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AS323915

Practical Energy Analysis with Revit: Case Studies from a Nonprofit Design Firm

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Learning Objectives

- Learn how to generate a conceptual-level Revit model suitable for running through Insight energy analysis
- Learn about the difference between input-based and output-driven design factors that impact energy analysis
- Discover the value of using analysis tools early in the design phase of a project
- Learn about how energy and daylighting analysis impacted recent projects, based on case studies

Description

Energy and daylighting analysis with Insight software provide designers with the ability to analyze the performance of their designs, leading to more-efficient buildings and sustainable practices.
In this session, we'll explain how these tools are used and illustrate how one nonprofit firm is using this technology to design energy-efficient health centers in Haiti. This session will demonstrate how attendees can perform their own building-performance analysis using Revit software and Insight.
We'll present case studies where energy and daylighting analysis were used to design more-sustainable buildings and reduce operating costs for health-care centers in developing countries, where resources are limited and maximizing the environment is a necessity.

Prior knowledge in Revit is helpful, but non-software users will benefit from the information shared in this presentation.

Speakers

Clarke Morrison - Strategic BIM Consultant, Microdesk

Clarke is responsible for growing client relationships, uncovering new business partnerships, and working with Microdesk's Director of Consulting to ensure quality delivery of service. Clarke has 15 years of experience in architectural design and AEC technology and has worked with many leading design firms in the country.

Luc Wing - Solutions Specialist - MEP, Microdesk

Luc is an AEC technology consultant with a specialty in building performance analysis. He provides project support, standards and content creation, and energy analysis for a variety of AE clients.

Omar Hernandez - Director of Construction Management, Build Health International

Omar’s role as Director of Estimating & Construction Management includes overseeing all projects from engineering design through material procurement and final construction. He is an engineer with over fourteen years of experience in construction in both the Dominican Republic and Haiti.

