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Insight Versus IES on a Net-Zero Project: Building Performance Modeling Best Practices

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Learning Objectives

　　Discover how Revit and Insight can be used in designing a net-zero project from concept to documentation
　　Discover the best approaches to modeling in Revit for reliable simulation results from Insight and Green Building Studio
　　Learn about the pros and cons when comparing Insight, IES VE, and Ladybug Tools, and select the tool that is right for your project
　　Learn how to manage the sustainability BIM workflow to develop design details and achieve performance goal

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Description

Revit and Insight are getting popular among architects due to the rapid feedback on energy/ daylight analysis when updating the design at the early stage. But how can we ensure the best results? How can we apply the methodology in detailed design phases and integrate the engagement from engineers? The class will present how Revit and Insight were used in designing a net-zero project in New York from concept development to construction documents. See the rules and tips that the design/energy team concluded in building up the graphical model with proper system settings in Revit for promising analysis results from Insight and Green Building Studio. Learn why the team determined to use Insight and other environmental performance analysis tools (i.e. IES VE and Honeybee) for future high performance projects.

Speaker

Xiaofei Shen is an Architect/ Sustainability Engineer in AECOM New York. He has been working in High Performance Building design and simulation for five years after obtaining his Master of Architecture degrees from Tongji University, Shanghai and Center for Architecture Science and Ecology, New York. His effort has been devoted to crossing the line between artistic design and scientific method through parametric performance simulation, generative design optimization, and interactive data visualization. The primary works Xiaofei was involved include the net-zero Renewable Energy and STEM Center for Suffolk County Community College, the façade envisioning competition for New York's MetLife Building and the resilient community planning for Southwest Brooklyn. The projects were rewarded in ASLA, Metals in Construction, Folly, IBPSA Building Simulation, etc. His research about Multi-Objective Optimization for High Performance Design has been presented in SimBuild, CAADRIA, and IBPSA.

Project Summary

Suffolk County Community College (SCCC)'s new Renewable Energy, Science, Technology, Engineering and Math (STEM) Center will be a model for "Net Zero Energy Buildings" in Long Island, New York - renewable energy produced within the property line is equal to or exceed the energy consumed by the building. The building utilized energy and water conservation throughout the design which shrinks the capacity demand of the renewables. Envisioned as a "living laboratory," the 26,000-square-foot STEM Center consists of classrooms, labs, study lounges and symposium space where students are able to measure and analyze the exposed building systems.

Massing. The building geometry has been optimized to balance daylight, energy, and solar. Set as a rising triangular wedge, the two story building is infused with natural light from all directions. A series of stepped north-facing clerestory windows and a full roof of PVs define the basic geometry of the building.

Envelope. The Window to Wall Ratio (WWR) at different façade is differentiated and optimized with balanced daylight and energy. The effect of an enhanced envelope based on Passivhaus standards on the building Energy Use Intensity (EUI) was also studied as part of this exercise. Permanent exterior solar shades in various types are proposed for east (vertical), west (vertical), and south (horizontal) of the building.

System. The proposed HVAC system includes a Dedicated Outdoor Air System (DOAS) for ventilation and Variable Refrigerant Flow (VRF) heat recovery system with Ground Source Heat Pump (GSHP) which provides heating and cooling throughout the building, as well as supplemental electric heating.

SCCC STEM Center

Why Insight: From Concept to Documentation

Challenges & Opportunities

Challenges in Net Zero Building Design

Multi-disciplinary inputs need to be optimized and confirmed for best estimates on the energy behavior. A Building Energy Model (BEM) for different purposes is usually required for verification and optimization. BEM is the analysis of building energy performance through its simulation using predefined criteria describing building configuration and utilization.

- Requirements for energy code compliance only: facade and system are designed and modeled based on ASHRAE 90.1 mandatory requirements.
  - Inputs are confirmed
  - The process is straight forward
- Requirements for typical high performance/ green buildings: facade and system are designed and modeled for the baseline and the proposed for EUI comparisons.
  - Inputs are various but assumptions are acceptable
  - The process is back and forth
- Requirements for Net Zero projects: internal loads and operational profiles matters to achieve best estimates on the energy consumption.
  - Inputs must be precise
  - The process is back and forth but the goal is clear: Net Zero

	Code Compliance	High Performance	Net Zero
Massing	confirmed	optimized	optimized
Envelope	confirmed	optimized	optimized
Layout/ Zoning	confirmed	confirmed	optimized
Building Profile	assumption	assumption	confirmed
Equipment	assumption	assumption	confirmed
Lighting	confirmed	optimized	optimized
HVAC Type	confirmed	optimized	optimized
HVAC Settings	confirmed	optimized	optimized

Challenges in Bridging BEM and BIM

A typical Net Zero project usually requires additional time to design/ deliver.

Question 1: A separate BEM model is always needed?

Challenge: Most BEM tools are only available as standalone applications with few integrated BIM capability. When information is exchanged between BIM and BEM, very little data is shared, and much duplicated effort occurs. Less efficient.

Opportunity: BIM offers an extensible medium for building data storage which provides opportunities to include BEM parameters. A separation can be avoided:

- gbXML. Building data can be exchanged without repeating of the work.
- Insight. No exchanges between architectural and engineering models is needed. More integrated simulation capabilities in BIM are available.

Therefore, helping to improve efficiency of BEM and reduce waste in the design process. Time and cost saving.

Question 2: Hold off BEM until BIM is fully ready?

Challenge: Most BEM occurs when BIM is nearing completion when a full list of confirmed design inputs is collected for "best" estimates. However, energy analysis shall occur earlier at concept, and design decisions shall be more informed throughout the entire lifecycle in net zero design. Less compatible.

Opportunity: BIM offers a platform where every stakeholder can fill in the inputs and assumptions in the model, so the BEM can be proceeded earlier.

