AUTODESK UNIVERSITY

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Insight 360: Energy Analysis…for Architects?

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Learning Objectives

- Understand the features of Insight 360
- Discover the benefits of early energy analysis (not energy modeling!)
- Learn how to integrate energy analysis into typical production
- Understand output and documentation

Description

It's early in the design process. Wouldn't it be great if there was something that evaluated the benefit of adding insulation, the impact of installing heftier glazing, or the increased efficiency in rotating your building 10 degrees? Architects don't want to get into energy "modeling." That's not their gig. Let's leave that to the MEP (mechanical, electrical, and plumbing) and energy engineering professionals. Early energy analysis is the way to go, and tools within Revit software are available to help guide the process. In this session, we will investigate the tools available, including Insight 360 software, and the benefits of running energy analysis early in project design. We'll discuss the fine line between energy "modeling" and energy "analysis," as well as workflow implementation and documentation. This session features Revit. AIA Approved.

Your AU Experts

Kimberly Fuhrman, LEED AP BD+C, has over 20 years of experience with Autodesk products in both civil and architectural fields. Kimberly is the BIM Manager at LSC Design, Inc., in York, Pennsylvania. She serves on the Architectural Advisory Committees for several technical colleges, and on the Market Leadership Advisory Board for the USGBC-Central Pennsylvania Community. She is a Revit Architecture Certified Professional, an Expert Elite member, Revit Inside the Factory Insider (formerly Gunslinger), and the Revit Structure Content Manager for AUGI World. She was a speaker at Autodesk University 2015. In her spare time, Kimberly is a regular contributor to the cadpanacea.com blog.

Dennis McNeal, AIA, is a licensed architect and BIM Manager for AECOM's Roanoke Virginia office working with a diverse team of architects and engineers. Dennis joined AECOM after working at Autodesk for 15 years as a Software Quality Analyst and Product Owner with a focus on energy analysis for architects.

What is Energy Analysis?

Before we get into specifics of Energy Analysis (we'll shorten it to EA to save some typing!), it is important to understand its meaning and purpose from an architectural perspective. Note that we will not be discussing in-depth Energy Modeling – that's MEP territory! Energy Analysis, according to a study by Perkins+Will in 2014 for the American Council for an Energy Efficient Economy, WBEA (Whole Building Energy Analysis) is:

> *"…the process of analyzing a building's energy performance by calculating how well the integration of that building's form, systems, and envelope perform under the surrounding environmental conditions."*

Simply put, EA is a basic scenario comparison of building models, comparing things like building orientation, building envelope construction, glazing percentages and materials, and basic systems. It's an if/then challenge: if we do **this** to the building, then **this** happens. If we increase glazing, then daylighting increases…or does it? The tools within Insight 360 provide clues to the best case scenario.

Benefits of Early Energy Analysis

Why would an architect take time out of a busy or rushed design schedule to run energy analysis? First and foremost would be to offer the client/owner a better building. Energy efficient buildings provide owners with reduced operating costs, healthier occupants, and less impact on the environment. If a building is constructed without improved energy design, and an owner finds out later that they could have had a better performing building, and in return reduced operating costs, who is going to be on the receiving end of that phone call? The architect. Of course, if the *owner chooses* to go with less energy efficiency, it is their choice, but we have at least given them the options. In the grand scheme of things, the time it takes to run energy analysis is minimal, but the options you can give the owner early in design will have more than monetary payoffs in the end.

Not Another Change Order!?!

Not only can EA provide clients with potential reduced operating costs, but it can also save changes during construction. By having discussions early in design with the entire design team and owners (a la "BIM"), decisions can be made with more certainty. Early decisions and collaboration reduce the number of change orders later. (Note: I did not say there won't be any change orders! Unfortunately, they tend to be a fact of construction life.) Being able to see the effects of changes in a virtual model ahead of construction brings those changes to the model, rather than the physical building. That in itself is worth every penny of time spent in design.

Those Pesky Codes!

