The writing of a project Mission Statement is the first collaborative activity completed by all members of the team. It allows for alignment around project goals and shared expectations which elevates project objectives and potential outcomes. In addition, the project Mission Statement organizes and guides most decisions and procedures for the entirety of the AER. See the *Reference Manual* for additional information (page 17).

## 7 IDENTIFYING MISSION STATEMENT

Everyone on the project team works on the production of a project Mission Statement, offering input and feedback to reach a level of refinement satisfactory to all. Doing so ensures that each professional is in agreement with its goals and in so doing offers each member of the team a sense of ownership. In order to complete this, the following will be identified:

- Project Values
- Project Cost Priorities
- People Based Priorities
- Performance Targets & Metrics

During the Alignment and Goal Setting Meeting, team members align around the Mission Statement in order to achieve the intended project outcomes. See *Identifying a Project Mission Statement* on page 48 for additional information and a template.

## 3 Identifying Project Values

The project team identifies and aligns around project values for the ID AER. These core values are integral to the ID process, and have an impact on all aspects of the project including the project scope and design. The project values will identify the aims, goals, and intended outcomes for the project.

## 4 Identifying Project Cost Priorities

The project team identifies and aligns around project cost priorities for the ID AER. The cost priorities will be related to the financial resources that the owner has available, as well as the preliminary project budget. The project's cost priorities will influence the project scope, and it is important for this to be identified at the beginning of the project before energy efficient measures and design solutions are selected and developed.

## 5 Identifying People Based Priorities

The project team identifies and aligns around people based priorities for the project. This includes the identification of tenant and occupant requirements within the building. In addition, the team reviews project specific roles within the ID AER to set clear expectations.

## 6 Reviewing Performance Targets

The project team identifies and reviews performance targets and metrics, relating to pre- and post-retrofit benchmarking, as well as goals relating to the energy use intensity (EUI) and level of certification for the project. This often ensures the project achieves a greater amount of energy savings. Additionally, certification programs can provide a number of benefits including attracting more tenants than buildings that are not certified, as well as increasing the building's value. The team will decide if Energy Certification/Accreditation will be pursued during the project. See the *Reference Manual* for additional info on performance targets and benchmarking (pages 29-30), as well as available certification programs (pages 35-36).

## 8 Identifying Energy Free Design Goals

The project team identifies and aligns around Energy Free Design goals for the ID AER. These goals are related to passive design strategies, such as daylighting, solar shading, natural ventilation, and increased tree coverage, as well as possible renewable energy strategies in order to reduce immediate and long term energy demands. See the *Reference Manual* for additional info (page 18).

## 9 Identifying Whole Building Systems Goals

The project team identifies and aligns around Whole Building Systems goals for the ID AER. These goals consider the contingent energy savings associated with the retrofit of two or more building systems, and encourage the project to review additional scope scenarios, such as bundling energy efficient measures, to achieve greater energy savings. See the *Reference Manual* for additional info (pages 19, 47-50).

## 10 Identifying Predictive Modeling Goals

The project team identifies and aligns around Predictive Energy Modeling goals for the ID AER. This includes identifying the project's strategy for predictive modeling. For a Partial scale ID AER, this might include inverse modeling of some form, as well as the use of modeling platforms such as a building information model (i.e. OpenStudio) or Design Builder. Goals relating to benchmarking and forecasts of potential energy savings or benefits, are also reviewed. See the *Roadmap Reference Manual* for additional information (pages 29-30 and 45-46).

## 11 Identifying M + V Goals

The project team identifies and aligns around Measurement + Verification (M+V) goals for the ID AER. Goals are related to the level of pre- and post-retrofit M+V undertaken in the project. Additionally, the team reviews goals relating to the amount of M+V instrumentation, existing building commissioning (EBCx), the consideration of third party annual energy usage reporting, the issuing of post-occupancy surveys to occupants and tenants, and the training of Operation and Maintenance personnel. See the *Reference Manual* for additional information (pages 31-32 and 43-44).

## 12 13 14 BUDGET, SCOPE &amp; SCHEDULE

As a result of the Pre-Project Resource Gathering stage, the Project Manager and Owner have developed a preliminary scope, budget, and schedule for the project. At the CM, the project team identifies and aligns around the preliminary scope, budget, and schedule for the ID AER. This includes a full review of each item in order for the project team to understand any constraints within the project.

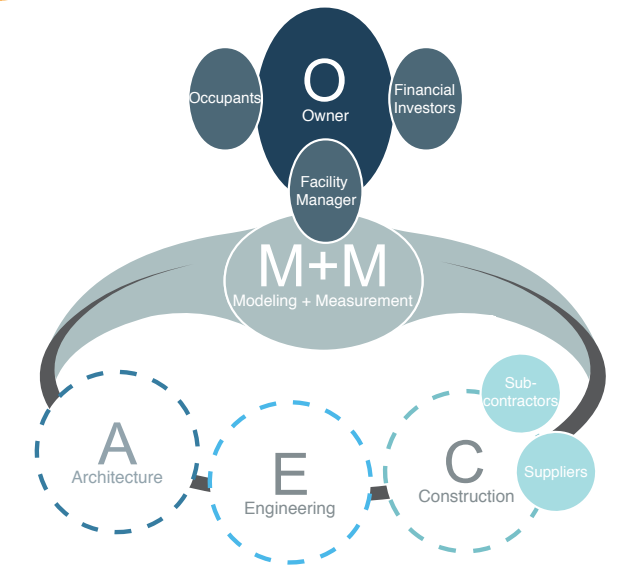
## 15 IDENTIFYING TEAM ACTIVITIES

At the end of the CM, the meeting facilitator and/or the Project Manager identifies the needed team roles (see page 44) and assigns Design Development Resource Gathering (RG) activities to team members. All Design Development RG Checklists will be assigned to the appropriate team member.

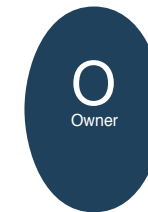
Required team members will schedule the Design Development RG stage Sub-Team Meetings in advance, and if possible at the end of this CM. Additionally, the next CM will be scheduled in advance and all project team members will be available to attend this meeting. For additional information, see *Identifying Design Development Collaborative Sub-Team Meetings* (page 46).

### 15 Identifying Team Roles

During a Partial scale ID AER, there may be a limited number of professionals on the team. This may require some team members to take on additional tasks, which are not typically offered as part of their services but for which they are fully competent. Roles are assigned accordingly during the Collaborative Meeting.



PROJECT MANAGER \_\_\_\_\_



SUB-TEAM LEAD + REPORTER

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SUB-TEAM LEAD + REPORTER

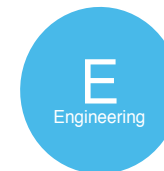
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SUB-TEAM LEAD + REPORTER

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SUB-TEAM LEAD + REPORTER

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SUB-TEAM LEAD + REPORTER

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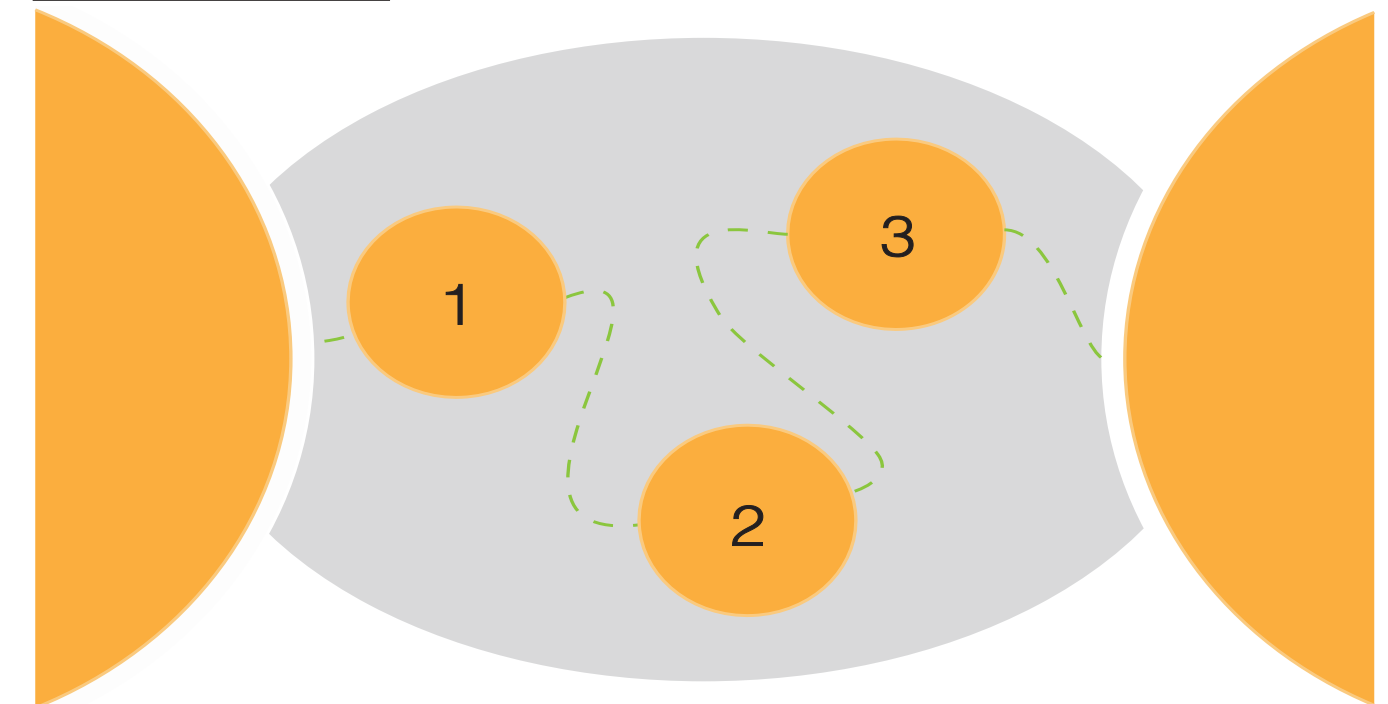
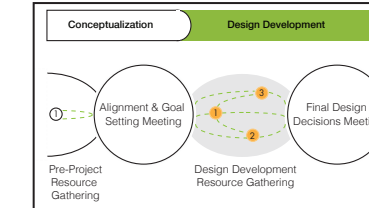


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## 16 Identifying Design Development Collaborative Sub-Team Meetings

### PHASE LEGEND



1. SUB-TEAM MEETING 1 to review **Energy Free Design** solutions, **Whole Building Systems Design** solutions and **M+V Plan** in order to select energy efficient measures (EEMs) relative to the project budget and intended return on investment (ROI).

- Determine which EEM measures are appropriate to your AER with respect to project constraints

2. SUB-TEAM MEETING 2 to review **Predictive Modeling** and **Cost Feedback** information in order to select EEMs relative to the project budget and ROI.

- Rigorously analyze model's results and Cost Feedback information
- Adjust project scope accordingly

3. SUB-TEAM MEETING 3 to review final **Predictive Modeling** to select EEMs.

- Based upon the findings of Sub-Team Collaborative Meetings 1+2
- Finalized EEMs and project scope relative to the project budget and ROI

### 7 Identifying a Project Mission Statement

The following template can be used by team members to create a project Mission Statement during the Collaborative Meeting. The Mission Statement includes the Purpose (Why) outlining the reasons for completing an ID AER project, intended Outcomes which includes project goals, and Outputs (How) which explains the process used in achieving project goals. See page 41 in this document and the *Reference Manual* (pages 16-20) for additional information about Mission Statements.

#### PROJECT MISSION STATEMENT:

Purpose - WHY - Reasons for acting:

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Outcomes - WHAT - Goals for the project:

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Outputs - HOW - Process (by doing what and how):

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# DESIGN DEVELOPMENT (DD) PHASE

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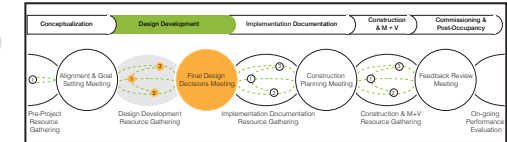
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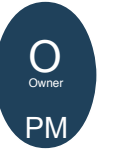
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DD.CM.1 FINAL DESIGN DECISIONS MEETING CHECKLIST

DD.CM.GUIDELINES FINAL DESIGN DECISIONS MEETING GUIDELINES

### PHASE LEGEND





# CHECKLIST

- ① SCHEDULE the required number of collaborative Sub-Team Meetings to review Design Development progress and ensure the project is aligned with the Mission Statement
  - DELIVERABLE: Schedule the Sub-Team Meetings and notify required team members
- ② Develop and review ENERGY CERTIFICATION/ACCREDITATION process, if required as part of Performance Targets, Metrics, and Accreditation
  - DELIVERABLE: Submit summary outlining the selected energy certification/accreditation program and associated design implications (if applicable)
- ③ Develop and review project BUDGET
  - DELIVERABLE: Submit project budget to project team members
- ④ Develop and review project SCHEDULE
  - DELIVERABLE: Submit project schedule to project team members
- ⑤ Identify and review applicable PERMITS
  - DELIVERABLE: Submit list of applicable permits to project team members
- ⑥ Lead collaborative Design Development SUB-TEAM MEETING 1 to review Energy Free Design solutions developed by Architectural team member, Whole Building Systems Design solutions developed by Engineering team member, and M+V Plan in order to select energy efficient measures (EEMs) relative to the project budget
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 1
- ⑦ Lead collaborative Design Development SUB-TEAM MEETING 2 to review Predictive Modeling analysis of potential energy savings of selected EEMs and make adjustments to the project scope based on the results
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 2
- ⑧ Lead collaborative Design Development SUB-TEAM MEETING 3 to review final Predictive Modeling results for the final project scope of EEMs relative to the project budget
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 3
- ⑨ SCHEDULE the next Collaborative Meeting, Final Design Decisions, and invite project team members
  - DELIVERABLE: Schedule Final Design Decisions Meeting and notify all project team members

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### ① Scheduling Sub-Team Meetings

The Project Manager schedules collaborative Sub-Team Meetings to review the progress made by team members throughout the Design Development phase. Within this stage of the project, the Project Manager meets with the Architectural team member to encourage the selection of Energy Free Design solutions, the Engineering team member to encourage the selection of Whole Building Systems Design solutions, the M+M to encourage the use of Predictive Modeling, and reviews the M+V Plan with the Engineering and/or M+M team member. The Project Manager ensures design and scope are aligned with the project's Mission Statement and budget. In addition, the Project Manager also shares with team members the updated project schedule, budget, applicable permits, and any other findings that will impact the project's design. For additional information, see *Identifying Design Development Collaborative Sub-Team Meetings* on page 46.

### ② Developing Energy Certification Process

The Project Manager develops and reviews the energy certification/accreditation process for the project, if required as part of Performance Targets, Metrics, and Accreditation. This includes a review of requirements for the program, such as Energy Star and/or LEED, and any possible implications they may have on the project. This information is communicated to all team members in order to ensure their requirements are taken into account when developing designs solutions.

### ⑤ Identifying Applicable Permits

The Project Manager identifies and reviews permits and gathers the information necessary to submit all permits. Possible permits include city and regional building permits including zoning, demolition, and construction. Additional resources can typically be found by visiting your local municipality or town office in-person or online. Once the necessary permits have been identified, a list of these requirements is generated and circulated to the project team. In addition, the Project Manager assigns any required permit tasks to the appropriate team member(s), if applicable.

### ③ DEVELOPING PROJECT BUDGET

The Project Manager develops a detailed project budget based on the project scope. The Project Manager shares the budget with all team members to ensure design solutions are aligned with available financial resources.

### ④ DEVELOPING PROJECT SCHEDULE

The Project Manager further develops the project schedule based on the project scope. This schedule highlights key deadlines and identifies when Collaborative Meetings will take place during the course of the project. The Project Manager distributes the Project Schedule to all team members.

