

Final Technical Report (FTR)

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Summary

The OpenEfficiency Initiative supported the deployment of federal energy efficiency tools and data standards into energy efficiency programs operated by utilities and local governments, with the goal of reducing the cost and improving the savings performance of whole buildings programs. Over more than three years, the effort supported a range of pilots testing the integration of these tools into a range of energy efficiency program types. The effort also produced a set of open source tools that can be used to support program management.

The project focused on improving energy efficiency program performance using three core strategies:

- Improved connectivity supporting workflow and data integration
- Standardization, automation and credentialing of whole building calculations
- Adoption of data standards

Six pilots that employed the federal tools to support these strategies were conducted. The pilots tested the integration of these tools into existing program models and workflows. The program models supported included mandated city benchmarking, energy audit delivery for public buildings and affordable multifamily housing (2 pilots), commercial new construction, credentialed savings calculations for the installation of Variable Refrigerant Flow systems, and building portfolio customer engagement with local governments. The pilots are described in case studies developed based on interviews of the program managers, conducted by evaluation consultants from the project team.

The project produced open source data tools to support improved program delivery efficiency, collectively called the OpenEfficiency Platform. These tools are available for download on GitHub and via the program webpage at the www.psdconsulting.com website. The tool kit includes a configured and extensible open source hub for connecting the Application Program Interfaces (APIs) of various federal tools with Salesforce, and a Salesforce Managed Package for program reporting and customer contact management. The OpenEfficiency Platform Managed Package utilizes a highly normalized data model that can support a wide range of different energy efficiency program types with tracking, reporting and contact management, and has enhanced features for managing mandates for benchmarking. The API hub helps move data from federal tools (and other data sources) into the OEP Managed Package for use in program management.

The project produced a research report on the barriers confronted and opportunities to improve whole building programs using federal tools and data standards. This report is targeted at energy efficiency program designers and evaluators. In addition, extensive interviews with whole building energy modeling and energy efficiency program stakeholders were conducted. These interviews resulted in two reports, the first focused on the national market for energy modeling, calculation standards and data standards. The second market survey report focused on the unique characteristics and barriers of California utility energy efficiency program market, the largest public investment in energy efficiency programs in the country, and often seen as a market leader. These reports target policy makers and advocates for whole building energy efficiency, looking to increase their understanding of complex issues and to provide strategies for addressing these issues.

Introduction

Whole building commercial programs can be challenging to deliver due to their complexity and scope. A broad suite of federal tools and industry standards can be leveraged to reduce program cost and risk, and to improve scalability. The OpenEfficiency Initiative (OEI) was a DOE funded effort to expand the deployment of federal tools and industry standards into whole building commercial efficiency programs. The Initiative includes supporting pilots in the adoption of federal tools and system integration. In parallel to the pilots OEI is developed an open source data exchange platform. This platform helps to integrate data from the different tools and streamline whole building commercial program management. The challenges are explored in more detail in the project report, “Assessment of Common Barriers to Commercial Whole-Building Energy Efficiency Programs and Potential Solutions”. The pilots addressed: streamlining building modeling, building and performance data integration and management, and program reporting. The tools and standards used in the pilots were:

OpenStudio® / PAT. OpenStudio® is DoE’s free, open-source, commercial whole building energy modeling software (DoE, 2018d). Parametric Analysis Tool (PAT) allows energy modelers to create and run parametric analysis of OpenStudio® with multiple scenarios (DoE, 2018a).

ENERGY STAR Portfolio Manager® (ESPM). The EPA’s ESPM is a free commercial building benchmark website that tracks energy and water consumption (EPA, 2018). ESPM includes both building system and schedule inputs.

Building Energy Asset Score. The DoE’s Building Energy Asset Score (Asset Score) is a free commercial building benchmark website that provides a standardized tool for assessing the physical and structural energy efficiency of commercial and multifamily buildings (EERE, 2018).

Building Energy Asset Score Audit Template. The DoE’s Building Energy Asset Score Audit Template (Audit Template) is a free feature on the Building Energy Asset Score website (DoE, 2018c). The tool is used to collect, store, and report commercial building audit data.

Green Button. The Green Button Connect Alliance has developed Green Button, an industry-led reference standard for utility meter data access and data structure (The Green Button Alliance, 2018). This standard is being adopted by utilities to provide access to customer data.

Energy Design Assistance Program Tracker (EDAPT). EDAPT is a free, open source program management software. It tracks and manages projects, performs automated quality checks of energy model designs, and generates project documentation and reports for commercial buildings (NREL, 2018b). OpenStudio® XML files can be uploaded in EDAPT.