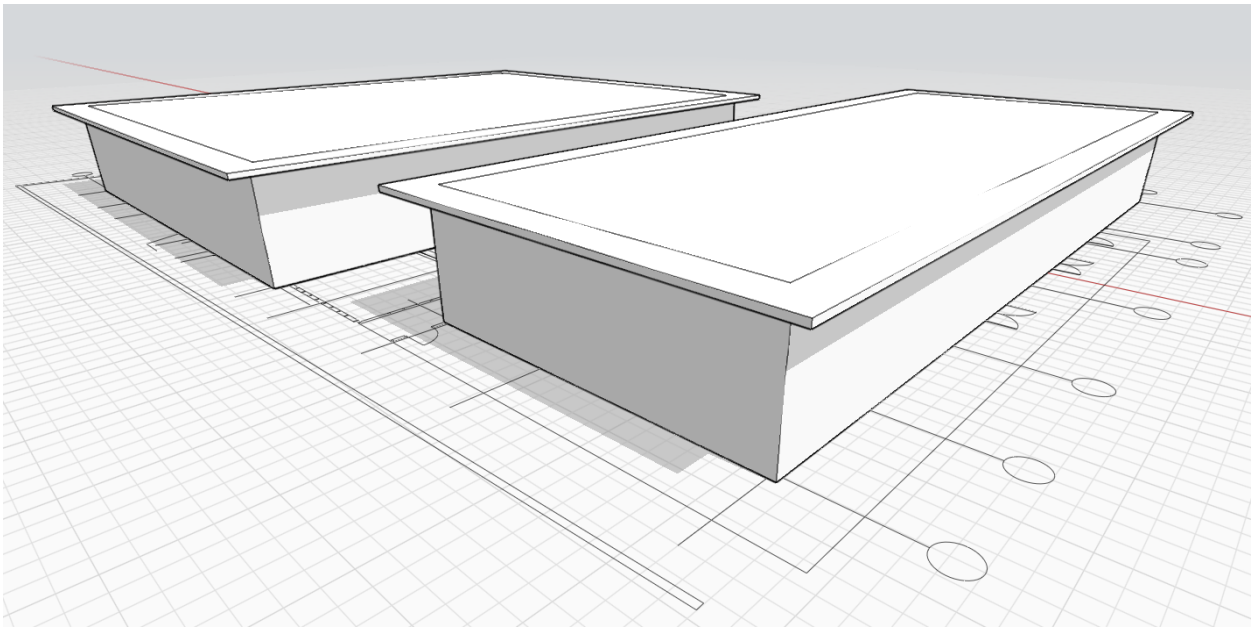
Contents

CASE STUDY: Saint Rock Hospital

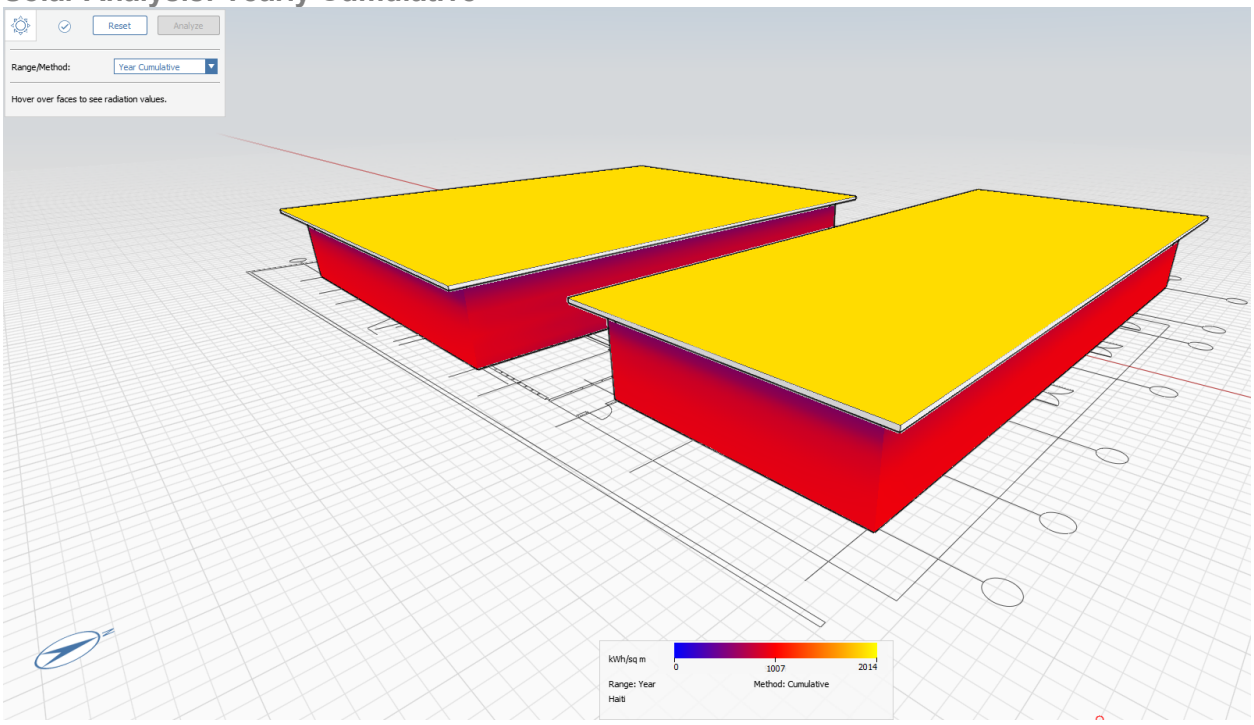
- Location: Carrefour, Haiti
- Size: 15,000 Square Feet
- Main geo-political challenges: no reliable electricity, steeply-sloped site, remote location, political turmoil
- Materials and logistical challenges: unskilled labor for construction and operations & maintenance, high fuel costs

Conceptual Massing and Analysis with FormIt

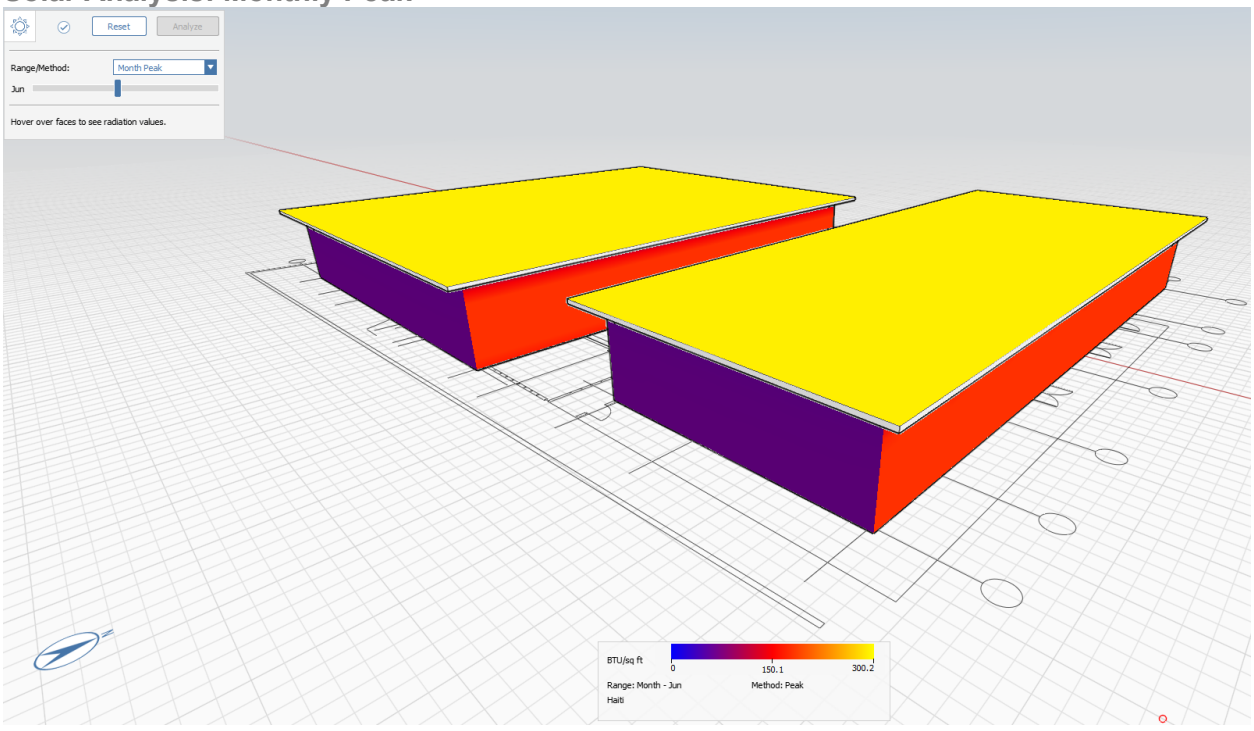
- Simple FormIt massing
    - Solar Analysis
    - Energy Analysis



