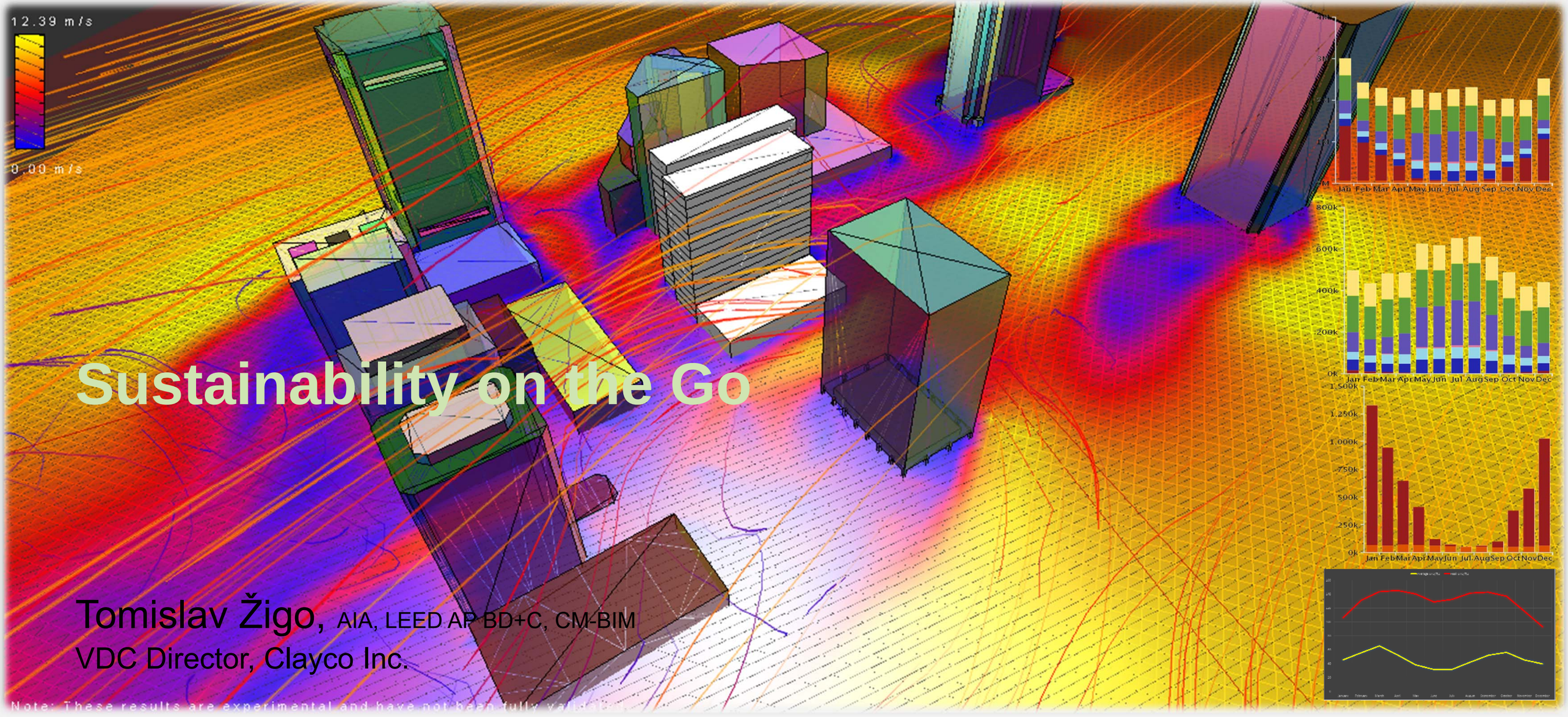


Sustainability on the Go

Tomislav Žigo, AIA, LEED AP BD+C, CM-BIM
VDC Director, Clayco Inc.

Class summary

Wouldn’t you, just for fun, like to use an application that offers true parametric modeling capability, generative geometry, and whole building performance analysis, and yes, feels like a natural extension to Revit? Are you a designer under pressure to add that extra punch to your presentations by convincing potential clients you have clearly addressed the ever-increasing demand for energy efficient buildings? Now push this a bit further and enhance the level of collaboration by enabling an instantaneous feedback by using Autodesk Formit while presenting your ideas backed by analytical datasets to clients thousands of miles away. Autodesk Vasari & FormIt open the potential for a unique workflow that is rooted

Key learning objectives

At the end of this class, you will be able to:

- Conceptual Energy Modeling in Early Design Stages
- Enabling Flexible Analysis Workflow in the Could
- Utilizing Vasari and FormIt for Rapid Energy Modeling
- Interpretation and Analysis of the Results

When is a good time to start thinking about Building Performance Analysis?

A great building must begin with the unmeasurable, must go through measurable means when it is being designed and in the end must be unmeasurable.

Louis Kahn

good design ≈ ΔS^{-1}

When not

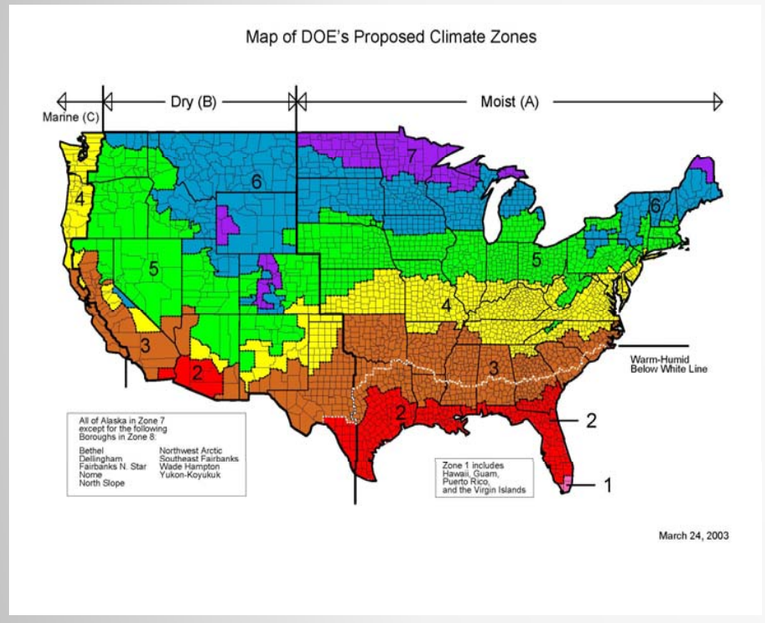
- When the design process has proceeded so far that it is highly unlikely that anything can be changed. For example, in an effort to demonstrate that a recently designed building was “green,” a developer commissioned a building simulation.

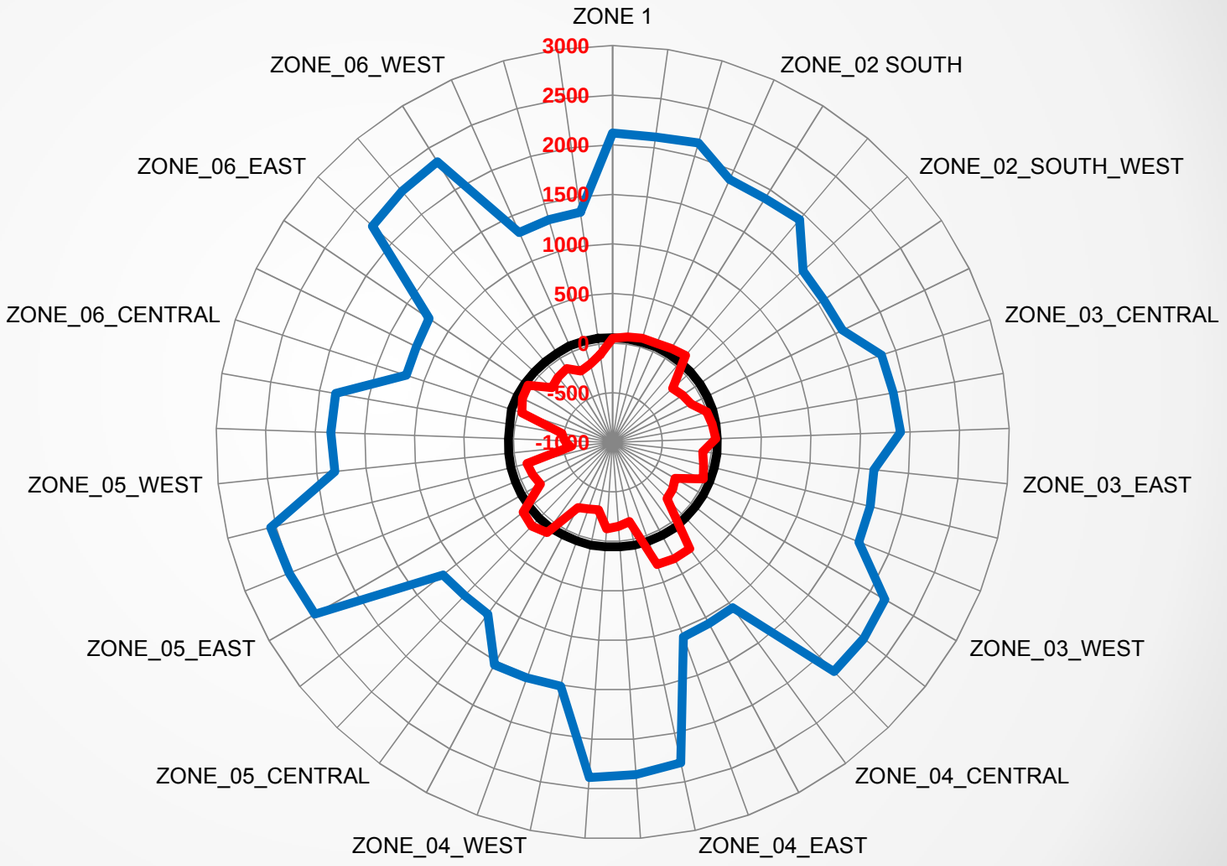
- When the design questions that need to be answered are outside of the realm of what typical simulation programs can evaluate. Examples of such questions include airflow patterns in an atrium and effluent dispersion from fume hood exhaust stacks.

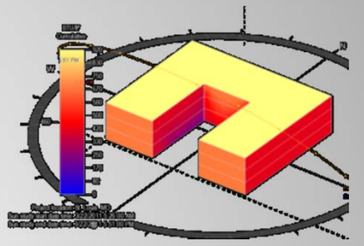
- When you need detailed design information, not just energy results.

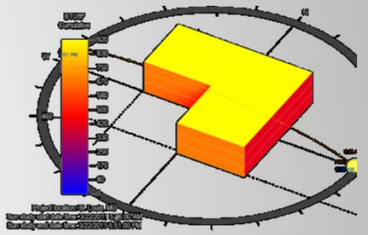
lifecycle impact

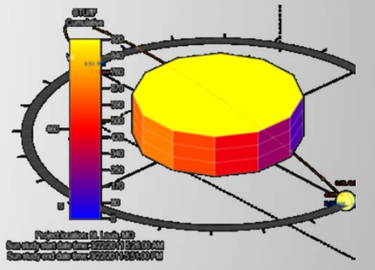
- Building the body of knowledge











—EUI

Harnessing the power of Cloud

- How many Clouds are out there
- Recognize proven technology
- Recognized the necessity
- Alignment with the corporate vision

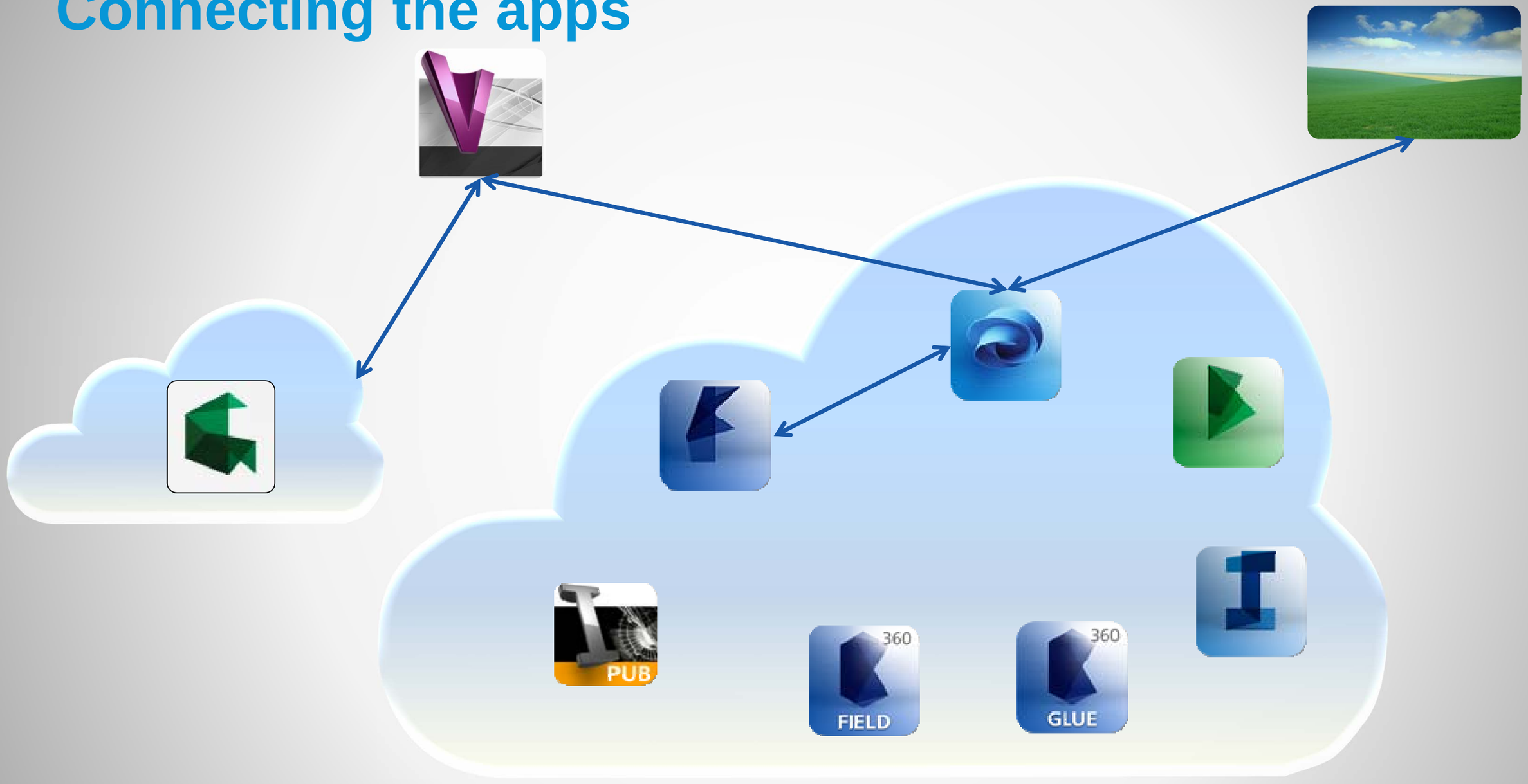
Functional requirements

- Overcome the need for workstation centric workflow
- Empower the user via mobile solution
- Give the ability to approximate and abstract the design intent in through and easy to use interface
- Establish the feedback mechanism that requires no user interaction on the design side

Functional requirements

- Delivers sustainability analysis within a compressed time frame
- Pushes the results in the field (mobile solution)
- Captures the workflow
- And serve as the starting point of SD development
- Engages all of the parties in an early discussion

