Rapid Energy Modeling Lab

Autodesk University

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Tom Vollaro
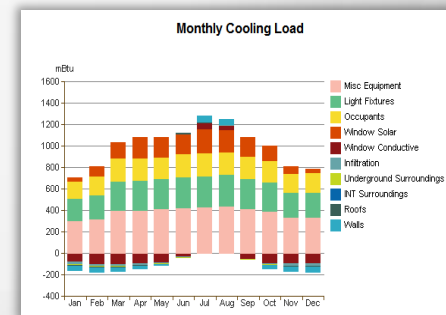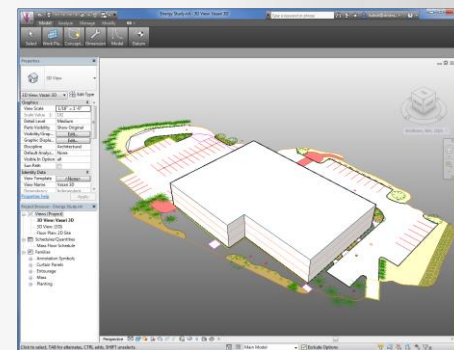John Sullivan

Rapid Energy Modeling Training Outline

- Rapid Energy Modeling (REM) Overview

- Stages in the REM Workflow

- Mass modeling using Autodesk FormIt

- Mass modeling using Autodesk Vasari

- Green Building Studio basic features and functionality
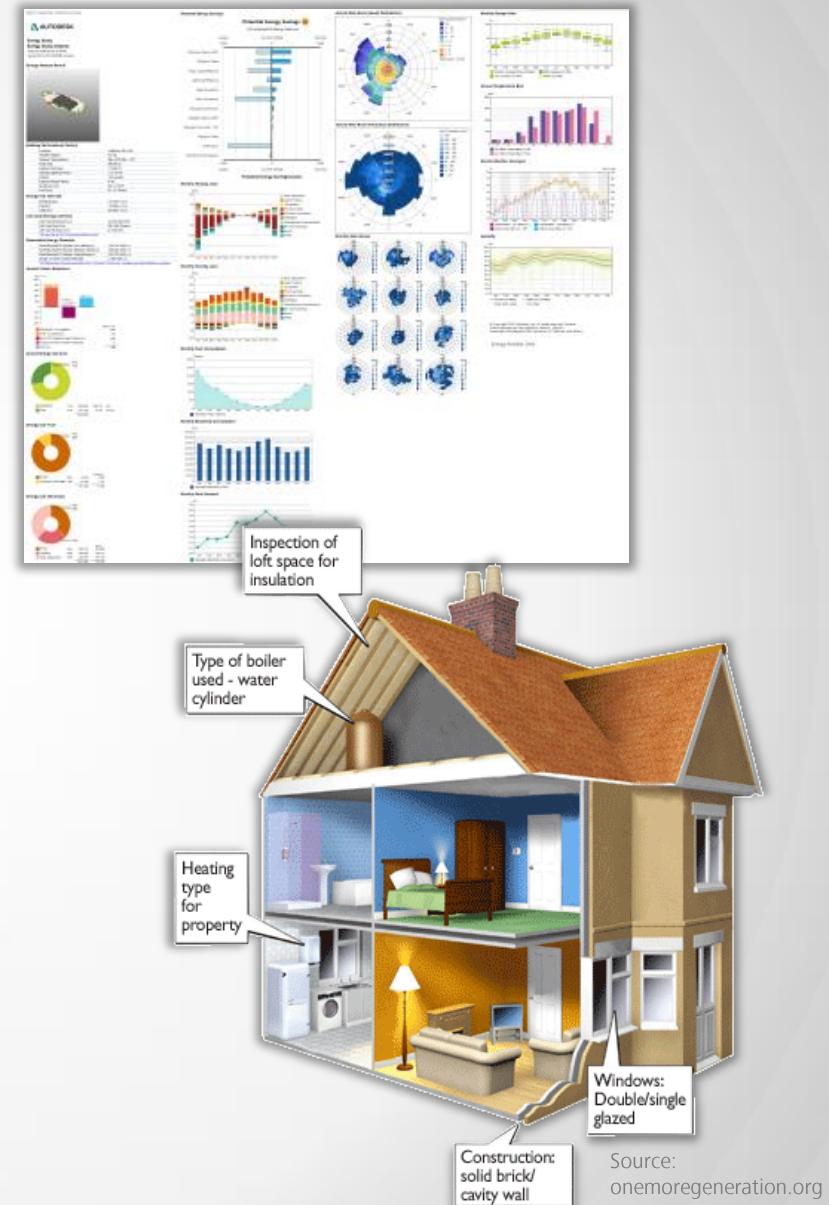
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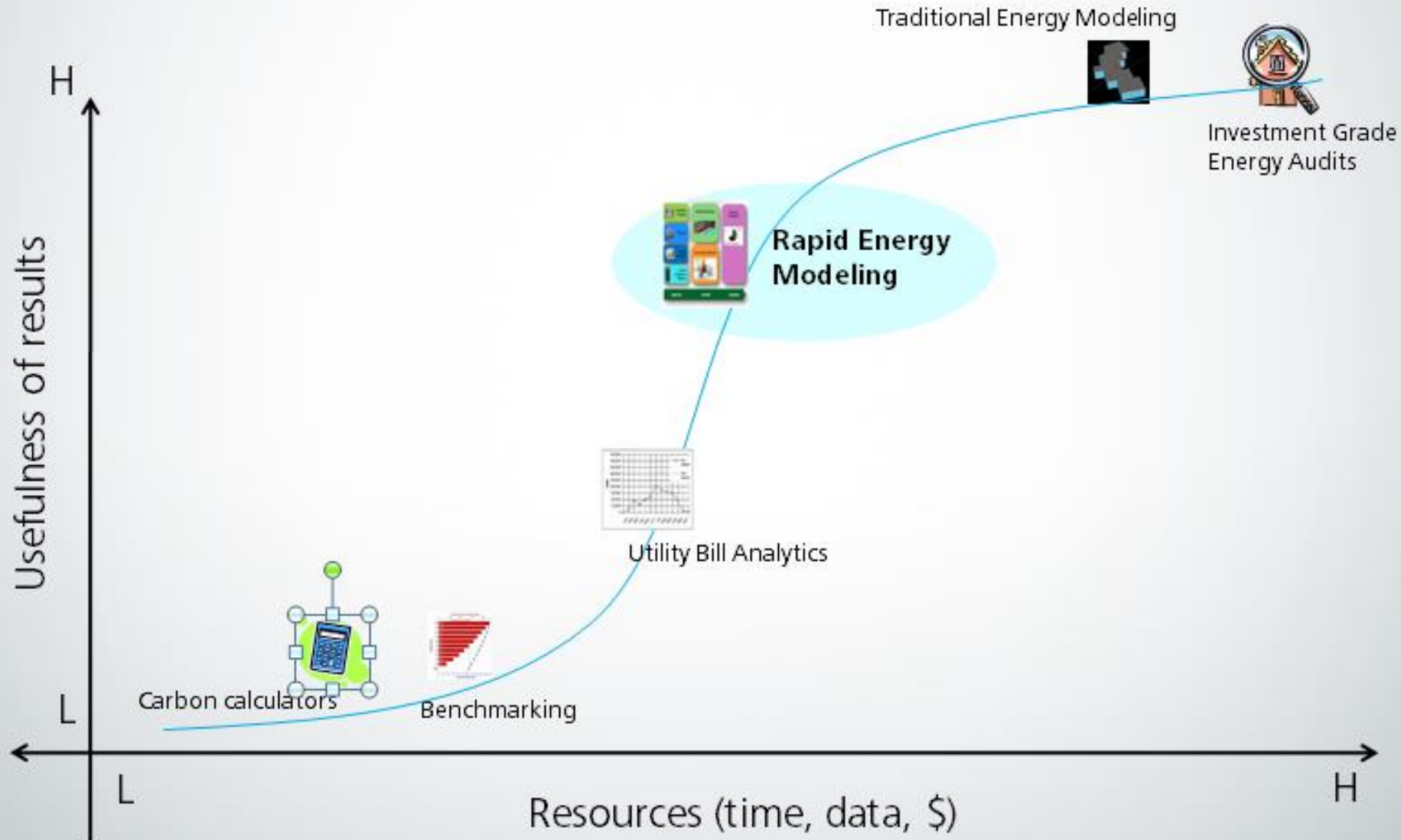
Rapid Energy Modeling (REM)

