

# Building Energy Asset Score

**COMMERCIAL BUILDING**  
**ENERGY ASSET SCORE**  
OVERALL BUILDING SCORE

**BUILDING INFORMATION**

Example Building  
2020 A St.  
Chicago, IL 60601

Building Type: Office  
Gross Floor Area: 100,000 ft<sup>2</sup>  
Year Built: 2005

Score Date: 02/21/2013  
Building ID #: XXXXX

COMMERCIAL BUILDING  
**Energy Asset Score**

My Buildings | na.wang@pnnl.gov

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

test2

**USE TYPES**

- Office  
1 block, 100,000.00'
- Retail  
1 block, 40,000.00'

Add Use Type

**Score Building** | Feedback | ?

**1** | Uses MORE Energy

**Current Score: 6**

**Potential Score: 7.5**

**Estimated Savings: 33%**

**10** | Uses LESS Energy

High-Efficiency

Assumed Occupancy and Operating Conditions	Estimated Source Energy Use <sup>1</sup> (aBtu/yr)	Energy Use Intensity by Fuel Type
Number of Assumed Occupants: 500	Current Building: 159	Site Energy Use (aBtu/yr): 44, 48.4
Hours of Operation: 49 hrs/week	Upgraded Building: 107	Source Energy Use (aBtu/yr): 14, 16.1
Cooling Set Point: 75°F		Electricity Gas Fuel Oil
Heating Set Point: 70°F		District Heating District Cooling
Misc. Energy Loads: 0.75 W/ft <sup>2</sup>		

The Commercial Building Energy Asset Score is a national rating system developed by the U.S. Department of Energy. The Score reflects the energy efficiency of a commercial building based on the building's structure, heating, cooling, ventilation, and hot water systems. The building's Structure and Systems are individually modeled and assessed. The Opportunities page provides recommendations for how to improve the building's energy efficiency, increase the building's Asset Score, and save money.

This report is based on self-reported building information. Official scores must be determined by a qualified third-party auditor in accordance with the U.S. Department of Energy's Commercial Building Energy Asset Score (CBEAS) program. Changes affect the estimated source energy that would result from operating at the efficiency improvements identified on the Opportunities page. Actual savings will depend on the actual energy efficiency measures implemented.

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# Project Summary

## Timeline:

Start date: 04/01/2011

Planned end date: Ongoing program

### Key Milestones

1. Audit Template production release for pilot users: 12/15/2017
2. Audit Template adopted by San Francisco: 04/05/2018
3. Asset Score production release with PV: 09/30/2018

## Budget:

### Total Project \$ to Date:

- DOE: \$10.5M
- Cost Share: \$0

### Total Project \$:

- DOE: \$TBD
- Cost Share: \$0

## Key Partners:

New York City
City of San Francisco
City of Atlanta
City of Los Angeles
Institute for Market Transformation (IMT)

## Project Outcome:

- A standardized tool to collect, manage, and report building data (asset, audit, retro-commissioning).
- A credible scoring system for commercial and multi-family buildings that can be used to inform investments and real estate transactions.
- A cost-effective way to quickly evaluate a building's integrated performance and encourage deep retrofits and programs towards the net zero goal.

# Team



**Nora Wang, Ph.D., R.A.;** (*Project lead*)

*A variety of research experience in energy efficiency and sustainability, co-chair and member of several standard committees and working groups for building efficiency rating and labeling*

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**Supriya Goel;** (*technical team lead*)

*EnergyPlus expert, key member of energy codes program, member of SPC 211P committee*

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**Juan Gonzalez Matamoros;** (*OS implementation, large-scale simulation*)

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**Alex Vlachokostas, Ph.D.;** (*Technology research, modeling strategies*)



**Dave Millard;** (*software team lead*)

*System engineer, 30 years of experience in leading software development*

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# Team



**Edward Ellis;** (Database development, FEDS API)

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**Trisha Henriksen; Adriana Cannon;**  
(Front-end software development)

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**Mark Borkum, Ph.D.; Michael Akopov;**  
(BuildingSync XML, Asset Score API)