Connecting the apps



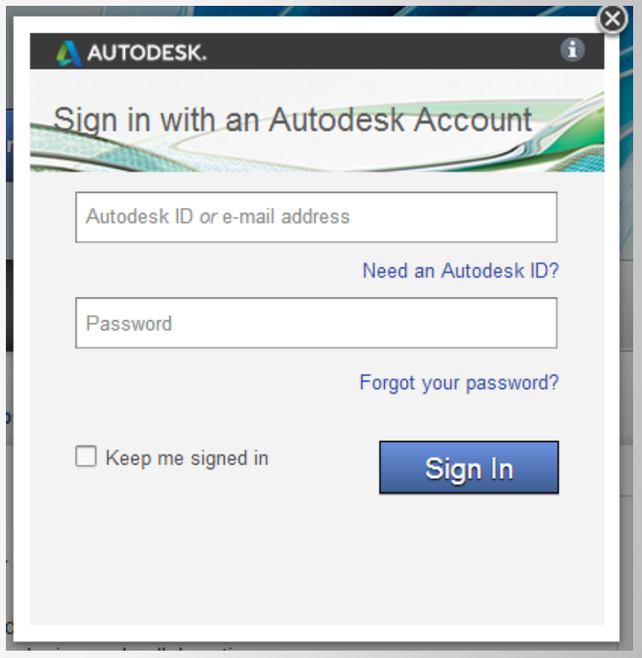
Ingredients

- Existence of Autodesk Subscription account and the valid login
- iPad with at minimum Wi-Fi connectivity, preferably 3rd and 4th generations
- FormIt and Autodesk 360 apps installed and logged into Autodesk 360 account
- Autodesk 360 Sync that is installed on back-office side
- Autodesk Vasari Beta 3 installed on back-office side
- Subscription access to Green Building Studio account

Information Pathways

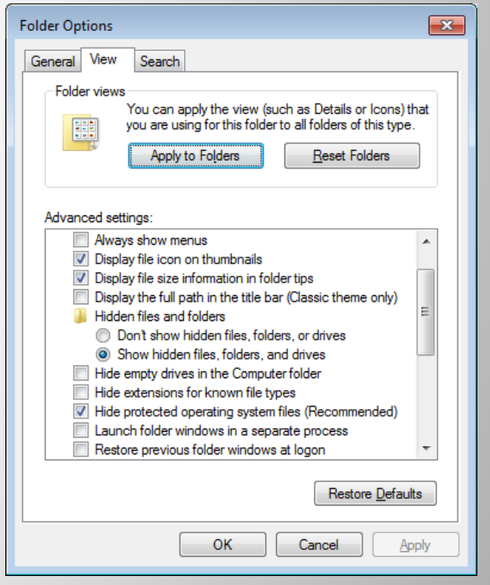
- Model(s) in the Cloud
  - https://360.autodesk.com/landing

AUTODESK 360



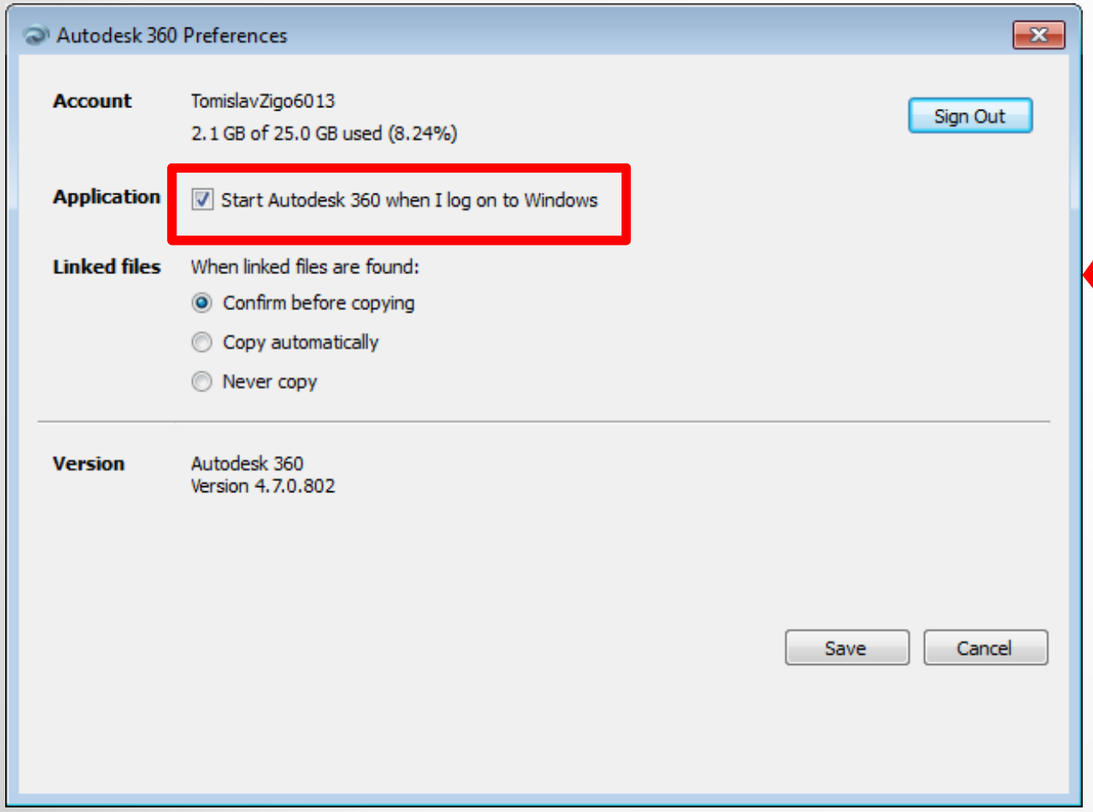
Grounding the Cloud

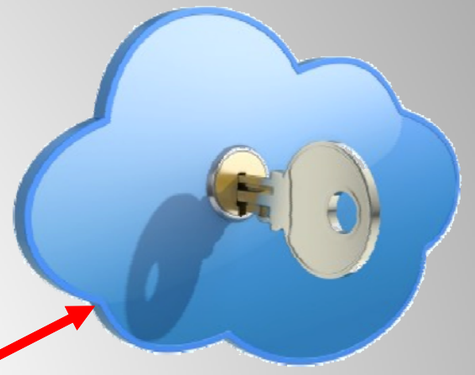
- Some recommendations….
  - Create a Conceptual Modeling user on your domain
    - VDC_Field or whatever works for you
  - Add VDC_Field user to your Autodesk Subscription list of users
  - Make VDC_Filed user a part of local workstation administrator user group
  - Modify Folder view options by enabling the following:
    - Show hidden files, folders, or drives

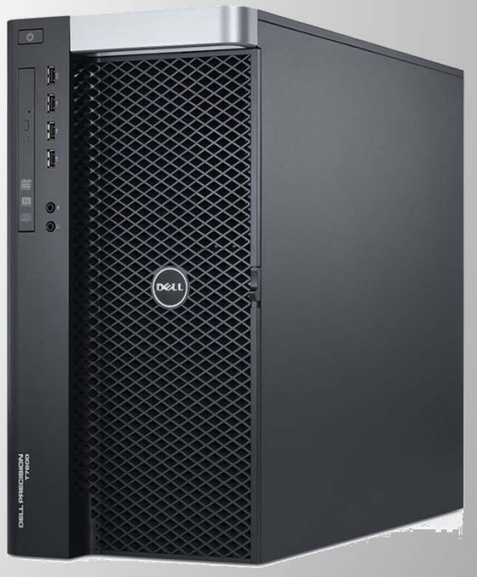


Calling for rain….

- Start Autodesk 360 Sync Services….
  - C:\Program Files\Autodesk\Autodesk Sync







When it rains….

- Start Vasari….

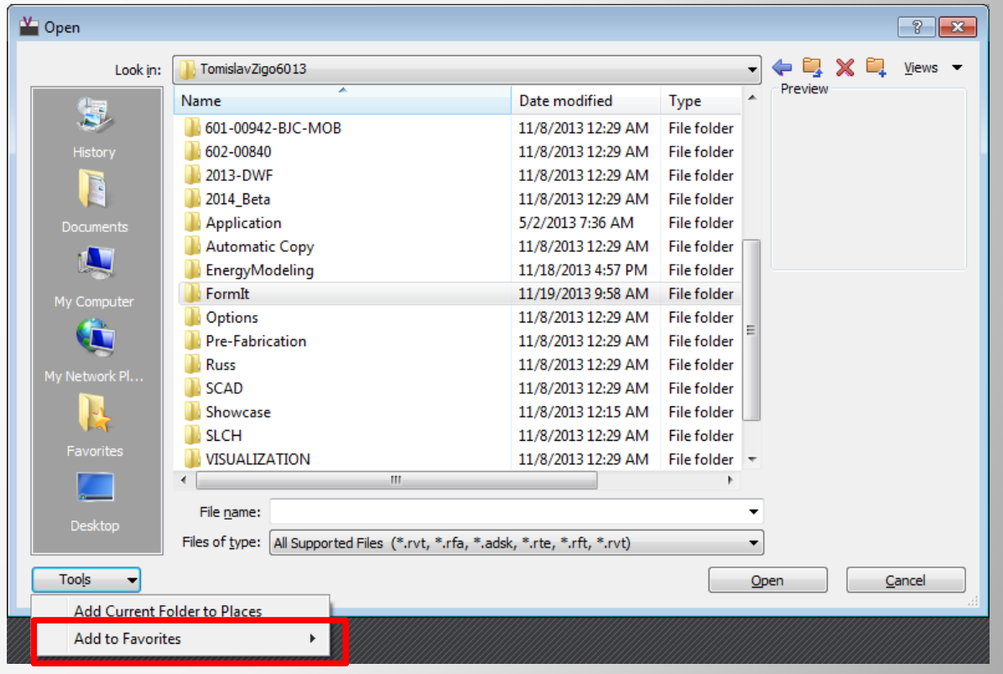
  C:\Users\

  ”**VDC_Field.Domain_Name**”

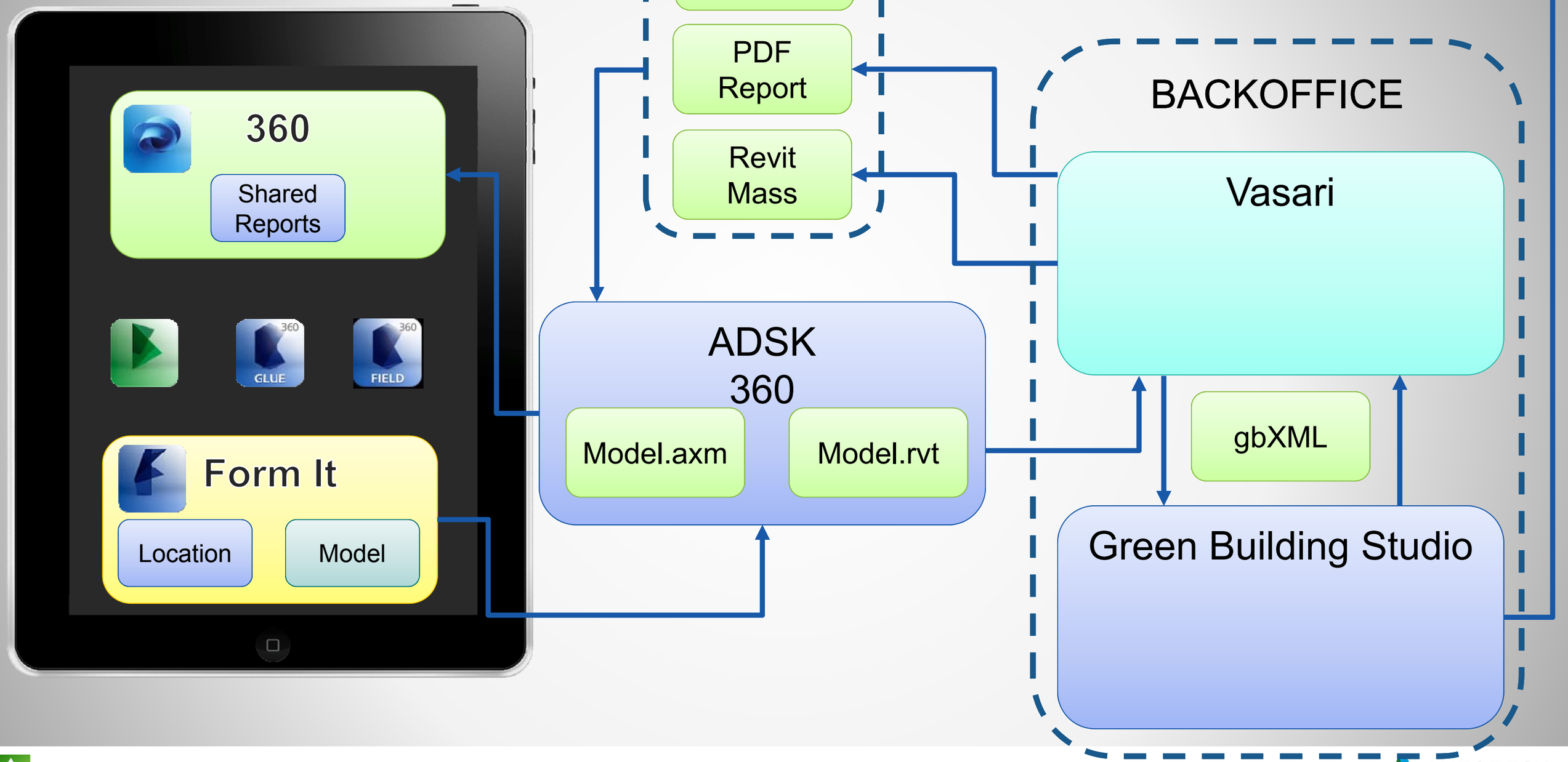
  \AppData\Local\Autodesk\Autodesk Sync\Cloud\

  “**VDC_Field**”

- Establish the permanent link with FormIt Cloud Data



Modeling Process

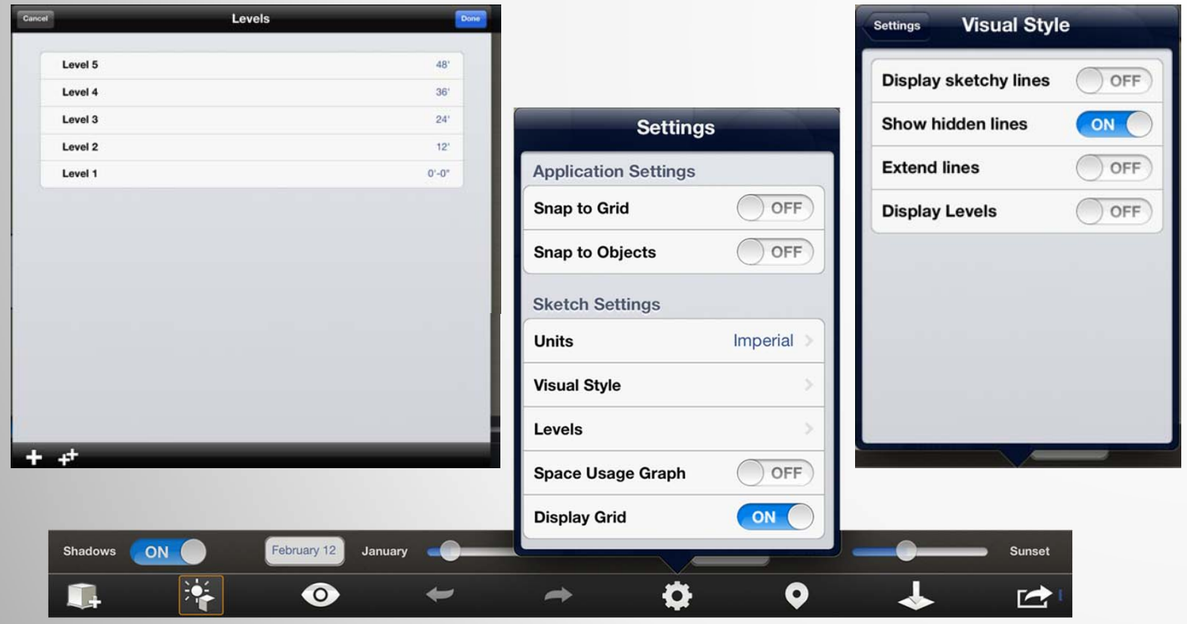

Salon
PDF Report
Revit Mass
BACKOFFICE
Vasari
360
Shared Reports
GLUE
FIELD
ADSK 360
Model.axm
Model.rvt
gbXML
Form It
Location
Model
Green Building Studio