Solar Analysis: Yearly Cumulative



Solar Analysis: Monthly Peak



Insight Energy Analysis Overview

Whole building Analysis:

Energy use: fuel & electric; heating & cooling loads

Daylighting analysis

Solar analysis

Multiple simulations at once

Fast, automatic energy analytical model creation; Thousands of simulations are run in the cloud simultaneously; learn which design decisions have the biggest impact on building performance.

Output-driven

Minimal user input yields accurate results; set project location, model simple forms

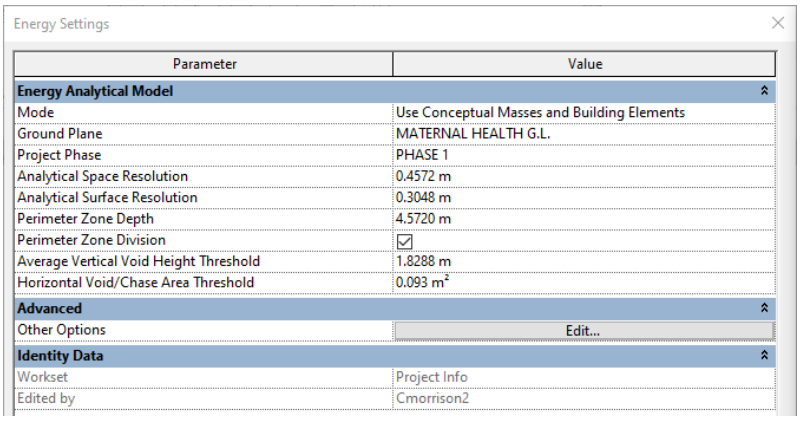
Seamless integration with modeling tools

