



2023 Building Performance Analysis Conference

September 11-13, 2023 | Austin, Texas

SMNR 18 - Modeling Existing Buildings II

BETTER Together

Alex Chapin, PE Software Engineer, NREL

2023 ASHRAE
Annual Conf

Learning Objectives

- 1. Identify the benefits of BETTER and SEED platforms**
2. Identify problems connected to adaptive reuse of an old distillery in terms of energy efficiency, moisture, and thermal comfort
3. Explain the importance of accurately estimating energy use and highlight potential consequence of over or underestimation of energy use
4. Explain how machine learning could be used for energy model calibration

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Acknowledgements

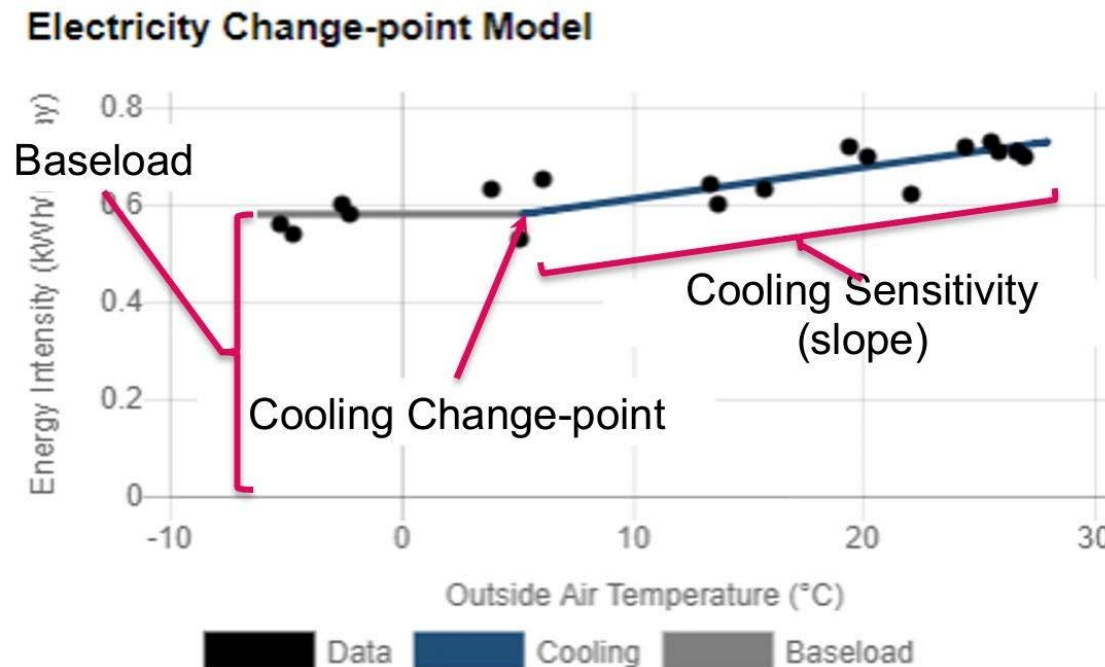
- SEED Team
 - Nicholas Long - National Renewable Energy Laboratory (NREL)
 - Katherine Fleming - NREL
 - Hannah Eslinger - NREL
 - Isabel Langlois-Romero - NREL
 - Alex Swindler - NREL
 - Ross Perry - Department of Energy
 - Robin Mitchell - Lawrence Berkeley National Laboratory (LBNL)
- BETTER Team
 - Han Li - LBNL
 - Carolyn Szum - LBNL
- Note that Alex Chapin is funded by the Department of Energy to develop the SEED Platform

Outline/Agenda

- Describe BETTER and SEED
- Explain benefits of BETTER integration in SEED
- Discuss DC case study

BETTER Analysis

- Building Efficiency Targeting Tool for Energy Retrofits (BETTER)
 - Replaces ASHRAE level 1 audits
 - Streamlines ASHRAE level 2 audits
 - Uses change-point model

