



Energy Analysis with Autodesk Revit, Building Design Suites & Subscription.

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Overview...

- Introduction:
 - Core technology, values & purpose
 - Overview of Energy Analysis information
 - Summary of Revit Energy Analysis features & workflows
- Software demonstration:
 - Energy Analysis for Revit '*using Building elements*'
- All you'll need to try it for yourself
- Resources for further information
- Q&A

Introduction: Core Technology, Values & Purpose...

Powerful parametric modeling with a range of EAM creation methods.



BIM

Configure, store and share models, settings & results.

Collaborative

Frictionless

Minimum time & effort to conduct analysis.

Conduct *higher quality* Energy Analysis *more easily, earlier in* and *more regularly throughout* the building lifecycle.

CLOUD

SIM

The power of virtually infinite computing



Tried and trusted whole building energy simulation.



Flexible

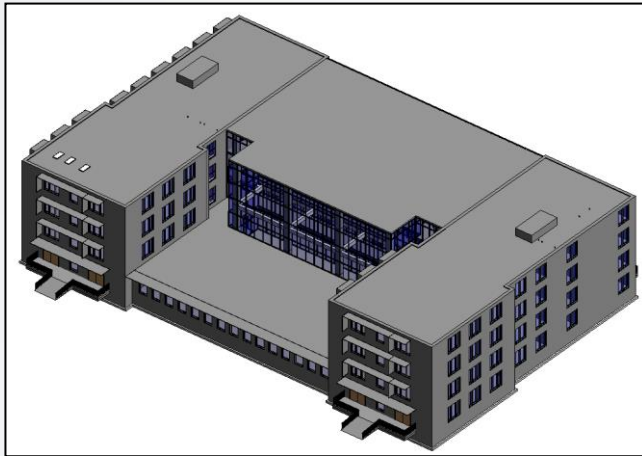
A range of workflow options using & providing globally applicable data.

BIM to BPA platform and solutions...

Building Information Modeling

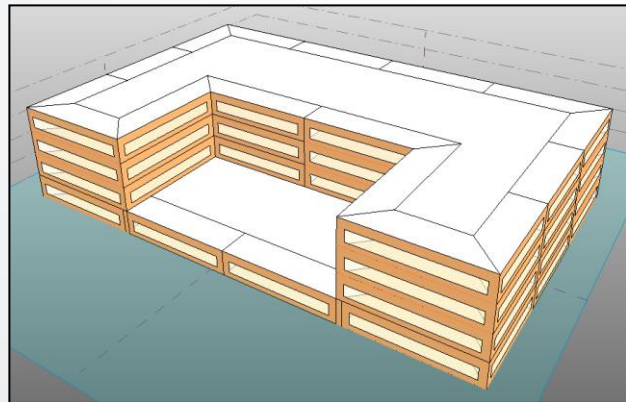
Building Performance Analysis

Revit
(building elements)

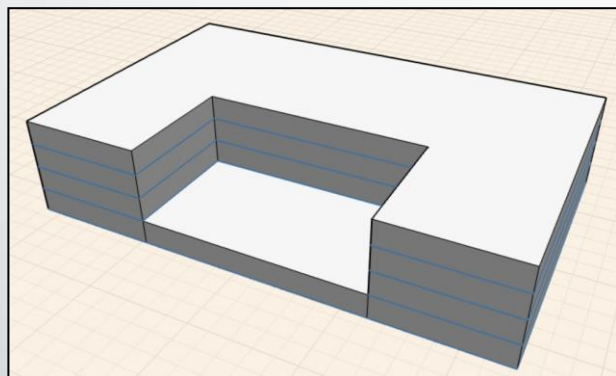


Green Building Studio & Project Solon

Vasari
(conceptual masses)