Compass. Compass is PSD’s proprietary program management software (PSD, 2018). It is integrated with OpenStudio®, ESPM, ECAM, MuleSoft, and Salesforce and has file upload and export features. Compass is an example of a proprietary program platform leveraging Federal tools using data exchange.

Salesforce. Salesforce is a proprietary customer relationship management (CRM) tool. It can provide program, reporting, outreach, and interaction management with minimal IT development (Salesforce, 2018). It is commonly used by utilities and program implementers to support demand side management (DSM) programs.

MuleSoft Anypoint Community Edition. MuleSoft’s Anypoint software is a platform for API development and management (MuleSoft, 2018). The MuleSoft Anypoint Community Edition is a free license version of Anypoint.

Standard Energy Efficiency Data (SEED). The DoE’s Standard Energy Efficiency Data Platform™ (SEED) is a free, open source software application that helps organizations match and manage data records for energy performance of large groups of buildings (EERE, 2018).

Building Energy Data Exchange Specification (BEDES). Lawrence Berkeley National Laboratory (LBNL)’s BEDES is a reference standard that provides a taxonomy and dictionary of terms and definitions for building energy efficiency (DoE, 2018b).

Building Sync XML (BSXML). DoE’s Building Sync® is a standard XML schema for commercial building energy audits and can be used to exchange data between tools (NREL, 2018a).

These various tools and standards were supported by the creation and testing of the OpenEfficiency Platform. The platform is an architecture supporting the flow of data between tools and into the Salesforce CRM application.

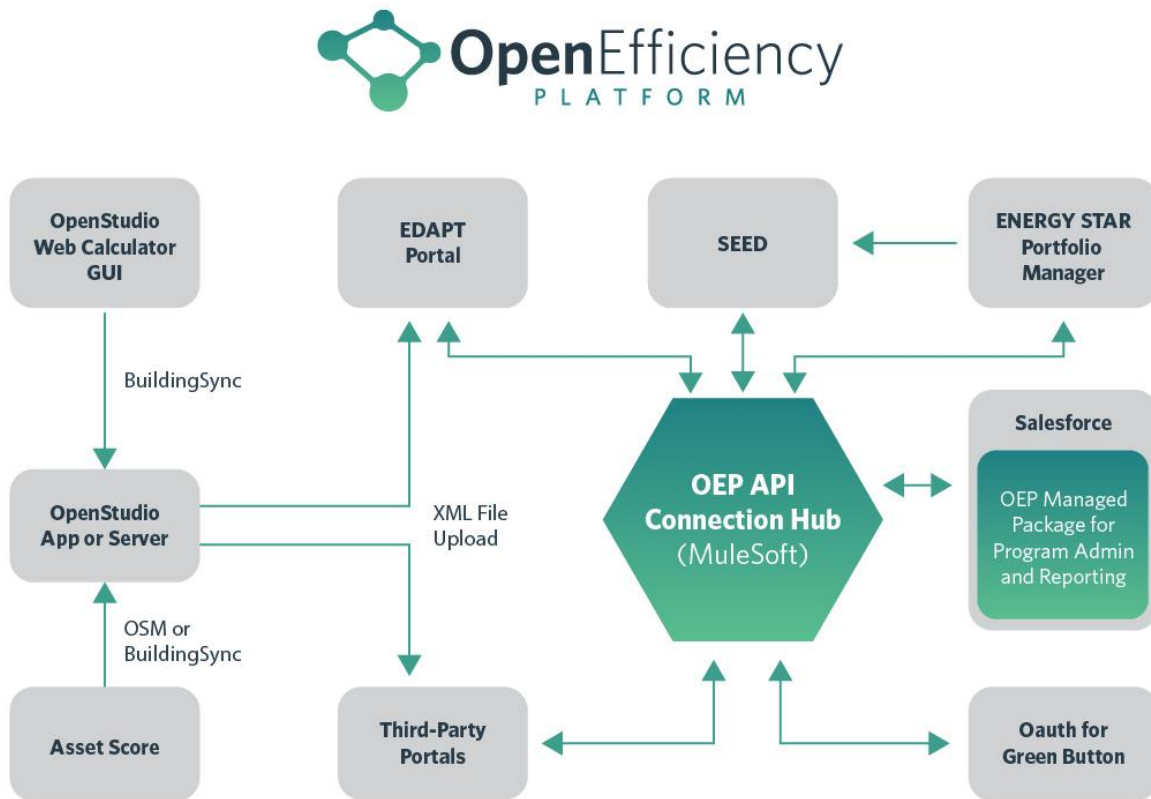


Figure 1: Data flow for the federal tools addressed in the project.