### ⑥ Commitment to Energy Free Design

The Project Manager demonstrates commitment to the Integrated Design Protocol 4 – Energy Free Design. Energy Free Design focuses on the use of passive design and possible renewable energy strategies for the reduction of immediate and long term energy demand within the building. The Project Manager encourages the selection of Energy Free Design solutions within the AER project. See the *Reference Manual* for additional info (page 18).

### ⑥ Commitment to Whole Building Systems

The Project Manager demonstrates commitment to the Integrated Design Protocol 5 – Whole Building Systems Design. Whole Building Systems Design focuses on the integration of building systems to maximize efficiency. The Project Manager encourages the selection of Whole Building Systems Design solutions within the AER project. See the *Reference Manual* for additional info (page 19).

### ⑥ Commitment to M+V

The Project Manager demonstrates commitment to the Integrated Design Protocol 7 – Measurement + Verification (M+V). M+V includes the commissioning and existing building commissioning (EBCx) of systems in order to ensure systems are operating efficiently, the evaluation of building data to substantiate energy savings claims, and the verification of indoor environmental quality. M+V includes the instrumentation of the building with controls and sensors such as sub-metering and a building automation system (BAS) to optimize the building systems. The Project Manager encourages the use of M+V within the AER project both pre- and post-retrofit. See the *Reference Manual* for additional info (pages 19, 31-32).

### ⑦ ⑧ PREDICTIVE MODELING

The Project Manager demonstrates commitment to the Integrated Design Protocol 6 – Predictive Modeling. Predictive Modeling focuses on developing a simulation model for the project. Once the model is created, potential design solutions and various energy efficient measures (EEMs) are tested to determine the potential energy savings of each solution. This will help the team select EEMs that will achieve greater energy savings for the project. The Project Manager encourages the use of Predictive Modeling throughout the AER project. See the *Reference Manual* for additional info (page 19).

### ⑨ COLLABORATIVE MEETING PREP

In preparation for the second Collaborative Meeting (CM), Final Design Decisions, the Project Manager schedules a date and notifies all team members. It is essential that all team members are in attendance at this CM to ensure an integrated process, as well as the alignment of the project team members and the AER project. All Design Development Resource Gathering (RG) activities need to be completed prior to the meeting. In preparation for the Final Design Decisions CM, the Project Manager creates an agenda for the meeting and distributes it to all team members.



- ① Develop and review typical OCCUPANCY hours and use information (including all tenants, if applicable) from Owner/Project Manager, and its effect on design solutions
  - DELIVERABLE: Submit summary outlining occupant/tenant information and possible design implications
- ② Develop and review possible ENERGY FREE DESIGN solutions (in collaboration with M+M and Construction team members):
  - Develop and review possible NATURAL VENTILATION design solutions
  - Develop and review possible SOLAR SHADING design solutions
  - Develop and review possible DAYLIGHTING solutions, if applicable
  - Develop and review possible RENEWABLE ENERGY solutions
  - Develop and review possible SOLAR HEAT GAIN design solutions
  - Develop and review possible THERMAL MASS design solutions, if applicable
  - Develop and review possible ENVELOPE ENHANCEMENTS design solutions
  - Develop and review building wide PLUG LOAD strategies and limits\*
    - DELIVERABLE: Submit summary outlining recommended Energy Free Design solutions
- ③ Participate in collaborative Design Development SUB-TEAM MEETINGS to review Design Development progress and ensure the project is aligned with the Mission Statement and budget
  - Participate in Sub-Team Meeting 1 to present Energy Free Design solutions, and review Whole Building Systems Design solutions and M+V Plan in order to select EEMs relative to the project budget
  - Participate in Sub-Team Meeting 2 to present and review Predictive Modeling analysis of potential energy savings of selected EEMs and to make adjustments to the project scope based on the results
  - Participate in Sub-Team Meeting 3 to present and review final Predictive Modeling results for the final project scope of EEMs

*\*TO BE COMPLETED BY THE ARCHITECTURAL OR ENGINEERING TEAM MEMBER*

**ASSIGNED TO:**

**CONTACT INFO:**

**DATE COMPLETED:**



## ② Developing Energy Free Design Solutions

The Architectural team member develops and reviews Energy Free Design solutions for the project, and works with the M+M to test possible design solutions using Predictive Modeling as well as the Construction team member to identify preliminary cost estimates for these solutions. Energy Free Design focuses on the use of passive design and possible renewable energy strategies for the reduction of immediate and long term energy demand within the building. Examples of Energy Free Design solutions include the reduction of the demand of plug loads, natural ventilation, increased insulation, daylighting, and shading. See the *Reference Manual* for additional info (page 18).

## ② Developing Natural Ventilation Solutions

The Architectural team member develops and reviews natural ventilation solutions, if applicable to the project. Natural ventilation can reduce the energy demand of mechanical ventilation systems and increases occupant comfort within the building. Solutions relating to natural ventilation can be optimized with the inclusion of solar and vegetative shading, which can help to cool air before it enters the building. If possible, the Architectural team member considers the use of mixed-mode cooling, which supplements natural ventilation with mechanical conditioning when needed.

## ② Developing Solar Shading Solutions

The Architectural team member develops and reviews solar shading solutions, if applicable to the project. Solar shading solutions include the use of light shelves, overhangs, and landscaping to control the amount of sunlight entering the building. In addition, the Architectural team member reviews the building's climate zone to determine if there is a high cooling load or a high heating load in order to determine the type of solutions that will be used.

## ① OCCUPANCY EFFECT ON DESIGN

The Architectural team member works with the M+M team member to develop and review the typical occupancy hours and use, and any potential effect on the design solutions. The typical occupancy hours are reviewed in order to develop schedules for conditioning and lighting the building in order to reduce energy use. The Architectural team member prepares a summary of these findings and distributes it to all other team members. See the *Reference Manual* for additional info (page 33).

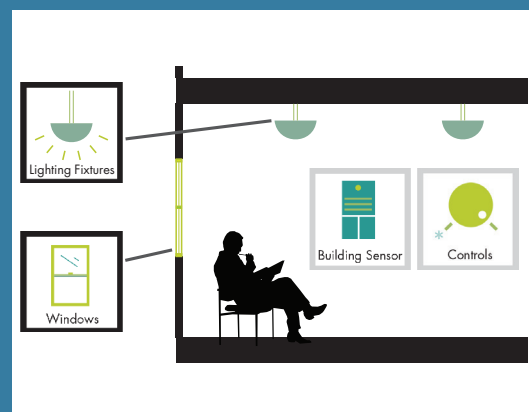
## ② ENERGY FREE DESIGN

Additional resources on Energy Free Design include:

- 50 to 50, American Institute of Architects,  
<http://www.aia.org/practicing/akr/AIAB089185>



### ② DAYLIGHTING SOLUTIONS

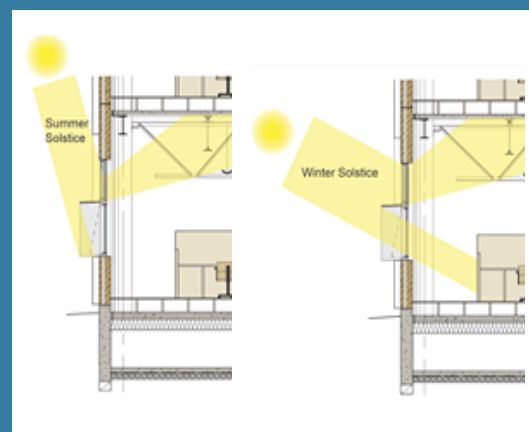


Example of Optimizing Multi-system Performance Using Bundled Daylighting Solutions

### ② Developing Daylighting Solutions

The Architectural team member develops and reviews daylighting solutions, if applicable to the project. Daylighting is the use of natural daytime light to illuminate the interior of the building (typically through the use of top lighting and side lighting), which helps increase occupant comfort and contributes to improved productivity. By increasing the amount of daylighting used in the building, the use of artificial electric lighting can be reduced, thereby reducing energy demand. The Architectural team member also considers the installation of daylighting sensors to automatically detect when electric lighting can be turned off. See the *Reference Manual* for additional info (page 49).

### ② DAYLIGHTING & SOLAR SHADING



Example of Daylighting & Solar Shading Devices  
\*<http://www.wbdg.org/resources/daylighting.php>

### ② Developing Renewable Energy Solutions

The Architectural team member develops and reviews renewable energy solutions, if applicable to the project. Renewable energy is a form of energy from natural sources that do not have a negative impact on the environment. The Architectural team member assesses whether or not there is room available on the site for possible renewable energy solutions. Some examples of renewable energy solutions include solar thermal and power, wind power, and geothermal.

### ② Developing Solar Heat Gain Solutions

The Architectural team member develops and reviews solar heat gain solutions, if applicable to the project. Solar heat gain can help to increase the temperature within the building by absorbing the solar energy transmittance from sunlight. For example, direct solar heat gain can be achieved by allowing the sun to penetrate through windows to warm a space. Thermal mass can be used to increase the solar heat gain within the building.

### ② Developing Thermal Mass Solutions

The Architectural team member develops and reviews thermal mass solutions, if applicable to the project. Materials within the building can be used as a thermal mass to collect energy from the sun during the day that can later be slowly released into the building. This helps to condition the building and prevent temperature fluctuations as the outdoor temperature changes throughout the day. Thermal mass materials typically can include concrete, masonry, and wallboard.

### ② Developing Envelope Enhancement Solutions

The Architectural team member develops and reviews envelope enhancement design solutions for the project. The envelope includes the roof, exterior walls, and windows, all of which contribute to indoor environmental quality. Possible envelope enhancement design solutions include increasing the **insulation** of the building (either the exterior walls and/or the roof), enhancing the R-value of the windows (double or triple glazing), and **decreasing air infiltration**. By making enhancements to the envelope, the building's energy load can be reduced and significant energy savings can be achieved.

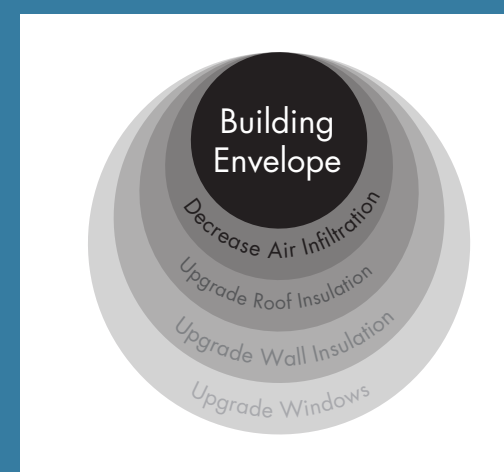
### ② Developing Plug Load Strategies

The Architectural or Engineering team member develops plug load strategies and establishes limits for the building post-retrofit. Plug loads are any and all equipment that are plugged in to an electrical outlet on a regular basis, which can account for 30% of energy use in office buildings. Plug load strategies help identify ways of reducing loads in order to save energy. Strategies can include switching off inactive equipment, eliminating unnecessary equipment, and behavioral strategies such as turning off the lights, which can add up to substantial savings. See the *Reference Manual* for additional info (page 48). Additional resources on reducing plug loads can be found in the National Renewable Energy Laboratory's (NREL) *Assessing and Reducing Plug and Process Loads in Office Buildings*: <http://www.nrel.gov/docsfy13osti/54175.pdf>

### ③ Participating in Sub-Team Meetings

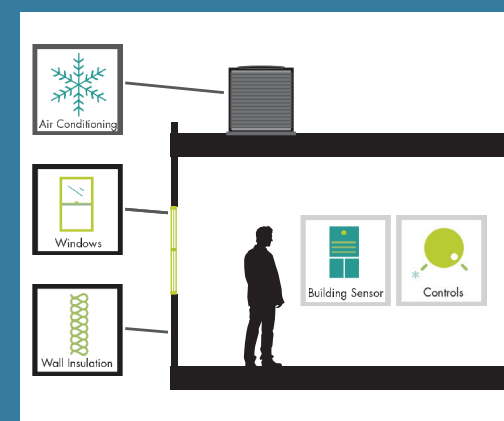
Throughout this Design Development Resource Gathering (RG) stage the Architectural team member participates in collaborative Sub-Team Meetings to review the selection of Energy Free Design solutions with the other project team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement, as well as the project budget and intended return on investment. For additional information, see *Identifying Design Development Collaborative Sub-Team Meetings* on page 46.

### ② ENVELOPE SOLUTIONS



Example of Building Envelope Solutions - Combining Systems to Reduce Load

### ② ENVELOPE SOLUTIONS



Example of Reducing the Load by Bundling Envelope Solutions & Sensors/Controls



- ① Develop and review possible **WHOLE BUILDING SYSTEMS DESIGN** solutions (in collaboration with M+M and Construction team members):
  - Develop and review potential **ENERGY SAVINGS** based on original scope of work
    - DELIVERABLE:** Submit summary outlining potential energy savings for original scope of work
  - Develop and review **ADDITIONAL SCOPE** scenarios that would ensure higher energy savings:
    - Develop and review opportunities for **BUNDLED EEMs**
    - Develop and review potential **ENERGY SAVINGS** associated with bundled EEMs
      - DELIVERABLE:** Submit summary outlining Whole Building Systems Design solutions, potential energy savings, and recommended additional scope scenarios
- ② Develop and review building wide **PLUG LOAD** strategies and limits\*
  - DELIVERABLE:** Submit summary outlining recommended plug load strategies and limits
- ③ If responsible for M+V, develop and review the **MEASUREMENT + VERIFICATION (M+V) Plan\*\***
  - DELIVERABLE:** Submit summary outlining any updates to the M+V Plan\*\*
- ④ Participate in collaborative Design Development **SUB-TEAM MEETINGS** to review Design Development progress and ensure the project is aligned with the Mission Statement and budget
  - Participate in Sub-Team Meeting 1 to present Whole Building Systems Design solutions and M+V Plan (if responsible), and review Energy Free Design solutions developed by Architect in order to select EEMs relative to the project budget
  - Participate in Sub-Team Meeting 2 to present and review Predictive Modeling analysis of potential energy savings of selected EEMs and to make adjustments to the project scope based on the results
  - Participate in Sub-Team Meeting 3 to present and review final Predictive Modeling results for the final project scope of EEMs

*\*TO BE COMPLETED BY THE ARCHITECTURAL OR ENGINEERING TEAM MEMBER*

*\*\*TO BE COMPLETED BY THE ENGINEERING OR M+M TEAM MEMBER*

**ASSIGNED TO:**

**CONTACT INFO:**

**DATE COMPLETED:**





### ① Whole Building Systems Design Solutions

The Engineering team member develops Whole Building Systems Design solutions for the project, and works with the M+M to test possible design solutions using Predictive Modeling, as well as the Construction team member to identify preliminary cost estimates. Whole Building Systems Design focuses on the integration of building systems to maximize efficiency. Building systems can be defined more broadly as heating, air conditioning, ventilation, plumbing, water, artificial lighting, plug loads, insulation, windows and glazing, and exterior skins including the roof. In addition, the Engineering team member reviews opportunities to increase the project scope by one or two systems and/or components to achieve greater energy savings within the AER project. See the *Reference Manual* for additional info (pages 41-42, 47-50).

### ① Developing Potential Energy Savings

The Engineering team member works with the M+M team member to develop and review the potential energy savings for the original project scope. The Predictive Model for the project is used to evaluate the potential energy savings for each energy efficient measure (EEM). The Engineering and the M+M team members collaborate in preparing a summary of the potential energy savings.

### ① Developing Additional Scope Scenarios

The Engineering team member develops possible additional scope scenarios for achieving greater energy savings within the AER project. This includes reviewing opportunities for increasing the project scope such as bundling of energy efficient measures (EEMs). Increasing the project scope promotes the accrual of savings when multiple systems are retrofitted at the same time. The Engineering team member reviews potential energy savings associated with bundled EEMs and prepares a summary of their recommendations for presentation to the Building Owner and project team members. See the *Reference Manual* for additional info (pages 41-42, 47-50).

