INTEGRATED DESIGN PROCESS

BEST PRACTICES FOR COMMERCIAL FACILITIES

TABLE OF CONTENTS

What is the integrated design process (IDP)?

- An alternative to the conventional design process.
- Based on holistic systems' optimization, iterative approach and lifecycle costing lead to energy and emission savings.
- Relies on diverse expert and stakeholder collaboration to help avoid sub-optimal design choices.
- Is most effective at the early design stage, but can provide benefits at any stage.

THE CONVENTIONAL DESIGN PROCESS

Develop owner's project requirements (OPR)*

This document details the owner's needs, objectives, scope, size and type of overall site and structures, plus lifecycle plans.

Preliminary design

Architect and client commit to general design concepts including orientation, layouts, structural scheme, general exterior appearance, windows, doors and basic materials.

Basic design

Mechanical and electrical engineers follow general design concepts and suggest appropriate systems based on standards and industry conventions.

Detailed design

Systems and equipment are selected in successive stages, focusing on typical options that will work within conventional design constraints.

This process is predictable in terms of timing, budget and outcomes, but it limits opportunities to consider ideas from all stakeholders and it limits the potential of achievable facility performance.

* Owner's project requirements (OPR) is the most common term, but terms also used include: functional program, design briefs, facilities programs and space needs analysis.

COMPARING THE INTEGRATED AND CONVENTIONAL DESIGN PROCESSES

Integrated	Conventional
Includes all project stakeholders from the outset.	Only includes expanded team members when necessary.
Invests time and energy at a large scale at the start of the project.	Dedicates less time, energy and collaboration at the start of the project.
Decision-making is influenced by a large interdisciplinary team.	Majority of decisions made by a limited number of stakeholders.
Iterative process.	Linear process.
Systematic and comprehensive design process.	Systems thinking process, often siloed.
Strives for complete optimization.	Optimization is limited by constraints.
Seeks synergies.	Less proactive search for synergies.
Incorporates lifecycle cost analysis.	Focuses on initial costs.
Design iterations continue post-occupancy.	Design process ends with delivery of final construction.

KEY FEATURES OF IDP

- **Early appointment of the design facilitator,*** who must be an expert-level project manager and facilitator. Ideally, the design facilitator also has energy and emissions reduction expertise.
- **Formation of an interdisciplinary team*** of specialists, operations staff and other stakeholders at the early design phase.
- **Budget parameters are applied at the whole-facility level**, with no strict separation of budgets for individual facility systems. This provides flexibility to consider approaches that provide overall net benefits.
- **Testing and demonstration of various design assumptions** using modelling and simulation software throughout the process, to provide objective feedback.
- **Consideration and evaluation of design features that allow for future flexibility** and technology enhancements, such as renewable energy, electric vehicle charging, design for aging, emergency preparedness, etc.
- **Early and ongoing coordination** with commissioning and operational readiness teams.

* Refer to appendices for more information.

IDP GENERAL STEPS

1. Participate in and review the OPR to establish performance targets and strategies.
2. Assemble design team and identify missing specialists.
3. Hold a kickoff design workshop.
4. Assess site conditions and consider site development issues.
5. Develop concept design.
6. Select building structure type.
7. Develop building envelope design.
8. Develop preliminary daylighting, lighting and power system design.
9. Develop preliminary heating, cooling and ventilation system design.
10. Screen materials for environmental performance.
11. Complete design and contract documentation.
12. Develop quality assurance strategies for construction and operation.
13. Closely measure, monitor, support and report performance of project execution, commissioning and transition to operations.

IDP BENEFITS AND COSTS

Benefits in project cost savings, lifecycle costs and quality

- Early coordination of systems can maximize effectiveness and reduce total project costs.
- Experienced cross-functional team shares risk and encourages confidence in pursuit of more aggressive targets.
- Focus on energy efficiency, low-emission systems and lifecycle costs helps ensure sustainability, resiliency and future flexibility.