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**Richard Fowler;** (Software testing and user support)

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**PSD Consulting;** (Help desk)



# Overall Approach

- Create a free Asset Scoring Tool application with simplified data requirements using the EnergyPlus building modeling engine (via OpenStudio).
- Develop a quick and easy way to help unsophisticated building owners or managers to initiate an energy efficiency analysis and provide flexible entry points.
- Provide a standardized report to disaggregate building energy information and identify energy improvement opportunities
- Create a streamlined, flexible workflow to integrate
  - (1) portfolio screening and prioritization (Asset Score Preview),
  - (2) energy audit and reporting (Audit Template), and
  - (3) building simulation and valuation (Asset Score).

# Challenge

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**Opportunity 1:** Increasing number of local jurisdictions are implementing building energy audit ordinances.

**Challenge:**

- No standardized data collection and reporting platform. Data submitted in spreadsheets need intensive review and cleansing.
- Data stored in unstructured database limit their utilization for advanced modeling and analysis.
- Cities have different local requirements and implementation processes.

**Opportunity 2:** Increasing interest and market investment in renewable onsite generation and grid-interactive efficient buildings.

**Challenge:**

- One touchpoint to align with other BTO products.
- Align with other EERE offices' research and guidance.

# Approach: Audit Template

- Leverage Asset Score's existing software capability
  - Standardizing inputs and outputs
  - Automating error checking
  - Verifying required fields
  - Seamless data transfer to other tools
  - Easy access to previously entered audit reports
  - Easy sharing and transferring building records
  - Obtaining Asset Score Report
- Align with new development of industry standard (ASHRAE/ACCA Standard for Commercial Building Energy Audits).

ASHRAE Level 3 Audit Data  
(& energy model)

