The IDP process

Nils Larsson, MRAIC
Executive Director

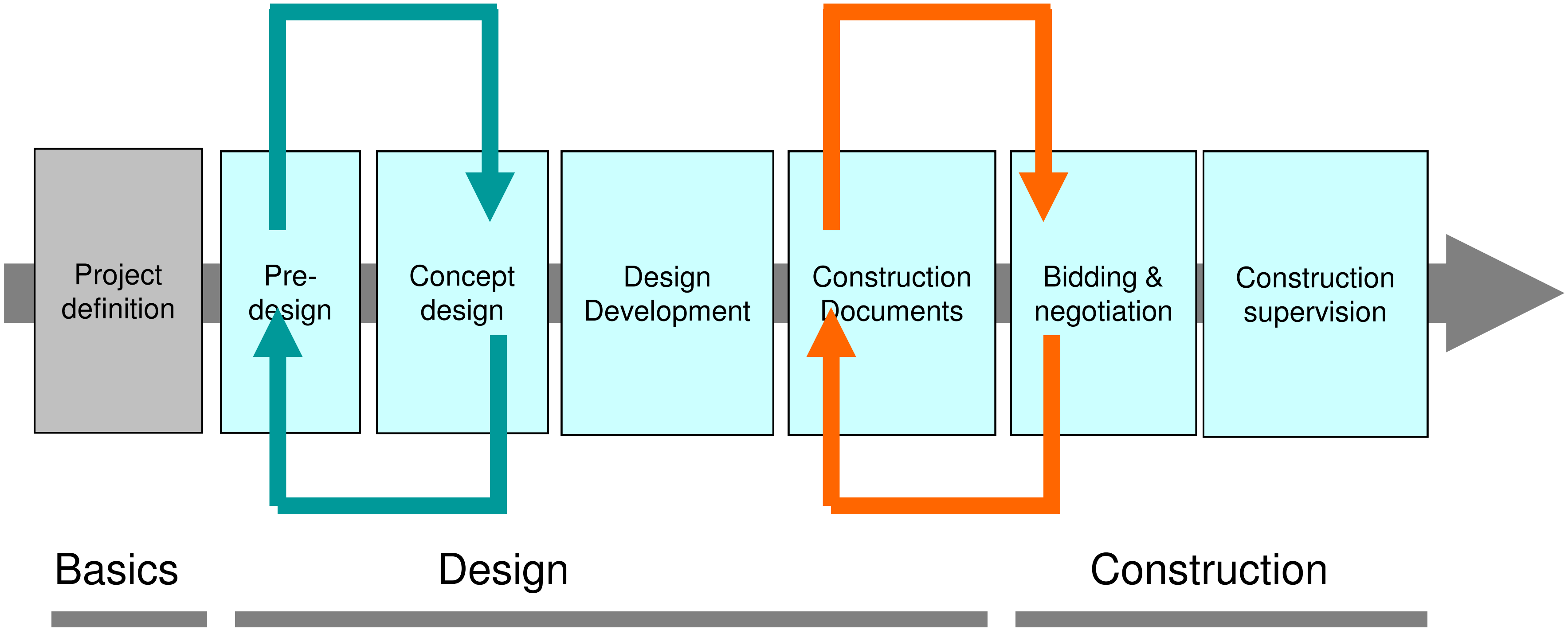
iiSBE

Problems in the conventional process

- The architect may develop a concept design that is agreed to by the client;
- After both parties are committed, then engineers and other key actors are brought in, to ensure that the chosen concept can perform as efficiently as possible;
- That is too late, and the design's performance potential may be limited from its inception;
- There are also new specialties, such as daylighting, thermal storage etc. that require skills not often found in conventional design firms;
- At a later stage, there may be attempts to graft high-performance technologies on to the design, but that is usually an expensive failure.

The Conventional Process

Design iterations are inevitable in any design process, but they only make a positive contribution if carried out early in the process.

