iiSBE frameworks for performance targeting and assessment

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Main sections

- SNTool for Neighbourhoods
- SBTool Site
- SBTool for Buildings
- Integrated Design Process
- Post-Occupancy performance evaluation

Purposes of the iiSBE SB Tool set

- To develop simple tools for the establishment of sustainability performance targets and to assess predicted or actual performance for small urban areas and buildings;
- To review the impacts of different weighting schema on overall performance.

Neighbourhoods
are not buildings

Issues that emerge at the neighborhood scale

- In most cases, neighbourhoods are existing entities under continuing development and re-development, with existing structures, uses and population;
- Local roads, pedestrian ways and public green spaces;
- Local transportation, both public and private;
- A mix of public and private infrastructure;
- A variety of physical building types (different sizes and heights);
- The historical origin of a neighbourhood, and significant events during its past, will facilitate or constrain future development.

Can we assess the performance of a neighbourhood?

- Yes and no;
- We can certainly assess the aggregate energy, emissions and water etc. performance at any time, even though it involves much field work;
- And we can make approximate comparisons of the performance of neighborhoods of very similar types (but how many are really similar?);
- If we have information on the base level of performance, we can also set performance targets for the future;
- But to *predict* how they will perform and whether they will reach certain target values is not possible except for new greenfield development areas that are under strict central management;

Neighborhood origins – a sample

The great diversity of neighbourhood origins makes it difficult to make direct comparisons of performance.

Greenfield (unbuilt) land
Vacant land previously used for agriculture or buildings
Park / recreation area
Historical / heritage area
Old industrial area
Central area office zone
Central area shopping zone
Mixed-use area, pre-1950
Mixed-use area, post-1950
Old village absorbed by growing urban area
Old residential suburb, pre-1950
New residential suburb, post-1950
Suburban technology / manufacturing park
University campus
New town, centrally planned
Suburban shopping centre

iiSBE SNTool 2020

Introduction to the iiSBE SN Tool

- The tool is a generic performance assessment framework for rating the sustainable performance of urban areas (clusters and neighborhoods)
- The system can be used by municipalities or non-government organizations (NGOs) to set targets for future achievements or to assess existing performance;
- The scope (number of criteria and indicators) can be varied from a Maximum version (160+ potentially active criteria) to a Minimum version (number of criteria to be defined – currently 34);
- Generic criteria are intended to be modified for local conditions and priorities;

Basic points

- This is a framework, and users must establish performance benchmarks, context factors and weights in order to make it operational;
- The system is set up to allow easy insertion of local criteria in a local language;
- An algorithm provides quasi-objective weighting (relative importance) of criteria;
- No matter how many criteria are active, the sum of weights is always 100%;
- Nevertheless the files are shown with dummy data, so that users can see how the system works;

Structure

- The system consists of 2 linked Excel files;
- The *Settings A* file is applicable to any small urban area in any location;
- *Scoring B* file allows users to adapt the tool to specific local conditions in individual small urban areas that conform to the general conditions established in the A Settings file;
- The *Scoring B* file obtains information about active criteria, weights, benchmarks and their values from File A, and File B must therefore always be able to locate File A.

Structure

- General characteristics defined in File A are copied by relevant fields in File B;
- The information developed for File A can be used in a large number of B Files, to suit generic characteristics defined in File A;
- When the files are separated, part of the contents of File B can be further modified, while key elements remain fixed.

iiSBE SN Tool (File A)

- The A file defines the generic characteristics of criteria applicable to neighbourhoods in general within a specific urban region;
- It allows the scope (number of potentially active criteria) to be established;
- It requires that the user organization review and modify default targets and weights for individual criteria;
- It requires that benchmarks for performance be established (Negative, Minimum, Good Practice and Best Practice);
- Even though File A operates at a generic neighbourhood level, these benchmarks have to be set in relation to established norms in the region where the system is to be active;

The A *Settings* File

- Therefore, the benchmarks for a File A for a desert region will be quite different from a coastal or Alpine region, although many of the same criteria and indicators might be used;
- An important question is the relative importance of performance results for each criterion;
- Criteria are weighted according to a quasi-objective algorithm that operates at the level of individual criteria, taking into account major Issue area, predicted Intensity, Extent and Duration of the effects;
- All scoping, target-setting, benchmarking and weighting steps should be carried out by a third party not directly tied to the success of the results.

Performance issues referenced in SNTool

This list shows the two top levels; Issues and Categories

A	Context and vulnerabilities
A1	Predicted Climate Change impacts in region
A2	Vulnerability to flooding events
A3	Vulnerability to windstorm events
A4	Vulnerability to major fire events
A5	Vulnerability to drought
A6	Vulnerability to earthquakes
B	Built Urban Systems
B1	Urban Structure and Form
B2	Transportation Infrastructure
B3	Other local infrastructure
C	Economy
C1	Economic Structure and Value
C2	Economic activity
C3	Cost and Investment
D	Energy
D1	Non-renewable energy, aggregated
D2	Renewable and Decarbonised energy
D3	Energy recycling and storage

E	Non-Renewable Resources
E1	Potable water, stormwater and greywater
E2	Solid and Liquid Wastes
E3	Resource consumption, retention and maintenance
F	Environment
F1	Ecosystems and landscapes
F2	Environmental impacts
F3	Outdoor environmental quality
F4	Atmospheric emissions
G	Social Aspects
G1	Safety and Accessibility
G2	Traffic and Mobility Services
G3	Communication services
G4	Public and private facilities and services
G5	Local Food
G6	Management and community involvement
G7	Society, Culture and Heritage
G8	Perceptual

SNTool Issue B *Built Urban Systems* showing Category and Criteria titles

(see additional worksheets in Appendix)

B	Built Urban Systems	
B1	Urban Structure and Form	
	B1.1	Concentration of land parcels.
	B1.2	Urban compactness
	B1.3	Building plot ratios
	B1.4	Residential density
	B1.5	Urban street canyons (H/W aspect ratio)
	B1.6	Homogeneity of the urban fabric
	B1.7	Urban diversity
	B1.8	Conservation of Land
B2	Transportation Infrastructure	
	B2.1	Walking distance to public transport for area residents.
	B2.2	Walking distance to public transport for area workers and students.
	B2.3	Extent and connectivity of pedestrian streets and walkways.
	B2.4	Extent and connectivity of bicycle paths separated from vehicular traffic.
	B2.5	Connectivity of the street network
	B2.6	On-street and indoor car parking spaces relative to local population.
	B2.7	Local road network
B3	Other local infrastructure	
	B3.1	Availability and access to a public municipal water supply.
	B3.2	Availability and access to a public sewage disposal system.
	B3.3	Availability and access to a public electrical supply system.
	B3.4	Availability and access to a public telecommunications system.
	B3.5	Availability and access to renewable energy infrastructure.

Weight assignments for use in SNTool weighting Criteria	Weights for sustainability assessment of small urban areas in Lisbon region	iiSBE SNTool A Settings File Max scope 30Nov20

In the Weights table below, authorized users can change text or numbers in yellow cells.

A		B		C		D	
Primary system affected (1 to 3 points)		Impact of Potential Effect (1 to 8 points)		Extent of potential effect (1 to 16 points)		Duration of potential effect (1 to 16 points)	
1	Built environment	1	Minor	1	Building	1	< 3 years
2	Economy	4	Moderate	2	Block	2	3 to 10 years
2	Energy	8	Major	4	Neighborhood	4	10 to 30 years
3	Atmosphere and oceans			8	Urban / region	8	30 to 75 years
2	Non-renewable resources			16	Global	16	>75 years
2	Natural environment	The weights shown in this table are used in the WeightsA worksheet as part of overall weight calculations for criteria. You can modify these important weighting factors.					
1	People, society and culture						

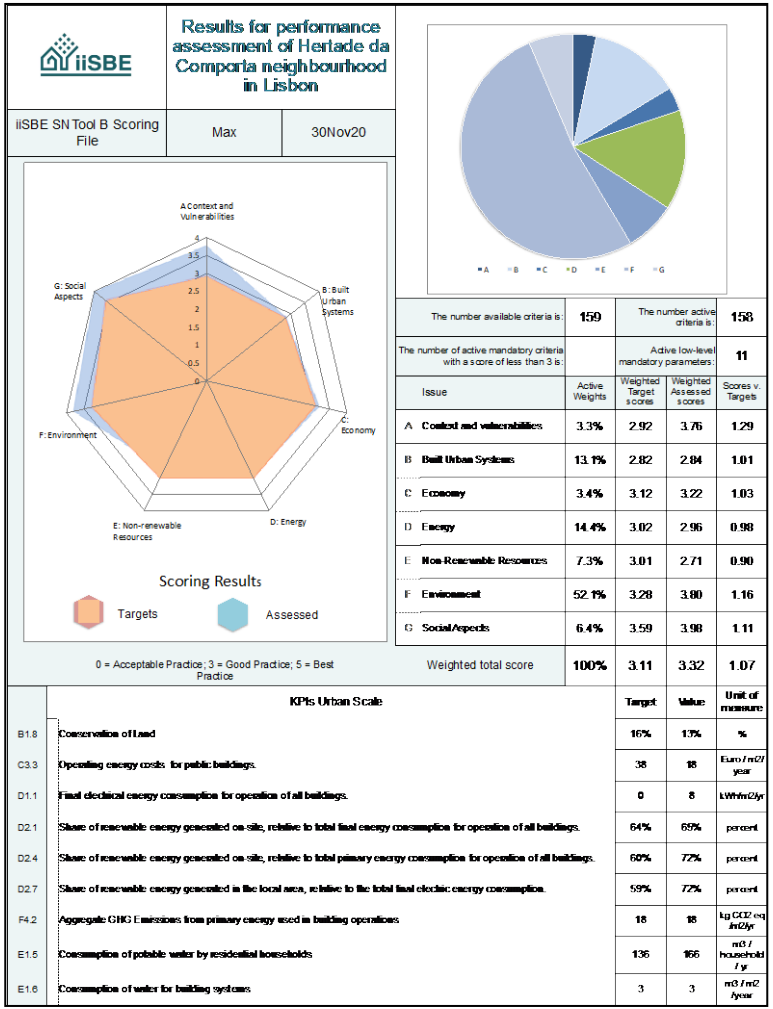
SetWeights worksheet

Key issue weights are set on the SetWeights worksheet.

Weights for parameters are based on degrees of extent, duration and intensity of effect, combined with links to key issue areas.

File B Results

The Results worksheet in File B shows the aggregated scores of all active criteria, with some of both Target and Assessed (calculated) scores shown, as well as the ratio of Assessed Scores to Targets.



iiSBE

Results for performance assessment of Herlade da Comporta neighbourhood in Lisbon

iiSBE SN Tool B Scoring File	Max	30Nov20

The number available criteria is:	159	The number active criteria is:	158
The number of active mandatory criteria with a score of less than 3 is:		Active low-level mandatory parameters:	11

Issue	Active Weights	Weighted Target scores	Weighted Assessed scores	Scores v. Targets
A **Context and vulnerabilities**	3.3%	2.92	3.76	1.29
B **Built Urban Systems**	13.1%	2.82	2.84	1.01
C **Economy**	3.4%	3.12	3.22	1.03
D **Energy**	14.4%	3.02	2.96	0.98
E **Non-Renewable Resources**	7.3%	3.01	2.71	0.90
F **Environment**	52.1%	3.28	3.80	1.16
G **Social Aspects**	6.4%	3.59	3.98	1.11
Weighted total score	100%	3.11	3.32	1.07

0 = Acceptable Practice; 3 = Good Practice; 5 = Best Practice

	KPIs Urban Scale	Target	Value	Unit of measure
B1.8	Conservation of Land	16%	17%	%
C3.3	Operating energy costs for public buildings.	38	18	Euro / m2/ year
D1.1	Final electrical energy consumption for operation of all buildings.	0	8	kWh/m2/yr
D2.1	Share of renewable energy generated on-site, relative to total final energy consumption for operation of all buildings.	64%	69%	percent
D2.4	Share of renewable energy generated on-site, relative to total primary energy consumption for operation of all buildings.	60%	72%	percent
D2.7	Share of renewable energy generated in the local area, relative to the total final electric energy consumption.	59%	72%	percent
F4.2	Aggregate GHG Emissions from primary energy used in building operations	18	18	kg CO2 eq /m2/yr
E1.5	Consumption of potable water by residential households	136	166	m3 / household / yr
E1.6	Consumption of water for building systems	3	3	m3 / m2 /year

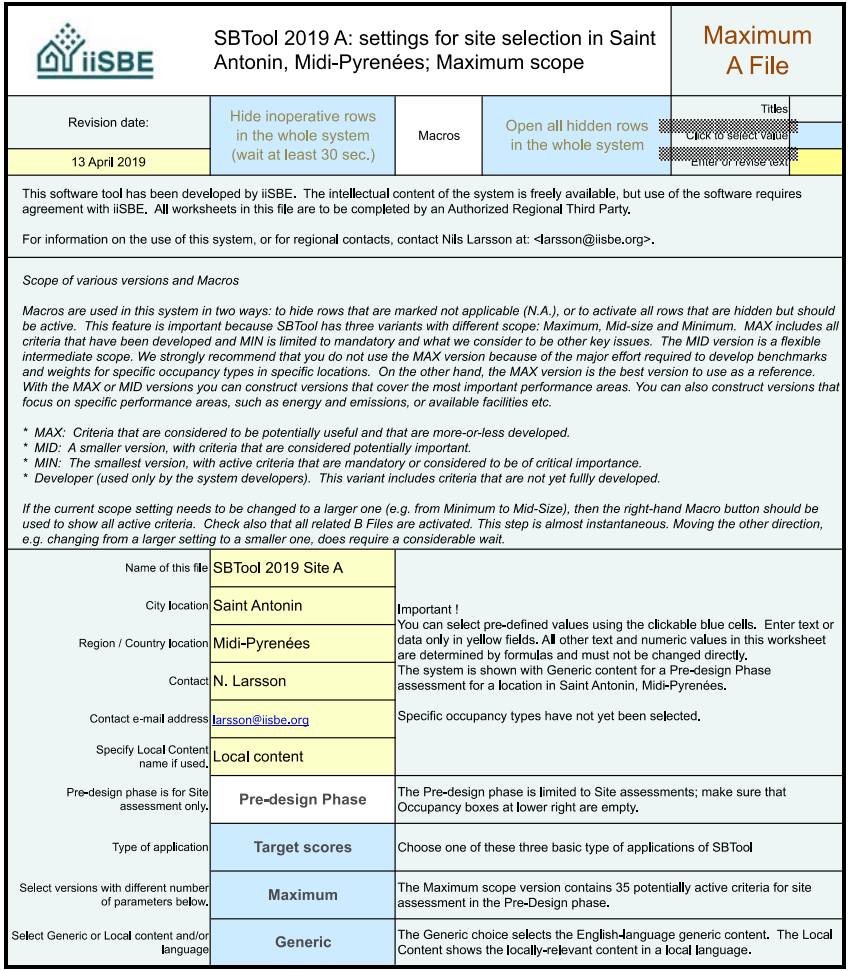
Similarity to building tools

Many of the structural features in SNTool are similar to those found in the SBTool for buildings:

- Similar arrangement of Issues, Categories and Criteria, but different contents.
- A similar weighting structure.
- Modifiable text content.

SBTool Site and SBTool Buildings 2020

SBTool Site 2020



iiSBE	SBTool 2019 A: settings for site selection in Saint Antonin, Midi-Pyrenées; Maximum scope			Maximum A File
Revision date: 13 April 2019	Hide inoperative rows in the whole system (wait at least 30 sec.)	Macros	Open all hidden rows in the whole system	Titles; Click to select value; Enter or revise text

This software tool has been developed by iiSBE. The intellectual content of the system is freely available, but use of the software requires agreement with iiSBE. All worksheets in this file are to be completed by an Authorized Regional Third Party.

For information on the use of this system, or for regional contacts, contact Nils Larsson at: <larsson@iisbe.org>.

Scope of various versions and Macros

Macros are used in this system in two ways: to hide rows that are marked not applicable (N.A.), or to activate all rows that are hidden but should be active. This feature is important because SBTool has three variants with different scope: Maximum, Mid-size and Minimum. MAX includes all criteria that have been developed and MIN is limited to mandatory and what we consider to be other key issues. The MID version is a flexible intermediate scope. We strongly recommend that you do not use the MAX version because of the major effort required to develop benchmarks and weights for specific occupancy types in specific locations. On the other hand, the MAX version is the best version to use as a reference. With the MAX or MID versions you can construct versions that cover the most important performance areas. You can also construct versions that focus on specific performance areas, such as energy and emissions, or available facilities etc.

** MAX: Criteria that are considered to be potentially useful and that are more-or-less developed.*
** MID: A smaller version, with criteria that are considered potentially important.*
** MIN: The smallest version, with active criteria that are mandatory or considered to be of critical importance.*
** Developer (used only by the system developers). This variant includes criteria that are not yet fullly developed.*

If the current scope setting needs to be changed to a larger one (e.g. from Minimum to Mid-Size), then the right-hand Macro button should be used to show all active criteria. Check also that all related B Files are activated. This step is almost instantaneous. Moving the other direction, e.g. changing from a larger setting to a smaller one, does require a considerable wait.

Name of this file	SBTool 2019 Site A	
City location	Saint Antonin	Important ! You can select pre-defined values using the clickable blue cells. Enter text or data only in yellow fields. All other text and numeric values in this worksheet are determined by formulas and must not be changed directly. The system is shown with Generic content for a Pre-design Phase assessment for a location in Saint Antonin, Midi-Pyrenées.
Region / Country location	Midi-Pyrenées	
Contact	N. Larsson	
Contact e-mail address	larsson@iisbe.org	Specific occupancy types have not yet been selected.
Specify Local Content name if used.	Local content	
Pre-design phase is for Site assessment only.	Pre-design Phase	The Pre-design phase is limited to Site assessments; make sure that Occupancy boxes at lower right are empty.
Type of application	Target scores	Choose one of these three basic type of applications of SBTool
Select versions with different number of parameters below.	Maximum	The Maximum scope version contains 35 potentially active criteria for site assessment in the Pre-Design phase.
Select Generic or Local content and/or language	Generic	The Generic choice selects the English-language generic content. The Local Content shows the locally-relevant content in a local language.

SB Tool – Site Selection

- The SBTool system consists of two distinct assessment file modules that are linked to phases of the life-cycle.
- The **Site Assessment** file set is used to characterize a location, to identify off-site services available and the key characteristics of the site itself. This work is carried out during the Pre-Design phase and may or may not involve the architect.

13 April 2019	SBTool 2019 A: settings for site selection in Saint Antonin, Midi-Pyrenées; Maximum scope
SBTool 2019 Site A	

All worksheets are copy-protected to avoid damage to formulas. The passwo "SBTool".

S	Location, Services and Site Characteristics	
S1	Site Location and Context	
	S1.1	Location of site relative to zones with major flooding, earthquake or v
	S1.2	Location of site relative to zones of fire risk.
	S1.3	Proximity of a site with potential residential occupancy to centres of a
	S1.4	Proximity to public transportation access points.
	S1.5	Access to emergency services.
	S1.6	Proximity to health care facilities.
	S1.7	Proximity to public primary educational facilities.
	S1.8	Proximity to public secondary educational facilities.
	S1.9	Proximity to public, social and recreation facilities.
	S1.10	Proximity to small retail commercial facilities.
	S1.11	Proximity to large retail commercial facilities.
	S1.12	Proximity to other facilities of local importance.
S2	Off-site services available	
	S2.1	Frequency of service of local public transportation systems.
	S2.2	Network density of local public transportation systems.
	S2.3	Availability of renewable energy sources in the local area.
	S2.4	Access to a public electrical supply network.
	S2.5	Access to a public broadband communications network.
	S2.6	Access to a public potable water supply and distribution service.
	S2.7	Access to a public sanitary sewage collection and treatment service.
	S2.8	Access to a solid waste collection and disposal service.
	S2.9	Availability within the urban area of recycled materials and products.
	S2.10	Availability within the urban area of materials and products that can be re-used in new structures.
S3	Site Characteristics	
	S3.1	Pre-development ecological sensitivity or value.
	S3.2	Pre-development agricultural value.
	S3.3	Pre-development contamination status of land.
	S3.4	Ambient air quality conditions - particulates PM2.5
	S3.5	Ambient air quality conditions - carbon monoxide.
	S3.6	Ambient air quality conditions - other.
	S3.7	Ambient noise conditions.
	S3.8	Availability of existing structure(s) on the site suited to new functional requirements.
	S3.9	Impact of orientation and topography of the site on the passive solar potential of buildings.
	S3.10	Feasibility for the use of renewable energy systems on the site.
	S3.11	Impact of size and shape of the land parcel on the economic viability of the development.
	S3.12	Regulations applicable to the site pertinent to heritage conservation.
	S3.13	Regulations applicable to the site pertinent to mixed use and medium-rise development.
	S3.14	Regulations applicable to the site pertinent to the use of private vehicles.