- REM is an analytical approach to simulate building energy usage using quick, low-cost techniques

- The REM process - *streamlined, to move rapidly with minimal data* - helps to rapidly evaluate energy usage and energy conservation measures (ECMs) across a portfolio of assets

- Develops an estimate of a building's energy performance based on geometry, location, design, occupancy and usage

- Stages in the REM process include:

  - Capturing existing building conditions
  - Developing this data into 3D models
  - Analyze the model to develop estimate's of a building's energy performance

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Why Employ REM?

- Provides building energy assessments and carbon reduction analyses with an efficient budget, short timeframe, small initial data set and minimal training

- Model and analyze multiple building configurations and usage characteristics simultaneously

- Quickly assess expected building energy performance characteristics and identify areas for improvement

- Create an energy usage baseline across a portfolio of buildings

Inspection of loft space for insulation

Type of boiler used - water cylinder

Heating type for property

Windows: Double/single glazed

Construction: solid brick/ cavity wall

Source: onemoregeneration.org

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The relative benefits of energy assessment methods

Traditional Energy Modeling

Investment Grade Energy Audits

Rapid Energy Modeling

Utility Bill Analytics

Carbon calculators   Benchmarking

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L

Usefulness of results

L   H

Resources (time, data, $)

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Components of the REM Process

Capture → Model → Analyze

Satellite & Aerial Images — Google Earth, Google Maps, Bing Maps, …others

Photos — On site, Web views

Rapid
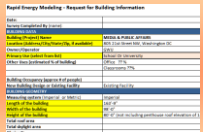
Bldg Data — Questionnaires to Owner Records

Drawings — CAD Drawings, PDFs, As-built Sets

Onsite — Laser Scans, Photogrammetry

Time Intensive

Conceptual Model — Autodesk FormIt, Autodesk Vasari, Autodesk Revit

Detailed Model — Autodesk Revit

Energy Analysis
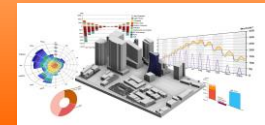
Conceptual Energy Analysis Tools (CEA)

- Autodesk Vasari
- Autodesk Revit

- Green Building Studio (GBS)

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Conceptual Energy Modeling

- What is Conceptual Energy Modeling?

  - Performing energy analysis on conceptual or mass models quickly and easily with a simple level of detail

- Energy modeling capabilities are embedded within Autodesk Revit and Vasari

- Green Building Studio (GBS) tie-in with Revit & Vasari

  - GBS is driven by the DOE-2.2 engine for whole building energy analysis

  - More detailed analyses can done in GBS where there are more advanced options for building materials, utility and HVAC data

  - From GBS, can be imported into eQuest, Energy Plus, TRACE 700 or other applications

  - GBS uses intelligent defaults based on ASHRAE to fill in blanks

Steps for Conceptual Energy Analysis in Vasari

Mass Forms + Mass Floors + Energy Settings → Energy Model → Energy Reports
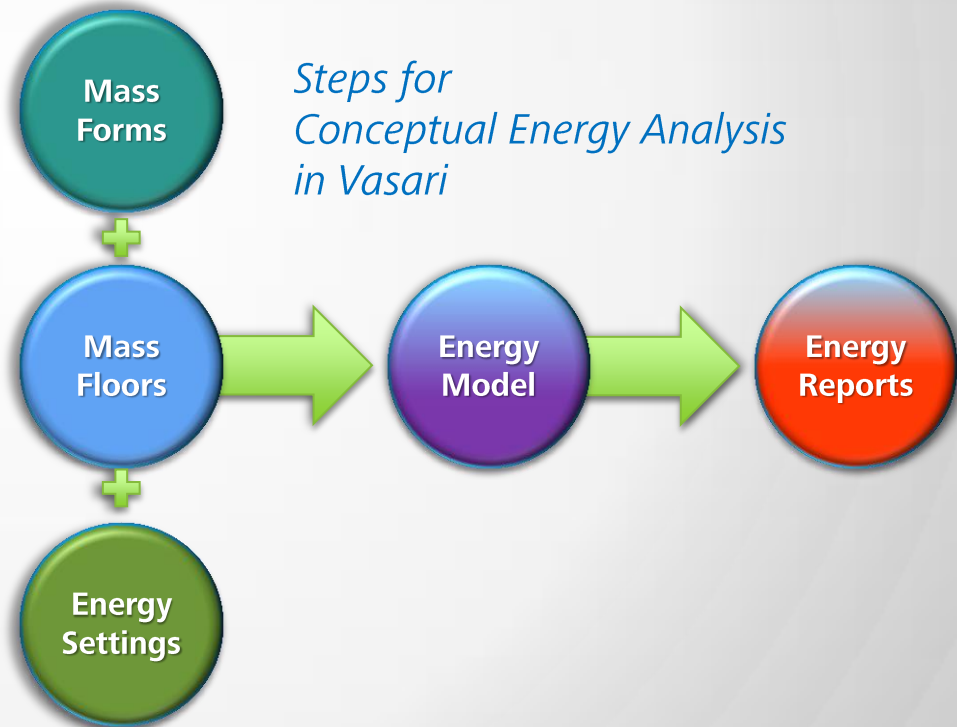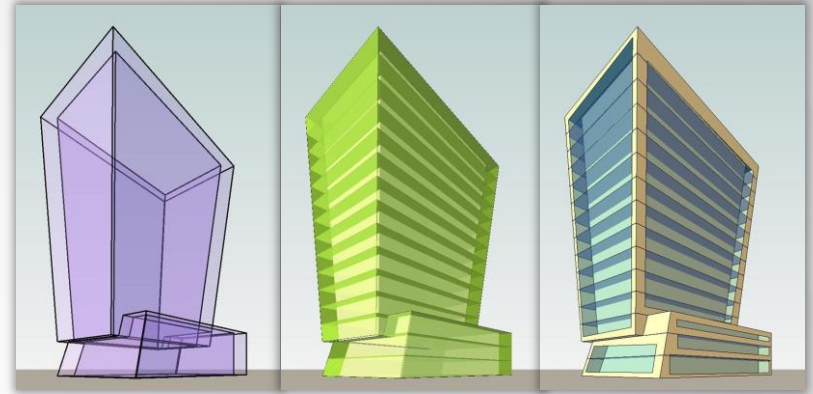
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Rapid Energy Modeling Applications & Workflows