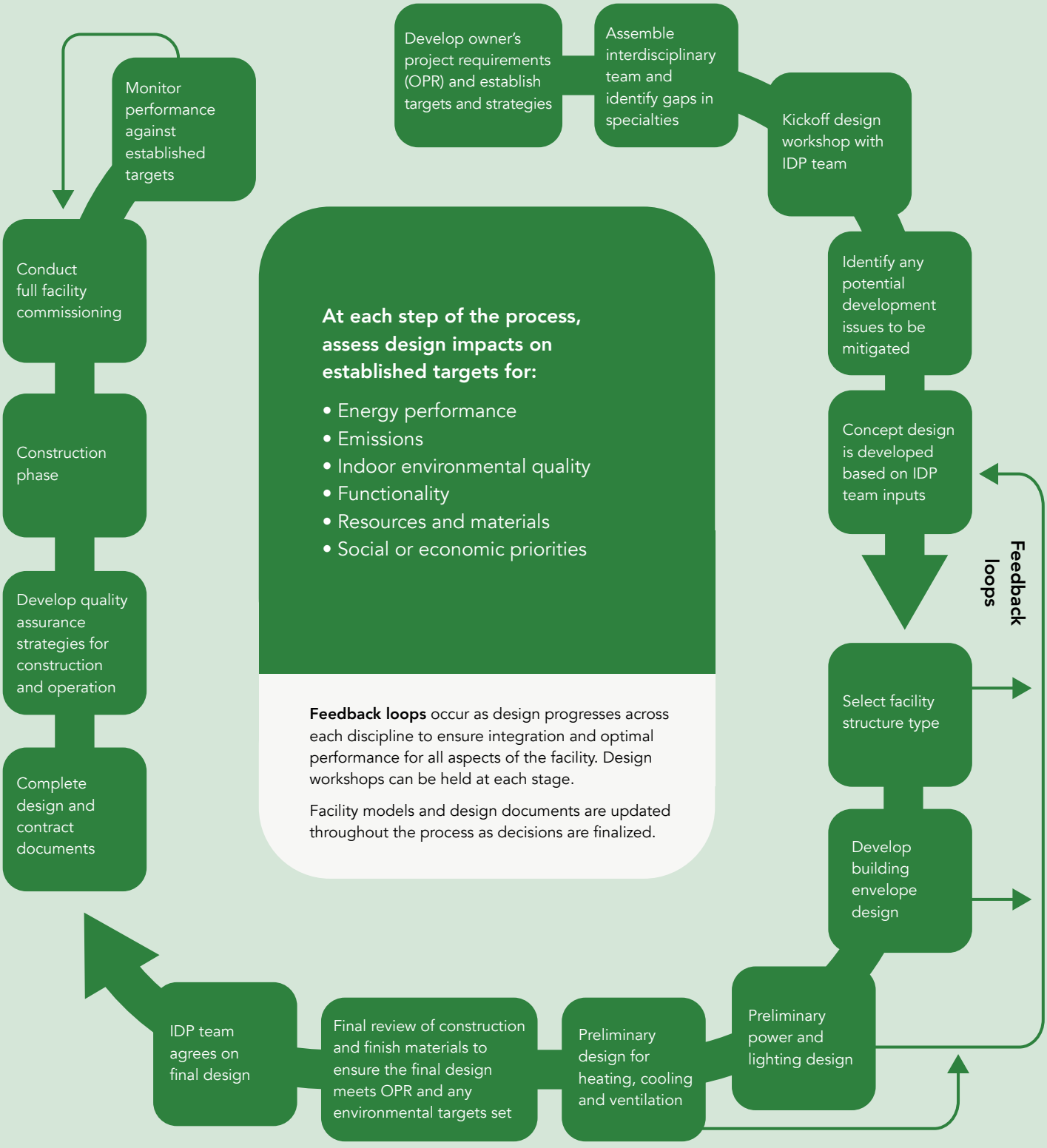
Potential added costs and/or extra time required

- Specialist consulting fees.
- Modelling and simulation costs.
- Greater upfront investment in higher performance building materials and technologies.
- Internal project team members may need more time away from regular duties, requiring overtime or secondment.
- Project timeline may be impacted by availability of resources, data collection and studies.

EXAMPLES OF IDP BENEFITS

Facility type	Project scope	Design stage	**Energy savings** compared to conventional
Manitoba Hydro Place	• Construction of two 18-storey office towers. • 695,250 sq ft. • 377' solar chimney.	Preliminary	**65 – 70%** energy savings by following IDP process and harnessing maximum passive solar, wind, and geothermal energy.
Crestwood Place	• Construction of two matching office towers (Tower 7, Tower 8). • Each 75,000 sq ft.	Basic and detailed design	Tower 7 was built with conventional design management to C-2000 performance requirements, which aims at **50%** energy performance over standard practice. Tower 8 was built following the IDP to achieve **30%** better efficiency than Tower 7.
evolv1	• Construction of a multi-tenant office building. • 3 storeys, 104,000 sq.ft. • First-ever project to receive a Zero Carbon Building design certification under Canada Green Building Council's Zero Carbon Building Standard.	Preliminary	First commercial **net-positive energy** and carbon neutral multi-tenant office building in Canada.

INTEGRATED DESIGN PROCESS



IDP ENERGY AND EMISSIONS FEATURES

The IDP should include the following features to ensure the most important performance elements related to energy and emissions are considered:

1. Early and continuous target setting, training and collaboration

- Provide team members with adequate energy and emissions information and training.
- Integrate efficiency and emissions targets throughout the project.

2. Holistic approach to energy use and emissions

- Whole-building design: evaluate building as a whole, considering interdependencies between building envelope, mechanical systems, lighting and occupancies.
- Lifecycle analysis: assess operations, maintenance and environmental impacts of materials and systems over building life.

3. Energy modelling and simulation

- Use advanced energy modelling tools to simulate building performance with different designs.
- Conduct iterative simulations to refine and improve throughout the process.