- gbXML. Default energy settings with reasonable multi-disciplinary assumptions can be passed through for BEM at the early stage.
- Insight. Different Level of Details (LOD) are acceptable which allows the BEM functionality to be integrated at different BIM stages.

Therefore, the enhanced compatibility allows multiple analysis tools, each with a different focus, to be utilized in the Net Zero design. Earlier and better estimates.

Question 3: Lack of continuous BEM standard in BIM?

Challenge: There has been no established global standard for defining BEM-related properties in BIM process. Less accurate.

Opportunity: BIM provides the methodology to transfer information more effectively than multiple formats.

- BIM templates. Pre-defined BIM templates can be utilized between different projects and professionals
- Insight. A more integrated design tool without transferring the information.

Therefore, the more accurate and reliable BEM results can ensure the design performance and the Net Zero capabilities when delivered. Reduced risks.

Insight Uses

The BIM model was used and updated throughout the design process until delivery. Insight, with other environmental simulation and energy modeling tools are leveraged in most design stages and fit most performance analysis tasks.

Diverse Simulation Types: Approaches to Net Zero

A BIM model covers all aspects of a buildings, which offers opportunities for Insight to be utilized for a wide range of diverse performance analysis.

- Massing Orientation - trade-off: daylight and energy (insight, honeybee)
- Facade Optimization - trade-off: daylight, thermal load, and cost
  - o geometry: vertical/ horizontal shades and solar tubes (honeybee)
  - o material properties: glazing types and wall constructions (insight)
  - o thermal analysis: insulation thickness and location (honeybee)
- Space Definition - space layout and how the building is operated (insight)
  - o occupancy schedule, LPD and EPD values, heating/ cooling loads
- Building System Optimization - comparison between multiple options
  - o method of servicing: heating/ cooling/ ventilation system types. DOAS + VRF (insight, honeybee, IES)
  - o heating and cooling source: ground source heat pump (IES)
  - o servicing configuration: sequence of operation. schedule, setpoints, efficiency, heat recovery (IES)
  - o lighting. daylight sensors and occupancy sensors (IES)
- PV Optimization - trade-off: capacity and efficiency (insight, honeybee)
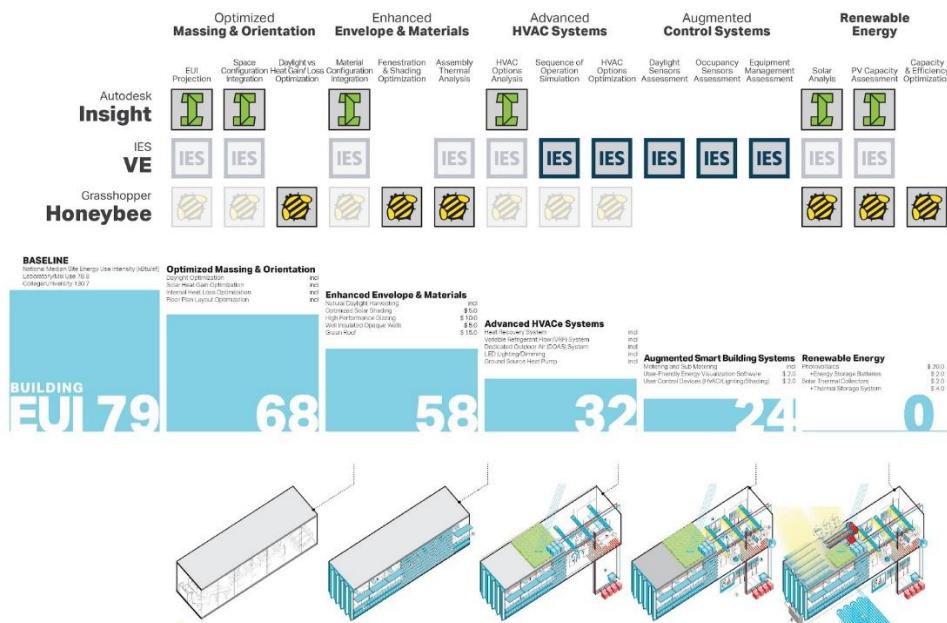
Diverse Level of Details: Adaptations to Design Stages

A BIM model can cover all stages of design. Given the benefits of the platform, Insight utilizes simplified workflow, and allows energy modeling to be completed within different detail levels - a multidimensional construct for each phase.

- LOD 100 - early concept design: no geometric information
  - Climate alignment
  - Solar radiation
  - Energy projection
  - Sustainability goal setting
- LOD 200 - late concept design
  - Spatial geometry - massing orientation optimization
  - Window-to-wall ratio optimization on four orientations
  - Facade configuration & thermal performance per heat gain/ loss
  - Space level occupancy, lighting, equipment
  - HVAC types optimization
  - PV capacity analysis
- LOD 300 - detailed design
  - Fenestration optimization per daylight/ energy performance
  - Shading optimization per daylight/ energy performance
  - (Detailed facade construction - thermal bridging infiltration rates)
  - HVAC thermal zoning.
  - (HVAC servicing schedules. sequence of operation, efficiency)
  - (PV system configuration)
- LOD400 - construction documentation
  - Glazing and wall configuration + schedule documentation
  - Space and room schedule documentation
  - Lighting fixture configuration + schedule documentation
  - HVAC Equipment configuration + schedule documentation
  - HVAC description
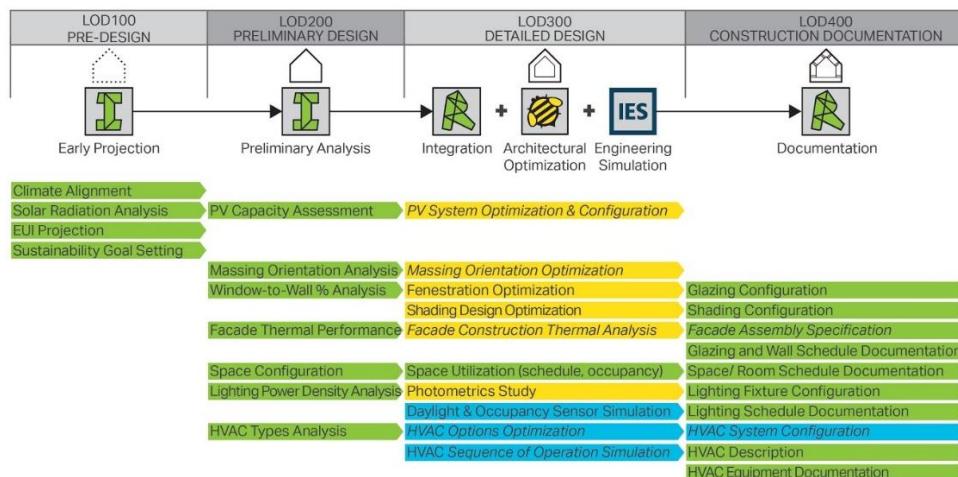
Methodology: How we ensure the best results?