SB Tool – Site criteria

Excerpt from weighting Site Selection worksheet in SBTool

Go to BasicA worksheet to select different versions of the system.	Generic weightings for site assessment in Saint Antonin, Midi-Pyrenées	Generic / Pre-design Phase / New Construction	Weighting Factors: Regional adjustment	A	B	C	D
iiSBE	Maximum Version 35 active parameters Pre-design Phase	Weighting of Categories in percent (sum of Criteria scores) / Weighting of Criteria in percent	Score / Blue click boxes below allow weights in this column to be adjusted by authorized third parties to reflect varying regional conditions and priorities. Grey click boxes CAN NOT be changed.	Score / Extent of potential effect (1 to 5 points)	Score / Duration of potential effect (1 to 5 points)	Score / Impact of Potential Effect (1 to 4 points)	Go to BasicA worksheet to select different versions of the system.
Weights for Criteria are established through the estimates of sustainability impacts. Some of these may be changed to suit various context conditions, or generic building characteristics, such as occupancy type, height etc. These modifiers can be seen in Columns H-J (hidden). Parameters can also be inactivated, which re-distributes their weights among remaining Criteria. Note that Category weights are the sum of Criteria weights, and Issue weights are the sum of Category weights. Default generic weights are shown but these initial weights may then modified by authorized third parties.				Note that all weights established in this worksheet are applicable to a specific building type and region, but must NOT be set to suit the characteristics of a particular project.			Change weights

Min	Mid	Max	Dev		Location and Site Assessment											
Parameters active in Issues A = 6					Location, Services and Site Characteristics	100.0%										
		.		S1	Site Location and Context	45.9%										
◆	◆	◆	◆	S1.1	Location of site relative to zones with major flooding, earthquake or volcanic risks.		15.97%	3	OK	4	Urban / region	5	>75 years	4	Major	1	Cost and economics
◆	◆	◆	◆	S1.2	Location of site relative to zones of fire risk.		9.58%	3	OK	3	Neighborhood	4	30 to 75 years	4	Major	2	Well-being, security and productivity of individuals
	■	■	■	S1.3	Proximity of a site with potential residential occupancy to centres of employment or vice versa.		2.40%	3	OK	3	Neighborhood	2	3 to 10 years	2	Moderate	2	Social and cultural issues
■	■	■	■	S1.4	Proximity to public transportation access points.		2.40%	3	OK	3	Neighborhood	2	3 to 10 years	2	Moderate	1	Functionality and servicability
■	■	■	■	S1.5	Access to emergency services.		1.20%	3	OK	3	Neighborhood	1	1 to 3 years	2	Moderate	2	Well-being, security and productivity of individuals
		■	■	S1.6	Proximity to health care facilities.		2.40%	3	OK	3	Neighborhood	2	3 to 10 years	2	Moderate	2	Well-being, security and productivity of individuals

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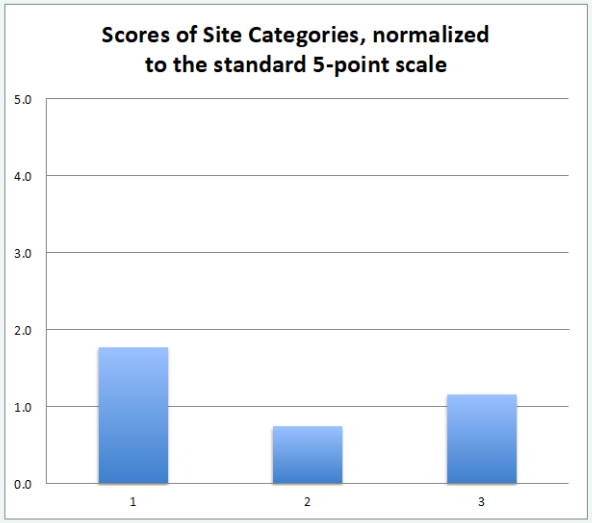
SBTool 2019

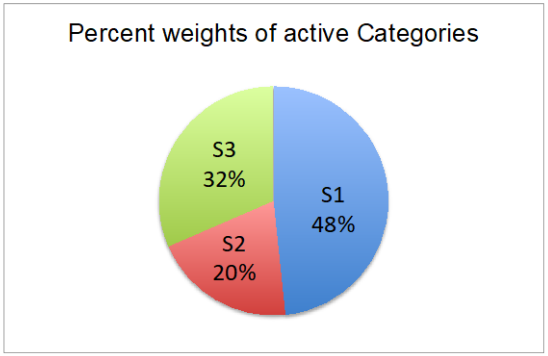
Self-assessment scores for Location, services and site characteristics, for a project in ProjectX, Saint Antonin, Midi-Pyrenées

Maximum version	Pre-design Phase	Target scores



0 = Acceptable Practice; 3 = Good Practice; 5 = Best Practice

Relative Performance Results **A**



Project Information

With current context and building data, the number of active low-level parameters is:	35	Max. potential low-level parameters:	35
The number of active mandatory criteria with a score of less than 3 is:	N.A.	Active low-level mandatory parameters:	6

To see a full list of Issues, Categories and Criteria, go to the ParametersB worksheet.	Weighted Targets	Weighted Scores	Score v. Target
S1 **Site Location and Context**	1.38	1.77	1.28
S2 **Off-site services available**	0.62	0.74	1.19
S3 **Site Characteristics**	1.01	1.15	1.14
Weighted project score	**3.00**	**3.66**	**1.22**

Target scores performance level is Good Practice or better

Site Selection results in SBTool

SBTool Buildings 2020

Assessment, rating, labeling & certification

- Assessment: an evaluation
- Rating: a score or result relative to a norm or global benchmark. Ratings can be based on self-assessment or carried out by third parties.
- Certification: validation of rating or assessment results by a knowledgeable third party that is independent of both the developer / designer and the tool developer.
- Labeling: proof of a rating or certification result, issued by the certifier.

Labels, or proof of certification

What many commercial developers really want...

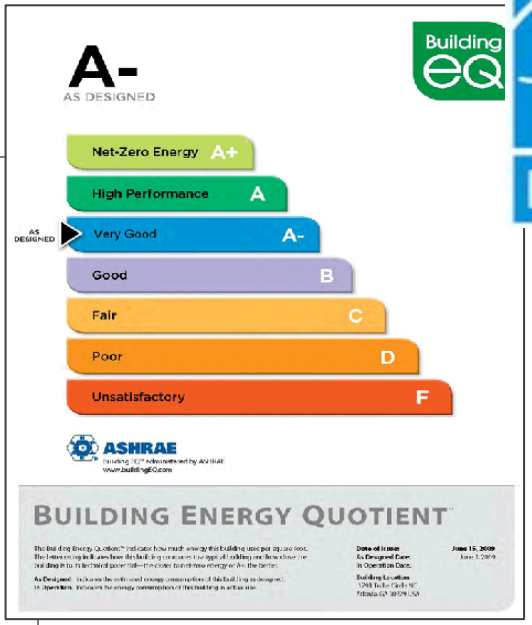
LEED® for Commercial Interiors

Total Possible Points**	**110***
Sustainable Sites	21
Water Efficiency	11
Energy & Atmosphere	37
Materials & Resources	14
Indoor Environmental Quality	17

* Out of a possible 100 points + 10 bonus points

** Certified 40+ points, Silver 50+ points, Gold 60+ points, Platinum 80+ points

Innovation in Design	6
Regional Priority	4



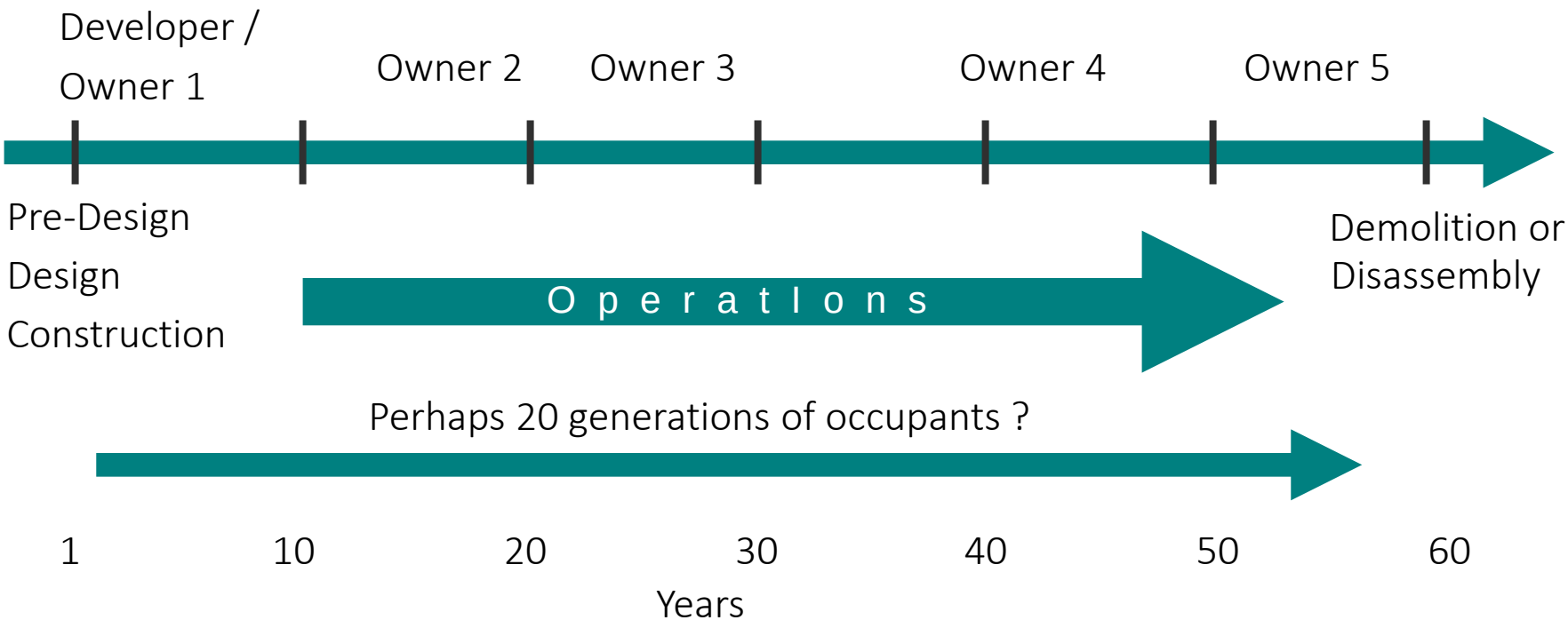
What are the traditional issues to judge?

- Location
- Capital cost
- Operating cost
- Market appeal
- Beauty….

We have added other important issues in sustainable building

- Energy and resource consumption;
- Environmental impact;
- Indoor Environmental Quality;
- Functional / serviceability issues.
- Social and perceptual factors;
- Economic factors

Time scales and the public interest



SBTool - introduction

- SBTool Generic is a generic building performance assessment framework for rating the sustainable performance of sites and building projects;
- Think of it as a toolkit for rating systems;
- The system can be used by authorized organizations, such as municipalities or non-government organizations (NGOs) to establish rating systems to suit their own regions and building types;
- SBTool can be used by owners and managers of large building portfolios to specify their performance requirements to their staff, to consultants, or participants in competitions;
- It can also be used as an educational tool, since developing benchmarks for a wide range of issues is a useful experience for graduate students;

Basic features

- SBTool handles a variety of conditions;
  - pre-design, design, construction and operations
  - … new and renovation projects;
  - … up to two occupancy types in a single project;
  - … provides relative and absolute outputs;
- This is a framework, and users must establish performance benchmarks, context factors and weights in order to make it operational;
- Nevertheless the files are shown with dummy data, so that you can see how the system works;
- The system is set up to allow easy insertion of local criteria in a local language (but this is currently disabled to speed up the process).

Basic features

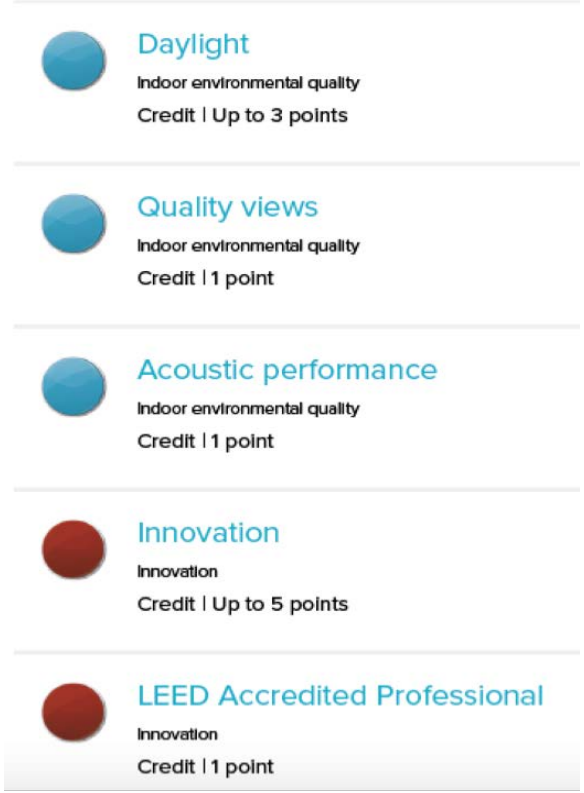
- The scope (number of criteria) can be varied in the Design phase from a Maximum version (115 potentially active criteria) to a Minimum version (12)
- No matter how many criteria are active, the sum of weights always total 100%;
- An algorithm provides quasi-objective weighting (relative importance) of criteria;

SBTool compared to commercial rating systems

- Commercial rating systems use a system of fixed points to give more or less importance to various issues;
- This causes problems when the system is used outside its region of origin;
- BRE solved this problem from the outset by cautioning users that if BREEAM is used outside of the UK, the system must be adjusted;
- USGBC preferred to maintain the simple integrity of LEED by allowing regional organizations to add certain extra requirements and points to the system;
- This did not really solve the issue;
- Despite these defects, the commercially-oriented systems have played a major role in promoting the general goal of high performance in many regions.

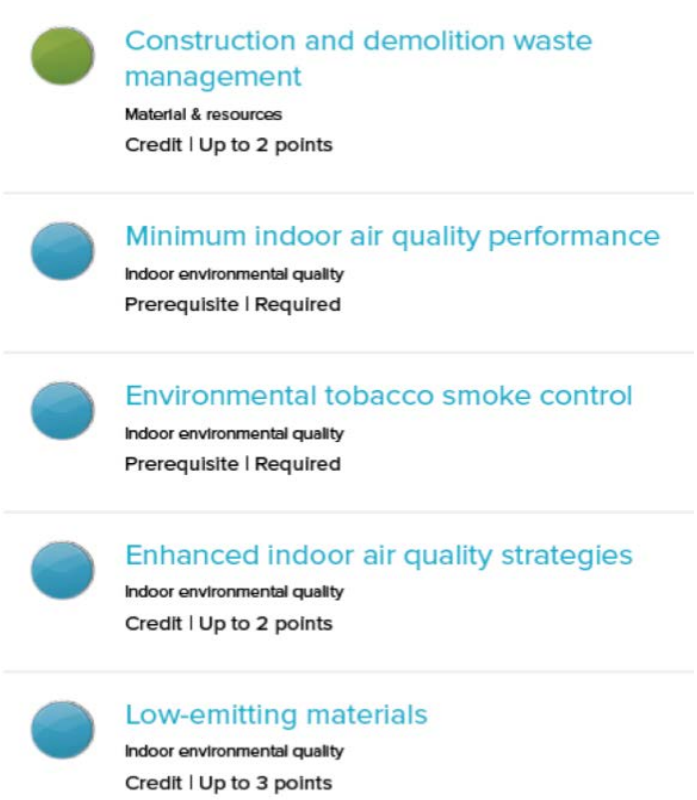
Some problems

The following excerpts from LEED V4 scoring tables are examples of the issue:



Why is Daylight worth 3 points, and Acoustic performance worth 1?

And how are Innovation or the use of a LEED accredited professional measures of performance?



Issues and Categories

A to G, Design, Construction and Operations phases

A Site Regeneration and Development, Urban Design and Infrastructure
A1 Site Regeneration and Development
A2 Urban Design
A3 Project Infrastructure and Services

B Energy and Resource Consumption
B1 Total Life Cycle Non-Renewable Energy
B2 Electrical peak demand for facility operations
B3 Use of Materials
B4 Use of Potable Water, Stormwater and Greywater

C Environmental Loadings
C1 Greenhouse Gas Emissions
C2 Other Atmospheric Emissions
C3 Solid and Liquid Wastes
C4 Impacts on Site
C5 Other Local and Regional Impacts

D Indoor Environmental Quality
D1 Indoor Air Quality and Ventilation
D2 Air Temperature and Relative Humidity
D3 Daylighting and Illumination
D4 Noise and Acoustics
D5 Control of electromagnetic emissions

E Service Quality
E1 Safety and Security
E2 Functionality and efficiency
E3 Controllability
E4 Flexibility and Adaptability
E5 Optimization and maintenance of environmental operating performance.

F Social, Cultural and Perceptual Aspects
F1 Social Aspects
F2 Culture & Heritage
F3 Perceptual

G Cost and Economic Aspects
G1 Cost and Economics

Performance trade-offs

- It is important to realize that there are performance trade-offs and that it is very difficult for a building to have very high performance in all aspects;
- For example, very good operating performance might be associated with a high level of embodied energy and emissions, which would get a lower score;
- Similarly, excellence in indoor environment may come at the expense of operating energy;
- The system includes the ability to require a certain minimum score (for example 3.0, 3.5 etc.) for the mandatory criteria, which ensures that the trade-off process does not result in a building that performs poorly in important areas.

SB Method - Structure

- The system consists of 2 linked Excel files;
- The *SBTool-A* file is used by local government or NGO organizations to set locally relevant weights, benchmarks and standards for generic building types in their own region;
- File A contains two separate generic assessment modules; one for Site Assessment and the other for Building Assessments;
- *SBTool-B* files allow designers to provide information about a single project, to use an IDP support module as design guidance and to carry out self-assessments;
- The information developed for File A can be used in a large number of B Files, to suit specific building characteristics defined in File A;

Three scenarios: one A File can produce many B files

SBTool File A
Regional and Generic building settings for Graz

2 generic occupancy types are active: Residential and Office
Design phase is selected
Mid-size scope: 54 criteria are potentially active
Criteria are active for New Construction, Renovation, for Natural and Mechanical Ventilation
Tall Building threshold is set for 25 floors
Benchmarks, standards and context factors are established for the specific location.