- **Autodesk FormIt**
  - Web (beta) & mobile tablet-based app for iPad and Android
  - Mass Modeling

- **Autodesk Vasari**
  - Conceptual 3D modeler
  - Mass Modeling & energy simulation

- **Autodesk Revit**
  - Building Information Modeling (BIM) application
  - Mass Modeling & energy simulation

- **Green Building Studio**
  - Energy analysis service driven by DOE 2.2 engine
  - Enhanced energy analysis & design alternatives
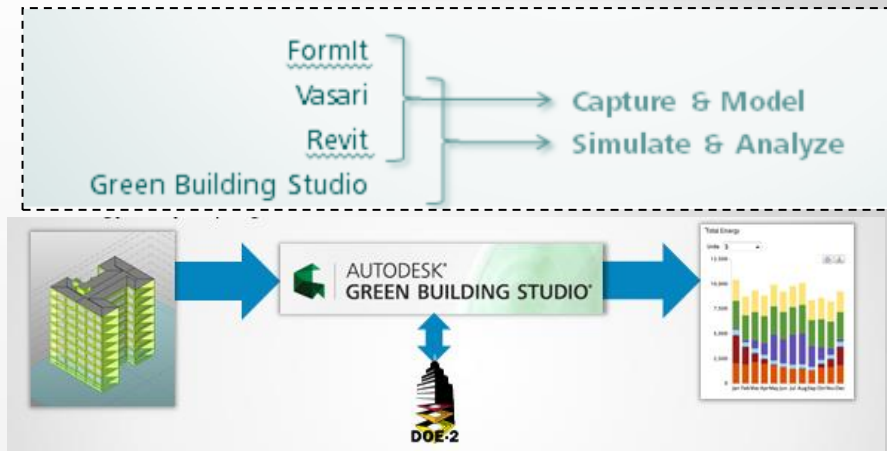
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Introduction to Autodesk FormIt Mobile

- Mobile application for portable devices with easy-to-use modeling tools

- Modeling as you go – on or off site

- Uses real-world location of site in a searchable maps interface

- Imports satellite image of the site

- Metric or imperial units

- Seamless BIM workflow
  - Synchronize designs to the cloud
  - Easy transfer to Vasari, Revit and other desktop applications via RVT or SAT file formats
- Available for iOS, Android

Introduction to Autodesk FormIt Web (beta)

- The same basic drawing and modeling operations as FormIt mobile

- Open and save FormIt files created on mobile

- All files are converted to SAT and RVT

- Available now at
  http://beta.autodeskformit.com
  (Chrome and Firefox)

FormIt Exercise (see handout)
10 Minutes
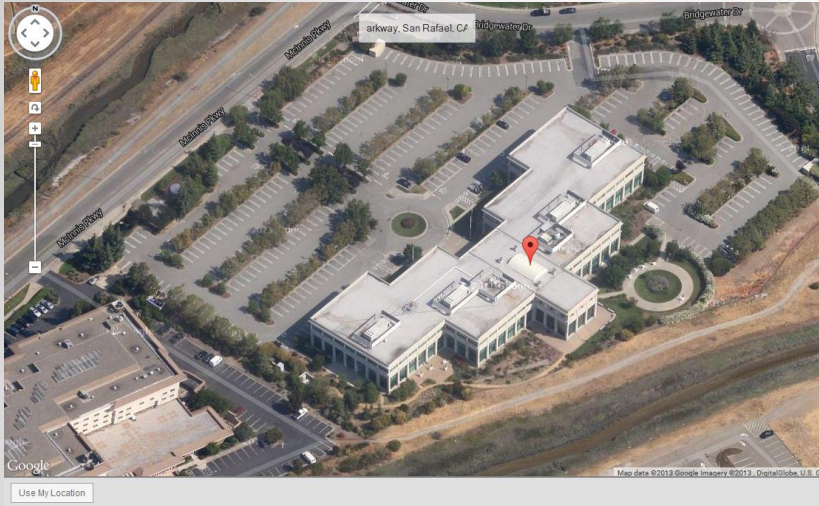
Import satellite image
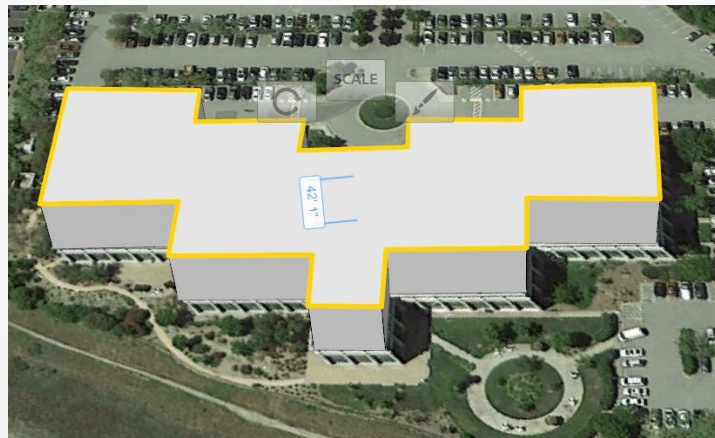
Create mass model

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Introduction to Autodesk Vasari

- Vasari is a BIM-based parametric conceptual modeling and analysis application

- Vasari incorporates energy modeling and analysis features which utilize Autodesk's Green Building Studio web service