ASHRAE Level 2 Audit Data

ASHRAE Level 1 Audit Data

Asset Score  
Data

New York City Audit Data

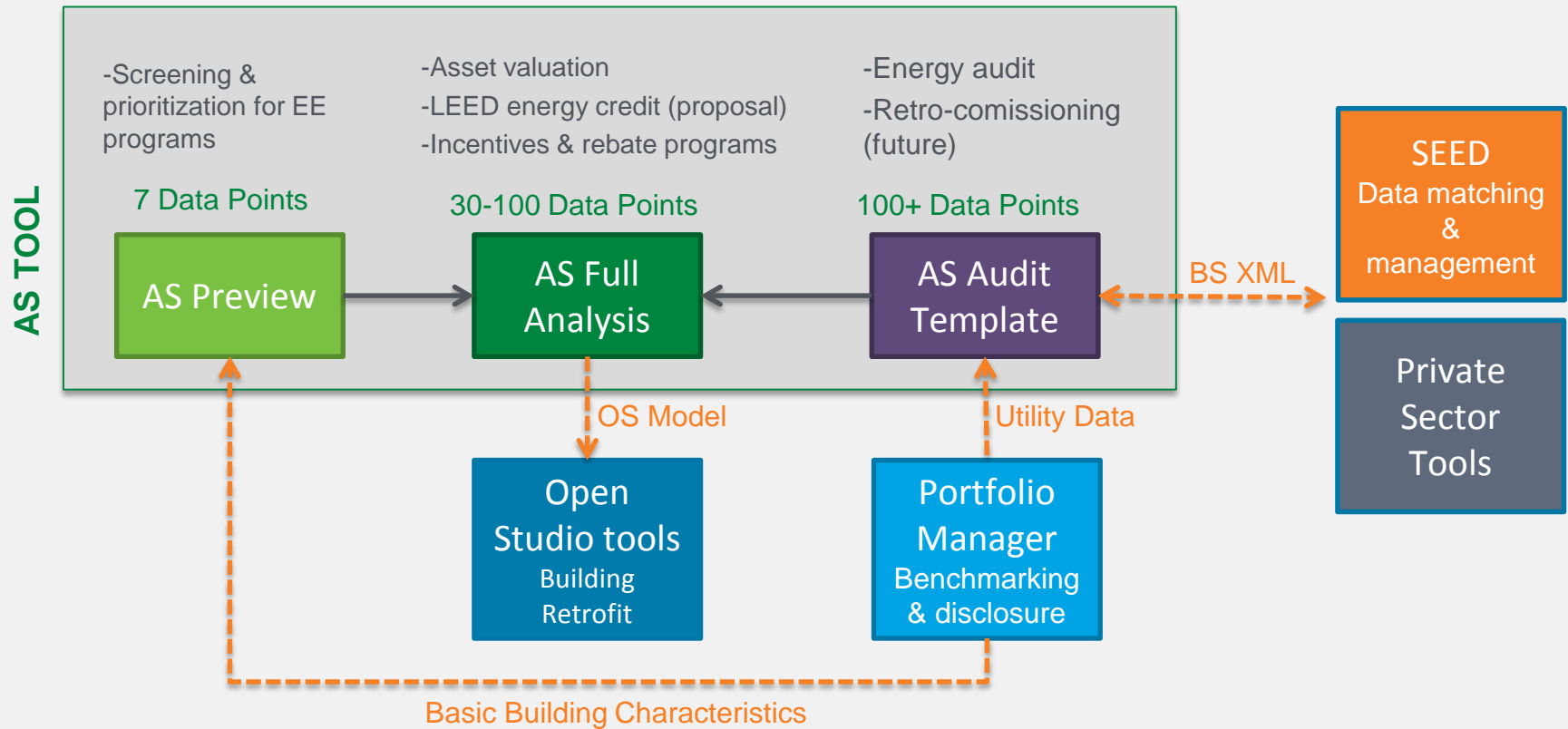
Atlanta Audit Data

San Francisco  
Audit Data

Audit Template Data

# Approach: Audit Template

- Integrate with BTO tool ecosystem and other tools.



