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INTEGRATIVE PROCESS AND ECO-CHARRETTE
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ONLINE TRAINING BY KRISHNAJI PAWAR
LEED AP(BD+C),GSAS CGP,GCP,ISO 14001
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MODULE 03

Integrative Design and Sustainable Buildings

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Integrative Design and Sustainable Buildings

Maximize opportunities for integrated, cost-effective adoption of green design and construction strategies, emphasizing human health as a fundamental evaluative criterion for building design, construction and operational strategies. Utilize innovative approaches and techniques for green design and construction.



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LEARNING OBJECTIVES

- **How Integrated Design and Sustainable Buildings Work Together**
- **Relationship between Integrated Design and Sustainable Buildings**
- **Roadmap to the Integrated Design Process**
- **Integrative Project Planning and Design**

How Integrated Design and Sustainable Buildings Work Together

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- After realizing that the construction industry causes the most ecological damage from energy use, fossil fuels, and waste during the life cycle, sustainable architecture goes "green" and "energy efficiency" becomes more popular.
- Sustainable design and integrated design have evolved together.
- Any building is a system with many subsystems and many design parameters.
- Integrated design optimizes dynamic interaction between building systems and components.
- As design projects become more complex and sophisticated, integrating and coordinating all disciplines becomes more important.
- This desire to include all disciplines in the design creates a disorganized, difficult-to-coordinate process.
- In order to achieve sustainability and bring together all disciplines responsible for delivering the built environment, building designers need perfectly calibrated solutions.







Relationship between Integrated Design and Sustainable Buildings

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- Integrated design provides a solution to these searches.
- The integrated building design process addresses energy needs across the building's life cycle, including structure, environmental impacts, material and natural resource use, waste management, and user relationships.
- Sustainable architecture is not limited to energy efficiency.
- Sustainable integrated design practice combines the best ingredients given the time, space, and opportunity to introduce a new way of designing and building.
- The design is assessed for cost, quality of life, future flexibility, efficiency, environmental impact, productivity, creativity, and occupant enlivenment.



Relationship between Integrated Design and Sustainable Buildings +

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From a sustainability perspective, certain features common to green buildings are particularly good candidates for integrated design because of its inherent interdisciplinary nature. The following features are examples:

- **Daylighting**
- **Green roofs**
- **Exposed thermal mass**
- **Higher energy performance**
- **Reduced embodied carbon**
- **Optimized indoor climate**
- **More user involvement**

Relationship between Integrated Design and Sustainable Buildings

- Even with green building rating systems and energy design tools laying out the steps, an integrated building process can improve cost-effectiveness by recognizing interrelationships between systems and building performance, integrating efficient and sustainable design elements, and defining the best design path.
- Green building rating systems like BREEAM, LEED, and DGNB focus on indoor air quality, hazardous substance avoidance, responsible resource use, bio-diversity, and green transport to mitigate climate change and greenhouse gas emissions.
- However, with a growing number of new demands that must be integrated into the design of modern buildings to satisfy the complexity of building design targets and cost issues, integrated design is strongly supported instead of integrated energy design, which green building rating systems generally prefer.
- In other words, instead of using the LEED checklist or other green building rating systems as a design tool in later phases, this article suggests engaging the project team around the underlying goals in a multidisciplinary and collaborative way at the early design phases to have a large impact on building performance from a lifecycle perspective, both in terms of environmental performance (LCA) and costs (LCC).



Roadmap to the Integrated Design Process

Roadmap to the Integrated

Design Process

By taking into consideration all the benefits and key success factors of the integrated design process, a roadmap is presented in Table in order to achieve sustainable design.