- Available for free on the web at: http://autodeskvasari.com/
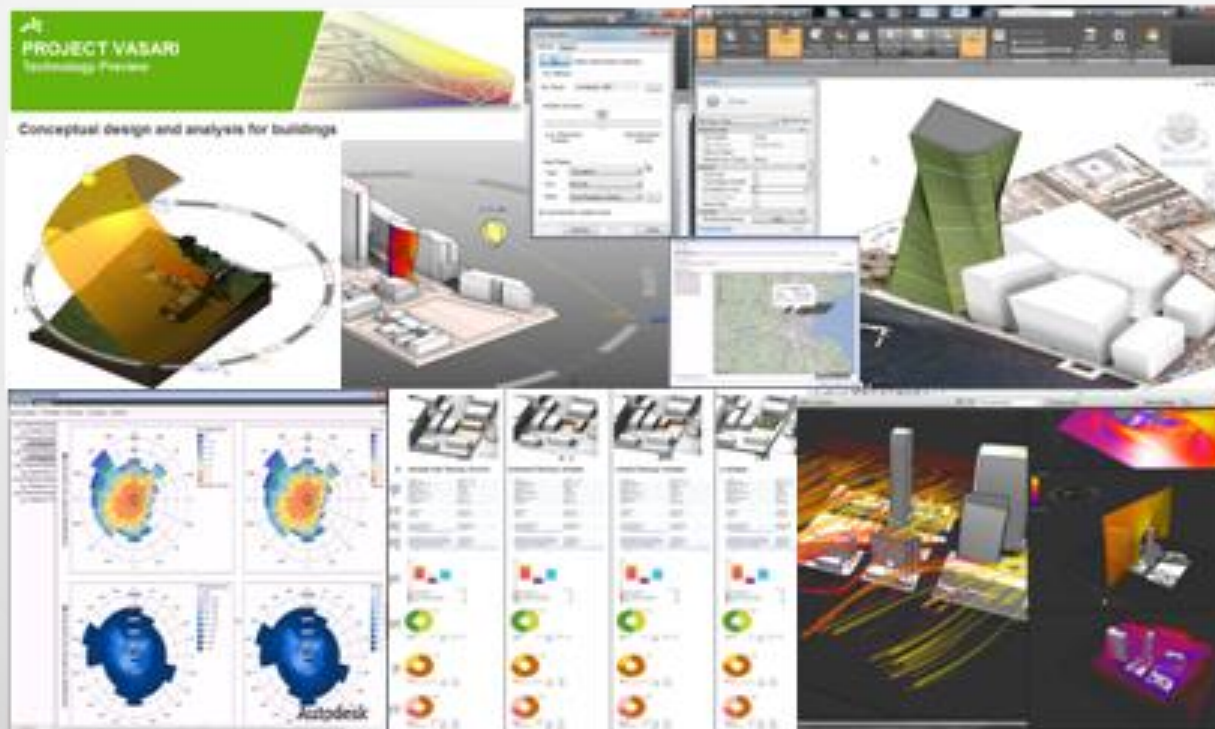
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Autodesk Vasari Analysis Tools

- Vasari provides building performance analytics with the following tools:
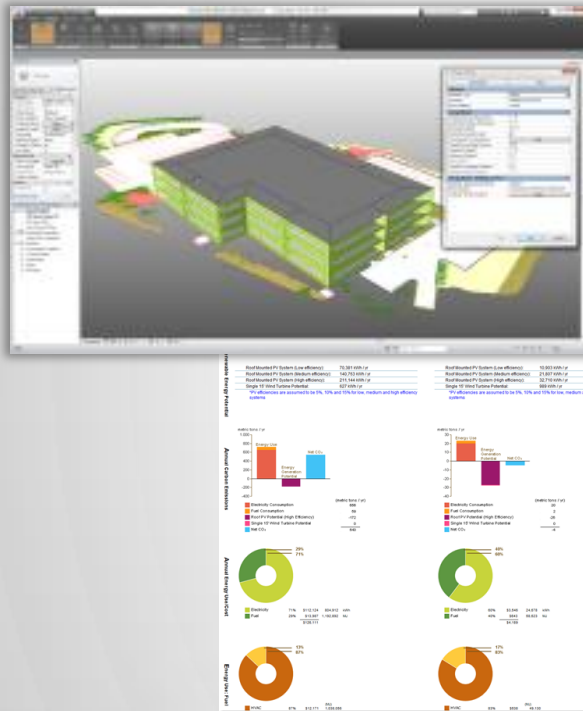
- Energy analysis
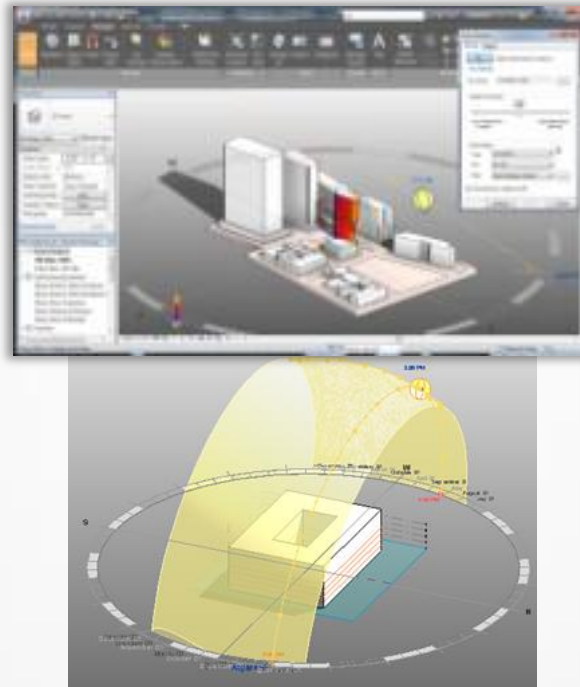
- Solar radiation analysis

- Wind analysis

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Vasari Rapid Energy Modeling Workflow