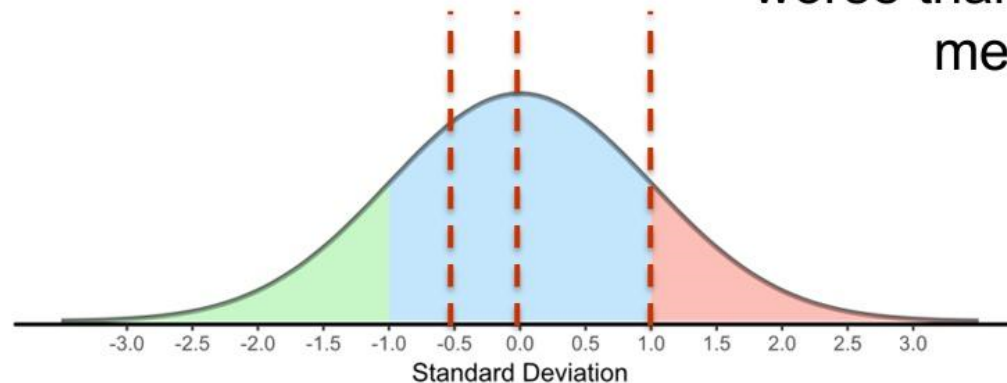


BETTER Analysis

- Energy efficiency target

Aggressive ($\frac{1}{2}$ a standard deviation better than the dataset median)

Conservative (1 standard deviation worse than the dataset median)

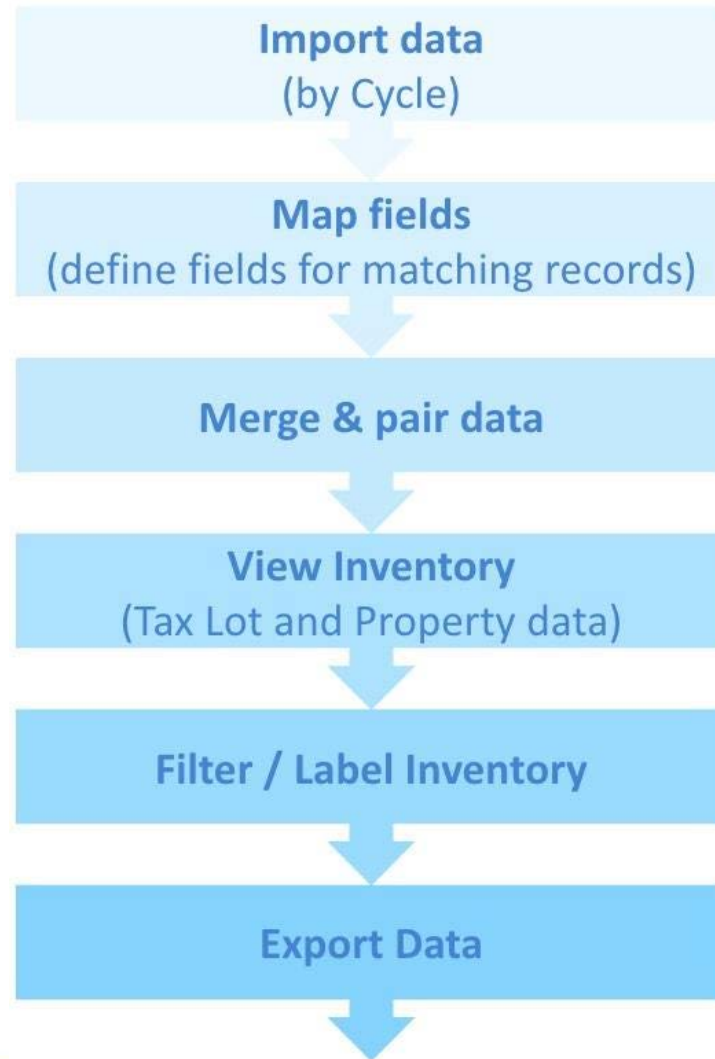


Nominal (equal to the dataset median)