Content defined by municipality or NGO

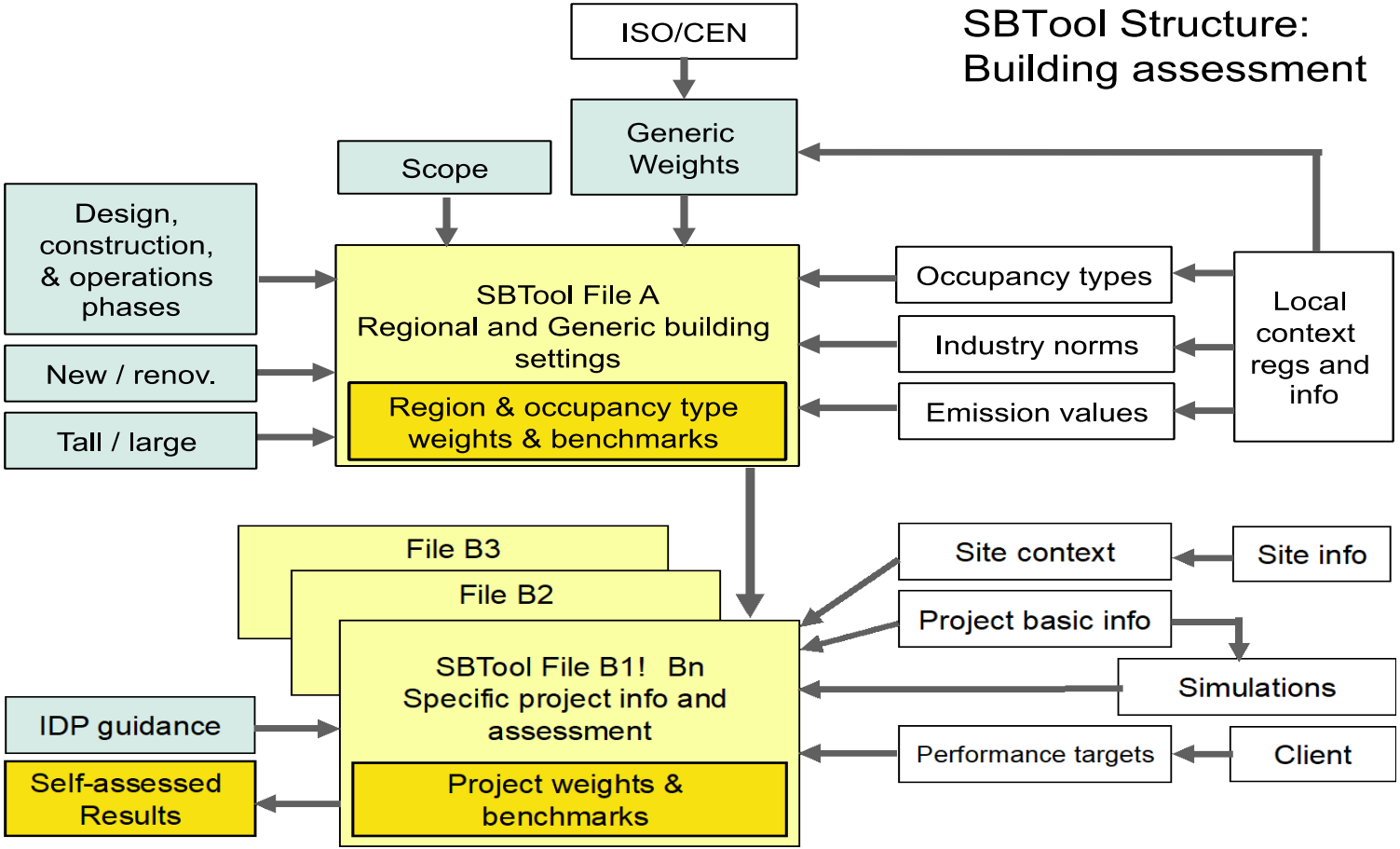
Residential and Office occupancy
Design phase
Mid-size scope: 48 criteria active
New Construction
Natural Ventilation active
Building is 32 floors

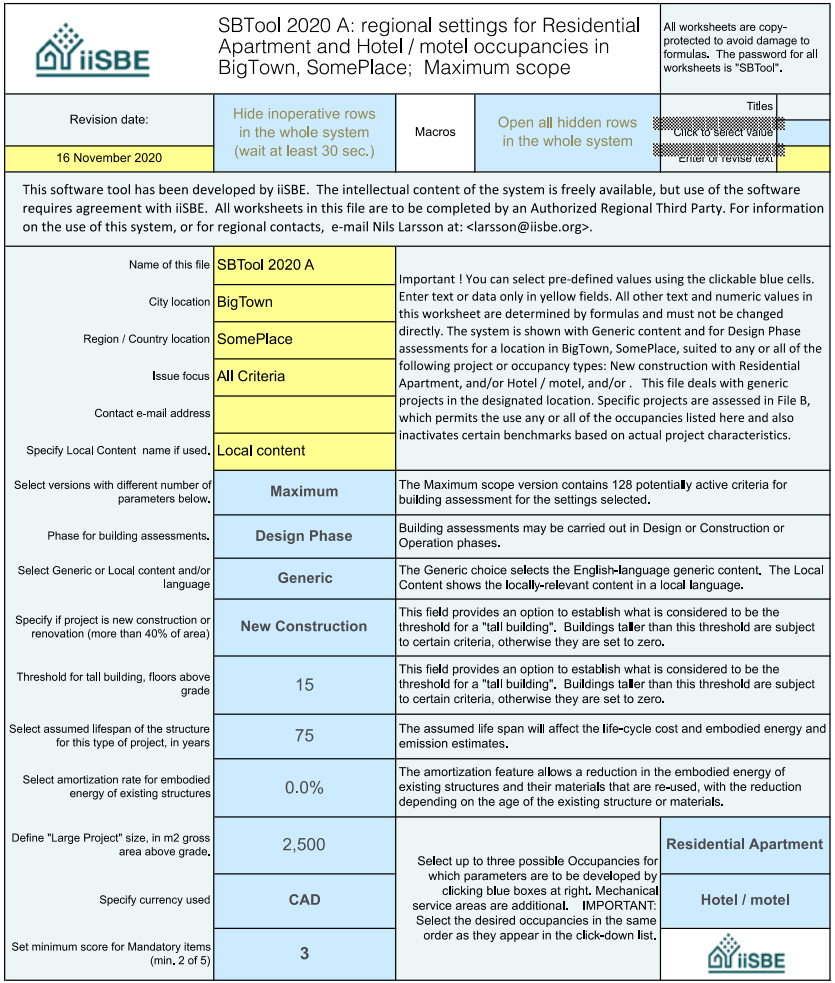
Office occupancy
Design phase
Mid-size scope: 28 criteria active
New Construction
Mechanical Ventilation active
Building is 12 floors (< threshold)

Residential occupancy
Design phase
Mid-size scope: 22 criteria active
New Construction
Natural Ventilation active
Building is 6 floors (< threshold)

Three examples of B files completed by designers or owners

SBTool Structure: Building assessment





SBTool 2020 A: regional settings for Residential Apartment and Hotel / motel occupancies in BigTown, SomePlace; Maximum scope

All worksheets are copy-protected to avoid damage to formulas. The password for all worksheets is "SBTool".

Revision date:	Hide inoperative rows in the whole system (wait at least 30 sec.)	Macros	Open all hidden rows in the whole system	Titles / Click to select value / Enter or revise text
16 November 2020				

This software tool has been developed by iiSBE. The intellectual content of the system is freely available, but use of the software requires agreement with iiSBE. All worksheets in this file are to be completed by an Authorized Regional Third Party. For information on the use of this system, or for regional contacts, e-mail Nils Larsson at: <larsson@iisbe.org>.

Name of this file	SBTool 2020 A	Important ! You can select pre-defined values using the clickable blue cells. Enter text or data only in yellow fields. All other text and numeric values in this worksheet are determined by formulas and must not be changed directly. The system is shown with Generic content and for Design Phase assessments for a location in BigTown, SomePlace, suited to any or all of the following project or occupancy types: New construction with Residential Apartment, and/or Hotel / motel, and/or . This file deals with generic projects in the designated location. Specific projects are assessed in File B, which permits the use any or all of the occupancies listed here and also inactivates certain benchmarks based on actual project characteristics.
City location	BigTown	
Region / Country location	SomePlace	
Issue focus	All Criteria	
Contact e-mail address		
Specify Local Content name if used.	Local content	
Select versions with different number of parameters below.	Maximum	The Maximum scope version contains 128 potentially active criteria for building assessment for the settings selected.
Phase for building assessments.	Design Phase	Building assessments may be carried out in Design or Construction or Operation phases.
Select Generic or Local content and/or language	Generic	The Generic choice selects the English-language generic content. The Local Content shows the locally-relevant content in a local language.
Specify if project is new construction or renovation (more than 40% of area)	New Construction	This field provides an option to establish what is considered to be the threshold for a "tall building". Buildings taller than this threshold are subject to certain criteria, otherwise they are set to zero.
Threshold for tall building, floors above grade	15	This field provides an option to establish what is considered to be the threshold for a "tall building". Buildings taller than this threshold are subject to certain criteria, otherwise they are set to zero.
Select assumed lifespan of the structure for this type of project, in years	75	The assumed life span will affect the life-cycle cost and embodied energy and emission estimates.
Select amortization rate for embodied energy of existing structures	0.0%	The amortization feature allows a reduction in the embodied energy of existing structures and their materials that are re-used, with the reduction depending on the age of the existing structure or materials.
Define "Large Project" size, in m2 gross area above grade.	2,500	Select up to three possible Occupancies for which parameters are to be developed by clicking blue boxes at right. Mechanical service areas are additional. IMPORTANT: Select the desired occupancies in the same order as they appear in the click-down list.
Specify currency used	CAD	
Set minimum score for Mandatory items (min. 2 of 5)	3	

Residential Apartment

Hotel / motel

iiSBE

SBTool BasicA worksheet

SBTool BasicB worksheet

iiSBE	SBTool 2020 B Project Assessment file for ProjectX, BigTown, SomePlace with All Criteria focus.			Maximum B File	
Revision date for Files A and B	Hide inoperative rows in the whole system (wait at least 30 sec.)	Macros	Open all hidden rows in the whole system	Titles	
16 November 2020				Click value	
16 November 2020				Enter / revise text	

This is File B of SBTool Maximum version. Many values have been defined in the 'A' file, based on the general location and generic occupancy type(s). These values are modified based on the specific site and project characteristics provided in this file by the designer. This 'B' file contains data about a specific new construction project called ProjectX with a total gross area above and below grade (initial estimate) of 3040 m2. The project is located in BigTown, SomePlace, has an estimated lifespan of 75 years, and will contain Residential Apartment, Hotel / motel

Most basic parameters in this File including scope, phase, new v. renovation, occupancy types, life-span and thresholds for project size and height, were established in File A. Choices with respect to actual project occupancies, area, height and system types can be made in the InitialSpec worksheet of this file, as long as choices made and information entered are consistent with the criteria established in File A. You can select pre-defined values using the clickable blue cells. All other text and numeric values in this worksheet are determined by formulas and must not be changed directly.

User's description of the project			
Project name	ProjectX	The project name designates the project that is being assessed using this file. Information relevant to the project is to be entered in designsted cells.	
City and country location for weights and benchmarks.	BigTown, SomePlace	The location and the parameter values relevant for that location have been set in File A, and cannot be altered by the user of this file.	
Select total scores on whole building or pro-rated individual occupancy scores.	Whole building basis	Both Target and Assessment evaluations can be made at the level of a single score for the whole project or by using the pro-rated sum of individual occupancies, where this is applicable.	
Phase	Design Phase	Building assessments may be carried out in Design or Construction or Operation phases.	
Version of system selected (scope)	Maximum	**The Maximum scope version contains 128 potentially active criteria for building assessment for the settings selected. in File A**	
Issue focus	All Criteria	The Issue Focus indicates the degree to which active criteria are focused on a paricular issue area, such as Energy and Environment, IEQ, Service Quality etc. Having a small number of active criteria facilitates a narrower focus.	
Content type	Generic	The default content used in File A for benchmark and other information is based on generic conditions (more or less Canada), expressed in English. File A can also be set to allow a local content and/or language to be used.	
The eligible occupancy types shown at right were established in the SBT-A Region file.	Residential Apartment	OK	Green OK marks at left indicate the three (maximum) active occupancies that have been selected in the InitialSpec worksheet, from the potential occupancy list established in File A. Note that Assessments carried out in this (B) file are only valid for these active occupancies. If there are no green OK marks, go to InitialSpec to establish actual occupancies in the project.
	Hotel / motel	OK	
New construction or renovation	New Construction	OK	..
Threshold for tall building, floors above grade	15	Buildings below this height inactivate certain criteria that are relevant to tall buildings.	
Assumed life span	75	The assumed life span is used to convert absoulte value of embodied energy and emissions to an annualized basis.	
Amortization rate for existing materials that are used.	0.00%	Credit can be given for the re-use of existing structures and their materials, depending on the age of the existing structure.	
"Large Project" size definition, in m2 gross building area.	2,500	"Large Project" size definition, in m2 gross building area.	
Type of currency	CAD	The type of currency used is applicable to cost criteria.	
Score required for mandatory criteria	3	Mandatory items (set on the Weight worksheet, see also see Issues worksheet) are parameters of exceptional importance.	

SBTool tradeoffs

- SBTool has a large number of criteria that can be activated;
- The development of benchmarks for all active criteria in the full system requires a prohibitive amount of work and time;
- In addition, when a large number of criteria are active, the weight of each is very small;
- We suggest that users should review the Max version to see the rage of options possible, but then to select a small or mid-size system scope, which provides a focus on specific areas of interest;
- The following slides show examples of mid-size scope options that also show how various thematic focus areas can be emphasized.

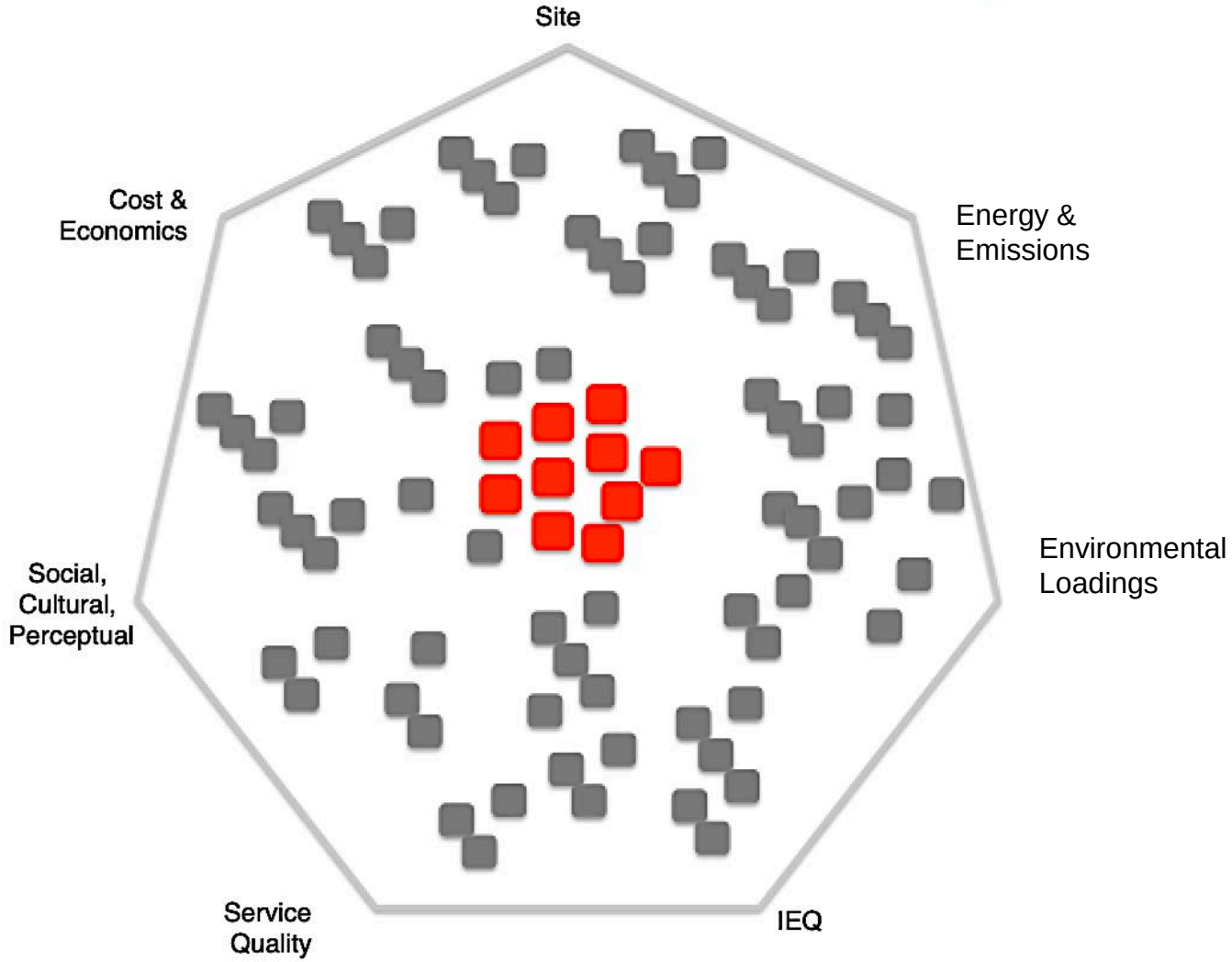
SBTool: Active criteria by scope and phase

Issue area	Scope	Pre-design	Design	Construction	Operation
Site Location, Available Services and Site Characteristics	Max.	35			
	Mid.	20			
	Min.	8			
Site Regeneration and Development, Urban Design and Infrastructure	Max.		22	0	21
	Mid.		12	0	11
	Min.		2	0	2
Energy and Resource Consumption	Max.		10	6	10
	Mid.		8	4	7
	Min.		4	2	3
Environmental Loadings	Max.		19	7	18
	Mid.		6	1	6
	Min.		2	0	2
Indoor Environmental Quality	Max.		18	0	19
	Mid.		10	0	10
	Min.		2	0	2
Service Quality	Max.		20	9	25
	Mid.		10	4	13
	Min.		2	1	2
Social, Cultural and Perceptual Aspects	Max.		10	2	10
	Mid.		5	1	5
	Min.		1	0	1
Cost and Economic Aspects	Max.		4	1	4
	Mid.		3	1	3
	Min.		1	0	1
Total System	Max.	35	103	25	107
	Mid.	20	54	11	55
	Min.	8	14	3	13

Number of criteria by Issue and Phase

The “Max” file is the largest available, the “Min” is the smallest and the “Mid” sized file is an intermediate size.