Responsibilities: Clarify BEM Roles in BIM

BIM/ BEM roles need to be clearly defined in each design stage. For example, architects own the settings of the geometry, but energy modelers can take the control of the materials if the person has the specialties on this.

	Architect/ Engineer	High Performance Designer	BIM Manager/ Coordinator
Basic Roles	Design Criteria Setups; Review Model Issues;	Goals Verifications; BEM Simulation;	BIM Templates; BIM Coordination;
Pre-design	Building Code Check; Design Criteria Setups; Programming Matrix; Room Date Sheet development;	Climate Analysis; EUI Projection Energy code/ High Performance Goals verification;	Project BIM Global Setup;
Preliminary Design	Programming Stacking; Setup the building geometry and Rooms in Revit with internal loads and occupancy schedule assumptions defined;	Massing Orientation Analysis; Facade Glazing % Test; Conceptualization on Facade assembly, shadings, and HVAC options	Setup default BEM parameters for primary family types (walls, glazing, floors, roof, rooms, spaces)
Detailed Design	Preferred facade manufacturers; HVAC Sizing and Sequence of Operation;	Daylight Analysis; Finalize facade thermal/ daylight performance; Setup the Spaces in Revit with data transferred from Rooms; Energy modeling within Insight and/ or exported to IES VE for HVAC design optimization;	Setup BEM schedules for daylight/ energy reports and design documentation.
Construction Document	Code compliance checking; Product Specifications;	Code compliance modeling; Finalize Daylight/ energy reports;	Final deliverables coordination; BIM/ BEM templates updates;

Standards: Well-Defined Building Elements

BEM Matching BIM LOD

There are primarily two types of energy modeling: conceptual and detailed.

- Conceptual. Building geometry is mass only. Global energy settings override the building envelopes and building HVAC systems.
- Detailed. Building geometry is as modeled and internal load per space. identify building envelopes and HVAC systems per element.

When the BIM LOD is getting more accurate, different types of BIM data standard is required in BEM

- LOD 100 - early concept design: no geometric information
  - Conceptual BEM
  - Location. climate and surroundings
  - Basic thermal zones and generic conditions, temperature
  - Generic building level facade types
  - Generic building level thermal profile. occupancy, lighting, equipment, schedule
- LOD 200 - late concept design
  - Conceptual or Detailed BEM
  - Spatial geometry (subject to change)
  - Facade constructions (subject to change)
  - Building or space level occupancy, lighting, equipment
  - Method of servicing. heating/ cooling/ ventilation
- LOD 300 - detailed design
  - Detailed BEM
  - Fixed spatial geometry
  - Detailed facade construction. thermal bridging infiltration.
  - Fixed building profile
  - Servicing schedules. sequence of operation
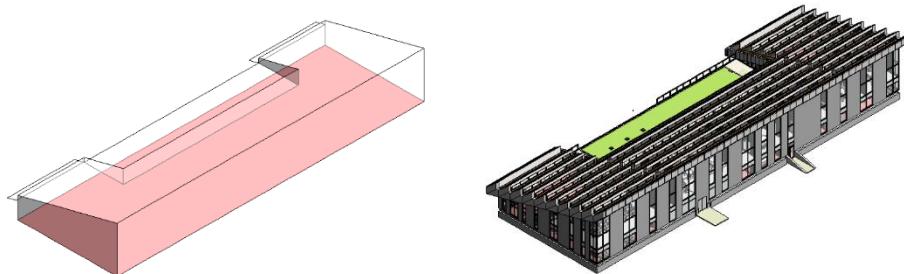
Envelope Material Properties

Glazing properties for daylight analysis

- Edit type - material and finishes - material
- Analytical properties is for energy analysis, not illuminance analysis
- Tvis property set by changing custom color parameter
  - determine the thickness of window pane and # of panes
  - determine Tvis value
  - set color of glass material to RGB values
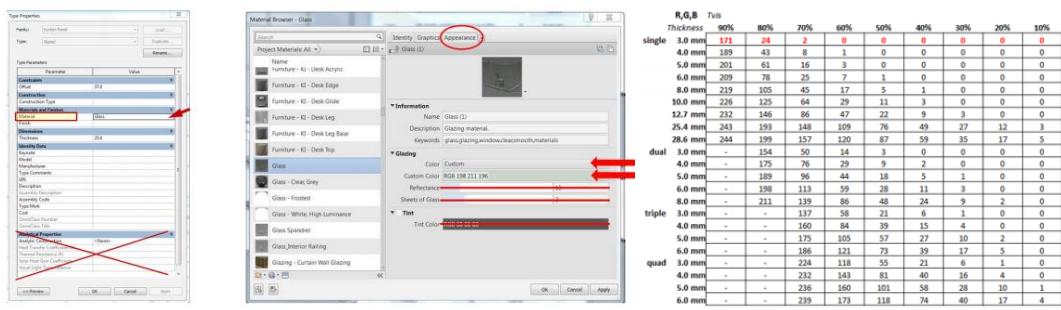
Resource: Autodesk

Passive House spent 1/10 of the heating load compared to an average building. So it is critical to set up proper building fabric constructions in the revit model. R-40 walls and R-50 roofs are typical thermal properties for buildings in New York as a passive house.