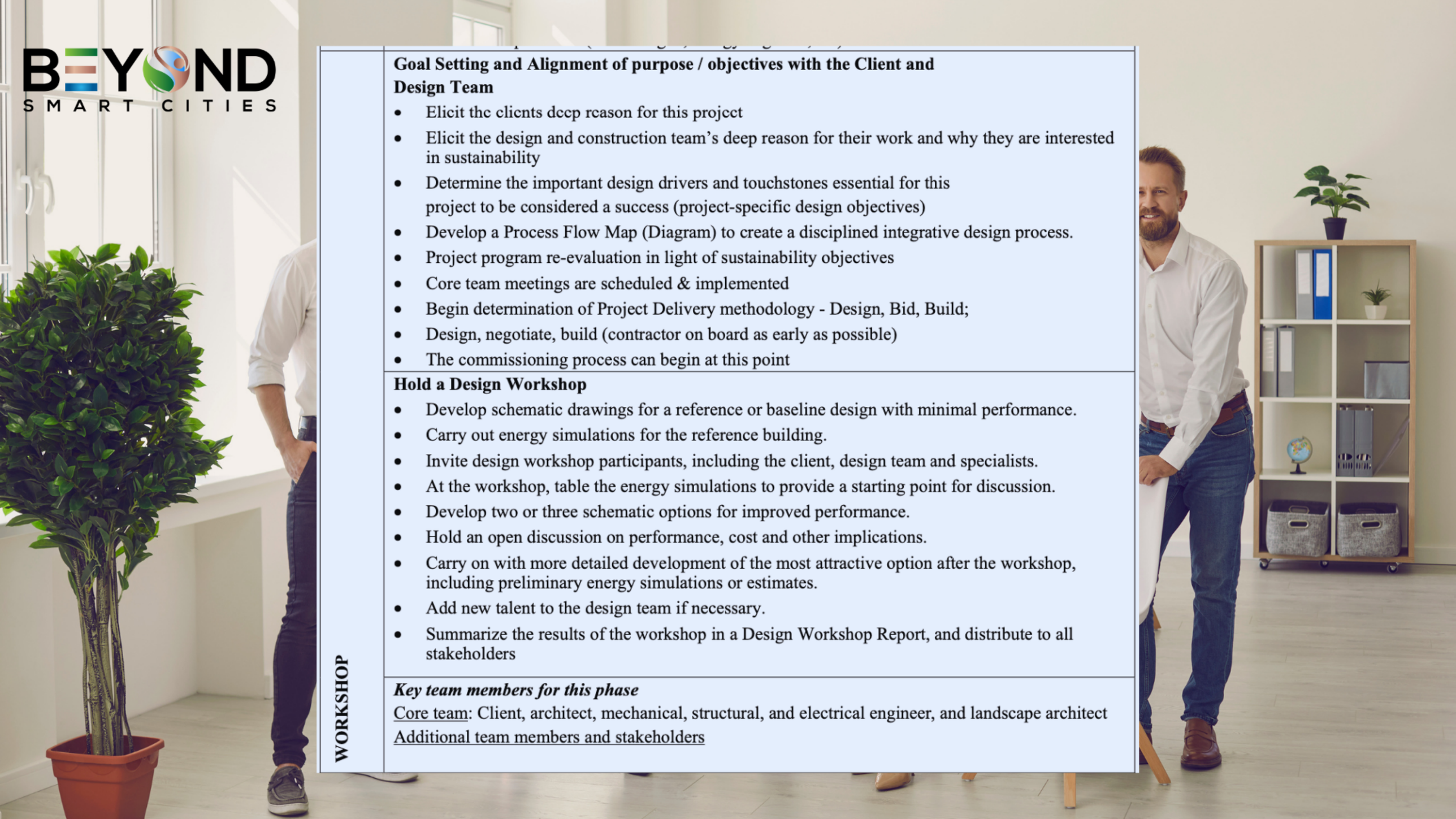


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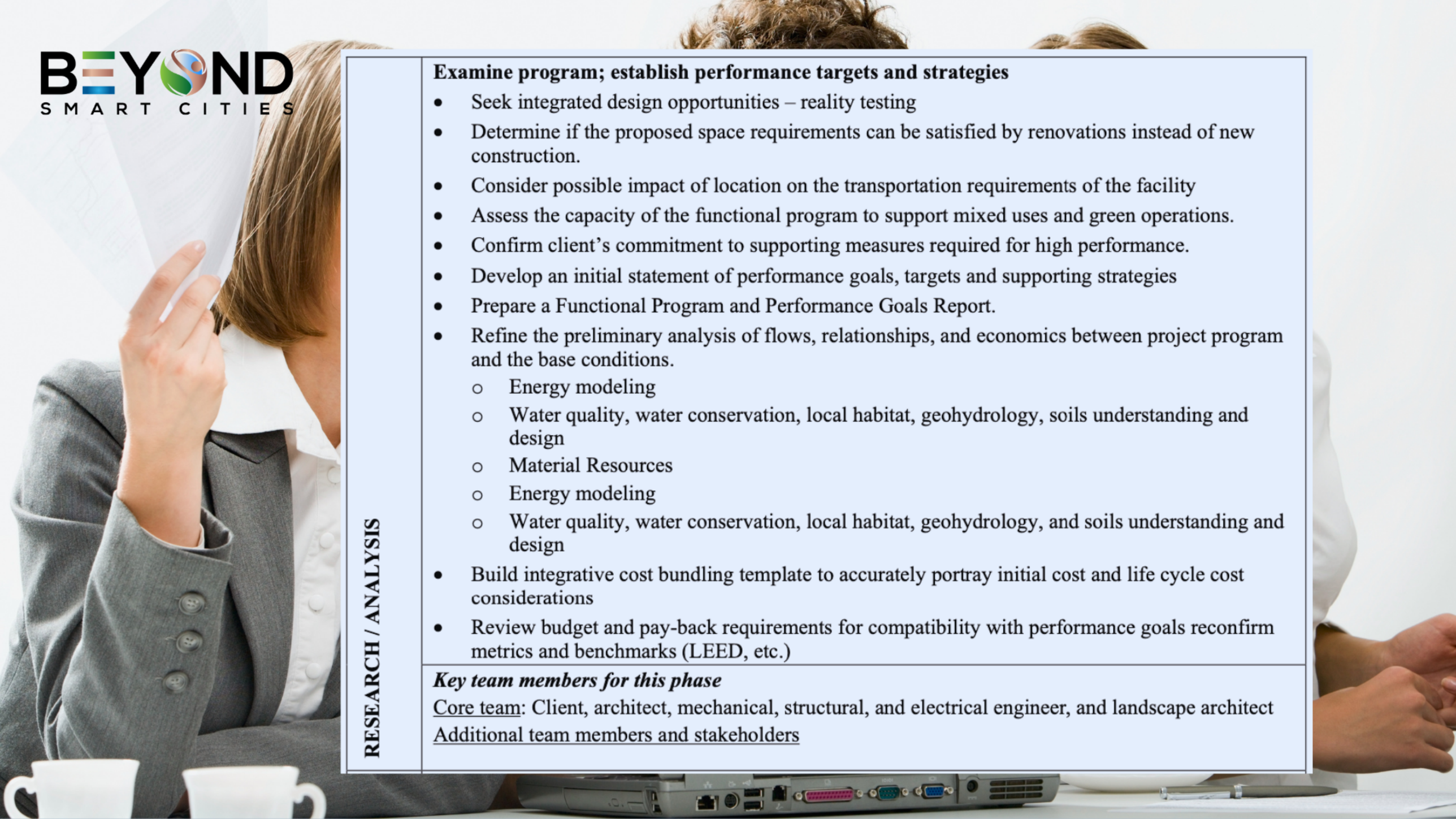
PREDESIGN – THE DISCOVERY PHASE	**Consider site development issues** • Minimize building footprint on site. • Minimize loss of solar or daylight potential of adjacent property. • Consider measures to minimize impacts on subsurface ecology and aquifers. • Develop preliminary landscape plans to provide windbreaks, shading, and to minimize water demand. • Ensure that the building will form a positive contribution to the streetscape. • Carry out an Environmental Impact Assessment. • Summarize site development issues in a Draft Site Impact Plan.
	Key team members for this phase Core team: Client, architect, mechanical, structural, and electrical engineer, and landscape architect Additional team members and stakeholders, including: • Contractor (depending on project delivery type) • Representative of occupant's perspective • Building operators (if possible) • Additional specialists (i.e. ecologist, energy engineer, etc)