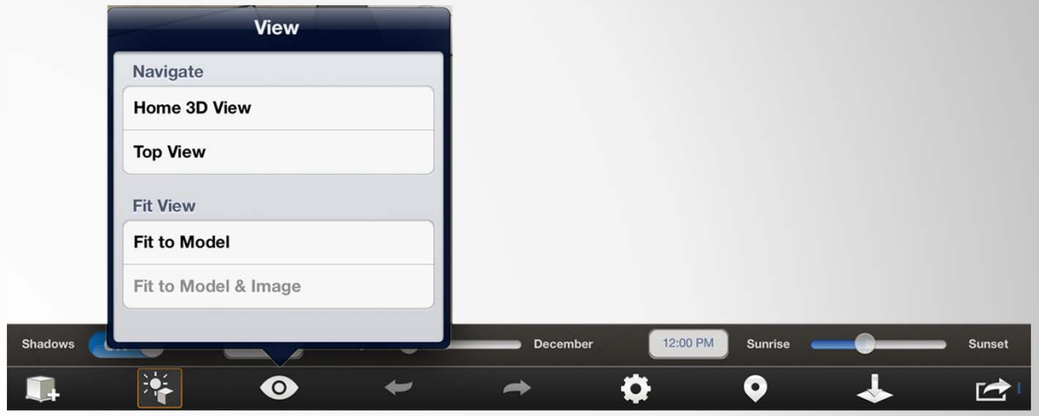
An easy start

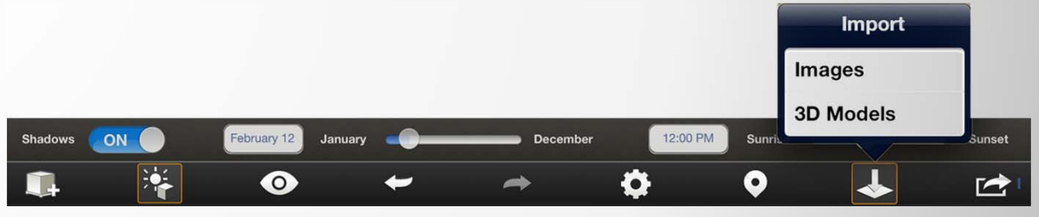
- Starting FormIt for the first time
  - Follow the tutorial
  - Log into the Subscription Account
- Take 5 min to explore the settings and palates
- Find your location and establish project goals
- Start modeling

Interface


Shadows
ON
February 12
January
December
12:00 PM
Sunrise
Sunset

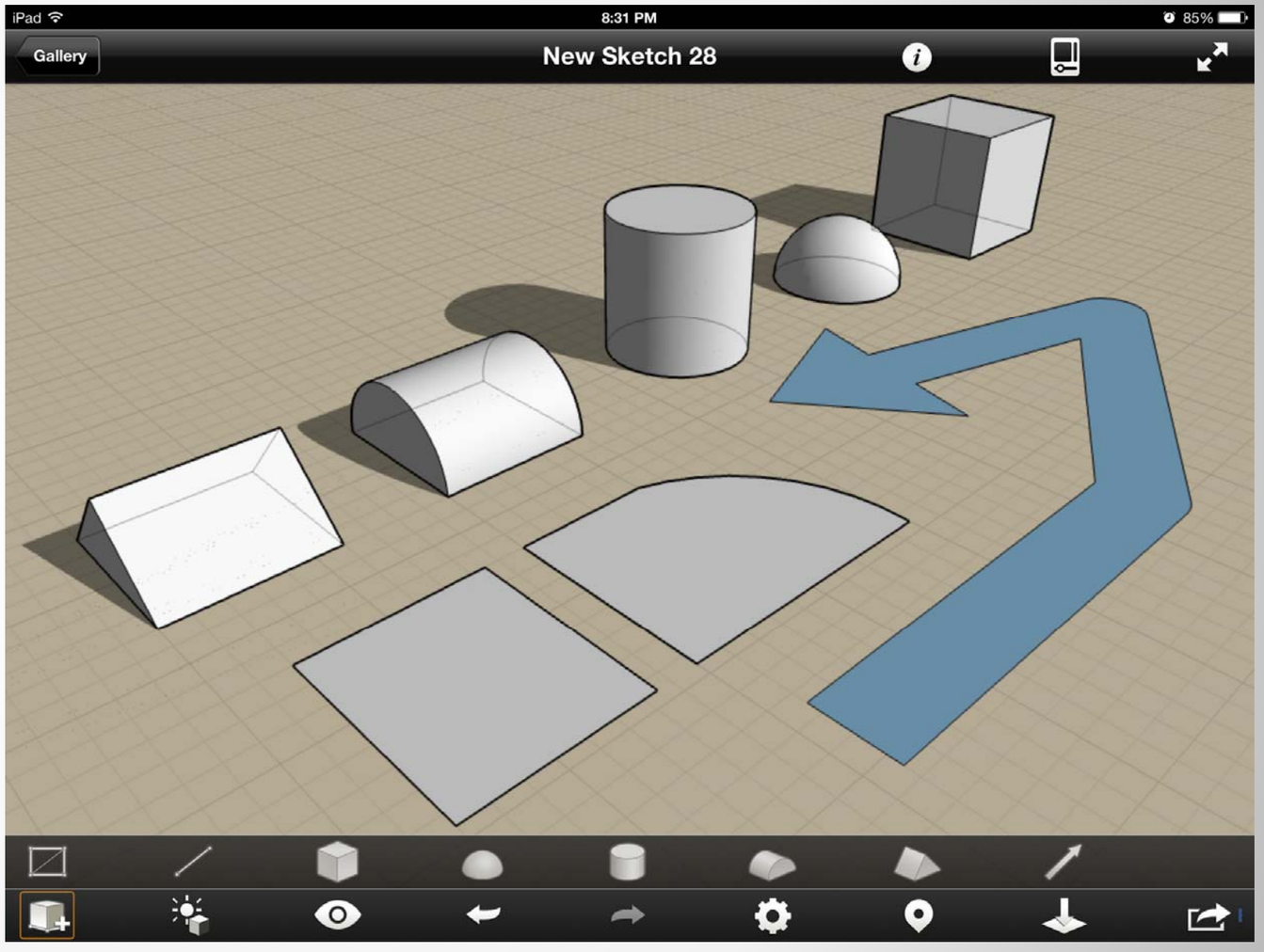

Levels
Cancel
Done
Level 5 48'
Level 4 36'
Level 3 24'
Level 2 12'
Level 1 0'-0"
Settings
Application Settings
Snap to Grid OFF
Snap to Objects OFF
Sketch Settings
Units Imperial
Visual Style
Levels
Space Usage Graph OFF
Display Grid ON
Settings
Visual Style
Display sketchy lines OFF
Show hidden lines ON
Extend lines OFF
Display Levels OFF
Shadows
ON
February 12
January
Sunset


View
Navigate
Home 3D View
Top View
Fit View
Fit to Model
Fit to Model & Image
Shadows
December
12:00 PM
Sunrise
Sunset

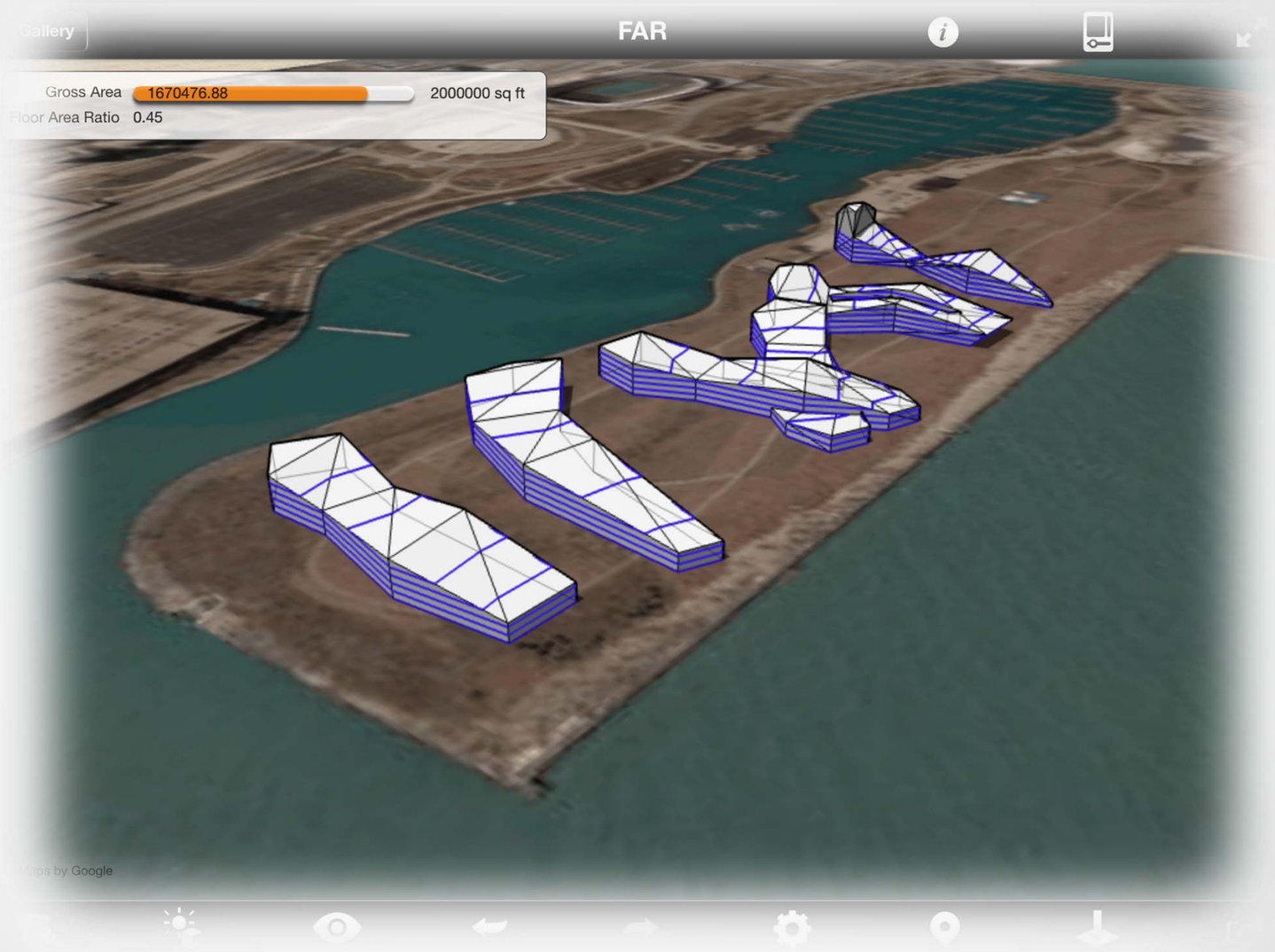

Import
Images
3D Models
Shadows
ON
February 12
January
December
12:00 PM

S....Up Like

- Primitives
  - Scalable
  - Array
  - Context menu
- Rectangles
- Lines and Arcs
- Arrows



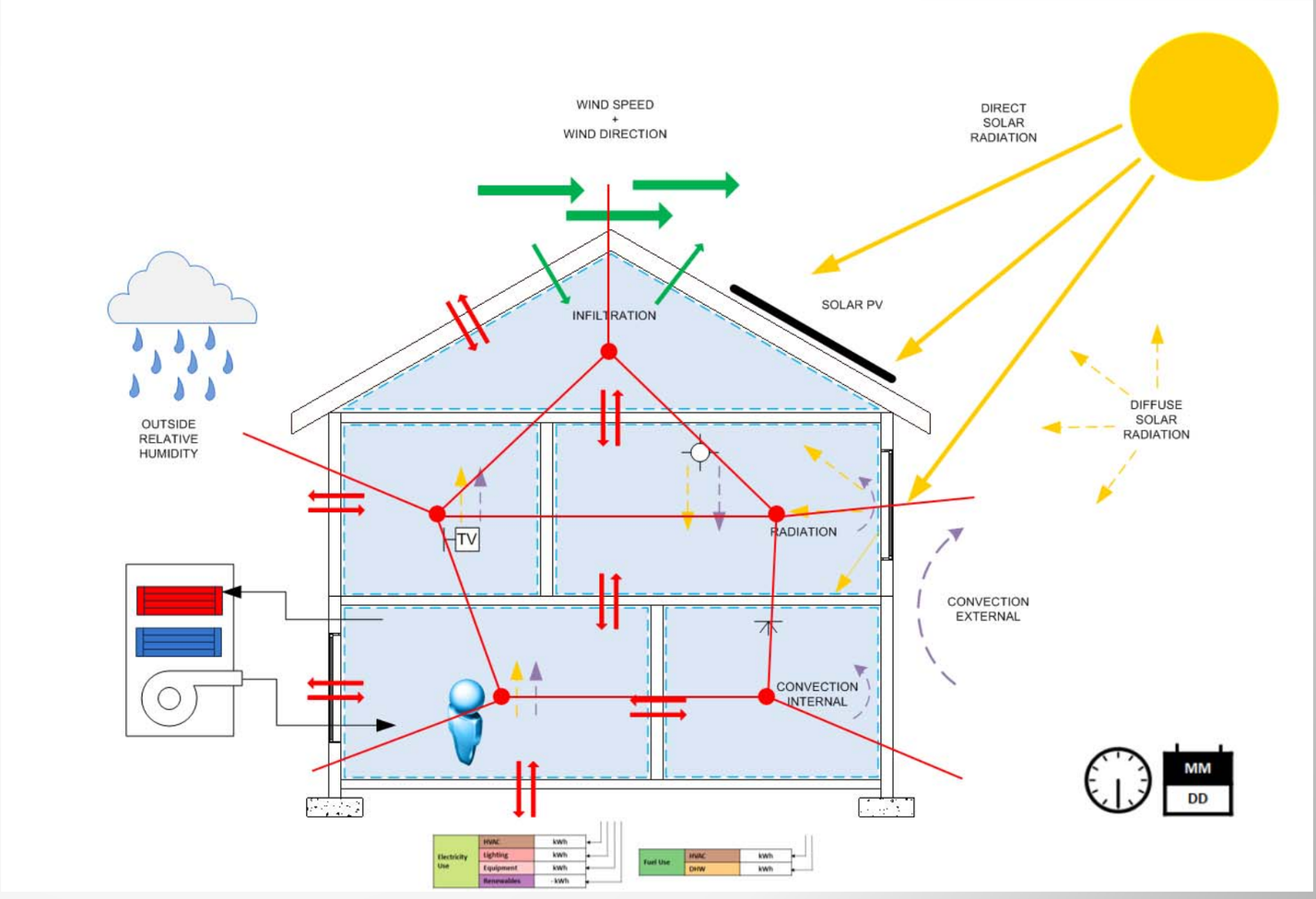
Demo


Gallery
FAR
Gross Area
1670476.88
2000000 sq ft
Floor Area Ratio
0.45
Maps by Google