Thermal properties for energy modeling: Heat transfer coefficient (U); Thermal Resistance (R).

- Construction Settings. Assembly Layers.
- Material Settings. Material Browser Thermal Tab. swap out different assets for each material or edit the properties directly.
- Glazing properties. change the analytical construction for the window family or curtain panel family
- Energy Settings. Check Detailed Elements. Revit will use the thermal properties assigned to each element and those results will be represented in the "BIM Settings" triangle in each Insight factor.
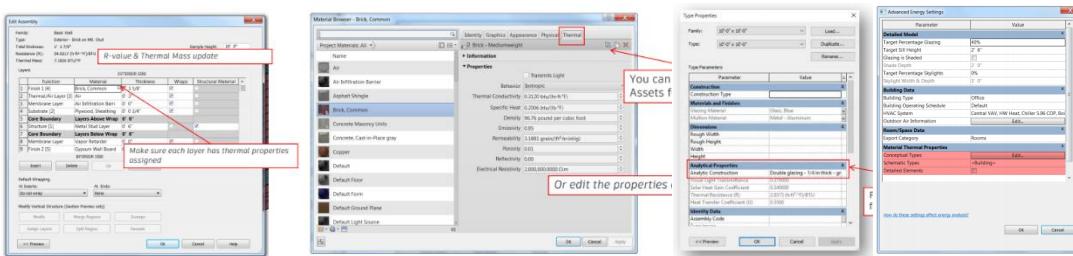
Resource: Autodesk

Space and Zones

Space is critical to calculate the heating/ cooling load of the building when analyzing the building energy performance. Information that is required to be defined within the space which can be used for energy modeling include: volume, mass, occupancy,, HVAC, and exterior. lighting can be calculated automatically from the lighting fixtures places in space.

- Space definition: name, number. Space definitions should be matching to room definitions and can be automatically transferred from rooms in Revit
- Space geometry: area, height. The walls, doors, and windows generating rooms, spaces, and zones should be defined as Room Bounding
- Space utilization: assigned usages and behavioral attributes that describe occupancy, interior lighting (LPD), and equipment (EPD) should be defined via different Space Types

Space can be grouped into zones where outdoor air information and heating/ cooling set point temperature can be defined from mechanical side.

Mechanical Elements

Servicing characteristic: operating methodology including hearing cooling and ventilation system.

- The power consumption of the equipment
- The heating or cooling capacity in the case of HVAC equipment
- the model represents the heating and cooling flow, showing which chiller feeds which equipment in what zone

Best Practices: Well-Structured Building Model

Quick Checklist

- Location: the climate and context where the building is located
- Check energy settings:
- Be sure to set building type

  - Always use the combined mode - masses + elements
  - Try to set the analytical space/ surface resolution to 8"/ 4"
- Specify ground plane
- Building orientation: project north
- Envelope Constructions:
  - window glazing thermal properties defined
  - wall and roof constructions
- Space:
  - Check if the spaces are placed throughout the model
  - Create a schedule to check: infiltration, LPD and EPD, occupancy
  - Operating schedule and profile
- Daylighting and occupancy controls
- HVAC types and zones

Architectural Elements

- Focus the model
  - Create your own revit energy model view
  - Delete elements not required for energy analysis, such as railings and furnishings
- Create your own schedules for BEM relevant elements?
  - Exterior/ Interior, type, assembly name, location, thickness, R value/ U value, surface area
- Walls:
  - Place walls based on their centerlines
  - Substitute simple one layer for walls. Avoid multi-layers
  - Set walls that protrude into a space, but that do not divide the space to "non-room bounding". same solutions for multi-layered walls or rainscreen system. Otherwise it will make a hole in the energy model or the exterior wall will become shading.
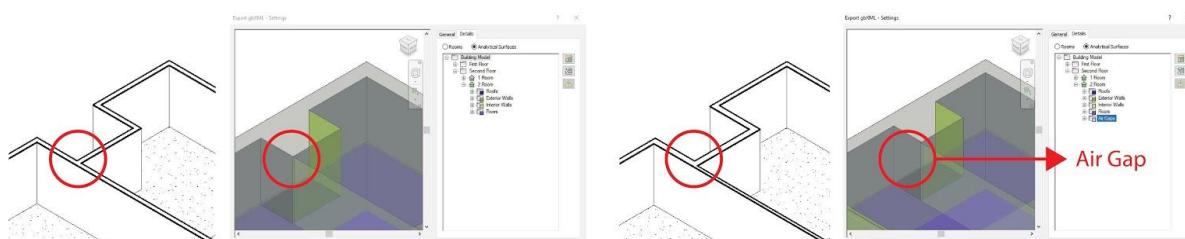
Best Practices: Place Walls based on Centerlines.

- o For gbXML exporting: revit constructions and materials are not utilized by IES VE. therefore at the "Set Model Properties" dialog, identify these at the building and/ or room level
- o For gbXML exporting: the same wall type used for the exterior can be used for the interior. The GbXML export process will differentiate between internal and external walls automatically
- Floors
  - o Finished Floors. Avoid separately modeled finished floor or modeled the finished floors as non room boundary.
  - o Outside Floors. Disable room bounding of outside floor elements
  - o Atriums. Avoid openings on the floors: better to identify room on each floor separately.
  - o After completing the floor, you will be prompted "Would you like walls that go up to this floor's level to attach to its bottom?" Answer NO to this prompt.