1 Create Mass Model

2 Create Mass Floors

3 Review or Modify Energy Settings

4 Enable Energy Model

5 Sign In to Autodesk 360

9 Revise, Simulation, Compare

8 GBS My Projects Sync

7 Review Simulation Results

6 Run Energy Simulation

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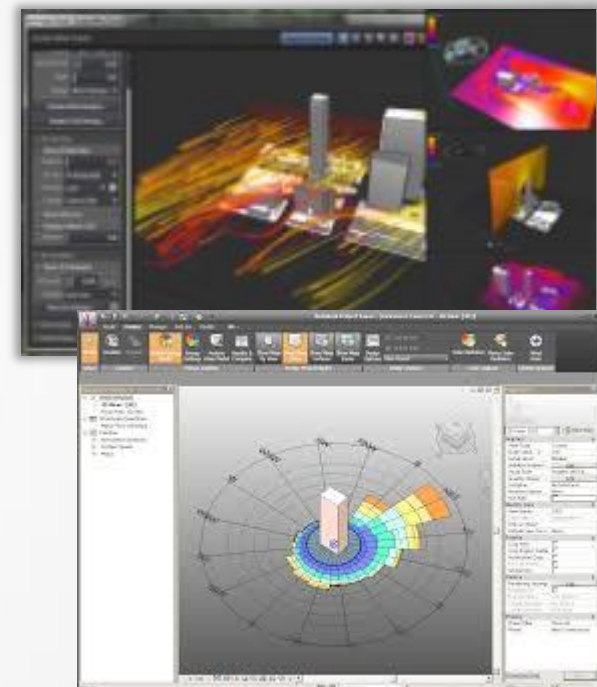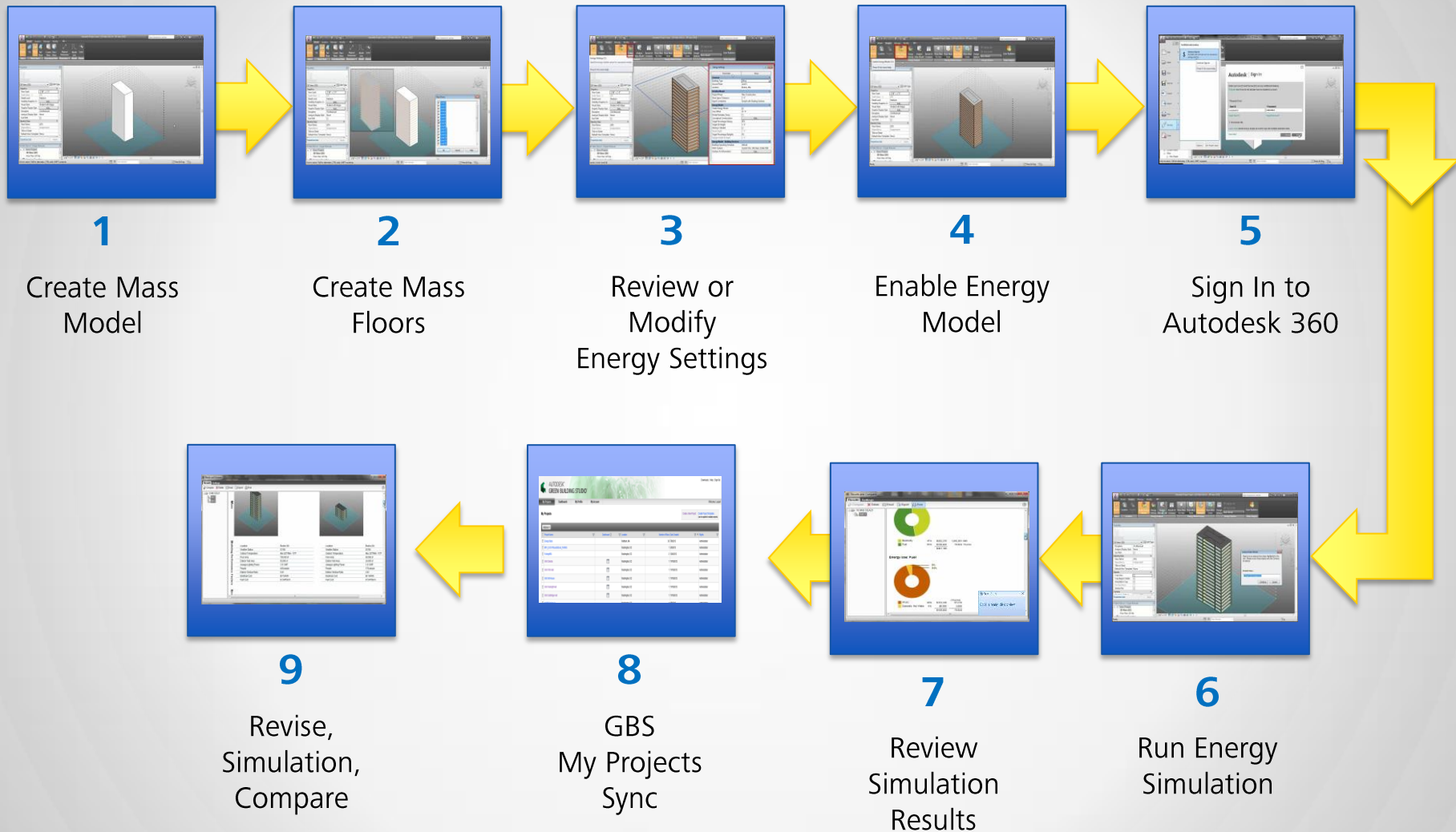
Exercise: Rapid Energy Modeling Workflow in Vasari
(see handout; 25 minutes)
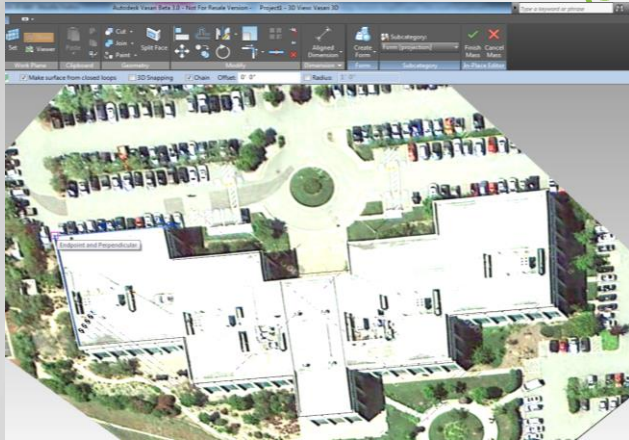
Import satellite image

Create mass model

Create levels & mass floors

Designate Energy Settings

Energy Settings

Parameter	Value
Common	
Building Type	Office
Location	111 McInnis Parkway, San Rafael, CA 94903, USA
Ground Plane	Level 1
Energy Model	
Analytical Space Resolution	1' 6"
Analytical Surface Resolution	1' 0"
Perimeter Offset	15' 0"
Divide Perimeter Zones	☑
Conceptual Constructions	Edit...
Target Percentage Glazing	50%

Enable Energy Model
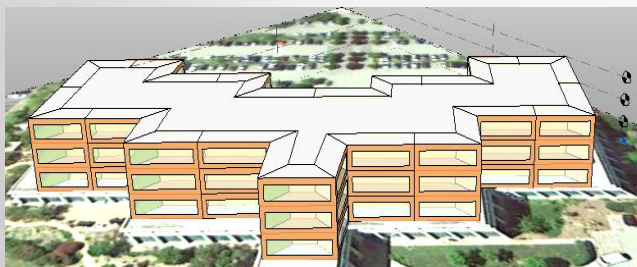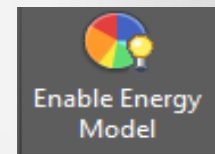
Enable Energy Model & Run Simulation