Standard Energy Efficiency Data (SEED) Platform



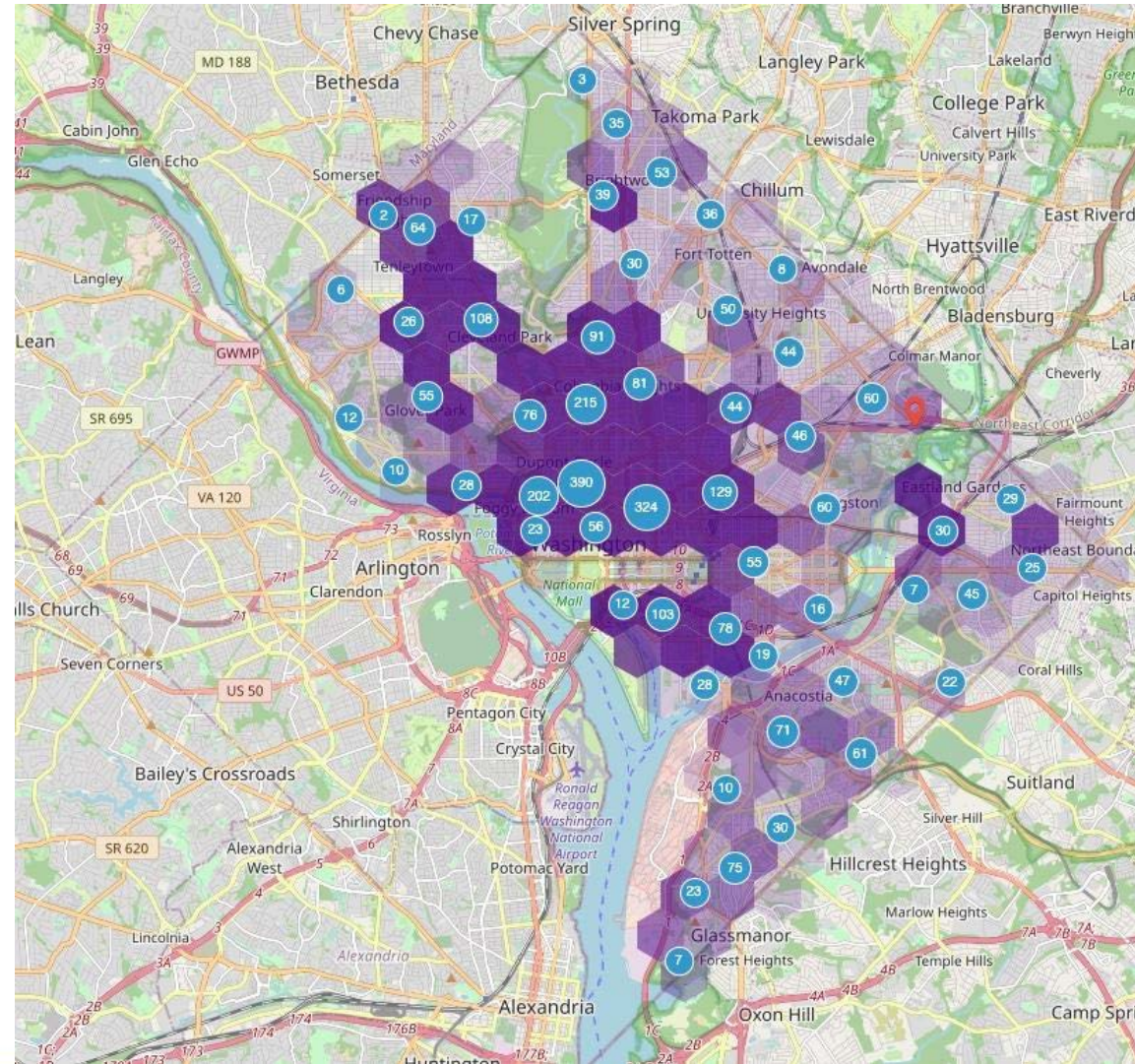
SEED Workflow



SEED & BETTER

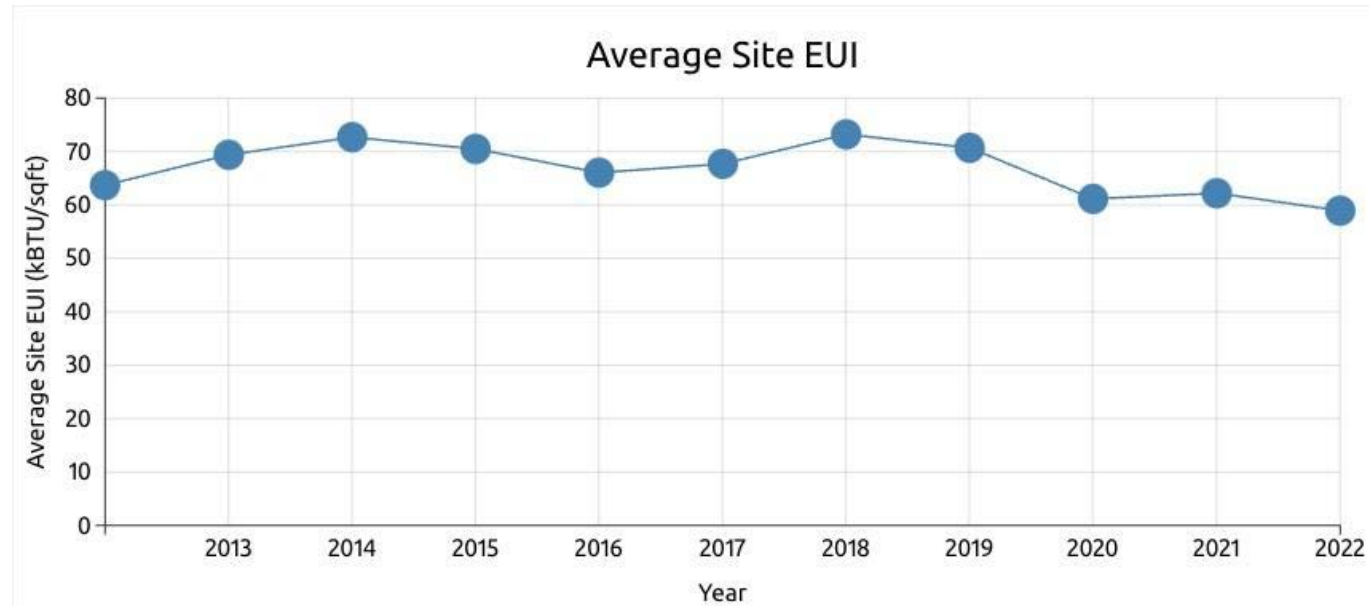
- Batch BETTER analysis of whole portfolio
- Required data for BETTER can be stored in SEED
 - Building type
 - ≥ 12 months of utility data
 - Location
- Can view BETTER reports/data in SEED
- SEED users can create data quality rules and labels to filter data

Case Study – Washington, D.C.



Case Study – Washington, D.C.

- Building Energy Performance DC
 - Now: buildings >25,000 SF
 - Calendar year 2024: buildings >10,000 SF
 - 3,208 buildings
 - ~298 million SF of total gross floor area covered