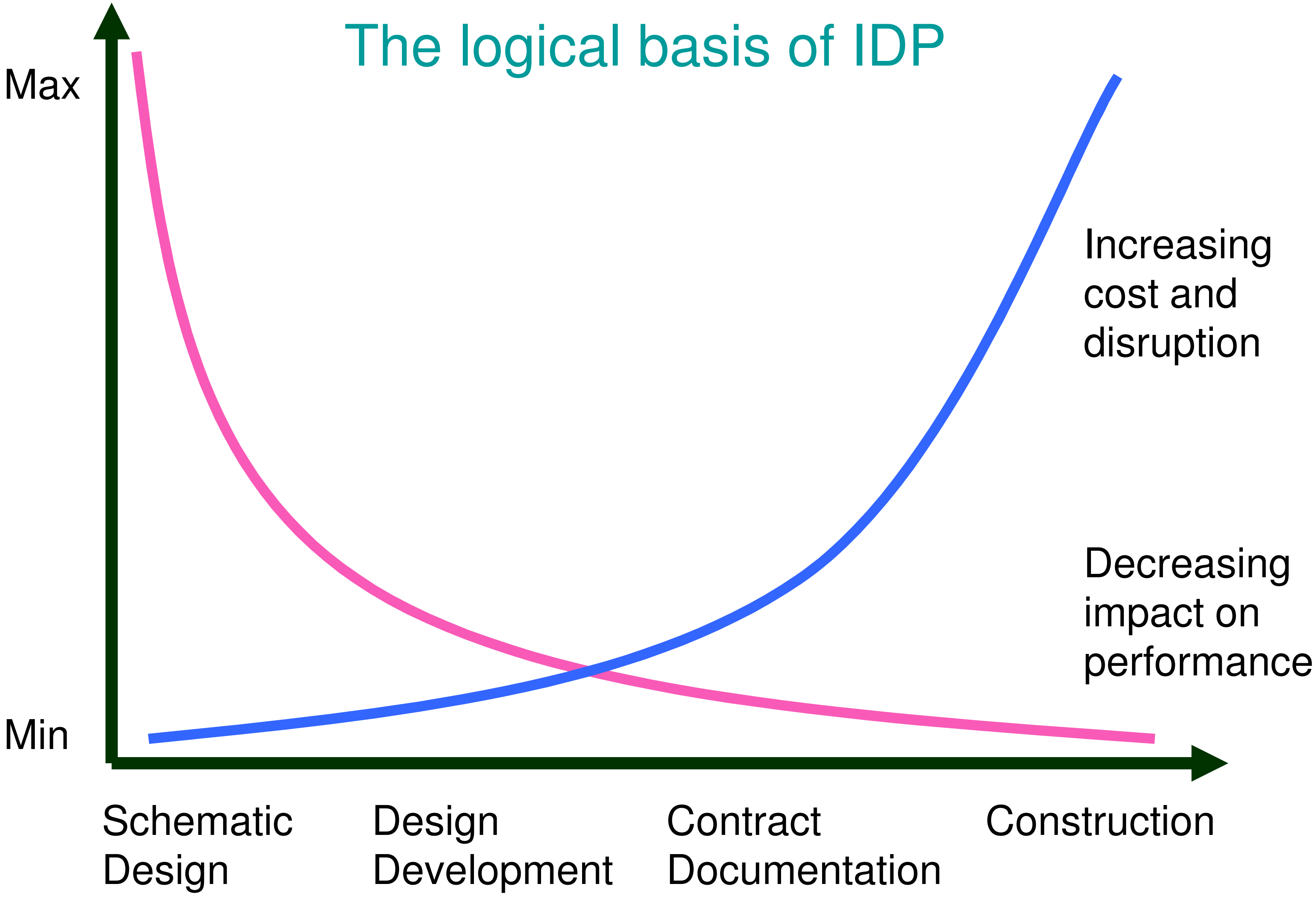


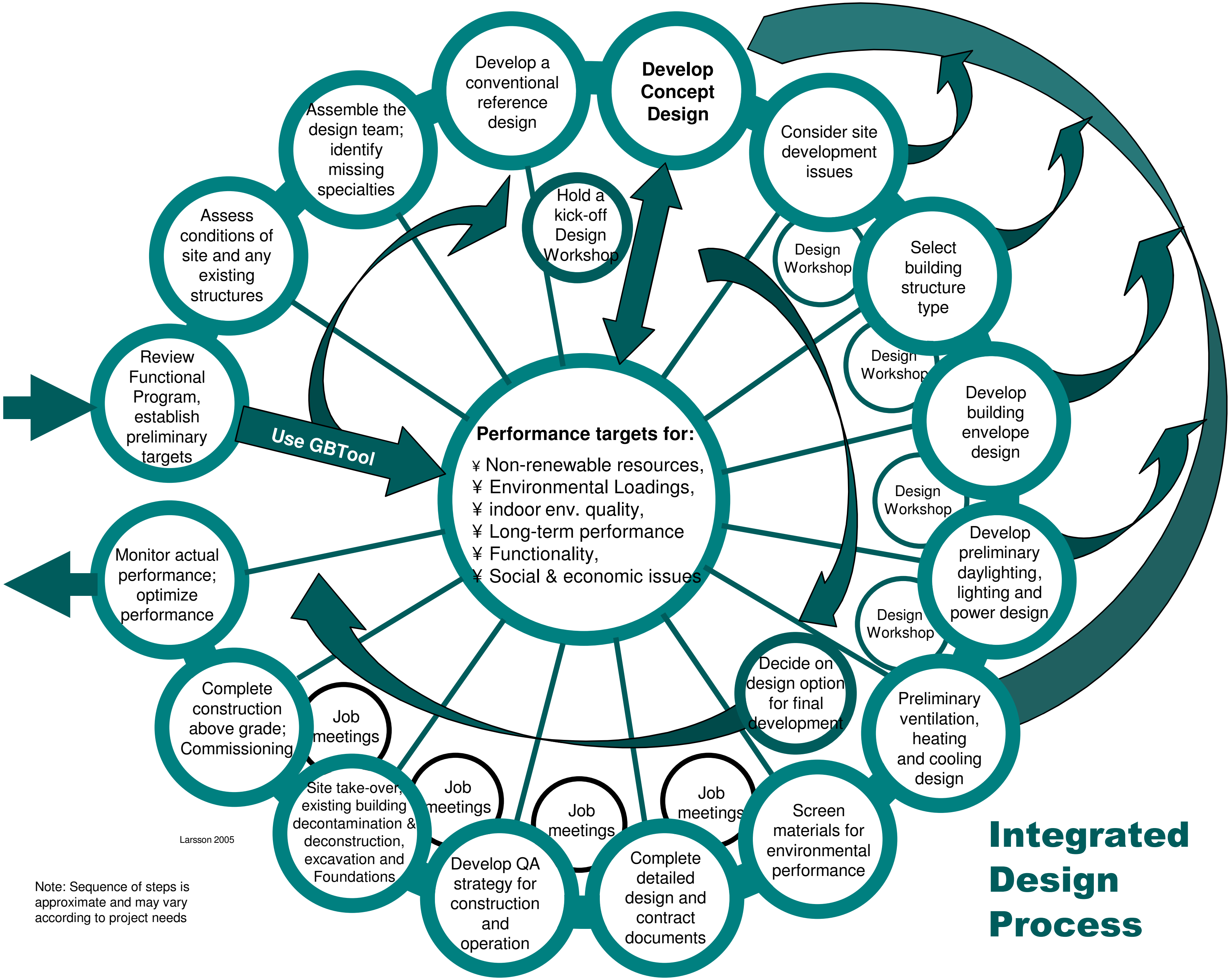
Integrated Design Process

- Experience indicates that changes in the design process can make major contributions to the performance of buildings;
- The *Integrated Design Process* (IDP), developed in Canada and Europe has shown this empirically;
- Primarily developed in the NRCan C-2000 program during the 1994-2003 period;
- International guidelines for IDP were also developed in IEA Task 23;
- We are not claiming to have discovered something new, but have applied old principles that are not being widely used.

What is IDP and why is it a Good Thing?

- IDP is a method to intervene in the design stage to ensure that all issues that can be foreseen to have a significant impact on sustainable performance are discussed, understood and dealt with at the beginning of the design process;
- IDP helps the client and architect to avoid a sub-optimal design solution;
- It enables the achievement of high levels of building performance through integrated systems design.


The logical basis of IDP
Max
Min
Increasing cost and disruption
Decreasing impact on performance
Schematic Design
Design Development
Contract Documentation
Construction



Integrated Design Process

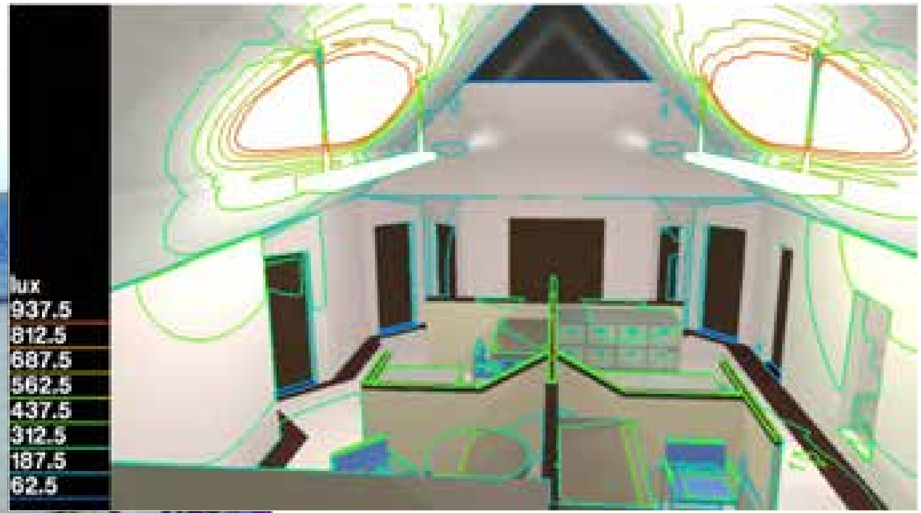
Note: Sequence of steps is approximate and may vary according to project needs