Note that numbers are slightly out of date



Scope options to emphasize various issues

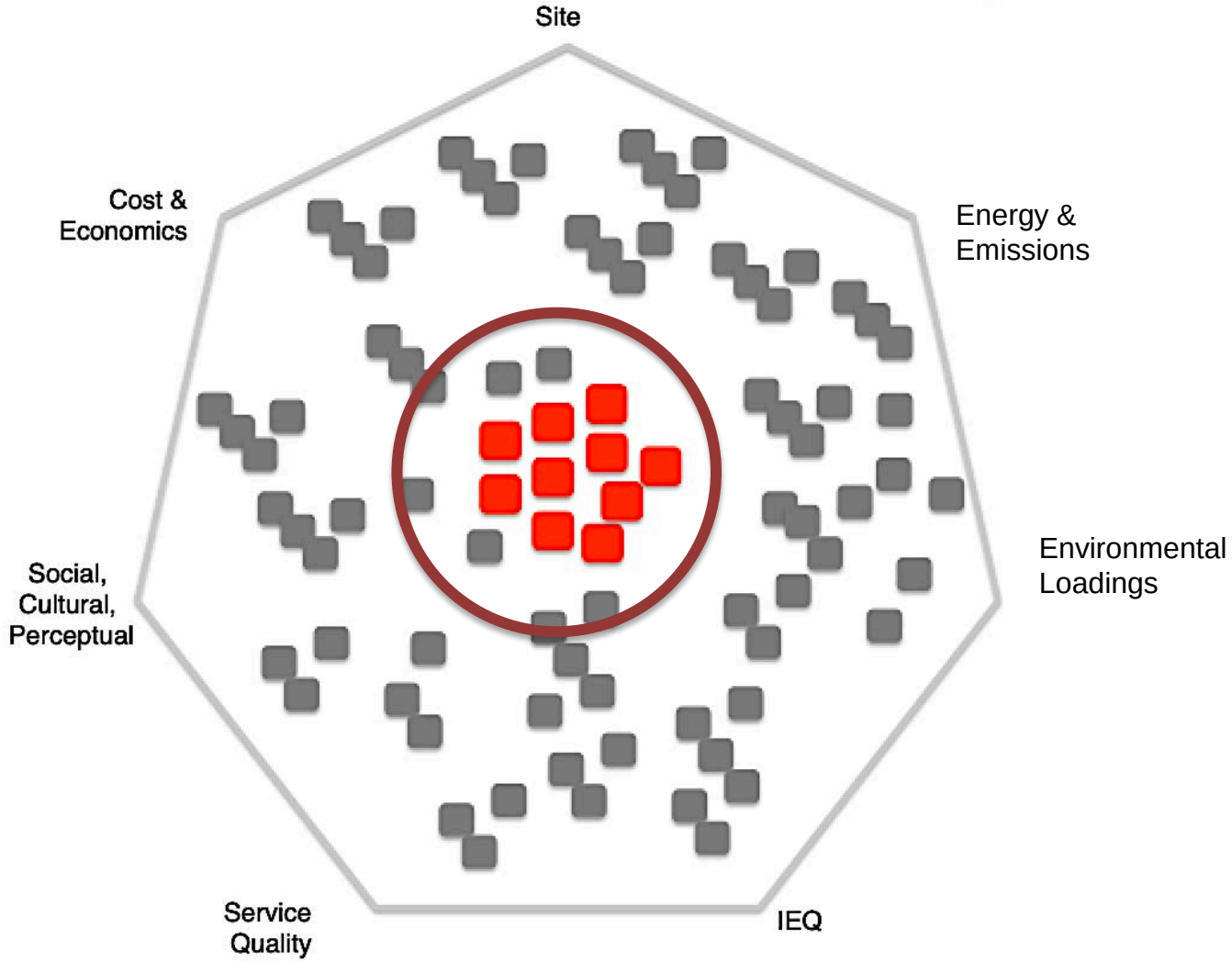
SBTool 2020

Maximum scope
Active Criteria

Optional criteria

Mandatory criteria

Scope options to emphasize various issues

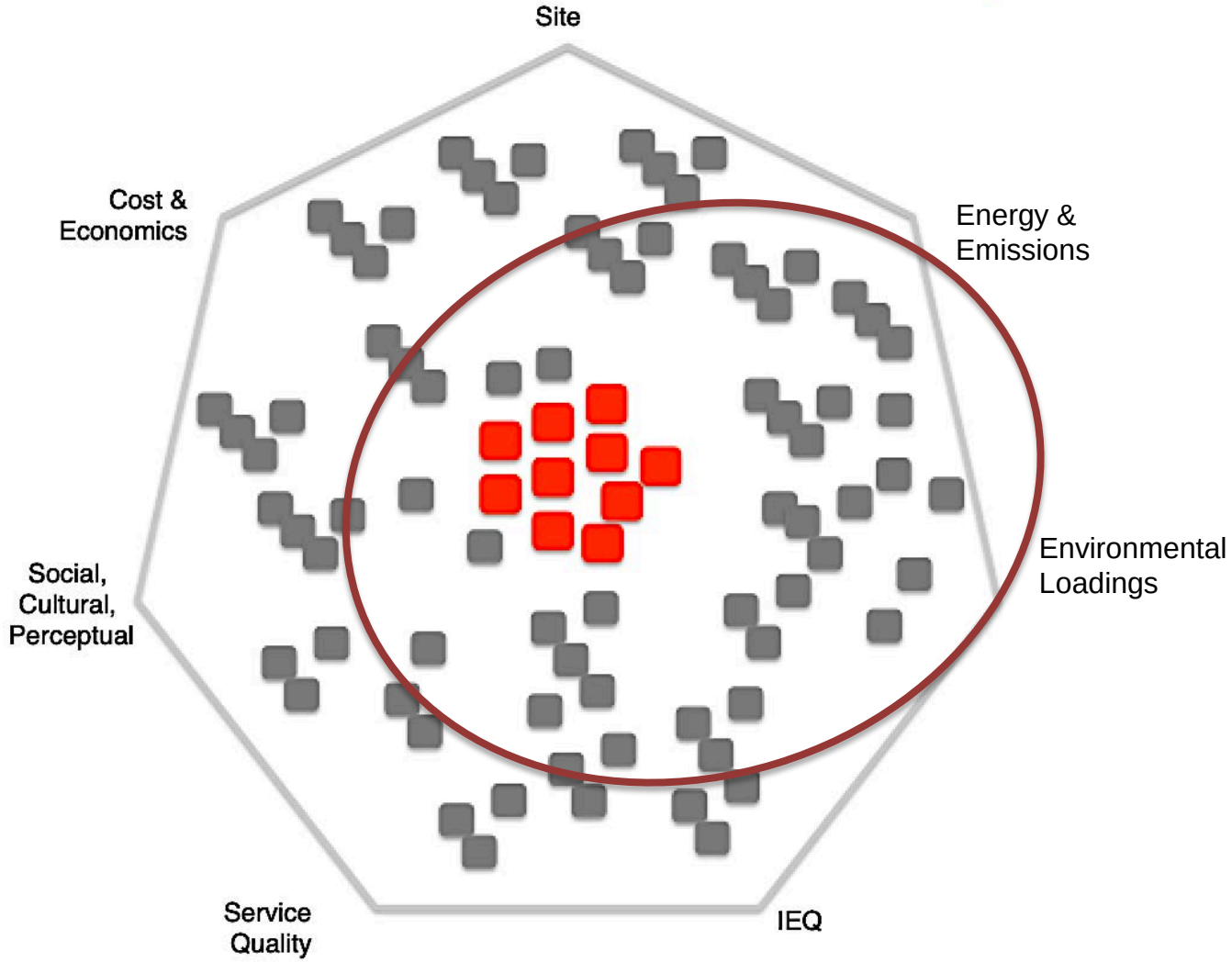


SBTool 2020

Minimum scope
Active Criteria

Optional criteria

Mandatory criteria



Scope options to emphasize various issues

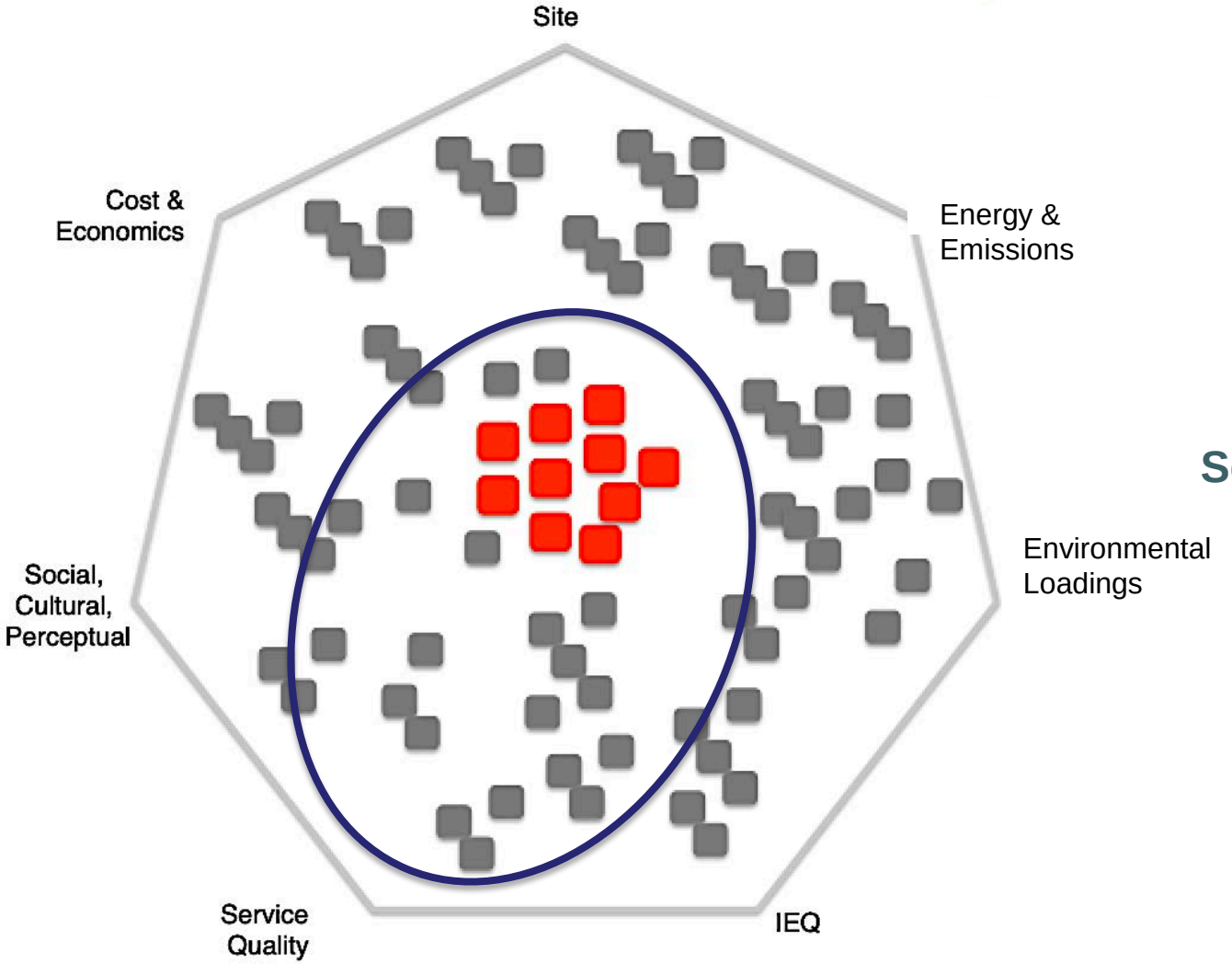
SBTool 2020

Mid-size; Energy and environmental focus

Active Criteria

Optional criteria

Mandatory criteria



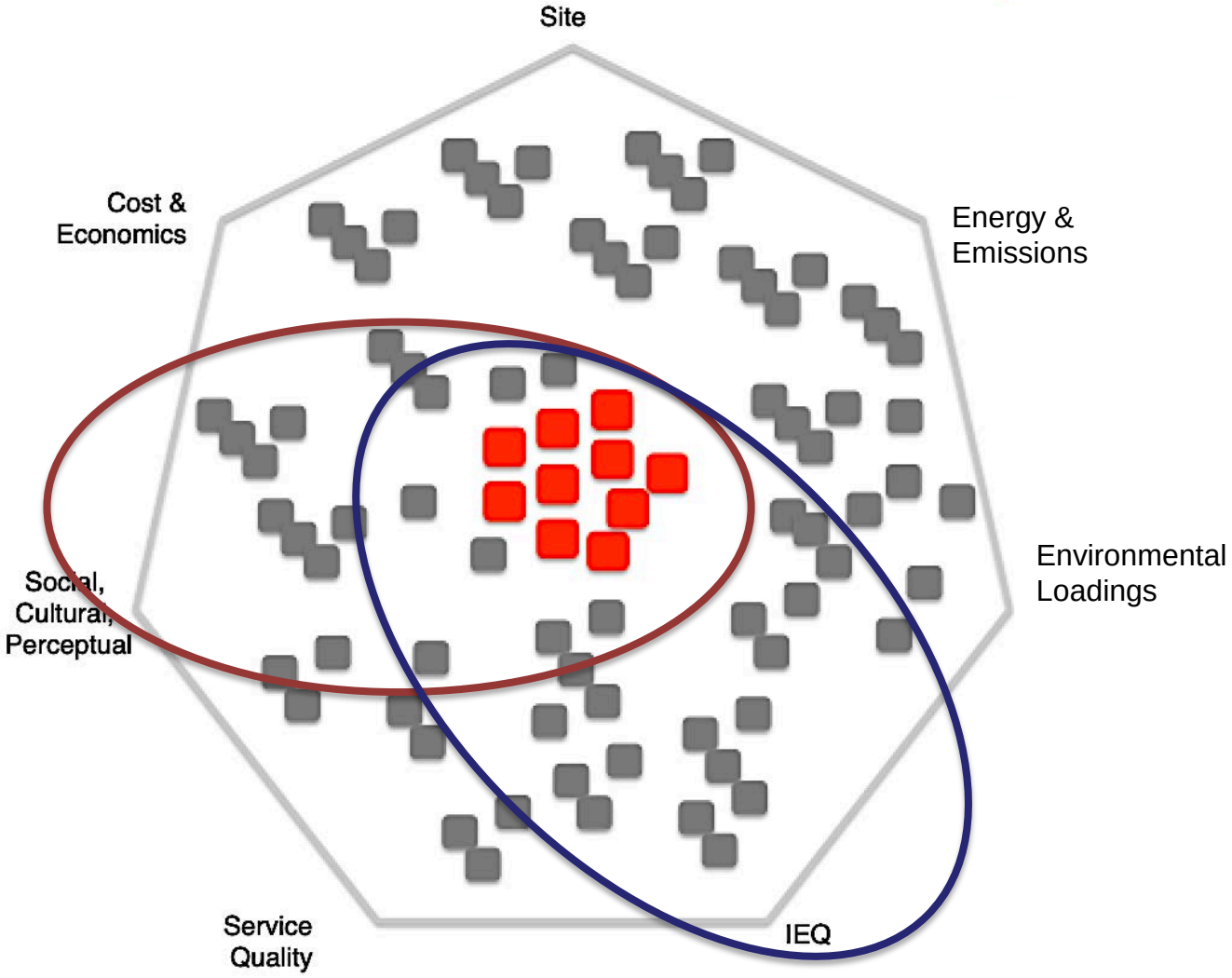
Scope options to emphasize various issues

SBTool 2020

Mid-size;
Service quality focus
Active Criteria

Optional criteria

Mandatory criteria



Scope options to emphasize various issues

SBTool 2020

Mid-size;
IEQ focus
Active Criteria

Optional criteria

Mandatory criteria

Scoring and Benchmarking

Benchmarking

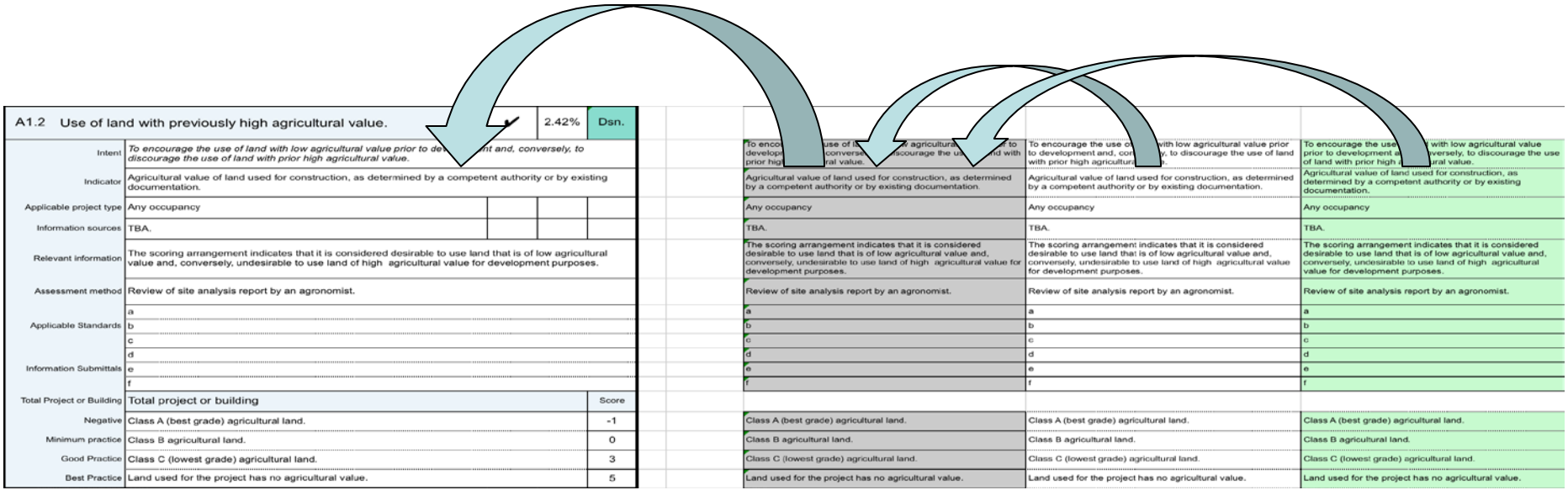
- When is a certain level of performance good, and when is it bad?
- That depends on what we compare it to;
- So performance is always considered relative to that of other buildings of a similar type that are considered to be typical or the best (or worst) of their type;
- The establishment of such benchmarks is an important part of assessment;

Benchmarking

- The system requires that benchmarks be developed for each criterion, so that the predicted or actual performance can be compared to values of a similar building in the same region;
- Specifically, relevant benchmarks for Unacceptable (-1), Acceptable (0), Good Practice (+3) and Best Practice (+5), need to be developed;
- The Generic version of SBTool does contain default benchmarks, but these are mainly intended to show how the system works, and must be replaced by your own values;
- The system is designed to facilitate this by permitting local values to be easily inserted.

File A

Example benchmark, showing possibility for local content



A1.2 Use of land with previously high agricultural value.			2.42%	Dsn.
Intent	*To encourage the use of land with low agricultural value prior to development and, conversely, to discourage the use of land with prior high agricultural value.*			
Indicator	Agricultural value of land used for construction, as determined by a competent authority or by existing documentation.			
Applicable project type	Any occupancy			
Information sources	TBA.			
Relevant information	The scoring arrangement indicates that it is considered desirable to use land that is of low agricultural value and, conversely, undesirable to use land of high agricultural value for development purposes.			
Assessment method	Review of site analysis report by an agronomist.			
Applicable Standards	a			
	b			
	c			
Information Submittals	d			
	e			
	f			
Total Project or Building	Total project or building			Score
Negative	Class A (best grade) agricultural land.			-1
Minimum practice	Class B agricultural land.			0
Good Practice	Class C (lowest grade) agricultural land.			3
Best Practice	Land used for the project has no agricultural value.			5

To encourage the use of land with low agricultural value prior to development and, conversely, to discourage the use of land with prior high agricultural value.	To encourage the use of land with low agricultural value prior to development and, conversely, to discourage the use of land with prior high agricultural value.	To encourage the use of land with low agricultural value prior to development and, conversely, to discourage the use of land with prior high agricultural value.
Agricultural value of land used for construction, as determined by a competent authority or by existing documentation.	Agricultural value of land used for construction, as determined by a competent authority or by existing documentation.	Agricultural value of land used for construction, as determined by a competent authority or by existing documentation.
Any occupancy	Any occupancy	Any occupancy
TBA.	TBA.	TBA.
The scoring arrangement indicates that it is considered desirable to use land that is of low agricultural value and, conversely, undesirable to use land of high agricultural value for development purposes.	The scoring arrangement indicates that it is considered desirable to use land that is of low agricultural value and, conversely, undesirable to use land of high agricultural value for development purposes.	The scoring arrangement indicates that it is considered desirable to use land that is of low agricultural value and, conversely, undesirable to use land of high agricultural value for development purposes.
Review of site analysis report by an agronomist.	Review of site analysis report by an agronomist.	Review of site analysis report by an agronomist.
a	a	a
b	b	b
c	c	c
d	d	d
e	e	e
f	f	f
Class A (best grade) agricultural land.	Class A (best grade) agricultural land.	Class A (best grade) agricultural land.
Class B agricultural land.	Class B agricultural land.	Class B agricultural land.
Class C (lowest grade) agricultural land.	Class C (lowest grade) agricultural land.	Class C (lowest grade) agricultural land.
Land used for the project has no agricultural value.	Land used for the project has no agricultural value.	Land used for the project has no agricultural value.

