

Development and Deployment of EnergyPlus in Support of the CA Energy Efficiency Strategic Plan

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EnergyPlus

- Low energy design: natural ventilation, radiant cooling ...
- Accurate treatment of thermal mass and unmet loads
- Sub-hourly time-step, e.g. 15 min
- Operations: connect to building control system
- Free, transparent, open source
- Continues to be developed by DOE in response to stakeholder needs
- Key role in Title-24: reference tool for compliance and analysis

Simergy Project

Goal: develop a free Graphical User Interface that enables EnergyPlus to be used more easily and effectively by building designers and other professionals

Public/private partnership: collaborative development and derivative works

Funders: US DOE, California Energy Commission, Infosys Technologies, Trane and Hydro-Quebec

Team includes: LBNL, Infosys, Digital Alchemy, Trane, Hydro-Quebec, Arup, HOK, SOM, GARD, Taylor Engineering

Strong interest from major A&E's; also aimed at small firms

Simergy CA Applications

- T-24 analysis
- T-24 compliance
- Savings by Design – EE program rules
- Retrofit analysis
- ZNE pilots – next generation design analysis tool
- Future 'potentials' studies, DEER updates
- ...

Simergy Features

- Four input methods for building geometry:
 - IFC from CAD/BIM (ISO Standard, National BIM standard)
 - gbXML from CAD/BIM
 - Freeform or trace over 2-D dxf or dwg and extrude vertically
 - Stereotypical shapes
- Drag and drop, component-based HVAC schematic editor
- Extensive templates and libraries – edit → innovative systems
- IP and SI units
- Wide range of standard reports
- Interactive visualization of detailed output

Features defined in user requirements workshops by A&E's

Simergy – Geometry Import from CAD

The screenshot displays the Simergy software interface, which is used for building simulation and design. The main window is divided into several sections:

- Top Menu Bar:** Includes File, Design Alternatives, Site, Buildings, Systems, Simulate, Reports, Results Visualization, Libraries, and Template.
- Import/Export Panel:** Contains buttons for Import, Export, Create/Edit Bldg Stories, Create/Edit Zone, and Zone Grouping.
- Active Project Model:** Shows a 3D perspective view of a building model on a grid. The left sidebar lists the project structure, including Design Alternative - Baseline Design, Site: Autogenerated building site, Buildings, Building Systems, Site Power Demand, Site Power Generation, Adjacent Sites, Solar Obstructions, Simulations, and Configurations.
- Create/Edit Building Stories:** A panel for configuring building stories. It includes fields for Building Name (Building - 1), Base Story (1), and Num of Floors (2). It also has tabs for Geometry, Glazing, Custom Glazing, Custom Spaces, and Wall Tools. The Shape Parameters section includes fields for X1, Y1, X2, Y2, X3, and Y3, along with a Rotator. A diagram shows a vertical cross-section of a room with labels for Ceiling Elevation, Space/Thermal Zone, and Floor to Floor Height.
- Main View:** A detailed 2D floor plan of the building. The plan shows a central corridor (CORRIDOR 1stfl) connecting various rooms, including STAIRS 1 and STAIRS 2, multiple ROOM 1stfl units (numbered 5-31), a MEETING RM 1stfl, a LOBBY 1stfl, and a VESTIBULE 1stfl. A legend indicates wall types: Left of Wall, Center of Wall, and Right of Wall.
- Bottom Panel:** Contains a Point field (29.17, 139.51 ft), Snap Type, Grid, Ortho, DWG/DXF, and On buttons. It also includes Location fields for X, Y, Z, and Rotation, along with a Bk Color button.

Simergy – Drag'n'Drop HVAC System Editor

The screenshot displays the Simergy HVAC System Editor interface. The main workspace shows a schematic diagram of an HVAC system with various components like air handlers, filters, coils, and ducts. The left panel shows a tree view of the project structure, including buildings, spatial zones, and HVAC systems. The bottom panel features a table with the following data:

PropertyName	Value	PropertyName2	Value2
Name	Air Loop - 1	Connector List Name	Air Loop 1Connector List
Library.epl		TestModel_6_3_2012.epp	