Spaces and Zones

- Set Volume Computations to "Areas and Volumes".
- Make sure spaces are placed throughout the entire model
  - o In Visibility Graphics, turn on Spaces - In fill and reference
  - o Visually check the model in plan view and in section view
  - o Pay attention to shafts and chase walls
  - o Create space schedule and remove undefined spaces
- Model multi-level spaces as separate rooms per level.
- Separate out room-bounding and non room-bounding elements
  - o Focus the BEM model and turn off non-related elements
  - o Check or uncheck room bounding elements when necessary
  - o Verify all walls and floors are room bounding
- Define all upper and lower boundaries of the spaces
  - o Ceilings. Determine whether or not the plenum area is conditioned. If so, plenum area must be included in a space; If not, plenum area must be defined as a separate space.
  - o Space offset on the level. Use a section to inspect the vertical shape of the space to ensure it is properly aligned. Ensure the space goes from top of slab to top of slab (level to level) with limit offset defined as zero. (no offset from the level)
  - o Space offset above the roof. For spaces on the top floor, use a limit offset of 1' so that the space rises above the roof element.
- Revit Space/ Zone properties
  - o Create schedules for information filling in. good for QC
  - o Space name, space type, area, fl-to-fl height, plenum, conditioned
  - o Occupancy density, Sensible gain, latent gain,
  - o LPD, lighting controls, EPD
  - o Zone: supply cfm, return cfm, exhaust cfm

<Space Schedule>

A	B	C	D	E	F	G	H	I
Name	Space Type	Area	Area per P	Specified Lighti	Specified Powe	Outdoor Air p	Outdoor Air pe	Specified Exha
Admin	BBJ Admin	2968 SF	200 SF	0.30 W/ft²	0.75 W/ft²	5.0 CFM	0.06 CFM/SF	0.00 CFM
Barber	BBJ Multi-purpos	602 SF	10 SF	0.40 W/ft²	0.50 W/ft²	7.5 CFM	0.06 CFM/SF	0.00 CFM
Cell	BBJ Cell	65693 SF	40 SF	0.64 W/ft²	0.10 W/ft²	5.0 CFM	0.06 CFM/SF	1.00 CFM
Central Control	BBJ Central Contr	5910 SF	200 SF	0.30 W/ft²	0.75 W/ft²	5.0 CFM	0.06 CFM/SF	0.00 CFM
Children's Play	BBJ Community	1423 SF	10 SF	0.62 W/ft²	1.00 W/ft²	7.5 CFM	0.12 CFM/SF	0.00 CFM
Clinic	BBJ Medical	15475 SF	50 SF	0.56 W/ft²	5.00 W/ft²	15.0 CFM	0.00 CFM/SF	
Community	BBJ Community	36374 SF	10 SF	0.62 W/ft²	1.00 W/ft²	7.5 CFM	0.12 CFM/SF	0.00 CFM
Concourse	BBJ Corridor	108192 SF	1000 SF	0.41 W/ft²	0.10 W/ft²	0.0 CFM	0.06 CFM/SF	0.00 CFM
Conference	BBJ Admin	1636 SF	200 SF	0.30 W/ft²	0.75 W/ft²	5.0 CFM	0.06 CFM/SF	0.00 CFM
Cooking	BBJ Multi-purpos	1430 SF	10 SF	0.40 W/ft²	0.50 W/ft²	7.5 CFM	0.06 CFM/SF	0.00 CFM
Dayroom	BBJ Dayroom	173675 SF	35 SF	0.40 W/ft²	0.30 W/ft²	5.0 CFM	0.06 CFM/SF	0.00 CFM
Emergency Respo	BBJ Central Contr	1213 SF	200 SF	0.30 W/ft²	0.75 W/ft²	5.0 CFM	0.06 CFM/SF	0.00 CFM
Exercise	BBJ Rec Room	13694 SF	8 SF	0.40 W/ft²	0.25 W/ft²	5.0 CFM	0.06 CFM/SF	0.00 CFM
Food Service	BBJ Food Service	4428 SF	50 SF	0.52 W/ft²	1.00 W/ft²	7.5 CFM	0.18 CFM/SF	0.00 CFM
Food Storage	BBJ Storage	3509 SF	1000 SF	0.16 W/ft²	0.10 W/ft²	0.0 CFM	0.06 CFM/SF	0.00 CFM

Best Practices: Use Schedule to Place Space Properties

- If you have specified LPD and/or EPDs, uncheck the export default values box in the Energy Settings
- Create zones for each space
- Confirm that each space has a corresponding HVAC zone by searching the Zone column for any instances of Default. If a space is in the Default zone, that means you haven't created an exportable HVAC zone for that space.