Alice Turner Library, Saskatoon

- >50% energy reduction
- 60% GHG reduction
- Excellent daylighting

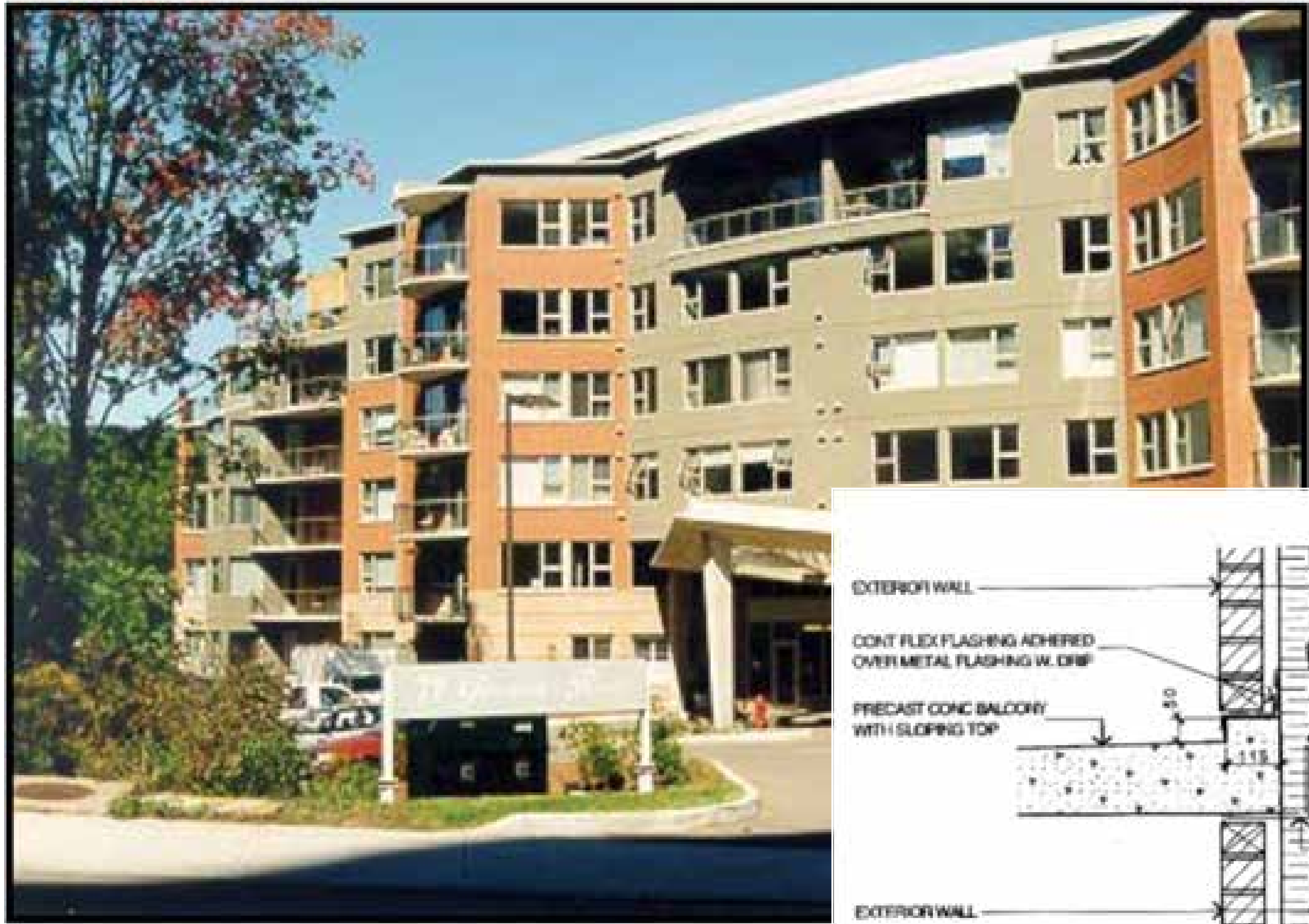
Kindrachuk Agrey Architects Ltd

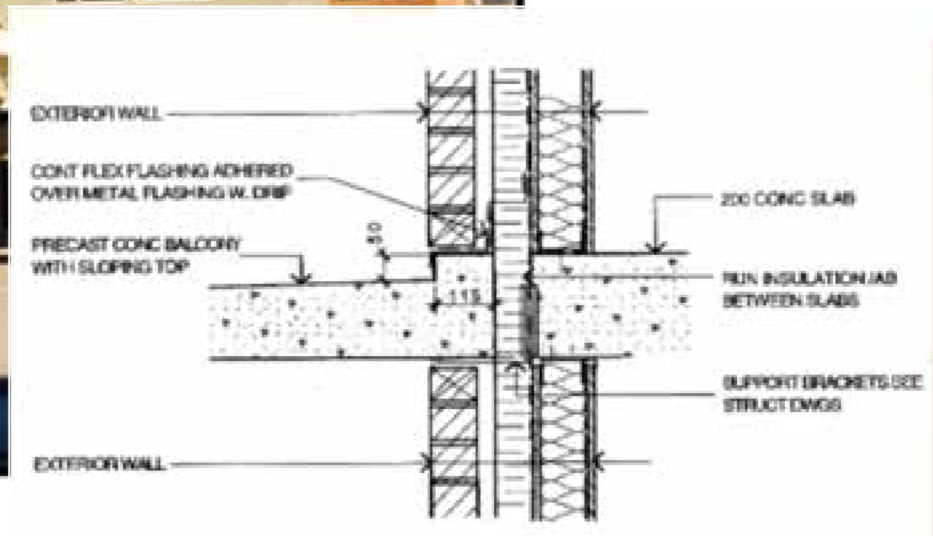
Green on the Grand, Kitchener



- >50% energy reduction
- Excellent daylighting
- Use of engineered wood

Enermodal Engineering and Snider, Reichard & March Architects





C-2000 Condominium in Dundas, Ontario, monitored by Enermodal Engineering

- 48 units in six floors
- Annual energy consumption 137 kWh/m2, more than 35% reduction from MNECB
- Annual water consumption 0.5 m3/m2, 25% of normal

Mountain Equipment Coop, Winnipeg

- 95% of materials in existing structure re-used;
- >50% energy reduction
- About 10% incremental cost

A complex community college project, whose architect (Corbett Cibinel Architects) states that completion on time and budget was only possible through IDP.

Kuwabara Payne McKenna Blumberg & Smith Carter

Manitoba Hydro HQ is the latest.