Project Team

The project team was led by Performance Systems Development (PSD). PSD managed the project, developed and supported the pilots, and developed the open source tools. Subcontractors to PSD were:

- Cadmus – Providing research and report development and pilot evaluation.
- SKEE (Steve Kromer) – Providing industry survey, support for EnergyPlus adoption in California and pilot evaluation.
- National Renewable Energy Lab (NREL) – Providing support for EDAPT tool enhancements, SEED and Mulesoft Anypoint Community Edition dockerization, interface development for OpenStudio based calculations.

Project Pilot Partners supported the various pilots with co-funding and direct support to PSD. Project Pilot Partners were:

- The Energy Coalition (TEC) – Based in Southern California, TEC contributed the majority of the cofunding for project across several efforts that evolved over the course of the project. These efforts included testing of the Building Energy Asset Score (in combination with ENERGY STAR Portfolio Manager) as a reduced cost energy audit approach (working with Los Angeles County), and the development of portfolio engagement tools for public buildings using ENERGY STAR Portfolio Manager, monthly utility energy data and interval data obtained via Green Button Connect.
- Los Angeles County – The Southern California Regional Energy Network (SoCalREN) provided funding support for the work with TEC.
- Xcel Energy – The Energy Design Assistance for commercial new construction program at Xcel Energy in Colorado used the NREL EDAPT program portal in combination with the EnergyPlus/OpenStudio energy modeling tools. Xcel Energy implemented the OEP Managed Package and worked to connect the EDAPT platform to Salesforce without the integration hub.
- Vermont Energy Investment Corp. (VEIC) – Working with PSD, VEIC developed standardized automated simulation calculations for the determination of credentialed energy savings supporting their work in Vermont, Illinois, New York, and Washington DC. The VEIC subsidiary, Commons Energy, tested the combination of Building Energy Asset Score and ENERGY STAR Portfolio Manager as an audit approach for the performance contracting services offered to affordable housing and public sector buildings.
- City of San Francisco – A late addition to the pilots, the City piloted the data hub and OEP Managed Package to reduce the effort associated with the administration of their benchmarking mandate.

Two other utility partners participated as observers, Philadelphia Gas Works and PECO.

Methodology

The project originally intended to develop the API data hub and then test the data hub's ability to expand use of federal tools in the pilots. Delays in project funding approval meant that the majority of planned project cofunding was no longer available. In order to obtain the DOE required cofunding, the order of events in the project were adjusted, starting some of the pilots testing use of the federal tools prior to development of the data hub. This shift in timing ended up being an advantage as tools that were not envisioned at the start of the project were subsequently developed. The development of the OpenEfficiency Platform Salesforce Managed Package created significant value for the project

participants able to make use of this tool. Adoption of the OEP Managed Package outside the Project Pilot Partners has already started.

The scope for the project was extended as part of the Budget Period 3 approval. The OEP Managed Package was extended to support the benchmarking mandate use case and the data hub was extended to integrate with the SEED benchmarking data management platform. These efforts were able to be accomplished within a relatively constrained timeline because they were implemented as extensions to already developed data hub and OEP Managed Package.

After the delay in project startup, The Energy Coalition and Los Angeles County were instrumental to providing the required cofunding for the project. The training and tools implemented in the pilot phases have supported significant expansion of the TEC services offering and the development of new tools and services continues to expand past the pilot period.

In parallel to the pilots, Cadmus researched whole building barriers and opportunities for the federal tools and standards to be used, resulting in their project report. SKEE also undertook a national survey of stakeholders in whole building programs, resulting in two reports. After the close of the pilots in late 2018, Cadmus and SKEE undertook extensive interviews of the pilot participants and produced case study reports. PSD has made the open source tools available on the Github platform.

Accomplishments

The goal of the OpenEfficiency Initiative (OEI) was to increase the range and depth of energy savings from whole building commercial energy efficiency (EE) programs through reduced program administrative costs and better alignment of program operations with private-sector market experience. The effort proposed to accomplish this goal by focusing on the following objectives:

- Design an open source platform to support commercial EE programs by integrating an expanding range of Department of Energy (DOE) developed tools.
- Address barriers which Program Administrators (PAs) experience as they reach energy savings opportunity plateaus through traditional program design.
- Reduce owner costs to program participation through data and process standardization and alignment of EE programs with private sector energy services and finance.
- Integrate savings prediction and automated measurement of savings for cost effective Measurement & Verification of real energy savings.