Run Energy Simulation

Results & Compare
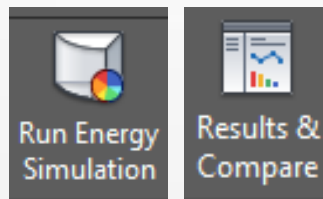
Energy Analysis Result

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Review Results

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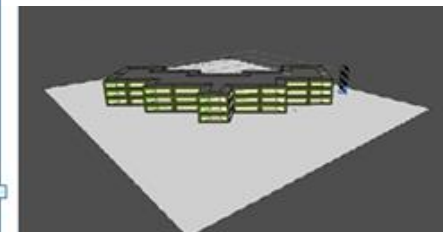
Energy Analysis Using Green Building Studio (GBS)

- GBS uses the industry standard DOE 2.2 (eQuest) engine for energy analysis

- If <u>very</u> detailed analytics are required GBS allows you to export a DOE2/eQuest INP file or an EnergyPlus IDF file to extend your analysis in those whole building energy analysis programs
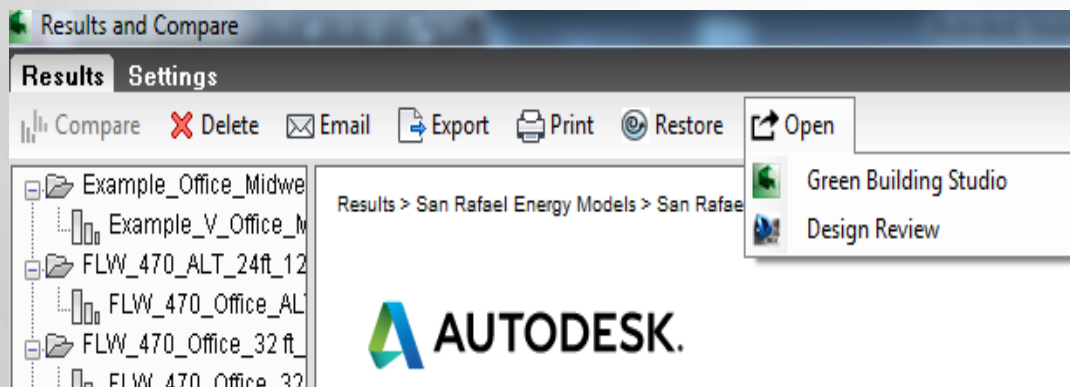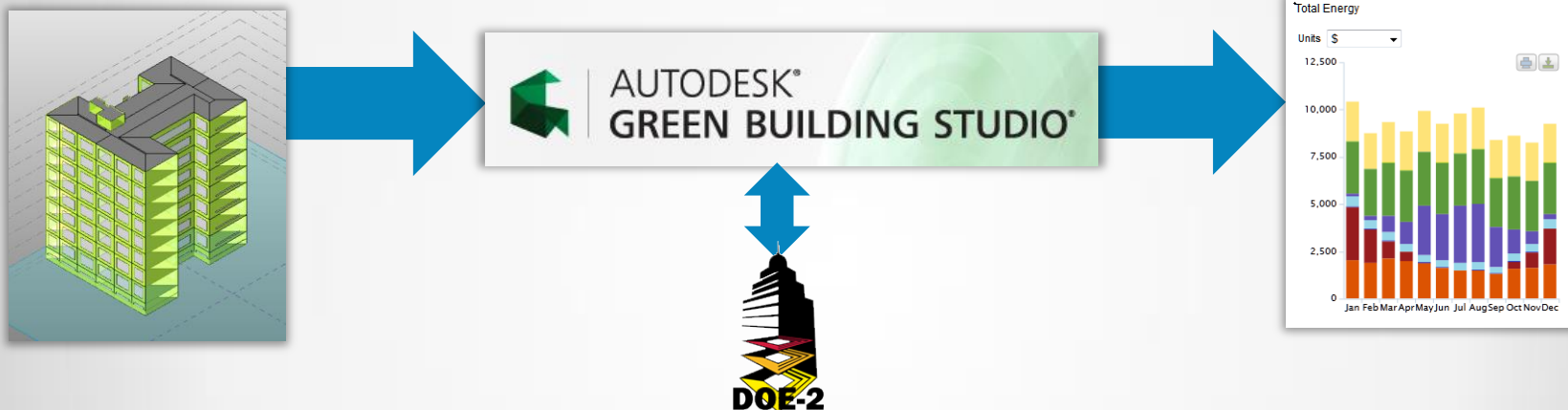
- Vasari results can also be opened in GBS, or uploaded as GBXML into GBS