Vasari Workflow

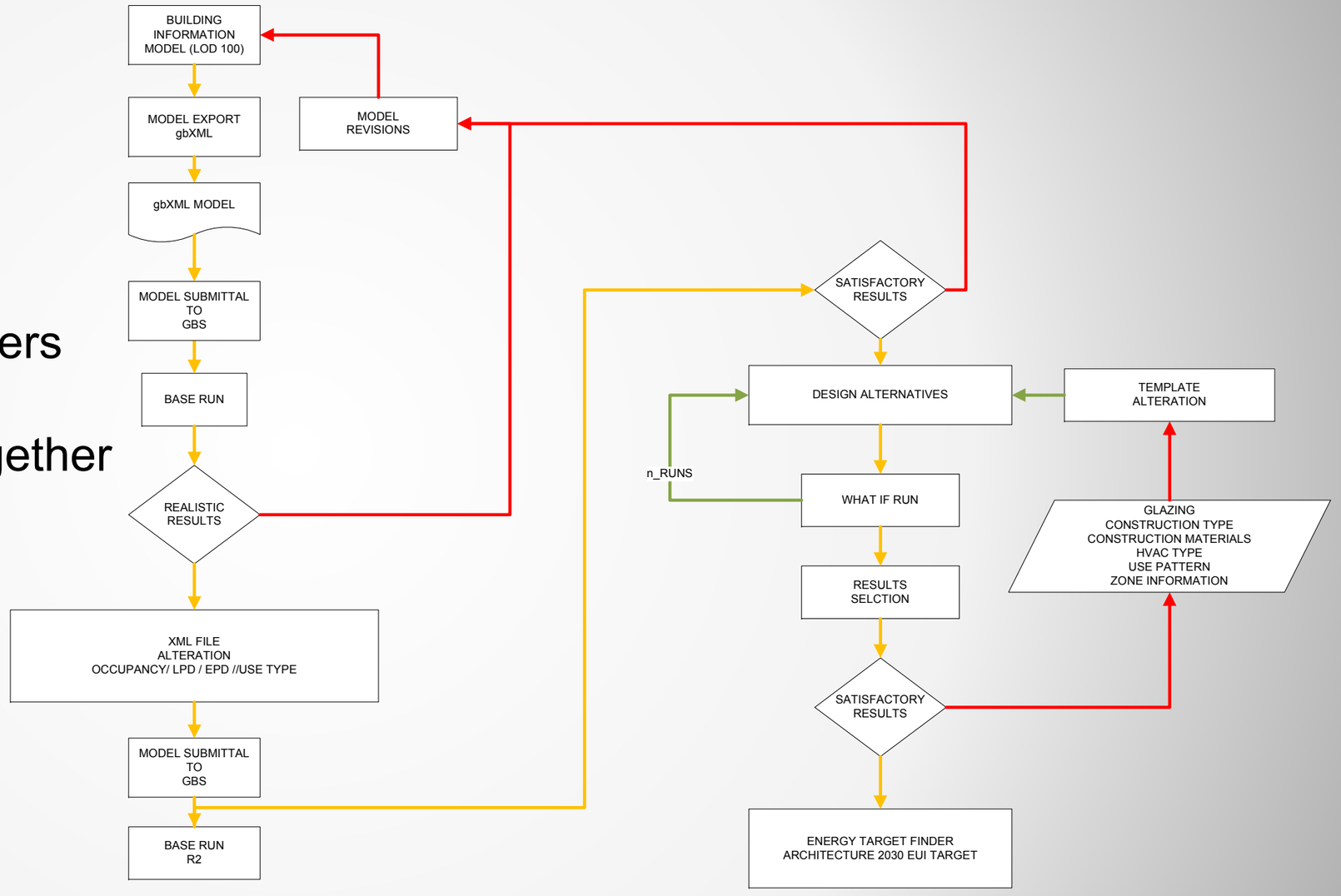
Whole Building Energy Simulation

- Set of discrete spaces
- Hourly climate data
- All sources of heat gain/loss
- FEM computation



Process map

- Pre cooked runs advantage
- Develop a naming scheme
- Talk to your in-house engineers
- Keep all the project runs toigether



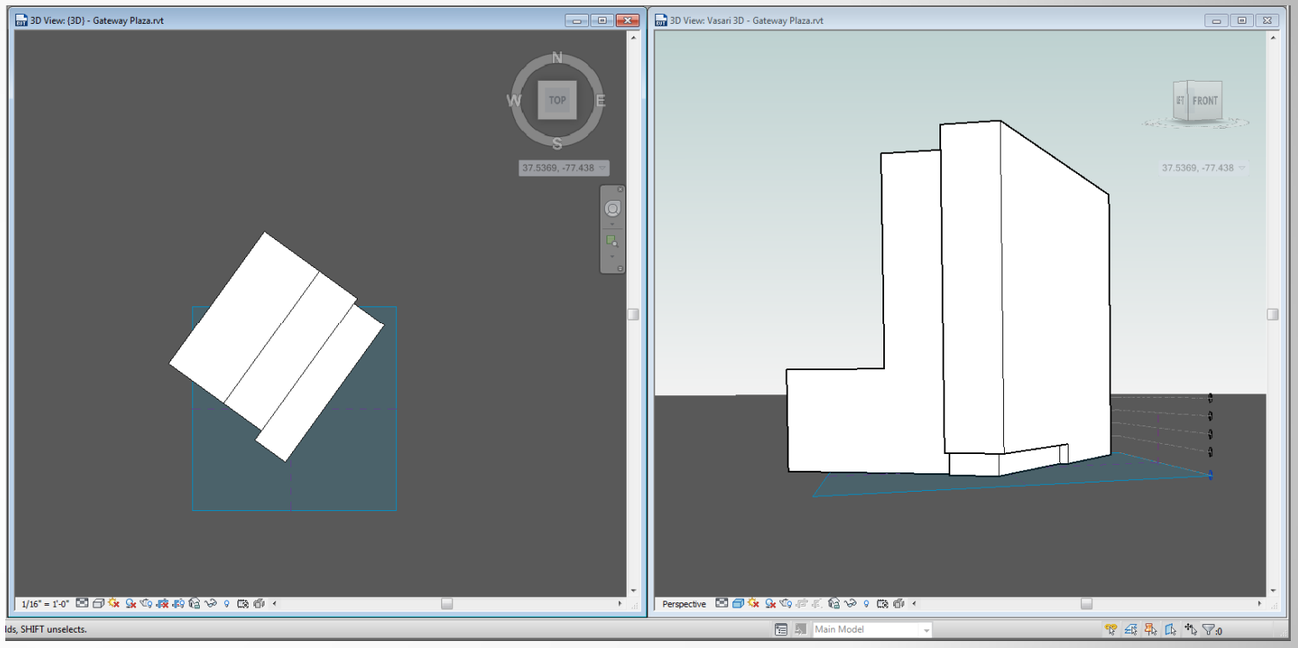
What are we looking for….

- Evaluate and document building performance at the conceptual level.
- Understand the immediate environmental factor.
- Establish the performance benchmark for schematic and design development.
- Communicate effectively.

Case study

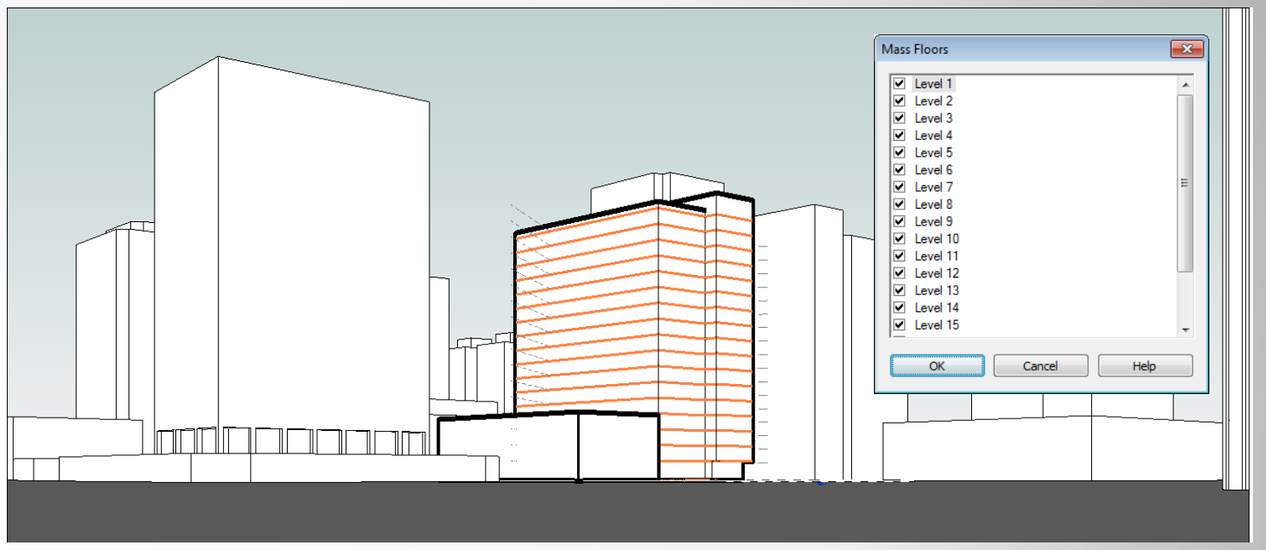
Not quite from scratch…

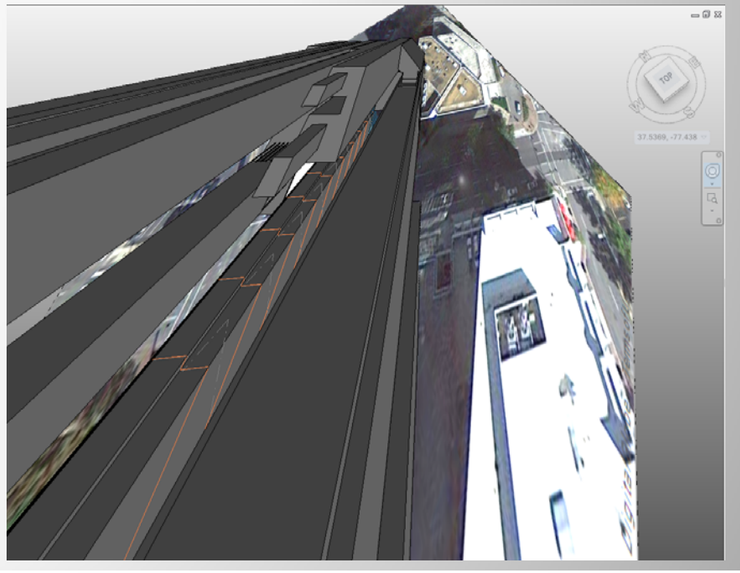
- Design intent
- Location
- Climate data
- Compatible geometry



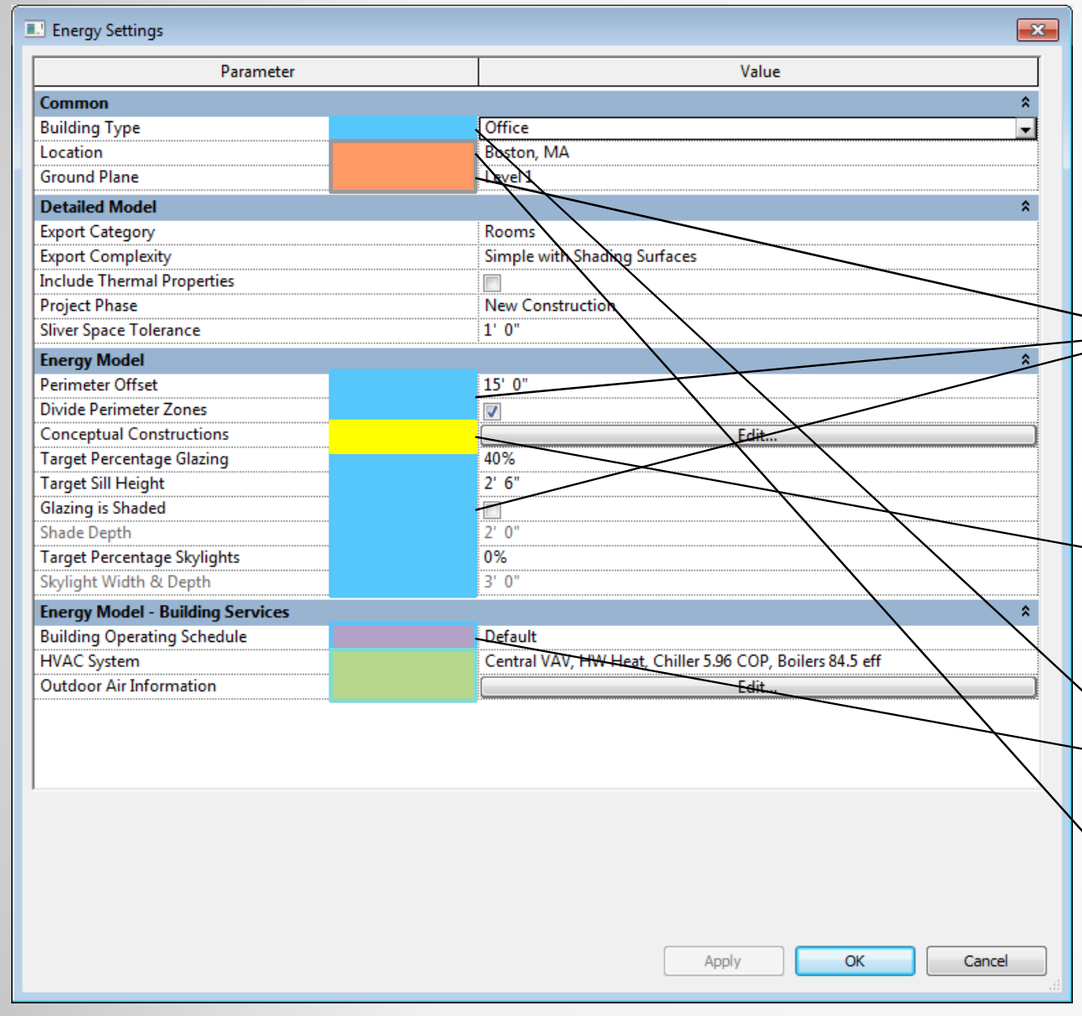
And also not perfect yet…

- Re-import location
- Re – import context
- Pesky satellite imagery
- Watch for those perspective views
- Rebuilding levels….





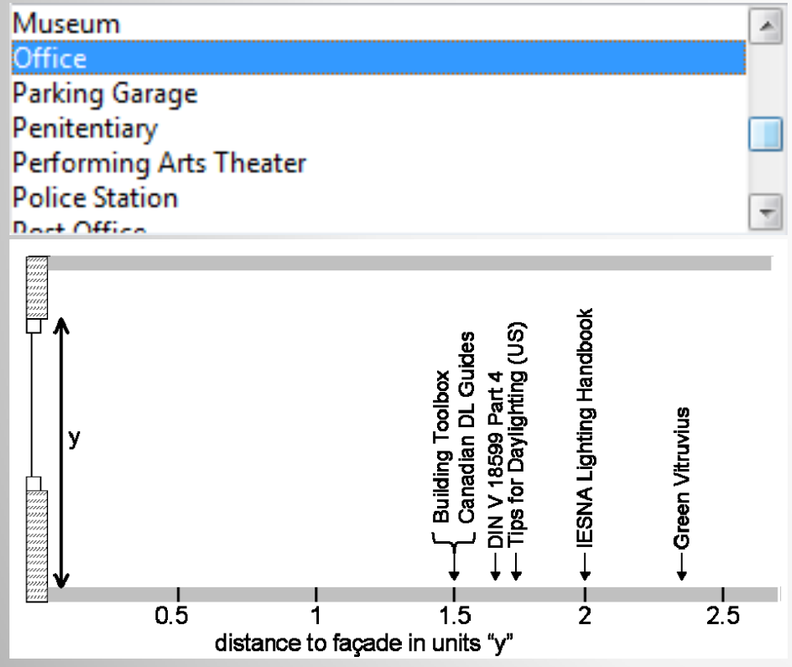
The true starting point….