Energy Codes and certifications such as LEED®, WELL®, Green Globes, 2030, etc., are also reasons to use early EA. Energy codes are continually being updated, and more stringent. Energy savings just from increased energy codes is right around 30% from just a decade ago.
(Source:http://energy.gov/sites/prod/files/2014/05/f15/saving_with_building_energy_codes.pdf)

Building certifications keep raising the bar higher with requirements, advocating for more sustainable and environmentally responsible buildings. Energy analysis provides information to help inform data needed for codes and certifications.

But, Why Me??

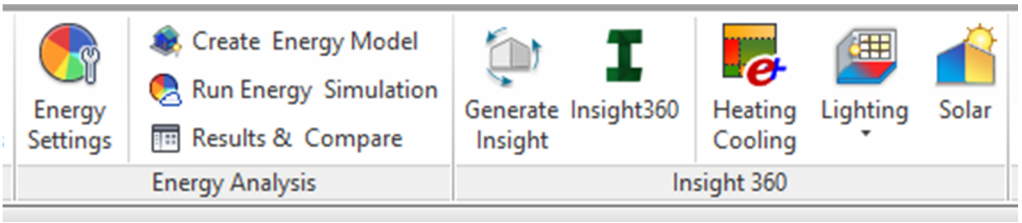
Why should architects do the EA? Why not leave it to the MEP? Because EA encompasses all aspects of building construction, not just systems. Often, engineers are not brought into the project until later in the design process. Even during land development, EA can be beneficial to evaluate building orientation using massing elements. The architect can easily create several design options for the client, complete with EA before an MEP is brought on board. Again, we are using basic construction information, not nosediving into MEP territory.

Introducing Insight 360

https://insight360.autodesk.com/oneenergy

Insight 360 works in conjunction with Revit and FormIt 360. Autodesk's FormIt 360 is a fabulous design software that works seamlessly with Revit. (See my other AU2016 class session, AR18557-Inviting FormIt 360 to the Revit Party!) For this class session, we will focus on using Insight 360 with Revit. The Insight 360 add-in for Revit is a subscription-only feature.

Features



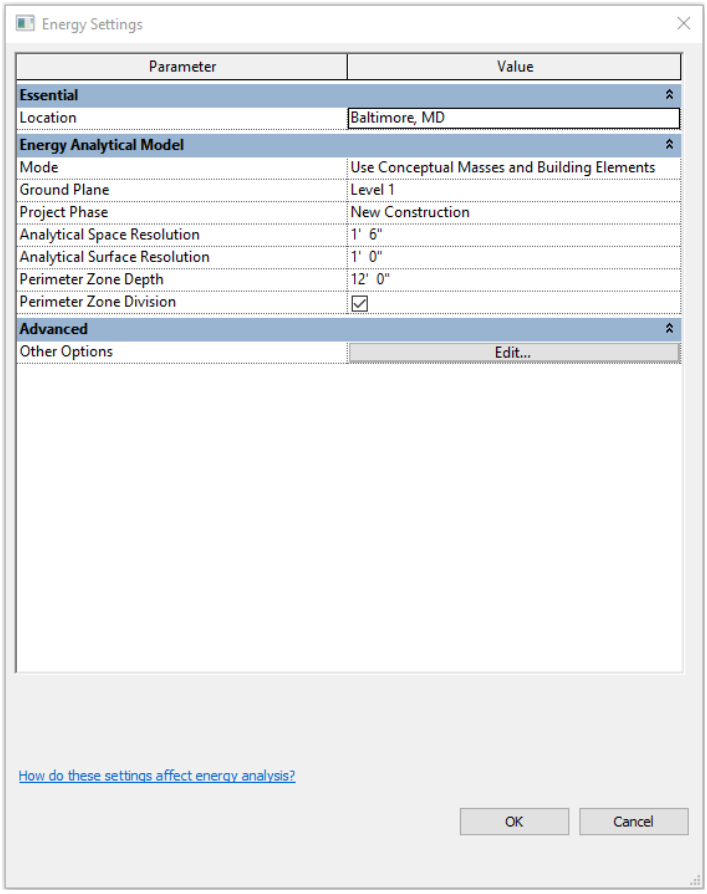
ENERGY ANALYSIS AND INSIGHT 360 PANELS IN REVIT 2017