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Review Energy Report

Potential Energy Savings Charts

Compiled from 37 separate energy simulation runs
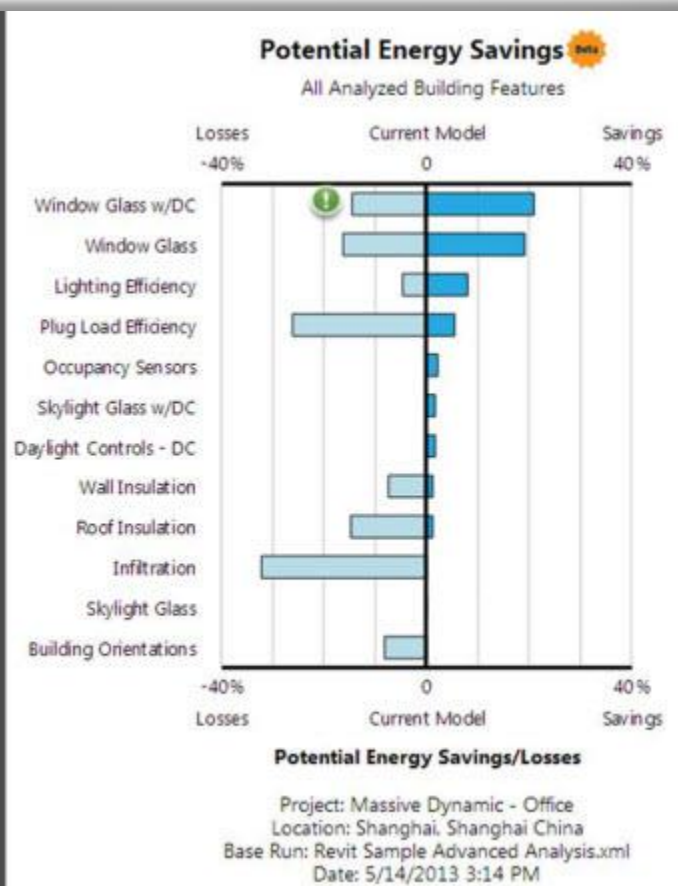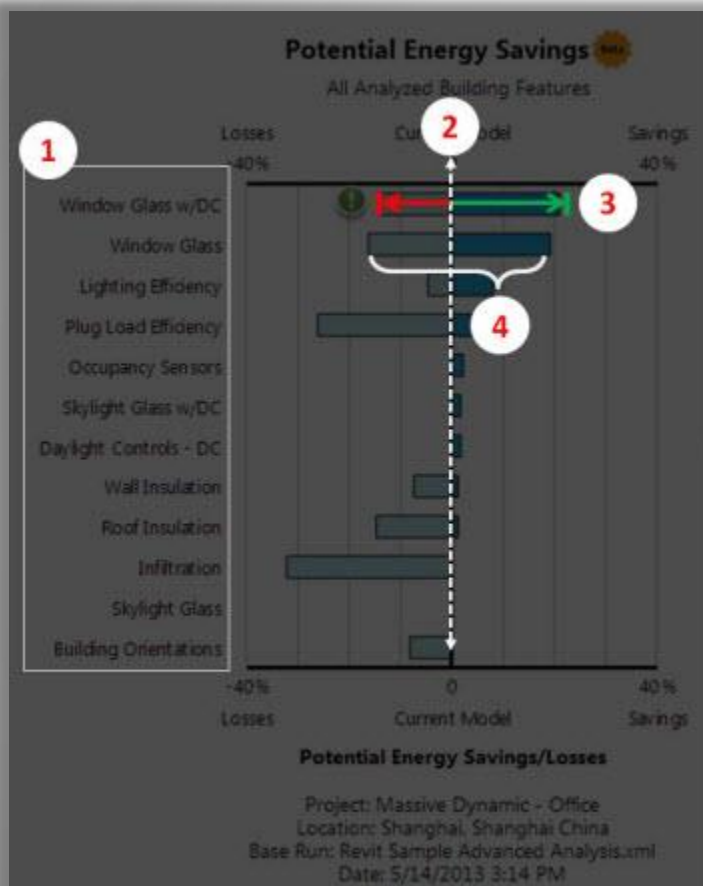
1. Building Features Analyzed
2. Current model baseline
3. Savings/Losses potential
4. Sensitivity

Potential Energy Savings Chart
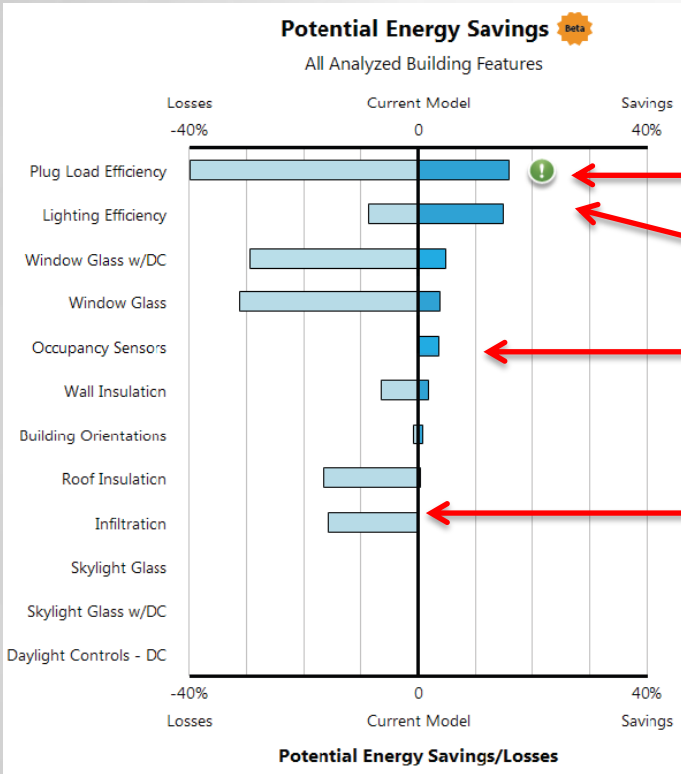
- Large bars are important building features affecting energy use (more sensitive)
- Bars that extend further to the right of the baseline have higher potential for energy savings
  - Smaller bars are less important to energy use (less sensitive)

  - Bars that extend further to the left have higher potential for energy losses

Using the Potential Energy Savings Charts

Use this data to help focus on the building features that have the biggest impact on energy performance
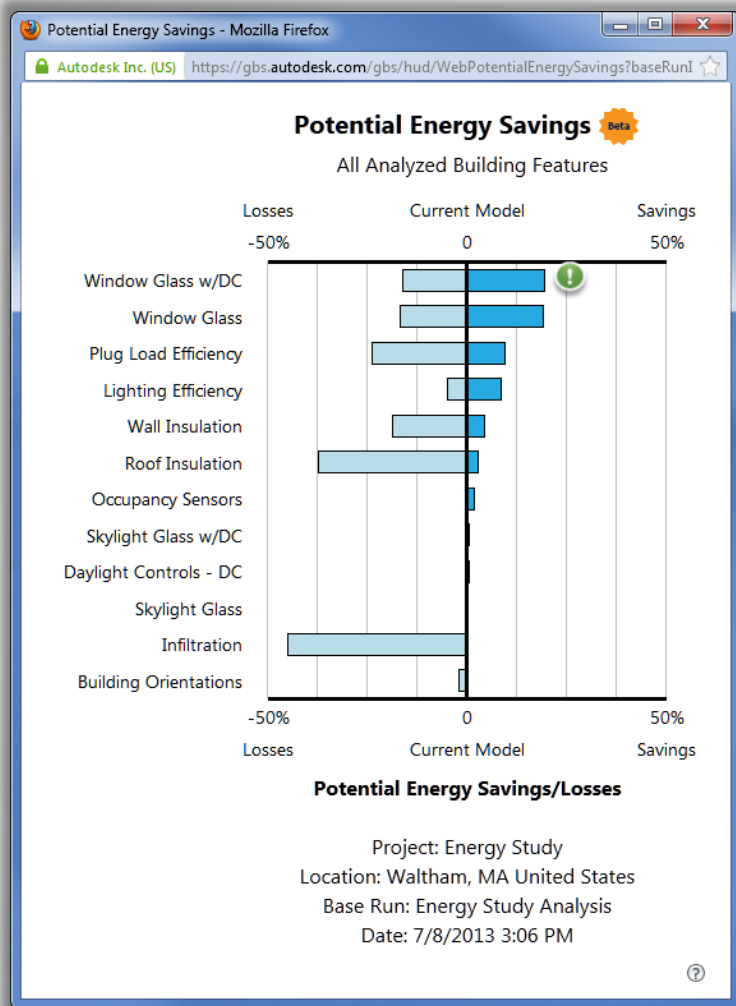
- **Focus on the largest opportunities to improve on the baseline**

  Investigate the features at the top of the list that have large bars on the right of the vertical line.