PREDESIGN – THE DISCOVERY PHASE	**Identify Base Conditions – the context of the project**
	Core Project Programming
	Preliminary Analysis of Flows, Relationships, and Economics between Project Program and the Base Conditions • Energy efficiency and Sources / Microclimates / Building Use • Water quality and conservation and local habitat, geohydrology and soils • Material Resources – informed by Life Cycle Assessment • Consider transportation impact of occupants and users – evaluate alternate resources and location of project
	Assemble the Design Team • Ensure that the proposed design team is aware that the project has high-performance goals. • Identify and retain design team members with skills and experience related to the program. • Ensure that contract conditions do not create a disincentive for the mechanical engineer. • If the budget permits, include performance incentive payments in contracts for the principal designers. • Assess additional consultants who may be needed to achieve some level of effective sustainability (Energy Modeler; Daylighting Modeler; Lighting designer; Commissioning Authority; a Landscape Architect or Civil Engineer; Building science expertise; Green Material and specifications expertise; a facilitator for group meetings; etc.)

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WORKSHOP	**Goal Setting and Alignment of purpose / objectives with the Client and Design Team** • Elicit the clients deep reason for this project • Elicit the design and construction team's deep reason for their work and why they are interested in sustainability • Determine the important design drivers and touchstones essential for this project to be considered a success (project-specific design objectives) • Develop a Process Flow Map (Diagram) to create a disciplined integrative design process. • Project program re-evaluation in light of sustainability objectives • Core team meetings are scheduled & implemented • Begin determination of Project Delivery methodology - Design, Bid, Build; • Design, negotiate, build (contractor on board as early as possible) • The commissioning process can begin at this point
	Hold a Design Workshop • Develop schematic drawings for a reference or baseline design with minimal performance. • Carry out energy simulations for the reference building. • Invite design workshop participants, including the client, design team and specialists. • At the workshop, table the energy simulations to provide a starting point for discussion. • Develop two or three schematic options for improved performance. • Hold an open discussion on performance, cost and other implications. • Carry on with more detailed development of the most attractive option after the workshop, including preliminary energy simulations or estimates. • Add new talent to the design team if necessary. • Summarize the results of the workshop in a Design Workshop Report, and distribute to all stakeholders
	Key team members for this phase Core team: Client, architect, mechanical, structural, and electrical engineer, and landscape architect Additional team members and stakeholders



RESEARCH / ANALYSIS	**Examine program; establish performance targets and strategies** • Seek integrated design opportunities – reality testing • Determine if the proposed space requirements can be satisfied by renovations instead of new construction. • Consider possible impact of location on the transportation requirements of the facility • Assess the capacity of the functional program to support mixed uses and green operations. • Confirm client's commitment to supporting measures required for high performance. • Develop an initial statement of performance goals, targets and supporting strategies • Prepare a Functional Program and Performance Goals Report. • Refine the preliminary analysis of flows, relationships, and economics between project program and the base conditions. ○ Energy modeling ○ Water quality, water conservation, local habitat, geohydrology, soils understanding and design ○ Material Resources ○ Energy modeling ○ Water quality, water conservation, local habitat, geohydrology, and soils understanding and design • Build integrative cost bundling template to accurately portray initial cost and life cycle cost considerations • Review budget and pay-back requirements for compatibility with performance goals reconfirm metrics and benchmarks (LEED, etc.)
	Key team members for this phase Core team: Client, architect, mechanical, structural, and electrical engineer, and landscape architect Additional team members and stakeholders