Additional Troubleshooting
- If there are unexpected shades elements inside the model, make sure that there are no air gaps within the full external boundary of your building model and that all volumes are accounted:
  - Lower analytical space and surface resolution if there are significant gaps in the model surface
  - Create a mass that fits just within the interior of the space (to ensure water tightness)
- If model results are completely gray shaded spaces.
  - Be sure to specify the origin point somewhere in the center of the model
  - Transfer project standards from Revit default template to avoid overly complicated revit templates
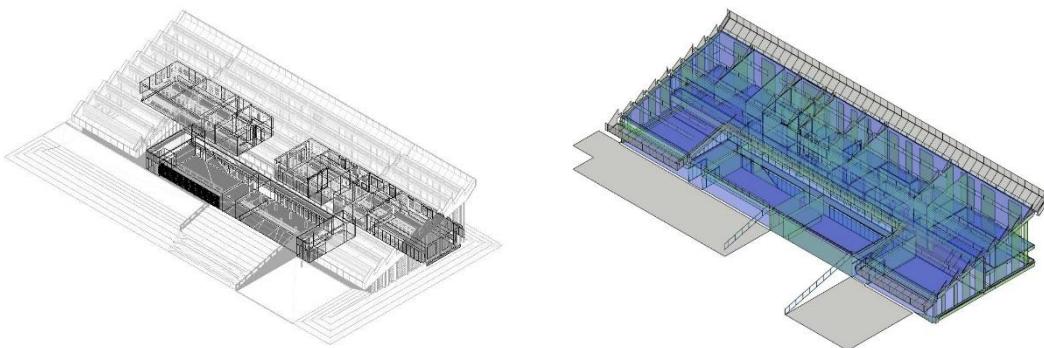
Comparisons: Insight vs IES vs Honeybee

Summary
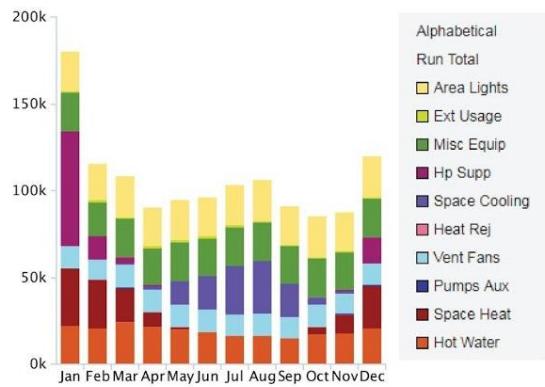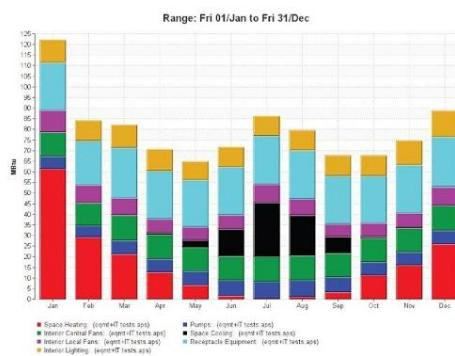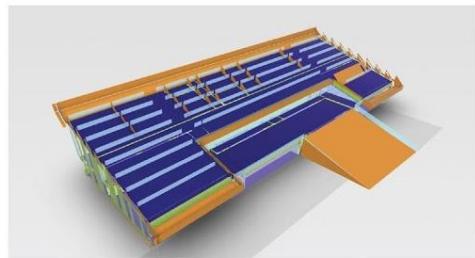
BIM solutions offer some of the energy modeling functionality today, but more is needed. In SCCC, as mentioned above, we have used multiple programs to deal with the diverse demands between different projects, in different phases and supporting different users.

In summary:

- Insight is a design tool for Architects and Engineers;
- IES is an engineering tool for Engineers;
- Honeybee can be a design tool and an engineering tool for Architects.

	Insight	IES	Honeybee
Applications	energy modeling daylight analysis solar study heating/ cooling loads cloud based simulation Revit Integration	energy modeling daylight analysis solar study heating/ cooling loads Revit Convertible Customized HVAC	energy modeling daylight analysis solar study heating/ cooling loads Customized HVAC Customized Visualize Parametric Optimize
Accuracy (reliable results)	High-level estimates. Results for design purpose only.	High accuracy. Detailed HVAC modeling for code compliance and Net Zero verifications	Accuracy to be verified. Results for design purpose only.
Versatility (controllable variables)	Limited options on HVAC types and configurations Limited options for results visualizations	Customizable HVAC types and configurations Limited options for results visualizations	Customizable inputs, outputs, visualizations Multi-variable and Multi-objective energy/ daylight/ cost trade-off optimizations
Efficiency (time saved)	BIM integration with no data transfer needed Quick energy/ daylight analysis at early stages	gbXML format exported from BIM is acceptable additional time needed for customized scripts	additional time needed to import BIM model additional time needed for customized scripts
Accessibility (quick learning time)	Short. Simplified workflow User interface is straight forward	Long. Demanding capabilities needed for mechanical engineering and energy modeling	Long. Demanding capabilities needed for parametric modeling with grasshopper

Insight

- Software uses
  - Quick energy and daylight analysis and high-level estimates. Guide design decision at early stages
  - Integrated with the BIM model. Understand the performance and provide feedback seamlessly throughout the design process.
  - Good for SD and DD