Visible text is based on a formula that selects appropriate text at right

Selected content

Default content

Local content

Example benchmark, showing data benchmarks for the total project

A1.3 Vulnerability of the site to flooding.		✔	1.88%	Dsn.
Intent	*To discourage the selection of land for building where there is a substantial risk that the site may be flooded.*			
Indicator	Height above 100-year flood plain as defined in official documentation or assessment by competent authorities.			
Applicable project type	Any occupancy			
Information sources	TBA.			
Relevant information	0			
Assessment method	Review of site analysis report.			
Applicable Standards	a			
	b			
	c			
Information Submittals	d			
	e			
	f			
Total Project or Building	Total project or building		m	Score
Negative	The height of the minimum elevation of the site above the elevation of the 100-y… flood plain is :		1.0	-1
Minimum practice			1.3	0
Good Practice			2.0	3
Best Practice			2.5	5

Data values are inserted in yellow fields to establish slope

File A

Example benchmark, showing text benchmarks for the total project

A1.5 Remediation of contaminated soil, groundwater or surface water.		0.98%	Dsn.
Intent	*To assess the success of remediation of contaminated soil, groundwater, or surface water in*		
Indicator	Status of soil, groundwater, or surface water after treatment.		
Applicable project type	Any project type with contaimnated soil, groundwater or surface water.		
Information sources	Environmental agencies and NGOs.		
Relevant information	Type and intensity of original contamination, methods of remediation, final levels of contamination and asessment of long term human health or ecological risks. Frequent causes are surface water contaminated by parking lots, or soils contaminated by previous industrial activity.		
Assessment method	Review of pre- and post remediation site analysis report by a geophysical and soils chemistry specialist		
Standards or references	a		
	b		
	c		
	d		
Information Submittals	e		
	f		

	Assessment criteria for total project	Score
Negative	After treatment, the site is documented as having a level of sub-surface contamination that presents unacceptable risks to long-term human health or the ecology.	-1
Minimum practice	After treatment, the site is documented as having a level of sub-surface contamination that presents acceptable risks to long-term human health or the ecology.	0
Good Practice	After treatment, the site is documented as having a level of sub-surface contamination that presents low risks to long term human health or the ecology.	3
Best Practice	After treatment, the site is documented as having a level of sub-surface contamination that presents no detectable risks to long term human health or the ecology.	5

Phase

Weight

Scoring from -1 to +5 is standard; for subsequent assessments values can be interpolated to half-points

File A

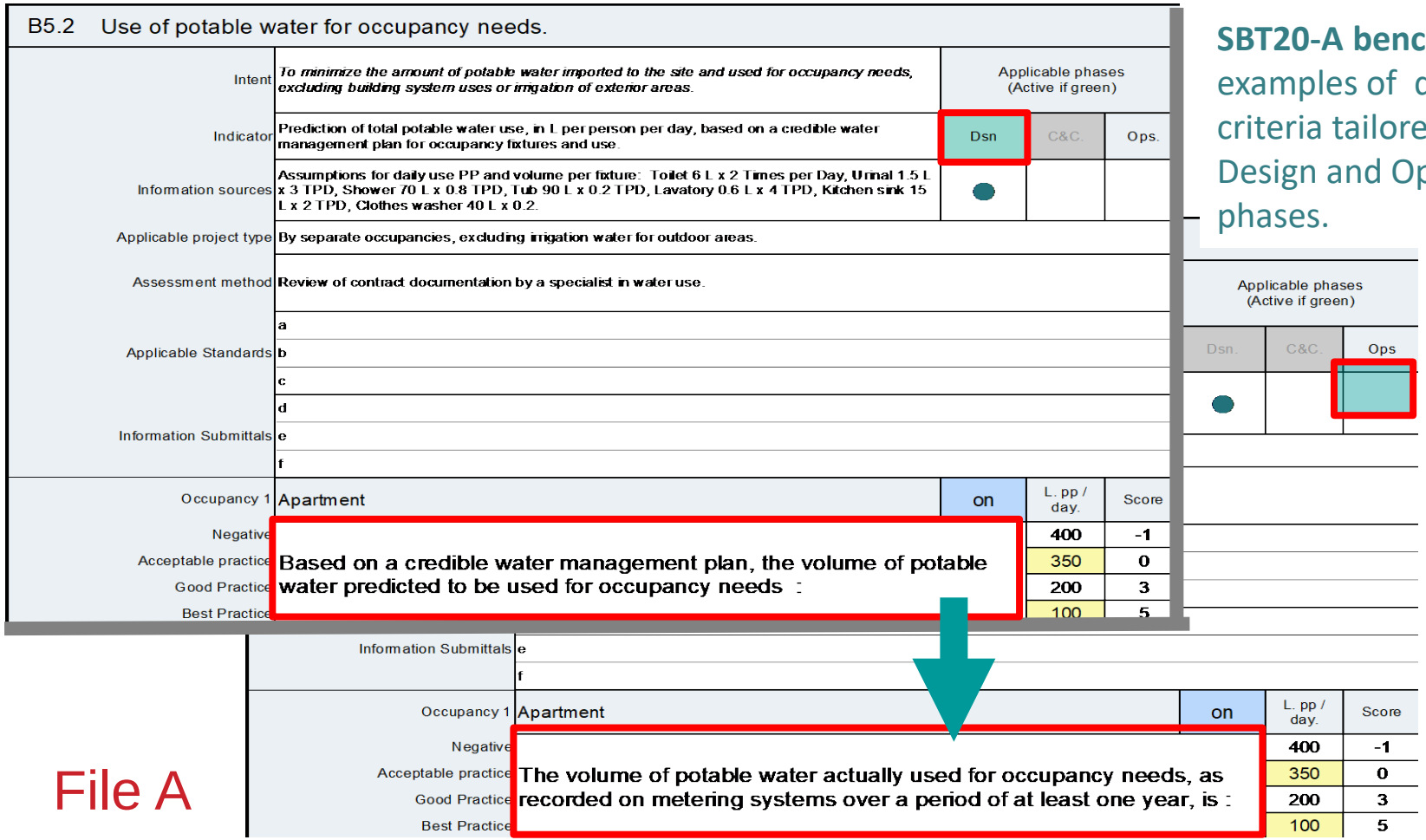
File A

Example benchmark, showing data benchmarks modified for residential and non-residential occupancies

C3.2 Solid non-hazardous waste from facility operations sent off the site.		1.70%	Dsn.
Intent	*To encourage the provision of facilities for storage of waste on each floor or each major work area, and space for the central sorting and storage of waste, with access to a truck loading area.*		
Indicator	*Facilities provided in the design for the storage and sorting of solid wastes in both dispersed and central locations.*		
Applicable project type	Separate criteria for residential and non-residential; NA for parking or open space		
Information sources	We specify storage areas per dwelling and per work group, and assume that the central storage area will be sized to suit.		
Relevant information	*Information on type, capacity and location of facilities for sorting and storing solid waste.*		
Assessment method	*Review of c*		
Standards or references	a b c		
Information Submittals	d e f		

Occupancy 1	Assessment criteria for Residential apartments	on	percent	Score
Negative	Each dwelling unit has been provided with space for temporary storage of solid waste and recycling, and storage for solid waste has been provided on each floor. A central sorting and storage area is located close to to a truck loading area and it is estimated that the percentage of total waste that can be sorted and stored is:		71%	-1
Minimum practice			75%	0
Good Practice			87%	3
Best Practice			95%	5
Occupancy 2	Assessment criteria for Offices	on	percent	Score
Negative	A central sorting and storage area is located close to a truck loading area, and storage has been provided sufficient for all wastes that may accumulate over a period of one week. It is estimated that the percentage of total waste that can be sorted and stored is:		70%	-1
Minimum practice			75%	0
Good Practice			90%	3
Best Practice			100%	5

SBT20-A benchmarks: examples of default text criteria tailored to suit Design and Operating phases.



B5.2 Use of potable water for occupancy needs.

		Applicable phases (Active if green)		
Intent	*To minimize the amount of potable water imported to the site and used for occupancy needs, excluding building system uses or irrigation of exterior areas.*			
Indicator	Prediction of total potable water use, in L per person per day, based on a credible water management plan for occupancy fixtures and use.	Dsn	C&C.	Ops.
Information sources	Assumptions for daily use PP and volume per fixture: Toilet 6 L x 2 Times per Day, Urinal 1.5 L x 3 TPD, Shower 70 L x 0.8 TPD, Tub 90 L x 0.2 TPD, Lavatory 0.6 L x 4 TPD, Kitchen sink 15 L x 2 TPD, Clothes washer 40 L x 0.2.	●		
Applicable project type	By separate occupancies, excluding irrigation water for outdoor areas.			
Assessment method	Review of contract documentation by a specialist in water use.			
Applicable Standards	a			
	b			
	c			
Information Submittals	d			
	e			
	f			

Occupancy 1	Apartment	on	L. pp / day.	Score
Negative	Based on a credible water management plan, the volume of potable water predicted to be used for occupancy needs :		400	-1
Acceptable practice			350	0
Good Practice			200	3
Best Practice			100	5

		Applicable phases (Active if green)		
		Dsn.	C&C.	Ops
		●		

Occupancy 1	Apartment	on	L. pp / day.	Score
Negative	The volume of potable water actually used for occupancy needs, as recorded on metering systems over a period of at least one year, is :		400	-1
Acceptable practice			350	0
Good Practice			200	3
Best Practice			100	5

File A

Weighting

SB Method - weighting

- It is important to deal with the question of the relative importance of various criteria and their scores;
- The simplest approach is for an expert panel assign fixed scores for various criteria;
- But the assignment of 6 points for one criterion and 2 points for another means that the first is considered to be three times as important as the second;
- That may be true in some cases, but questions arise:
- Who decides on the various scores?
- Should the scores not be different for various regions?
- To provide more consistency in the assignment of weighting points, we use an algorithm that automatically assigns a weighting score based on the relevance of major impact categories, as well as factors for the **probable intensity, duration and extent of performance effects.**

iiSBE SetWeight	Weight assigments for use in SBTool weighting criteria	Weights established for Comporta, Lisbon region	SBTool 2020 A

In the Weights table below, authorized users can change text or numbers in yellow cells.

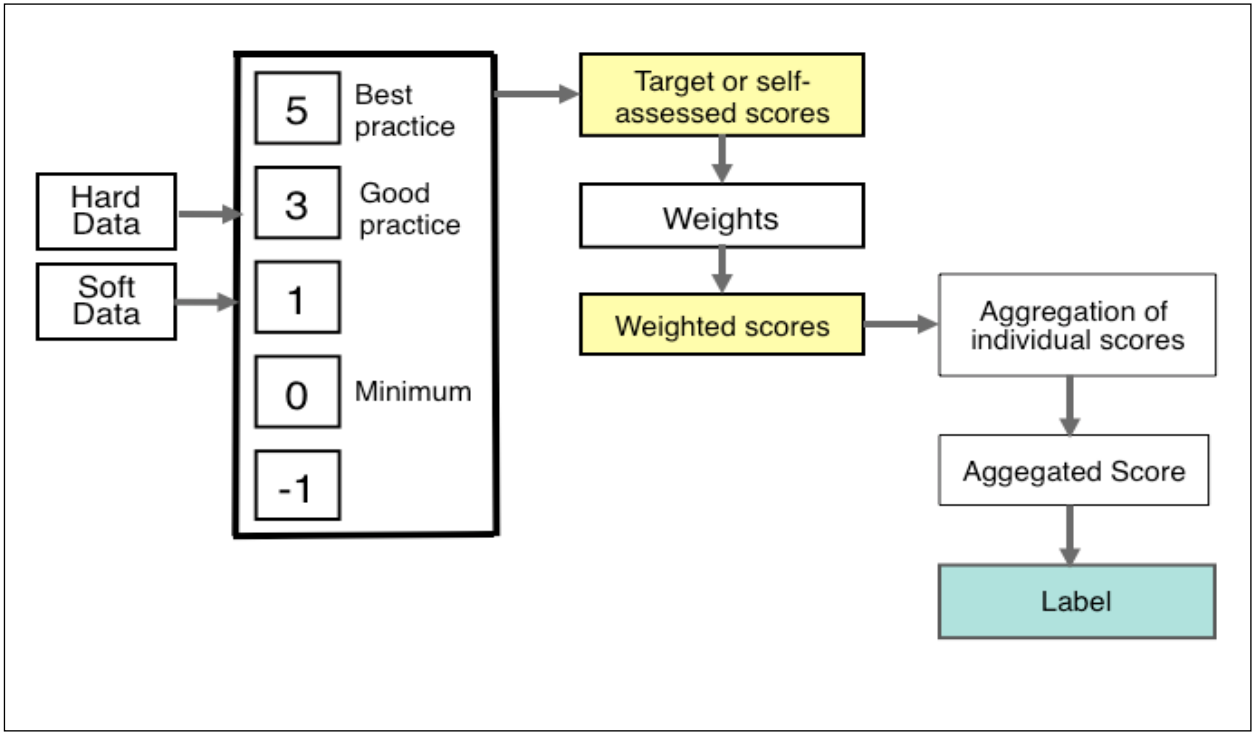
A		B		C		D		E	
Primary system directly affected		Local adjustment factor		Intensity of potential effect		Extent of potential effect		Duration of potential effect	
◆		◆		◆		◆		◆	
1	Cost and economics	1	Much less	1	minor	1	Building & Site	1	1 to 3 years
1	Functionality and servicability	2	Less	2	Moderate	2	Neighborhood	2	3 to 10 years
2	Well-being and productivity	3	OK	4	MAJOR	4	Urban / Region	4	10 to 30 years
2	Society and culture	4	More			8	Global	8	30 to 75 years
3	Land resources	5	Much more					16	>75 years
3	Non-renewable material resources								
3	Non-renewable water resources								
3	Health, safety and security								
4	Renewable energy resources								
4	Non-renewable energy resources								
3	Ecosystem(s)								
4	Local and regional atmosphere								

To change weights of categories left and above, change numbers in the yellow cells. The active weights are used in the WeightsA-G worksheet to indicate relative importance of individual criteria.

SBTool weighting core table

- Weights for each parameter are based on degrees of extent, duration and intensity of effect, combined with links to key issue areas.
- Regional authorities can modify the weighting values shown and they may also increase or reduce the resulting weights to a maximum of 10% +/-.

SBTool Scoring schema



Assessment Results

SBTool Assessment Results

Results are shown relative to the zero benchmark

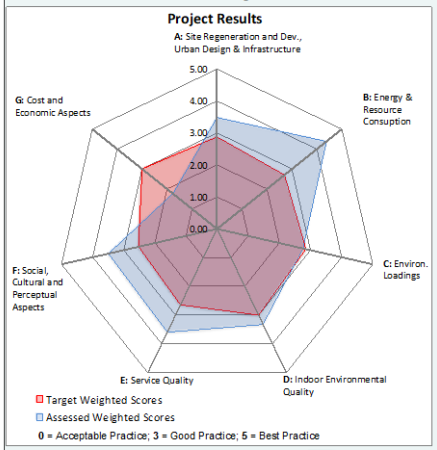
IISBE

SBTool 2019

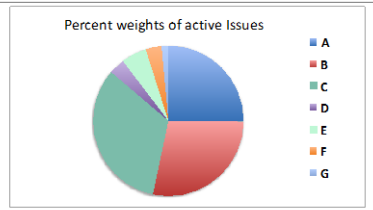
Scores for assessment of ProjectX project in BigTown, SomePlace

Maximum version	Design Phase	24-Apr-20

Whole building basis



Relative Performance Results **B**

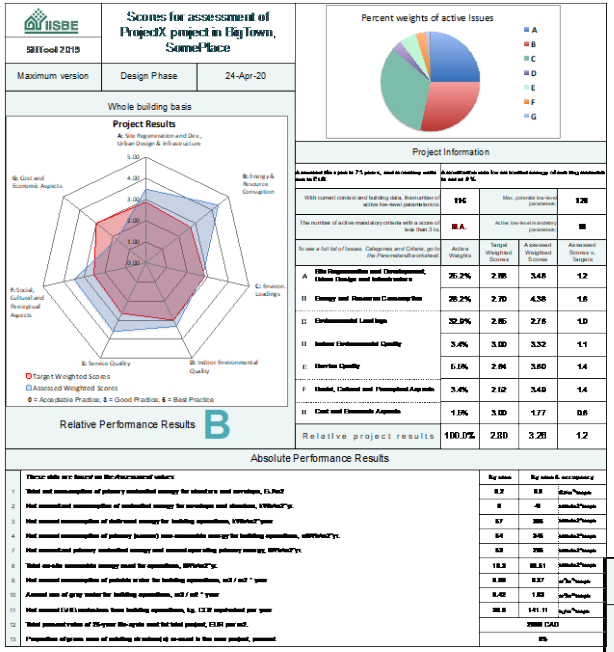


Project Information

Assumed life span is 75 years, and monetary units are in EUR		Amortization rate for embodied energy of existing materials is set at 0 %		
With current context and building data, the number of active low-level parameters is:	116	Max. potential low-level parameters:		128
The number of active mandatory criteria with a score of less than 3 is:	N.A.	Active low-level mandatory parameters:		10
To see a full list of Issues, Categories and Criteria, go to the ParameterS worksheet	Active Weights	Target Weighted Scores	Assessed Weighted Scores	Assessed Scores v. Targets
A Site Regeneration and Development, Urban Design and Infrastructure	25.2%	2.88	3.48	1.2
B Energy and Resource Consumption	28.2%	2.70	4.38	1.6
C Environmental Loadings	32.9%	2.85	2.76	1.0
D Indoor Environmental Quality	3.4%	3.00	3.32	1.1
E Service Quality	5.5%	2.64	3.60	1.4
F Social, Cultural and Perceptual Aspects	3.4%	2.52	3.49	1.4
G Cost and Economic Aspects	1.5%	3.00	1.77	0.6
Relative project results	100.0%	2.80	3.26	1.2

Absolute Performance Results

	These data are based on the Assessment values	By area	By area & occupancy	
1	Total net consumption of primary embodied energy for structure and envelope, GJ/m2	0.2	0.9	GJ/m²/mph
2	Net annualized consumption of embodied energy for envelope and structure, kWh/m2*yr.	9	41	kWh/m2*mph
3	Net annual consumption of delivered energy for building operations, kWh/m2*year	67	305	kWh/m2*mph
4	Net annual consumption of primary (source) non-renewable energy for building operations, ekWh/m2*yr.	54	245	kWh/m2*mph
7	Net annualized primary embodied energy and annual operating primary energy, kWh/m2*yr.	63	286	kWh/m2*mph
8	Total on-site renewable energy used for operations, kWh/m2*yr.	18.3	83.61	kWh/m2*mph
9	Net annual consumption of potable water for building operations, m3 / m2 * year	0.08	0.37	m³/m²*mph
10	Annual use of grey water for building operations, m3 / m2 * year	0.42	1.93	m³/m²*mph
11	Net annual GHG emissions from building operations, kg. CO2 equivalent per year	30.9	141.11	kg/m²*mph
12	Total present value of 25-year life-cycle cost for total project, EUR per m2.	2800 CAD		
13	Proportion of gross area of existing structure(s) re-used in the new project, percent	0%		



But they are also provided as absolute results, e.g. kWh/m2 per year;

SBTool is unique in that it also shows results normalized by occupancy e.g. kWh/m2/yr*maph;

Absolute Performance Results

	These data are based on the Self Assessment values	By area	By area & occupancy	
1	Total net consumption of primary embodied energy for structure and envelope, G.J/m2	0.3	33.3	GJ/m²*maph
2	Net annualized consumption of embodied energy for envelope and structure, kWh/m2*yr.	14	1598	kWh/m2*maph
3	Net annual consumption of delivered energy for building operations, kWh/m2*year	681	77689	kWh/m2*maph
4	Net annual consumption of primary (source) non-renewable energy for building operations, ekWh/m2*yr.	893	101921	kWh/m2*maph
7	Net annualized primary embodied energy and annual operating primary energy, kWh/m2*yr.	907	103520	kWh/m2*maph
8	Total on-site renewable energy used for operations, kWh/m2*yr.	5.6	634.20	kWh/m2*maph
9	Net annual consumption of potable water for building operations, m3 / m2 * year	0.16	17.76	m³/m²*maph
10	Annual use of grey water for building operations, m3 / m2 * year	1.42	161.72	m³/m²*maph
11	Net annual GHG emissions from building operations, kg. CO2 equivalent per year	77.4	8831.39	kg/m²*maph
12	Total present value of 25-year life-cycle cost fot total project, EUR per m2.	2800 EUR		
13	Proportion of gross area of existing structure(s) re-used in the new project, percent	0%		

Related SBTool worksheets

Key Benchmarks worksheet

Fill in values for Reference (minimum acceptable level of performance) and Best Practice in yellow cells below, for each occupancy type of interest. Also state info sources. The values relevant to the two occupancy types you have specified will be copied to lines 9 and 10, and these will then be copies to Bmk worksheets B and C.