- **Avoid reducing energy performance..**

  …by making sure you don't backslide on building features that have large bars on the left of the vertical line.

- **Know where you can be flexible**

  Building features where modifications will have little effect on energy performance have small bars on both the left and right side of the vertical line.

- **For an existing building, prioritize your time during the building audit**.

  Building features that have a big impact should get more of your attention during an audit and subsequent efficiency studies.

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Green Building Studio Results – *Energy and Carbon Screen*
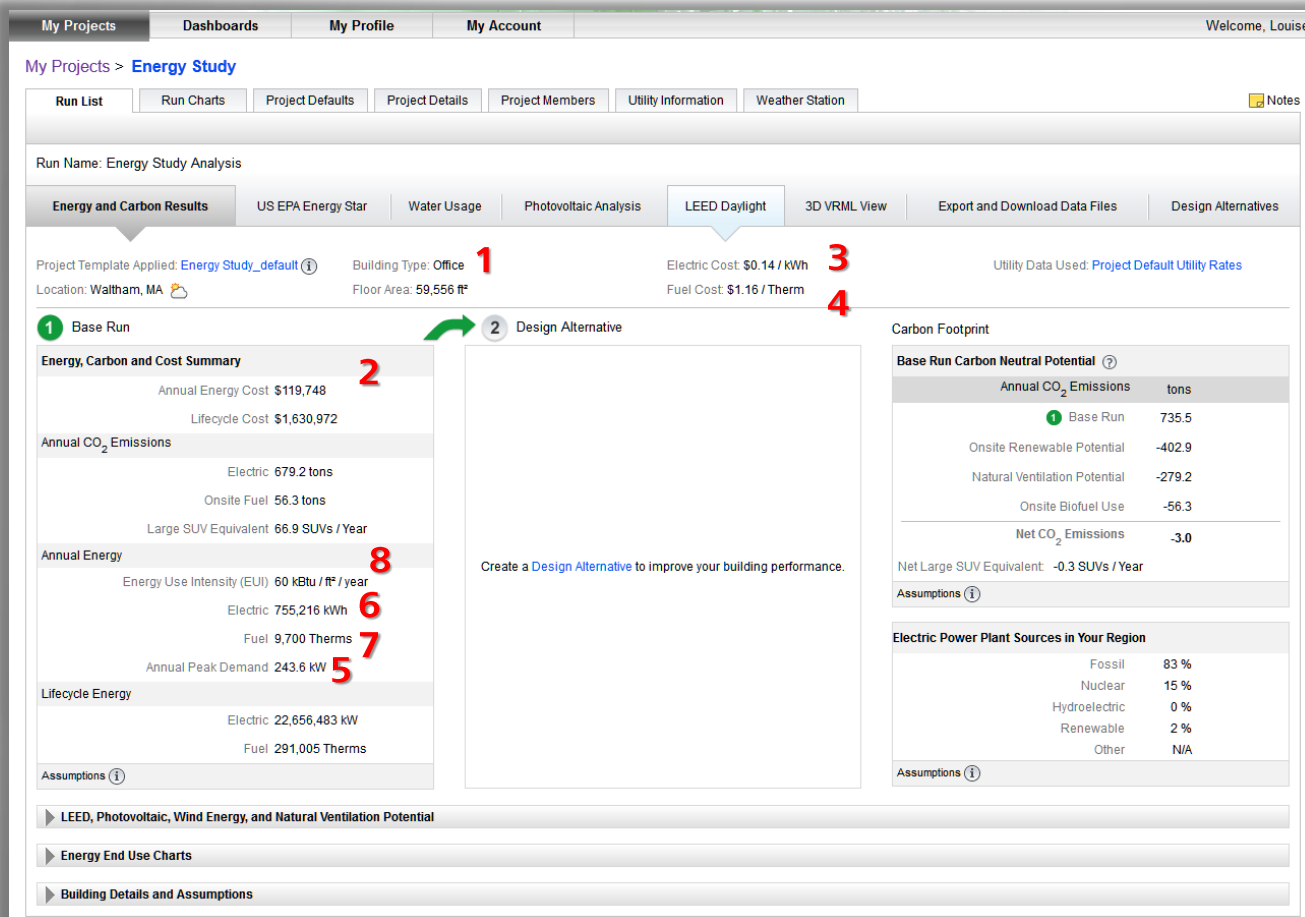
1. Floor Area
2. Total Annual Energy Cost
3. Electric Cost (/kWh)
4. Fuel Cost (/Therm)
5. Annual Peak Electric Demand (kW)
6. Annual Electric Use (kWh)
7. Annual Fuel Use (Therm)
8. Energy Use Intensity (EUI)

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Additional Results on the Energy and Carbon Results Screen

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Design Alternatives in GBS

Parameter options:
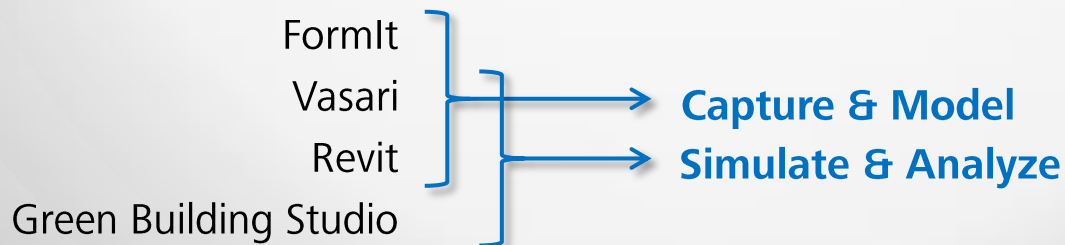
- Rotation
- HVAC
- Lighting Efficiency
- Lighting Control: Occupancy Controls
- Daylighting Sensors and Control
- Roof Construction
- Roof Glazing Type
- Roof Glazing Amount
- Wall Construction
- Wall Glazing Type
- Wall Glazing Amount

- The top portion of the table has standard links to the Run List
- The bottom portion of the page has tabs corresponding to the values in the run

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REM in Review

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  - Capturing existing building conditions
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  - Analyze the model to develop estimate's of a building's energy performance

- REM is performed using following Autodesk applications

FormIt
Vasari → **Capture & Model**
Revit → **Simulate & Analyze**
Green Building Studio

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Vasari Rapid Energy Modeling Workflow

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