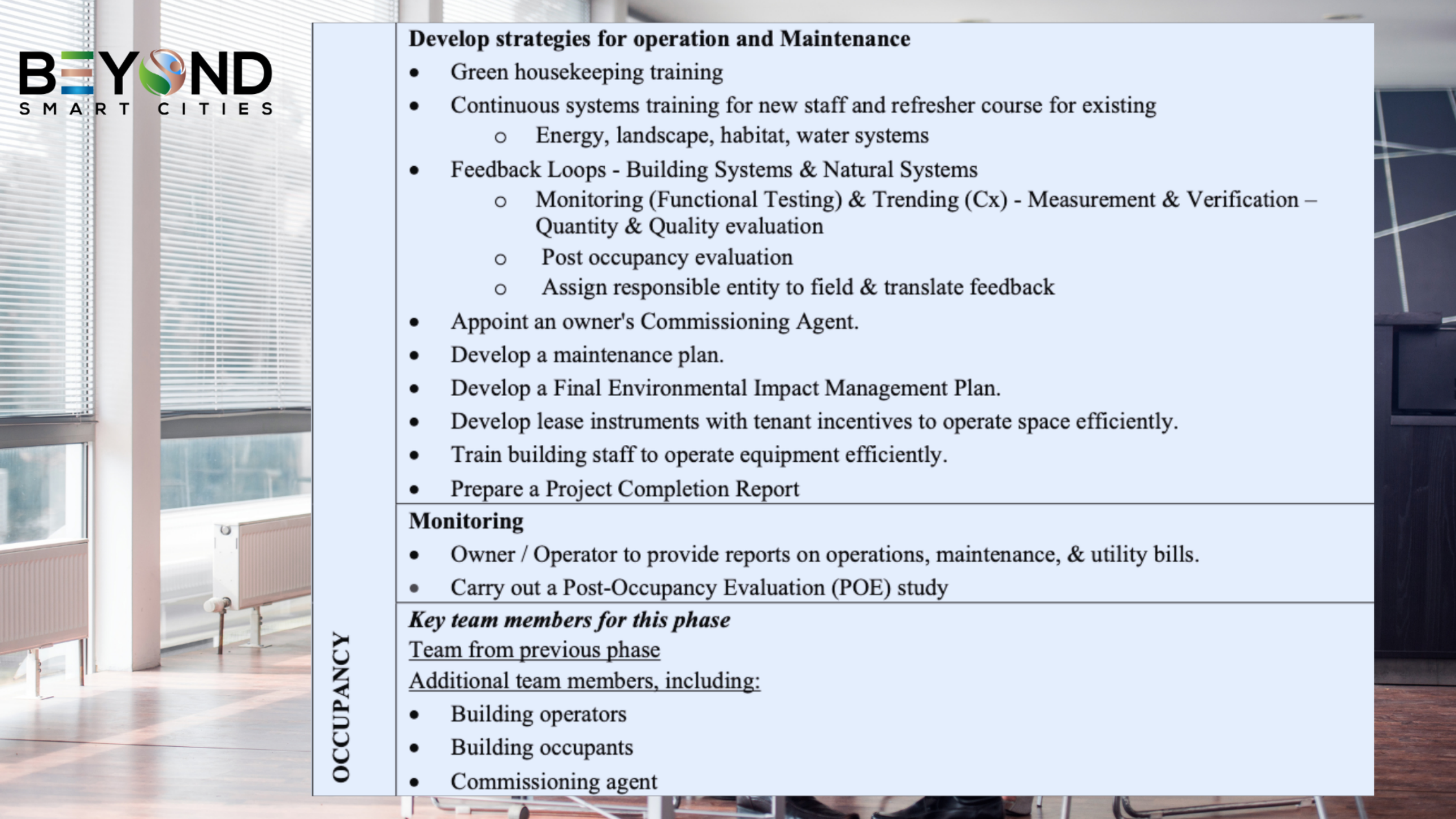
CONCEPT DESIGN OR EARLY SCHEMATİC DESİGN	• Assess the refined analysis of flows, relationships, and economics between project program and the base conditions ○ Energy efficiency and Sources / Microclimates / Building Use ○ Water quality and conservation and local habitat, geohydrology and soils ○ Material Resources ○ Transportation impact of occupants and users ○ Indoor Environmental Quality Issues ○ Community System relationships – Habitat health restoration; the interrelationship of natural systems with human systems • Review any integrative cost bundling studies in process – refine as necessary • Evaluate the building or project program in light of the above findings • Iterate design concepts with the above and set up a schedule to make sure all the issues are in play throughout the design process. • Confirm alignment around the purpose and aspirations of the project with client and design and construction team members • Confirm the alignment of client, design, and construction (or cost estimating) team around the objectives and aspirations • Review any Integrative cost bundling studies in process – refine as necessary • Reconfirm metrics and benchmarks (LEED, etc.)