### ① WHOLE BUILDING SYSTEMS DESIGN

Additional resources on Whole Building Systems Design include:

- Advanced Energy Retrofit Guide for Office Buildings, Pacific Northwest National Laboratory: <https://buildingdata.energy.gov/cbrd/download/19>

### ④ SUB-TEAM MEETINGS

Throughout this Design Development Resource Gathering (RG) stage the Engineering team member participates in collaborative Sub-Team Meetings to review the selection of Whole Building Systems Design solutions with the Project Manager and Owner. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement, as well as the project budget and intended return on investment. For additional information, see *Identifying Design Development Collaborative Sub-Team Meetings* on page 46.

### ① Developing Opportunities for Bundled EEMs

The Engineering team member develops opportunities for bundled energy efficient measures (EEMs) (see the *Reference Manual* for additional info, pages 47-50). Bundling offers building owners an opportunity to upgrade systems and/or system components that are under-performing, which when combined with the necessary planned upgrades, yield deeper energy savings. Two methods exist for bundling building systems and their components:

- **Increasing System Scope:**

Increasing Project Scope involves the addition of one or more system components within any one system type in order to achieve a higher level of operating efficiency. For example, if the light fixtures are being replaced, the building would also benefit from the installation of occupancy sensors and a BAS. Bundling these components, albeit increasing the scope of the lighting system work, would allow a building owner to monitor the frequency at which space is being used and the ability to adjust lighting as needed.

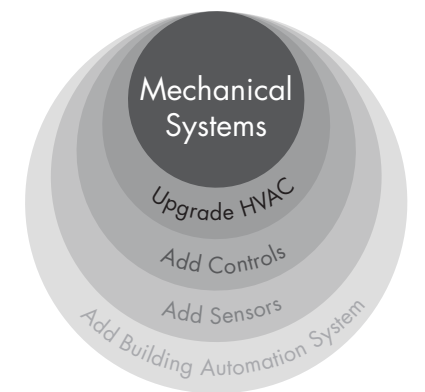
- **Combining Systems:**

Combining Systems involves retrofitting at least two building systems, with at least one component of the building envelope, addressed. For example, in upgrading the mechanical systems, a building would stand to benefit from upgraded windows and wall insulation. Bundling mechanical systems and the building envelope affords an opportunity to reduce the energy load, thus reducing the size of HVAC equipment needed to heat and cool the building.

### ② Developing Plug Load Strategies

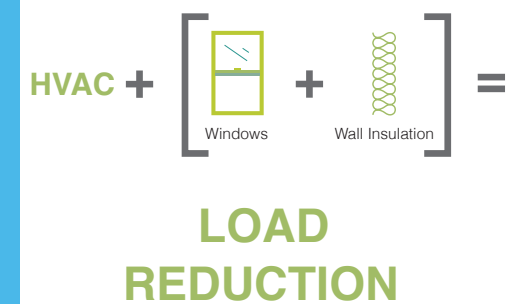
The Engineering or Architectural team member develops plug load strategies and establishes use limits for the building post-retrofit. Plug loads are any and all equipment plugged in to an electrical outlet on a regular basis. Plug load strategies and use limits can significantly reduce a building's loads in order to save energy. Strategies can include switching off inactive equipment, eliminating unnecessary equipment, and behavioral strategies such as turning off lights, all of which can add up to substantial savings. See the *Reference Manual* for additional info (page 48). Additional resources on reducing plug loads can be found in the National Renewable Energy Laboratory's (NREL) *Assessing and Reducing Plug and Process Loads in Office Buildings*: <http://www.nrel.gov/docs/fy13osti/54175.pdf>

#### ① INCREASING SYSTEMS SCOPE



Example of Increasing Systems Scope - Mechanical Systems

#### ① COMBINING SYSTEMS



Example of Combining Systems - Mechanical Systems & Building Envelope

### ③ Developing an M+V Plan

If responsible for M+V, the Engineering team member reviews the M+V Plan for the project and considers any necessary revisions or enhancements to the design based on the recommended scope of energy efficient measures (EEMs) and the project budget. M+V includes the commissioning and existing building commissioning (EBCx) of systems in order to ensure systems are operating efficiently, the evaluation of building data to substantiate energy savings claims, and the verification of indoor environmental quality. M+V includes the instrumentation of the building with controls and sensors such as sub-metering and a building automation system (BAS) to optimize the building systems. M+V instrumentation is typically applied to the building envelope and mechanical systems, and can automate all systems together, separately, or on a building system component level. The Engineering team member prepares a summary outlining any updates to the M+V Plan and distributes this report to all other team members. See the *Reference Manual* for additional info (pages 31-32).



- ① Develop and review estimates and cost feedback information for possible Energy Free Design and Whole Building Systems Design solutions, in collaboration with the Architectural and Engineering team members
  - DELIVERABLE: Submit summary outlining estimates and cost feedback information
- ② Participate in collaborative Design Development SUB-TEAM MEETINGS to review Design Development progress and ensure the project is aligned with the Mission Statement and budget
  - Participate in Sub-Team Meeting 1 to review Energy Free Design solutions developed by Architectural team member, Whole Building Systems Design solutions developed by Engineering team member, and M+V Plan in order to select EEMs relative to the project budget
  - Participate in Sub-Team Meeting 2 to review Predictive Modeling analysis of potential energy savings of selected EEMs and to make adjustments to the project scope based on the results
  - Participate in Sub-Team Meeting 3 to review final Predictive Modeling results for the final project scope of EEMs

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### ① Developing Estimates and Cost Feedback

The Construction team member works with the Architectural and Engineering team members to develop preliminary cost estimates for possible Energy Free Design and Whole Building Systems Design solutions in order to select energy efficient measures (EEMs) that are aligned with the project budget and intended return on investment. This information is reviewed during the Sub-Team Meetings in order to determine the recommended scope of EEMs.

### ② Commitment to Energy Free Design

The Construction team member demonstrates commitment to and encourages the use of the Integrated Design Protocol 4 – Energy Free Design. Energy Free Design focuses on the use of passive design and possible renewable energy strategies for the reduction of immediate and long term energy demand in the building. See the *Reference Manual* for additional info (page 18).

### ② Commitment to Whole Building Systems

The Construction team member demonstrates commitment to and encourages the use of the Integrated Design Protocol 5 – Whole Building Systems Design. Whole Building Systems Design focuses on the integration of building systems to maximize efficiency. See the *Reference Manual* for additional info (page 19).

### ② Commitment to M+V

The Construction team member demonstrates commitment to and encourages the use of the Integrated Design Protocol 7 – Measurement + Verification (M+V) both pre- and post-retrofit. M+V includes the commissioning and existing building commissioning (EBCx) of systems to ensure systems are operating efficiently, the evaluation of building data to substantiate energy savings claims, the verification of indoor environmental quality, and the instrumentation of the building. M+V instrumentation can automate all systems together, separately, or by building system component level. See the *Reference Manual* for additional info (pages 19, 31-32).

### ② PREDICTIVE MODELING

The Construction team member demonstrates commitment to and encourages the use of the Integrated Design Protocol 6 – Predictive Modeling during the ID AER project. Predictive Modeling focuses on developing a simulation model for the project. Once the model is created, the M+M team member tests potential design solutions and various energy efficient measures (EEMs) to determine the potential energy savings of each solution. See the *Reference Manual* for additional info (page 19).

### ② SUB-TEAM MEETINGS

Throughout this Design Development phase Resource Gathering (RG) stage the Construction team member participates in collaborative Sub-Team Meetings. During this stage of the project, the Construction team member encourages the selection of Energy Free Design and Whole Building Systems Design solutions. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement, as well as the project budget and intended return on investment. For additional information, see *Identifying Design Development Collaborative Sub-Team Meetings* on page 46.

## RESOURCE GATHERING (RG) DOCUMENT

### MODELING + MEASUREMENT (M+M) ACTIVITIES



CHECKLIST

DESIGN DEVELOPMENT

RESOURCE GATHERING

- 1a) Develop and review the PREDICTIVE MODEL for the project
  - Consider the creation of WHOLE BUILDING ENERGY MODELING
    - YES, whole building energy modeling has been completed (submit documentation)
    - Whole building energy modeling has NOT been completed (explain below):  
\_\_\_\_\_
  - Consider the completion of a CLIMATE ANALYSIS using the Predictive Model
    - YES, a climate analysis has been completed (submit documentation)
    - A climate analysis has NOT been completed (explain below):  
\_\_\_\_\_
  - Collaborate with Architectural and Engineering team members to evaluate Energy Free Design solutions and Whole Building Systems Design solutions using PREDICTIVE MODELING
    - Use Predictive Modeling to review potential ENERGY SAVINGS based on the original scope of work
    - Use Predictive Modeling to review potential ENERGY SAVINGS based on additional scope scenarios/bundled energy efficient measures (EEMs)
      - DELIVERABLE: Submit summary outlining predictive modeling results for tested design solutions
- 1b) If responsible for M+V, develop and review the MEASUREMENT + VERIFICATION (M+V) Plan\*
  - DELIVERABLE: Submit summary outlining any updates to the M+V Plan\*
- 1c) Consider the completion of a LIFE CYCLE ASSESSMENT (LCA) using Athena EcoCalculator (or similar)
  - YES, a life cycle assessment has been completed (submit documentation)
  - A life cycle assessment has NOT been completed (explain below):  
\_\_\_\_\_
- 1d) Identify and review applicable ENERGY CODES
  - DELIVERABLE: Submit list of applicable energy codes and summary of possible design implications

*\*TO BE COMPLETED BY THE ENGINEERING OR M+M TEAM MEMBER*

**ASSIGNED TO:** \_\_\_\_\_ **CONTACT INFO:** \_\_\_\_\_ **DATE COMPLETED:** \_\_\_\_\_







- 2a) Participate in collaborative Design Development SUB-TEAM MEETINGS to review Design Development progress and ensure the project is aligned with the Mission Statement and budget
  - Participate in Sub-Team Meeting 1 to present M+V Plan (if responsible), and review Energy Free Design solutions and Whole Building Systems Design solutions in order to select EEMs relative to the project budget
  - Participate in Sub-Team Meeting 2 to present and review Predictive Modeling analysis of potential energy savings of selected EEMs and to make adjustments to the project scope based on the results
  - Participate in Sub-Team Meeting 3 to present and review final Predictive Modeling results for the final project scope of EEMs

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



## DESIGN DEVELOPMENT PHASE

## RESOURCE GATHERING (RG) DOCUMENT

## MODELING + MEASUREMENT (M+M) GUIDELINES

M+M

Modeling + Measurement

## ①a Developing a Predictive Model

The M+M team member develops and reviews the Predictive Energy Model for the project. The M+M team member calibrates the model using the building's baseline data. Once the model is calibrated, the M+M team member collaborates with the other project team members to test potential design solutions and various energy efficient measures (EEMs) for their effectiveness in achieving intended performance targets. See the *Reference Manual* for additional info (pages 45-46).

## ①a Completing a Climate Analysis

The M+M team member proposes the completion of a climate analysis for the project. A climate analysis uses local climate data to simulate performance for the building. This can be helpful for accurately determining the energy savings potential of possible EEMs. If a climate analysis is completed, the M+M team member creates a summary report of the outcomes and distributes this report to all of the team members.

## ①a Reviewing Design Solutions

The M+M team member collaborates with the Architectural and Engineering team members to review and test potential design solutions using Predictive Modeling. The M+M team member uses the Predictive Model to evaluate the potential energy savings for each energy efficient measure (EEM) for both the original scope of work and for additional scope scenarios/bundled EEMs. Once completed, the M+M prepares a summary of the Predictive Modeling results for the tested design solutions. In addition, the M+M team member coordinates with the Engineering team member to prepare a summary outlining the energy savings based on the original scope of work, as well as the energy savings based on the recommended additional scope scenarios/bundled EEMs.

## ①a WHOLE BUILDING MODELING

The M+M team member considers the development of whole building energy modeling for the retrofit project. Tools such as OpenStudio can be used to create a whole building energy model for the AER project.

OpenStudio is a collection of open source software tools that can be used for whole building energy modeling. OpenStudio can be downloaded at no cost from the National Renewable Energy Laboratory here: <https://openstudio.nrel.gov>.

## ①b DEVELOPING AN M+V PLAN

If responsible for M+V, the M+M team member reviews the M+V Plan for the project and considers any necessary revisions or enhancements to the design based on the recommended scope of energy efficient measures (EEMs) and the project budget. M+V includes the commissioning and existing building commissioning (EBCx) of systems in order to ensure systems are operating efficiently, the evaluation of building data to substantiate energy savings claims, and the verification of indoor environmental quality. M+V also includes the instrumentation of the building with controls and sensors such as sub-metering and a building automation system (BAS) to optimize building systems. The M+M team member prepares a summary outlining any updates to the M+V Plan and distribute this report to all team members. See the *Reference Manual* for additional info (pages 31-32).

### 1c) Completing a Life Cycle Assessment

The M+M team member considers the completion of a Life Cycle Assessment (LCA) for the project. *"An LCA evaluates the environmental impact a building over the course of its entire life span. It accounts for the energy used in bringing all materials to the site including in the manufacturing, transportation of resources, usage and occupancy, operations and maintenance, and demolition or recycling of the existing building and/or building elements."*<sup>1</sup>  
<sup>1</sup><http://www.aia.org/practicing/akr/AIAB089185>

### 1d) Identifying Applicable Energy Codes

The M+M team member identifies energy codes and reviews possible project implications. Energy codes set standards for the energy-efficient design of buildings which impacts the amount of energy usage in buildings. Possible energy codes include local, regional, national, and international codes such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 standard and the International Energy Conservation Code (IECC). Typically, a state and/or local jurisdiction will set the energy code requirements. Once this review has been completed, the M+M team member develops a list of the applicable energy codes and a summary outlining any impacts on the project.

### 1c) LIFE CYCLE ASSESSMENT

There are tools available, such as the Athena EcoCalculator, which can be used to complete an LCA for the project. The Athena EcoCalculator is an Excel workbook and is a simple tool to use. It includes existing LCA data and the results given take into account all life cycle stages.

The Athena EcoCalculator can be downloaded at no cost from the Athena Sustainable Materials Institute here: <http://www.athenasmi.org/our-software-data/ecocalculator/>

### 2a) SUB-TEAM MEETINGS

Throughout this Design Development Resource Gathering (RG) stage the M+M team member participates in collaborative Sub-Team Meetings to review the progress made on the Predictive Model and the M+V Plan with the Project Manager, Owner, and other team members. In addition, the M+M team member participates in collaborative Sub-Team Meetings to review the development of the design solutions for the project. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Design Development Collaborative Sub-Team Meetings* on page 46.

## DESIGN DEVELOPMENT PHASE

DD.CM.1

### ID COLLABORATIVE MEETING (CM) DOCUMENT

#### FINAL DESIGN DECISIONS MEETING CHECKLIST

- ① Identify who will FACILITATE the Final Design Decisions Meeting  
 Team Member Name: \_\_\_\_\_  
 Contact Information: \_\_\_\_\_
- ② Review Integrated Design Mission Statement for team and project ALIGNMENT
- ③ Review FINANCIAL & PREDICTIVE ENERGY MODEL Verification of EEMs
- ④ Confirm and approve ENERGY FREE DESIGN SOLUTIONS
- ⑤ Confirm and approve WHOLE BUILDING SYSTEMS DESIGN SOLUTIONS (and additional scope scenarios, if applicable)
- ⑥ Confirm and approve M + V PLAN
- ⑦ Confirm and approve ENERGY CERTIFICATION/ACCREDITATION process
- ⑧ Confirm and approve final project SCOPE
- ⑨ Confirm and approve project BUDGET
- ⑩ Confirm and approve project SCHEDULE
- ⑪ Identify and review preliminary project PHASING
- ⑫ Identify and assign Implementation Documentation ACTIVITIES to project team members
- ⑬ Identify the number of collaborative SUB-TEAM MEETINGS during the Implementation Documentation Resource Gathering stage

REPORTING:

PROJECT MGMT.
PROJECT MGMT.
M+M
ARCHITECTURE
ENGINEERING
ENG./M+M
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.