The pilots were to impact over 300 buildings and reach customers in multiple states through five pilots. Other key project milestones were:

- The development of the open source platform to support whole building energy efficiency program management
- An assessment of barriers encountered by whole building programs and potential solutions
- A market survey of whole building program stakeholders
- An evaluation of the project pilots
- A final paper and presentation

All these goals and milestones were met including impacting thousands of buildings, across three states in six pilots.

The OpenEfficiency Initiative project team engaged in four core activities:

1. Support for the development and implementation of the project pilots
2. Development of the open source platform tools and associated documentation.
3. Development of documentation resources including presentations and papers
4. Broad market and targeted efforts to support adoption of the federal tools and standards by program administrators

Pilot Descriptions

Because of the timing issues described in the Methodology section of this reports, the early pilots focused on testing the use of the federal tools in whole building energy efficiency programs. The later pilots made more use of the platform, after it was developed. The following pilot descriptions are ordered by date of initiation.

SoCalREN: Testing of the Integration of Building Energy Asset Score with Portfolio Manager

The first pilot effort focused on PSD providing training on the Building Energy Asset Score and the Audit Template to The Energy Coalition and their energy audit contractors. The project was approved by and funding supplied by Los Angeles County, the program administrator for the Southern California Regional Energy Network. Data on 13 public buildings was collected using these tools and ENERGY STAR Portfolio Manager. This effort was also the first field test for the Audit Template. PSD worked with this data to transform the OpenStudio/Energy plus files produced by the Asset Score into credentialed calculations that would be suitable for submission for review for incentive award to a custom measure program. The resulting data was used to test the combination of the Asset Score with the ENERGY STAR Portfolio Manager score in a quadrant analysis to help building owners develop an investment strategy. The combined score approach was promoted at various conferences and as part of OpenEfficiency Initiative project outreach.

Impacts from this pilot include:

- Subsequent further testing of the combined score approach by Pacific Northwest National Lab working with the City of Portland, OR.
- An audit contractor trained in the pilot, kW Engineering, implemented the BuildingSync schema into their internal database.
- The Energy Coalition began testing using Asset Score as a project screening tool in their audit process.
- PSD developed a better understanding of the limitations of applying the Asset Score generated building zoning to individual efficiency projects.

The Energy Coalition: Data Integration Supporting the Ongoing Evolution of Data Analytics

This pilot was the longest lasting and largest of the six pilot projects. The project focused on leveraging data for portfolio reporting and management. It integrated data from a variety of sources including portfolio wide meter billing data obtained from the local utility, ENERGY STAR Portfolio Manager data, and interval meter data obtained from Green Button Connect. The data was integrated into a portal which was integrated with Salesforce. The pilot has evolved as more data became available and as program opportunities developed. This data has been used to create portfolio wide reports that encompassed thousands of meters and hundreds of buildings per report. Each report contains all the

utility meters associated with an individual local government or agency, assigned to buildings. In all, tens of thousands of buildings were impacted by this pilot.

TEC is now supporting a Pay for Performance pilot using the data integrations and workflows developed in the pilot, integrating in the ECAM spreadsheet for measurement and verification of performance. The addition of the Green Button Connect obtained meter data has provided TEC to 15 minute interval meter usage data updated daily. The Open Authorization (OAuth 2.0) connection, used to authenticate the city account holder to the utility was included in the open source data hub.

Impacts from this pilot include:

- Development of strategies for prioritization of usage data coming from different sources at different times.
- Development of SEED use cases
- Spreadsheet upload of utility data for thousands of meters
- Integration with ENERGY STAR Portfolio Manager
- OAuth 2.0 authorization for Green Button Connect
- Integration with Salesforce
- Portfolio and building targeting reporting and building reporting

TEC also worked with PSD and SKEE to support credentialing of EnergyPlus based calculations within the California Public Utility Commission regulated energy efficiency programs. This included the development by SKEE of a report analyzing the issues impacting whole building energy modeling in California. The draft of this report has been circulated to critical parties; including state agencies and regulatory staff, program administrators and key evaluation firms; receiving a very positive reception. The draft report contains a wealth of information on existing programs and background on how the current situation came to be. In April 2019, Southern California Edison agreed to submit an OpenStudio created EnergyPlus simulation to the CPUC custom measure review team. This will open up many more opportunities for EnergyPlus adoption within utility programs in California.

