Computer Modeling for Residential Energy Assessments

National Renewable Energy Laboratory
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Project Summary

Timeline:
Start date: 10/1/2016
Planned end date: 9/30/2020

Key Milestones

Key Partners:

| National Association of State Energy Officials | Southface Energy Institute |
| Energy Trust of Oregon | Oregon Department of Energy |
| Earth Advantage | PNNL |
| Vermont Energy Investment Corporation | LBNL |

Budget:

Total Project $ to Date:
- DOE: $100k
- Cost Share: $0

Total Project $:
- DOE: $300k
- Cost Share: $0

Project Outcomes:
Analysis of the Home Energy Score and HERS energy calculation methodology to find a pathway to a common metric.

Updates to the Home Energy Score HPXML API in response to users.
Team

Noel Merket, Research Engineer, NREL
Expertise: Software development, HPXML, Home Energy Score, data analysis

Scott Horowitz, Senior Engineer, NREL
Expertise: Software development, energy modeling, optimization

Leslie Badger, Senior Analyst, Vermont Energy Investment Corporation
Expertise: data analysis, data system administration, program and project management

David Heslam, Executive Director, Earth Advantage
Expertise: Leader in energy labeling, energy auditing researcher, high performance home builder

With additional support from:

- National Association of State Energy Officials
- Southface
- Oregon Department of Energy
- Earth Advantage
- Pacific Northwest National Laboratory
- Berkeley Lab
- Vermont Energy Investment Corporation
- EnergyTrust of Oregon
Challenge

1. Differences in rating/scoring systems’ results causes homeowner confusion and less confidence.

2. Connecting existing software to the Home Energy Score API requires software developer effort to convert building modeling inputs into the required format.
Discover **why** models are giving differing energy predictions.

1. Simulate a sample of homes through Home Energy Score and REM/Rate (a popular HERS rating tool).
2. Compare results by end use, fuel type
3. Use machine learning to **identify characteristics associated with differences in modeling approaches**

**Output:** Technical Report with information on focus areas
Approach: HPXML API

- HPXML is a file format (like docx) that facilitates describing home energy audit data.
- Software vendors are already making the investment to export to HPXML.
- The Home Energy Score HPXML API allows developers to leverage their investment in HPXML to access the scoring tool.
Impact

Comparative Analysis

• The analysis and report provided actionable information to decision makers to move towards a single simulation engine solution for residential energy audits.

HPXML API

• 3 of 6 software vendors using the Home Energy Score API to generate scores use HPXML.
• ~15% of scores are calculated through the HPXML API.
Progress: Comparative Analysis

- **Technical Report published.** Areas of interest include:
  - Natural gas heating in basements
  - Cooling in homes with high window area
  - Lighting and appliance assumptions
  - Heat pump water heaters
Progress: Comparative Analysis

Will migrating HEScore to EnergyPlus change the results?

Energy Plus feasibility study using ResStock sample:

...not much.
Progress: HPXML API

• Released v3.0 to utilize newest version of HPXML and Home Energy Score
  – Includes PV and evaporative coolers.
  – Better installer and continuous integration testing

• Multiple bug fix releases in response to user requests:
  – v3.1: 6/2017
  – v3.1.1: 8/2017
  – v3.1.3: 3/2018
Stakeholder Engagement

The comparative analysis was stakeholder driven from the beginning:

HPXMLE API Software Partners:
Remaining Project Work

Home Energy Score component of OpenStudio/EnergyPlus residential modeling platform

Standard Format
Agreed Upon Common Rulesets
Shared Energy Calculation

Software Applications

- HERS Tools
- HEScore Tools
- WAP Tools

Benefits
- Accelerates new technologies into software tools
- Increases consistency across DOE/industry programs
- Reduces developer effort to use EnergyPlus
- Lowers industry-wide costs of maintaining multiple engines
- Allows private-sector competition around innovations for user interface, business support, etc.
Thank You

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REFERENCE SLIDES
**Project Budget**

**Project Budget:** Through FY18, a lower-level analysis and maintenance budget. In FY19 and forward, a larger budget to implement HEScore in OS/E+

**Variances:** N/A

**Cost to Date:** 80% of FY18 budget spent as planned

**Additional Funding:** N/A

### Budget History

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# Project Plan and Schedule

## Project Schedule

**Project Start:** 10/1/2016  
**Projected End:** TBD

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### Past Work

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### Current/Future Work

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