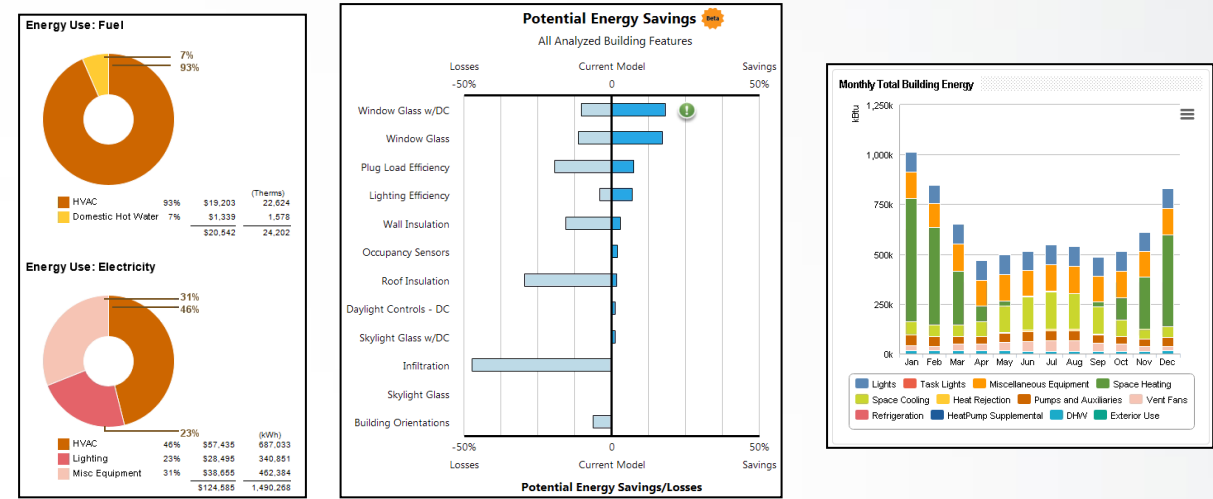


FormIt
iOS, Android, Web

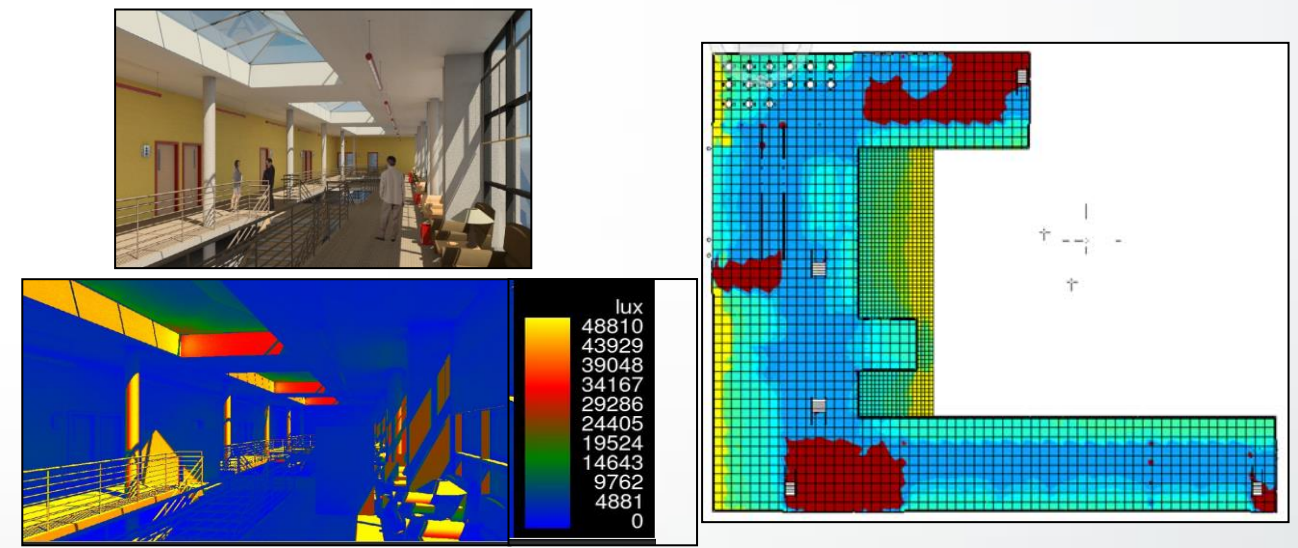


Conceptual to Detailed

← Energy →

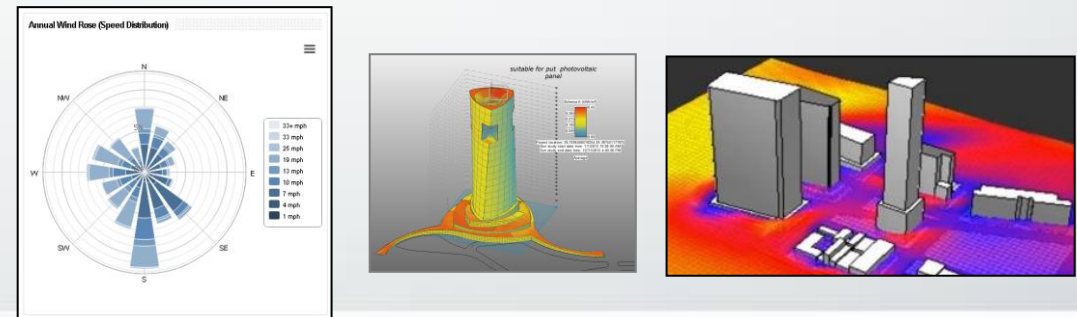


← Lighting →



A360
Rendering & Lighting Analysis for Revit

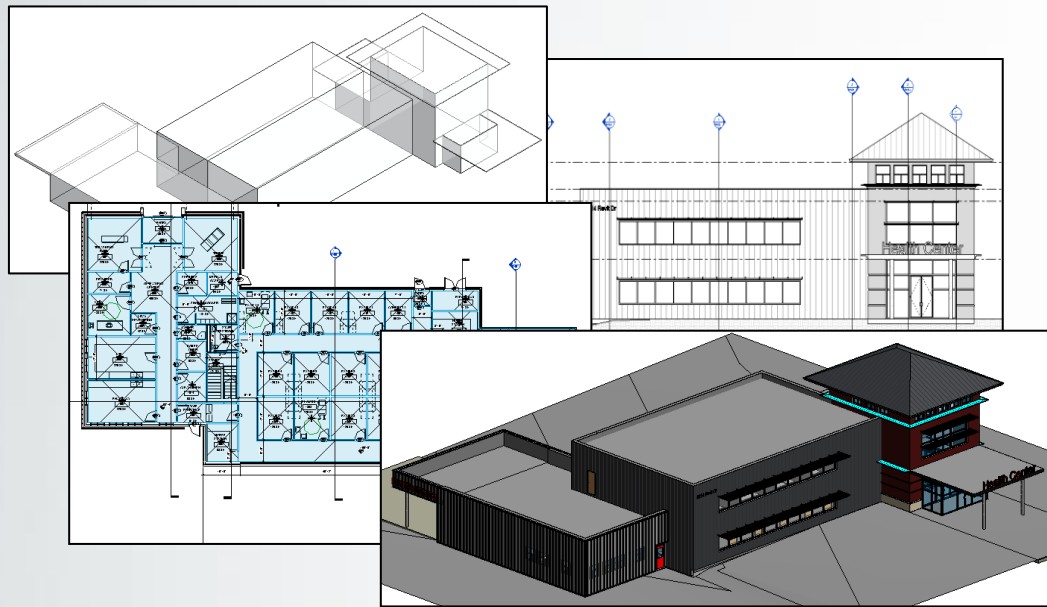
← Climate, Solar & Airflow →



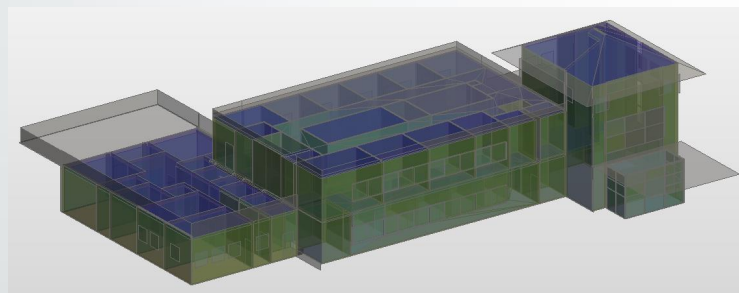
Climate Server 'Ecotect' features

Summary of Energy Analysis information & workflow...