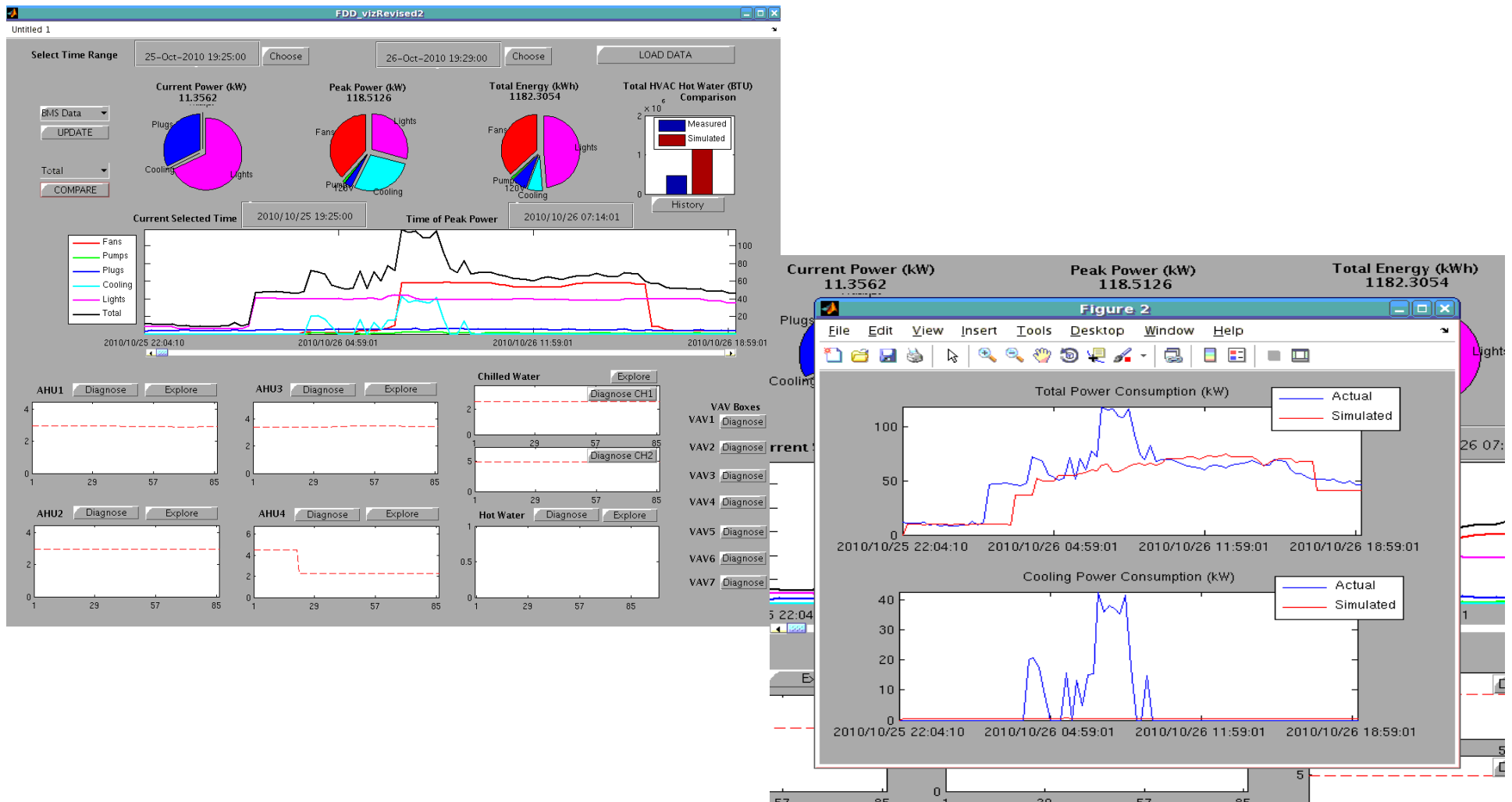
Additional interface elements include a 'Hide Controls' button, a 'Space Boundaries' checkbox, and a 'Show grid' checkbox. The status bar at the bottom indicates '0%' completion and provides navigation options like 'Sim Model View' and 'HvacAir Manage Workspace'.

Beyond Design: Whole Building Performance Monitoring and Fault Detection

- Proof-of-concept at Naval Station Great Lakes
- Real-time EnergyPlus connected to building control system via BACnet
- Solarimeter and sub-metering installed
- Compare simulation and measurements:
 - Whole building electric and gas
 - Lighting
 - Plugs
 - Major HVAC: chillers, large fans
- Set-up: significant differences:
 - Fix the building (R-Cx)
 - Calibrate the model
- Operation: identify and fix new differences → maintain performance
- Next steps: simplify installation, extend to integrated R-Cx, retrofit analysis and commissioning, performance tracking for persistence