Target EE:
140 kWh/m2

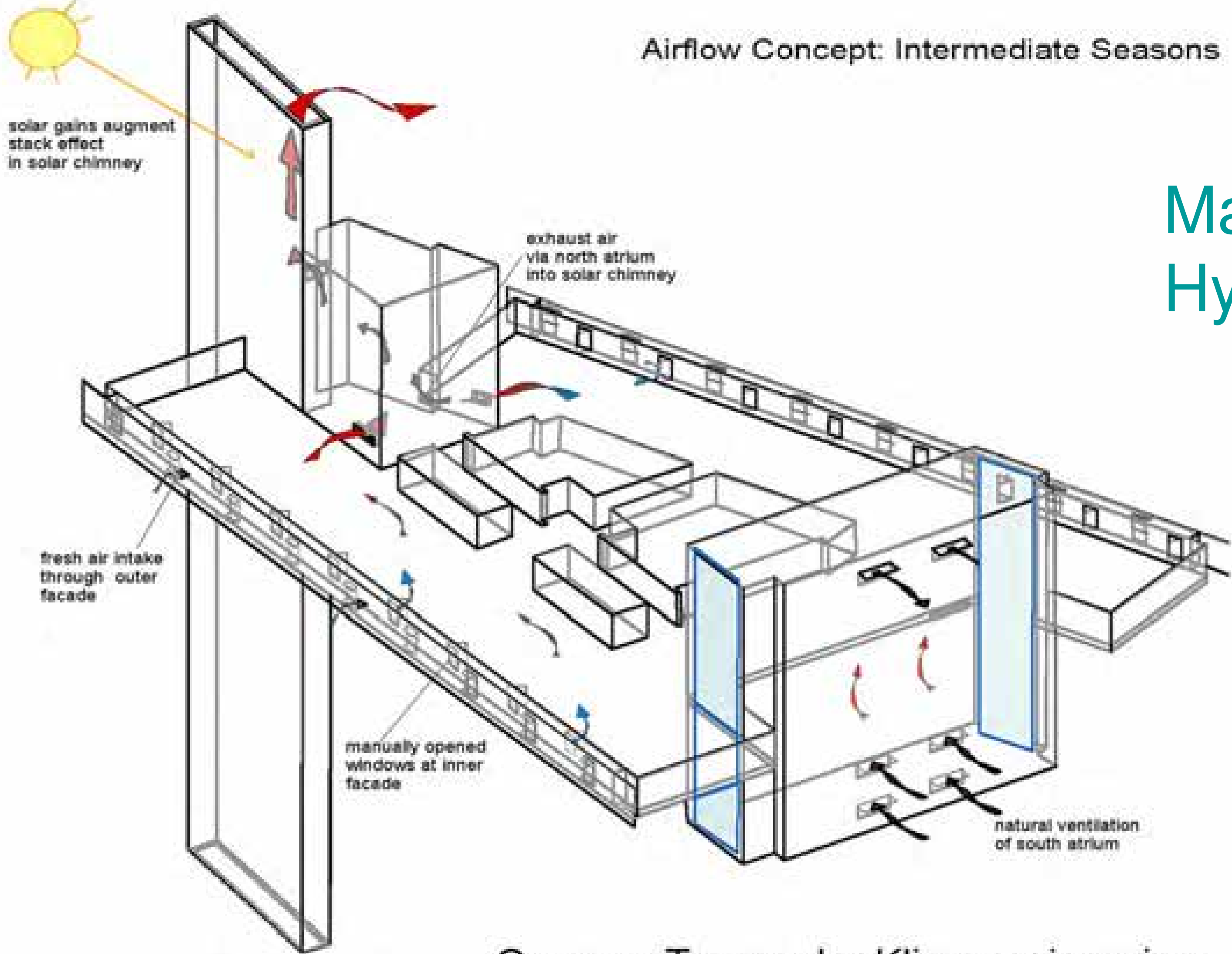
MNECB:
230 kWh/m2

4 Times Sq:
221 kWh/m2

Construction cost: $188 m or $2933 / m2

Energy Efficiency

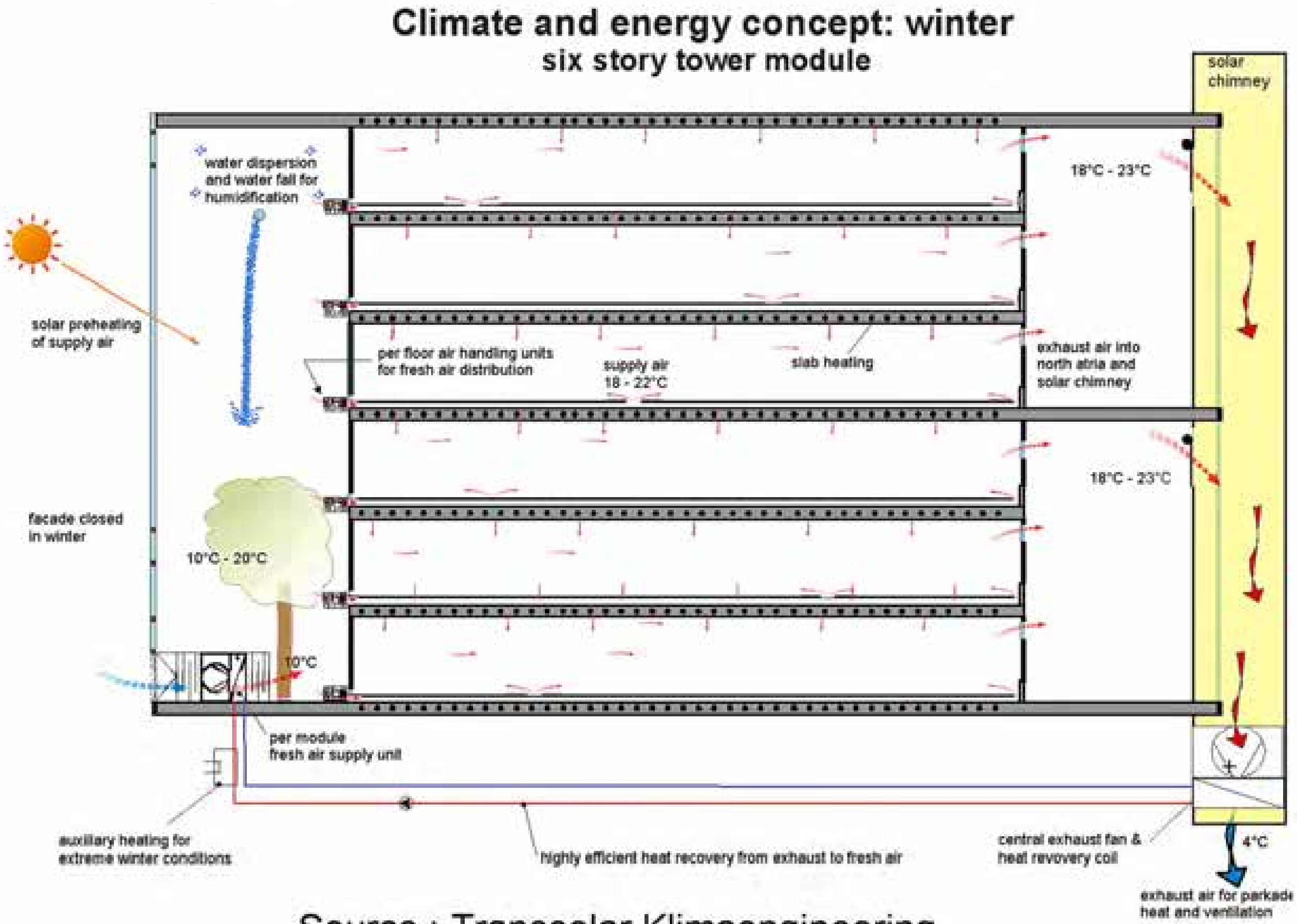
Manitoba Hydro HQ



Source : Transsolar Klimaengineering

Energy Efficiency

Manitoba Hydro HQ



Source : Transsolar Klimaengineering

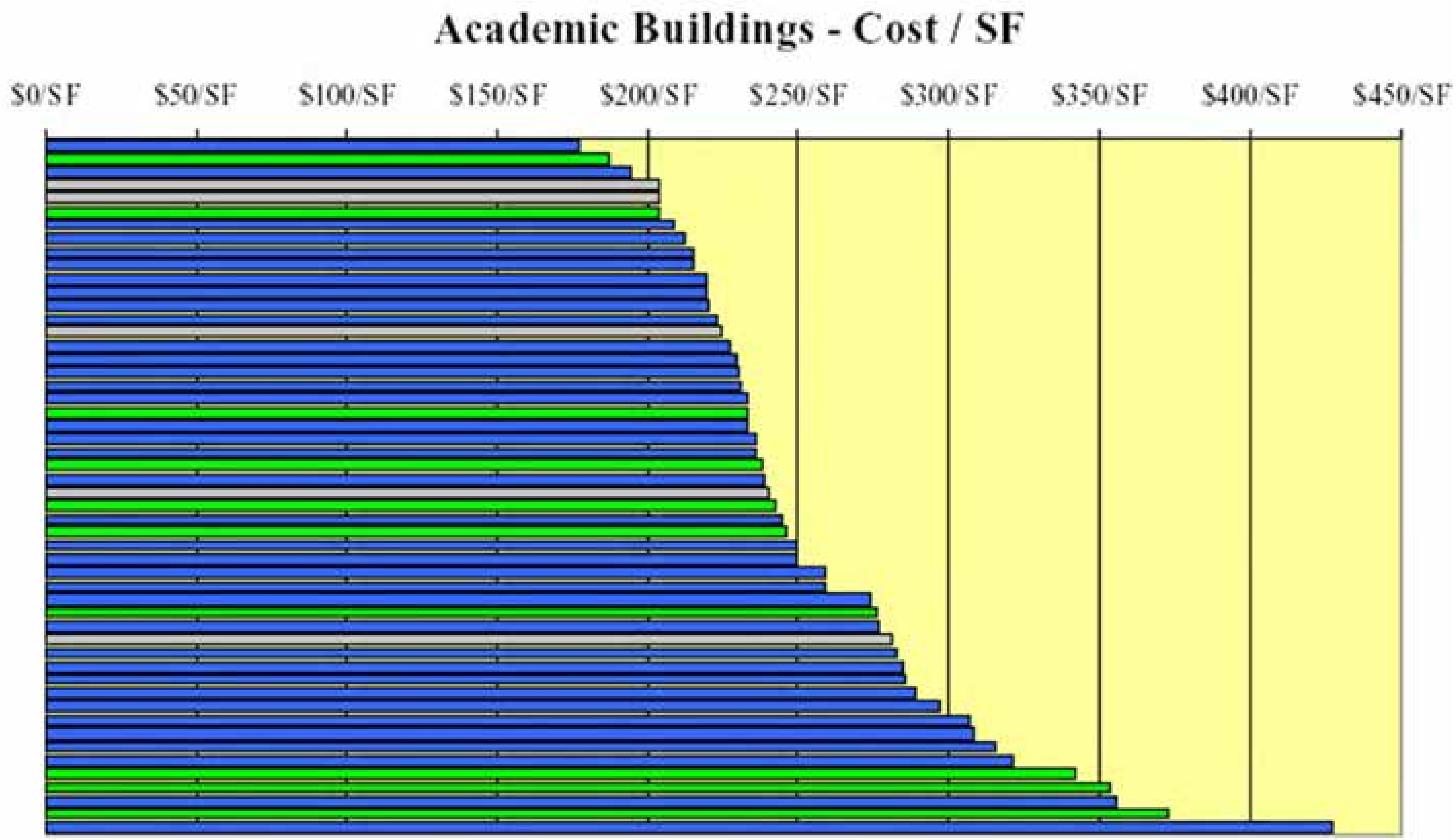
Dockside Green in Victoria by Windmill and VanCity