There is already sufficient interest from CalTF that they have scheduled multiple meetings on the general topic of unifying the modeling and data environment in California. They have scheduled a charrette for later this spring and invited the author to facilitate discussion. Others have asked to be placed on the distribution list for the completed report. IBPSA has retained a consultant to scope a further study the use of modeling in utility programs and will be using the report to support this effort.

[Commons Energy: Reducing the Cost and Improving the Effectiveness of Energy Audits](#)

The Commons Energy Pilot was the smallest of the pilots. This effort built on the project work done in Southern California to test the use of the Building Energy Asset Score in combination with ENERGY STAR Portfolio Manager. Commons Energy is a public benefit energy service company serving affordable housing and local government owned public buildings and a subsidiary of the Vermont Energy Investment Corporation (VEIC). The Commons Energy workflow starts with a low-cost audit used to help sell the building owner on an investment grade audit. The project pilot focused on evaluating how effective the Asset Score and Portfolio Manager could be as the initial audit with the OpenStudio/EnergyPlus model extracted from the Asset Score being used to develop savings for an investment grade audit. The project provided training and support for integrating data from the audit and Portfolio Manager into the Asset Score extracted OpenStudio model.

Impacts

- After an initial assessment that the process was not a good fit, Commons Energy is again looking at using the Asset Score.

Vermont Energy Investment Corp (VEIC): Standardizing and Automating Whole Building VRF Calculations

VEIC works in a range of states where they either control or influence the standards for calculations. PSD worked with VEIC to use OpenStudio to develop standardized scripted EnergyPlus based calculation of savings for Variable Refrigerant Flow heat pump systems in combination with Direct Outside Air System ventilation. These calculations were subsequently used to support incentive programs in Vermont and in the District of Columbia. VEIC also supported the introduction of these standardized simulation calculations into the Illinois Technical Resource Manual. VEIC also used the calculations to support a statewide potential study on VRF technology for NYSERDA.

PSD was able to work with NREL to use the calculation scripts, specified by VEIC and implemented by PSD, to develop a simplified input interface for the data required by these scripts. This interface can be accessed via web browser, demonstrating the web server based delivery of complex simulation calculations using a simplified interface suitable for data entry by a contractor. The calculations use scripts to build detail into an OpenStudio prototype model. These prototype models could be defined similar to the prototype models that support “Partially Deemed” calculations in Technical Reference Manuals (TRM) used around the country. PSD uses the term “Dynamically Deemed” calculations to describe how these simulation based calculations relate to the current TRM based calculations. These calculations can also support the submission of standard data files such as BuildingSync XML and Home Performance XML as the data input to the calculations. These calculators also produce an XML output that can be fed into the OpenEfficiency Platform for incentive tracking.

Impacts:

- VEIC was able to use the automated calculations to support program planning and
- After review of results in comparison to eQUEST models, VEIC was able to gain adoption of the OpenStudio automated EnergyPlus calculations into the Illinois TRM.
- VEIC has been able to use the calculations to support the District of Columbia Sustainable Energy Utility, operated by VEIC.
- VEIC has used the automated calculations to conduct a statewide study of commercial heat potential for NYSERDA. The report cited the contributions of the OpenEfficiency Initiative.
- PSD has been funded to present results of EnergyPlus calculations for heat pump systems to the New York Department of Public Service staff and at the national Home Performance Conference.
- The NEEP 2019 EM&V Forum will feature a PSD presentation on Dynamically Deemed Calculations.
- NYSERDA has funded development of a specification for a residential version of the calculator to support heat pumps installed in combination with envelope improvements.