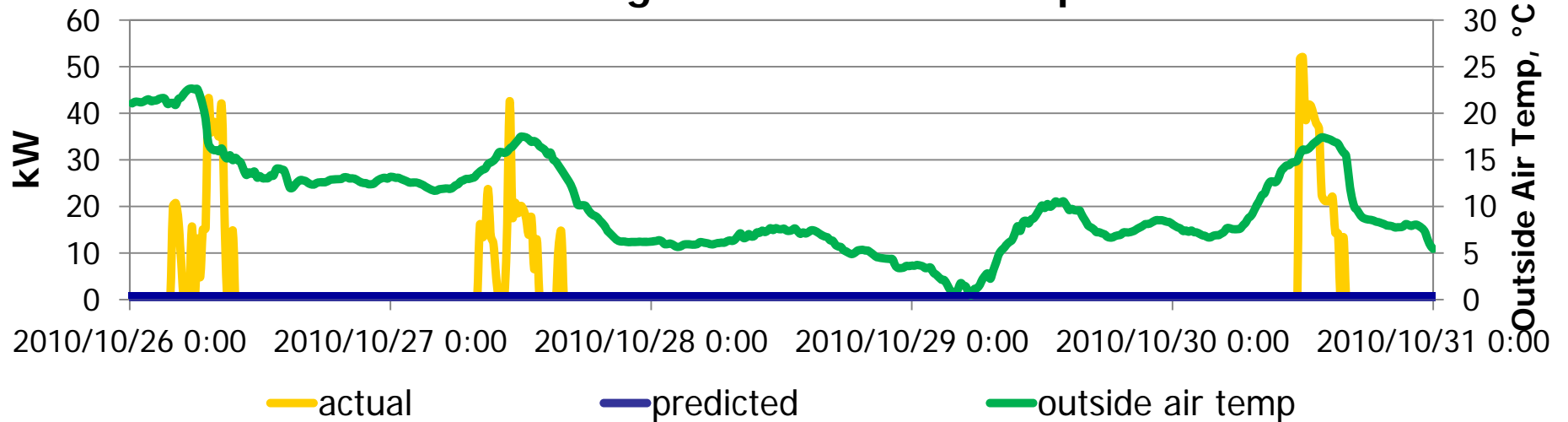


Dashboard

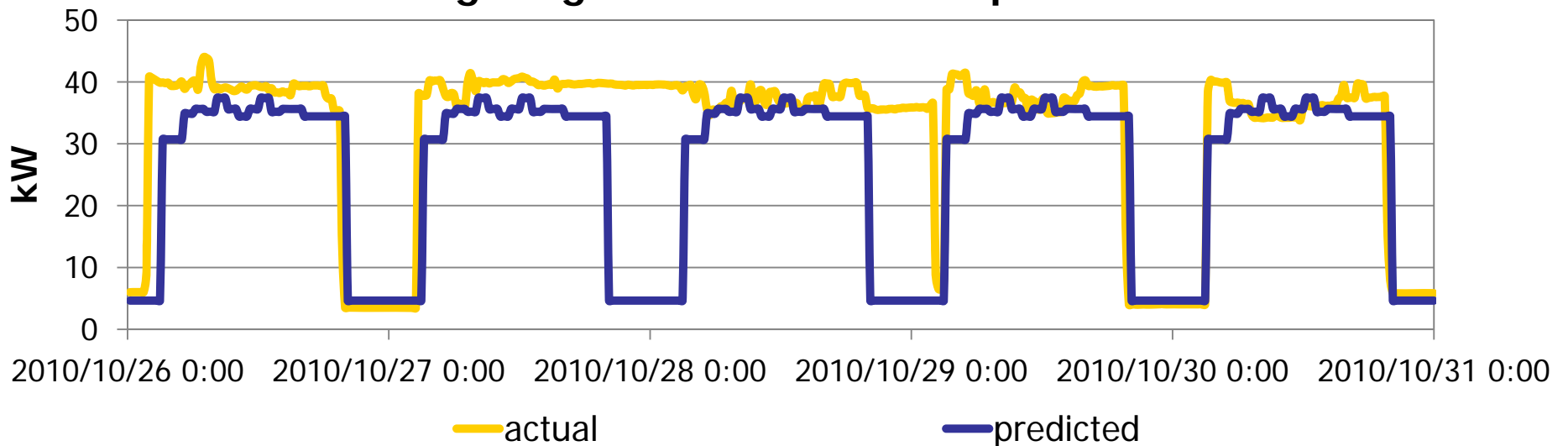


Measured vs Predicted End Uses

Cooling Electric Power Comparison



Lighting Electric Power Comparison



Simergy Next Steps

- Version 0.9 (beta) release September 30, 2012
- Version 1.0 release ~January 2013
- Planned for Version 2:
 - Support for early stage design
 - Automated code compliance – CA Title 24 and ASHRAE 90.1
 - Support for integrated retro-commissioning, retrofit and performance tracking
 - Support for advanced daylighting
- LBNL's Architect/Engineer/Contractor/Owner partnership:
 - Beta testers and early adopters
 - Feedback on new feature needs