REPORTING GUIDELINES:

ACTIVITY REPORTER:

Based on the Reporting Chart, the assigned Activity Reporter serves as the point person to create an Activity Report of decisions and outcomes made at the Collaborative Meeting for each identified activity. Once the Activity Report is completed, the final document should be given to the Summary Reporter on an agreed to date after the Collaborative Meeting.

SUMMARY REPORTER:

The Summary Reporter serves as the point person to collate the Activity Reports from the Collaborative Meeting for the creation of a Summary Report. Once the Summary Report is completed, the final document should be distributed to the entire team on an agreed to date after the Collaborative Meeting.



### 3 Model Verification of EEMs

All team members review the financial implications and performance results of the predictive model to confirm the selected energy efficient measures (EEMs). This includes an overview of the outcomes from the Resource Gathering stage Sub-Team Meetings, which evaluated the potential energy savings for each measure in both the original scope of work and for any additional scope scenarios/bundled EEMs. Using this information, project team members make informed decisions that contribute to increased energy savings during the retrofit project.

### 4 Confirming Energy Free Design Solutions

The recommended Energy Free Design solutions are confirmed and approved by the project team. These solutions relate to passive design strategies such as daylighting, solar shading, natural ventilation, and landscape, as well as possible renewable energy strategies in order to reduce immediate and long term energy demands.

### 5 Confirming Whole Building Design Solutions

Recommended Whole Building Design solutions and any additional scope scenarios are confirmed and approved by the project team. These solutions consider the contingent energy savings associated with the retrofit of two or more building systems, and encourage the project to review additional scope scenarios, such as bundling energy efficient measures, to achieve greater energy savings.

### 1 IDENTIFYING A CM FACILITATOR

Similar to other stages, the Project Manager identifies the team member who will facilitate the process oriented Collaborative Meeting (CM) and coordinate the project team. The CM facilitator is responsible for ensuring the team will complete the required Checklist activities. In order to complete the agenda, the CM facilitator manages time and keeps the team on schedule.

### 2 TEAM AND PROJECT ALIGNMENT

Once a Mission Statement has been established for the ID AER project, the team and project aligns around intended outcomes. During this CM, the Mission Statement is reviewed by the entire team to remind all of project's goals, values, cost priorities, and performance metrics. Any necessary adjustments to the project's development, and/or team member roles are made in order to ensure the project goals are met. Throughout the duration of the project, team members' decisions are guided by and aligned with the Mission Statement.

## 6 Confirming an M+V Plan

The Measurement + Verification (M+V) Plan for the project confirmed and approved during the CM. The M+V Plan may include the commissioning and existing building commissioning (EBCx) of systems in order to ensure systems are operating efficiently, the evaluation of building data to substantiate energy savings claims, the verification of indoor environmental quality, as well as the installation of M+V instrumentation within the building. Once confirmed, the team encourages the implementation of the M+V Plan within the project.

## 8 9 10 Confirming Project Scope, Budget, and Schedule

Once the performance results of the predictive model testing of energy efficient measures (EEMs), the Energy Free Design Solutions, Whole Building Systems Design solutions, and the M+V Plan have been confirmed and approved, the final project scope, budget, and schedule is also confirmed by the project team. During the CM, team members ensure that the final project scope, budget, and schedule are in alignment to the project's Mission Statement. If adjustments to any of these items are needed, these are reviewed by the project team during the Final Design Decisions Meeting.

## 11 Identifying Preliminary Project Phasing

Project Phasing is the act of coordinating particular building activities in an appropriate sequence relative to a project's needs. Constraints may exist that keep a project from completing all retrofitting activities at one time, thus requiring phases. The scheduling of planned and/or additional scope energy efficient measures (EEMs) are reviewed during this CM to ensure optimum phasing based on tenants, scope of work, and available budget. Team members identify and review opportunities for phasing within the project. When phasing a project, loads should be reduced first and envelope improvements effected thereafter. See *Reference Manual* for additional information (pages 51-52).

## 7 ENERGY CERTIFICATION PROCESS

The project team reviews the energy certification/accreditation process and necessary requirements for the project, if applicable. All team members need to be aware of the program being used and the documentation requirements needed as part of the certification/accreditation process. This will ensure that all requirements of the selected certification/accreditation program are met when the project has been completed.

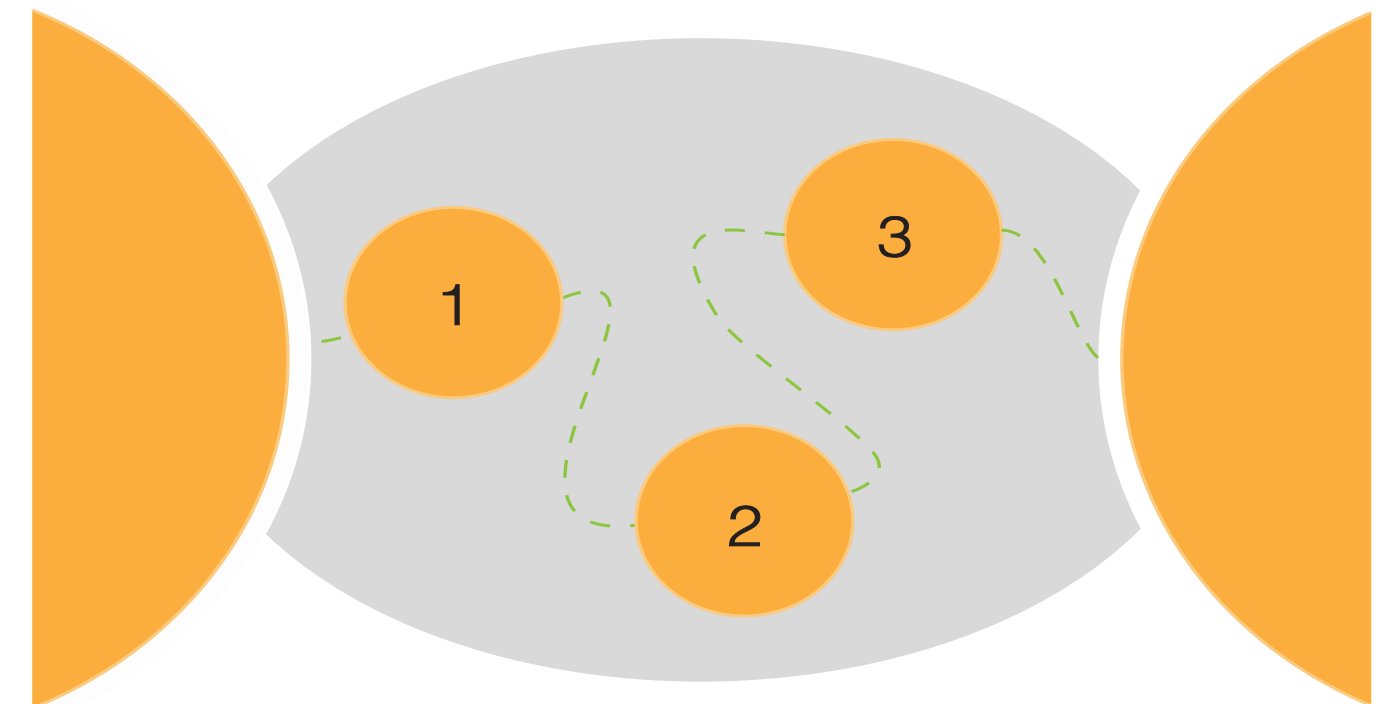
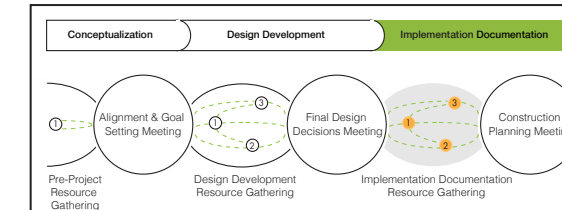
## 12 ASSIGNING ACTIVITIES

At the end of the Final Design Decisions CM, the meeting facilitator and/or Project Manager assigns Implementation Documentation Resource Gathering (RG) activities to team members. All Implementation Documentation RG Checklists are assigned to the appropriate team member. In addition, the required Implementation Documentation Sub-Team Meetings are reviewed by all of the team members.



### 13 Identifying Implementation Documentation Collaborative Sub-Team Meetings

#### PHASE LEGEND



**1. SUB-TEAM MEETING 1** to review and coordinate **Implementation Drawings**, as well as the development and coordination of a **Whole Building Model** (if applicable)

- Ensure project scope is aligned with Mission Statement
- Develop a Whole Building Model Strategy (if applicable)

**2. SUB-TEAM MEETING 2** to review and coordinate recommendations for a **Project Phasing Plan**, **Construction Schedule**, and **Purchase Orders**

- Review Project Phasing scenarios based on project budget, constraints, and performance targets
- Review the Construction Schedule and Purchase Orders

**3. SUB-TEAM MEETING 3** to review the final coordination of **Implementation Drawings** and a **Whole Building Model** (if applicable)

# IMPLEMENTATION DOCUMENTATION (IMPDOC) PHASE

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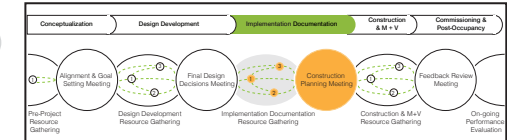
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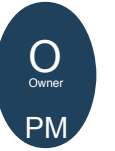
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IMPDOC.CM.1 CONSTRUCTION PLANNING MEETING CHECKLIST

IMPDOC.CM.GUIDELINES CONSTRUCTION PLANNING MEETING GUIDELINES

### PHASE LEGEND





- ① SCHEDULE the required number of collaborative Sub-Team Meetings to review Implementation Documentation progress and ensure the project is aligned with the Mission Statement
  - DELIVERABLE: Schedule the Sub-Team Meetings and notify required team members
- ② Lead ENERGY CERTIFICATION/ACCREDITATION process and begin to gather documentation required (if applicable)
- ③ Develop and review a project CONSTRUCTION SCHEDULE
  - DELIVERABLE: Submit a project CONSTRUCTION SCHEDULE (coordinated with Construction team member)
- ④ Develop and review a project PHASING plan with team members
  - DELIVERABLE: Submit a project PHASING plan (coordinated with team members)
- ⑤ Develop and review project PURCHASE ORDERS with Construction (C) team member
  - DELIVERABLE: Submit outline of required project PURCHASE ORDERS (coordinated with C)
- ⑥ Assist contractor to administer INTEGRATED DESIGN REQUESTS FOR PROPOSALS (ID RFPs) for sub-contractors/suppliers with shared energy savings goals
- ⑦ Lead collaborative Implementation Documentation Phase SUB-TEAM MEETING 1 to review and coordinate Implementation Drawings, as well as the development and coordination of a Whole Building Model (if applicable)
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 1
- ⑧ Lead collaborative Implementation Documentation Phase SUB-TEAM MEETING 2 to review and coordinate recommendations for a Project Phasing Plan, Construction Schedule, and Purchase Orders
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 2
- ⑨ Lead collaborative Implementation Documentation Phase SUB-TEAM MEETING 3 to review the final coordination of Implementation Drawings and a Whole Building Model (if applicable)
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 3
- ⑩ SCHEDULE the next Collaborative Meeting, Construction Planning, and invite project team members
  - DELIVERABLE: Schedule Construction Planning Meeting and notify all project team members

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### ① Scheduling Sub-Team Meetings

The Project Manager schedules collaborative Sub-Team Meetings to review the progress made by team members throughout the Implementation Documentation phase. During this stage of the project, these meetings review the implementation drawings, whole building modeling, project phasing, construction schedule, and purchase orders with team members. The Project Manager ensures the design and scope are aligned with the project's Mission Statement. For additional information, see *Identifying Implementation Documentation Collaborative Sub-Team Meetings* on page 90.

### ④ Developing a Phasing Plan

The Project Manager develops and reviews recommendations for a Project Phasing Plan. These recommendations are based on issues unique to this AER project, the available budget, schedule, and/or occupant needs. As previously outlined, when phasing a project loads should be reduced first and envelope improvements effected thereafter. In order to create a final Project Phasing Plan, recommendations are reviewed with other team members during a Sub-Team Meeting. Once reviewed, the Project Manager prepares the final Project Phasing Plan and distributes it to the team. See the *Reference Manual* for additional info (pages 51-52).

### ⑤ Reviewing Purchase Orders

Based on the final project scope, the Project Manager coordinates with the Construction team member to develop and review project purchase orders in preparation of the Construction phase of the ID AER. Once purchase orders have been prepared, the Project Manager collaborates with the Construction team member to prepare an outline of requirements and manage the procurement process.

### ② ENERGY CERTIFICATION PROCESS

The Project Manager ensures that the energy certification/accreditation process and goals for the project are implemented and taken into account as the Implementation Drawings are developed for the project (if applicable). In addition, the Project Manager ensures that all team members are aware of the necessary requirements of the selected energy certification/accreditation program. The Project Manager also coordinates with team members to complete and/or gather the documentation that is required for certification/accreditation.

### ③ CONSTRUCTION SCHEDULE

The Project Manager coordinates with the Construction team member to develop a Construction Schedule based on the project scope. This schedule highlights key deadlines and identifies when Collaborative Meetings will take place during the course of the project. Once completed, the Project Manager distributes the Construction Schedule to all team members.

### ⑥ Administering Integrated Design RFPs

In preparation for the Construction phase, the Project Manager assists the Construction team member in administering and issuing Integrated Design (ID) Requests for Proposals (RFPs). The ID RFPs ensure that the sub-contractors and suppliers share the project's energy savings goals, and are willing to work collaboratively towards the project's Mission Statement. In general, the lowest bidder is not always the best choice. The project's goals and priorities should be taken into consideration and the candidate who will best support the project's needs should be selected. Additional information about ID RFPs can be found in the *Reference Manual* on pages 17, 21, and 22.

### ⑦⑧⑨ Leading Sub-Team Meetings

The Project Manager leads the Implementation Documentation phase Sub-Team Meetings with applicable team members. During this phase, the Project Manager demonstrates commitment to the seven Integrated Design (ID) protocols and encourages the implementation of project goals and Mission Statement. During these meetings, the Project Manager ensures the team and project remain aligned and are fully integrated to maximize energy savings within the AER. The goal of these meetings is to ensure the project is progressing and is ready for the next Collaborative Meeting, the Construction Planning Meeting. In order for this to occur, throughout the Implementation Documentation RG stage, team members make progress on their assigned Checklist activities, which need to be completed prior to the Construction Planning Meeting. For additional information, see *Identifying Implementation Documentation Collaborative Sub-Team Meetings* on page 90.

### ⑩ COLLABORATIVE MEETING PREP

In preparation for the third Collaborative Meeting (CM), Construction Planning, the Project Manager schedules the meeting and notifies all team members. It is key that all team members are in attendance at CMs to ensure an integrated process, as well as the alignment of the whole project team. All Implementation Documentation Resource Gathering (RG) activities need to be completed prior to this meeting. In preparation for the Construction Planning CM, the Project Manager creates an agenda for the meeting and distributes it to all team members.