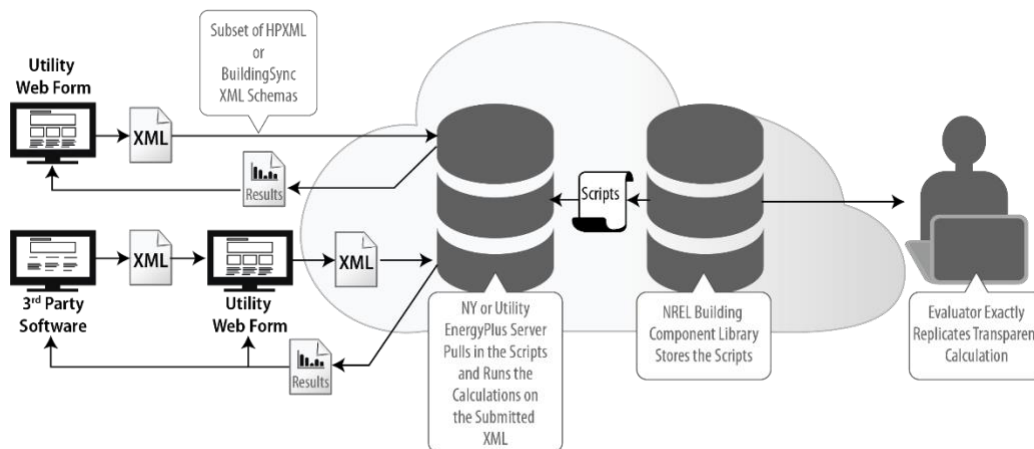


Figure 2: Server based OpenStudio calculations supporting multiple utilities or programs with transparent calculations.

Xcel Energy: EDAPT to Managed Package

Xcel Energy started the project with the most experience with the federal tools, already having adopted OpenStudio and the EDAPT platform as part of their Energy Design Assistance commercial new construction program. Other factors emerged that slowed the pilot. These included the reluctance of the Xcel Energy IT staff to adopt the Mulesoft Anypoint Platform and PSD’s timing in the development of the extended features of Managed Package. PSD had developed a simplified version of the OEP Managed Package to support Xcel Energy focused on the EDAPT data fields. As the project moved forward, PSD began adding more data elements and features to the OEP Managed Package. Xcel Energy was able to install the enhanced version of the OEP and began work on automating the data flow between Salesforce and EDAPT. In the absence of the OEP data hub (Mulesoft AnyPoint Community Edition), Xcel Energy struggled with the data connection. The OEP Managed Package was able to work in the absence of this connection using imported data, but with less automation.

Impacts:

- Xcel Energy’s reporting process simplified and errors were reduced
- The value of the Mulesoft Anypoint connection to the OEP Managed Package was reinforced by the issues encountered by Xcel Energy in making a direct connection between the Managed Package and EDAPT.
- Xcel Energy is examining options to extend portal to Salesforce model to other program types. Having more than one program supported by the data hub may be key to getting utility IT approval.

City of San Francisco: Cities Adding a CRM to SEED using the Managed Package

The pilot with the City of San Francisco was added at the start of Budget Period 3. The City had developed a Salesforce customization to support their benchmarking mandate. The City staff were managing data in the SEED database platform but without an automated connection to Salesforce, repeated manual data transfers were taking up too much time. Working with TEC, PSD had previously developed a SEED based use case. The pilot focused on replicating the functionality of the City of San Francisco’s Salesforce customization into the OpenEfficiency Platform Managed Package, and adding the

required data into the OEP data hub Mulesoft configuration and connecting the hub to SEED. NREL provided support for the SEED aspects of the project and supported the simplified deployment of the Mulesoft data hub. LBNL supported the hosting of the data hub with their instance of SEED, currently being used by the City of San Francisco. The City of Berkeley also used the LBNL SEED instance and was able to deploy the OEP Managed Package and the SEED to Salesforce connection outside of the pilot project. The Institute for Market Transformation hosted a national webinar on the project for cities around the country with more than 20 cities attending.

Impacts:

- San Francisco reports being able to example their number of benchmarked buildings without adding new staff resources.
- The City of Berkeley has adopted the framework with deployment support from City of San Francisco staff.
- The City of San Diego has requested a demo and a quote for support in setting up and hosting the applications (SEED and Mulesoft).
- The City University of New York has begun investigating how the OEP Managed Package and Salesforce to SEED link could help New York City with their efficiency programs.
- The City of San Francisco has begun investigating using the OEP Managed Package to support additional program models.