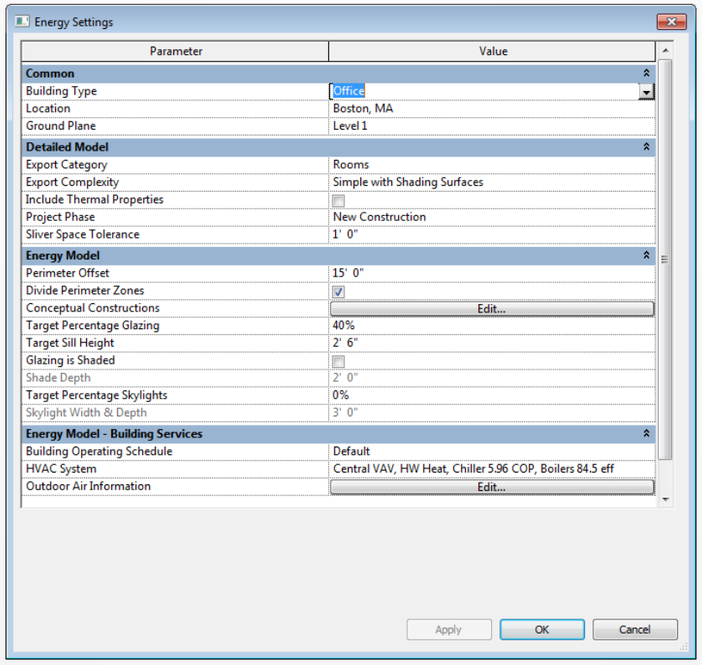


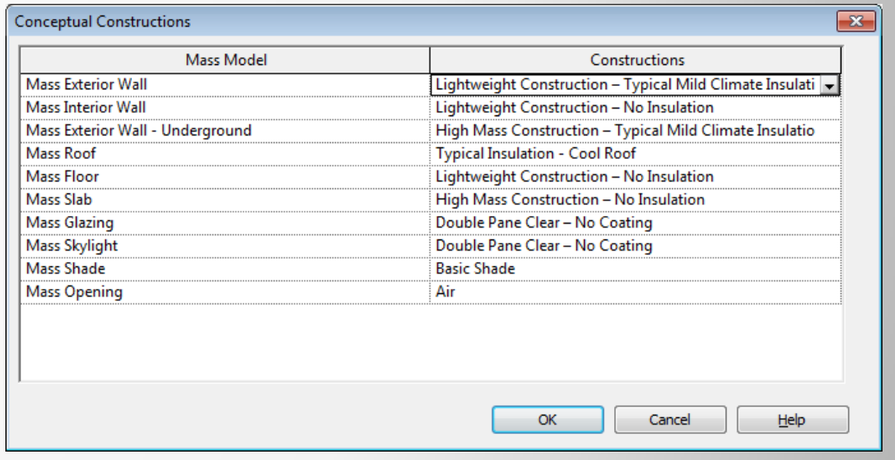
Main Energy Use Drivers	Item / Description
Form	**Ground plane** – This determines the Revit level used to differentiate surfaces above or below ground in the Energy Analysis. Sloping sites cannot be dealt with at this time. **Core Offset** – Mass floors can be split into a perimeter and core 'thermal zones' which is usual practice for Energy Analysis. Setting this to zero will mean no core is created. **Divide Perimeter Zones** – This provides the option for perimeter thermal zones to be subdivided which is also usual practice for Energy Analysis. Note that perimeter zones are currently splitting cardinal directions which can lead to some error (+/- 5% on average but it can be higher). Vasari currently provides more accurate thermal zoning. **Other** – These parameters all relate to glazing, skylights and shading applied to the Conceptual Masses
Materials	**Conceptual Construction** – These offer a small but broad selection of thermal properties useful for wide range sensitivity testing. Typical selections are close to ASHRAE 90.1 baseline standards.
Systems	**HVAC System** – These are close to ASHRAE 90.1 baseline standards. **Outdoor Air Information** – Energy used to heat/cool fresh air required by occupants.
Utilization	**Building Type** – This sets ASHRAE 90.1 datasets occupancy levels, lighting and equipment power densities and schedules. **Building Operating Schedule** – Default means "default for building type"
Climate	**Location** – Sets latitude, longitude, height above sea level (all required for solar shading) and Climate file. TMYs and indicated by '59…' reference.
Tariff	These are automatically determined by Green Building Studio based on location using latest data from EIA

Energy Settings and few basic rules

- Building Type
- Conceptual construction type
- Conceptual HVAC system

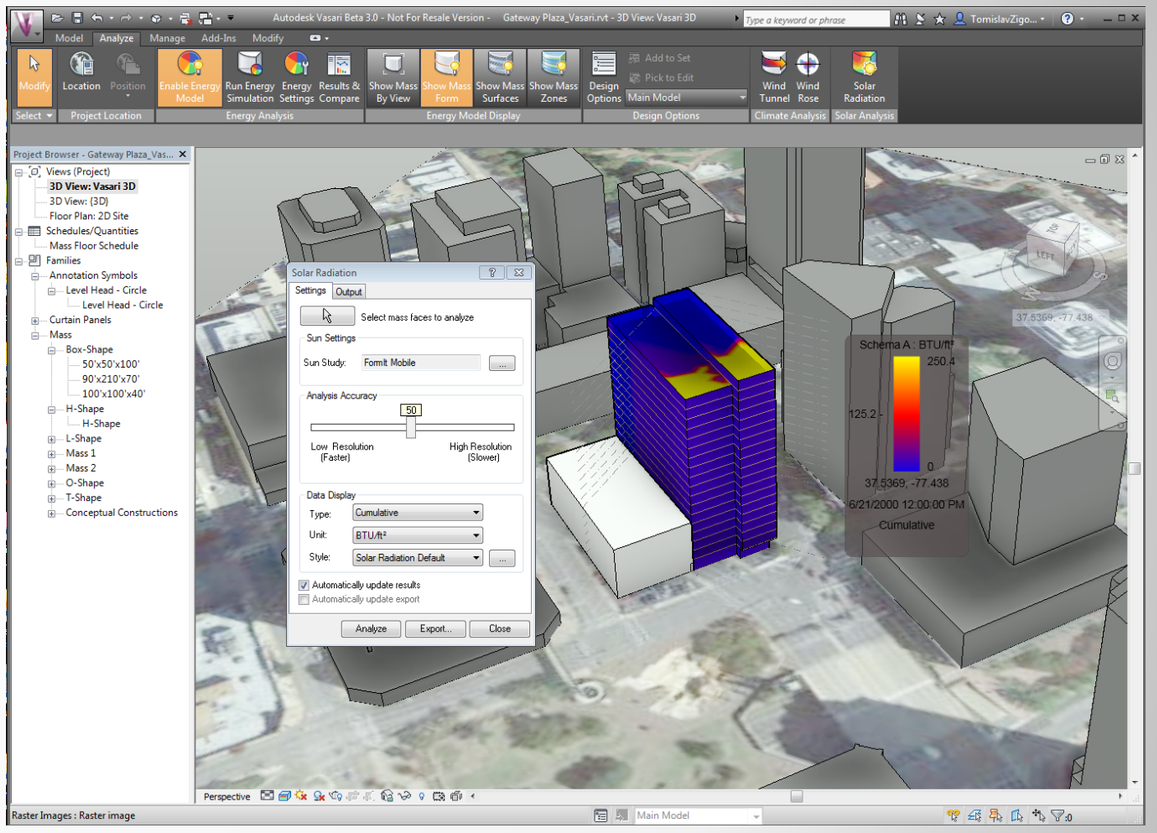






Low hanging fruit …. first

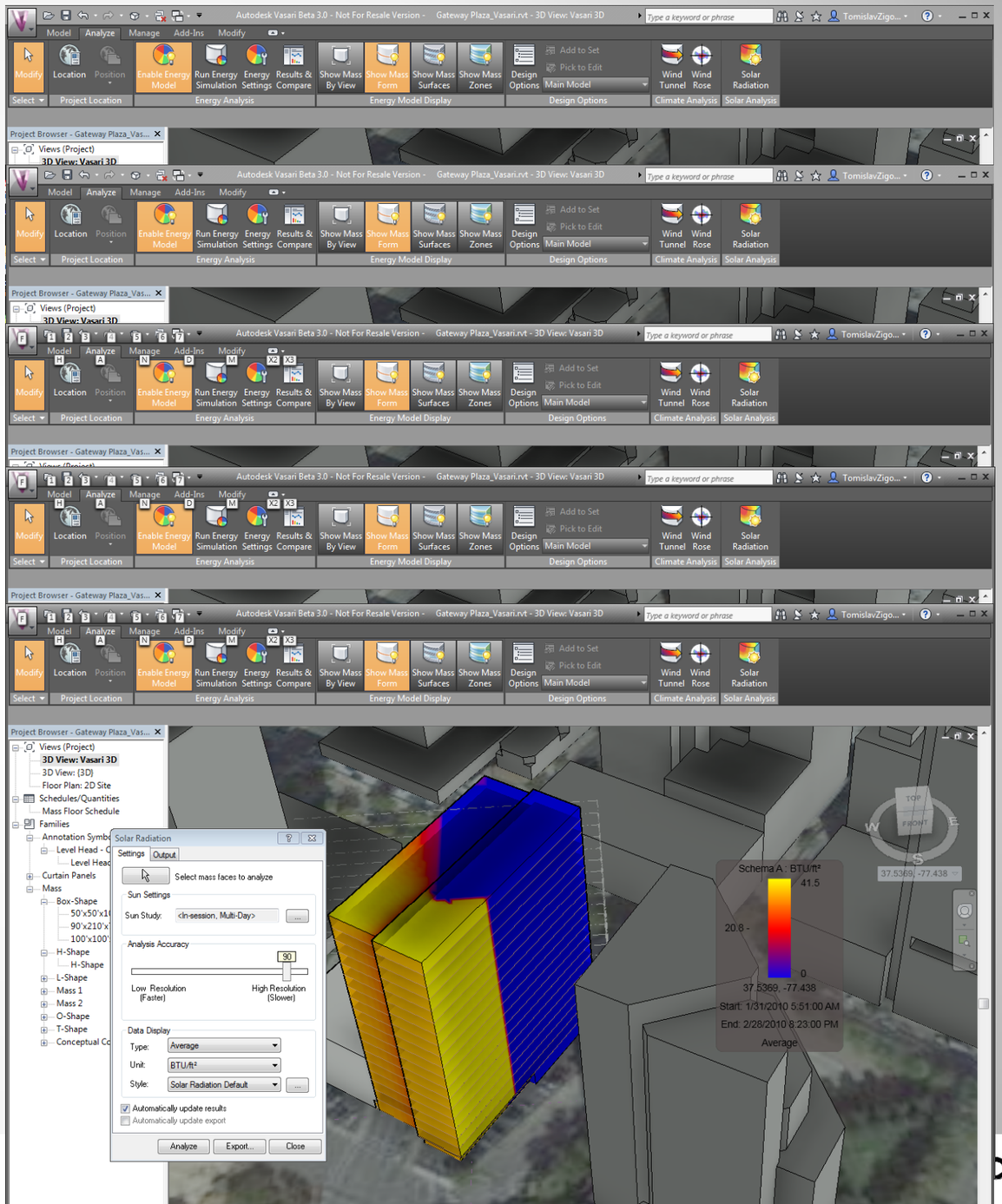
- Insolation
  - Peak
  - Average
  - Cumulative
  - Singe or Multi Day
- Watch that scale (scale?)
  - Adjust view scale…



Clayco Inc.

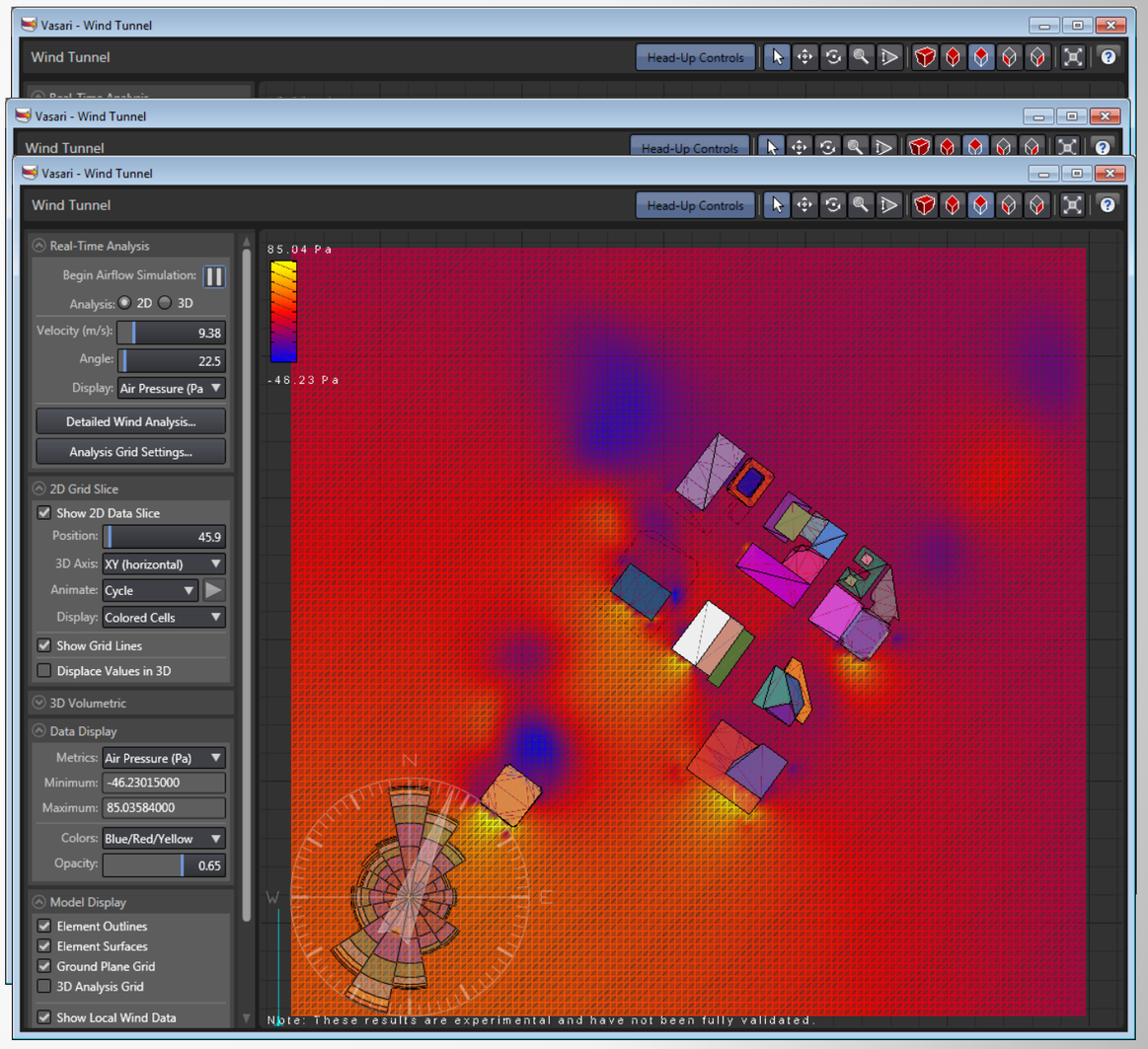
Still low hanging fruit…

- Valuable information
  - Envelope loads
  - Shading potential
  - Context impact
  - I wish engineers ask for this from day one
- Works only …
  - On mass faces…
  - Shading devices not evaluated