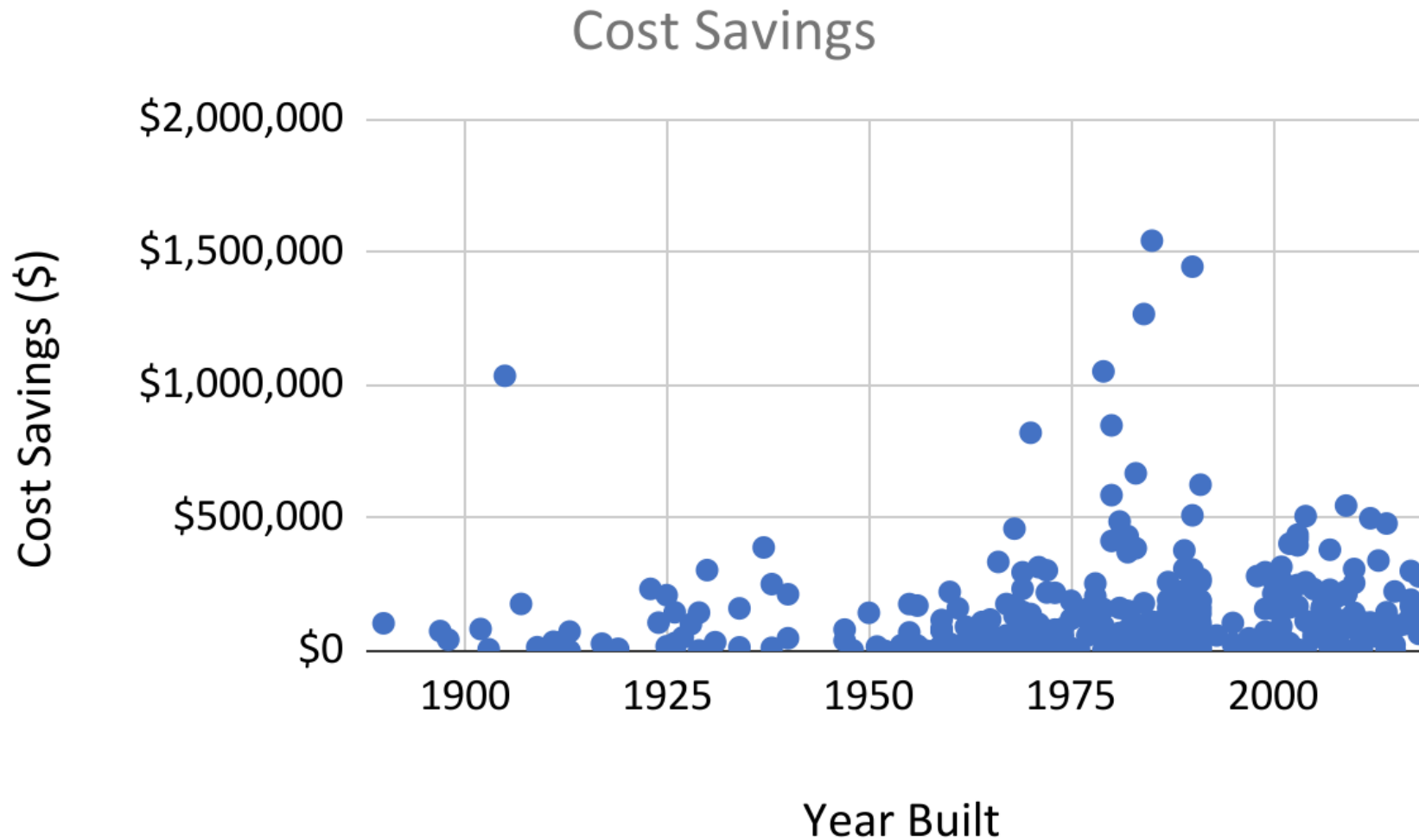


Case Study – Washington, D.C.