## RESOURCE GATHERING (RG) DOCUMENT

### ARCHITECTURE ACTIVITIES



- ① Develop and review architectural IMPLEMENTATION DOCUMENTS for Energy Free Design solutions that are aligned with the project Mission Statement
  - DELIVERABLE: Submit architectural Implementation Documents
- ② Consider the creation of an architectural BUILDING INFORMATION MODEL (BIM) coordinated with Engineering and M+M team members
  - YES, an architectural BIM has been developed (submit documentation)
  - An architectural BIM has NOT been developed (explain below):  
\_\_\_\_\_  
\_\_\_\_\_
- ③ Develop and review recommendations for a project PHASING plan
  - DELIVERABLE: Submit recommendations for a project Phasing plan
- ④ Participate in collaborative Implementation Documentation SUB-TEAM MEETINGS to review project development and ensure the project is aligned with the Mission Statement
  - Participate in Sub-Team Meeting 1 to review and coordinate Implementation Drawings, as well as the development and coordination of a Whole Building Model (if applicable) with necessary team members
  - Participate in Sub-Team Meeting 2 to review and coordinate recommendations for a Project Phasing Plan, Construction Schedule, and Purchase Orders with applicable team members
  - Participate in Sub-Team Meeting 3 to review the final coordination of Implementation Drawings and a Whole Building Model (if applicable) with necessary team members

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:





### ① Architectural Implementation Documents

The Architectural team member develops and reviews Implementation Documents outlining the selected energy efficient measures (EEMs) and Energy Free Design solutions chosen for the project. This task is undertaken in coordination with the Project Manager, the Engineering, and the Modeling and Measurement (M+M) team members. As the drawings are developed, Sub-Team Meetings may be needed to coordinate the documents, fully integrate design solutions, and ensure that the project remains aligned with the Mission Statement.

### ② Developing an Architectural BIM Model

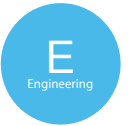
If applicable, the Architectural team member proposes the creation of an Architectural building information model (BIM) for the project. If created, the BIM is developed and coordinated in collaboration with the Engineering and M+M team members. Similarly to the development of the Implementation Documents, Sub-Team Meetings to coordinate the model may be necessary to fully integrate the design solutions and ensure that the project remains aligned with the Mission Statement.

### ③ Developing a Project Phasing Plan

The Architectural team member develops and reviews recommendations for a Project Phasing Plan. These recommendations are based result from the available budget, schedule, and/or occupant needs. As previously outlined, when phasing projects loads should be reduced first and envelope improvements effected thereafter. In order to create a final Project Phasing Plan, recommendations are reviewed with other team members during a Sub-Team Meeting. See the *Reference Manual* for additional info (pages 51-52).

### ④ SUB-TEAM MEETINGS

Throughout this Resource Gathering Stage, the Architectural team member participates in collaborative Sub-Team Meetings to review implementation drawings, whole building modeling, project phasing, and the construction schedule with the Project Manager, Owner, and other team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Implementation Documentation Collaborative Sub-Team Meetings* on page 90 of this *Project Team Guide*.



- ① Develop and review engineering IMPLEMENTATION DOCUMENTS for Whole Building Systems Design solutions that are aligned with the project Mission Statement
  - DELIVERABLE: Submit engineering Implementation Documents
- ② Consider the creation of an engineering BUILDING INFORMATION MODEL (BIM) coordinated with Architectural and M+M team members
  - YES, an engineering BIM has been developed (submit documentation)
  - An engineering BIM has NOT been developed (explain below):  


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- ③ Develop and review recommendations for a project PHASING plan
  - DELIVERABLE: Submit recommendations for a project Phasing plan
- ④ If responsible for M+V, encourage the implementation of M+V PLAN/GOALS\*
- ⑤ Participate in collaborative Implementation Documentation SUB-TEAM MEETINGS to review project development and ensure the project is aligned with the Mission Statement
  - Participate in Sub-Team Meeting 1 to review and coordinate Implementation Drawings, as well as the development and coordination of a Whole Building Model (if applicable) with necessary team members
  - Participate in Sub-Team Meeting 2 to review and coordinate recommendations for a Project Phasing Plan, Construction Schedule, and Purchase Orders with applicable team members
  - Participate in Sub-Team Meeting 3 to review the final coordination of Implementation Drawings and a Whole Building Model (if applicable) with necessary team members

*\*TO BE COMPLETED BY THE ENGINEERING OR M+M TEAM MEMBER*

**ASSIGNED TO:** \_\_\_\_\_

**CONTACT INFO:** \_\_\_\_\_

**DATE COMPLETED:** \_\_\_\_\_



### ① Engineering Implementation Documents

The Engineering team member develops and reviews Implementation Documents outlining the selected energy efficient measures (EEMs) and Whole Building Systems Design solutions for the project. This task is undertaken in coordination with the Project Manager, the Architectural, and the Modeling and Measurement (M+M) team members. As the drawings are developed, Sub-Team Meetings to coordinate the documents may be necessary to fully integrate the design solutions and ensure that the project remains aligned with the Mission Statement.

### ② Developing an Engineering BIM Model

If applicable, the Engineering team member proposes the creation of an Engineering building information model (BIM) for the project. If created, the BIM is developed and coordinated in collaboration with the Architectural and M+M team members. Similarly to the development of the Implementation Documents, Sub-Team Meetings to coordinate the model may be necessary to fully integrate the design solutions and ensure that the project remains aligned with the Mission Statement.

### ③ Developing a Project Phasing Plan

The Engineering team member develops and reviews recommendations for a Project Phasing Plan. These recommendations result from the available budget, schedule, and/or occupant needs. As previously outlined, when phasing projects loads should be reduced first and envelope improvements effected thereafter. In order to create a final Project Phasing Plan, recommendations are reviewed with other team members during a Sub-Team Meeting. See the *Reference Manual* for additional info (pages 51-52).

### ④ ENCOURAGING M+V GOALS

If responsible for Measurement + Verification (M+V), the Engineering team member encourages the implementation of the M+V Plan and goals. The Engineering team member coordinates the planning and implementation of M+V related activities throughout the project, which may include additional collaboration with the Project Manager, Construction, and/or M+M team members. See the *Reference Manual* for additional info (pages 31-32).

### ⑤ SUB-TEAM MEETINGS

Throughout this Resource Gathering Stage, the Engineering team member participates in collaborative Sub-Team Meetings to review implementation drawings, whole building modeling, project phasing, and the construction schedule with the Project Manager, Owner, and other team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Implementation Documentation Collaborative Sub-Team Meetings* on page 90 of this *Project Team Guide*.



- ① Develop and review a project CONSTRUCTION SCHEDULE
  - DELIVERABLE: Submit a project Construction Schedule (coordinated with Project Manager)
- ② Develop and review recommendations for a project PHASING plan
  - DELIVERABLE: Submit recommendations for a project Phasing plan
- ③ Develop and review project PURCHASE ORDERS with Project Manager (PM)
  - DELIVERABLE: Submit outline of required project Purchase Orders (coordinated with PM)
- ④ Administer, issue, and respond to INTEGRATED DESIGN REQUESTS FOR PROPOSALS (ID RFPs) for sub-contractors/suppliers with shared energy savings goals
  - DELIVERABLE: Submit outline of ID RFP documentation
- ⑤ Participate in collaborative Implementation Documentation SUB-TEAM MEETINGS to review project development and ensure the project is aligned with the Mission Statement
  - Participate in Sub-Team Meeting 2 to review and coordinate recommendations for a Project Phasing Plan, Construction Schedule, and Purchase Orders with applicable team members

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### ① Developing a Construction Schedule

The Construction team member works alongside the Project Manager to develop a Construction Schedule based on the project scope. This schedule highlights key deadlines and identifies when Collaborative Meetings will take place during the course of the project. Once this is finalized, the Project Manager distributes the Construction Schedule to all team members.

### ② Developing a Project Phasing Plan

The Construction team member develops and reviews recommendations for a Project Phasing Plan. These recommendations result from the available budget, schedule, and/or occupant needs. As previously outlined, when phasing projects loads should be reduced first and envelope improvements effected thereafter. In order to create a final Project Phasing Plan, recommendations are reviewed with other team members during a Sub-Team Meeting. See the *Reference Manual* for additional info (pages 51-52).

### ④ Administering Integrated Design RFPs

In preparation for the Construction phase, the Construction team member administers and issues Integrated Design (ID) Requests for Proposals (RFPs). The ID RFPs ensure that the sub-contractors and suppliers share the project's energy savings goals, and are willing to work collaboratively towards the project's Mission Statement. This is essential to being able to achieve the targeted energy savings and goals within the ID AER. In general, the lowest bidder is not always the best choice. The project's goals and priorities should be taken into consideration and the candidate who will best support the project's needs should be selected. Additional information about ID RFPs can be found in the *Reference Manual* on pages 17, 21, and 22.

### ③ REVIEWING PURCHASE ORDERS

Given the final project scope, the Construction team member coordinates with the Project Manager to develop and review project purchase orders in preparation for the Construction phase of the ID AER. Once purchase orders are prepared, the Construction team member collaborates with the Project Manager to prepare an outline of requirements and manage this procurement process.

### ⑤ SUB-TEAM MEETINGS

Throughout this Resource Gathering Stage, the Construction team member participates in collaborative Sub-Team Meetings to review implementation drawings, project phasing, construction schedule, and purchase orders with the Project Manager, Owner, and other team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Implementation Documentation Collaborative Sub-Team Meetings* on page 90 of this *Project Team Guide*.

## RESOURCE GATHERING (RG) DOCUMENT

### MODELING + MEASUREMENT (M+M) ACTIVITIES



CHECKLIST

- ① Develop and calibrate the PREDICTIVE ENERGY MODEL and encourage the implementation of Predictive Energy Model goals
  - DELIVERABLE: Submit calibrated Predictive Energy Model
- ② Consider the creation of a BUILDING INFORMATION MODEL (BIM) coordinated with Architectural and Engineering team members
  - YES, a BIM has been developed (submit documentation)
  - A BIM has NOT been developed (explain below):  


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- ③ If responsible for M+V, encourage the implementation of M+V PLAN/GOALS\*
- ④ Participate in collaborative Implementation Documentation SUB-TEAM MEETINGS to review project development and ensure the project is aligned with the Mission Statement
  - Participate in Sub-Team Meeting 1 to review and coordinate Implementation Drawings, as well as the development and coordination of a Whole Building Model (if applicable) with necessary team members
  - If necessary, participate in Sub-Team Meeting 2 to review and coordinate recommendations for a Project Phasing Plan, Construction Schedule, and Purchase Orders with applicable team members
  - Participate in Sub-Team Meeting 3 to review the final coordination of Implementation Drawings and a Whole Building Model (if applicable) with necessary team members

*\*TO BE COMPLETED BY THE ENGINEERING OR M+M TEAM MEMBER*

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:





### ① Predictive Energy Model Goals

The M+M team member develops and calibrates the Predictive Model using the building's baseline data and encourages the implementation of the project's predictive modeling goals. The predictive model may be used to test energy efficient measures (EEMs) and design solutions as the implementation documents and possible Project Phasing Plans are developed. This will help ensure performance targets and project goals are met.

### ② Developing a Building Information Model

If applicable, the M+M team member proposes the creation of a building information model (BIM) for the project. If created, the BIM is developed and coordinated with the Architectural and Engineering team members. Similarly to the development of the Implementation Documents, Sub-Team Meetings to coordinate the model may be necessary to fully integrate the design solutions and ensure that the project remains aligned with the Mission Statement.

### ③ Encouraging M+V Goals

If responsible for Measurement + Verification (M+V), the M+M team member encourages the implementation of the M+V Plan and goals. The M+M team member coordinates the planning and implementation of M+V related activities throughout the project, which may include additional collaboration with the Project Manager, Engineering, and/or Construction team members. See the *Reference Manual* for additional info (pages 31-32).

### ④ SUB-TEAM MEETINGS

Throughout this Resource Gathering Stage, the M+M team member participates in collaborative Sub-Team Meetings to review implementation drawings, whole building modeling, project phasing, and the construction schedule with the Project Manager, Owner, and other team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Implementation Documentation Collaborative Sub-Team Meetings* on page 90.

## IMPLEMENTATION DOCUMENTATION PHASE

IMPDOC.CM.1

### ID COLLABORATIVE MEETING (CM) DOCUMENT

#### CONSTRUCTION PLANNING MEETING ACTIVITIES

- ① Identify who will FACILITATE the Final Design Decisions Meeting  
 Team Member Name: \_\_\_\_\_  
 Contact Information: \_\_\_\_\_
- ② Review Integrated Design Mission Statement for team and project ALIGNMENT
- ③ Review ENERGY CERTIFICATION/ACCREDITATION process and any implications on project Construction (if applicable)
- ④ Confirm and approve IMPLEMENTATION DRAWINGS
- ⑤ Confirm and approve partial BIM MODEL (if applicable)
- ⑥ Confirm and approve CONSTRUCTION SCHEDULE
- ⑦ Confirm and approve PROJECT PHASING
- ⑧ Confirm and approve PURCHASE ORDERS
- ⑨ Confirm and approve sub-contractors/suppliers from ID RFPs
- ⑩ Review M+V PLAN/GOALS
- ⑪ Identify and assign Construction & M+V ACTIVITIES to project team members
- ⑫ Identify the number of collaborative SUB-TEAM MEETINGS during the Construction & M+V Resource Gathering stage

REPORTING:

PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.
M+M
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.

REPORTING GUIDELINES:

ACTIVITY REPORTER:

Based on the Reporting Chart, the assigned Activity Reporter serves as the point person to create an Activity Report of decisions and outcomes made at the Collaborative Meeting for each identified activity. Once the Activity Report is completed, the final document should be given to the Summary Reporter on an agreed to date after the Collaborative Meeting.

SUMMARY REPORTER:

The Summary Reporter serves as the point person to collate the Activity Reports from the Collaborative Meeting for the creation of a Summary Report. Once the Summary Report is completed, the final document should be distributed to the entire team on an agreed to date after the Collaborative Meeting.



### 1 Identifying a Meeting Facilitator

The Project Manager identifies the team member who will facilitate the process oriented Collaborative Meeting (CM) and coordinate the project team. The CM facilitator is responsible for ensuring the team will complete the required Checklist activities. In order to complete the agenda, the CM facilitator manages time and keeps the team on schedule.

### 3 Reviewing the Energy Certification Process

If applicable, the project team reviews the energy certification/ accreditation process and any implications for construction. It is important that all team members are aware of the certification program that is being used and the requirements of the certification/ accreditation process. This will ensure that the certification/ accreditation goals are met when the project is completed.

### 4 Approving Implementation Documents

During the Resource Gathering stage, the project team worked to develop and coordinate the Implementation Documents. At the Construction Planning Meeting, the final drawings are reviewed, confirmed, and approved in preparation for project construction/installation. The project team confirms that the documentation and project scope are aligned with the Mission Statement to ensure the goals and performance targets will be met.

### 2 TEAM AND PROJECT ALIGNMENT

During this CM, the Mission Statement is reviewed by the entire team to remind all of project's goals, values, cost priorities, and performance metrics. Any necessary adjustments to the project's development, and/or team member roles are made in order to ensure the project goals will be met. Throughout the duration of the project, team members' decisions are guided by and aligned with the Mission Statement.

### 5 APPROVING THE MODEL

If applicable, the project team reviews, confirms, and approves the building information model (BIM) in preparation for construction/installation. Similarly to the development of the Implementation Documents, the project team worked to develop and coordinate the model during the Resource Gathering stage. At this CM, the project team confirms that the model is aligned with the project scope and Mission Statement.

## ID COLLABORATIVE MEETING (CM) DOCUMENT

## CONSTRUCTION PLANNING MEETING GUIDELINES

**6** Approving the Construction Schedule

As prepared by the Construction team member and Project Manager, the team members review, confirm, and approve the Construction Schedule for the AER. Team members ensure the schedule takes into account the project scope, key deadlines, and when Collaborative Meetings will take place throughout the remainder of the project.

**7** Approving the Project Phasing Plan

As prepared by the Project Manager, the team members review, approve, and confirm the Project Phasing Plan. The goal of the Phasing Plan is to accommodate the project's unique issues, available budget, schedule, and/or occupant needs, while achieving the intended goals, performance targets, and Mission Statement for the ID AER. See the *Reference Manual* for additional info (pages 51-52).