- **Energy Settings**

  Energy Settings are accessed via the **Project Information** button on the **Settings** panel of the Manage tab – OR – via the **Energy Settings** button on the

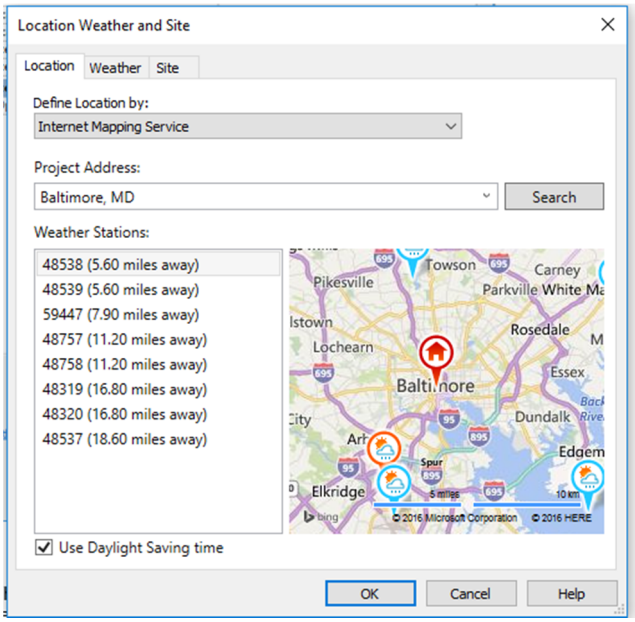
Energy Analysis panel of the **Analyze** tab. Both locations will open the Energy Settings dialog box. The Energy Settings are the first step in creating the Energy Model.

Within the Energy Settings dialog box are basic and advanced settings.



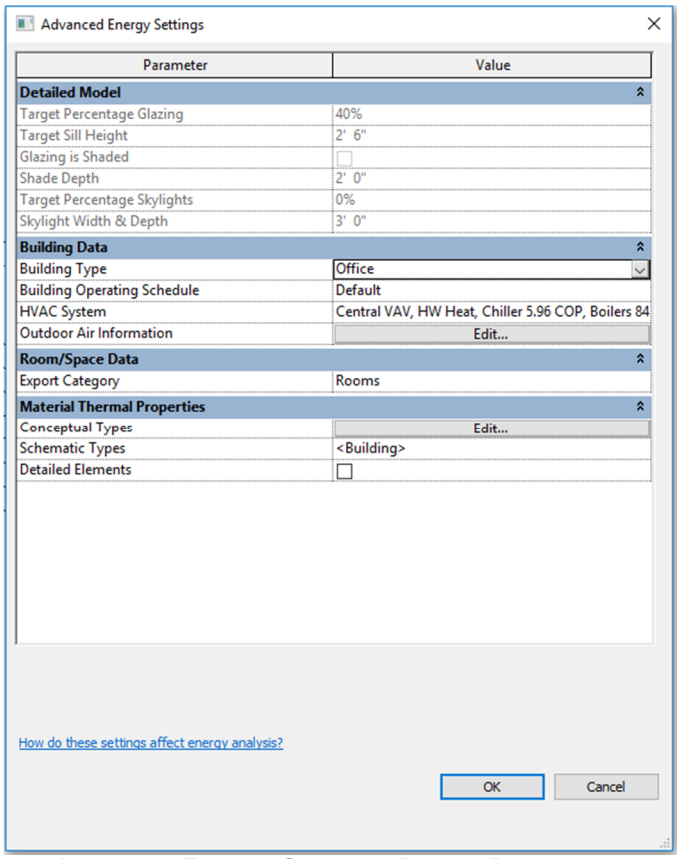
ENERGY SETTINGS DIALOG BOX

- **Location** – This one is fairly straightforward. Click on the ellipsis to set the location of the project. This can be as general or as specific as you like. If you have a site address, you can also select the nearest weather station from which to pull data. This is the only setting truly necessary.