Honeybee
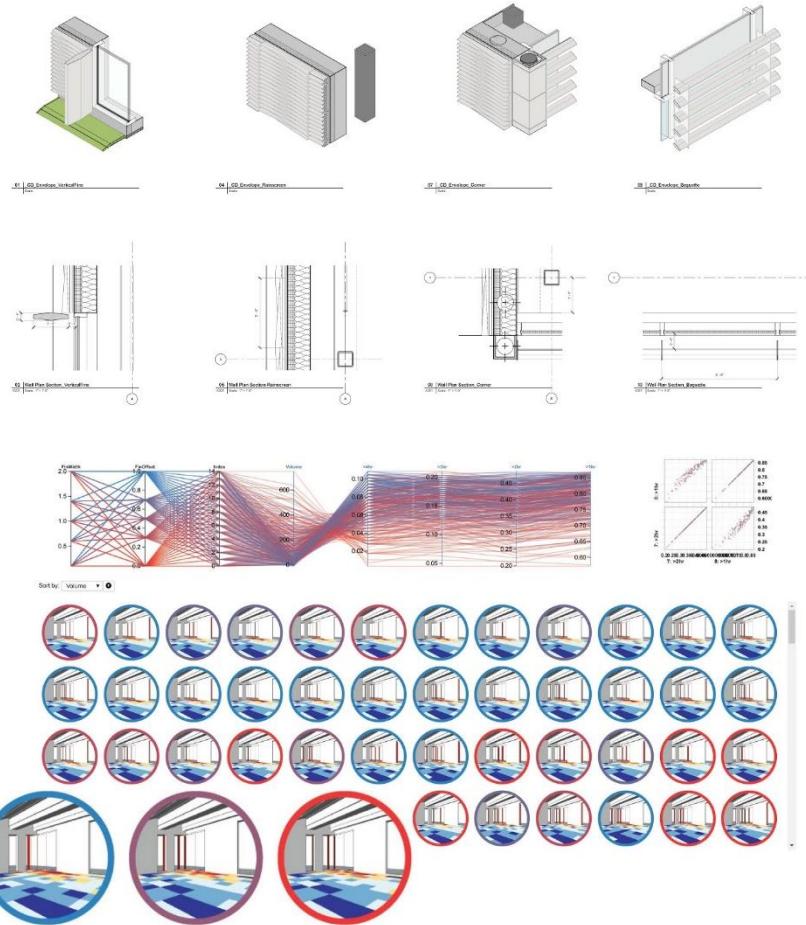
- Software uses
  - multi-objective optimization
  - customized visualization
  - Good for SD and DD

IES VE
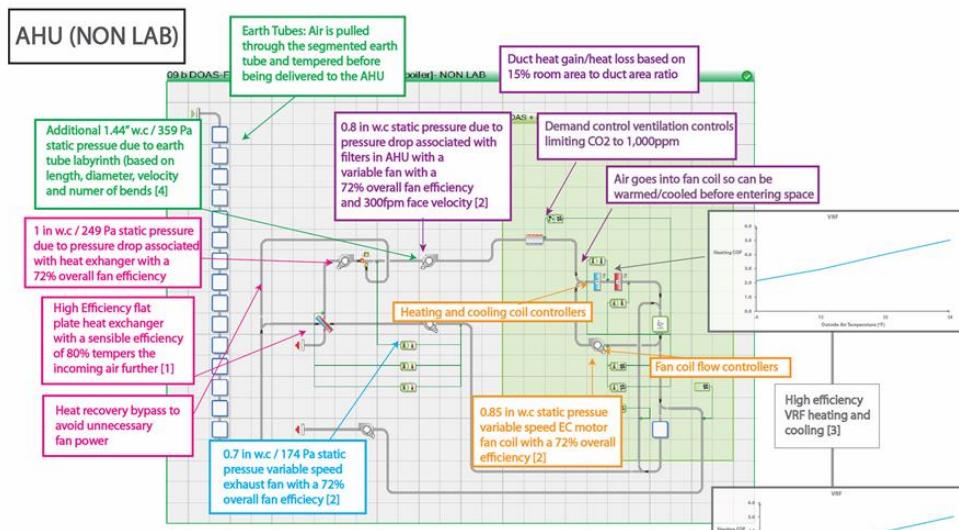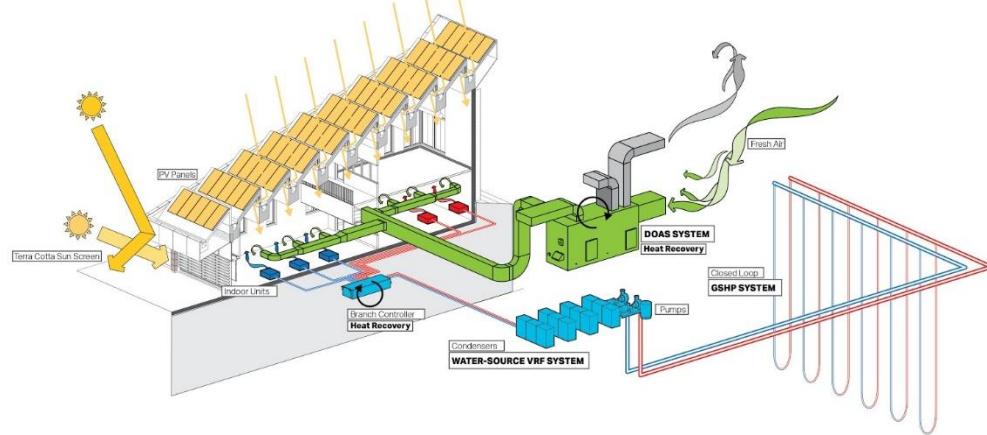
- Software uses
  - detailed HVAC modeling
  - thermal dynamic simulations
  - DD, CD - code compliance