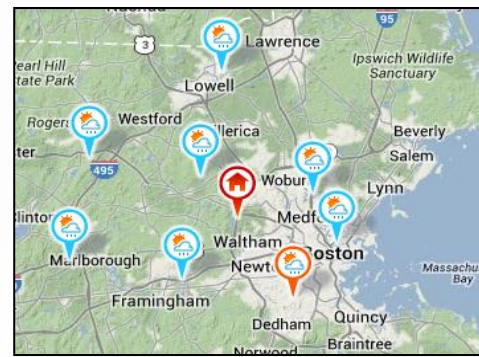
Model → Settings → Simulation



Project Documentation



+ Energy Analytical Model (EAM)



Location & Climate Data

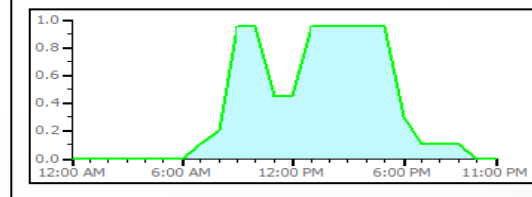
Multi Family	
Museum	
Office	
Parking Garage	
Penitentiary	
Performing Arts Theater	
Library - Storage	
Hospital/Health	
Office - Enclosed	
Office - Open Plan	
Office Common Activity Areas	

Building & Space Type Data

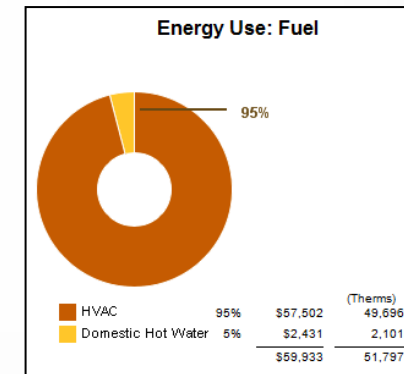
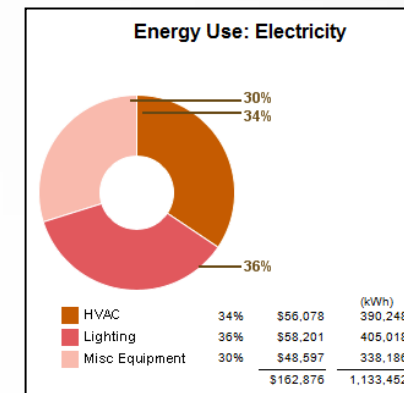
Thermal Conductivity	0.0200 btu/(hr-ft ² -°F)
Specific Heat	0.2900 btu/(lb-°F)
Density	1.80 pound per cubic foot
Analytical Properties	
Heat Transfer Coefficient (U)	0.0191 BTU/(h-ft ² -°F)
Thermal Resistance (R)	52.3308 (h-ft ² -°F)/BTU
Thermal mass	3.7137 BTU/°F
Absorptance	0.700000
Roughness	3

Materials Data

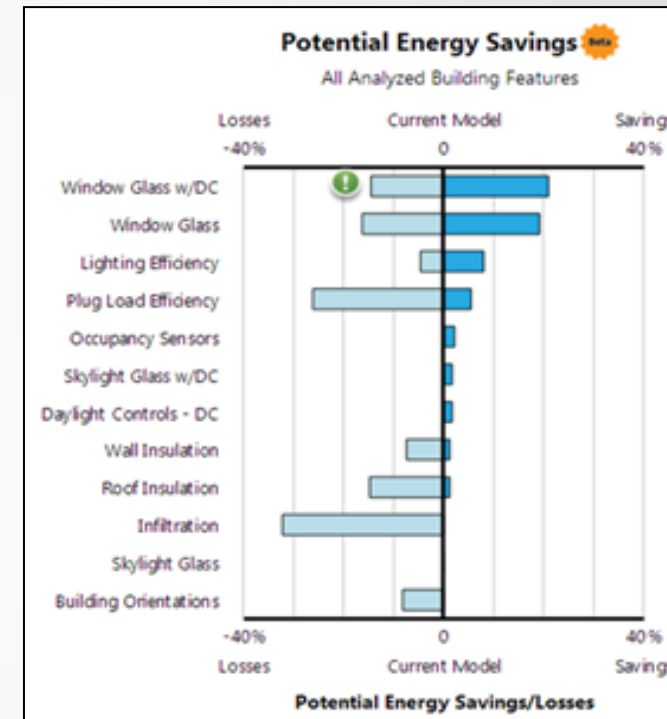
12 SEER/0.9 AFUE Split/Packaged Gas, 5-11 Ton
 11.3 EER Packaged VAV, 84.4% boiler heating
 Central VAV, HW Heat, Chiller 5.96 COP, Boilers 84.5 eff
 4-Pipe Fan Coil System, Chiller 5.96 COP, Boilers 84.5 eff
 Central VAV, Electric Resistance Heat, Chiller 5.96 COP