- **Mode** – Options for using Building Elements (walls, floors, roofs, etc.), Conceptual Masses, or a combination of both. Setting the mode to "Use Conceptual Masses and Building Elements" as the default in your template allows for greater flexibility.
- **Ground Plane** – may or may not correspond to the first floor level.
- **Project Phase** – uses the selected project phase only.
- **Analytical Space Resolution** – specifies the largest allowable gap between two elements to be considered a "closed space". The Revit model does not have to be completely enclosed to work. Tighter Space/Surface Resolution doesn't indicate greater accuracy of results, but can negatively impact analysis time.
- **Analytical Surface Resolution** – specifies the accuracy of the analytical surfaces in both directions – the default value is 1'. So, a surface with a width of 8" would not be considered an analytical surface.
- **Perimeter Zone Depth** – takes into the consideration the thermal differences within a certain distance of an exterior wall. The default value is 12'-0".
- **Perimeter Zone Division** – divides the building into 4 thermal zones (when using conceptual massing) and more detailed thermal zones when using building elements.

Advanced Settings



ADVANCED ENERGY SETTINGS DIALOG BOX

This is where architects tend to lose it. No, really! The advanced settings are just that…advanced! At first glance, it may not seem too intimidating, but there is some pretty intense stuff in here that can really trip up someone who is not familiar with MEP systems. From an architectural perspective, and early on in the design process, we don't care if we're using heat pumps or boilers…all we know is that the space will or will not be a conditioned space. The defaults here are representative of minimal or typical code requirements, or general construction norms (feel free to avoid these settings!)

Detailed Model:

- **Target Percentage Glazing** – how much of the wall is set to be glazed; 40% is a starting factor, and may be increased or decreased as needed.
- **Target Sill Height** – height above a mass or finished floor level
- **Glazing is Shaded** – mass glazing shaded by light shelves; applies to mass elements with mass floors enabled.
- **Shade Depth** – the depth of the light shelf applied to mass glazing
- **Target Percentage Skylights** – percentage of mass roof area openings; applies to mass elements with mass floors enabled.
- **Skylight Width & Depth** – dimension for mass roof skylights; value applies to both Width and Depth of the skylight.

Building Data:

- **Building Type** – hopefully you know what type of building you are designing.
- **Operating Schedule** - may be tough to nail down at first, but the building use can help to determine this. Worse case, of course, would be a 24/7 facility.
- **HVAC System** – unless you know for sure what the HVAC system will be, use what is prominent for your climate area, for commercial or residential units. This is where we typically get hung up on specifics too early in the design. The energy analysis results will certainly vary for different systems, but if you can get reasonably close, your results will be dependable.
- **Outdoor Air Information** – again, unless you know what the system requires, it's ok to accept the default (and minimum code) value of 15 cfm/person.

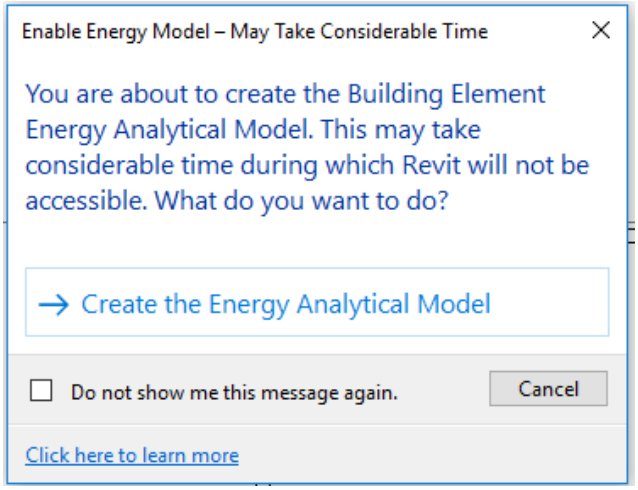
Room/Space Data

- **Export Category** – this one's easy; unless you're using analytical MEP volumes (spaces) use the default setting for Rooms.