OpenStudio

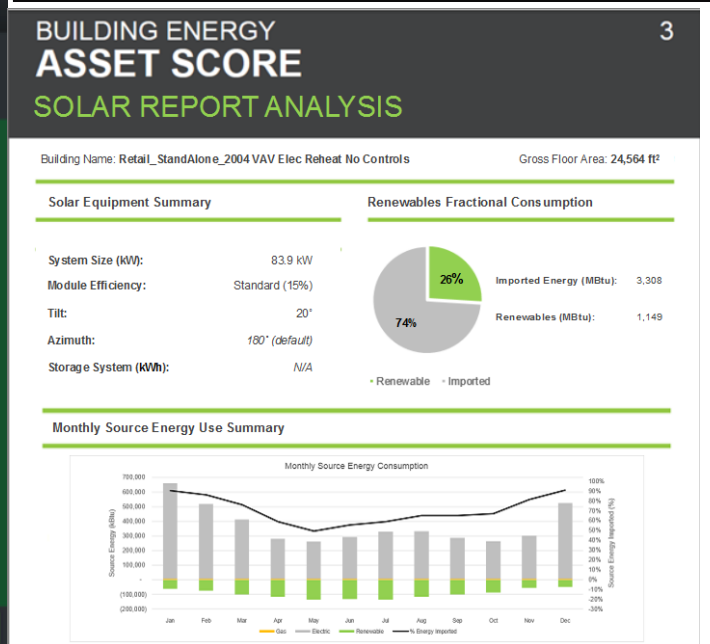
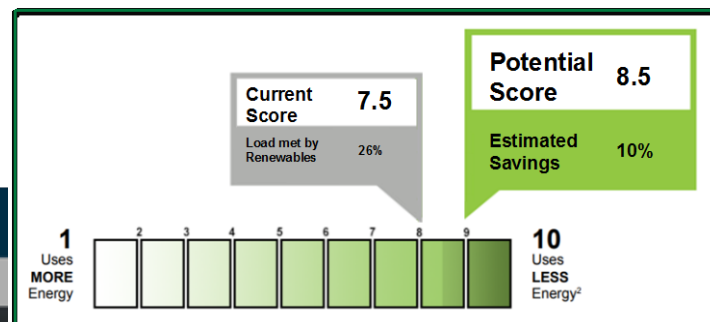
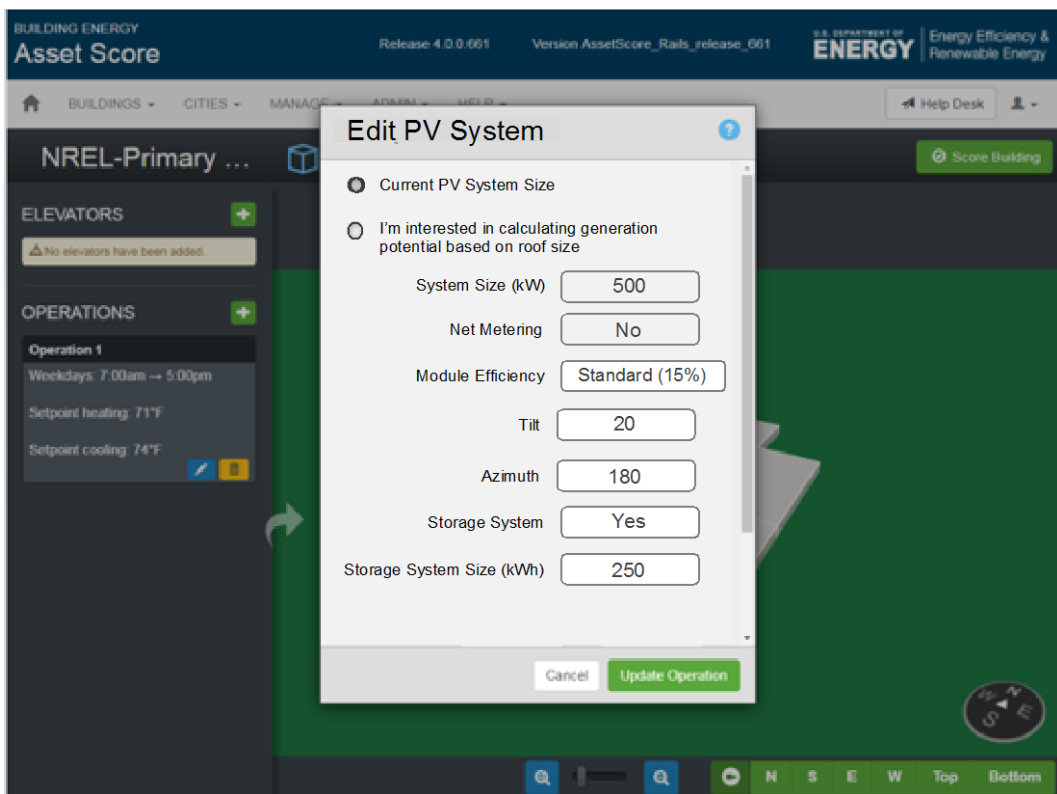


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# Approach: Onsite Renewable Generation

- Determine the appropriate level of data inputs for an accurate assessment while minimizing data collection burden.
- Leverage existing PV calculation tool (PVWatts).



# Impact

- **Near-term (Integration):** Integrate Asset Score suite of tools with existing building energy programs to support drive data-driven decision making for energy-efficiency investments and minimize the administrative burden of managing and exchanging data for effective program implementation.
- **Mid-term (Adoption):** Valuate 5% of total commercial space\*\* (4,350 million ft<sup>2</sup>) and identify 180 TBtu primary energy use savings (assuming 20% on average\*\*\*) and \$1,780 million cost savings.\*
- **Long-term (Transformation):** Asset Score serves as a proxy for energy efficiency in real estate transactions by easing the due diligence process and driving capital investment in high-efficiency building technologies and materials.

**2417** Buildings scored  
**248M** Square feet scored  
**47** States  
**2324** Registered users

As of April 2018

\*According to Energy Information Administration Annual Energy Review 2011. The total energy consumption in the commercial sector estimates for 18,021 TBtu in 2011 (p.40). The total consumer expenditure estimates for energy in the commercial sector is \$178,128 million in 2010 (p.79).

\*\*According to Commercial Buildings Energy Consumption Survey 2012, the total commercial floor space is 87,043 million sq.ft.