Systems & Operations Data



Energy Use & Cost



Potential Energy Savings

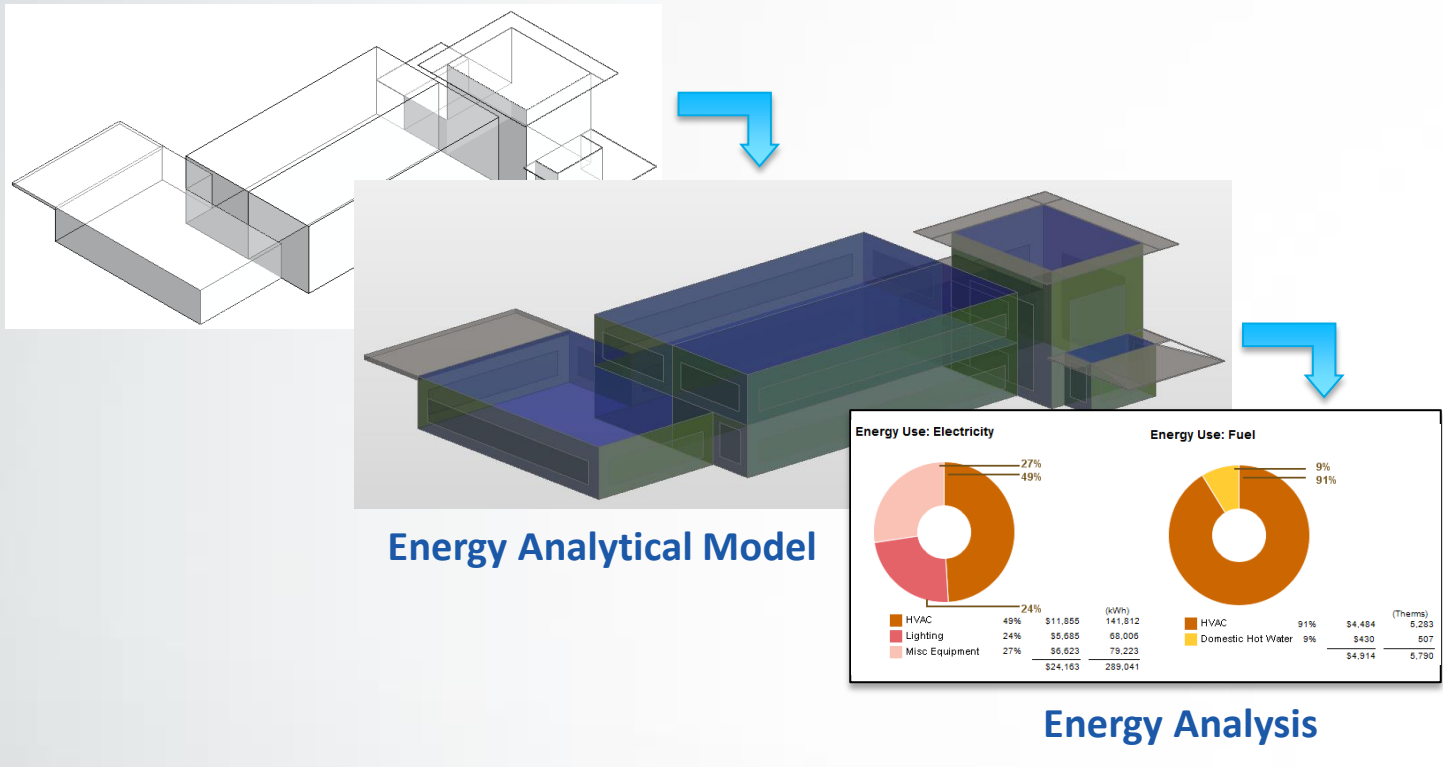
Feedback

Export

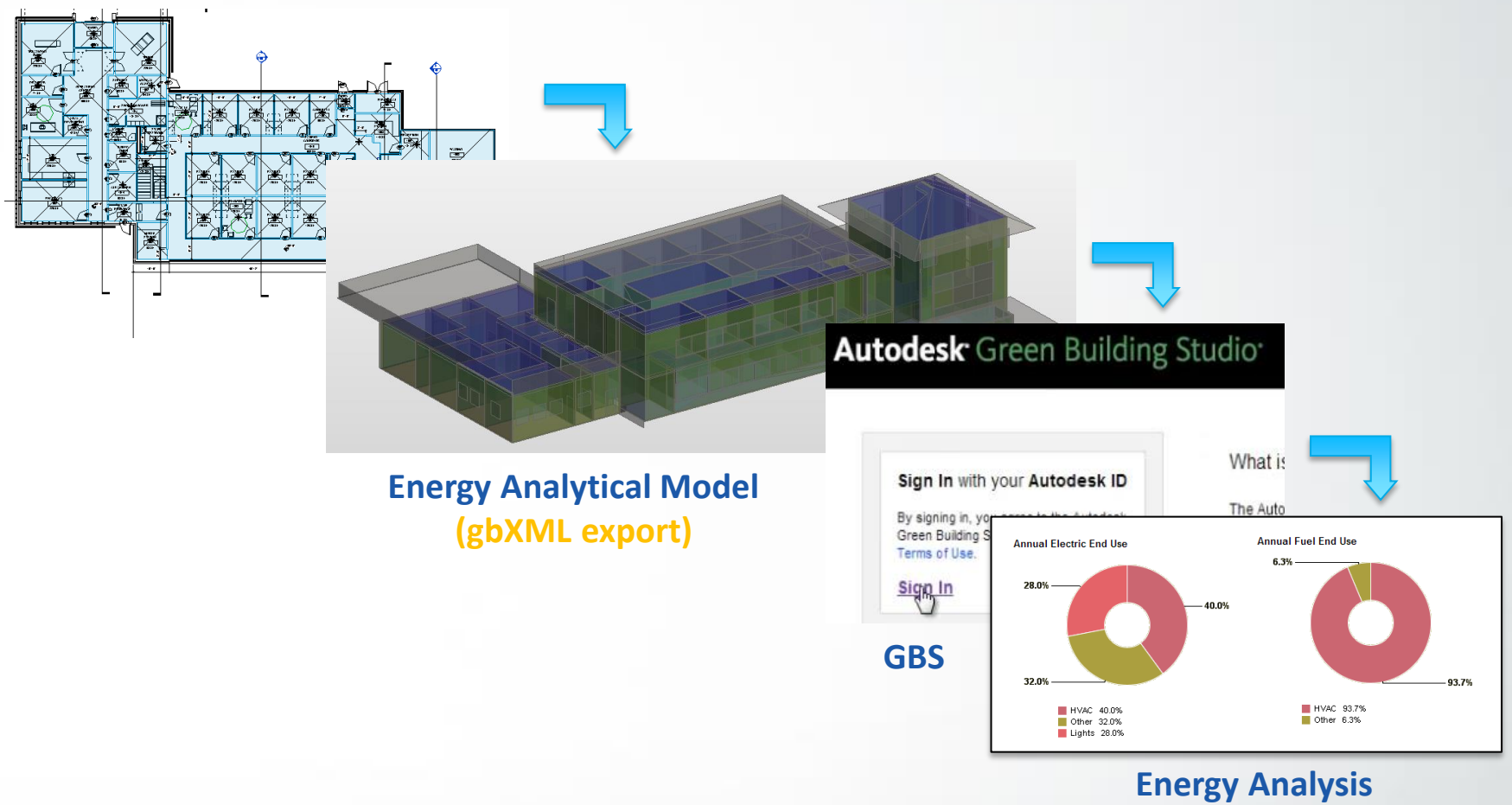


Revit Energy Analysis Features & Workflows...

Conceptual Massing elements

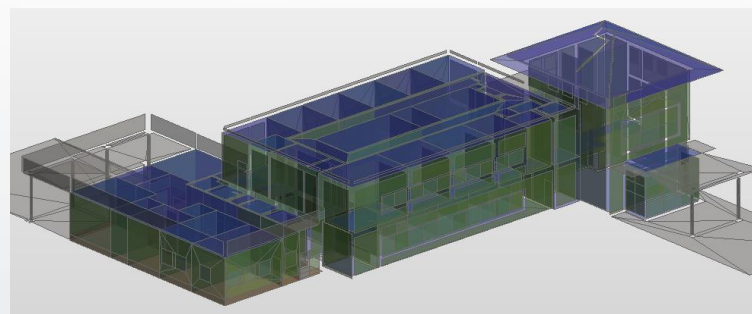
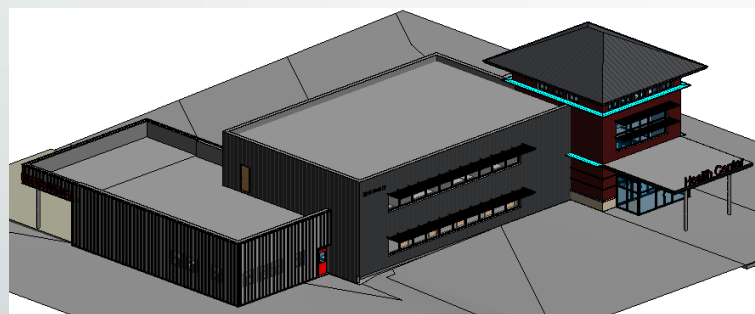