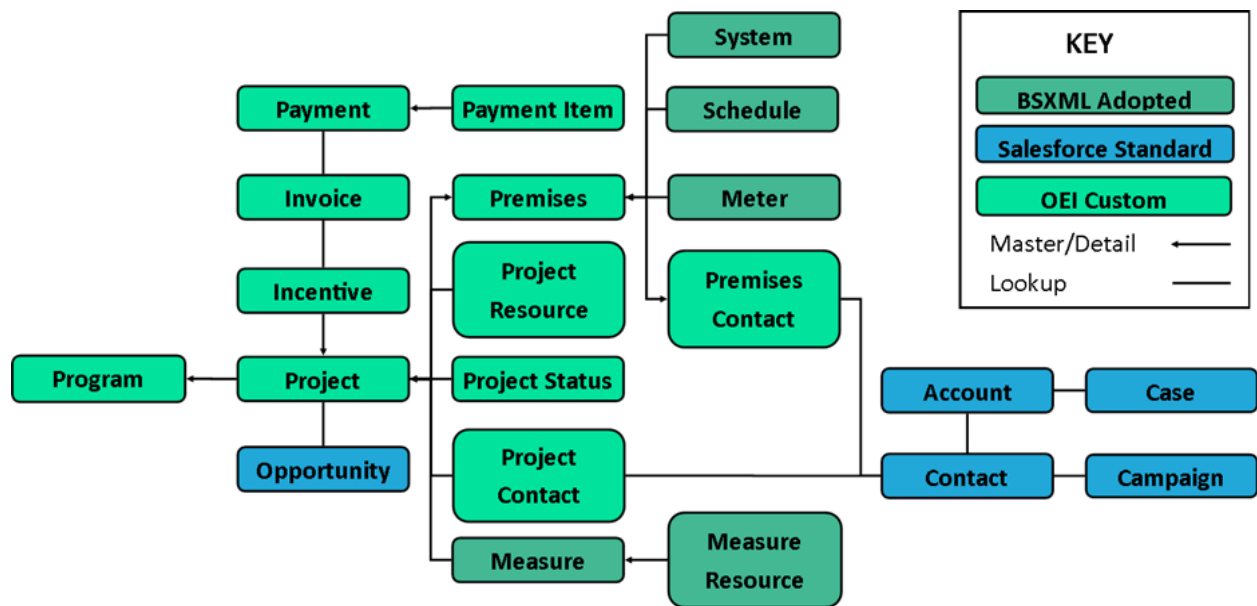


Figure 3. OEP Managed Package Data Model.

Findings

Findings are organized by the key strategies noted in the summary:

1. Improved connectivity supporting workflow and data integration – Tools need to be built that support both the distributed nature of today’s software development and computing, and that help

reduce the cost of moving data between platforms. This is true for connecting federal tools to energy efficiency program workflows as well as for connecting private sector tools.

2. Standardization, automation and credentialing of whole building calculations – The federal tools such as OpenStudio and EnergyPlus provide powerful mechanisms for the standardization and automation of building energy modeling. Energy efficiency programs attempting to impose the use of these tools on individual users (engineers and architects) in the private markets have encountered resistance from users and vendors. A more market friendly alternative is the creation of credentialed server-based simulation calculations that process standardized data submissions that can be produced by tools selected by the market. OpenStudio provides a robust framework for the creation of these credentialed server-based simulations.
3. Adoption of data standards – Broad adoption of data standards, at the taxonomy and schema levels, is key to improving connectivity and to automation of calculations.

Suggestions for Future Research and Development

There continue to be barriers for the credentialing by states and utilities of the energy and demand savings produced by the EnergyPlus simulation engine and OpenStudio simulation management platform. There is wide adoption of the free eQUEST energy modeling using the DOE2 physics engine by the energy modelers supporting commercial new construction programs and by the utility energy program evaluation community. It is difficult to gain acceptance to shift these influencers to a new modeling platform, regardless of the power and accuracy of the new system. Issues of trust in a new simulation engine and platform (mostly due to lack of access to information at the appropriate technical level for policy makers) and the consequences of shifts in savings results relative to historical reported savings are both significant problems. *Research comparing the results of these tools and the development mechanisms for reconciling those differences will be important to increasing trust and driving faster adoption.*

Benefits of adopting these modeling tools need to be further quantified. The key benefits identified in the project pilots and research include automation of simplified input simulations to calculate savings for measures such as heat pumps, packages of heat pumps and envelope measures, and controls. Interest in these measures is being driven by electrification and grid modernization. PSD has been funded to examine the shortfalls of the New York State Technical Reference Manual (NYS TRM) in supporting electrification and grid modernization by the E4TheFuture Foundation. This work is building on the lessons learned from the OpenEfficiency Initiative. This research is increasing understanding lack of accuracy, especially relative to demand impacts, in the deemed and partially deemed equations currently used by many energy efficiency programs for simple measure level calculations. *Additional research is needed on appropriately credentialing the time and location specific demand impacts available from simulations for use in non-wires grid modernization alternatives and in load management of electrification efforts.*

Mechanisms exist in many TRM's for the building by building approval of bespoke simulation models. These individually credentialed models require specific expertise to successfully build, are expensive to create, and expensive to review. These constraints pose a serious limit on the adoption of whole building simulation in utility programs. Simplified input whole building simulations, such as those demonstrated in the OpenEfficiency Initiative, can reduce the cost of obtaining a credentialed simulation by an order of magnitude. *Further research is needed to develop credentialed methodologies*

for the simplification of simulation inputs across a range of energy efficiency and load management measure types.