Material Thermal Properties (again, don't get too hung up on specifics)

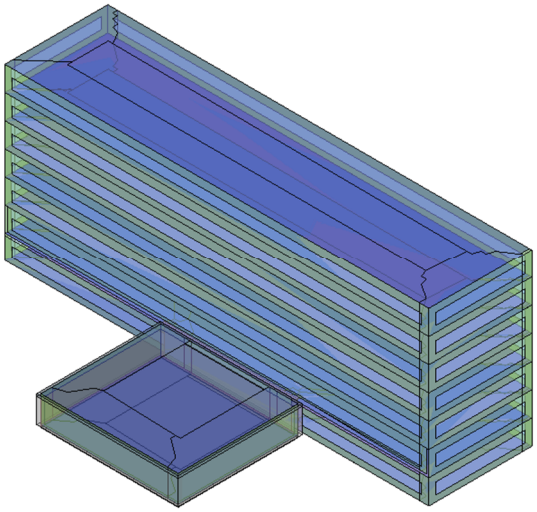
- **Conceptual Types** – applies thermal properties to conceptual mass elements.
- **Schematic Types** – used to override thermal properties of building elements
- **Detailed Elements** – if thermal properties are assigned to building elements by material, use this to override the Schematic Types for building elements.

The main reason settings (other than location) are unimportant is that I360 will run all the alternatives for you anyway. That's it! You're ready to create the energy model. Click the **Create Energy Model** button on the Energy Analysis panel.



ENERGY MODEL DIALOG

Once the Energy Model is created, a new 3D view appears called **3D Energy Model**. This shows the analytical surfaces and spaces overlaid on a transparent view of your Revit model, and is used to inform the energy data. This view can be navigated the same as any other 3D view.