Room/Space elements

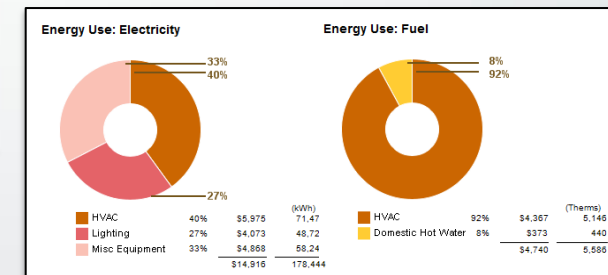


Typically fastest and most reliable with 'real' architectural Revit models

Building elements



Energy Analytical Model

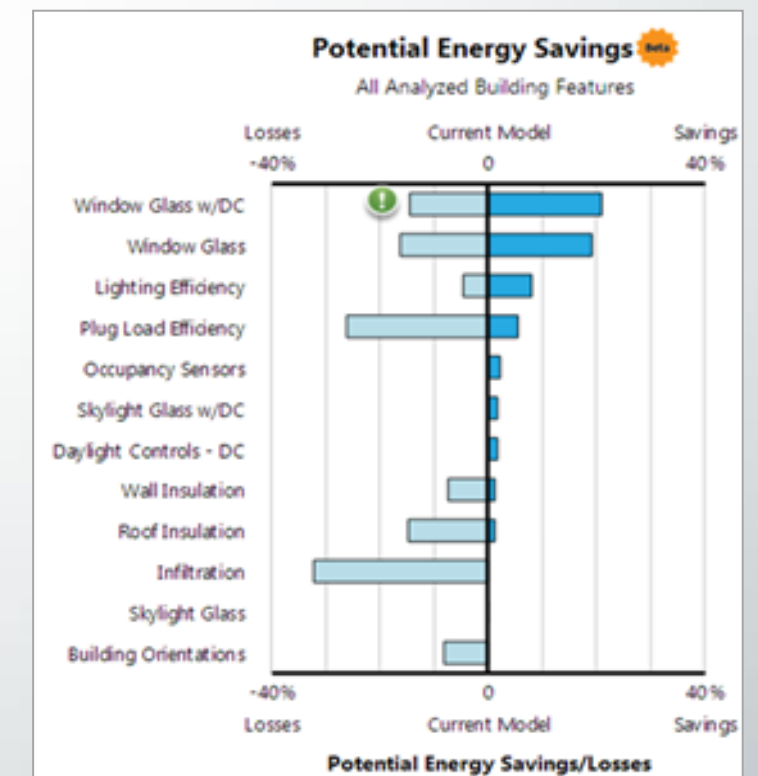
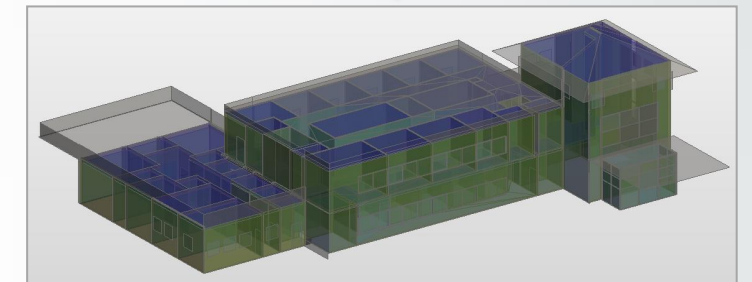
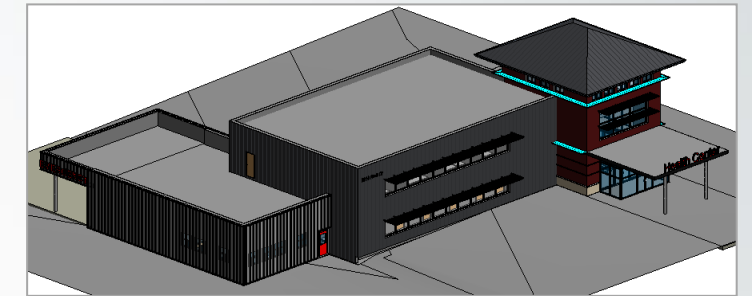


Energy Analysis

Demonstration...

- Energy Analysis *using Building elements*:

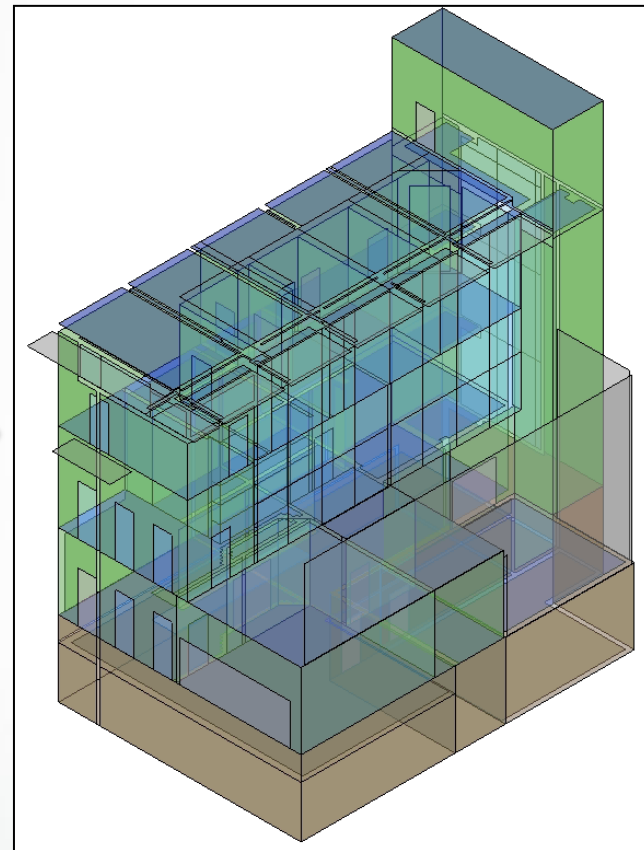
- Basic navigation – Ribbon icons
- Energy Settings – Minimum required:
 - Location & Climate data
 - Building type
- Energy Simulation
 - Energy Analytical Model creation, viewing & validation
- Results & Compare
 - Potential Energy Savings
 - Project Solon
 - Export gbXML, DOE2 etc.