\*\*\*Based on the analysis of buildings that have been valuated in Asset Score.

# Progress

- **Audit Template**
  - Completed Audit Template core development.
  - Completed and pilot tested San Francisco and New York City. San Francisco adopted the tool on April 5, 2018. New York City plans to start the training webinar in May.
  - Developing Atlanta and Los Angeles templates.
- **Asset Score Modeling**
  - Developed modeling engine and rating scale for commercial kitchen (food service).
  - Completed modeling strategies exhaust fan (for multifamily) and lower infiltration (for high-performance buildings), DOAS + WLHP, DOAS + VRF.
  - Developed methodology to evaluate buildings with PV.
- **Integration**
  - Developed Unique Building Identification to facilitate data exchange.
  - Released BS XML ingest service.
  - Synchronized with ASHRAE Standard 211 development.
  - Developed HVAC Total System Performance Ratio for energy codes.
  - Supporting city projects: Seattle, Portland, San Francisco.

# Stakeholder Engagement

Closely work with IMT and Cities (New York City, San Francisco, Atlanta, Los Angeles, Berkeley) and their stakeholders in the development and pilot process

- Cities were closely involved in the Audit Template design and development.
- Audit Template was piloted with 10-20 local audit companies in the participating cities for months.
- Real time feedback was collected and incorporated.

## Related/Expanded Projects

- Incorporate “HVAC Total System Performance Ratio (TSPR)” into Asset Score for the Washington State Energy Code (WSEC).
- Support Seattle’s “Tune-up Accelerator” program that provides retro-commissioning service and Asset Score analysis to 300 small commercial buildings (pilot for future legislation).
- Support Portland's pilot study to integrate Asset Score in the building permitting process.
- Collaborate with the BayREN Integrated Commercial Retrofits (BRICR) project to create a tool set piloted by PG&E Energy Watch partners in the City of San Francisco for portfolio scale energy retrofits.

# Remaining Project Work

- **Audit Template**
  - Complete Atlanta and Los Angeles templates and pilot testing
  - Add retro-commissioning and water audit
  - Add ASHRAE Level 1 audit template
  - Migrate NYC energy audit data from past years
- **Asset Score**
  - Release solar hot water, variable refrigerant flow, infiltration, commercial kitchen, and PV
  - Develop model strategies for commercial refrigeration and data center
- **Integration**
  - Add Unique Building Identification to Asset Score and city database

## Beyond FY18

- Add hospitals and laboratories
- Add DOAS + GSHP, Central GSHP, Central WSHP
- Move server to the cloud
- Convert all Audit Template buildings to Asset Score models

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# Thank You

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# REFERENCE SLIDES

# Project Budget

**Project Budget: \$10.5M**

**Cost to Date: Through 3/2018, \$9.7M**

**Additional Funding: Ongoing program**

## Budget History

4/1/2011- FY 2017 (past)		FY 2018 (current)		FY 2019 - TBD (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
\$9M	\$0	\$1.5M		TBD	\$0



# Project Plan and Schedule

Project Schedule												
Project Start: 04/01/2011	Completed Work											
Projected End: TBD	Active Task (in progress work)											
	Milestone/Deliverable (Originally Planned)											
	Milestone/Deliverable (Actual)											
	FY2016				FY2017				FY2018			
Task	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)
<b>Past Work</b>												
Audit Template production release for pilot testing												
Complete model strategies for exhaust fan, infiltration												
<b>Current/Future Work</b>												
Complete model strategies for DOAS + WLHP, DOAS + VRF												
Release additional Audit Template features for cities, ASHRAE level-1, updated ASHRAE template												
Release Baseline Building Sync Integration in Audit Template												
Report UBID pilot results and develop implementation guide												
Quarterly AS tool release of commercial kitchen												
Quarterly AS tool release of solar hot water, variable refrigerant flow, infiltration												
Complete model strategies for commercial refrigeration and updated data center												
Quarterly AS tool release of exhaust fan, data center, PV												
Go/No-Go: UBID feasibility												
Go/No-Go: Data center evaluation												