Energy, GHG emissions and water performance benchmarks for occupancy types listed, in BigTown, SomePlace

Password: SBTool

	Embodied non-renewable energy in original construction materials.		Embodied non-renewable energy in construction materials for maintenance or replacement(s).		Consumption of non-renewable energy for demolition or dismantling process.		Consumption of non-renewable energy for all building operations., except for occupant equipment.						Electrical peak demand for building operations., except for occupant equipment.		GHG emissions from energy embodied in original construction materials.		GHG emissions from energy embodied in construction materials used for maintenance or replacement(s).		GHG emissions from primary energy used for all purposes in facility operations.		Use of water for occupant needs during operations.		Information sources
	GJ / m2		GJ / m2 (cumulative over life)		GJ / m2		Electrical kWh / m2 per year (delivered)		On-site fuels kWh / m2 per year		Total kWh / m2 per year		W / m2 peak month		kg/m2 * yr.		kg/m2 * yr.		kg/m2 * yr.		m3 / m2 * year		Assumed lifespan = 75 yr.
	Reference	Best practice	Reference	Best practice	Reference	Best practice	Reference	Best practice	Reference	Best practice	Reference	Best practice	Reference	Best practice	Reference	Best practice	Reference	Best practice	Reference	Best practice	Reference	Best practice	
Active occupancies	Do not overwrite values or formulas in white or grey cells; enter text or data only in yellow cells!																						
Residential Apartment	3.5	2.0	1.8	1.0	0.4	0.2	25.0	15.0	60.0	30.0	85.0	45.0	30.0	20.0	0.01	0.00	0.00	0.00	0.19	0.10	1.8	0.4	
Hotel / motel	5.2	3.0	2.0	1.2	0.6	0.3	45.0	24.0	90.0	50.0	135.0	74.0	66.0	44.0	0.01	0.01	0.00	0.00	0.31	0.17	0.3	0.2	
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	
																							kg CO2 / kWh
Key benchmarks for active occupancies are automatically copied to other worksheets																							0.17
All occupancies	Enter locally applicable benchmarks below, but only in yellow cells.																						
Attached housing											0	0			0.00	0.00	0.00	0.00	0.00	0.00			
Residential Apartment	3.5	2.0	1.8	1.0	0.4	0.2	25	15	60	30	85	45	30.0	20.0	0.01	0.00	0.00	0.00	0.19	0.10	1.80	0.40	
	5.2	3.0	2.0	1.2	0.6	0.3	45	24	90	50	135	74	66.0	44.0	0.01	0.01	0.00	0.00	0.31	0.17	0.30	0.20	
											0	0			0.00	0.00	0.00	0.00	0.00	0.00			
Offices	4.0	3.0	2.0	1.1	0.6	0.3	110	40	80	30	190	70	54.0	30.0	0.01	0.01	0.00	0.00	0.43	0.16	0.30	0.15	
K to 12 school											0	0			0.00	0.00	0.00	0.00	0.00	0.00			
Resto / cafeteria	5.0	3.5	3.0	2.0	0.7	0.4	125	55	30	25	155	80	120.0	50.0	0.01	0.01	0.01	0.00	0.35	0.18	0.80	0.60	
Retail	5.0	3.5	3.0	2.0	0.7	0.4	125	55	40	25	165	80	120.0	50.0	0.01	0.01	0.01	0.00	0.37	0.18	0.10	0.05	
Supermarket											0	0			0.00	0.00	0.00	0.00	0.00	0.00			
Shopping Centre											0	0			0.00	0.00	0.00	0.00	0.00	0.00			
Theatre - Cinema											0	0			0.00	0.00	0.00	0.00	0.00	0.00			
Lobby, public space	6.0	4.5	0.6	0.3	1.0	0.6	20	12	20	10	40	22	20.0	16.0	0.01	0.01	0.00	0.00	0.09	0.05	0.09	0.09	
Parking and service area	7.0	5.0	0.5	0.4	1.1	1.2	15	14	3	2	18	16	8.0	9.0	0.02	0.01	0.00	0.00	0.04	0.04	0.02	0.01	
0											0	0			0.00	0.00	0.00	0.00	0.00	0.00			

Enter key benchmarks for active occupancies

Regional context worksheet

Regional Context for Amiel, Atlantis		
Click 1 or 2 at upper left to show details		*The purpose of this worksheet is to characterize aspects of urban surroundings that may support or limit the performance of the building. Go to Level 2 to see available text to make your choice, or change those choices.*
Context Issue		Click blue boxes to select specific condition
1	Urban area type	Small city of 10,000 to 50,000 population
2	Seismic zone type (Uniform Building Code, USA)	Zone 3
3	Climate zone (based on Köppen)	Cfa, Cwa: Humid subtropical (Houston, Milan, Okinawa, Sao Paulo, Hong Kong)
4	Winter Design temperatures	2 1/2% Winter Design Temperature is below 0 Deg. C.
5	Average annual soil temperature 2m. below grade in ºC	
6	Average difference, max. and min. diurnal temperatures in warm season, ºC	
7	Annual heating degree days below 18ºC.	
8	Annual cooling degree days above 18ºC.	
9	Average relative humidity during warm season	
10	Average relative humidity during warm season	
11	Annual precipitation, mm	
12	Solar irradiance, kWh/m2 per year on horizotal surface	

Regional Context for Amiel, Atlantis		
Click 1 or 2 at upper left to show details		*The purpose of this worksheet is to characterize aspects of urban surroundings that may support or limit the performance of the building. Go to Level 2 to see available text to make your choice, or change those choices.*
Context Issue		Click blue boxes to select specific condition
	Comment	Descriptors of condition
1	Urban area type	Small city of 10,000 to 50,000 population
		Rural setting
		Community of 1,000 to 10,000 population
		Small city of 10,000 to 50,000 population
		City of 50,000 to 250,000 in population
		City with population of more than 250,000
2	Seismic zone type (Uniform Building Code, USA)	Zone 3
		Zone 4
		Zone 3
		Zone 2
		Zone 1
3	Climate zone (based on Köppen)	Cfa, Cwa: Humid subtropical (Houston, Milan, Okinawa, Sao Paulo, Hong Kong)
		A1: Tropical rainforest (Kuala Lumpur, Singapore)
		A2: Tropical Monsoon (Bangladesh, Miami)
		A3: Tropical wet and dry or svanna (Rio de Janeiro, Mumbai, Veracruz)
		BW: Dry desert climate

Fuel emissions

The mix of fuels used to generate electricity varies widely between regions, and that affects the resulting emissions per kWh

Fuel emission values must be established for each region and are used to establish emissions for on-site fuels but also for delivered electricity

The worksheet expands horizontally to show more emission values and transmission losses

File A

Fuel Emissions Data for Amiel, Atlantis

Title
Click to select value
Enter or revise text

Emissions data is for: **Ontario, Canada**

Modify emissions data in this sheet to suit local generation mix.

Primary energy and environmental factors	Emissions from combustion in Kg. per GJ of energy produced CO_2	SO_2	For more detail click on 2 or 3 at upper left
Fuel used for off-site gen. of electricity only			Gross-up factor for primary energy (incl. combustion & delivery loss)
natural gas (BC)	131.39	0.00105	2.84
Fuel Oil (QC)	200.00	1.93889	3.02
(ON)	241.11	1.16389	3.26
mass and other		0.00	0.00
nuclear	0.00	0.00	
ission reservoir	0.00	0.00	Composite gross-up electrical primary energy based on generation mix, assuming only delivery losses for nuclear or hydro **2.12**
ission reservoir	0.00	0.00	
hydro, with low- or no-methane emission reservoir	0.00	0.00	
wind	0.00	0.00	
geothermal	0.00	0.00	

Electricity power generation base load mix	Generation mix by source
natural gas	8.40%
oil-fired	0.49%
coal-fired	24.59%
nuclear	40.80%
-methane emission reservoir	0.00%
-methane emission reservoir	24.91%
hydro, with low- or no-methane emission reservoir	0.00%
wind	0.00%
solar	0.00%
geothermal	0.00%
biomass	0.66%
other	0.0016%

Arcane calculations for electricty GHGs

Fuel type	GHG fuels as % of all GJ	kg. GHG per GJ primary
Nat. gas	8.4%	11.04
Oil	0.5%	0.98
Coal	24.6%	59.29
Biom/Oth	0.7%	0.00
kg. GHG / GJ for elec.		71.31

Note: Only emissions from non-renewables are included. Emissions for biomass and other fuels are assumed to be zero, as per IPCC.

This is the resulting gross-up factor which results in delivered electrical energy being converted into primary energy.

This worksheet expands horizontally to show more emission values and transmission losses

Percent of power generation by fuel type

Initial Design Specs

This worksheet shows an excerpt of initial design assumptions

Initial design specifications for ProjectX, BigTown, SomePlace

Title
Click to select value
Enter / revise text or data

The purpose of this worksheet is to identify the basic characteristics of the project and the separate occupancies within it, as far as may be known at this stage. Click on the upper left buttons to show different levels of detail.

iiSBE

SBTool 2019

Project description here

A. Basic Information

1	Project name	**ProjectX**	
2	Number of occupancies in this project (max.2)	2	
3	Is a site selected?	Yes	
4	Project site area, m2	1,000	
5	Permitted Floor Area Ratio on site (total gross area above grade / site area)	2.0	
6	Estimated age of existing structure in years, if applicable.		
7	Is the building new construction or renovation or an existing building?	**New construction**	
8	Will this building include mechanical cooling?	Not yet decided	
9	Will this building include mechanical ventilation?	Not yet decided	
10	Will this building include hybrid or natural ventilation systems?	Yes	
11	Will this building include ground- or water-source heat pumps?	Not yet decided	

B. Building occupancies (maximum 2)

		Select occupancy types (up to 3 of the 5 types activated in File A)	Number of floors	Gross area, m2
1	Occupancy type 1	Residential Apartment	6	1,640
2	Occupancy type 2	Hotel / motel	2	1,200

C. Occupancies by floor

		Select Occupancy Type	Number of floors	Gross m2 per floor	Gross m2
Below grade	Occupancy type and area of Floor -3, gross m2		0	0	0
	Occupancy type and area of Floor -2, gross m2		0	0	0
	Occupancy type and area of Floor -1, gross m2		0	0	0

Embodied energy (excerpt)

Materials and Approximate Embodied Energy for ProjectX, BigTown, SomePlace	Title		This worksheet can be used to give very approximate estimates of embodied energy for main structural and envelope components. Click on the blue box below to choose.
	Click to select value		
	Enter text or data		
	Amortization rate used	0.0%	

SBTool allows the embodied energy in existing materials that are re-used to be discounted according to their age. Thus, if an existing structure is 40 years old and an amortization rate of 5% is selected, the embodied energy is not included in the total for the project. See Basic worksheet to set the rate. All assemblies listed here are defined in EmbodiedA worksheet of Module A. Note that "X" means existing.

Using values from LCA program

J	Total Embodied Energy of Structure, Walls, and Heavy Materials	Structure Net GJ		Walls Net (without windows or glass) GJ		Weight of heavy materials not included in Structure or Walls, in Tonnes					Total Embodied Energy	
		Existing structure	New structure	Existing structure	New structure	Sand	Aggregate	Masonry	Steel	Glass	GJ / m2 & GJ /m2 * yr	kWh / m2 & kWh /m2 * yr
1	Estimated embodied energy, using values in this worksheet	0	0	0	0	100.0	300.0	400.0	150.0	75.0	0.0	0
2	Net GJ/m2 and kWh/m2 per year using approximations										0.00	0
3	Estimated embodied energy results in GJ from external LCA program (existing occupancies at full value)		50,000		18,000				Note that values at right are based on embodied energy values provided in EmbodiedA! Worksheet and annualized as per BasicB! B20		Results using data from external LCA program	
4	With existing embodied energy values prorated down as per Basic worksheet	0	50,000	0	18,000						0.33	91
5	Total net GJ/m2 and kWh/m2 per year from LCA program + heavy materials										0.004	1.219

Applications of SBTool

Earlier versions of SBTool work have influenced national systems being used in Italy, Czechia and Portugal.

Monaco

Competition in Monaco

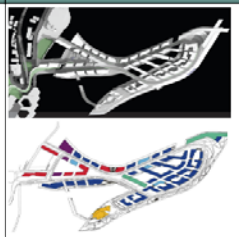
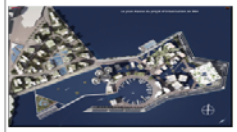
- SBTool can be used by a client to identify its specific performance requirements for competitions or long-term portfolio development;
- We followed this approach in a major invited competition in Monaco which involves an extension of 11 hectares into the sea in the middle of the urban area;
- This approach allowed the client to be very specific and also provides clarity for the competing teams.
- This was an invited competition for five international teams.

Application of the SBTool framework to an invited competition for a large development in Monaco

Principauté de Monaco — *Projet d'urbanisation en mer : comparaison générale des soumissions* — V18, 28 mai

avril 2008

Bilan comparatifs de l'ensemble de projets

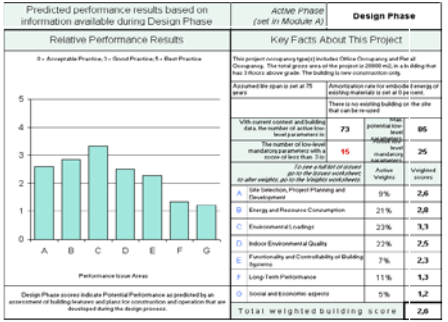
			Equipe A	Equipe B	Equipe C	Equipe D	Equipe E
							
		Observations générale					
		SBTool - score autoeval	3,6	3,8	4,1	3,7	4,5
		SBTool - score finale	**3,2**	**3,5**	**2,8**	**3,3**	**3,9**
		Observations sur l'utilisation de SBTool	Le dossier réalisé de version des textes de SBTool est dans la soumission, et inclut l'information supplémentaire détaillée jusqu'à C1.2.	Ils ont utilisé l'outil correctement et ont également fourni des informations supplémentaires très étendues et détaillées pour chaque critère.	Il y a seulement une version imprimée du dossier réalisé de SBTool dans la soumission. Plusieurs points étaient plus hauts que 5.0 et ceux-ci ont été donc réduits.	SBTool a été employé comme prévu.	SBTool a été employé comme prévu.
		Critères	Case grisée (gauche) = note révisée				
A	30.1%	**Site, implantation, développement urbain et marin**	Deux bras entourent une île centrale carrée qui contient un parc public du marché ouvert avec des vues du Monaco. L'impression globale est très urbaine et ordonnée, avec un bon accès piétonnier le long des secteurs de bord de mer.	Deux éléments linéaires sont divisés par un canal mais liés par plusieurs éléments de logement et un pont, tous bien reliés au secteur urbain existant. Les éléments traversiers peuvent porter des mbrs importantes sur les zones inférieures.	Beaucoup d'éléments divers sont reliés au continent par une presqu'île. Les grands espaces ouverts semblent inhospitaliers et créent yn paysage urbain "décousur". Les résidants de la "péninsule" auront des vues faibles de la mer.	Trois sous-éléments sont reliés à la bande de terre et au grand élément assurant le lien avec le continent. Le plan urbain et dense et semble bien fonctionner mais des secteurs commerciaux sont dispersés le long de bords de mer.	Cet arrangement place plusieurs éléments séparés loin du rivage. Un de ces éléments est sans issue à ses extrémités alors que d'autres sont reliés par des ponts. Pour les marcheurs, les distances à parcourir pourraient être assez longues.
A1	21%	*Choix de l'implantation en mer et contexte marin.*		L'utilisation du remblai comme base pour le bras externe peut réduire des écoulements de l'eau.			
A1.1	1.9%	Préservation de la qualité écologique des zones sensibles	1.0 La distance minimale entre le pied sous-marin de la fondation des ouvrages et le tombant coralien des Spélugues est de 5 m. Ces distances sont reparties sur les deux plans.	0.0 PF respecté – une distance supérieure à 56 m entre l'extension et les zones sensibles.	0.0 50 m; PF respecté	0.0 PF; Voir plan masse et documents graphiques	3.0 100 m
A1.2	1.2%	Préservation de la qualité écologique des fonds marins durs découverts	3.0 Les fonds durs découverts actuellement et qui ne le seront plus après la réalisation du Projet sont localisés entre le Cannadi Forum et les plages du Larvotto. Conformément au plan joint, la surface de fonds durs occupée par l'emprise du Projet est de 8,7%.	4.0 0% fonds durs sont occupés par l'emprise effective des fondations.	0.0 5%, on ligne 42 du document PF CDC-520.	2.5 10%; L'étude d'impact dénombre 1,6 ha de substrats durs recouverts pour sur les 20,5 ha Monégasques soient une occupabonde 7,8 %. La constitution d'enrochements (9 ha) et d'habitats artificiels vient compenser cette occupation.	4.0 0%; Ainsi que l'indiquent les plans des fondations des Cordons et du Ondins Marin, la totalité des empreses reposent sur les fonds dors actuellement recouverts de sédiments.

Italy

SBTool in Italy

- In 2002 ITACA, the *Federal Association of the Italian Regions*, adopted the iiSBE methodology as basis to develop an institutional assessment system for residential buildings: Protocollo ITACA;
- Main objective of the association is to promote and disseminate the good practices for the environmental sustainability and to develop common policies for the Regions (the environment falls within regional competence).
- The aim of ITACA was to establish an objective set of requirements to define green building and to develop a simple assessment method to measure the environmental performance of buildings;
- SBTool was found to give local authorities the ability to adapt the tool to their own conditions and priorities;
- The “Protocollo ITACA” was officially adopted by ITACA in January 2004, and is now the reference rating system of the regional authorities in Italy.

Protocollo ITACA



- As with all implementations of GBTool or SBTool, the assessments are carried out with reference to locally meaningful benchmarks and weights, while results are expressed both as absolute results, and as relative performance using the minimum acceptable benchmark as a reference;
- An important factor in the success of the Protocollo ITACA has been the role of iiSBE as an international body overseeing the activities of iiSBE Italia, and the partnership with the CNR and universities;
- Another significant step was the decision to reduce the number of parameters from the potential maximum of 118 to to 65;
- A more compact version, using 25 criteria was developed, and a still smaller version with 12 criteria now exists;

Recent developments in Italy

- During 2020, iiSBE Italia developed a web-based program that will allow users to use versions of SNTool, SBTool Site and SBTool Buildings on a web platform that is much easier to use than the current XLS files;
- iiSBE Italia has also developed a Territorial tool to deal with large areas, and this is also operational on the web platform;
- The work was carried out by a consultant under the terms of a current H2020 contract;
- The EU contract will end on 31 December and, at that point, version of the system will be provided to iiSBE International to use with all professionals located outside the EU.

Conclusions

- SBTool takes a very different approach from commercial rating systems, by providing an open framework in which authorized regional users insert local context values, performance benchmarks and targets to suit certain building types;
- This requires a considerable effort and time, but allows the calibrated system to provide much more meaningful results;
- Of course, this approach appeals more to users who are interested in expressing performance in an integrated way, than others who want the marketing benefits of a label;
- But we will continue to develop a system that we consider to be the right approach.

Integrated Design Process

IDP approach for a more comprehensive process

1. Consider program logic, renovation options and site issues
2. Set performance targets
3. Develop a building information model (BIM – a recent addition)
4. Undertake passive solar design and optimize envelope design
5. Maximize use of renewable energy
6. Use efficient systems to handle residual energy-using requirements
7. Construct and then commission key systems
8. Ensure effective operational management

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 is located in File B and 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 worksheet within SBTool

The number of completed steps is 4 and the number of inactived steps is 134	Key process steps for Megaplex, Amiel, Atlantis	To unprotect any worksheet, go to Tools, then Protection. Password is "IDP".
Click - to list upper level activities	IDP key steps are shown in a linear sequence, but some steps may be performed in a different sequence or may be repeated. You may therefore wish to change the order or content, on the IDPsteps worksheet. See Level 3 for detailed comments. To see text for inactive steps, see IDPlist worksheet.	Select up to 6 actors involved: AR DF ME Links within file and to websites Relevance (0=no, 1=yes, 2=resid., 3=renov.): 1 Click and select "a" to mark each step completed Relevant steps completed: 4

1.0	Develop a functional program, examine assumptions and establish performance targets
2.0	Assess site characteristics
3.0	Assess any existing structures and materials that may be re-used
4.0	Assemble the design team
5.0	Develop Reference design and benchmarks
6.0	Hold an initial Design Workshop
7.0	Develop Concept Design
8.0	Consider site development issues
9.0	Determine building structure
10.0	Develop building envelope design
11.0	Develop preliminary daylighting, lighting and power system design
12.0	Develop preliminary ventilation, heating & cooling and wet services designs
13.0	Decide on major design options for detailed development
14.0	Screen non-structural materials for environmental performance
15.0	Complete design and documentation
16.0	Develop QA strategies for construction and operation
17.0	Site takeover, existing building decontamination & deconstruction, excavation & foundations
18.0	Complete above-grade construction
19.0	Prepare a set of as-built construction documents
20.0	Operate and maintain the building
21.0	Carry out post-occupancy evaluation and monitor performance

Overview of IDP process steps which is the KeySteps worksheet in the SBTool B file; this shows the highest level of detail

File B

Details of IDP Steps and sub-steps

	Key process steps for Megaplex, Amiel, Atlantis	To unprotect any worksheet, go to Tools, then Protection. Password is "iDP".			IISBE		
1.09	Carry out an Environmental Impact Assessment, based on preliminary assumptions about the site characteristics, building program, size and location on the site.	EC		PM			
		GE					
1.10	Prepare a Functional Program and Performance Goals Report, including a completed File B of SBTool.	DF	AR	PM			
		CL					
2.0	**Assess site characteristics**						
2.01	Assess the suitability of the site in terms of easy access to good public transportation services.	UP	CL				
		AR					
2.02	Assess the suitability of the site in terms of access to commercial and public services, recreation and public green space.	UP	CL				
		AR					
2.04	Assess erosion potential of surface soils and soil stability and bearing strength of sub-surface soils.	GE					
		ST					
2.05	Assess the ecological quality of the site. Report on results in ContextB worksheet.	EC					
		GE					
2.06	This is a brownfield site, take steps to remediate conditions (see ContextB).	EC	EC				
		CL					
2.07	Examine soil for presence of radon.	GE					
2.08	Identify any features in adjacent properties that may place constraints on the design of the subject building.	AR					
2.09	Measure typical Sound Level (Leq) at the noisiest site boundary. Report on results in ContextB worksheet.	AS					
		UP					