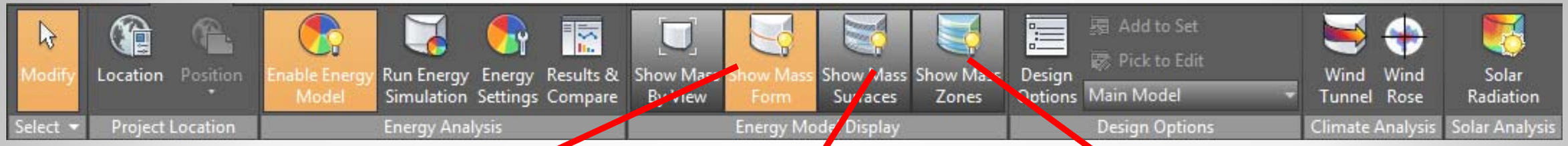


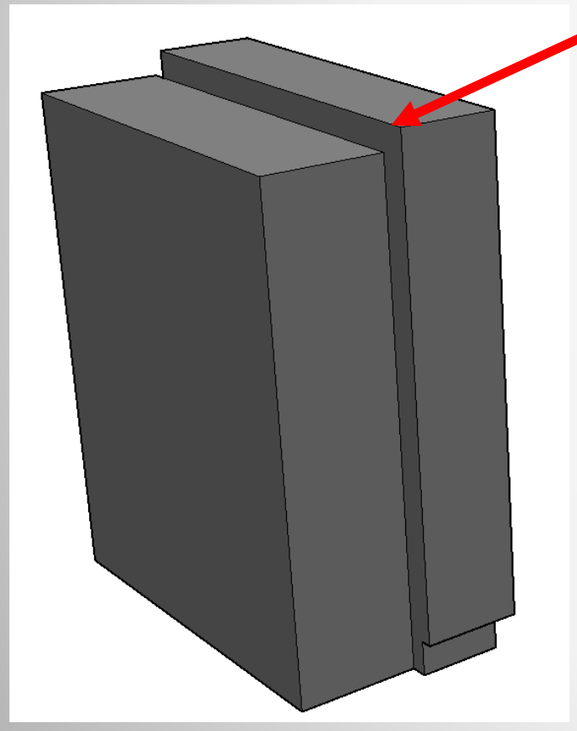
And now what everyone wants

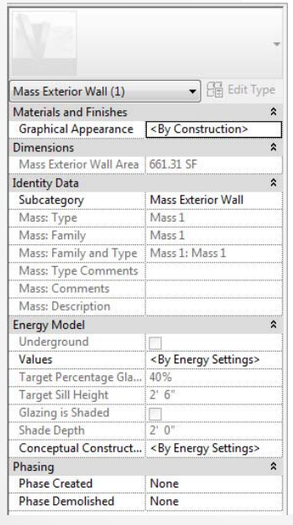
- Colors
  - Even though we have no idea …..
- Information
  - Smart way to evaluate impact of a new structure
  - Ability to create outdoor spaces
  - Comfort level prediction

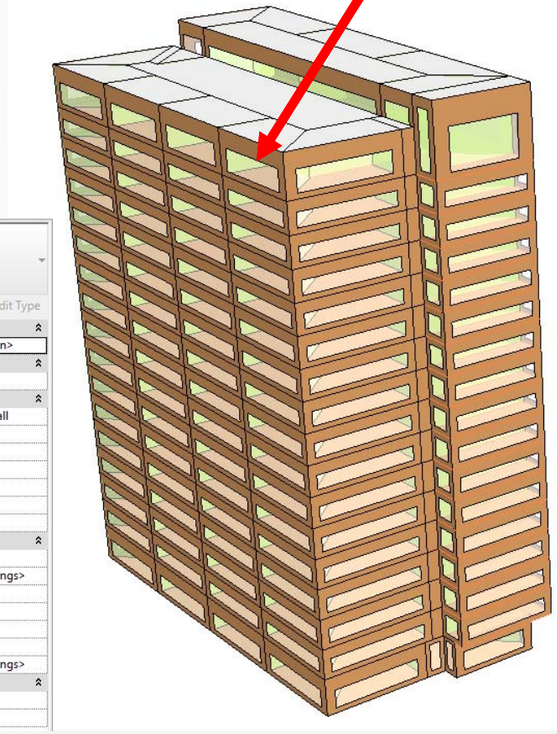


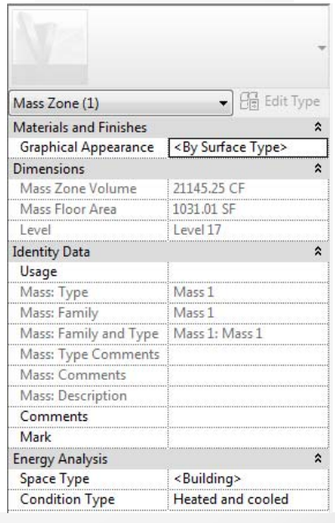
One model …three representations

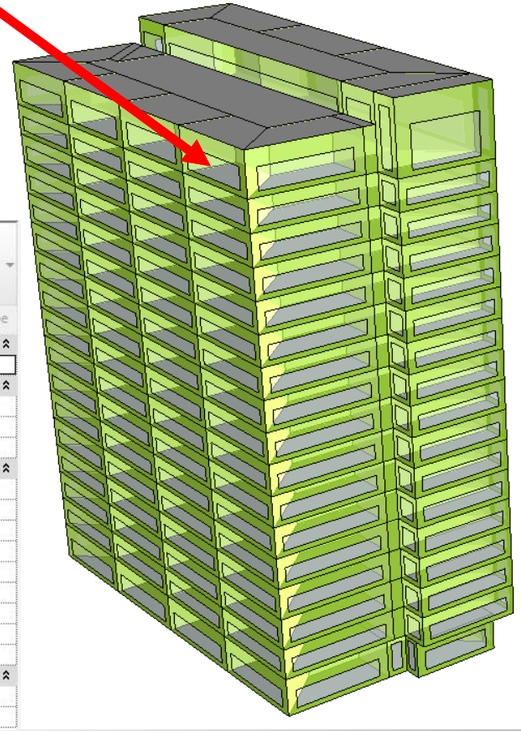








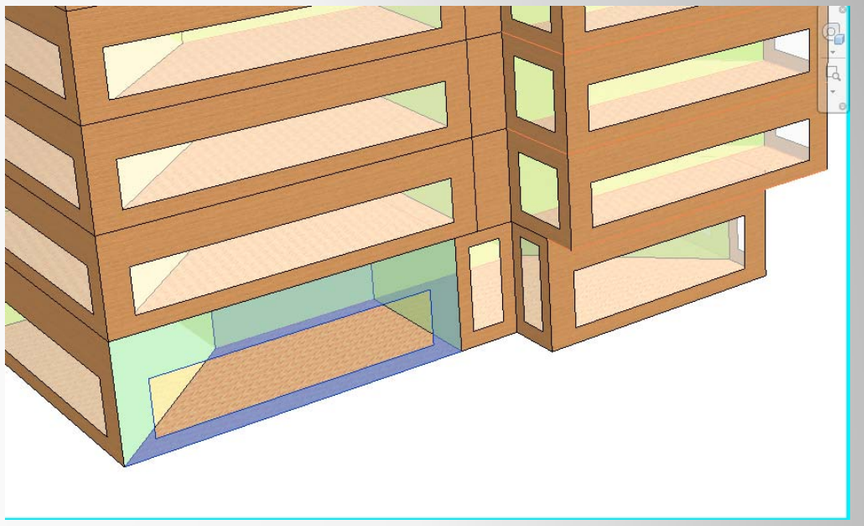




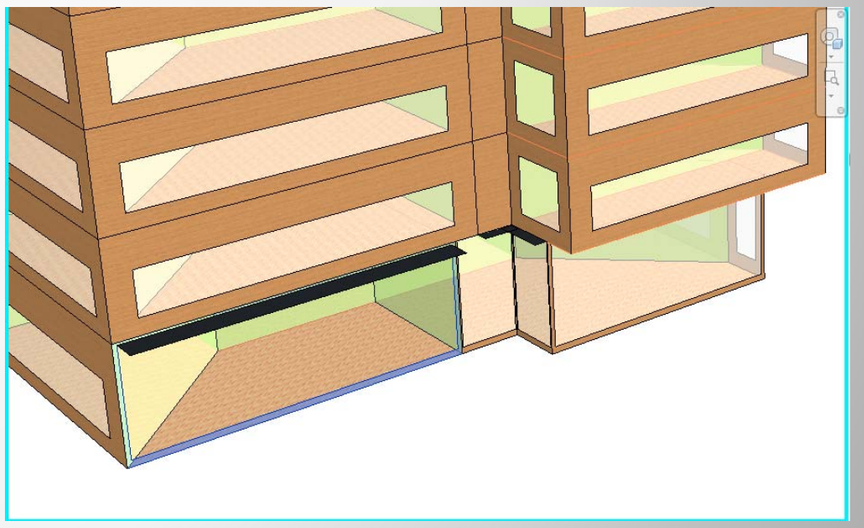
One model …fine-tuning

- Appearance
- Type
- Dimensional override
- Construction type
- Zone override

Energy Model	
Underground	☐
Values	<By Energy Settings>
Target Percentage Gla...	40%
Target Sill Height	2' 6"
Glazing is Shaded	☐
Shade Depth	2' 0"
Conceptual Construct...	<By Energy Settings>
Phasing	
Phase Created	None
Phase Demolished	None



Energy Model	
Underground	☐
Values	<By Surface>
Target Percentage Gla...	90%
Target Sill Height	1' 0"
Glazing is Shaded	☑
Shade Depth	4' 0"
Conceptual Construct...	<By Energy Settings>
Phasing	
Phase Created	None
Phase Demolished	None



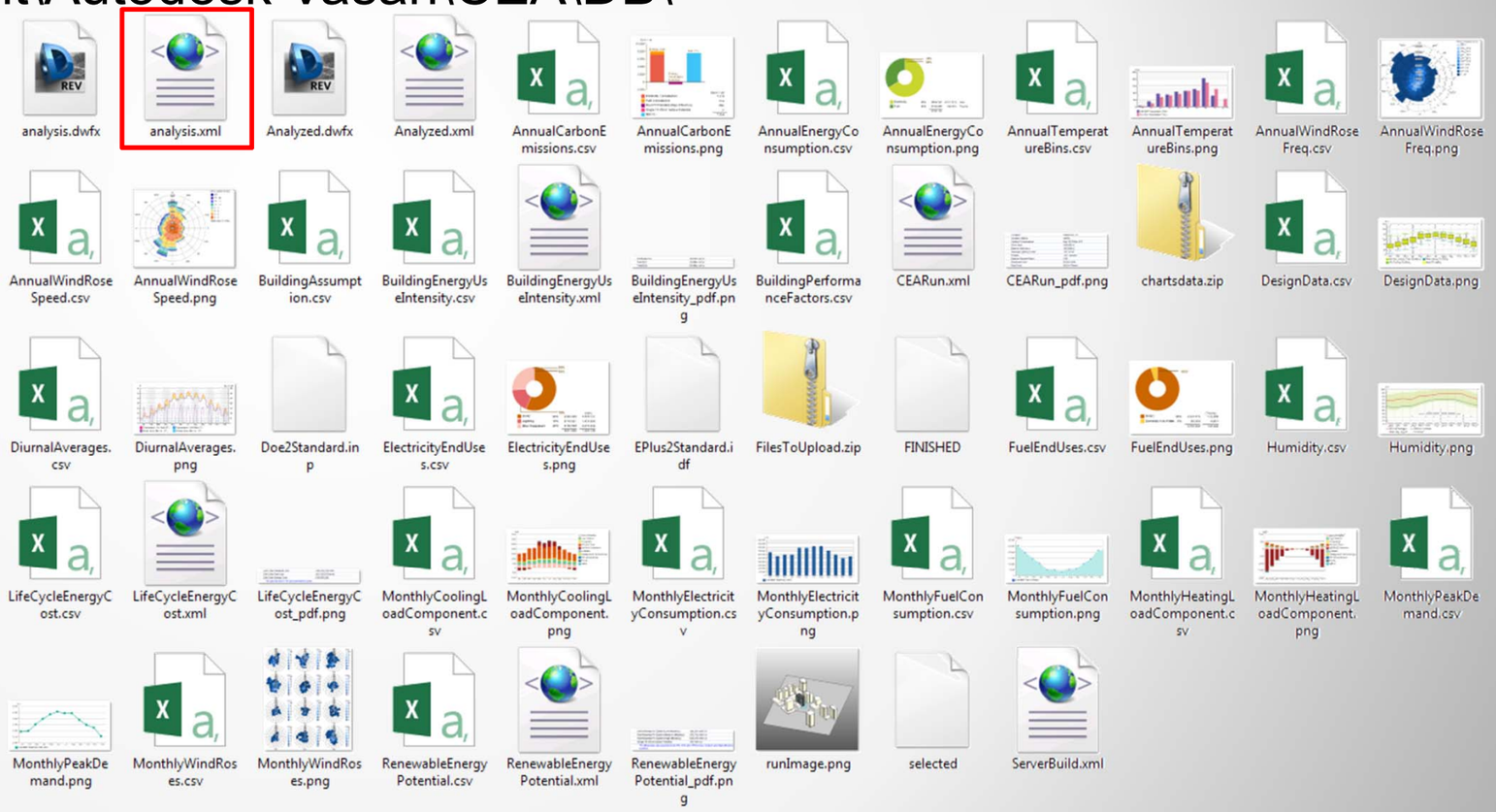
Good stuff at the end

- So what does Vasari do to your model???

- C:\Program Files\Autodesk\Vasari Beta 3\gbXML2dwfx.exe

Snooping through directories…

C:\Users\
”**VDC_FIELD**”\
AppData\Roaming\Autodesk\Revit\Autodesk Vasari\CEA\DB\
“**PROJECT**”\“**PROJECT RUN**”

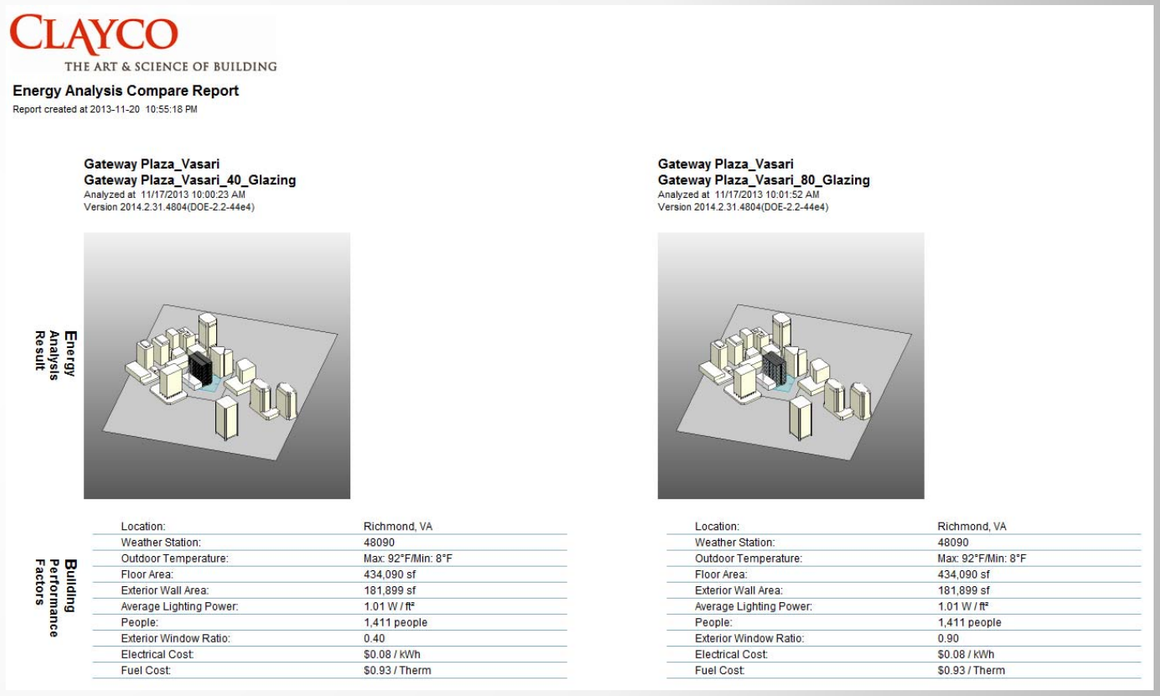


Focus of the analysis

- Overall massing
- Overshadowing
- Insolation at the main lobby storefront
- Peak and Average solar loads on the critical façade
- Pedestrian comfort level and shading strategies