Use FormIt or Revit masses

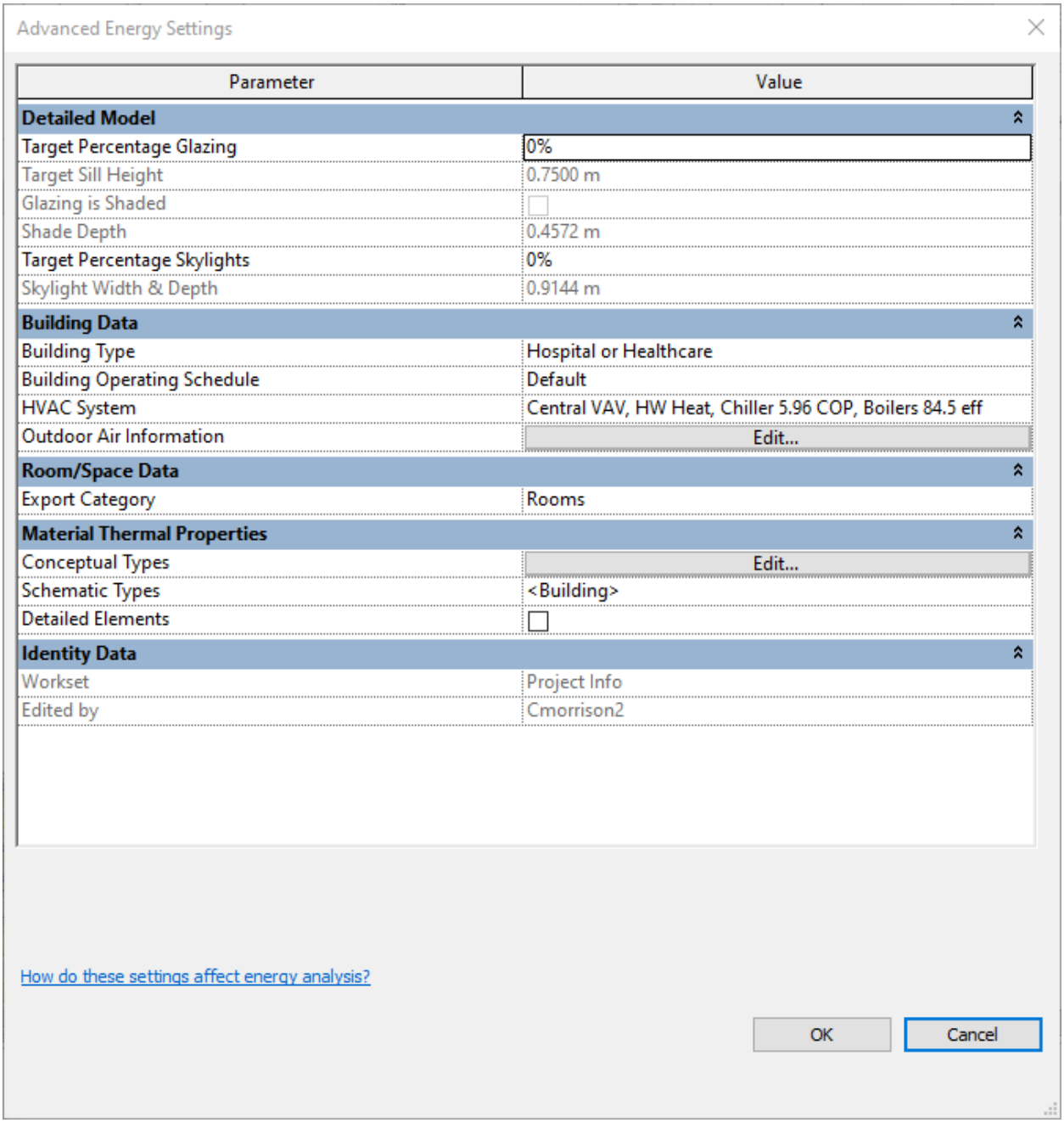
Revit building elements

No need to create separate energy model

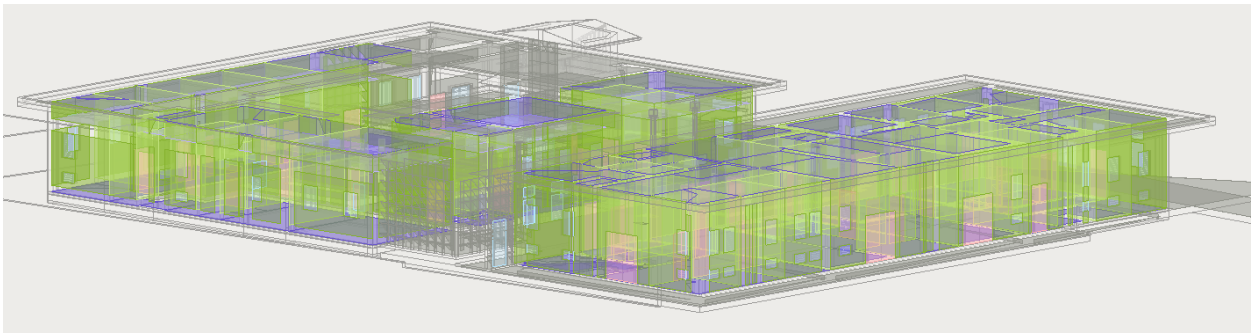
Output-driven Analysis; only fill out Mode, Ground Plane, Project Phase:



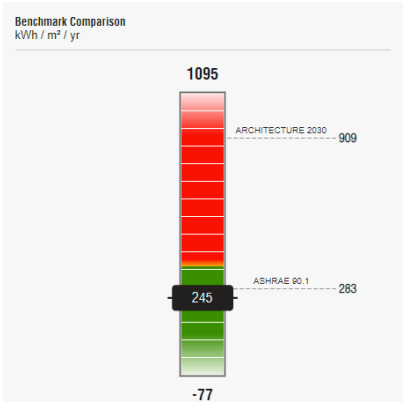
Factors that are analyzed by Insight, no input needed:

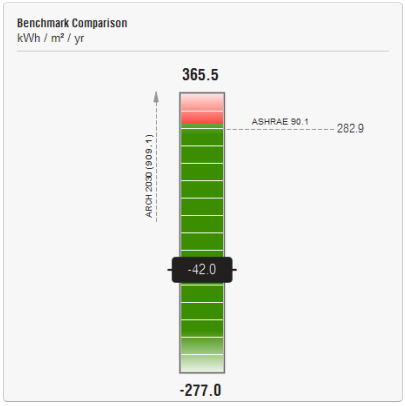


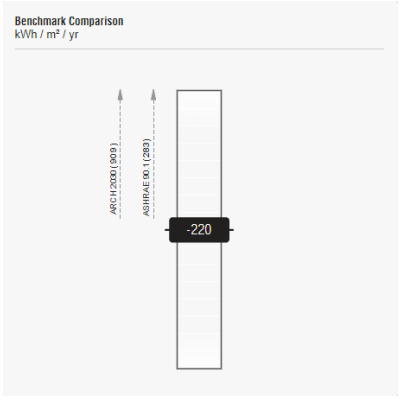
Automatic Energy Analytical Model creation:



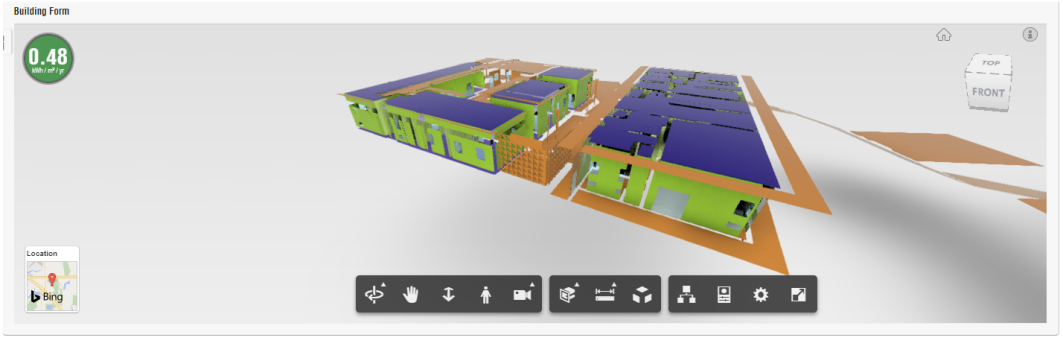
Benchmark Comparison:

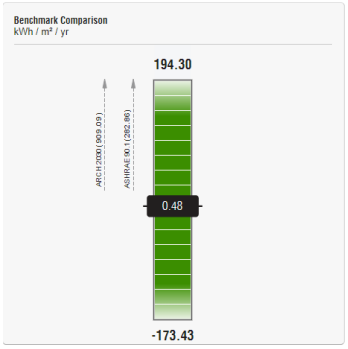


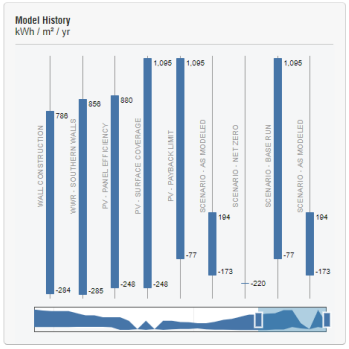


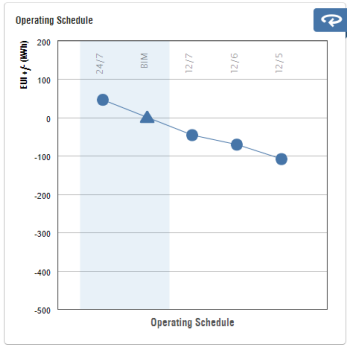


Insight Model Viewer:





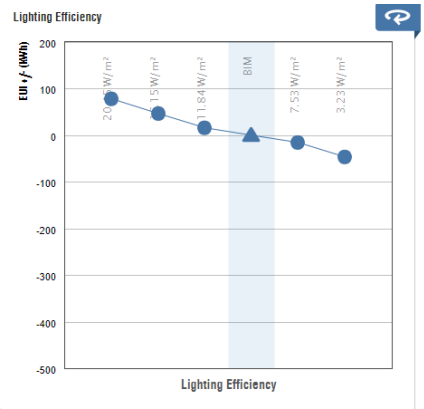


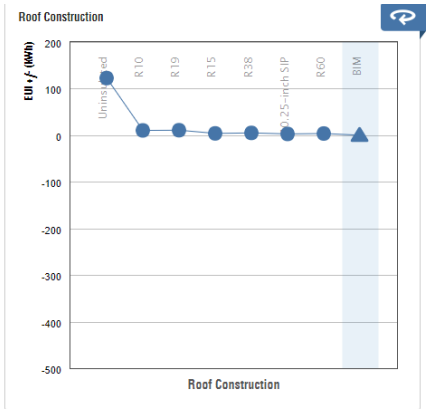


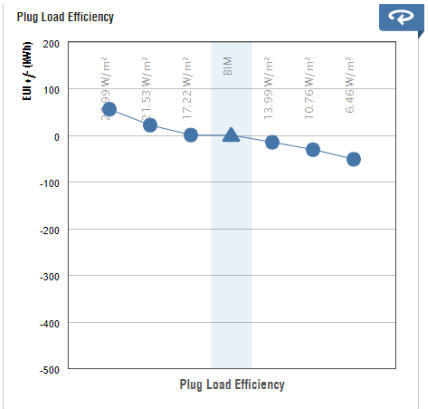
Building Element Analysis – Revit

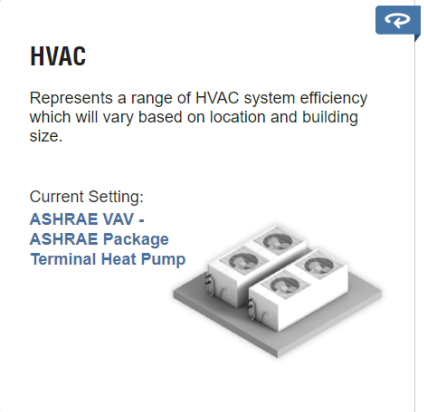
Most impactful factors:

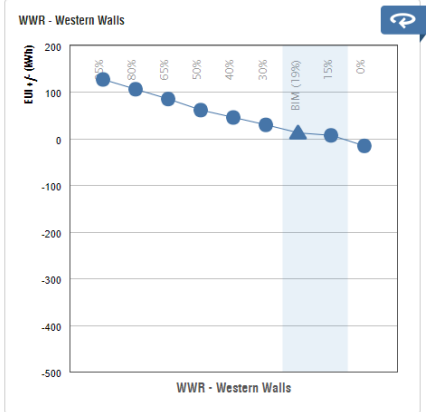
- Lighting Efficiency
- Roof Construction
- Plug Load Efficiency
- Window-wall ratio: West
- Window-wall ratio: East
- HVAC System