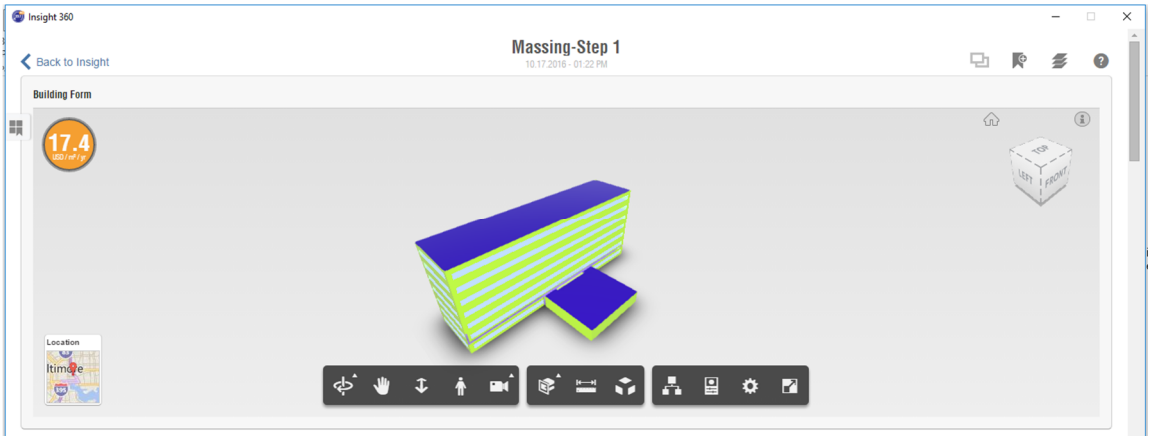
3D ENERGY MODEL

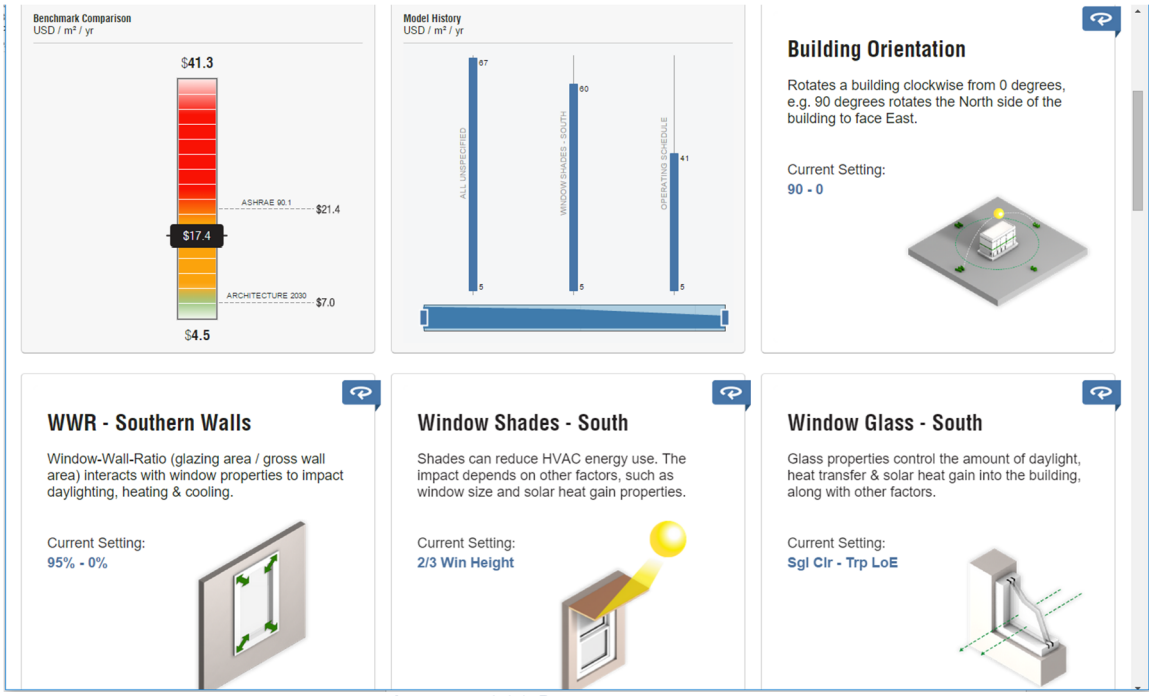
Generating Insight 360

The next step is to **Generate Insight**. This sends the energy model information to Insight 360. You will get a notification that it will take a few minutes to generate, and you will receive an email when Insight is complete. The email contains a web link to the Insight 360 project.

Insight 360 Dashboard

The Insight 360 Dashboard is an interactive workspace that allows the user to compare the effects of different design scenarios without affecting the actual Revit model. Below is the Insight Dashboard for our model. Insight 360 may be accessed through the Revit Analysis tab, or online from the Insight 360 home page.





INSIGHT 360 DASHBOARD

Starting at the top is the view of the analytical model. The analytical model can be navigated, zoomed, sectioned, and rotated the same as a Revit 3D model. In the upper left corner, in the circle is the resulting **Energy Cost Mean**.

The first block in the second row gives the **Benchmark Comparison**, which shows the Architecture 2030 and ASHRAE 90.1 benchmarks for the energy model. Both the Energy Cost Mean and the Benchmark Comparison update simultaneously to any dashboard changes. The goal is to get to green!
The middle block shows the **Model History**. This tracks all of the changes you have made to the energy analysis (but does not apply to the Revit model). The rest of the blocks are interactive specifications and ranges for the energy analysis.

Before changing any ranges, you may wish to save the defaults as a Scenario so that you can compare changes that you make, or create several different scenarios to compare different building configurations. To save a Scenario, click the bookmark in the upper right corner of the Insight page.

Dashboard Ranges

You will notice under each of the energy categories a short description and illustration, as well as a blue arrow in the upper right corner. Clicking this arrow flips the category block to show a range of available options. Clicking the arrow again flips it back to the illustration.