4. Objective consideration of sustainable building materials and technologies

- Evaluate materials for embodied energy and thermal performance.
- Evaluate high-efficiency options, alternative/renewable energy sources (solar panels, geothermal) and advanced lighting systems (LEDs, daylighting).

5. Passive design strategies

- Evaluate building orientation and layout to consider natural light and ventilation, reducing the need for artificial lighting and mechanical cooling/heating.
- Consider thermal mass and high-performance insulation to maintain stable temperatures, reducing reliance on heating and cooling systems.

6. Design for flexibility and scalability

- Consider modular systems that can be easily expanded or reconfigured to accommodate future changes in building use or occupancy.
- Consider current or future energy storage and demand response solutions strategies to manage peak loads and enhance energy stability.

7. Operational optimization

- Evaluate various building automation systems (BAS) to monitor, control and manage operational energy.
- Consider designs and technologies to aid in maintenance processes.

8. Commissioning and post-occupancy evaluation

- Plan and support thorough commissioning of systems to verify performance and proper operation.
- Team members conduct post-occupancy evaluations to assess actual energy performance against predicted outcomes, make adjustments and inform future projects.

9. Regulatory and certification alignment

- Ensure compliance with local building codes and regulations related to energy efficiency and emissions.
- Support building and process certifications, such as LEED and ENERGY STAR®, that provide frameworks and benchmarks for sustainability and energy performance.

10. Education and training

- IDP team supports education and training of facilities staff and on the operation and maintenance of systems to ensure optimal performance.
- IDP team supports continuous improvement and formal energy and environmental management systems (ISO 50001).

IDP FOR COMMERCIAL PROJECTS

Design is based on **achieving performance requirements and strategies** defined by the owner's team and may include guidance from:

- The LEED system* of frameworks, guides, rating system and certification (U.S. Green Building Council, Canada Green Building Council).
- Higher performance tiers or steps of Canadian building/energy codes (National Energy Code for Buildings).
- Low thermal energy demand intensity (TEDI) concepts and approaches, as defined in codes and reference documents by ASHRAE†, ISO (International Standards Organization) and others.
- ENERGY STAR for buildings (U.S. EPA, NRCan).
- BOMA, Green Globes, local or regional performance programs.
- Net-zero energy/emissions (ASHRAE, Canada Green Building Council).
- Passivhaus Institute of Germany and international affiliates, represented locally by Passive House Canada.
- ISO 50001 (ISO, NRCan).

* Refer to appendices for more information.

† American Society of Heating Refrigeration and Air Conditioning Engineers.

APPENDICES

OWNER'S PROJECT REQUIREMENTS (OPR)

- The OPR is a high-level document outlining project goals and requirements.
- Summarizes the owner's intent for their team, the design team, the construction team, the commissioning team, operations and maintenance staff, and other parties who may need to understand the original project goals and requirements.
- Should include specific expectations to guide the development of the site and architectural designs, building systems, building envelope and operating plans.
- The OPR is the primary reference to confirm that the design, construction and operation of the project meet the goals and requirements set by the owner.
- As the project progresses, the OPR should be updated to record decisions and tradeoffs made during design and construction.

ROLE OF THE IDP DESIGN FACILITATOR

The IDP design facilitator is a key team member who:

- Is responsible for the project's goals and objectives, and updates them throughout the process.
- Ensures team members have the resources needed to meet their objectives and complete their tasks.
- Is responsible for deadline compliance for specific events.
- Ensures the timely and engaged participation of all team members and experts.

Qualifications

- Skilled in facilitation and managing group dynamics.
- Energy and emissions reduction expertise.
- Expert-level project manager and communicator.
- Familiar with the principles of sustainable development.
- Knowledgeable about the IDP and green building principles.
- Certification in any of the above subject matter is beneficial.

IDP INTERDISCIPLINARY TEAM

Core team

- Owner/project leader
- Design facilitator
- Architect
- Facility engineers (civil, mechanical, electrical)
- Costing specialist
- Energy and energy modelling specialists
- Architectural and drafting modelling specialists
- Operations staff (office, process, maintenance)
- Procurement specialist

Satellite team (as needed)

- Operations support (health, safety, cleaning, security)
- HVAC, lighting, glazing and building envelope specialists
- Noise specialist
- Management accountant
- Ergonomics and accessibility specialists
- Suppliers and utility companies (gas, electricity, water, etc.)
- Cultural specialist
- Business park neighbours
- Local government, transit, traffic, transport planning
- Environmental/ecological specialists
- Landscape architect

IDP AND LEED

- LEED, or Leadership in Energy and Environmental Design, is the world's most widely used green building rating system.
- Backed by the U.S. Green Building Council and the Canada Green Building Council.
- LEED v4, released in 2019, is the first version to require aspects of the IDP.

SOURCES

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- International Initiative for a Sustainable Built Environment
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