A total of about 130,000 m2 of residential, office, retail and industrial space.

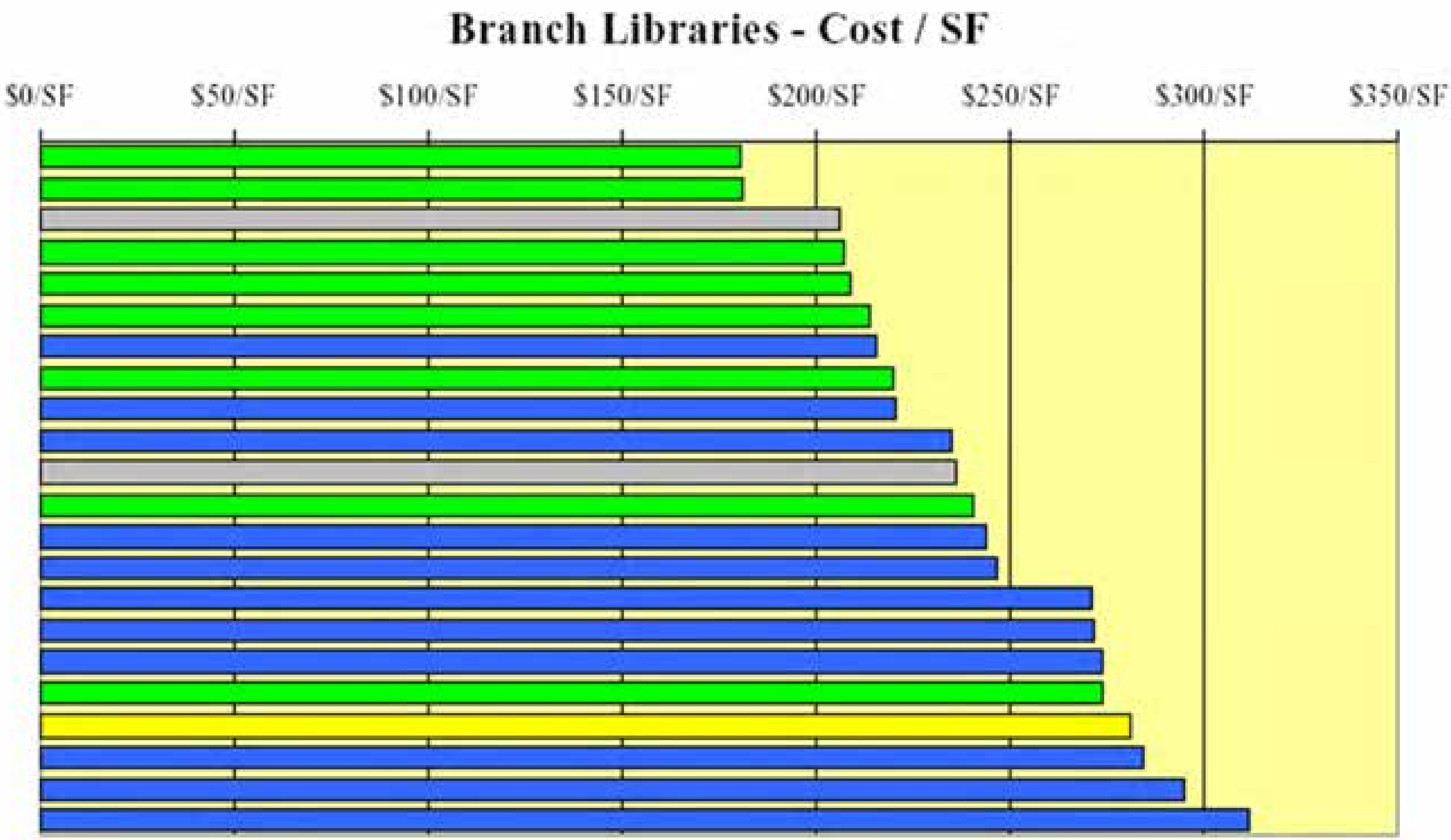
The first phase of the new development has received strong market support, selling out 85% of the units on the first official day of sales.

Targeted to be North America's first LEED Platinum community and is designed to be GHG neutral

The Capital Cost of LEED Buildings (Langdon & Davis)



The Capital Cost of LEED Buildings (Langdon & Davis)



Bar color denotes LEED level attempted – gold for LEED Gold, Silver for LEED silver, and green for LEED Certified.

Benefits to the Building Owner

Figure ES-1. Financial Benefits of Green Buildings Summary of Findings (per ft²)

Category	20-year NPV
Energy Value	$5.79
Emissions Value	$1.18
Water Value	$0.51
Waste Value (construction only) - 1 year	$0.03
Commissioning O&M Value	$8.47
Productivity and Health Value (Certified and Silver)	$36.89
Productivity and Health Value (Gold and Platinum)	$55.33
Less Green Cost Premium	($4.00)
Total 20-year NPV (Certified and Silver)	**$48.87**
Total 20-year NPV (Gold and Platinum)	**$67.31**