Obtaining results

- Vasari “Energy Analysis Compare Report”
  - Building performance factors
  - Energy Use Intensity
  - Lifecycle cost
  - Renewable potential
  - Annual Carbon Emissions
  - Annual Energy use
  - Potential Energy Savings ???
  - Monthly loads
  - Climate



CLAYCO
THE ART & SCIENCE OF BUILDING

Energy Analysis Compare Report

Report created at 2013-11-20 10:55:18 PM

Gateway Plaza_Vasari
Gateway Plaza_Vasari_40_Glazing
Analyzed at 11/17/2013 10:00:23 AM
Version 2014.2.31.4804(DOE-2.2-44e4)

Gateway Plaza_Vasari
Gateway Plaza_Vasari_80_Glazing
Analyzed at 11/17/2013 10:01:52 AM
Version 2014.2.31.4804(DOE-2.2-44e4)

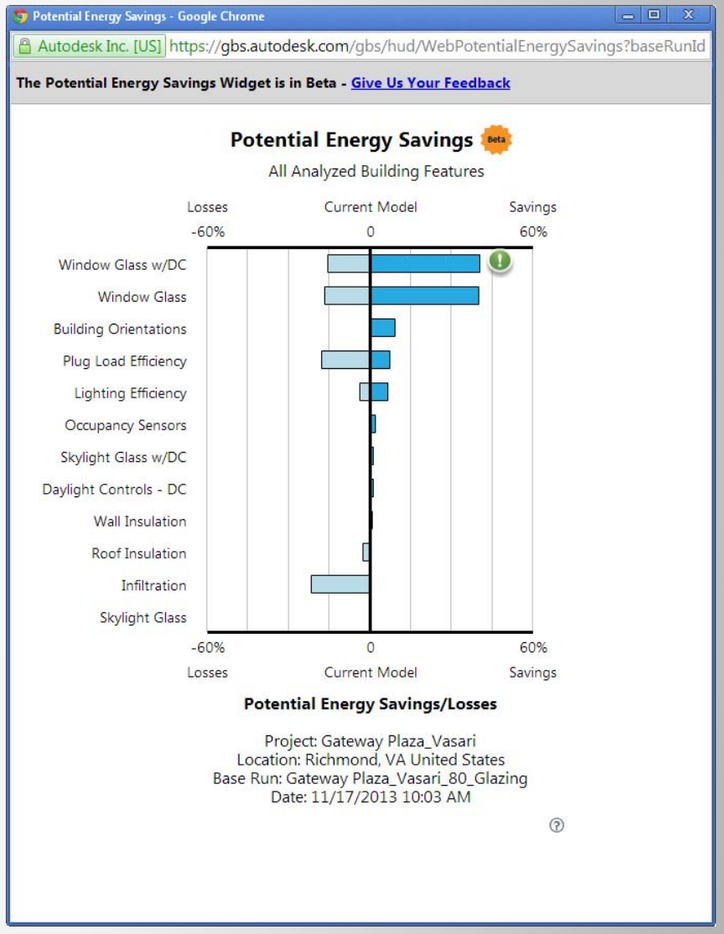
Energy Analysis Result

Building Performance Factors

Location:	Richmond, VA	Location:	Richmond, VA
Weather Station:	48090	Weather Station:	48090
Outdoor Temperature:	Max: 92°F/Min: 8°F	Outdoor Temperature:	Max: 92°F/Min: 8°F
Floor Area:	434,090 sf	Floor Area:	434,090 sf
Exterior Wall Area:	181,899 sf	Exterior Wall Area:	181,899 sf
Average Lighting Power:	1.01 W / ft²	Average Lighting Power:	1.01 W / ft²
People:	1,411 people	People:	1,411 people
Exterior Window Ratio:	0.40	Exterior Window Ratio:	0.90
Electrical Cost:	$0.08 / kWh	Electrical Cost:	$0.08 / kWh
Fuel Cost:	$0.93 / Therm	Fuel Cost:	$0.93 / Therm

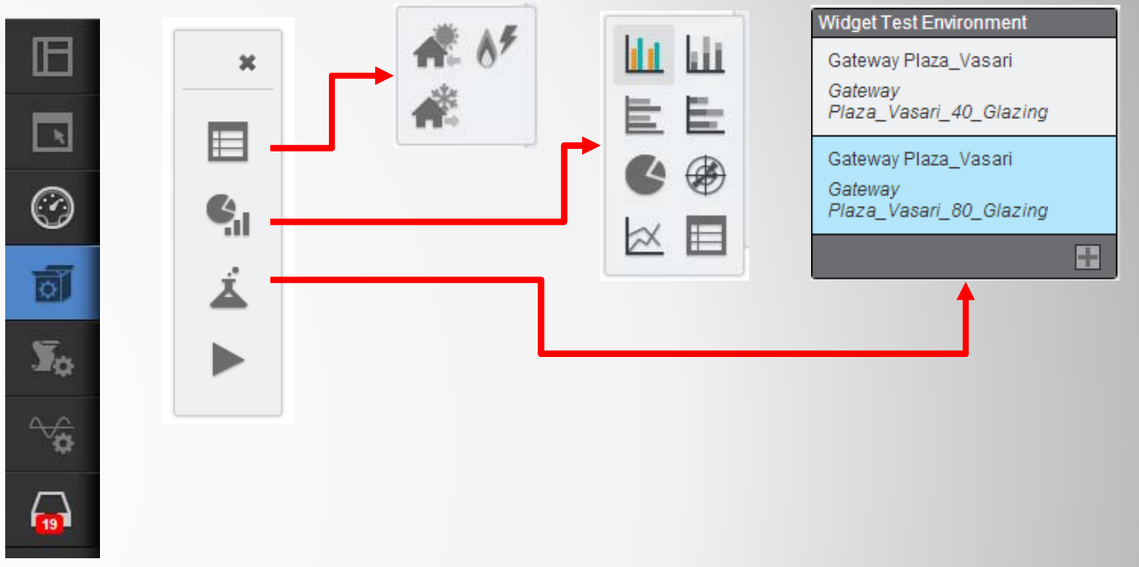
Or .... GBS approach

- Everything from Vasari and….
  - Dashboard and Widgets
  - Design options without geometry modification
  - Additional Cost and Energy Charts
  - Water usage
  - LEED daylighting
  - Additional data export
  - Potential Energy Savings



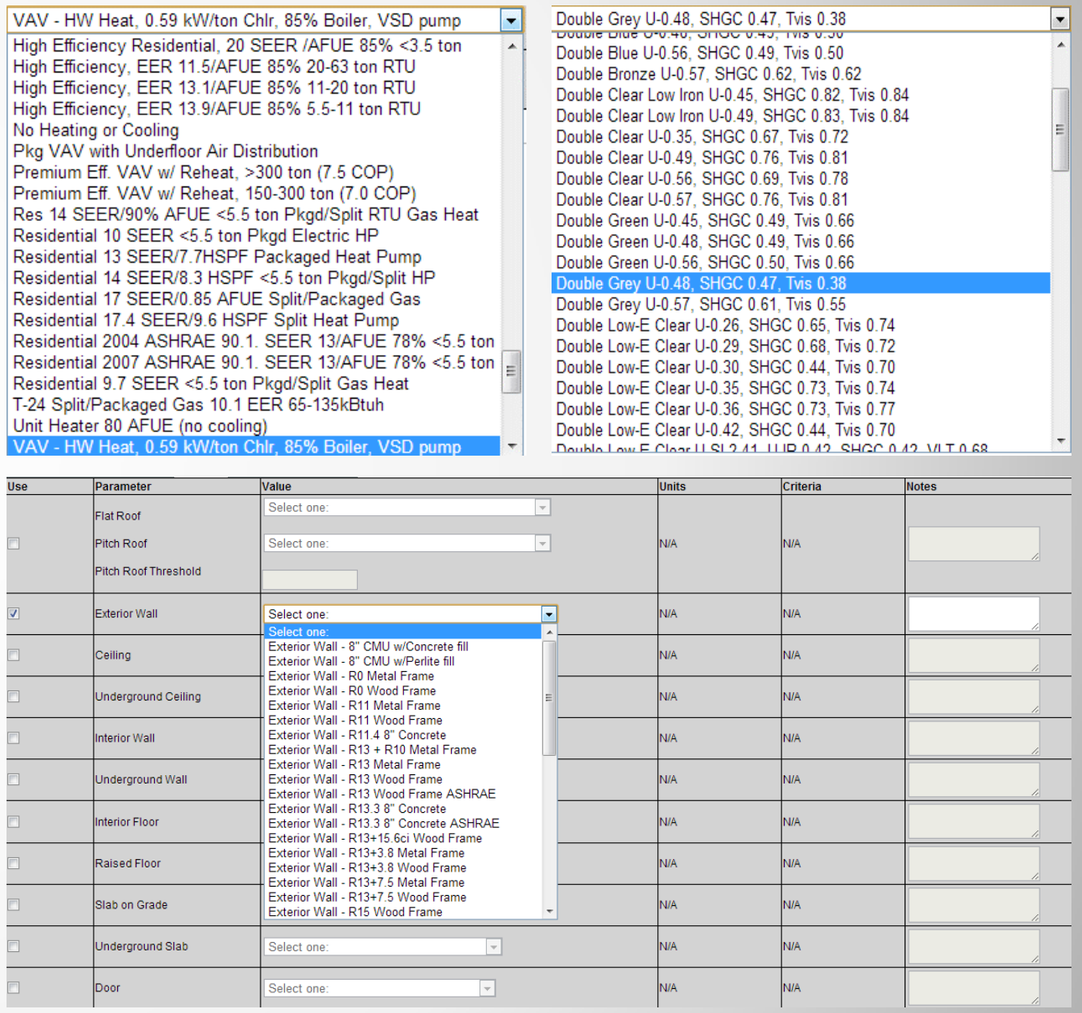
Welcome to project Salon-Alpha….

- Intuitive – Glue like interface
- Multiple Dashboards
  - Assembly of Widgets
- Enterprise wide sharing
  - *Templates*
  - *BPA-apps*
  - *Run-sets*
  - *Default-sets*



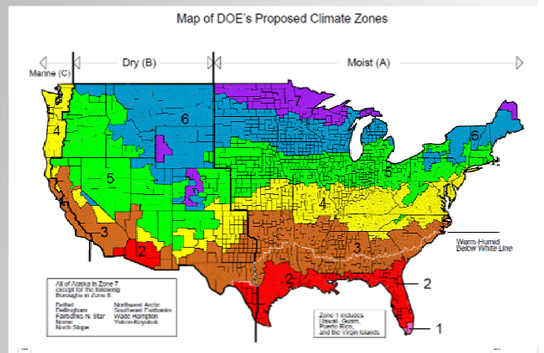
Take the advantage of Templates

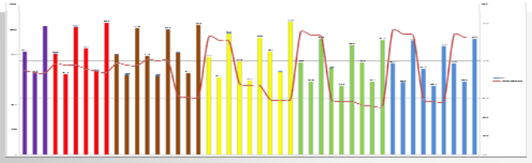
- Uploading gbXML to GBS
  - Ability to assign custom templates
    - Space loads
    - Zones
    - Surface definitions
    - Openings definitions
    - HVAC & DHW

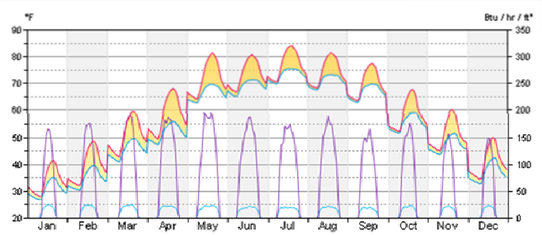


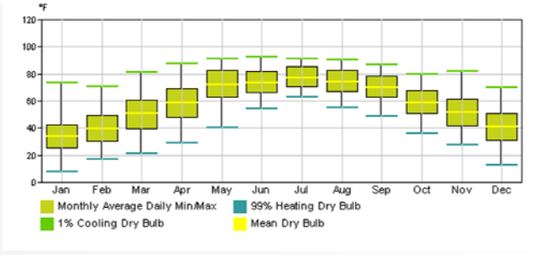
Interpreting and distributing results

CLIMATE SUMMARY



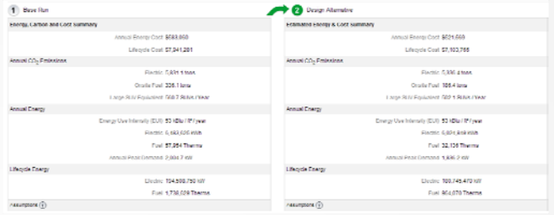


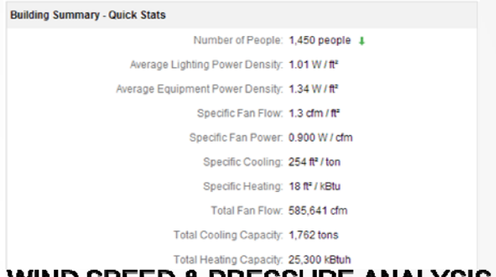


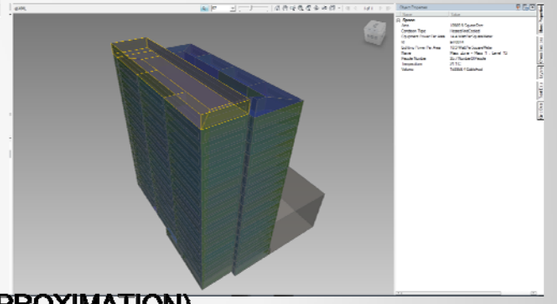


ANALYSIS RESULTS

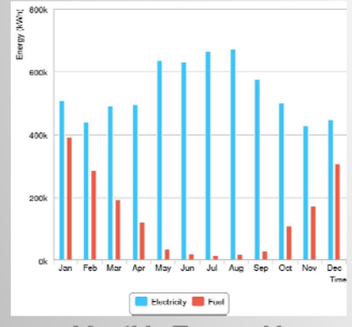
AUTODESK 360



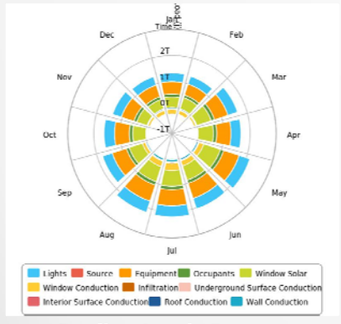




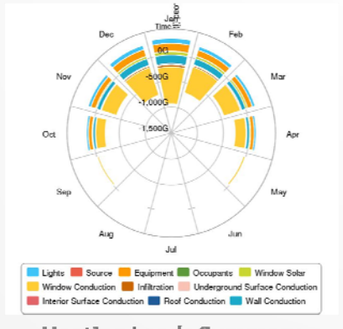
ENERGY USE SUMMARY



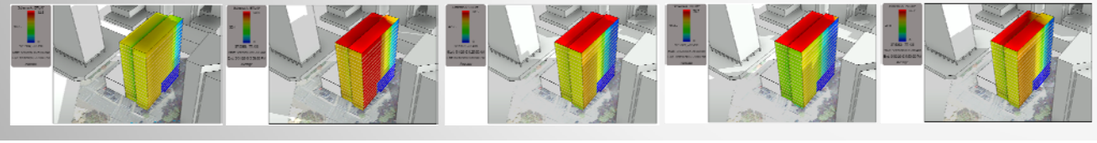
Monthly Energy Use



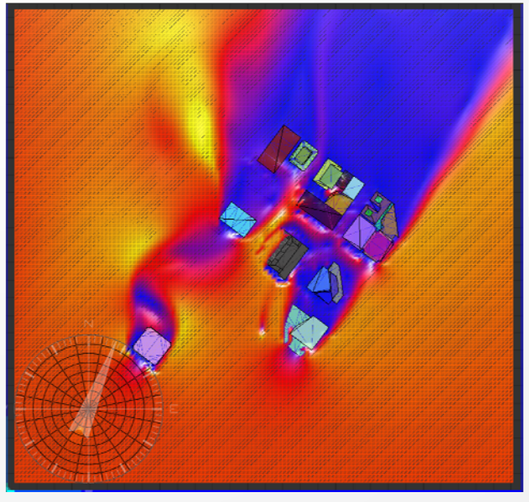
Cooling Loads Summary

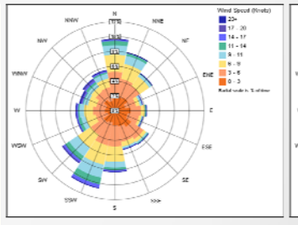


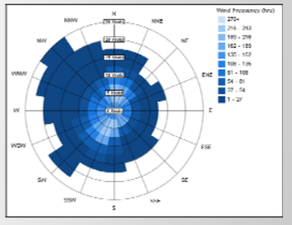
Heating Loads Summary



WIND SPEED & PRESSURE ANALYSIS (APPROXIMATION)