Revit EAM accuracy & precision



Sample Revit model with known measures



Resulting EAM

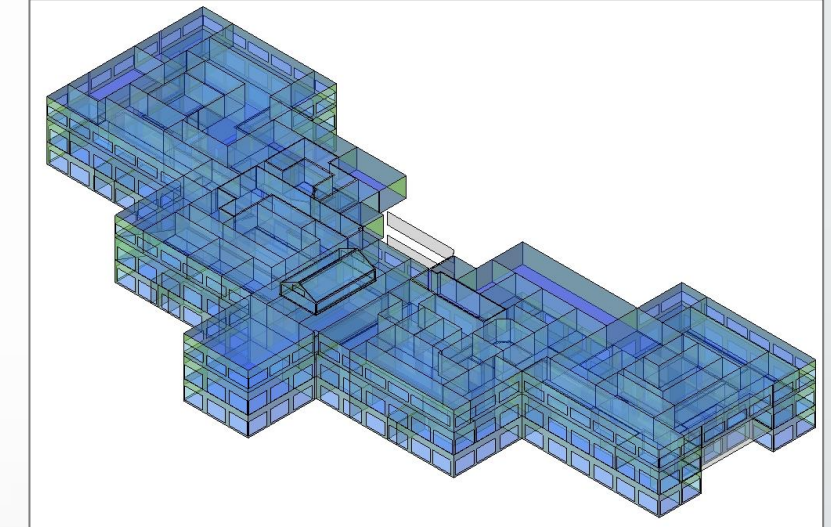
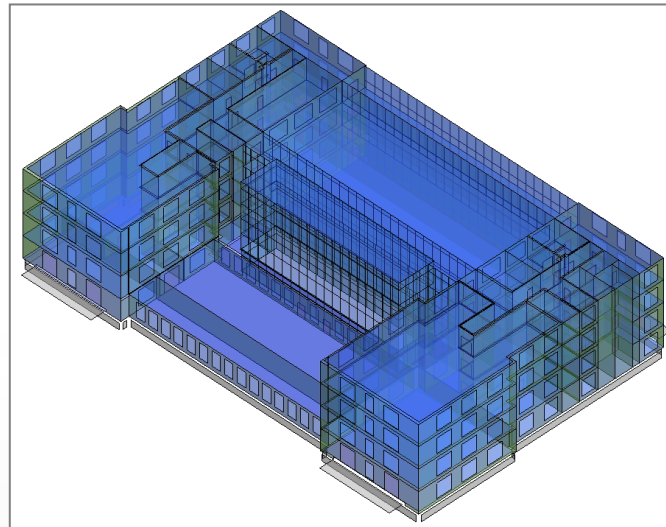
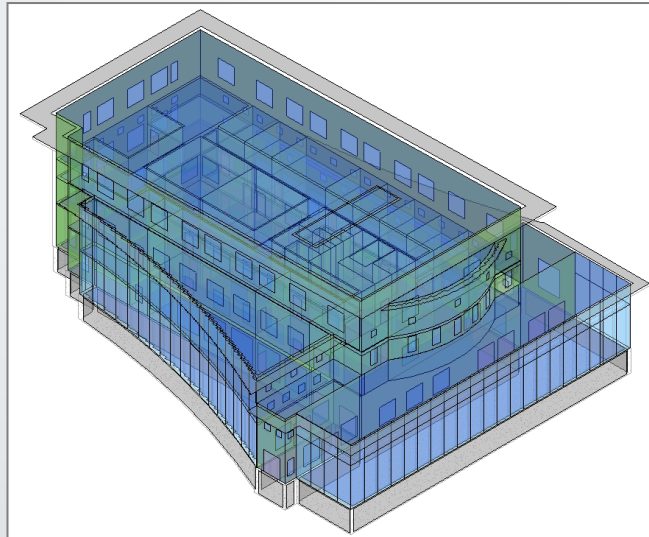
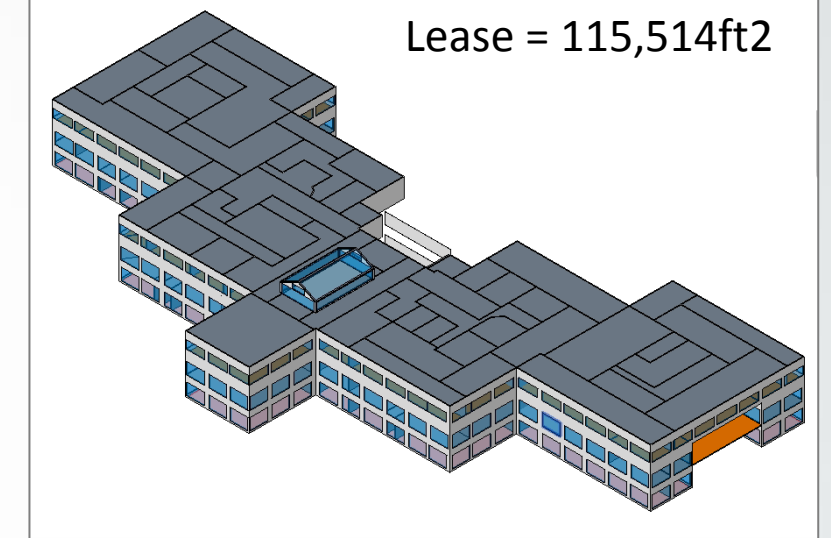
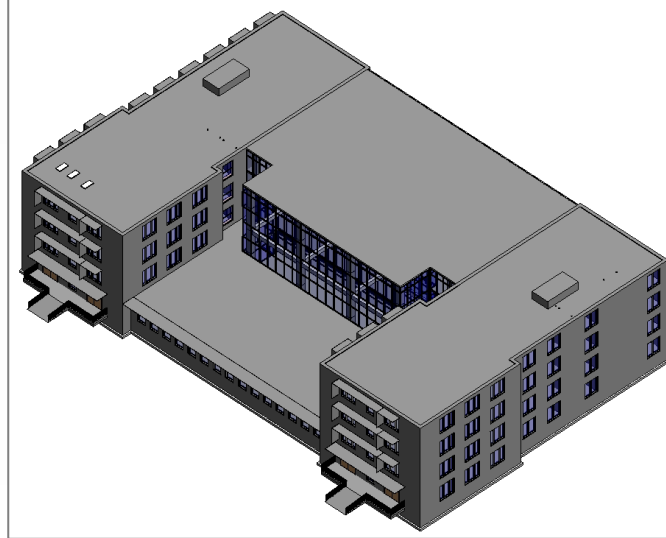
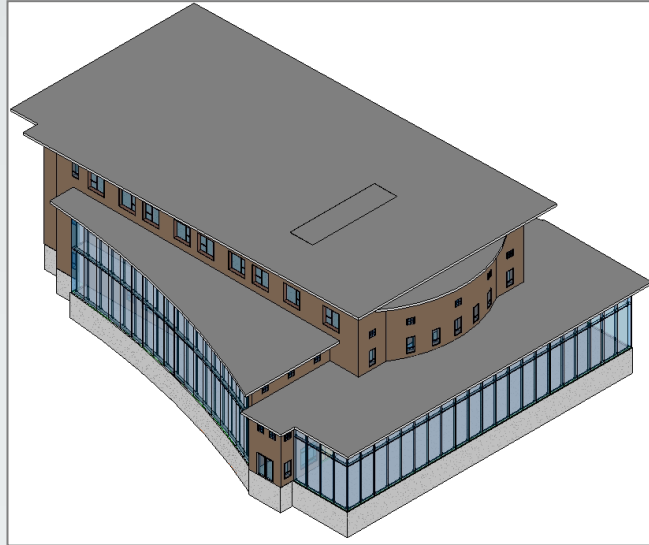


