OpenStudio bridges the gap between capable but complex engines and the easy-to-use applications that drive change.

Sample Applications

“Operating System”

OpenStudio Software Development Kit (SDK)

Modeling Engines (EnergyPlus, Radiance, Others)

User Expertise

Market Facing Modeling and Analysis Tools

Enabling Analysis for Emerging Technologies

Easy-to Use Tools for Practitioners

Mobile Applications

Portfolio-Scale Web Tools

DOE’S Energy Modeling Platform
The Emerging OpenStudio Eco System – FY11
The Emerging OpenStudio Eco System – FY12
The Emerging OpenStudio Eco System – FY13

Research & Education

Private Sector

A&E Practitioners

PNNL

LBNL

ANL

EEB

ORNL

NREL

Technology Exchange

Building Component Library

Xcel

CEC

Ngrid
The Emerging OpenStudio Ecosystem

- Research & Education
  - PNNL
  - EEB
  - LBNL
  - ANL
  - ORNL
  - NREL

- A&E Practitioners
  - Xcel
  - CEC
  - Ngrid

- Private Sector
  - Technology Exchange
  - Building Component Library

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OpenStudio Partners (Partial List)
Who Uses OpenStudio Tools?

Note: gmail.com, hotmail.com, yahoo.com, and NREL.gov are filtered out of these results
The Building Component Library

• An Internet-connected source of building energy modeling data:
  • Enables drag-and-drop modeling for **quick** technology evaluation
  • Provides **consistent**, detailed inputs to drive decision-making
  • **Searchable** readily available within applications
  • **Crowd sourced** content leverages sector knowledge
The BCL: A Source for Reusable Input Data

Components:

- Assembled to form complete energy models
- Include constructions, lights, schedules, weather data, PV components, and more
Measures:

• Contain logic needed to transform an energy model easily and consistently

• Can be applied singly or as part of a parametric analysis
An A&E Practitioner’s View
Rapid Geometry and Space Assignment with SketchUp

- Draw floor plan
- Extrude
- Add fenestration
- Draw envelope in minutes using SketchUp, or import from BIM
- Quickly assign constructions, loads, and schedules via templates and specify zones

Credit: David Goldwasser / NREL
The OpenStudio Application

Define Resources

Workflow

Review Results

Credit: David Goldwasser / NREL
Templated HVAC Systems for Rapid Modeling

1. Pick a System
2. Add Your Zones
3. Done
Drag and Drop HVAC System Models
High Level Simulation Summary
The OpenStudio Parametric Analysis Tool

Select measures from BCL and apply them to your baseline model

Inspect measures applied to specific alternative models

Compare energy performance, cost reduction, and paybacks

Results may be exported for integration with other applications
Incenting New Construction Efficiency

- **Energy Design Assistance (EDA)**
  - These programs are a primary tool to influence efficiency beyond code for new construction

- **Problems:**
  - EDA viability jeopardized as codes become more stringent
  - Must reduce admin costs to remain viable
  - Must maintain quality

- **Solution:**
  - Web service tracks projects, manages data and communications, and reports program-wide outcomes
  - OpenStudio provides automated quality and EDA protocol checking
  - EDAPT connects project data with model outcomes to streamline reporting
Incenting New Construction Efficiency

1 Application
Fill out on-line Application and submit.

2 Introductory Meeting (Intro)
Hold introductory meeting.

3 Preliminary Energy Analysis (PEA)
Upload preliminary energy model with energy efficiency measure alternatives and PEA Report.

4 Final Energy Analysis (FEA)
Upload final energy model with customer approved energy efficiency measures and submit FEA Report.

5 Construction Document (CD) Review
Review construction documents and match the model to them. Submit updated Model and CD Review.

6 Measurement & Verification (M&V)
OpenStudio-EDAPT Integration

OpenStudio baseline and design alternate models along with simulation results

EDAPT automatically documents project data and OpenStudio output

Template Reports

Detailed Portfolio Tracking
Advanced Applications
OpenStudio Enables Automated Model Generation

- Geometry and Space Type Definitions
- Detailed HVAC and Zoning
- Simulated End Uses

OpenStudio enables automated model generation by enabling the automatic generation of building geometry and space type definitions. Detailed HVAC and zoning are also automated. Equipment consumption is shown, with simulated end uses depicted on the left.

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**Equipment Consumption [kBTUx10^6]**

- Room: 42%
- Electricity: 14.8%
- Lighting: 14.6%
- Auxiliary Energy: 13%
- Heat Generation: 13.9%
- Chiller: 14.8%
- DHW: 14.6%

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Portfolio-Scale Automated Modeling

Customer Optimization For Energy Efficiency (COFEE)

**SALES PATHWAY**

1. **ROI, Energy Savings, etc.**  
   Site visit to gather information, and submit information to generate improved recommendations
   
   - What would be the return on investment?

2. **ROI, Energy Savings, etc.**  
   Plan client site visit and review initial ROI and energy saving results

3. **ROI, Energy Savings, etc.**  
   Receive updated recommendations

**SELF-SERVICE PATHWAY**

1. **ROI, Energy Savings, etc.**  
   Customer uses tool through computer or tablet to update their building information

2. **ROI, Energy Savings, etc.**  
   Reviews options and can call sales representative with questions.

3. **ROI, Energy Savings, etc.**  
   Customer can apply for incentive and start the retrofit process

**Portfolio of Millions of Tuned Models**

- Incentive Program 1
- Incentive Program 2
- Incentive Program 3

- Client’s Tuned Model

**Here are the incentives that best fit your building and goals. Option 2 pays for itself in less than a year.**

- Chooses incentive, completes rebate form, and goes forward with retrofit

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What High Level Data Are Used to Create Baseline Models?

- **Address:** PII
- **Size:** 10,000 ft²
- **Number of Floors:** 3
- **Vintage:** 1982
- **Building Type:** Office
- **Web app assists with geometry extraction**
An Expert System to Create Baseline Models

Enterprise Data Systems

JSON Description

OpenStudio Expert Modeling System

HVAC System and Constructions Generated by Knowledge Base

Weather Data

Building Geometry

Loads Prescribed by Building Type

- OpenOffice: 30%
- Conference: 15%
- Restroom: 15%
- Break: 15%
- Mechanical: 10%
- Corridor: 5%
- Stair: 5%
- IT_Room: 5%
- Lobby: 5%
- Footprint: 2%
- Winds: 2%
- Roof: 2%
- Wall: 2%

- folks
- lights
- plug loads
- ventilation
- cooling equipment
- distribution equipment
- heating equipment
- walls
- roofs
- floors
- windows
- footprint
- stories
- glazing percentage

Auto-Generated Model
Key Goals

- **Reduce cost** of investment-grade, level 3 audits below current cost of level 1 or 2
- **Produce higher quality, more consistent** audits with **greater residual value**
  - Not simply a report that prescribes actions and quantifies savings
  - Data and models aggregate and can be reused for further cost reduction in EISA 2007 compliance, portfolio assessment, etc.

http://simuwatt.com/rd100.html
simuwatt Software Guided Workflow

- Comprehensive workflow is modeled after NREL Deployment’s proven methodology
- UI design guided with input from industry professionals
simuwatt Software Guided Workflow

- Workflow includes space-by-space load assignment, scheduling, HVAC system specification, photo logging, note taking, and more
- Component definitions pulled from BCL
simuwatt EE™: Using OpenStudio & BCL to Redefine Audits

Automatically Generated OpenStudio Model Geometry

Simulated End Uses in OpenStudio Application

Component Data Pulled From BCL

Highly Efficient Software Guided Workflow