Yellow and blue circles are hyperlinks to relevant websites and other worksheets
Use blue clickable boxes to select actors to be involved in each step from list below

All	All
PM	Project manager
AR	Architect
AS	Acoustic specialist
BP	Building products rep
CA	Commissioning agent
CL	Client
CM	Construction manager
CS	Controls specialist
CV	Civil / services engineer
DF	Design facilitator
DS	Daylighting specialist
EC	Ecologist / env. Specialist
EE	Energy engineer

EL	Electrical engineer
GE	Geotechnical engineer
ID	Interior designer
LA	Landscape architect
LD	Lighting designer
MS	Materials specialist
ME	Mechanical engineer
OP	Operator of building
RS	Renewables specialist
ST	Structural engineer
TS	Telecoms specialist
UP	Urban planner
$$	Costing specialist

IDP Support

A simple checklist;

Top level titles and example of second level with more detail;

Also available as a stand-alone tool

The number of completed steps is 4 and the number of inactived steps is 135

iDP

Key process steps for ProjectX, BigTown, SomePlace

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

IISBE

Click 1 to 3 at user's discretion

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	AR	DF	ME
Select up to 6 actors involved			
Links within file and to websites	●	››	●
Relevant (0=no, 1=yes, 2=resid., 3=renov.)	1		
Click and select "a" to mark each step completed			
Relevant steps completed	4		

1.0	Develop a functional program, examine assumptions and establish performance targets
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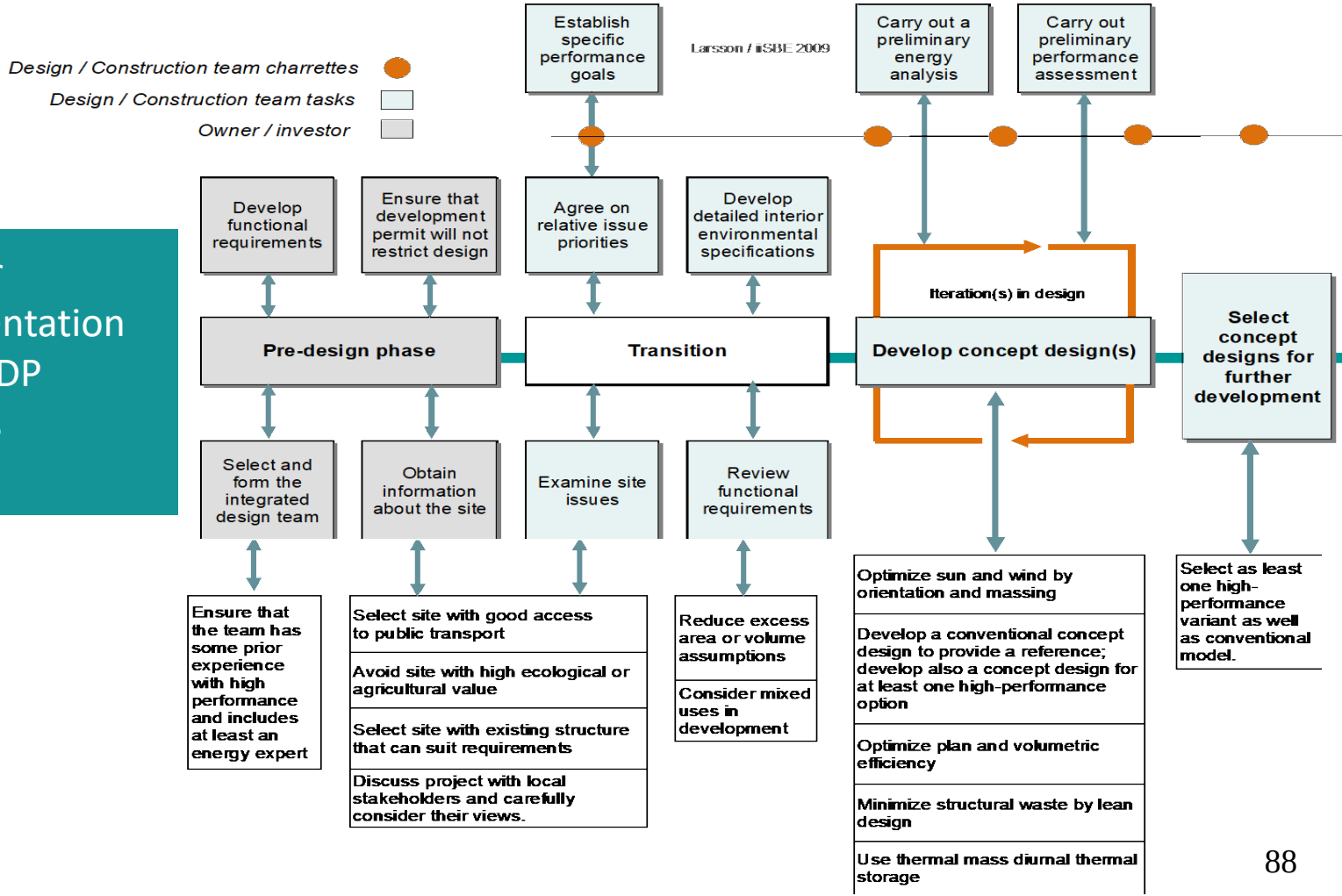
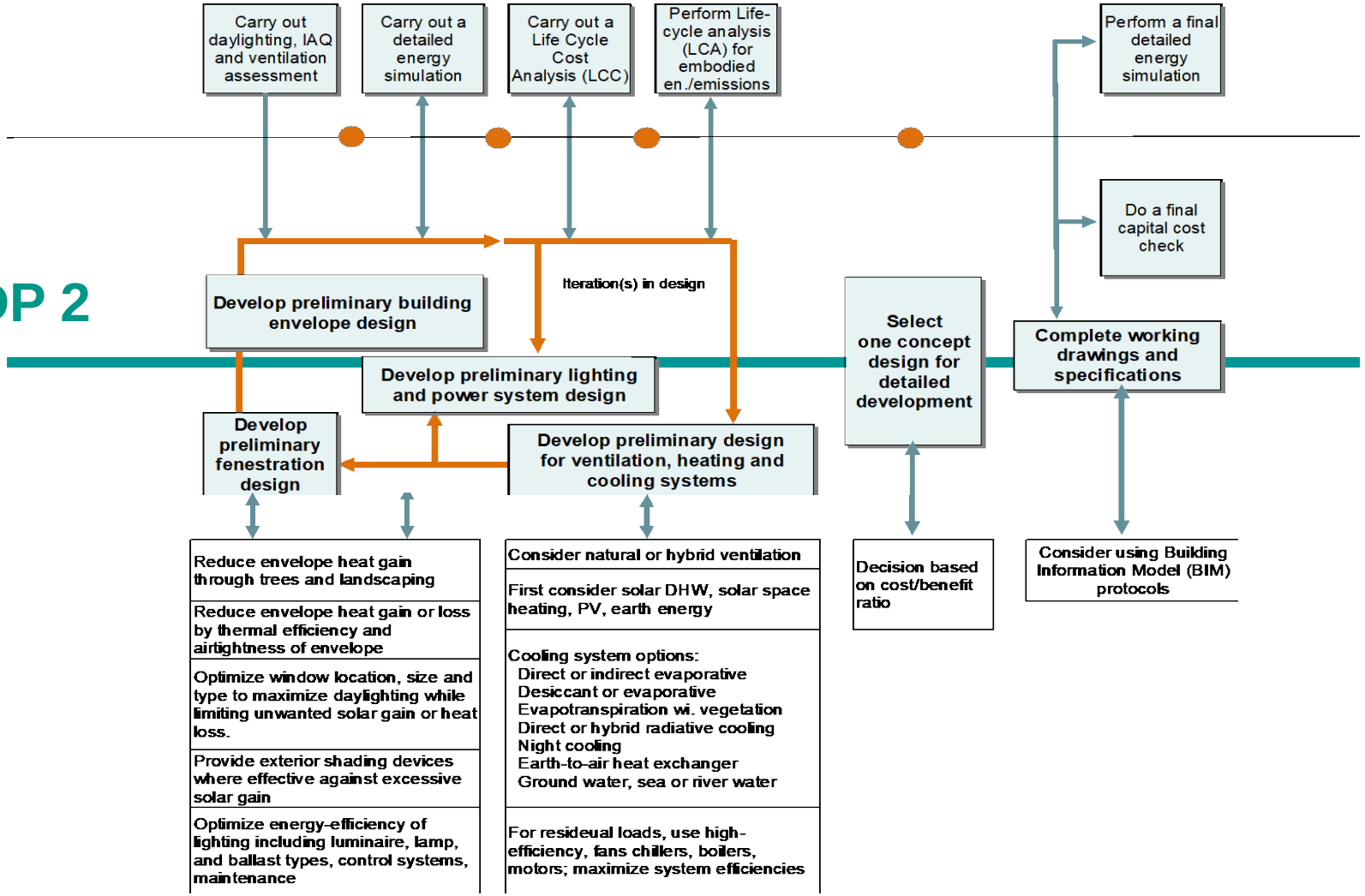
1.0	Develop a functional program, examine assumptions and establish performance targets								
2.0	Assess site characteristics								
3.0	Assess any existing structures and materials that may be re-used								
4.0	Assemble the design team								
5.0	Develop Reference design and benchmarks								
32	5.01	**Develop a sketch design for a simple (hypothetical) Reference building fulfilling the functional requirements.**	AR	RS					
			ST						☐
		Almost always, the client will be able to identify the basic parameters of a design that will satisfy the bare minimum performance requirements. The architect can then develop a schematic design based on typical market solutions for a similar building t							
33	5.02	**Develop a version of the Reference Design to fulfil requirements of applicable energy regulations.**							☐
34	5.03	**Develop benchmarks for minimally acceptable performance for parameters not covered by 5.01 or 5.02, using SBTool as a framework.**							☐
6.0	Hold an initial Design Workshop								
7.0	Develop Concept Design								

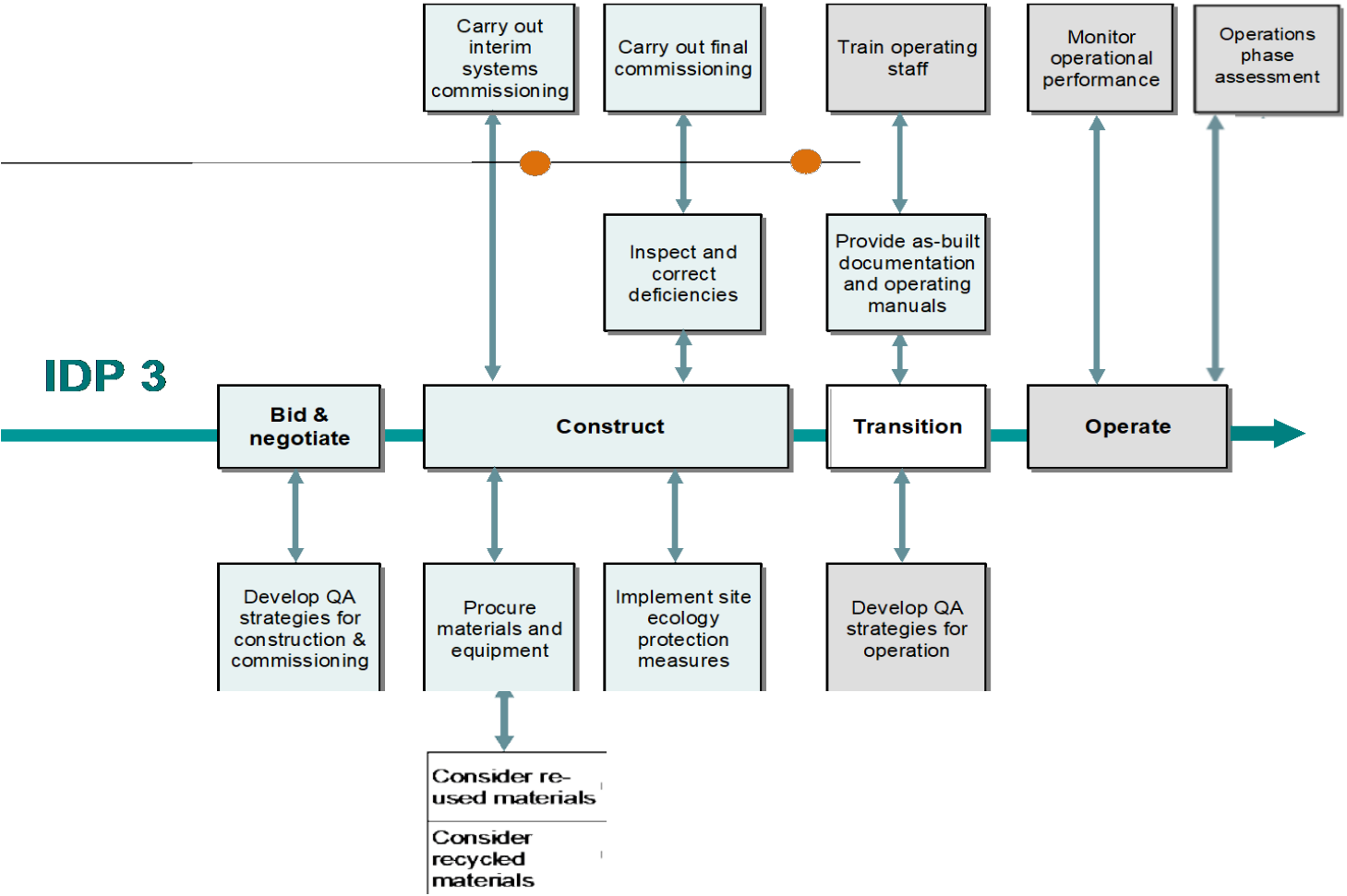
As with all other worksheets, content and language can be changed by the user.

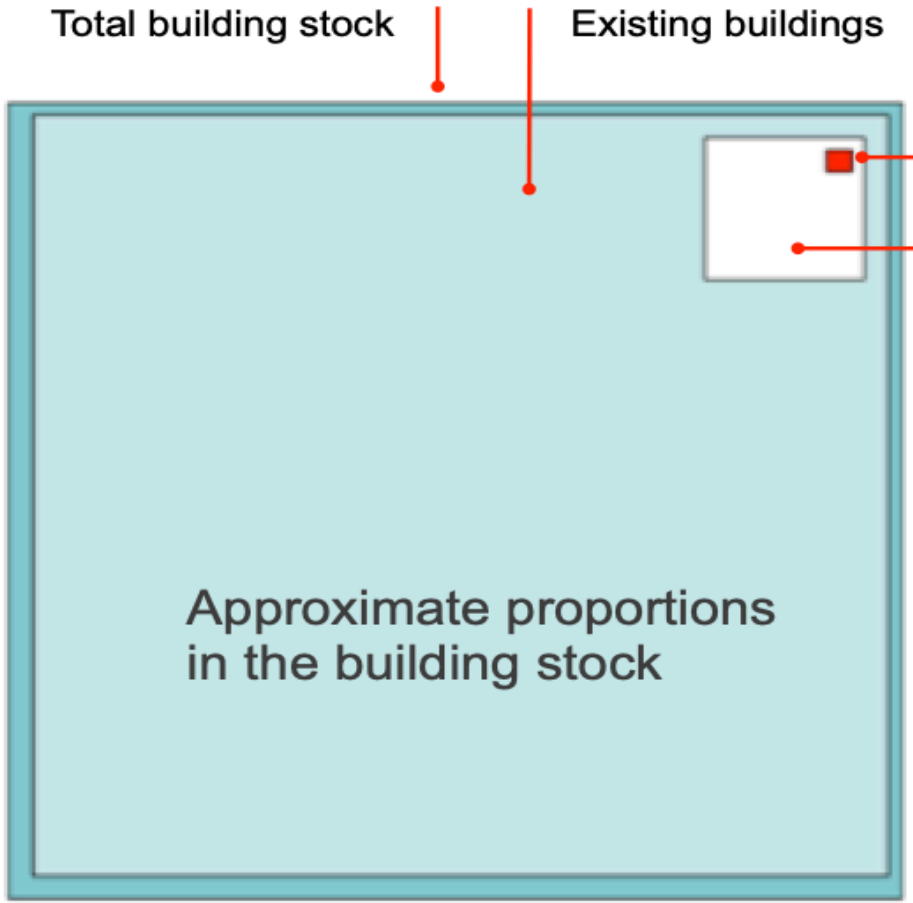
A linear representation of the IDP process (1 of 3)



IDP 2

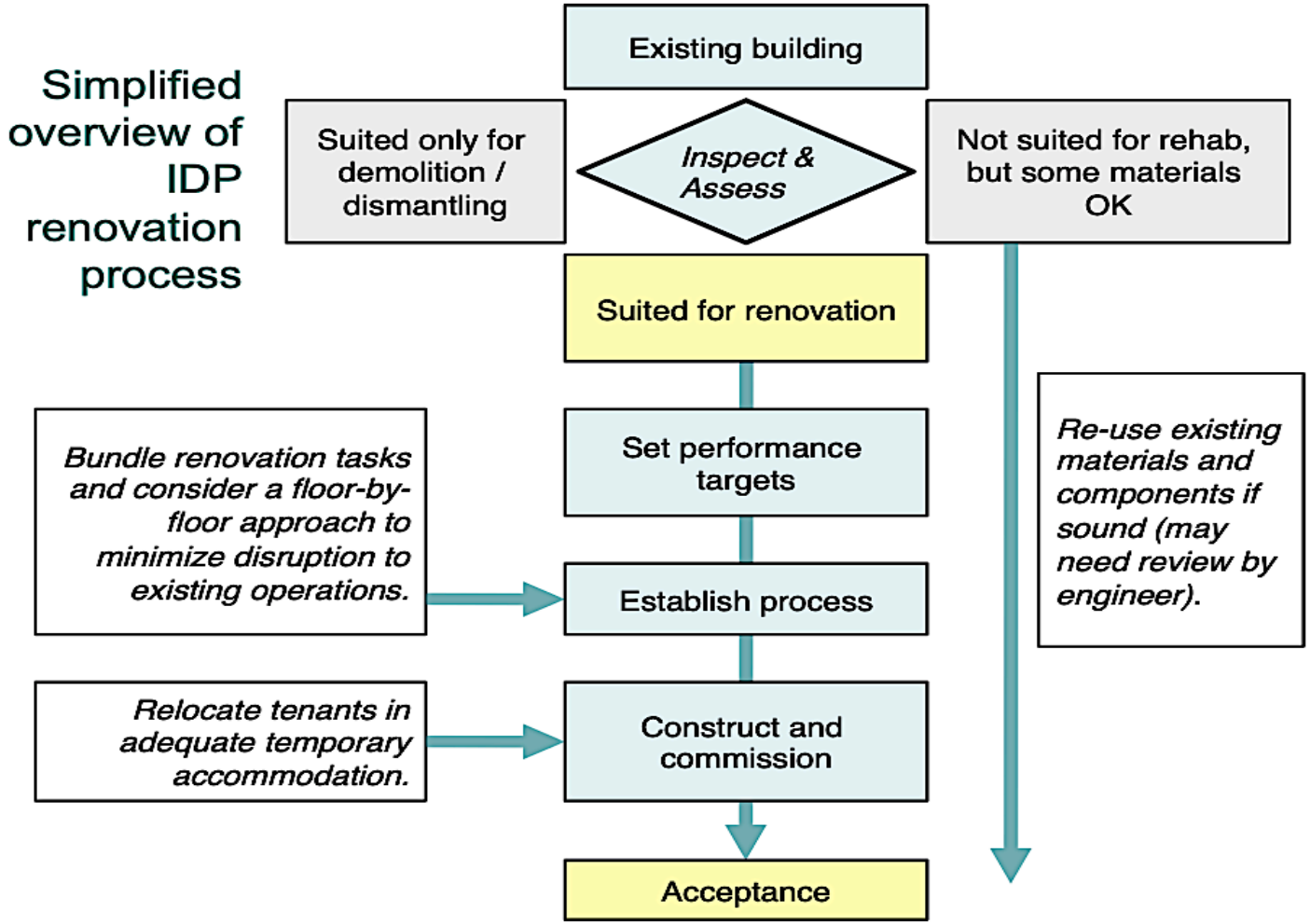

Carry out daylighting, IAQ and ventilation assessment
Carry out a detailed energy simulation
Carry out a Life Cycle Cost Analysis (LCC)
Perform Life-cycle analysis (LCA) for embodied en./emissions
Perform a final detailed energy simulation
Do a final capital cost check
Iteration(s) in design
Develop preliminary building envelope design
Develop preliminary lighting and power system design
Develop preliminary fenestration design
Develop preliminary design for ventilation, heating and cooling systems
Select one concept design for detailed development
Complete working drawings and specifications
Reduce envelope heat gain through trees and landscaping
Reduce envelope heat gain or loss by thermal efficiency and airtightness of envelope
Optimize window location, size and type to maximize daylighting while limiting unwanted solar gain or heat loss.
Provide exterior shading devices where effective against excessive solar gain
Optimize energy-efficiency of lighting including luminaire, lamp, and ballast types, control systems, maintenance
Consider natural or hybrid ventilation
First consider solar DHW, solar space heating, PV, earth energy
Cooling system options:
Direct or indirect evaporative
Desiccant or evaporative
Evapotranspiration wi. vegetation
Direct or hybrid radiative cooling
Night cooling
Earth-to-air heat exchanger
Ground water, sea or river water
For resideual loads, use high-efficiency, fans chillers, boilers, motors; maximize system efficiencies
Decision based on cost/benefit ratio
Consider using Building Information Model (BIM) protocols


Carry out interim systems commissioning
Carry out final commissioning
Train operating staff
Monitor operational performance
Operations phase assessment
Inspect and correct deficiencies
Provide as-built documentation and operating manuals
IDP 3
Bid & negotiate
Construct
Transition
Operate
Develop QA strategies for construction & commissioning
Procure materials and equipment
Implement site ecology protection measures
Develop QA strategies for operation
Consider re-used materials
Consider recycled materials



New buildings are a small proportion of the total stock

Simplified overview of IDP renovation process



Post-Occupancy Evaluation: Predicted v. Actual performance

We cannot judge performance by appearance

Source: Khaled A. Al-Sallal

Dubai World Trade Center, 1979,
278 kWh/m2

Emirates Tower, 2000,
560 kWh/m2

Post-Occupancy Comparative Evaluations

- iiSBE leads the international *Sustainable Building Challenge* process, a collection of high-performance projects with comparable performance data that is shown at every global SB conference, including Barcelona in 2014;
- iiSBE Canada carried out post-occupancy evaluations on 9 Canadian case study projects with researchers from 3 universities, and intends to do more of this in the future;
- POE focuses on comparisons of the performance of Reference buildings, Predicted performance at the design stage and Actual performance after two years of operation;
- The analysis is limited to a small number of Key Performance Indicators (KPI);
- Two levels of POE protocols have been developed.