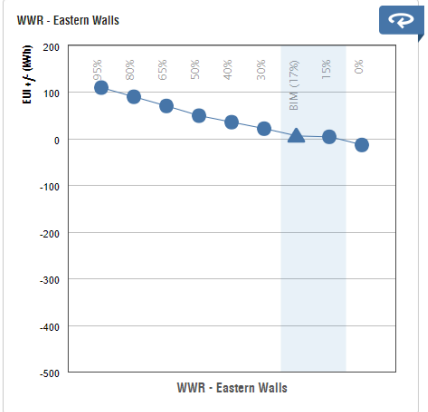




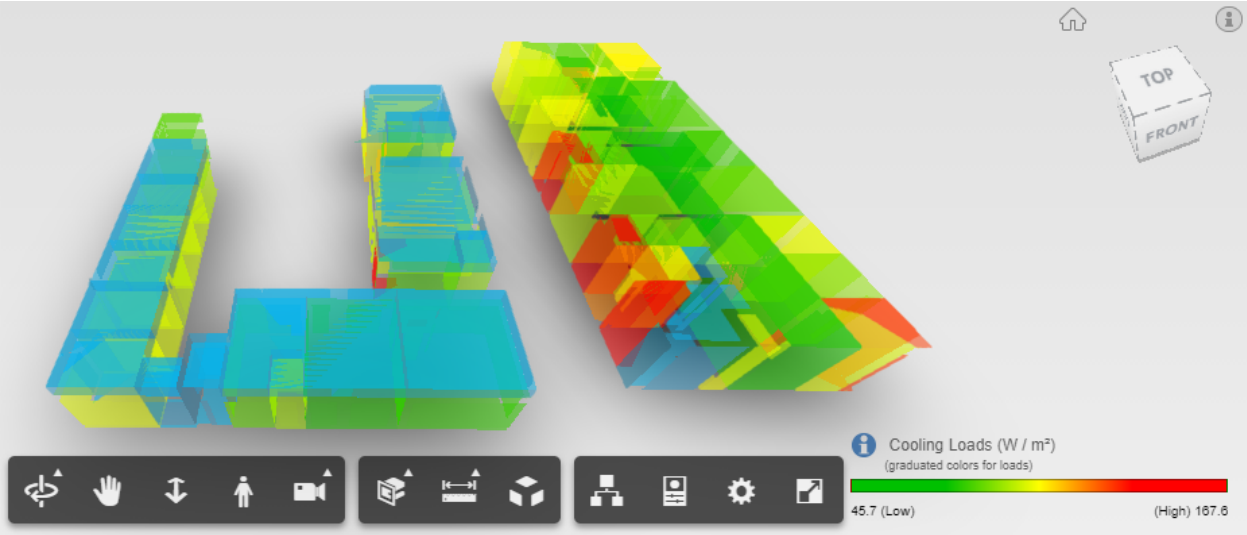








Insight Cooling Loads:



Daylighting Analysis

Daylighting methods:

- Insight: optimize factors
- LEED, Daylight Autonomy, Solar Access, Custom
- Cloud Rendering

Revit input

- Location
- Date and Time
- Sky Condition
- Surface & Glazing Materials
- Rooms to include