**8** Approving Purchase Orders

As prepared by the Project Manager and Construction team member, the project team members review the outlined purchase orders in preparation of the Construction phase of the ID AER. Team members ensure that the purchase orders are accurate and aligned with the Mission Statement. Once purchase orders have been confirmed and approved, the Construction team member coordinates with the Project Manager to manage the procurement process.

**9** Approving Integrated Design RFPs

As prepared by the Project Manager and Construction team member, the project team members review, confirm, and approve the Integrated Design (ID) Requests for Proposals (RFPs). The ID RFPs ensure that the sub-contractors and suppliers share the project's energy savings goals, and are willing to work collaboratively towards the project's Mission Statement. See the *Reference Manual* for additional info (pages 17, 21-22).

**10** M+V PLANS & GOALS

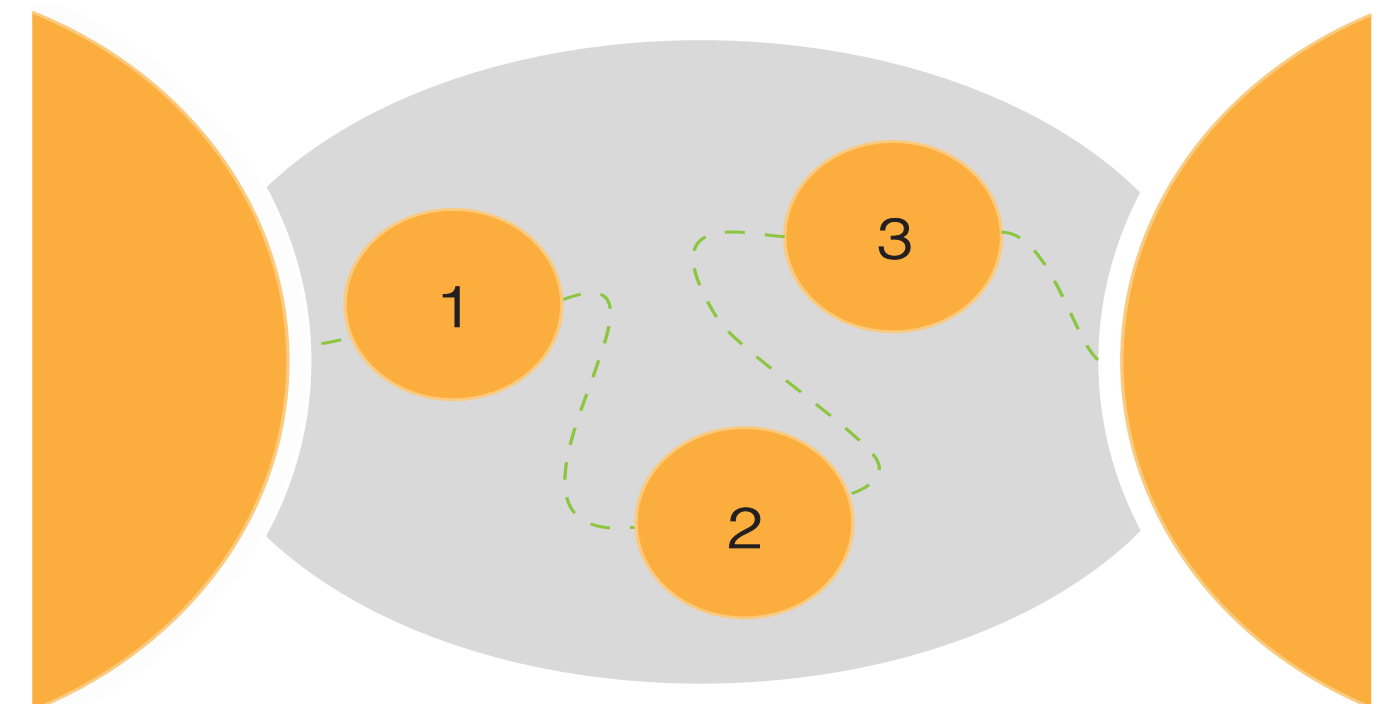
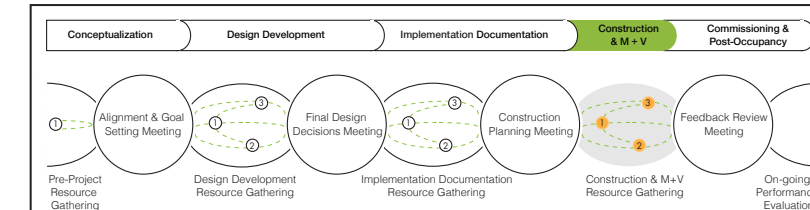
To ensure that the project is on track to meet the intended goals, the team members review the Measurement + Verification (M+V) Plan and goals. This includes a review of activities that will occur during the Construction & M+V phase, and any necessary team member coordination is discussed during the Construction Planning Meeting.

**11** ASSIGNING ACTIVITIES

At the end of the Construction Planning CM, the meeting facilitator and/or Project Manager assign Construction & M+V Resource Gathering (RG) activities to team members. All Construction & M+V RG Checklists are assigned to the appropriate team member. In addition, the required Construction & M+V Sub-Team Meetings are reviewed by the team members at the CM.

## 12 Identifying Construction & M+V Phase Collaborative Sub-Team Meetings

### PHASE LEGEND



1. **SUB-TEAM MEETING 1 to review Construction Progress and Project Budget**
  - Ensure the Construction Progress is on track, as well as aligned to the Mission Statement
2. **SUB-TEAM MEETING 2 to review M+V Plan and Installation of Sensors**
  - Review the M+V Plan to plan Construction & M+V phase activities
3. **SUB-TEAM MEETING 3 to review Construction Completion and On-Going Performance Evaluation Plan**
  - Ensure successful completion of construction in alignment to Mission Statement
  - Review plans for On-Going Performance Evaluation

# CONSTRUCTION & M+V (C/MV) PHASE

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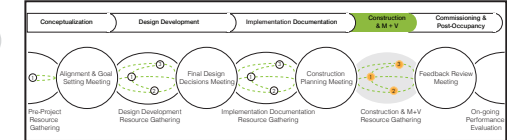
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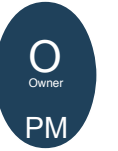
C/MV.MM.1 M+M CHECKLIST

C/MV.MM.GUIDELINES M+M GUIDELINES

### PHASE LEGEND







# CHECKLIST

- ① SCHEDULE the required number of Construction & M+V collaborative Sub-Team Meetings to ensure the project is aligned with the Mission Statement
  - DELIVERABLE: Schedule the Sub-Team Meetings and notify required team members
- ② Lead ENERGY CERTIFICATION/ACCREDITATION process and gather documentation required (if applicable)
- ③ Develop and review a plan for ON-GOING PERFORMANCE EVALUATION with project team
  - DELIVERABLE: Submit a plan for On-Going Performance Evaluation (coordinated with team)
- ④ Develop and review a plan for OPERATIONS + MANAGEMENT with project team
  - DELIVERABLE: Submit an Operations + Management plan (coordinated with team)
- ⑤ Coordinate with Engineer and/or M+M and Construction professional, to implement M+V PLAN/GOALS for the project
- ⑥ Lead collaborative Construction & M+V Phase SUB-TEAM MEETING 1 to review Construction Progress and Project Budget
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 1
- ⑦ Lead collaborative Construction & M+V Phase SUB-TEAM MEETING 2 to review M+V Plan and Installation of Sensors
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 2
- ⑧ Lead collaborative Construction & M+V Phase SUB-TEAM MEETING 3 to review Construction Completion and On-Going Performance Evaluation Plan
  - DELIVERABLE: Submit report outlining the results of Sub-Team Meeting 3
- ⑨ SCHEDULE the next Collaborative Meeting, Feedback Review, and invite required team members
  - DELIVERABLE: Schedule Construction Planning Meeting and notify required team members

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### ① Scheduling Sub-Team Meetings

The Project Manager schedules the collaborative Sub-Team Meetings to review the progress made by team members throughout the Construction & M+V phase. During this stage, these meetings review construction progress, project budget, M+V Plan and installation of sensors, as well as the on-going performance evaluation plan with team members. Since not all team members may be needed during these Sub-Team Meetings, the Project Manager and Owner determine who is necessary and notify the required team members. For additional information, see *Identifying Construction & M+V Collaborative Sub-Team Meetings* on page 122.

### ③ Developing an On-going Evaluation Plan

Once the Integrated Design (ID) AER is completed, it is essential to verify the energy savings within the building. Post-retrofit, M+V will be used to measure energy use and compare it to the pre-retrofit energy use and benchmarking. Following this initial post-retrofit M+V, it is important to have a longer-term plan in place to measure and verify the building's performance. This is outlined in an On-Going Performance Evaluation Plan. The Project Manager gathers recommendations from the other team members to develop a final On-Going Performance Evaluation Plan for the building.

### ② ENERGY CERTIFICATION PROCESS

The Project Manager continues to lead the energy certification process. As part of this effort, the Project Manager coordinates with team members to finalize the documentation required for certification/accreditation.

### ④ OPERATIONS + MANAGEMENT

Another component of longer-term M+V is the creation of an Operations + Management (O+M) plan that outlines the day to day functions of the building. In addition, whenever possible, it is important to have a facilities manager on staff that is trained to implement this plan.

The plan includes guidelines for proper operations of the building and recommendations for maintaining systems and equipment, which are guided by the project's Mission Statement and integrated decisions that have been made during the ID AER project. The purpose of this plan is to ensure that in daily operations and times of repair, decisions that reflect the building's energy goals and performance targets are made to ensure the highest performance possible.

### ⑤ Implementing the M+V Plan

The Project Manager coordinates with the Engineering and/or M+M team member, as well as the Construction team member to implement the M+V Plan. During the Construction and M+V phase, this may include the installation of M+V Instrumentation, which is typically applied to the building Envelope and mechanical systems. Additional info about M+V can be found in the *Reference Manual* on pages 31-32.

### ⑥⑦⑧ Leading Sub-Team Meetings

The Project Manager leads the Construction & M+V phase Sub-Team Meetings with applicable team members. During this phase, meetings review construction progress, budget, M+V Plan and installation of sensors, as well as the completion of construction and the On-Going Performance Evaluation Plan. These meetings verify that the project construction is aligned with the Mission Statement and that all Checklist activities are being completed by the assigned team members. For additional information, see *Identifying Construction & M+V Collaborative Sub-Team Meetings* on page 122 of this *Project Team Guide*.

### ⑨ COLLABORATIVE MEETING PREP

In preparation for the final Collaborative Meeting (CM) dedicated to feedback review, the Project Manager schedules a date and notifies required team members. For this final meeting, all team members may not be required to attend. The Project Manager and Owner determine which team members are required. All Construction & M+V Resource Gathering (RG) activities need to be completed prior to this meeting. In preparation for the Construction Planning CM, the Project Manager creates an agenda for the meeting and distributes it to the required team members.



- ① Develop and review architectural recommendations for an ON-GOING PERFORMANCE EVALUATION plan
  - DELIVERABLE: Submit recommendations for an On-Going Performance Evaluation plan
- ② Develop and review architectural recommendations for an OPERATIONS + MANAGEMENT plan
  - DELIVERABLE: Submit recommendations for an OPERATIONS + MANAGEMENT plan
- ③ Participate in collaborative Construction & M+V Phase SUB-TEAM MEETINGS to review project development and ensure the project is aligned with the Mission Statement
  - If necessary, participate in Sub-Team Meeting 1 to review Construction Progress and Project Budget
  - If necessary, participate in Sub-Team Meeting 2 to review M+V Plan and Installation of Sensors
  - If necessary, participate in Sub-Team Meeting 3 to review Construction Completion and On-Going Performance Evaluation Plan

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### ① Developing Recommendations for an On-Going Performance Evaluation Plan

Following the initial post-retrofit measurement and verification (M+V), a longer-term plan is developed to monitor, measure, and verify the building's performance. This is outlined in an On-Going Performance Evaluation Plan.

Architectural recommendations for the On-Going Performance Evaluation Plan, such as evaluating and managing plug loads, long-term procedures for tenant planning to ensure space planning optimizes building systems, yearly evaluation of envelope conditions and air infiltration, are considered by the Architectural team member. The Architectural team member outlines these recommendations in a summary report which is submitted to the Project Manager, who is responsible for creating the final On-Going Performance Evaluation Plan.

### ② Developing Recommendations for an Operations + Management Plan

The Operations + Management (O+M) plan outlines the day to day functions of the building. The plan includes guidelines for proper operations of the building and recommendations for maintaining systems and equipment. The Plan is guided by the project's Mission Statement and integrated design decisions made during the ID AER project. The purpose of this plan is to ensure that in daily operations and times of repair, decisions that reflect the building's energy goals and performance targets are made to ensure the highest performance possible.

The Architectural team member develops recommendations for the O+M Plan. These recommendations are outlined in a summary report and submitted to the Project Manager, who is responsible for creating the final O+M Plan.

### ③ SUB-TEAM MEETINGS

Throughout this Resource Gathering Stage, the Architectural team member participates, if necessary, in collaborative Sub-Team Meetings to review construction progress, budget, M+V Plan and installation of sensors, as well as the completion of construction and the on-going performance evaluation plan with the Project Manager, Owner, and other team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Construction & M+V Collaborative Sub-Team Meetings* on page 122 of this *Project Team Guide*.



- ① If responsible for M+V, oversee implementation of the M+V PLAN/GOALS for the project\*
  - Consider the installation of BUILDING SENSORS (such as lighting, CO2, occupancy)\*
    - YES, building sensors have been installed (submit documentation)\*
    - Building sensors have NOT been installed (explain below):\*
 

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  - Consider the installation of a BUILDING AUTOMATON SYSTEM (BAS)\*
    - YES, a Building Automation System (BAS) has been installed (submit documentation)\*
    - A Building Automation System (BAS) has NOT been installed (explain below):\*
 

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  - Consider creating a COMMISSIONING PLAN for newly installed building systems
    - YES, a Commissioning Plan has been created (submit documentation)\*
    - A Commissioning Plan has NOT been created (explain below):\*
 

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- ② Develop and review engineering recommendations for an ON-GOING PERFORMANCE EVALUATION plan
  - DELIVERABLE: Submit recommendations for an On-Going Performance Evaluation plan
- ③ Develop and review engineering recommendations for an OPERATIONS + MANAGEMENT plan
  - DELIVERABLE: Submit recommendations for an OPERATIONS + MANAGEMENT plan
- ④ Participate in collaborative Construction & M+V Phase SUB-TEAM MEETINGS to review project development and ensure the project is aligned with the Mission Statement
  - If necessary, participate in Sub-Team Meeting 1 to review Construction Progress and Project Budget
  - If necessary, participate in Sub-Team Meeting 2 to review M+V Plan and Installation of Sensors
  - If necessary, participate in Sub-Team Meeting 3 to review Construction Completion and On-Going Performance Evaluation Plan

*\*TO BE COMPLETED BY THE ENGINEERING OR M+M TEAM MEMBER*

**ASSIGNED TO:** \_\_\_\_\_ **CONTACT INFO:** \_\_\_\_\_ **DATE COMPLETED:** \_\_\_\_\_





### ① Implementing the M+V Plan

If responsible for M+V, the Engineering team member ensures that the M+V Plan and its goals are implemented during the retrofit project. The Construction and M+V phase may include the installation of M+V Instrumentation, which will require coordination with the Construction team member(s) and Project Manager.

To optimize building systems, various forms of M+V Instrumentation can be introduced into a building including sensors, controls, and a building automation system (BAS). Typically applied to the building envelope and mechanical systems, M+V Instrumentation takes place by automating all systems together, separately, or on a building system component. Additional info about M+V can be found in the *Reference Manual* on pages 31-32.