Post-occupancy evaluations of 9 Canadian buildings were carried out for the SB14 Barcelona conference

Five academic, three offices plus one community building, ranging in age from 2 to 15 years









Methodology

- Predicted performance

(based on design stage modelling and calculation)

vs.

- Actual performance

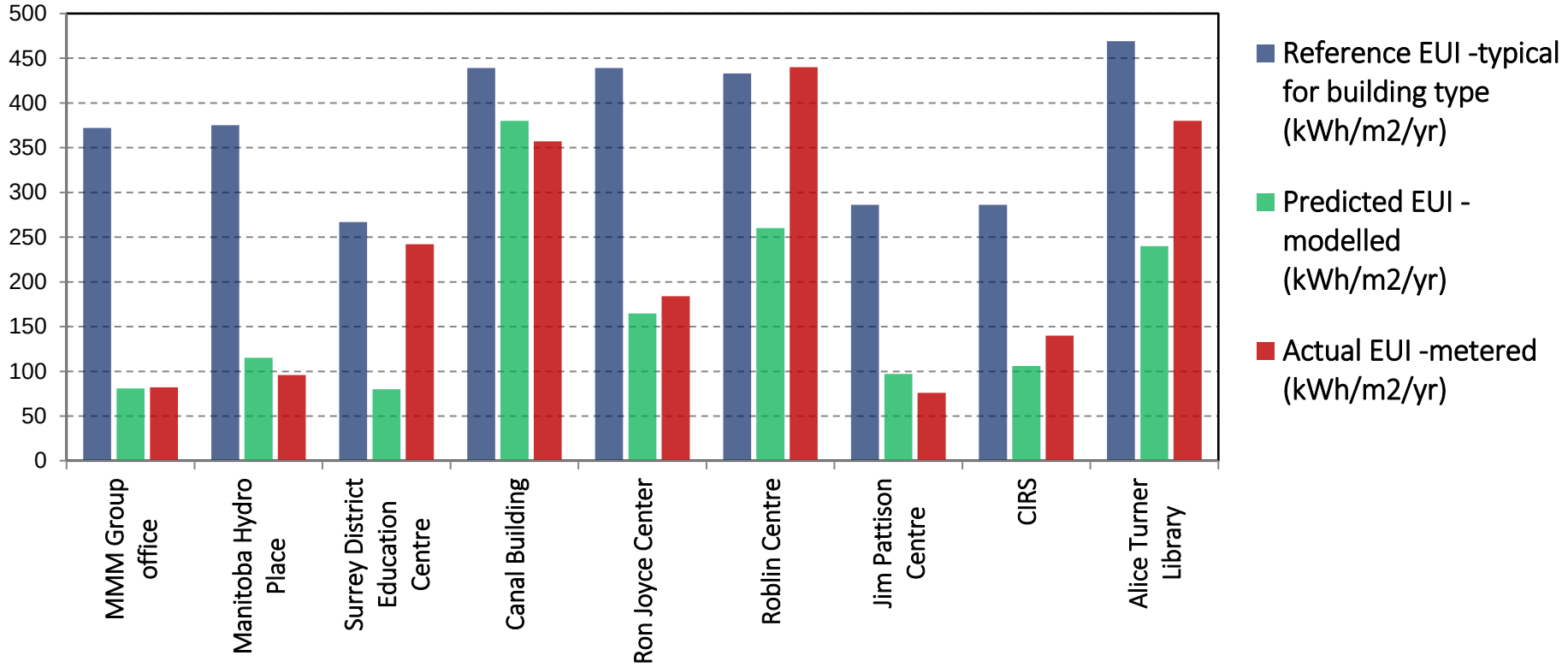
(based on occupied measured performance)

vs.

- Reference

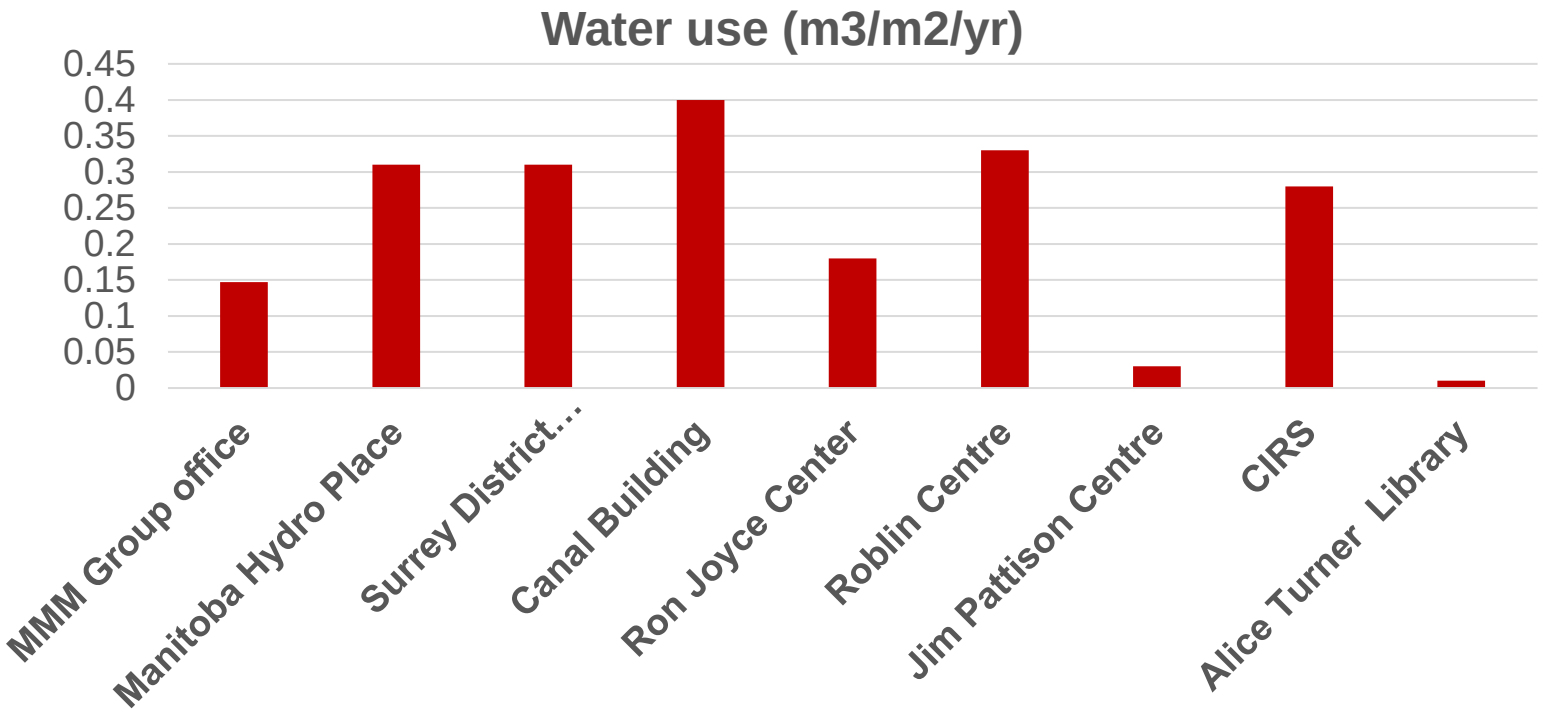
(based on benchmarks and standards)

Key findings – Energy use intensity (EUI)



Key findings – Water use

High variability between buildings, even with similar uses



Kuwabara Payne McKenna Blumberg & Smith Carter

Manitoba Hydro HQ is exceptional

Target EE:
140 kWh/m2

Actual:
112 kWh/m2

Typical for this type:
220-240 kWh/m2

Construction cost:
$188 m or $2933 / m2

Manitoba Hydro Head Office, Winnipeg, MB, Canada

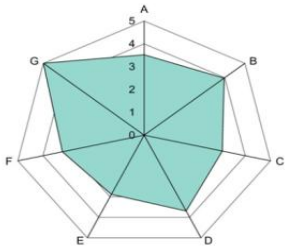
Design target scores for Manitoba Hydro HQ, Winnipeg, Canada

Predicted performance results based on information available during Design Phase

Active Phase (set in Region file) **Design Phase**

Relative Performance Results

0 = Acceptable Practice; 3 = Good Practice; 5 = Best Practice



Performance Issue Areas

Design Phase scores indicate Potential Performance as predicted by an assessment of building features and plans for construction and operation that are developed during the design process.

Project Information

This is a New construction project with a total gross area of 64810 m2. It has an estimated lifespan of 75 years, and contains the following occupancies: Office and Retail and is located in Winnipeg, Canada. The assessment is valid for the Design Phase.

Assumed life span is 75 years, and monetary units are in CD

Amortization rate for embodied energy of existing materials is set at 0 %

Design target scores

With current context and building data, the number of active low-level parameters is	97	Max. potential low-level parameters	115
The number of active low-level mandatory parameters with a score of less than 3 is	3	Active low-level mandatory parameters	9

	To see a full list of Issues, Categories and Criteria, go to the Issues worksheet	Active Weights	Weighted scores
A	Site Selection, Project Planning and Development	10%	3.5
B	Energy and Resource Consumption	21%	4.0
C	Environmental Loadings	20%	3.1
D	Indoor Environmental Quality	21%	3.7
E	Service Quality	20%	2.9
F	Social and Economic aspects	7%	3.2
G	Cultural and Perceptual Aspects	2%	5.0
	Total weighted building score		3.4

Absolute Performance Results

Relative performance level is Good Practice or better

	These data are based on the Self-Assessment values	By area	By area & occupancy	
1	Total net consumption of primary embodied energy for structure and envelope, GJ/m2	1	0	GJ/m^2/maph
2	Net annualized consumption of embodied energy for envelope and structure, MJ/m2*yr.	18	1	MJ/m^2/maph
3	Net annual consumption of delivered energy for building operations, MJ/m2*year	299	14	MJ/m^2/maph
4	Net annual consumption of primary non-renewable energy for building operations, MJ/m2*yr.	336	16	MJ/m^2/maph
5	Net annual consumption of primary non-renewable energy per dwelling unit in project, MJ/m2*yr.	N.A.	N.A.	MJ/m^2/maph
6	Net annual consumption of primary non-renewable energy per dwelling unit in residential element, MJ/m2*yr.	N.A.	N.A.	MJ/m^2/maph
7	Net annualized primary embodied energy and annual operating primary energy, MJ/m2*yr.	353	17	MJ/m^2/maph
8	Total on-site renewable energy used for operations, MJ/m2*yr.	314	15	MJ/m^2/maph
9	Net annual consumption of potable water for building operations, m3 / m2 * year	1.0	0.0	m^3/m^2/maph
10	Annual use of grey water and rainwater for building operations, m3 / m2 * year	20	1	m^3/m^2/maph
11	Net annual GHG emissions from building operations, kg. CO2 equivalent per year	18	1	kg/m^2/maph
12	Total present value of 25-year life-cycle cost fot total project, CD per m2.		8,951	
13	Proportion of gross area of existing structure(s) re-used in the new project, percent		0%	
14	Proportion of gross area of project provided by re-use of existing structure(s), percent		0%	

60% energy efficiency in an extreme climate, which is almost double the efficiency of any office tower in Canada; targetting LEED Platinum; over 94% of the city is accessible by public transit from the site; urban catalyst with the influx of 2000 emplyees to downtown

CLIENT: MANITOBA HYDRO DESIGN ARCHITECTS: KUWABARA PAYNE MCKENNA BLUMBERG ARCHITECTS ARCHITECTS OF RECORD: SMITH CARTER ARCHITECTS & ENGINEERS ADVOCATE ARCHITECTS: PRAIRIE ARCHITECTS INC. CLIMATE ENGINEERS: TRANSOLAR ENERGY KLIMA ENGINEERS

Integrated Building Systems

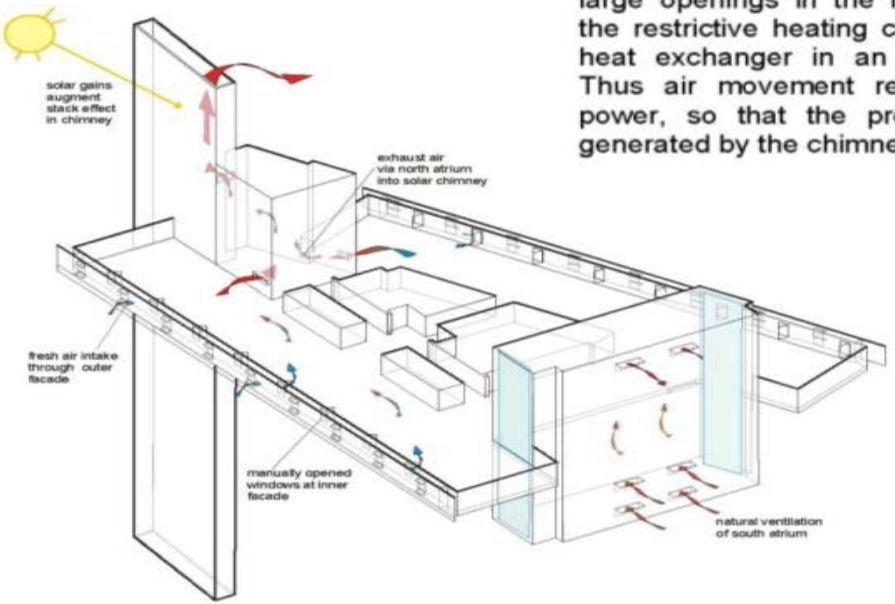
Intelligent facades integrate climate responsive technologies, like solar shading, humidification, radiant heating and passive solar collection

High Performance Double Facades

Energy Consumption – 60% Savings

Full natural ventilation mode

Ventilation is completely driven by solar-augmented thermal buoyancy and wind, through the exhaust chimney. Since the air is not conditioned, it can enter through large openings in the facade rather than the restrictive heating coil, cooling coil, or heat exchanger in an air handling unit. Thus air movement requires much less power, so that the pressure differences generated by the chimney are sufficient.



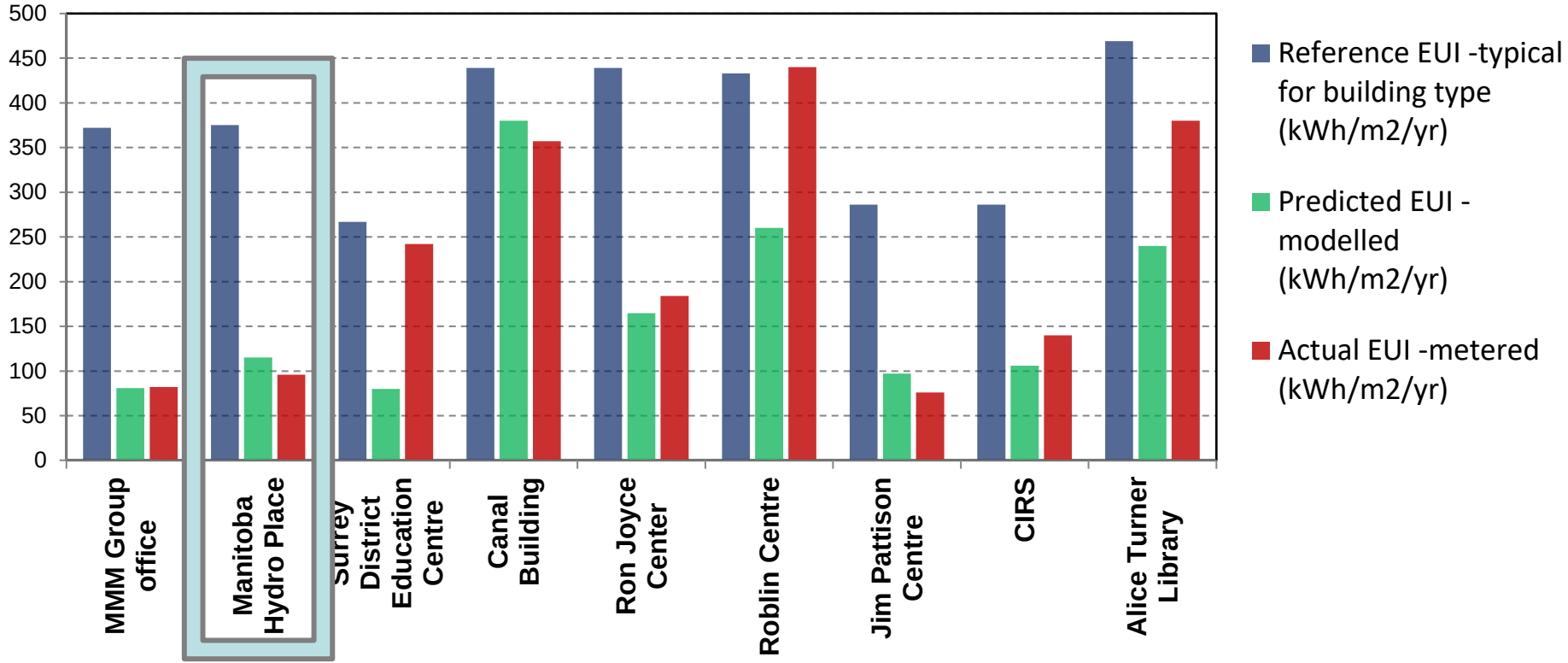
Intermediate season concept, tower floor isometric

Building Type / Use:
Corporate Headquarters/Commercial Work Space
Approximate gross area:
64,810 m² (690,000 Ft²)
Number of floors above ground:
23 (including penthouse)
City, Country:
Winnipeg, CANADA
Year of completion: 2008

Client:
Manitoba Hydro
Architects:
Kuwabara Payne McKenna Blumberg Architects (design architects)
Smith Carter Architects & Engineers (architects of record)
Prairie Architects Inc. (advocate architects)
Energy analysis:
Transsolar (Energy/Climate Engineers)

A final modelling predicted a **64.5% reduction**

Key findings – Energy use intensity (EUI)



Finally

Purposes of the iiSBE SB Tool set

- To develop simple tools for the establishment of sustainability performance targets and to assess predicted or actual performance for small urban areas and buildings;
- To review the impacts of different weighting schema on overall performance.

Contacts & Info

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- Nils Larsson (XD), larsson@iisbe.org