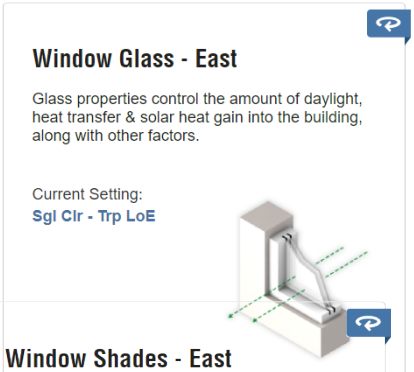
Visualize the results

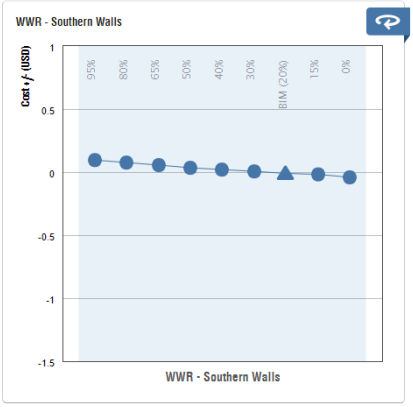
- Visual Styles
- Legends

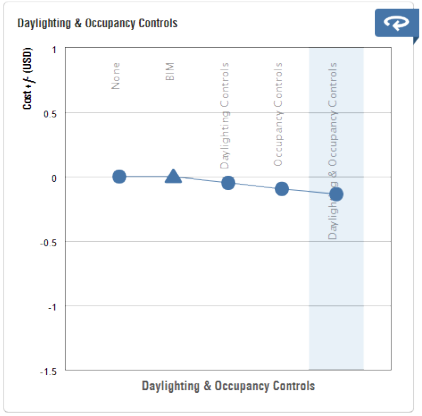
Cloud Rendering: download images

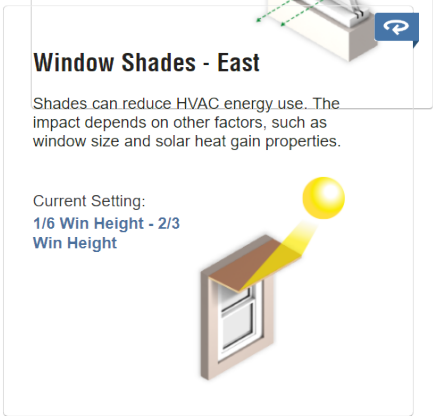
Insight – factors that impact daylighting:

- Window to Wall Ratio
- Glazing Types
- Daylight Controls
- Shading Devices









Daylight Autonomy and Annual Sunlight Exposure

Lighting Analysis - Results Summary

LEED v4 EQc7 opt1 sDA/ASE
For all Rooms Included in Daylighting

Jan 1 to Dec 31, 8:00 am to 6:00 pm
(Both sDA and ASE must be met for Room area to qualify)

$sDA_{300/50}$ + $ASE_{1000/250}$ 3 Points
78% of Building area meets sDA % hours
in Rooms with <20% area above ASE

Detailed Summary:
78% of Building area meets sDA % hours
0% of sDA Building area fails for Rooms >ASE

1% of Building area >ASE hours threshold

85% of Rooms meet sDA >55% Room area
70% of Rooms meet sDA 75% Room area
0% of Rooms >ASE hours >20% Room area

Design Tips

Daylight Autonomy Tips

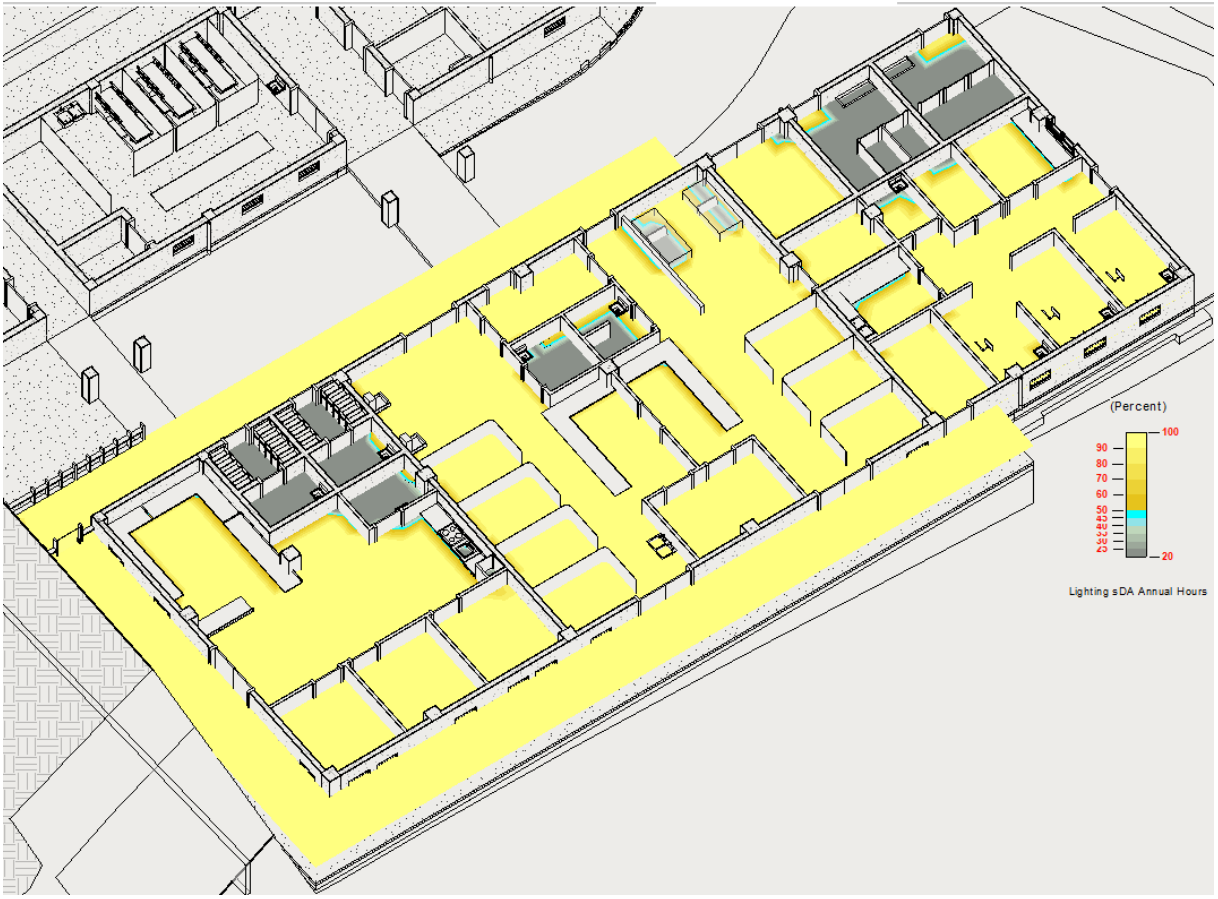
Included rooms are illuminated by natural daylight most hours of the year, and direct sun levels are within recommended limits. Take care to maintain solar shading and limit glazing transparency.