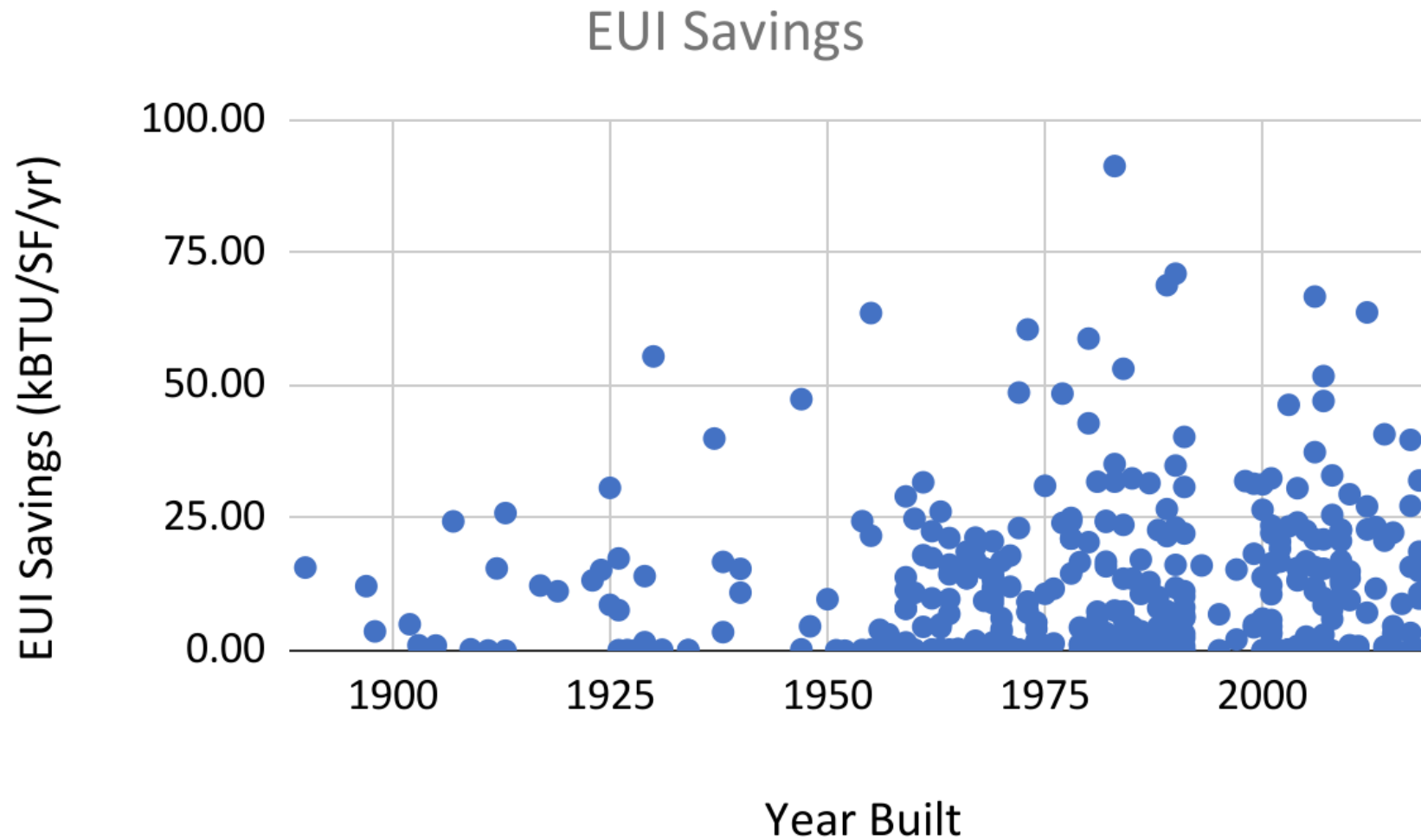
- BETTER Analysis of Office Buildings

Buildings	364
Gross Floor Area (SF)	101,792,937
Average Site EUI (kBTU/SF/yr)	49.48
Predicted Site EUI (kBTU/SF/yr)	37.27
Total Cost Savings (\$)	\$49,573,132

Case Study – Washington, D.C.



Case Study – Washington, D.C.



Case Study – Washington, D.C.