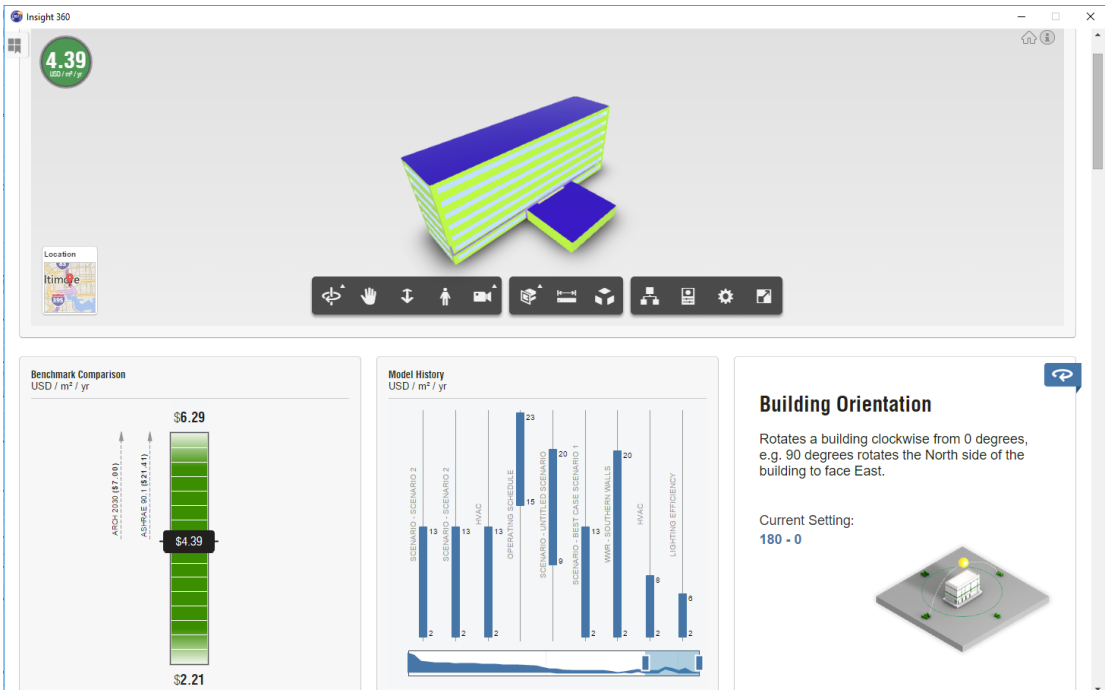
Clicking anywhere on the chart opens a second dialog box that shows an active slider as well as the Energy Cost Mean value. The blue triangle indicates the value as modeled

(BIM). The steeper the incline of the values, the more opportunity for potential savings. Moving the slider creates an immediate increase or decrease in the Energy Cost Mean Value. Closing the dialog box (the “X”) returns you to the dashboard.

INTERACTIVE RANGE GRAPH AND ENERGY COST MEAN

Notice in our example that to get the Energy Cost Mean to green, we had to use a 0% Window-Wall Ratio. This really isn’t practical, and probably not necessary. This would be ideal if we could only use this one factor. The key is finding the right combination of *all* of the factors to get as close as possible to green. Certain things (such as building orientation) may be difficult or impossible to adjust.

Results

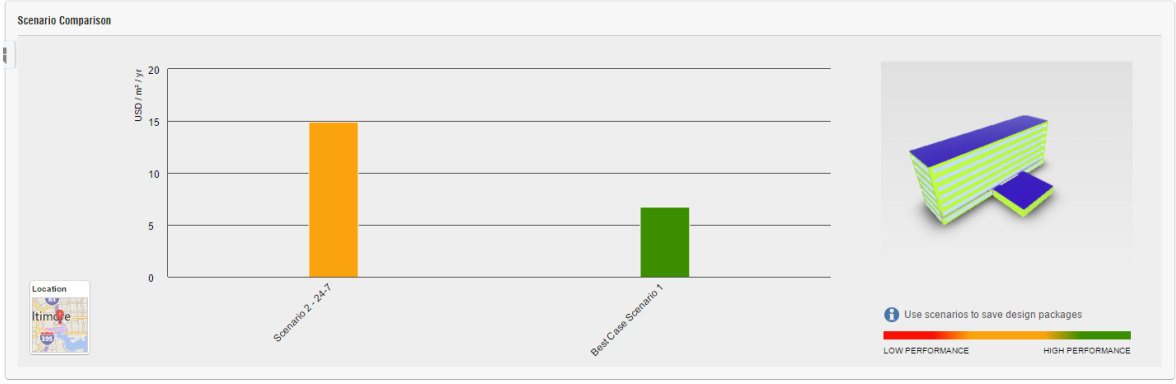


INSIGHT 360 DASHBOARD RESULTS

Remember the goal to “get to green” on the Benchmark Comparison? This assures that you meet or exceed the benchmark values given for ASHRAE 90.1 and/or Architecture 2030. The Benchmark Comparison results update automatically as changes are made to the analysis. All changes are tracked in the Model History block. The slider at the bottom can be used to view previous changes throughout your analysis.