EAM Components	Actual	EAM	Difference
Spaces - Floor area (ft ²)	5,719	5,725	0.1%
Spaces - Volume (ft ³)	73,564	71,920	-2.2%
Surfaces - Roofs (ft ²)	1,291	1,212	-6.1%
Surfaces - Exterior walls (ft ²)	8,144	7,858	-3.5%
Surfaces - Interior walls (ft ²)	5,582	5,376	-3.7%
Surfaces - Interior floors (ft ²)	4,521	4,818	6.6%
Surfaces - Underground walls (ft ²)	2,375	2,324	-2.1%
Surfaces - Underground slabs (ft ²)	2,244	2,182	-2.8%
Surfaces - Doors (ft ²)	368	358	-2.7%
Surfaces - Fixed windows (ft ²)	1,867	1,889	1.2%
Surfaces - Operable windows (ft ²)	309	301	-2.6%
Average Difference			-1.6%

For more information see AU 2014 class AB2260:

<http://au.autodesk.com/au-online/classes-on-demand/class-catalog/2013/revit-for-architects/ab2260>

EAM accuracy & precision



EAM Component	Actual	EAM	Difference
Spaces - Floor Area (ft ²)	26,510	24,858	-6.2%
Spaces - Volume (ft ³)	362,959	361,081	-0.5%
Surfaces - Walls (ft ²)	45,966	45,701	-0.6%
Surfaces - Floors (ft ²)	26,405	24,932	-5.6%
Surfaces - Roofs (ft ²)	11,034	10,943	-0.8%
Surfaces - Doors (ft ²)	1,570	1,544	-1.7%
Surfaces - Windows (ft ²)	9,898	10,105	2.1%
Total Average			-1.9%

EAM Component	Actual	EAM	Difference
Spaces - Floor Area (ft ²)	102,574	95,912	-6.5%
Spaces - Volume (ft ³)	1,135,735	1,142,128	0.6%
Surfaces - Walls (ft ²)	110,150	109,274	-0.8%
Surfaces - Floors (ft ²)	105,158	95,913	-8.8%
Surfaces - Roofs (ft ²)	31,750	30,603	-3.6%
Surfaces - Doors (ft ²)	3,604	3,525	-2.2%
Surfaces - Windows (ft ²)	40,087	40,657	1.4%
Total Average			-2.8%

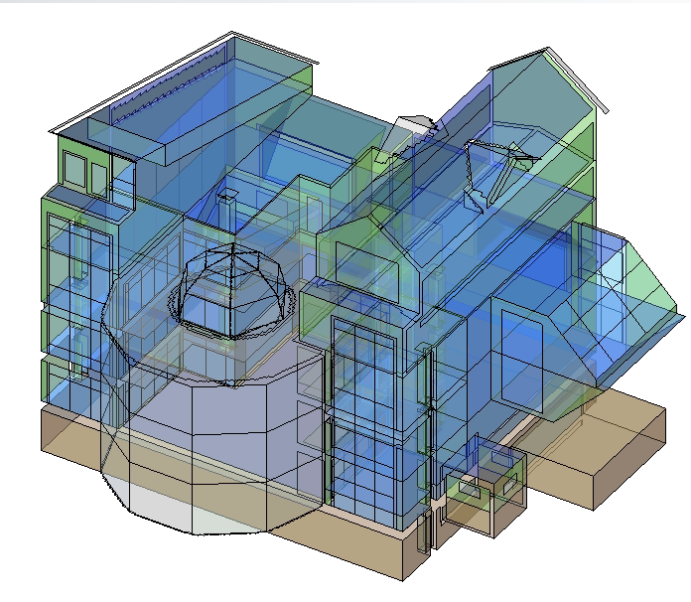
EAM Component	Actual	EAM	Difference
Spaces - Floor Area (ft ²)	116,447	116,865	0.4%
Spaces - Volume (ft ³)	1,433,339	1,416,906	-1.1%
Surfaces - Walls (ft ²)	162,876	161,784	-0.7%
Surfaces - Floors (ft ²)	121,834	116,865	-4.1%
Surfaces - Roofs (ft ²)	43,841	43,510	-0.8%
Surfaces - Doors (ft ²)	0	0	0.0%
Surfaces - Windows (ft ²)	24,891	24,687	-0.8%
Total Average			-1.0%