Source: Capital E Analysis

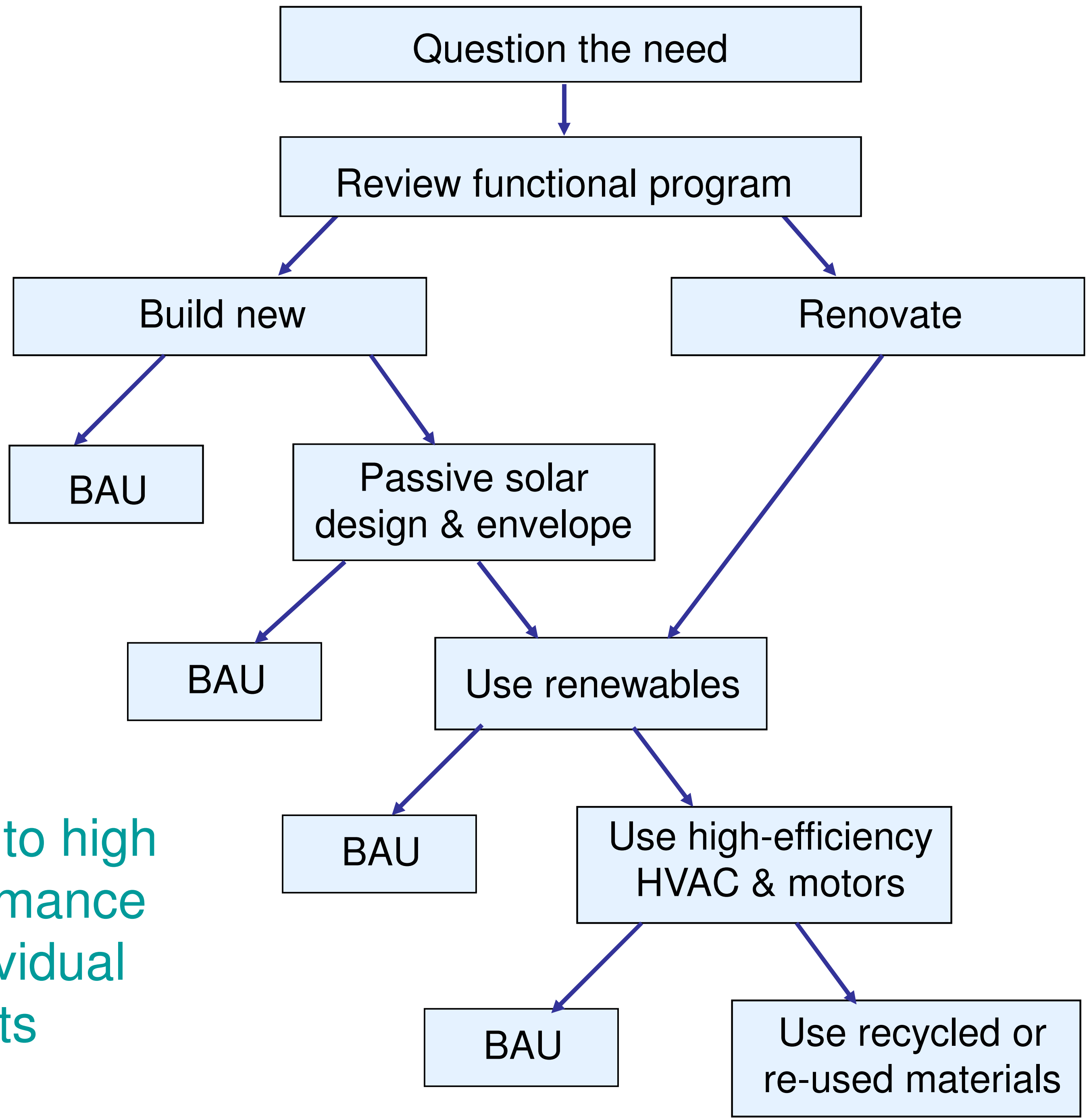
California Sustainable Building Task Force, 2003

An example of the benefit of high performance

- A reduction in energy consumption through better orientation, windows, walls, roofs and equipment will;
  - Reduce fuel and cost required for operation;
  - Reduce the size and / or number of boilers, chillers and pumps needed;
  - Reduce future maintenance and replacement costs;
- A design that maximizes daylighting will reduce the daytime lighting requirement, which;
  - Will reduce electrical consumption for daytime lighting;
  - Less daytime lighting will reduce the need for cooling;
  - This will reduce duct sizes and chiller capacity needed;
  - Which will, in turn, reduce current operating cost and future maintenance and replacement costs;
- Both of these approaches will reduce greenhouse gas emissions.

The elements needed for high performance

- A client who cares and who has an adequate budget is the starting point;
- The skill and knowledge of the design team is undoubtedly of major importance;
- The characteristics of the site is also key, since this can strengthen or weaken the ability of the designers to take advantage of orientation, prevailing winds, solar access etc;
- The availability of materials and equipment that support high performance is also important;
- A skilled construction team that cares about quality is the final element needed to produce an excellent building;
- And then, to take advantage of the potential, skilled operators are needed.



Steps to high performance in individual projects

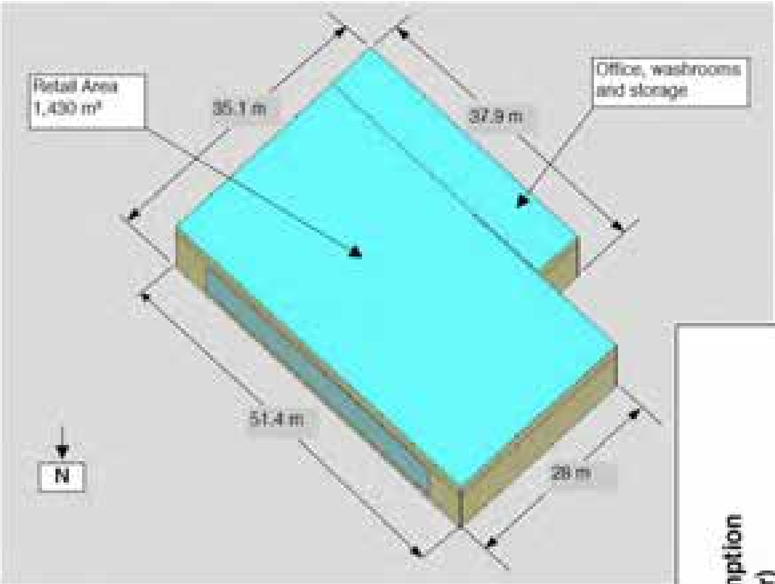
The integrated design process

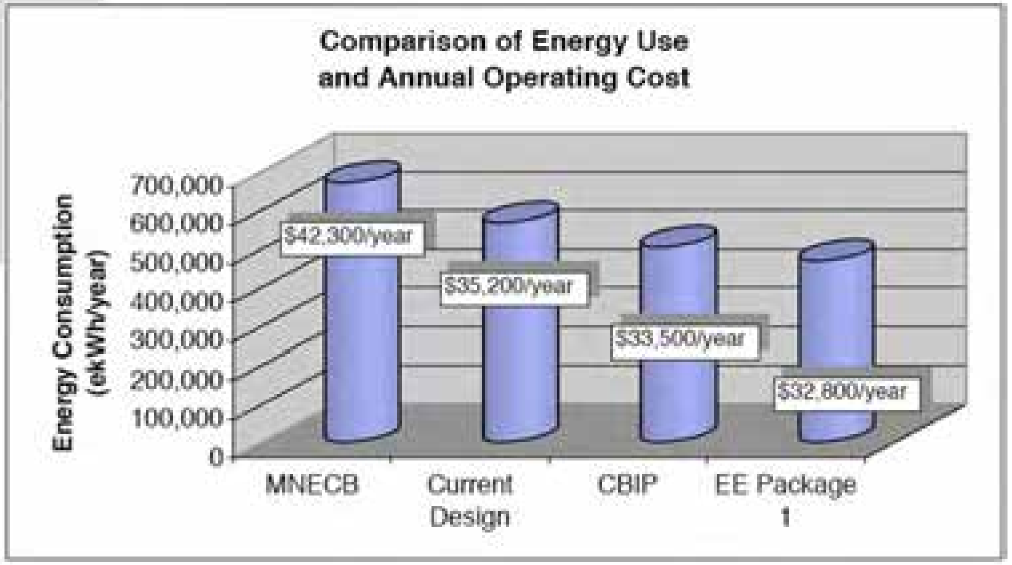
- The principle is to explore potential issues at the very beginning of the design process, and to hear viewpoints of the relevant actors in the process - from design to operation;
- And then to follow a design process that explores performance options in schematic way, before making a decision to proceed with contract documentation;
- This reduces the possibility of unpleasant surprises later in the process.