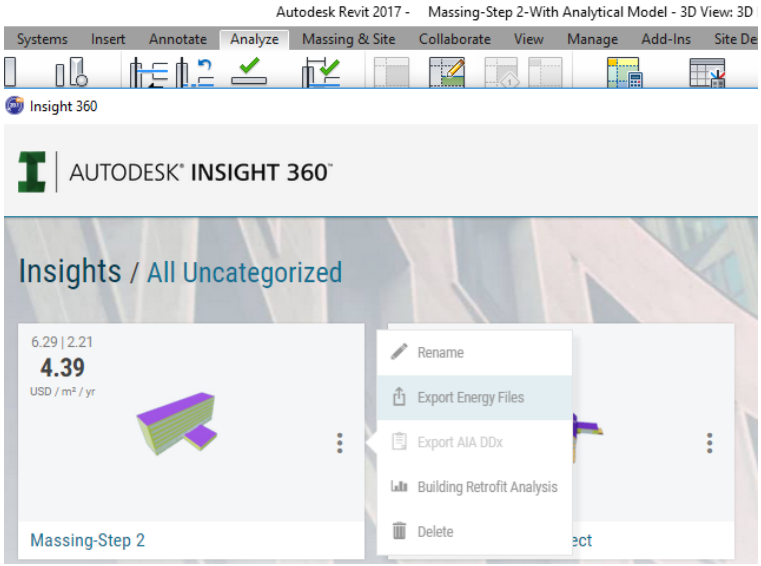
Output and Documentation

Several scenarios can be created and compared to give clients/owners options for their building design. Certainly the dashboard graphs themselves, and even the Insight 360 site can be used as visual references for team members and clients. Personally, I would be wary of showing a client the dollar figure for savings. It may be better to give them a percentage or a range of savings rather than a set figure. But, any substantial savings (such as our WWR example) may give the client options to consider for the building envelope.



INSIGHT 360 SCENARIO COMPARISON

Insight 360 can also export gbXML files for use in other energy modeling programs, such as Green Building Studio. These files can be exported from the Insight 360 home page. Click the ellipsis button to the right of the project.



INSIGHT 360 HOME PAGE – EXPORT ENERGY FILES

Workflow Process

This is always the big question: “How do we fit energy analysis into our already crazy project schedules?” My question in return is, “How can you afford NOT to?” I refer back to my thought that if the client/owner discovers that they could have had a more efficient building by making a few changes up front, someone is going to be in trouble! Insight 360 takes just a few minutes to create an initial energy analysis. After that, the time required really depends on the design, and the number of scenarios you create. Using 2-3 different scenarios is probably sufficient. After that, there won’t be much difference in the results.

When do you run Insight? Whenever you have a building design at a critical decision-making point. During schematic design, you may use it more frequently to decide on a

building layout. Once it gets into design or construction documents, you may run it once or twice to develop the envelope construction. After that point, you're probably handing off the model to your MEP for detailed energy modeling. Consider how much work you have saved them by using Insight 360!

Who runs Insight? More than likely this will be a senior technician or project architect. This person should have an understanding of the basic factors affected by Insight 360, and be able to provide scenarios that are appropriate for the building in regard to climate and construction.

Conclusion

Insight 360 is a simple but powerful tool for early energy analysis in design. Because of increased energy codes, green building certification requirements, and generally being able to provide a better building for our clients, early energy analysis has become part of the architect's toolbox. Insight 360's information applies to the building envelope – decisions made by the architect and owner – providing a better, more sustainable and environmentally responsible structure.

Resources & Reference

https://insight360.autodesk.com/oneenergy

Getting Started Guide
http://forums.autodesk.com/autodesk/attachments/autodesk/19/366/1/Insight%20GSG_0306.pdf

http://blogs.autodesk.com/insight360/

http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aiab096060.pdf

http://aceee.org/files/proceedings/2014/data/papers/11-203.pdf