Revit model size & complexity

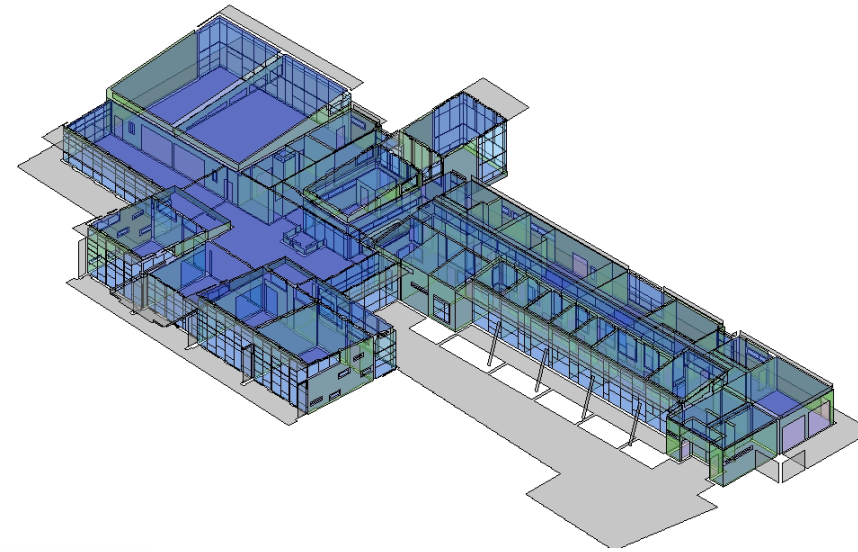
~2-5 days

Traditional EA tools & practices

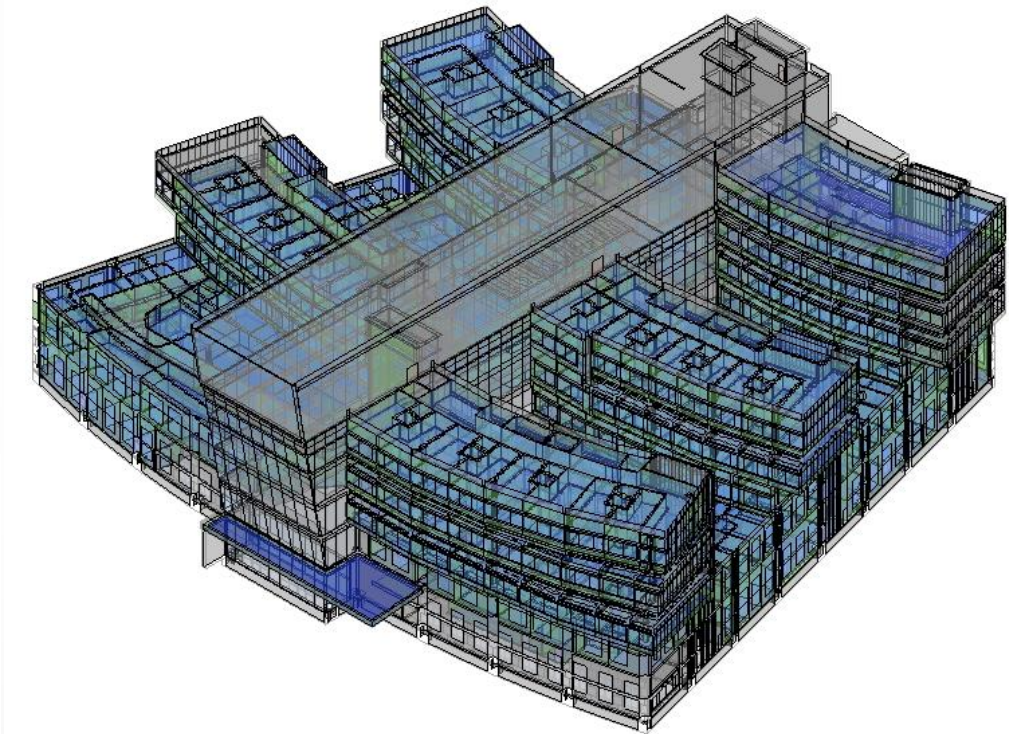
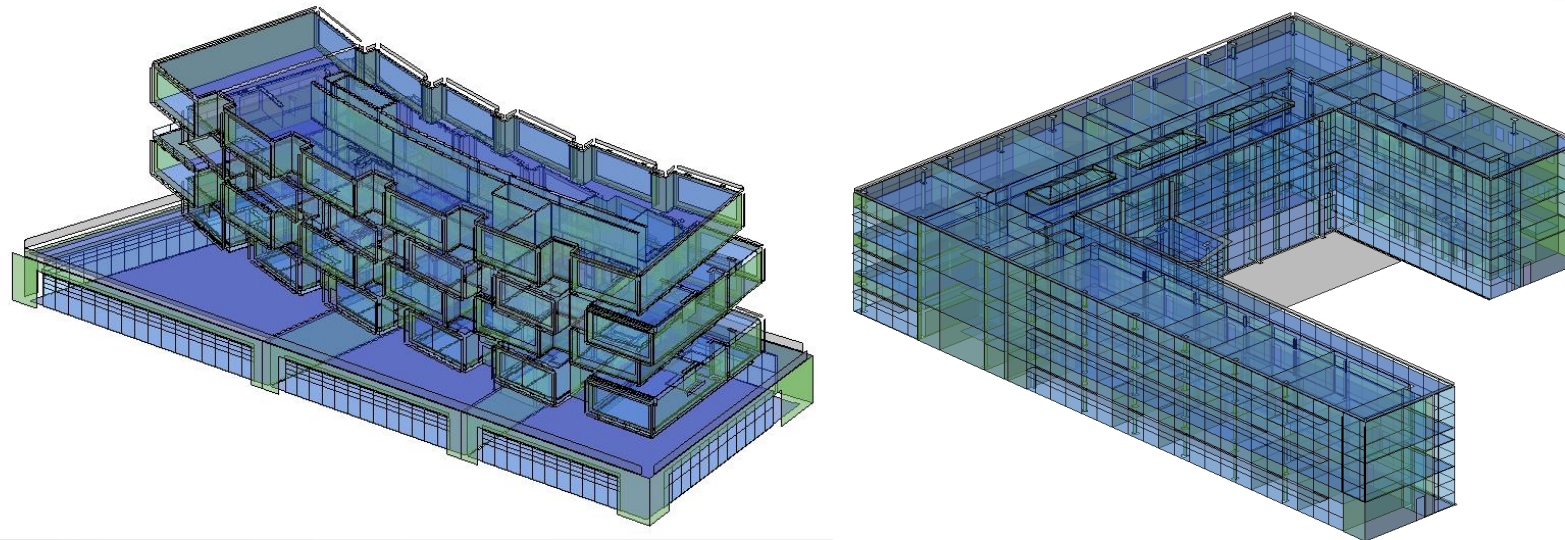
~2-3 Weeks



Multiple Complex Conditions



Typical size & complexity



Large & Complex

~30 min.

Revit Energy Analysis using Building elements

~3-5 hours

All you'll need to try it for yourself...

- Revit 2015 / Building Design Suite 2015
- A subscription enabled account
- Internet access
- And finally... a Revit model.

Q&A...

Resources for further information:

- Autodesk BPA blog:
<http://autodesk.typepad.com/bpa/>
- Autodesk BPA forum:
<http://forums.autodesk.com/t5/Building-Performance-Analysis/ct-p/2020>
- Autodesk Sustainability Workshop:
<http://sustainabilityworkshop.autodesk.com/>
- The Building Performance Analysis Certificate (Free Online Course)
<http://sustainabilityworkshop.autodesk.com/bpac>





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