Data standardization for commercial energy efficiency retrofits is also an area for further research. As identified in project reports, there are several schemas currently serving commercial building programs, primarily in new construction. These include gbXML (exported from various architectural tools and simulations), SDD XML (using in code compliance in California), BuildingSync XML (primarily being adapted for use in audit reporting), EDAPT XML (used to report OpenStudio modeling results into the EDAPT portal). The development of simplified simulations opens the possibility of using these inputs or some combination of inputs to drive standardized credentialed energy calculations for energy efficiency programs. In the residential sector the development of EnergyPlus/OpenStudio technology stacks to support processing of Home Performance XML (HPXML) data files is already occurring. PSD is currently working with NREL to support validation and expansion of the BuildingSync schema and with major software vendor using the gbXML schema to drive EnergyPlus modeling via OpenStudio. *Further research is necessary to determine if the flexibility available in the current schemas is adequate to support automated calculation.*

The open source OpenEfficiency Platform Managed Package is an easy way to add robust program management tools into the Salesforce product. The framework to connect the Salesforce Managed Package to external data sources, such as SEED, is already provided by the Mulesoft Anypoint Community Edition configuration developed by the OpenEfficiency Initiative. *Continued development of OEP Managed Package and data hub could significantly reduce the cost for entities such as cities, small municipal utilities, rural electric cooperatives and community choice aggregators to set up and manage energy efficiency programs.*

Products and Publications Developed:

The following resources were developed under the current project:

Project Research Documents		
	Whole Building Program Barriers and Opportunities Report	Report by Cadmus with support from PSD, NREL and SKEE. Target audiences are the designers and evaluators of whole building programs.
	CA Market Survey and Strategy Report	Report by SKEE assessing the use of whole building energy models in California, a complex regulatory environment.
	National Market Survey and Strategy Report	Report by SKEE on interviews with a diverse group of energy modeling stakeholders, along with recommendation for expanding adoption of modeling.
	SoCalREN Pilot Case Study	Description of the first pilot in the project.
	TEC Pilot Case Study and Evaluation Report	Description and interview based evaluation of the TEC pilot activity by SKEE.
	SF Case Study and Evaluation Report	Description and interview based evaluation of the San Francisco pilot by SKEE.
	VEIC Case Study and Evaluation Report	Description and interview based evaluation of the VEIC pilot by Cadmus.

	Commons Energy Case Study and Evaluation Report	Description and interview based evaluation of the Commons Energy pilot by Cadmus
	Xcel Energy Case Study and Evaluation Report	Description and interview based evaluation of the Xcel Energy pilot by Cadmus.
	ACEEE Summer Study Paper and Presentation	Peer reviewed paper and presentation for the 2018 ACEEE Summer study.
	Final Summary Report (this document)	
Software Related Documents		
	OEP Github site including help text, guides, use case, and examples	https://github.com/OpenEfficiencyPlatform/OEP
	Benchmarking User Case Guide	https://github.com/OpenEfficiencyPlatform/OEP/blob/master/SEED%20Benchmark/guides/OEP%20Benchmark%20Implementation%20Guide.docx
	Benchmarking Implementation Guide	https://github.com/OpenEfficiencyPlatform/OEP/blob/master/SEED%20Benchmark/guides/OEP%20Benchmark%20User%20Guide.docx
IT		
	Salesforce Managed Package	https://github.com/OpenEfficiencyPlatform/OEP/tree/master/Salesforce%20Package
	Mule Configuration Module for SEED to Salesforce Benchmark Use Case	https://github.com/OpenEfficiencyPlatform/OEP/tree/master/SEED%20Benchmark/mulesoft
	Mule Docker for Benchmark Use Case	https://github.com/OpenEfficiencyPlatform/OEP/tree/master/SEED%20Benchmark/docker
	Mule Configuration module for EDAPT Example	https://github.com/OpenEfficiencyPlatform/OEP/tree/master/EDAPT
	Mule Configuration module for basic ESPM Example	https://github.com/OpenEfficiencyPlatform/OEP/tree/master/ESPM

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