The integrated design process in more detail

- A reference design needs to be established, to establish performance benchmarks;
- These can be supplemented by non-energy benchmarks from a green building rating tool such as LEED or SBTool, but these may need to be modified to be relevant to local conditions;
- Performance goals for the project need to be defined, so that both client and designers know what they are aiming for;
- At least one, and preferably two, high performance design options should then be developed;
- One of the design options then needs to be selected, based on a full cost-benefit assessment.
- Energy simulations are essential, since they measure the predicted performance in the most important performance area.

An example of a workshop and energy simulations applied to a very small building





We held a one-day workshop to explore possible performance improvements to the standard design of a small store design for a chain of discount stores in small towns.

The total cost of the process, including pre- and post-simulations was $15k.

The Elements

Key elements in IDP

- A committed or at least open-minded client;
- A multi-disciplinary design team committed to high performance;
- A design facilitator and others with specialized supporting skills in energy, ecology, indoor environment, materials, costing, etc. Include also a senior level university student to act as recorder;
- Development of a reference case design, including energy analysis;
- An initial workshop or charrette, including all relevant actors, to table the reference design and to generate a full spectrum of ideas for one or more high-performance options;
- Additional workshops at key points in the process, involving all relevant actors;
- The use of energy and other simulation tools to assess potential performance during the design development process;
- Selection of a design option based on a full cost-benefit assessment before contract documentation begins.

An IDP Support Tool

- We have developed a simple IDP support tool for project managers;
- It was developed under contract to Natural Resources Canada and UNEP (Paris);
- It can be used separately or can link to the SBTool system;
- It is a simple checklist on an Excel spreadsheet;
- As with all iiSBE tools, it is designed to allow easy insertion of local languages and criteria.

iDP

Integrated Design Process Guidance for TBA

To unprotect any worksheet, go to Tools, then Protection. Password is "iDP".

Click 1 to 3 at upper left for detail

IDP steps are shown in a linear sequence, but some steps may be performed in a different sequence or may be repeated, and some may not apply to all project types. See Level 3 for detailed comments. To see text for inactive criteria, go to the corresponding number on the IDPList worksheet.

Actors involved	AR	DF	see list
Links within file and to websites	●	●	
Relevance (0=no, 1=yes, 2=resid., 3=renov.)	1		
Click to show completion of each step	✔		
Percent of relevant steps completed	0%		

A	**Develop a functional program, examine assumptions and establish performance targets**
B	**Assess site characteristics and any existing structures**
C	**Assemble the Design Team**
D	**Develop Reference Design and Benchmarks**
E	**Hold an initial Design Workshop**
F	**Develop Concept Design**
G	**Consider site development issues**
H	**Determine building structure**
J	**Develop Building Envelope Design**
K	**Develop preliminary daylighting, lighting and power system design**
L	**Develop preliminary ventilation, heating & cooling system designs**
M	**Decide on major design options for detailed development**
N	**Screen non-structural materials for environmental performance**
O	**Complete design and documentation**
P	**Develop QA strategies for construction and operation**
Q	**Site takeover, existing building decontamination & deconstruction, excavation & foundations**
R	**Complete above-grade construction**
S	**Implement Commissioning**
T	**Carry out Post-Occupancy Evaluation, operate the building and monitor its performance**

This is the highest level of Key Steps, which can also be seen in more detail

Details of Key Steps

To unprotect any worksheet, go to Tools, then Protection. Password is "iDP".

IDP steps are shown in a linear sequence, but some steps may be performed in a different sequence or may be repeated, and some may not apply to all project types. See Level 3 for detailed comments. To see text for inactive criteria, go to the corresponding number on the IDPList worksheet.

Actors involved: AR DF — see list

Links within file and to websites

Relevance (0=no, 1=yes, 2=resid., 3=renov.): 1

Click to show completion of each step

Percent of relevant steps completed: 0%

72	K3	Estimate the power requirements for future tenant and occupant equipment.	EL		1
			DF		
73	K4	Optimize the energy efficiency of vertical or horizontal building transportation systems.	AR	EE	1
			ME	EL	
74	K5	Develop strategies to shave peak electrical demand.	EE	EE	1
			LD		

L Develop preliminary ventilation, heating & cooling system designs

75	L1	Develop preliminary design for natural or hybrid ventilation system.	AR	DF	1
			EE	ME	
76	L2	Develop preliminary design for space heating system.	ME	AR	1
			EE		
77	L3	Develop preliminary design for space cooling system.	ME		1
			AR		
78	L4	Consider the use of free cooling (night-time flushing) where possible.	ME		1
79	L5	Ground- or water-source thermal storage - not applicable - see ProjectSpec cell C11	ME		0
			GE		
80	L6	Develop preliminary design for refrigeration systems.	ME		1
			GE		

The Process

Reviewing requirements and the functional program

- The program may reflect long experience, but some input may be overlooked, for example, that of operating and maintenance staff or of previous condominium Boards;
- Competitive pressures will probably determine units types and sizes, but assumptions should be checked to ensure there is some flexibility in the future to convert the building to rental, or to a hotel or other use that may become of importance in this area;
- Make sure that the splendid lobby does not absorb the area and funds that were needed for recycling facilities…
- Can parking requirements be reduced?

A	Develop a functional program, examine assumptions and establish performance targets
B	Assess site characteristics and any existing structures
C	Assemble the Design Team
D	Develop Reference Design and Benchmarks
E	Hold an initial Design Workshop
F	Develop Concept Design
G	Consider site development issues
H	Determine building structure
J	Develop Building Envelope Design
K	Develop preliminary daylighting, lighting and power system design
L	Develop preliminary ventilation, heating & cooling system designs
M	Decide on major design options for detailed development
N	Screen non-structural materials for environmental performance
O	Complete design and documentation
P	Develop QA strategies for construction and operation
Q	Site takeover, existing building decontamination & deconstruction, excavation & foundations
R	Complete above-grade construction
S	Implement Commissioning
T	Carry out Post-Occupancy Evaluation, operate the building and monitor its performance

Establishing Reference and Target Benchmarks

A	Develop a functional program, examine assumptions and establish performance targets
B	Assess site characteristics and any existing structures
C	Assemble the Design Team
D	Develop Reference Design and Benchmarks
E	Hold an initial Design Workshop
F	Develop Concept Design
G	Consider site development issues
H	Determine building structure
J	Develop Building Envelope Design
K	Develop preliminary daylighting, lighting and power system design
L	Develop preliminary ventilation, heating & cooling system designs
M	Decide on major design options for detailed development
N	Screen non-structural materials for environmental performance
O	Complete design and documentation
P	Develop QA strategies for construction and operation
Q	Site takeover, existing building decontamination & deconstruction, excavation & foundations
R	Complete above-grade construction
S	Implement Commissioning
T	Carry out Post-Occupancy Evaluation, operate the building and monitor its performance

- The design team needs performance benchmarks for guidance, to define both minimum acceptable and target values;
- To begin with, the Architect should produce a schematic design for a reference design (the one your accountant wants you to build), to facilitate comparisons;
- This will be useful for for energy simulations;
- Benchmarks of local industry values for other parameters, such as water consumption, materials use, IAQ, solid waste handling etc., are also needed.
- Some of these found as standards referred to in municipal regulations, ASHRAE, LEED, etc. but others are not;
- If time and budget permits, it is worthwhile to define a wide spectrum of benchmarks. This may not be worth it for a single building, but may be for a group of buildings.

The Design Charrette(s)

- Hold one or more design charrette(s), intensive but short workshops;
- Specialists can present new ideas that the owner and designers may not be aware of;
- Client and designers can hold frank discussions about their pre-conceptions;
- The feasibility of adopting one or more performance upgrade options can be considered;
- A charrette can be one or two days in length.