### ① Considering Commissioning of Systems

The Engineering team member reviews and considers the commissioning of newly installed systems within the retrofit project. Commissioning ensures that new equipment and/or systems are installed correctly and functioning properly in order for them to run as energy efficiently as possible. Commissioning occurs after the installation of new equipment and/or systems to test they are running properly, and if not, allow for changes that would make them more efficient.

Commissioning may seem unnecessary, but the process of verifying that all components of the building are working well individually and together is imperative in order to accurately identify the energy savings that have been achieved.

### ① BUILDING SENSORS

The Engineering team member reviews and considers the installation of building sensors. Deeper energy savings can be achieved by optimizing the performance of building systems through the use of sensors. Examples include the use of lighting sensors to detect when occupants leave a room or when there is enough daylighting available to power-off electric lighting. Building sensors can also help to monitor systems within the building. Bundling the installation of sensors with controls and a building automation system (BAS) can contribute to increased long-term energy savings.

### ① BUILDING AUTOMATION SYSTEM

The Engineering team member reviews and considers the installation of a building automation system (BAS) to achieve greater continued energy saving. A BAS typically is an integrated computer system that can be used to monitor and control systems within a building, as well as collect important energy related data. This allows the operation and maintenance personnel to analyze this information and make adjustments to building controls and equipment use as necessary. Additional info about the benefits of installing a BAS can be found in the *Reference Manual* on page 50.

## ② Developing Recommendations for an On-Going Performance Evaluation Plan

Following the initial post-retrofit measurement and verification (M+V), it is important for the retrofit to have a longer-term plan in place to monitor, measure, and verify the building's performance. This is outlined in an On-Going Performance Evaluation Plan.

Engineering recommendations for the On-Going Performance Evaluation Plan, such as the best method for monitoring and measuring the performance of the systems within the building, are considered by the Engineering team member. The Engineering team member outlines these recommendations in a summary report which is submitted to the Project Manager, who is responsible for creating the final On-Going Performance Evaluation Plan.

## ③ Developing Recommendations for an Operations + Management Plan

The Operations + Management (O+M) plan outlines the day to day functions of the building. The plan includes guidelines for proper operations of the building and recommendations for maintaining systems and equipment. The Plan is guided by the project's Mission Statement and integrated design decisions made during the ID AER project. The purpose of this plan is to ensure that in daily operations and times of repair, decisions that reflect the building's energy goals and performance targets are made to ensure the highest performance possible.

The Engineering team member develops recommendations for the O+M Plan. These are outlined in a summary report and submitted to the Project Manager, who is responsible for creating the final O+M Plan.

## ④ SUB-TEAM MEETINGS

Throughout this Resource Gathering Stage, the Engineering team member participates if it is necessary in collaborative Sub-Team Meetings to review construction progress, budget, the M+V Plan and installation of sensors, as well as the completion of construction and the on-going performance evaluation plan with the Project Manager, Owner, and other team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Construction & M+V Collaborative Sub-Team Meetings* on page 122 of this *Project Team Guide*.



- ① Lead project construction/installation using LEAN CONSTRUCTION Management/Project Delivery and ensure project construction/installation aligns with Mission Statement
- ② Develop and review recommendations for an OPERATIONS + MANAGEMENT plan
  - DELIVERABLE: Submit recommendations for an Operations + Management plan
- ③ Coordinate with the Engineer and/or M+M and Project Manager to implement M+V PLAN/GOALS for the project (if installation of M+V equipment and/or diagnostic testing is necessary)
- ④ Participate in collaborative Construction & M+V Phase SUB-TEAM MEETINGS to review project development and ensure the project is aligned with the Mission Statement
  - Participate in Sub-Team Meeting 1 to review Construction Progress and Project Budget
  - Participate in Sub-Team Meeting 2 to review M+V Plan and Installation of Sensors
  - Participate in Sub-Team Meeting 3 to review Construction Completion and On-Going Performance Evaluation Plan

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### ① Using Lean Construction Management

The Construction team member(s) leads project construction/ installation using lean construction management and project delivery methods. This includes reducing the quantity of waste during construction, efficient scheduling of activities, a clear process for construction completion, as well as continuous improvement of the process being used. It is important that the construction methods are aligned with the project's Mission Statement, taking into account all aspects of the project's scope.

### ② Developing Recommendations for an Operations + Management Plan

The Operations + Management (O+M) plan outlines the day to day functions of the building. The plan includes guidelines for proper operations of the building and recommendations for maintaining systems and equipment. The Plan is guided by the project's Mission Statement and integrated design decisions made during the ID AER project. The purpose of this plan is to ensure that in daily operations and times of repair, decisions that reflect the building's energy goals and performance targets are made to ensure the highest performance possible.

The Construction team member develops recommendations for the O+M Plan. These are outlined in a summary report and submitted to the Project Manager, who is responsible for creating the final O+M Plan.

### ③ IMPLEMENTING THE M+V PLAN

The Construction team member coordinates with the Engineering and/ or M+M team member, as well as the Project Manager to implement the M+V Plan. Within the Construction and M+V phase, this may include the installation of M+V Instrumentation, which is typically applied to the building envelope and mechanical systems. Additional info about M+V can be found in the *Roadmap Reference Manual* on pages 31-32.

### ④ COLLABORATIVE MEETINGS

Throughout this Resource Gathering Stage, the Construction team member participates in collaborative Sub-Team Meetings to review construction progress, budget, the M+V Plan and installation of sensors, as well as the completion of construction and the on-going performance evaluation plan with the Project Manager, Owner, and other team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Construction & M+V Collaborative Sub-Team Meetings* on page 122 of this *Project Team Guide*.



- ① If responsible for M+V, oversee implementation of the M+V PLAN/GOALS for the project\*
  - Consider the installation of BUILDING SENSORS (such as lighting, CO2, occupancy)\*
    - YES, building sensors have been installed (submit documentation)\*
    - Building sensors have NOT been installed (explain below):\*
 

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  - Consider the installation of a BUILDING AUTOMATON SYSTEM (BAS)\*
    - YES, a Building Automation System (BAS) has been installed (submit documentation)\*
    - A Building Automation System (BAS) has NOT been installed (explain below):\*
 

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  - Consider creating a COMMISSIONING PLAN for newly installed building systems
    - YES, a Commissioning Plan has been created (submit documentation)\*
    - A Commissioning Plan has NOT been created (explain below):\*
 

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- ② Develop and review M+M recommendations for an ON-GOING PERFORMANCE EVALUATION plan
  - DELIVERABLE: Submit recommendations for an On-Going Performance Evaluation plan
- ③ Develop and review M+M recommendations for an OPERATIONS + MANAGEMENT plan
  - DELIVERABLE: Submit recommendations for an Operations + Management plan
- ④ Participate in collaborative Construction & M+V Phase SUB-TEAM MEETINGS to review project development and ensure the project is aligned with the Mission Statement
  - Participate in Sub-Team Meeting 2 to review M+V Plan and Installation of Sensors
  - Participate in Sub-Team Meeting 3 to review Construction Completion and On-Going Performance Evaluation Plan

*\*TO BE COMPLETED BY THE ENGINEERING OR M+M TEAM MEMBER*

**ASSIGNED TO:** \_\_\_\_\_ **CONTACT INFO:** \_\_\_\_\_ **DATE COMPLETED:** \_\_\_\_\_



### ① Implementing the M+V Plan

If responsible for M+V, the M+M team member ensures that the M+V Plan and its goals are implemented during the retrofit project. The Construction and M+V phase may include the installation of M+V Instrumentation, which will require coordination with the Construction team member(s) and Project Manager.

To optimize building systems, various forms of M+V Instrumentation can be introduced into a building including sensors, controls, and a building automation system (BAS). Typically applied to the building envelope and mechanical systems, M+V Instrumentation takes place by automating all systems together, separately, or on a building system component. Additional info about M+V can be found in the *Reference Manual* on pages 31-32.

### ① Considering Commissioning of Systems

The M+M team member reviews and considers the Commissioning of newly installed systems within the retrofit project. Commissioning ensures that new equipment and/or systems are installed correctly and functioning properly in order for them to run as energy efficiently as possible. Commissioning occurs after the installation of new equipment and/or systems to test that they are running properly, and if not, allow for changes that would make them more efficient.

Commissioning may seem unnecessary, but the process of verifying that all components of the building are working well individually and together is imperative in order to accurately identify the energy savings that have been achieved.

### ① BUILDING SENSORS

The M+M team member reviews and considers the installation of building sensors. Deeper energy savings can be achieved by optimizing the performance of building systems through the use of sensors. Examples include the use of lighting sensors to detect when occupants leave a room or when there is enough daylighting available to power-off electric lighting. Building sensors can also help to monitor systems within the building. Bundling the installation of sensors with controls and a building automation system (BAS) can contribute to increased long-term energy savings.

### ① BUILDING AUTOMATION SYSTEM

The M+M team member reviews and considers the installation of a building automation system (BAS) to achieve greater continued energy saving. A BAS typically is an integrated computer system that can be used to monitor and control systems within a building, as well as collect important energy related data. This allows the operation and maintenance personnel to analyze this information and make adjustments to building controls and equipment use as necessary. Additional info about the benefits of installing a BAS can be found in the *Reference Manual* on page 50.



## ② Developing Recommendations for an On-Going Performance Evaluation Plan

Following the initial post-retrofit measurement and verification (M+V), it is important for the retrofit to have a longer-term plan in place to monitor, measure, and verify the building's performance. This is outlined in an On-Going Performance Evaluation Plan.

M+M recommendations for the On-Going Performance Evaluation Plan, such as the best method for monitoring and measuring the performance of the systems within the building, are considered by the M+M team member. The M+M team member outlines these recommendations in a summary report which is submitted to the Project Manager, who is responsible for creating the final On-Going Performance Evaluation Plan.

## ③ Developing Recommendations for an Operations + Management Plan

The Operations + Management (O+M) plan outlines the day to day functions of the building. The plan includes guidelines for proper operations of the building and recommendations for maintaining systems and equipment. The Plan is guided by the project's Mission Statement and integrated design decisions made during the ID AER project. The purpose of this plan is to ensure that in daily operations and times of repair, decisions that reflect the building's energy goals and performance targets are made to ensure the highest performance possible.

The M+M team member develops recommendations for the O+M Plan. These are outlined in a summary report and submitted to the Project Manager, who is responsible for creating the final O+M Plan.

## ④ SUB-TEAM MEETINGS

Throughout this Resource Gathering Stage, the M+M team member participates if it is necessary in collaborative Sub-Team Meetings to review the M+V Plan and installation of sensors, as well as the completion of construction and the on-going performance evaluation plan with the Project Manager, Owner, and other team members. These meetings verify that the design and project scope are aligned with the project's goals and Mission Statement. For additional information, see *Identifying Construction & M+V Collaborative Sub-Team Meetings* on page 122 of this *Project Team Guide*.

# COMMISSIONING & POST-OCCUPANCY PHASE

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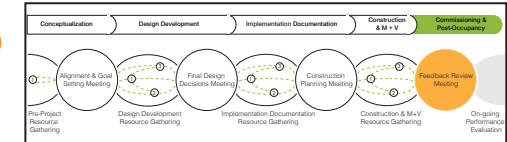
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### PHASE LEGEND



## COMMISSIONING & POST-OCCUPANCY PHASE BCX/PO.CM.1

### ID COLLABORATIVE MEETING (CM) DOCUMENT

#### FEEDBACK REVIEW MEETING ACTIVITIES

- ① Identify who will FACILITATE the Feedback Review Meeting  
Team Member Name: \_\_\_\_\_  
Contact Information: \_\_\_\_\_
- ② Review ENERGY CERTIFICATION/ACCREDITATION process completion (if applicable)
- ③ Confirm and approve ON-GOING PERFORMANCE EVALUATION plan
- ④ Confirm and approve OPERATIONS + MANAGEMENT plan
- ⑤ Confirm, approve, and review M+V PLAN for commissioning
- ⑥ Identify and review initial post-occupancy M+V results
- ⑦ Identify and review FEEDBACK from project team regarding the ID process
- ⑧ Identify required number of Commissioning & Post-Occupancy SUB-TEAM MEETINGS, if necessary
- ⑨ Identify and assign Commissioning & Post-Occupancy ACTIVITIES to team members

REPORTING:
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.
M+M
M+M
PROJECT MGMT.
PROJECT MGMT.
PROJECT MGMT.

#### REPORTING GUIDELINES:

##### ACTIVITY REPORTER:

Based on the Reporting Chart, the assigned Activity Reporter serves as the point person to create an Activity Report of decisions and outcomes made at the Collaborative Meeting for each identified activity. Once the Activity Report is completed, the final document should be given to the Summary Reporter on an agreed to date after the Collaborative Meeting.

##### SUMMARY REPORTER:

The Summary Reporter serves as the point person to collate the Activity Reports from the Collaborative Meeting for the creation of a Summary Report. Once the Summary Report is completed, the final document should be distributed to the entire team on an agreed to date after the Collaborative Meeting.



**1 Identifying a Meeting Facilitator**

For the final Collaborative Meeting (CM), the Project Manager identifies the team member who will facilitate the meeting and coordinate the project team. The CM facilitator is responsible for ensuring the team will complete the required Checklist activities. In order to complete the agenda, the CM facilitator manages time and keeps the team on schedule.

**2 Completing the Energy Certification/ Accreditation Process**

The Project Manager leads the completion of the energy certification process. If documentation is required from team members, it is discussed during this meeting to ensure that the requirements of the certification/accreditation program will be met.

**3 Confirming the On-Going Performance Evaluation Plan**

As prepared by the Project Manager, the team reviews the final On-going Performance Evaluation Plan during the CM. The On-going Performance Evaluation Plan outlines the long-term activities to monitor, measure, and verify the building's performance. It is important for this plan to state how performance is evaluated to ensure that the energy savings within the building are maintained. Any additional recommendations or changes are discussed by the team during this CM and incorporated into the final plan. Once completed, the team confirms and approves the plan.

**4 OPERATIONS + MGMT. PLAN**

As prepared by the Project Manager and Construction team member, the team reviews, confirms, and approves the final Operations + Management (O+M) Plan. It is important for the plan to outline the day to day functions of the building and include guidelines for proper operations of the building and recommendations for maintaining systems and equipment. The Plan is guided by the project's Mission Statement and integrated design decisions made during the ID AER project. In addition, whenever possible, it is important to have a facilities manager on staff that is trained to implement this plan.

The purpose of this plan is to ensure that in daily operations and times of repair, decisions that reflect the building's energy goals and performance targets are made to ensure the highest performance possible. Any additional recommendations or changes are discussed by the team during this CM and incorporated into the final plan.

### 5 Reviewing the M+V Plan

During this CM, to ensure that the project is on track to meet the intended goals, the team members review the Measurement + Verification (M+V) Plan and goals, especially those relating to commissioning. This includes a review of activities that will occur during the Commissioning and Post-Occupancy phase as well as after the project is completed. In addition, any necessary team member coordination is discussed during the Feedback Review Meeting.

### 6 Reviewing Post-Occupancy M+V Results

During the Feedback Review Meeting, the team reviews the initial post-occupancy measurement and verification (M+V) results. The actual energy savings is measured and compared to the estimated energy savings developed during the retrofit project. These results can indicate if any adjustments need to be made within the Commissioning and Post-Occupancy phase of the project.

### 7 Reviewing Team Feedback

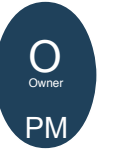
During the Collaborative Meeting, the team reviews feedback regarding the Integrated Design (ID) process. The team reviews what worked well within the process, what can be improved, and any implications for this particular building that need to be taken into consideration in possible future project phases. This activity is aimed at helping the Building Owner and other team members improve the ID process and team alignment on future projects.