	Key team members for this phase Core team from previous phase Additional team members, including: • Energy specialist • Cost consultant • Certification coordinator • Commissioning agent • Valuation professional
DESIGN DEVELOPMENT	**Develop Concept Design** • Finalize performance targets • Develop a concept plan, using functional requirements as a starting point. • Orient the building to optimize passive solar potential, and relate fenestration requirements to orientation. • Establish configuration & floor plate depth to balance daylighting & thermal performance. • Consider the possible roles of natural, hybrid or mechanical ventilation systems. • Consider whether cooling will be needed. • Examine the potential role of renewable energy systems. • Examine the most efficient forms of non-renewable heating, cooling and ventilation systems. • Determine floor-to-floor heights, taking into account possible future uses. • Carry out a first set of detailed energy simulations or energy analysis. • Prepare the Concept Design Report. • Refine costs as necessary – Continuous value engineering • Reconfirm Metrics and Benchmarks (LEED, etc.) • Verify alignment of schematic design proposals with purpose and goals of project document rating system credits (LEED, etc.)
	Select building structure • Consider column spacing and core position. • Consider measures to reduce embodied energy of the structure. • Consider thermal storage options using the structure as a heat sink. • In residential occupancies, consider appropriate balcony design. • Decide on building structure type taking into account the considerations above.
	Develop building envelope design • Select basic exterior wall systems. • Assign fenestration on each orientation to optimize daylighting and thermal benefits • Optimize the daylighting and thermal performance of fenestration. • Consider the use of operable windows. • Consider measures to reduce the embodied energy of the building envelope. • Optimize envelope detailing and thermal performance • Carry out a second set of detailed energy simulations
	Develop preliminary lighting and power system design • Develop preliminary lighting system design. • Estimate the power requirements for future tenant and occupant equipment. • Optimize the energy efficiency of vertical transportation systems. • Develop strategies to shave peak demand. • Summarize lighting issues for Comfort and Productivity Performance Plan

	Develop preliminary Ventilation, Heating and Cooling system designs • Develop preliminary ventilation system design. • Develop preliminary design for heating central plant. • Develop preliminary design for cooling central plant. • Consider thermal storage options using mechanical systems. • Develop preliminary design for ventilation, heating, and cooling delivery systems. • Develop preliminary ventilation, heating and cooling control systems. • Complete energy simulations assessing whole building design performance. • Summarize HVAC issues for the Comfort and Productivity Performance Plan. • Prepare a Design Development Report.
	Select materials • Minimize use of materials or components that rely on scarce material resources. • Select materials that balance durability and low embodied energy. • Consider re-use of components and recycled materials. • Design assemblies and their connections to facilitate future demountability. • Select indoor finishing materials to minimize VOC and other emissions.
	Complete design and documentation • Complete site development plan to minimize potable water consumption. • Design plumbing and sanitary systems to minimize water consumption. • Complete appropriate rain screen and pressure equalization envelope details. • Finalize lighting system design. • Finalize ventilation, heating, and cooling system designs. • Confirm adequate space exists for data and communications systems. • Select building energy management control systems. • Review the use of materials to minimize waste. • Carry out a final set of energy simulations. • Produce a final Longevity and Adaptability Plan • Prepare a final Life Cycle Cost Report. • Produce a final Occupant Comfort and Productivity Plan.
DESIGN DEVELOPMENT	***Key team members for this phase*** Team from previous phase Additional team members, including: • Contractor (sooner if possible) • Operation and maintenance staff • Materials expert • Acoustician • Client's marketing representative (if appropriate) • Industry and academic experts