A	Develop a functional program, examine assumptions and establish performance targets
B	Assess site characteristics and any existing structures
C	Assemble the Design Team
D	Develop Reference Design and Benchmarks
E	Hold an initial Design Workshop
F	Develop Concept Design
G	Consider site development issues
H	Determine building structure
J	Develop Building Envelope Design
K	Develop preliminary daylighting, lighting and power system design
L	Develop preliminary ventilation, heating & cooling system designs
M	Decide on major design options for detailed development
N	Screen non-structural materials for environmental performance
O	Complete design and documentation
P	Develop QA strategies for construction and operation
Q	Site takeover, existing building decontamination & deconstruction, excavation & foundations
R	Complete above-grade construction
S	Implement Commissioning
T	Carry out Post-Occupancy Evaluation, operate the building and monitor its performance

Preventing chaos

- Involving everyone in all decisions would cause chaos;
- The process can be managed in a disciplined way, with inputs from relevant actors obtained at various definite points in the process;
- Thus, benefits of additional views can be usefully integrated into the design process;
- Which actors are relevant at certain stages depends partly on the nature of the project (e.g. simple and small v. specialized and large building);
- Think of it as conducting a chamber orchestra.

Setting Goals: MEC Ottawa as an example

- Achieve a LEED "Gold" rating.
- Achieve C2000 Program criteria and CBIP compliance
- No use of materials that require CFC's, or HCFC's in their manufacture.
- No use of equipment that uses ozone-depleting substances.
- All new materials to have zero VOC targets.
- 50% of all new materials to have 20% post consumer or 40% post industrial recycled content.
- Use a C&D waste management plan for reuse and recycling and zero land fill.
- Maximum use of salvaged rather than new materials
- Minimum of 80% of all materials must be from within 500 km of the site.
- Minimum of 10% of the energy requirements from renewable energy sources.
- Reuse a minimum of 75% of the existing structure and shell.
- Integrate a maximum number of native & drought tolerant trees and plantings.
- A water conservation plan must be developed.
- High reflective surfaces (albedo) must be used for roofs & parking lots.
- Lighting load at 22 Watts/m^2 or less.

Develop and test alternative designs

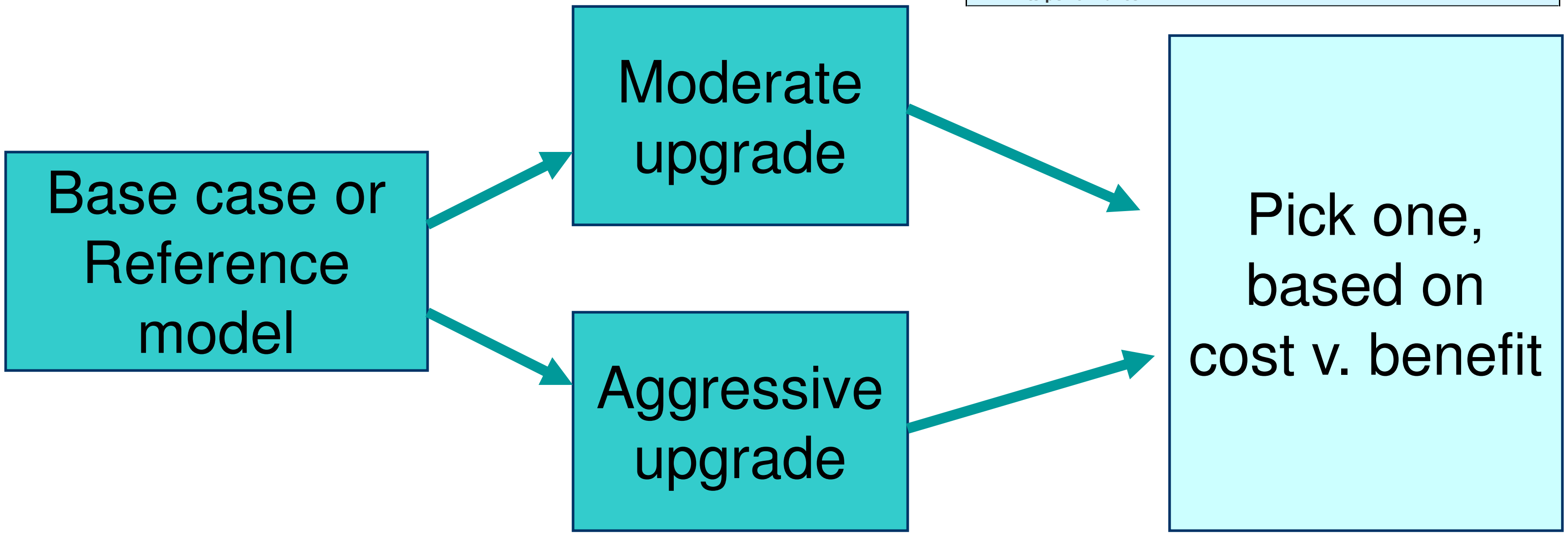
- Develop at least two design upgrade packages, using the Reference Design as a starting point: a moderate and a very aggressive improvement case;
- Carry out simulations for all variants;
- Compare the upgrade packages with the Reference case and select one that is achievable within the budget, but considering also operating savings.

A	Develop a functional program, examine assumptions and establish performance targets
B	Assess site characteristics and any existing structures
C	Assemble the Design Team
D	Develop Reference Design and Benchmarks
E	Hold an initial Design Workshop
F	Develop Concept Design
G	Consider site development issues
H	Determine building structure
J	Develop Building Envelope Design
K	Develop preliminary daylighting, lighting and power system design
L	Develop preliminary ventilation, heating & cooling system designs
M	Decide on major design options for detailed development
N	Screen non-structural materials for environmental performance
O	Complete design and documentation
P	Develop QA strategies for construction and operation
Q	Site takeover, existing building decontamination & deconstruction, excavation & foundations
R	Complete above-grade construction
S	Implement Commissioning
T	Carry out Post-Occupancy Evaluation, operate the building and monitor its performance

Design options and the Moment of Truth

A	Develop a functional program, examine assumptions and establish performance targets
B	Assess site characteristics and any existing structures
C	Assemble the Design Team
D	Develop Reference Design and Benchmarks
E	Hold an initial Design Workshop
F	Develop Concept Design
G	Consider site development issues
H	Determine building structure
J	Develop Building Envelope Design
K	Develop preliminary daylighting, lighting and power system design
L	Develop preliminary ventilation, heating & cooling system designs
M	Decide on major design options for detailed development
N	Screen non-structural materials for environmental performance
O	Complete design and documentation
P	Develop QA strategies for construction and operation
Q	Site takeover, existing building decontamination & deconstruction, excavation & foundations
R	Complete above-grade construction
S	Implement Commissioning
T	Carry out Post-Occupancy Evaluation, operate the building and monitor its performance

Note that "cost" and "benefit" extends to environmental costs and benefits.



Results

- IDP results in design integration, which results in better performance;
- For example, a design that maximizes daylighting will reduce the lighting load;
- Reduced cooling requirement will reduce duct sizes and chiller capacity needed;
- Current operating cost and future maintenance and replacement costs will also be reduced;
- And all this reduces greenhouse gas emissions.

Conclusion

- We can improve the potential performance of new buildings by 50% to 75% by focusing on improvements in the design process;
- The traditional design process locks in bad decisions that will limit performance during the first week of the process;
- The integrated design process offers a path to unlock the full potential of the process by involving all key stakeholders in the process.

Contacts & Info

- http://www.iisbe.org
- http://www.sbis.info
- Nils Larsson, larsson@iisbe.org