- Methodology: How to transfer models from Revit to IES?
  - Room Settings (from revit: room/ space sf, LPD, EPD, occupancy)
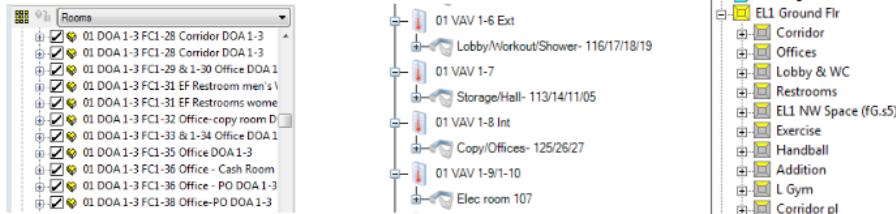
  - Zone Settings (from revit: zone box name)
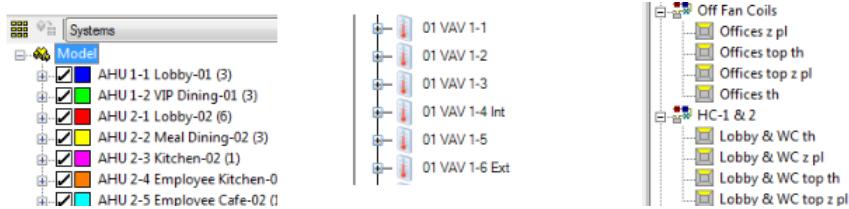
  - Envelope Settings (from Revit: Envelope constructions, WWR per orientation/ facade) (IES does not import the construction settings)
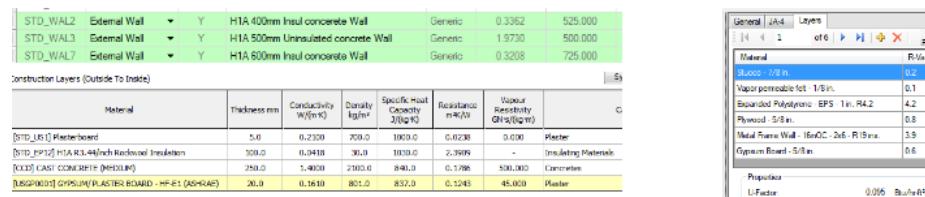
  - Profile Settings (IES does not import profile settings)
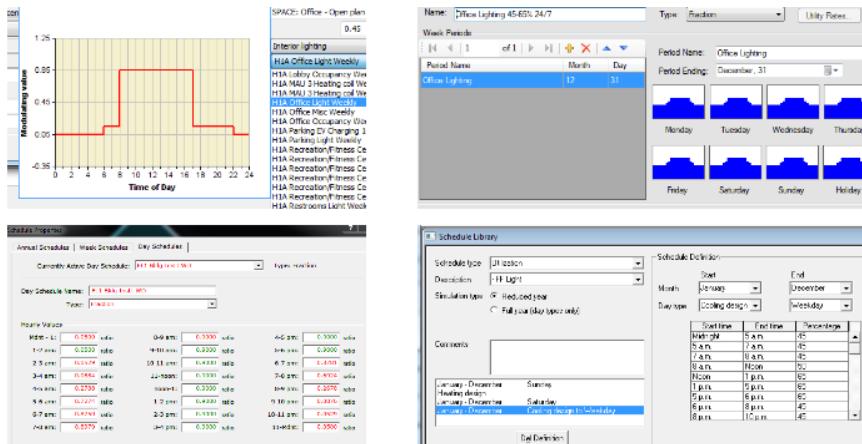
Performance: Develop Sustainability Design in BIM

New Challenges & Requirements

"Form follows performance, with the balancing of the budget."

More buildings with higher complexities requires more ambitious performance goals. How can we imagine, design, and deliver a greener world in a smarter way? The design of a building is a major determinant in its operational energy performance when decisions made. It becomes a consensus that less risk is taken if earlier energy performance can be informed.

New Challenges	New Requirements
No single program can cover all types of projects in all phases of design	A hybrid utilization of different BEM programs is needed with BIM integration. Multi-level capabilities are required for a high performance designer; Holistic thinking is also needed when driving a sustainability project.
BIM or BEM data is not readily available from most manufacturers	To achieve greater levels of accuracy in energy performance simulation requires BIM solutions to input greater levels of energy-relevant specifications from equipment manufacturers.
No data format standard has been developed for the digital transformation	Level of details following the similar and matchable BIM standard should be considered at each design phase. BIM guidelines and templates should be developed for BEM with good assumptions made ready from a good database.
Gap between three energy relevant disciplines: energy planning/ energy modeling/ energy auditing. high performance design to cover all	It also requires a bridge between BIM and actual energy performance once a building is in operation. This will inform better design decisions for subsequent retrofits or new builds, as well as giving facility teams an accurate 'digital twin' they can use to more effectively manage operational sustainability.

BIM guidelines

High Performance Analysis (Energy Modeling)

As the BIM model is used and updated though the design/ delivery process, it is effective to take the model and leverage that for high performance analysis, including energy modeling, with little or no modification, as long as the parameters in the model is properly defined. This analysis includes: heating and cooling loads, Daylight and lighting performance, Energy consumption, Carbon dioxide emission, and Energy Efficiency Measures (EEMs) payback years.

The value of High Performance Analysis (Energy Modeling) is:

- Achieve optimum, energy-efficient design solution by applying various rigorous analyses with few additional efforts for minimum code compliance, sustainability certifications, and enhanced high performance goals, such as net zero capabilities.
- Explore different energy saving alternatives at an early stage and throughout the entire project lifecycle while avoiding the time-consuming process of duplicating the building geometry, enclosure, and HVAC.
- Increase the accuracy of the inputs required in energy modeling and decrease the communications needed to exchange the information by providing extensible medium for parametric information storage where every stakeholder can work on.

Sustainability (LEED) Evaluation

Sustainability Evaluation is a process in which a project is evaluated based on LEED or other sustainable criteria. This can refer to materials, performance, or a process. Sustainability Evaluations can be applied to Planning, Design, Construction, and Operation. Sustainability evaluation is most effective when it is done in planning and design stages and then applied in the construction and operations phase. Model all sustainable aspects of a project throughout its life-cycle in order to obtain the desired sustainability certification in the efficient manner by condensing analysis into a single database.

The value of Sustainability (LEED) Evaluation is:

- Accelerate design review and LEED certification process with efficient use of a single database with all the sustainable features present and archived, such as aligning scheduling and material quantities tracking for more efficient material use and better cash flow analysis
- Improved communication between project participants in order to achieve LEED credits and decreased redesign efforts as a result which also allows to involve the customer throughout the design phase, gaining awareness of sustainability goals.
- Optimize building performance by tracking energy use, indoor air quality and space planning for the adherence to LEED standards leading, with an automated, real-time platform, to integrated facility management using a BIM model for design and environmental simulation