Building geometry
Design changes should maintain or increase ceiling and window head heights, and rooms currently have a good depth from glazed walls or skylights.

Glazing specification
Glazing transparency is good for overall daylight levels, ande may be decreased to reduce the potential impact of direct sun on occupant comfort and thermal energy management.

Shading
Direct sun is sufficiently shaded from affecting occupant comfort levels in included rooms. Avoid changes that would increase direct sun by reviewing sun and shading patterns using the Solar tool.

Daylighting Pattern Guide



Lighting Schedules:

<_InsightLighting Room Schedule>
LEED Daylight Autonomy Results Summary: 26.09, -81.75 - 45178
Building scores 3 LEED points with 78% Building area passing thresholds
At least 55% must exceed sDA300/50 in Rooms with ASE1000/250 < 20% of Room area

A	B	C	D	E	F	G	H	I	J	K
					sDA 300/50		ASE 1000/250		sDA/ASE	
Level	Name	Number	Area	Include In Daylighting	%	Points	%	Pass	%	Points
MATERNAL HEALT	FEMALE PATIENT T	MAT - 30	10 m²	☑	7	none	7	Yes	7	none
MATERNAL HEALT	MALE PATIENT TLT	MAT - 31	10 m²	☑	7	none	3	Yes	7	none
MATERNAL HEALT	DENTAL REGISTR	MAT - 33	7 m²	☑	75	3 pt	0	Yes	75	3 pt
MATERNAL HEALT	DENTAL OFFICE	MAT - 34	4 m²	☑	87	3 pt	0	Yes	87	3 pt
MATERNAL HEALT	STAFF TLT	MAT - 35	3 m²	☑	78	3 pt	0	Yes	78	3 pt
MATERNAL HEALT	MEP	MAT - 32	10 m²	☑	93	3 pt	7	Yes	93	3 pt
MATERNAL HEALT	STORAGE	MAT - 36	5 m²	☑	89	3 pt	0	Yes	89	3 pt
MATERNAL HEALT	DENTAL WORKRO	MAT - 37	6 m²	☑	55	2 pt	0	Yes	55	2 pt
MATERNAL HEALT	ON CALL	MAT - 41	7 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	ANTENATAL / POS	MAT - 43	39 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	RECLINERS	MAT - 42	11 m²	☑	69	2 pt	0	Yes	69	2 pt
MATERNAL HEALT	NURSE'S STATION	MAT - 47	11 m²	☑	74	2 pt	0	Yes	74	2 pt
MATERNAL HEALT	CLEAN / MED SUPP	MAT - 49	10 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	NURSE'S STATION	MAT - 48	11 m²	☑	91	3 pt	0	Yes	91	3 pt
MATERNAL HEALT	PAT. TLT	MAT - 46	4 m²	☑	0	none	0	Yes	0	none
MATERNAL HEALT	DIRTY	MAT - 44	7 m²	☑	96	3 pt	0	Yes	96	3 pt
MATERNAL HEALT	LABOR & DELIVER	MAT - 50	51 m²	☑	95	3 pt	1	Yes	95	3 pt
MATERNAL HEALT	LOCKER ROOM	MAT - 51	4 m²	☑	0	none	0	Yes	0	none
MATERNAL HEALT	LOCKER ROOM	MAT - 53	4 m²	☑	0	none	0	Yes	0	none
MATERNAL HEALT	STAFF TLT	MAT - 55	4 m²	☑	0	none	0	Yes	0	none
MATERNAL HEALT	SUPPLIES	MAT - 56	4 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	CONFERENCE ROO	MAT - 59	9 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	OFFICE	MAT - 60	8 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	OFFICE	MAT - 61	8 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	OPEN WORK SPAC	MAT - 57	15 m²	☑	60	2 pt	0	Yes	60	2 pt
MATERNAL HEALT	RECEPTION	MAT - 58	3 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	TLT	MAT - 52	3 m²	☑	0	none	0	Yes	0	none
MATERNAL HEALT	TLT	MAT - 54	3 m²	☑	0	none	0	Yes	0	none
MATERNAL HEALT	PATIENT TLT / SHO	MAT - 45	4 m²	☑	0	none	0	Yes	0	none
MATERNAL HEALT	DENTAL WAITING	MAT - 29	53 m²	☑						
MATERNAL HEALT	DENTAL CHAIR 1	MAT - 38	8 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	DENTAL CHAIR 2	MAT - 39	8 m²	☑	100	3 pt	0	Yes	100	3 pt
MATERNAL HEALT	DENTAL CHAIR 3	MAT - 40	7 m²	☑	100	3 pt	0	Yes	100	3 pt