### 8 IDENTIFYING SUB-TEAM MEETINGS

During the final Resource Gathering (RG) stage of the project, it may not be necessary to have Sub-Team Meetings. Because of this, during this CM the team discusses the need for a Sub-Team Meeting and if necessary, identifies the required number of Commissioning & Post-Occupancy Sub-Team Meetings. A potential Sub-Team Meeting can focus on the review of On-going Performance Evaluation including the measurement and verification (M+V) of energy savings, as well as the commissioning and monitoring of building systems.

### 9 ASSIGNING ACTIVITIES

At the end of the Feedback Review Meeting, the facilitator and/or Project Manager assign Commissioning & Post-Occupancy Resource Gathering (RG) activities to team members. All Commissioning & Post-Occupancy RG Checklists are assigned to the appropriate team member.



- ① If necessary, SCHEDULE the required number of Commissioning & Post-Occupancy collaborative Sub-Team Meetings
  - DELIVERABLE: Schedule the Sub-Team Meeting(s) and notify required team members
- ② Complete ENERGY CERTIFICATION/ACCREDITATION documentation (if applicable)
  - DELIVERABLE: Submit Energy Certification/Accreditation documentation
- ③ Coordinate the implementation of the ON-GOING PERFORMANCE EVALUATION plan
  - DELIVERABLE: Submit documentation of On-going Performance Evaluation results
- ④ Coordinate the implementation of the OPERATIONS + MANAGEMENT plan
  - DELIVERABLE: Submit documentation of Operations + Management implementation
- ⑤ Coordinate the implementation of the long-term M+V PLAN with Engineer (E) and/or M+M
  - DELIVERABLE: Submit documentation of M+V results (coordinated with E and/or M+M)
- ⑥ If applicable, lead collaborative Commissioning & Post-Occupancy Phase SUB-TEAM MEETING to review On-going Performance Evaluation including M+V of Energy Savings and Commissioning & Monitoring of Building Systems
  - DELIVERABLE: If applicable, submit report outlining the results of Sub-Team Meeting

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:





### ① Scheduling the Sub-Team Meeting(s)

If necessary, the Project Manager schedules collaborative Sub-Team Meetings to review the progress made by the team members throughout the Commissioning & Post-Occupancy phase, and notifies the required team members. This may include a meeting focused on the review of On-going Performance Evaluation including the M+V of energy savings, as well as the commissioning and monitoring of building systems.

### ③ Implementing the On-Going Performance Evaluation Plan

The Project Manager implements the On-going Performance Evaluation Plan throughout the Commissioning & Post-Occupancy phase. This outlines the longer-term plan to monitor, measure, and verify the building's energy performance. In addition, if possible, it is important that a facilities manager is trained to implement this plan.

### ④ Implementing the Operations + Management Plan

The Project Manager implements the Operations + Management Plan throughout the Commissioning & Post-Occupancy phase. This plan includes guidelines for proper operations of the building and recommendations for maintaining systems and equipment. In addition, if possible, it is important that a facilities manager is on staff and trained to implement this plan.

### ⑤ Implementing the Long-Term M+V Plan

The Project Manager implements the long-term M+V Plan throughout the Commissioning & Post-Occupancy phase in coordination with the Engineering or M+M team member. This may include the coordination of commissioning of newly installed building systems and possible third party annual energy usage reporting. Additional info about M+V can be found in the *Reference Manual* on pages 31-32.

### ② ENERGY CERTIFICATION PROCESS

During this stage, the Project Manager completes the energy certification process. This may involve filing documentation and paying applicable fees to complete and receive certification/accreditation for the finalized retrofit project. Once received, the Project Manager can work with the Owner to promote and market the certification/accreditation awarded to the building to occupants and potential tenants.

### ⑥ LEADING THE SUB-TEAM MEETING

If applicable, the Project Manager leads the Commissioning & Post-Occupancy phase Sub-Team Meeting(s) with required team members. During the meeting, the participants ensure that on-going performance evaluation, M+V, and/or Commissioning occurs in alignment with the project's Mission Statement.



- ① If responsible for M+V, coordinate the implementation of the long-term M+V PLAN with Project Manager (PM)\*
  - Consider implementing a COMMISSIONING PLAN for newly installed building systems\*
    - YES, a Commissioning Plan has been implemented (submit documentation)\*
    - A Commissioning Plan has NOT been implemented (explain below):\*
 

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  - Consider third party ANNUAL ENERGY USAGE REPORTING\*
    - YES, Annual Energy Usage Reporting has been implemented (submit documentation)\*
    - Annual Energy Usage Reporting has NOT been implemented (explain below):\*
 

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  - DELIVERABLE: Submit documentation of M+V results (coordinated with PM)
- ② If necessary, participate in collaborative Commissioning & Post-Occupancy Phase SUB-TEAM MEETING to review On-going Performance Evaluation including M+V of Energy Savings and Commissioning & Monitoring of Building Systems

*\*TO BE COMPLETED BY THE ENGINEERING OR M+M TEAM MEMBER*

ASSIGNED TO:

CONTACT INFO:

DATE COMPLETED:



### ① Implementing the Long-Term M+V Plan

If responsible for M+V, the Engineering team member implements the long-term M+V Plan and goals in coordination with the Project Manager. This may include the coordination of commissioning of newly installed building systems and possible third party annual energy usage reporting, as outlined below. Additional info about M+V can be found in the *Reference Manual* on pages 31-32.

### ① Implementing a Commissioning Plan

If responsible for M+V, the Engineering team member considers implementing a Commissioning Plan during the Commissioning & Post-Occupancy phase. Commissioning ensures that new equipment and/or systems are installed correctly and functioning properly in order for them to run as energy efficiently as possible. The process of verifying that all components of the building are working well individually and together is imperative in order to accurately identify the energy savings that have been achieved.

### ① Reporting Annual Energy Usage

An essential part of measurement and verification (M+V) is the reporting of actual energy savings. During the Commissioning & Post-Occupancy phase, the actual energy use during occupancy is measured and compared to the estimated energy use data that was developed during the retrofit project. If responsible for M+V, the Engineering team member determines if third party reporting of annual energy usage is necessary. This reporting can include both energy and cost savings that have been measured. Some energy certification/accreditation programs require this to verify energy savings. Tools that can be used for this reporting include Portfolio Manager; more information about this tool can be found in the *Reference Manual* on page 57.

### ② SUB-TEAM MEETING

If necessary, the Engineering team member participates in collaborative Sub-Team Meetings to review the progress made throughout the Commissioning & Post-Occupancy phase. This may include a meeting focused on the review of On-going Performance Evaluation including the M+V of energy savings, as well as the commissioning and monitoring of building systems. The Sub-Team Meeting participants ensure that on-going performance evaluation, M+V, and/or Commissioning occurs in alignment with the project's Mission Statement.



- ① If responsible for M+V, coordinate the implementation of the long-term M+V PLAN with Project Manager (PM)\*
  - Consider implementing a COMMISSIONING PLAN for newly installed building systems\*
    - YES, a Commissioning Plan has been implemented (submit documentation)\*
    - A Commissioning Plan has NOT been implemented (explain below):\*
 

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---
  - Consider third party ANNUAL ENERGY USAGE REPORTING\*
    - YES, Annual Energy Usage Reporting has been implemented (submit documentation)\*
    - Annual Energy Usage Reporting has NOT been implemented (explain below):\*
 

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  - DELIVERABLE: Submit documentation of M+V results (coordinated with PM)
- ② Consider issuing POST-OCCUPANCY SURVEYS to occupants/tenants
  - YES, Post-Occupancy Surveys have been issued to occupants/tenants (submit documentation)
  - Post-Occupancy Surveys have NOT been issued to occupants/tenants (explain below):
 

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- ③ If necessary, participate in collaborative Commissioning & Post-Occupancy Phase SUB-TEAM MEETING to review On-going Performance Evaluation including M+V of Energy Savings and Commissioning & Monitoring of Building Systems

*\*TO BE COMPLETED BY THE ENGINEERING OR M+M TEAM MEMBER*

ASSIGNED TO: \_\_\_\_\_ CONTACT INFO: \_\_\_\_\_ DATE COMPLETED: \_\_\_\_\_



### ① Implementing the Long-Term M+V Plan

If responsible for M+V, the M+M team member implements the long-term M+V Plan and goals in coordination with the Project Manager. This may include the coordination of commissioning of newly installed building systems and possible third party annual energy usage reporting, as outlined below. Additional info about M+V can be found in the *Reference Manual* on pages 31-32.

### ① Implementing a Commissioning Plan

If responsible for M+V, the M+M team member implements a Commissioning Plan, during the Commissioning & Post-Occupancy phase. Commissioning ensures that new equipment and/or systems are installed correctly and functioning properly in order for them to run as energy efficiently as possible. The process of verifying that all components of the building are working well individually and together is imperative in order to accurately identify the energy savings that have been achieved.

### ① Reporting Annual Energy Usage

An essential part of measurement and verification (M+V) is the reporting of actual energy savings. During the Commissioning & Post-Occupancy phase, the actual energy use during occupancy is measured and compared to the estimated energy use data that was developed during the retrofit project. If responsible for M+V, the M+M team member determines if third party reporting of annual energy usage is necessary. This reporting can include both energy and cost savings that have been measured. Some energy certification/accreditation programs require this to verify energy savings. Tools that can be used for this reporting include Portfolio Manager; more information about this tool can be found in the *Reference Manual* on page 57.

### ② POST-OCCUPANCY SURVEYS

Post-occupancy Surveys can be used to measure Occupant satisfaction and comfort using questions focused on indoor environment including lighting, air quality, thermal comfort, and acoustics. Results of these types of surveys can help the Owner and/or facilities manager make simple adjustments to improve occupant comfort. In addition, they can identify issues that can be addressed in future phases of retrofit work.

### ③ SUB-TEAM MEETING

If necessary, the M+M team member participates in collaborative Sub-Team Meetings to review the progress made throughout the Commissioning & Post-Occupancy phase. This may include a meeting focused on the review of On-going Performance Evaluation including the M+V of energy savings, as well as the commissioning and monitoring of building systems. The Sub-Team Meeting participants ensure that on-going performance evaluation, M+V, and/or Commissioning occurs in alignment with the project's Mission Statement.

I GLOSSARY





## GLOSSARY: GENERAL TERMS

Integrated Design.....collaborative process oriented set of decision making activities for identifying shared priorities and goals in an effort to build consensus amongst all members on the retrofit team.

Advanced Energy Retrofit.....a building and systems based renovation of an existing structure focused on the energy savings potential of proposed retrofit activities.

Resource Gathering.....stages of analysis, information gathering, and project development with particular activities assigned to each professional team member based on their professional competencies.

Collaborative Meeting.....coordinated in person meetings of the entire project team aimed at generating key all-team decisions necessary for advancing the project in order to achieve project alignment and provide for the integrated development of the project.

Mission Statement.....a set of clearly defined and shared goals detailing vision, performance targets, budget constraints, and general principles for guiding and measuring the project's progress and success.

Integrated Design (ID)

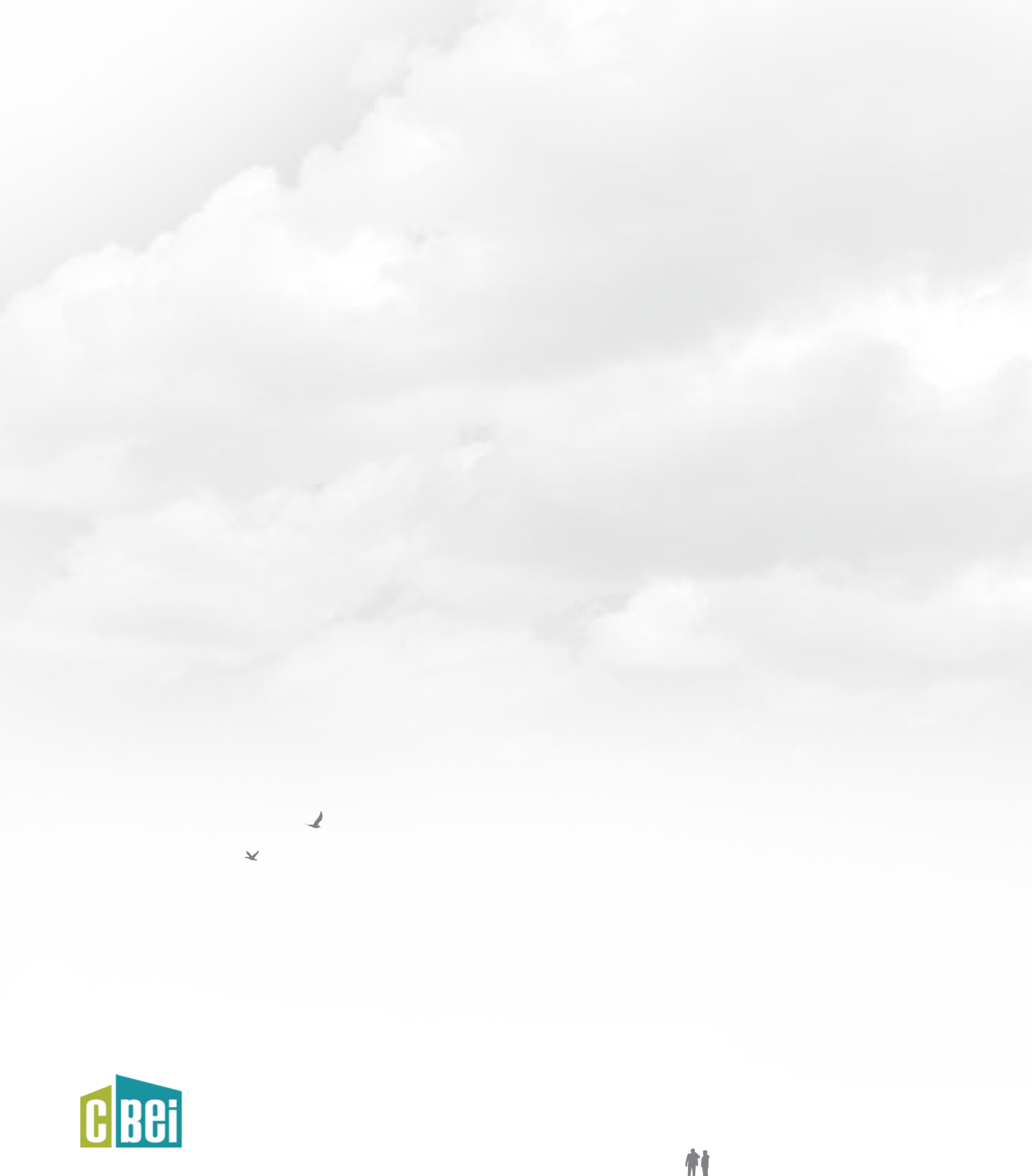
Requests for Proposals (RFPs)...solicitation of services from industry professionals and suppliers that sets performance based standards and financial goals for all team members; and ensures all team members have the requisite knowledge and experience for participating in an Integrated Design (ID) process.

Energy Free Design Solutions...strategies that are focused on attaining minimal energy usage by using passive energy solutions, load reduction, and renewable energy.

Whole Building Solutions.....solutions that focus on evaluating the impact of retrofitting two or more building systems and the orchestration of the building's systems as a whole.

## ACRONYMS

ID	Integrated Design
AER	Advanced Energy Retrofit
OOO	Owner, Operator, Occupant
RFP	Request for Proposal
AEC	Architecture, Engineering, Construction
A	Architecture
E	Engineering
C	Construction
M+M	Modeling + Measurement
M+V	Modeling + Verification
EEM(s)	Energy Efficient Measure(s)
EBCx	Existing Building Commissioning
DOE	Department of Energy
BTO	Building Technologies Office
CBEI	Consortium for Building Energy Innovation
SELS	Saving Energy in Leased Space
USGBC	United States Green Building Council
LEED	Leadership in Energy & Environmental Design
HVAC	Heating, Ventilation, Air Conditioning
BAS	Building Automation System
RG	Resource Gathering
CM	Collaborative Meeting



DESIGN + RESEARCH TEAM:

Dr. Franca Trubiano  
Kristen Albee