CONSTRUCTION	**Develop strategies for construction** • Develop plan to minimize C&D wastes during construction. • Develop Final Site Impact Management Plan. • Develop a Final Quality Assurance Plan • Develop a Commissioning Plan for all major systems. • Prepare the Pre-Construction Report.
	Construction documentation
	Bidding and negotiations • Pre-bid & post award conferences to explain unique aspects of project • Detailed review of drawings and specifications

CONSTRUCTION	**Construction** • Confirm client-design team-stakeholders-contractor alignment • Refine documentation and performance calculations to validate final design • Verify alignment of construction with purpose and goals with commissioning authority and contractor • Closeout process and training
	Key team members for this phase Team from previous phase Additional team members, including: • Specification writer • Contractor (sooner if possible) • Commissioning authority • Project manager



OCCUPANCY

Develop strategies for operation and Maintenance

- Green housekeeping training
- Continuous systems training for new staff and refresher course for existing
  - Energy, landscape, habitat, water systems
- Feedback Loops - Building Systems & Natural Systems
  - Monitoring (Functional Testing) & Trending (Cx) - Measurement & Verification – Quantity & Quality evaluation
  - Post occupancy evaluation
  - Assign responsible entity to field & translate feedback
- Appoint an owner's Commissioning Agent.
- Develop a maintenance plan.
- Develop a Final Environmental Impact Management Plan.
- Develop lease instruments with tenant incentives to operate space efficiently.
- Train building staff to operate equipment efficiently.
- Prepare a Project Completion Report

Monitoring

- Owner / Operator to provide reports on operations, maintenance, & utility bills.
- Carry out a Post-Occupancy Evaluation (POE) study

Key team members for this phase

Team from previous phase

Additional team members, including:

- Building operators
- Building occupants
- Commissioning agent



INTEGRATED DESIGN APPROACH TO SUSTAINABILITY EDUCATION

Architects must collaborate with other disciplines as design leaders. Energy efficiency and interdisciplinary approaches are needed in architectural education due to rising sustainability, technology, and collaboration trends. Sustainability and multidisciplinary work are accelerating, which necessitates sustainability education. Architectural students should learn about sustainable, multidisciplinary integrated design processes.

INTEGRATIVE PROJECT PLANNING AND DESIGN

INTENT

Maximize opportunities for integrated, cost-effective adoption of green design and construction strategies, emphasizing human health as a fundamental evaluative criterion for building design, construction and operational strategies. Utilize innovative approaches and techniques for green design and construction.

REQUIREMENTS

- Use cross-discipline design and decision making, beginning in the programming and pre-design phase. At a minimum, ensure the following process:
- Owner’s Project Requirements Document. Prepare an Owner’s Project Requirements (OPR) document. Develop a health mission statement and incorporate it in the OPR. The health mission statement must address "triple bottom line" values—economic, environmental and social. Include goals and strategies to safeguard the health of building occupants, the local community and the global environment, while creating a high-performance healing environment for the building’s patients, caregivers and staff.



PRELIMINARY RATING GOALS.





As early as practical and preferably before schematic design, conduct a preliminary LEED meeting with a minimum of four key project team members and the owner or owner's representative. As part of the meeting, create a LEED® action plan that, at a minimum:

- Determines the LEED certification level to pursue (Certified, Silver, Gold, or Platinum);
- Selects the LEED credits to meet the targeted certification level; and
- Identifies the responsible parties to ensure the LEED requirements for each prerequisite and selected credit are met.

I**ntegrated Project Team.** Assemble an integrated project team and include as many of the following professionals as feasible (minimum of four), in addition to the owner or owner's representative.

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CONCLUSION





- Globalization today has led to a collaborative process that focuses on the design, construction, operation, and occupancy of buildings throughout their lifecycle.
- This approach, involving a well-organized, multidisciplinary team, creates high-performance, sustainable buildings while minimizing costs, time, and effort.
- The integrated design approach, which involves a shared vision and holistic perspective, creates economic and environmental benefits in the context of sustainability.
- By utilizing integrated design, the project team can work together in a multidisciplinary and collaborative way during early design phases, significantly impacting the performance of buildings throughout their lifecycle.

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