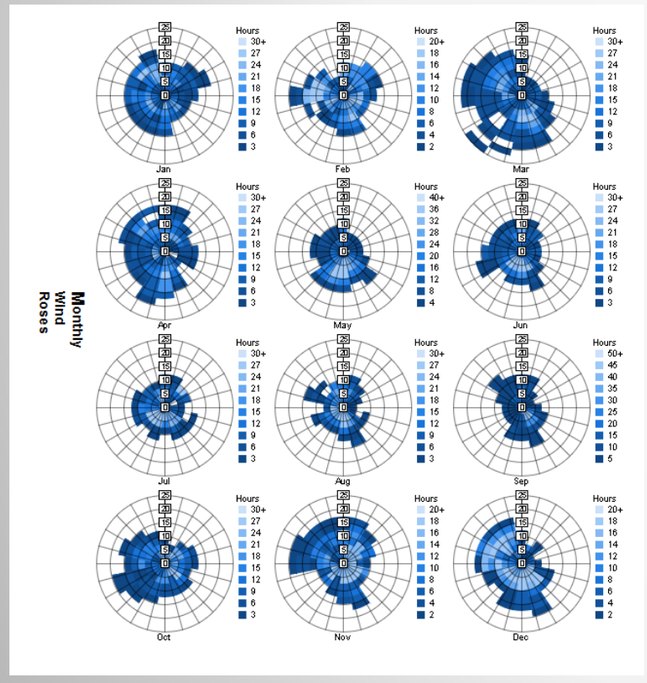


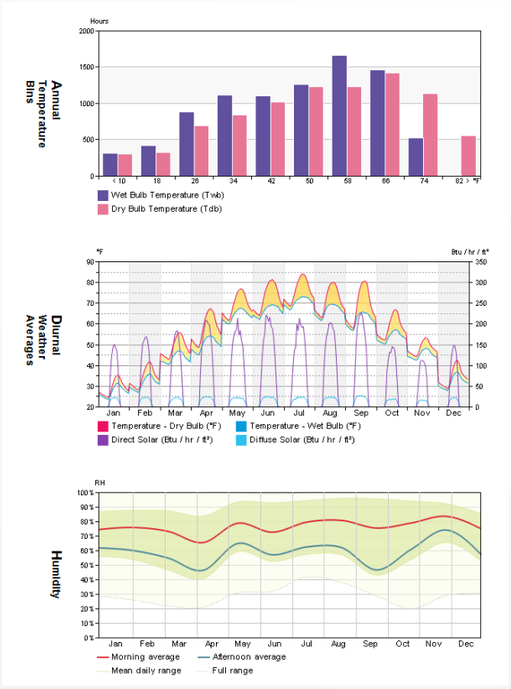


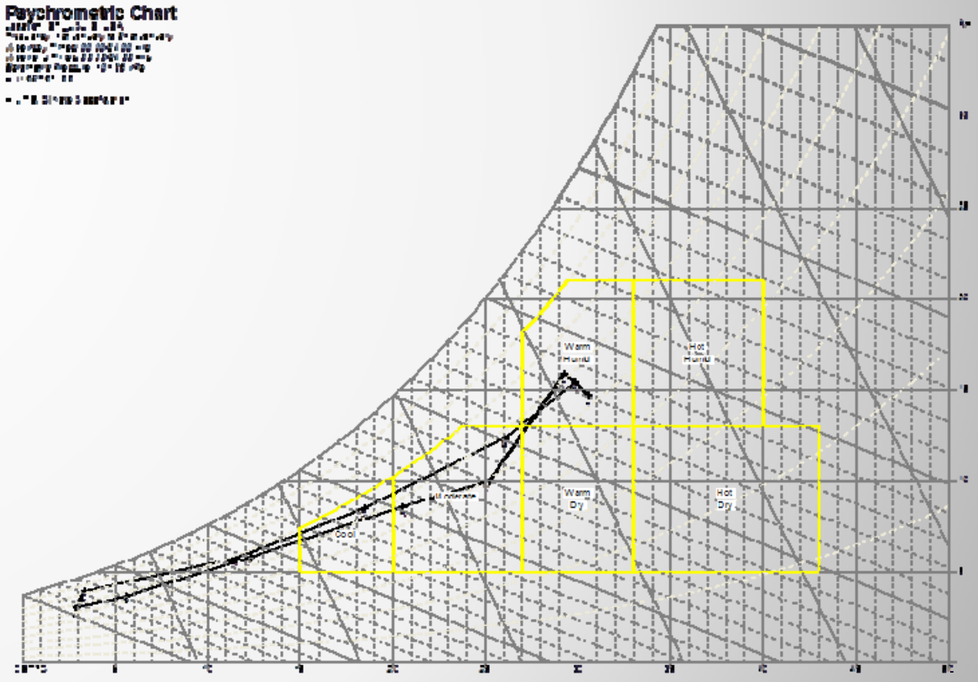


Some workflow and adoption suggestions…

- Insist on climate data on all projects….
- Teach your team how to use time-tested knowledge and tools

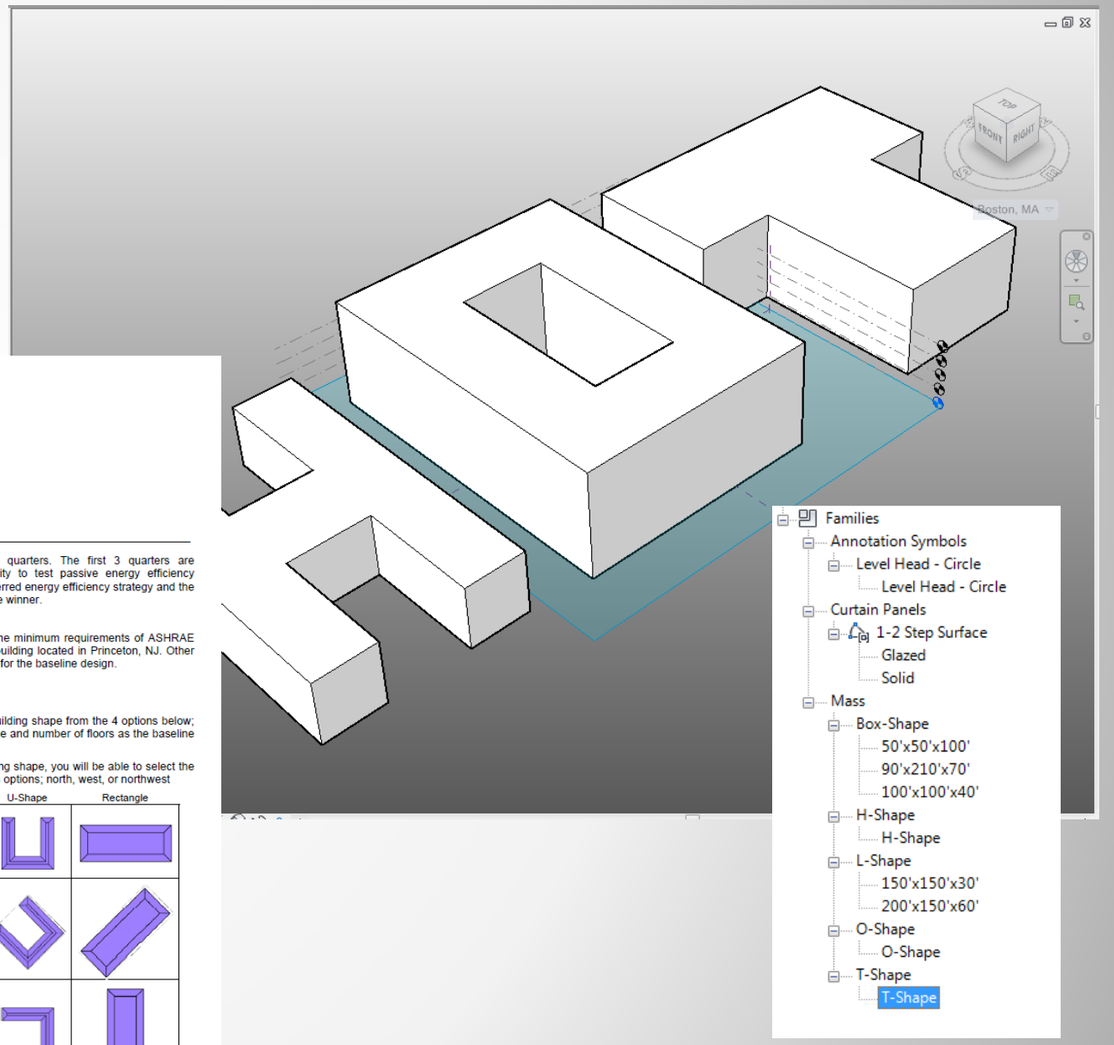






Some workflow and adoption suggestions…

- Start playing the Energy game….
- Make team comfortable in second guessing their design decisions.
- Don’t make BPA a basis of a exclusive club



CLAYCO
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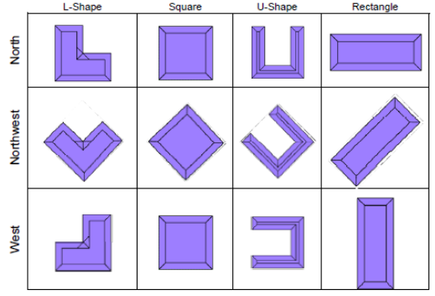
Green Building Studio SD Evaluation - Game

This energy modeling game is divided into 4 quarters. The first 3 quarters are experimental and each provides a different opportunity to test passive energy efficiency strategies. In the 4th quarter each team selects their preferred energy efficiency strategy and the team with the lowest EUI (Energy Use Intensity will be the winner.

The baseline model has been designed to meet the minimum requirements of ASHRAE 90.1 2007. It is a 50,000 SF, two story square shaped building located in Princeton, NJ. Other attributes are noted in the headlines of the options below for the baseline design.

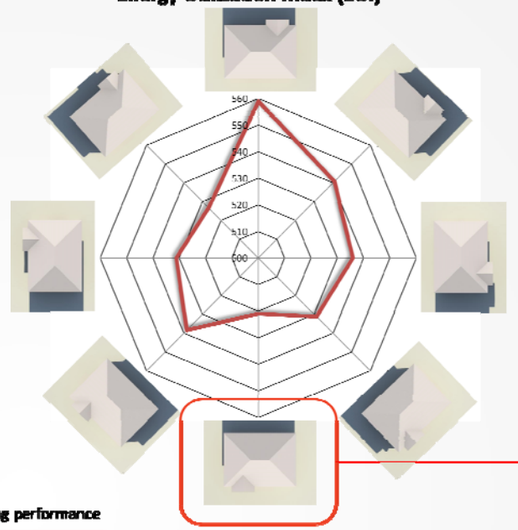
1. **Quarter #1**: Massing & Orientation
   a. You will be able to choose a different building shape from the 4 options below; each option has the same square footage and number of floors as the baseline building.
   b. Once you have chosen a different building shape, you will be able to select the building orientation of the building from 3 options; north, west, or northwest



Some workflow and adoption suggestions…

- No project is too small !!!

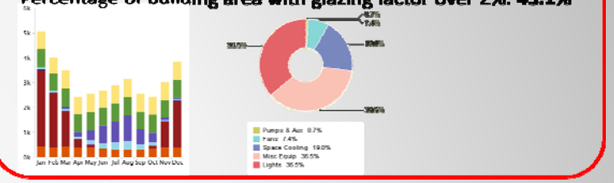
Energy Utilization Index (EUI)



Base amount of glazing by 19 m2

EUI:521.0 MJ/m2/YEAR

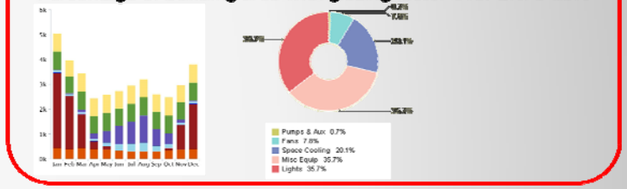
Percentage of building area with glazing factor over 2%: 43.1%



Increase in the amount to 23 m2

EUI:523.1 MJ/m2/YEAR

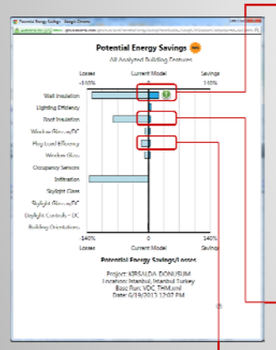
Percentage of building area with glazing factor over 2%: 54.8%



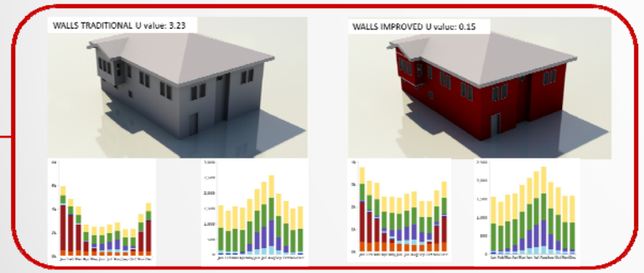
Energy modeling for optimization of energy use and first cost comparison

Analysis Starting Point

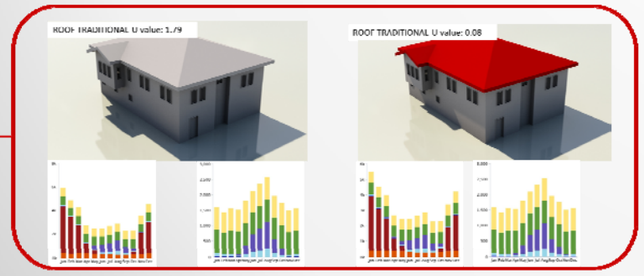
Looking for optimal targets



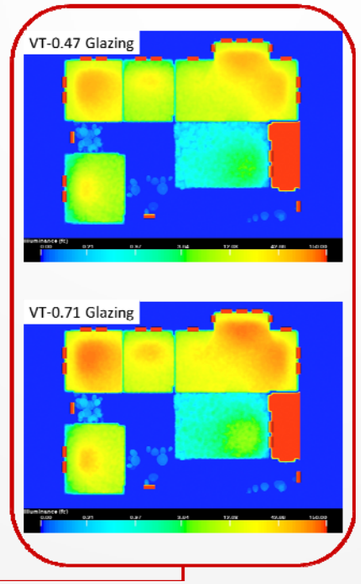
Better Wall Insulation results in decrease in energy use



Better Roof Insulation results in increase in energy use – not always an optimal solution



Glazing type – day lighting performance



Q & A

Thank You