Cycle: ▼
 Sorting By (in order): ✕ (from table below) 🗑️

Column List Profile: ▼
 Current Filters: ✕ (from table below) 🗑️

Actions: ▼
 Filter By Label: 🗑️
AND OR EXCLUDE

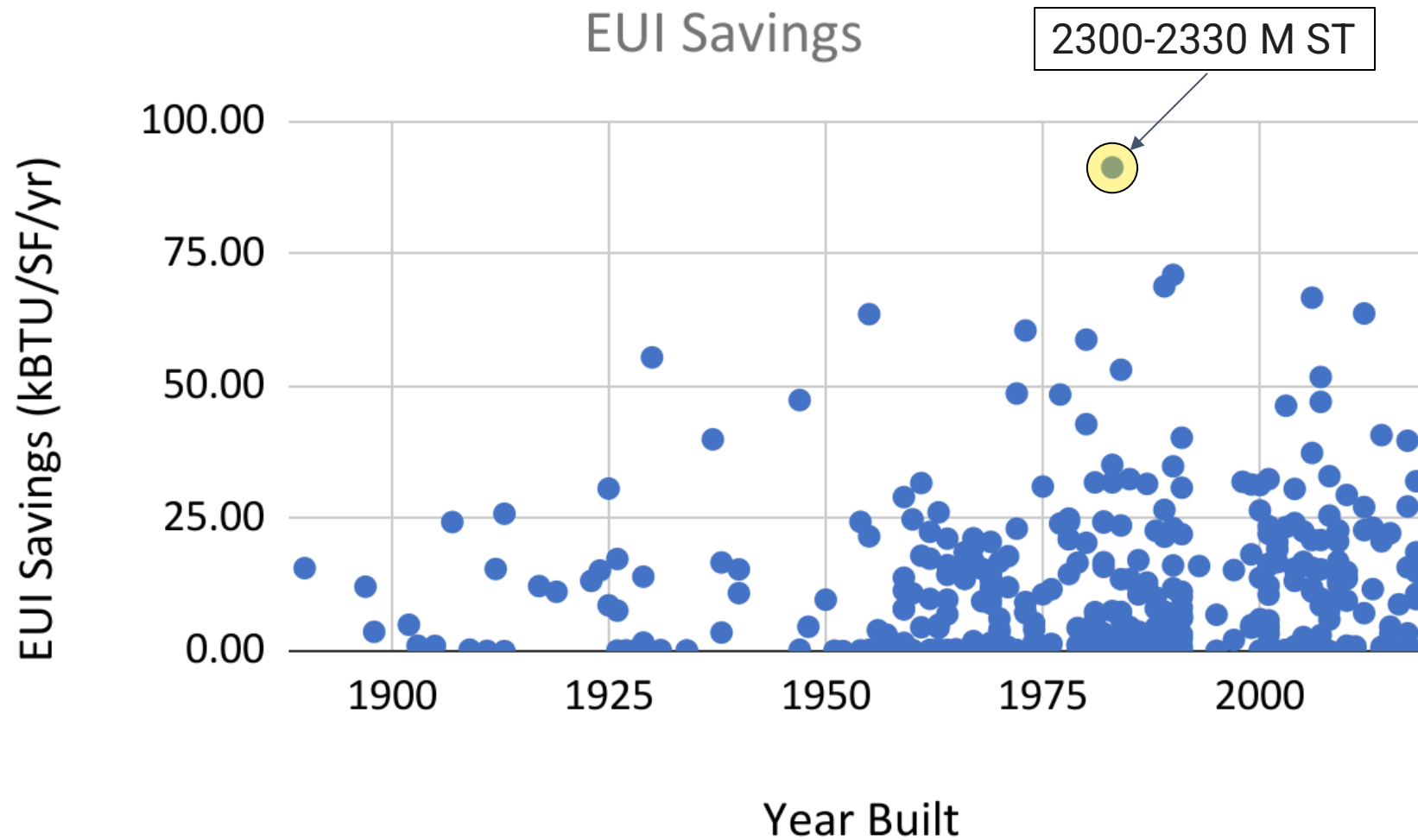
Filter Group: ▼
✅ 📄 ✕ ✎

View by Property | View by Tax Lot

1-100 of 536 ◀ ▶

					Object_Suffix	gross_floor_area_repor...	parent_property_name...	property_footprint (Inv...	BETTER Potential Cost ...	BETTER Potential Ener...	BETTER Potential G...
+	✓										
+	✓	h	⚡	ⓘ		251000			99592.56	832713.7	271.95
+	✓	h	⚡	ⓘ		103501			9758.51	145808.9	34.07
+	✓	h	⚡	ⓘ		365917			96705.79	808576.82	264.07
+	✓	h	⚡	ⓘ		627655			9660.56	259340.43	47.01
+	✓	h	⚡	ⓘ		239394.6			96037.68	802990.65	262.24
+	✓	h	⚡	ⓘ		252361			95942.5	802194.81	261.98
+	✓	h	⚡	ⓘ		60917			9565.58	256790.66	46.55
+	✓	h	⚡	ⓘ		205051			94486.15	804432.65	259.67
+	✓	h	⚡	ⓘ		210645			93428.35	781173.45	255.12
+	✓	h	⚡	ⓘ		404202			91550.87	2457707.64	445.51
+	✓	h	⚡	ⓘ		336820			90612.06	757625.92	247.43
+	✓	h	⚡	ⓘ		194131			88422.24	1293039.02	305.42
+	✓	h	⚡	ⓘ		236469			8603.65	230967.33	41.87
+	✓	h	⚡	ⓘ		73220			8538.08	229206.97	41.55

Case Study – Washington, D.C.



Case Study – Washington, D.C.

Building Type:

Office

Building Location:

WASHINGTON, DC

Potential Cost Savings:

\$387,027.08

71.1%

Electricity Energy/Cost Savings:

71.1%

GHG Emissions Reduction (tCO₂e):

1,056.8

71.1%

Gross Floor Area (ft²):

120,871.8

Closest Weather Station:

**Station: 724050-13743 : Ronald Reagan
Washington Natl Ap**

Potential Energy Savings:

11,041,732 kBTU

71.1%

Fossil Fuel Energy/Cost Savings:

N.A.%

GHG Emissions Intensity Reduction (kgCO₂e/ft²)

8.7

Case Study – Washington, D.C.

Property : 2300 M ST NW

Edit

Actions ▾

Cycle: 2021 ▾

Labels: High GHG and Old Needs onsite data Violation

Detail Column List Profile: Default ▾

DC Office BETTER Run #1702 Completed

\$387,027.08
Potential Cost Savings (USD)

3,236,012.37 kWh
Potential Energy Savings

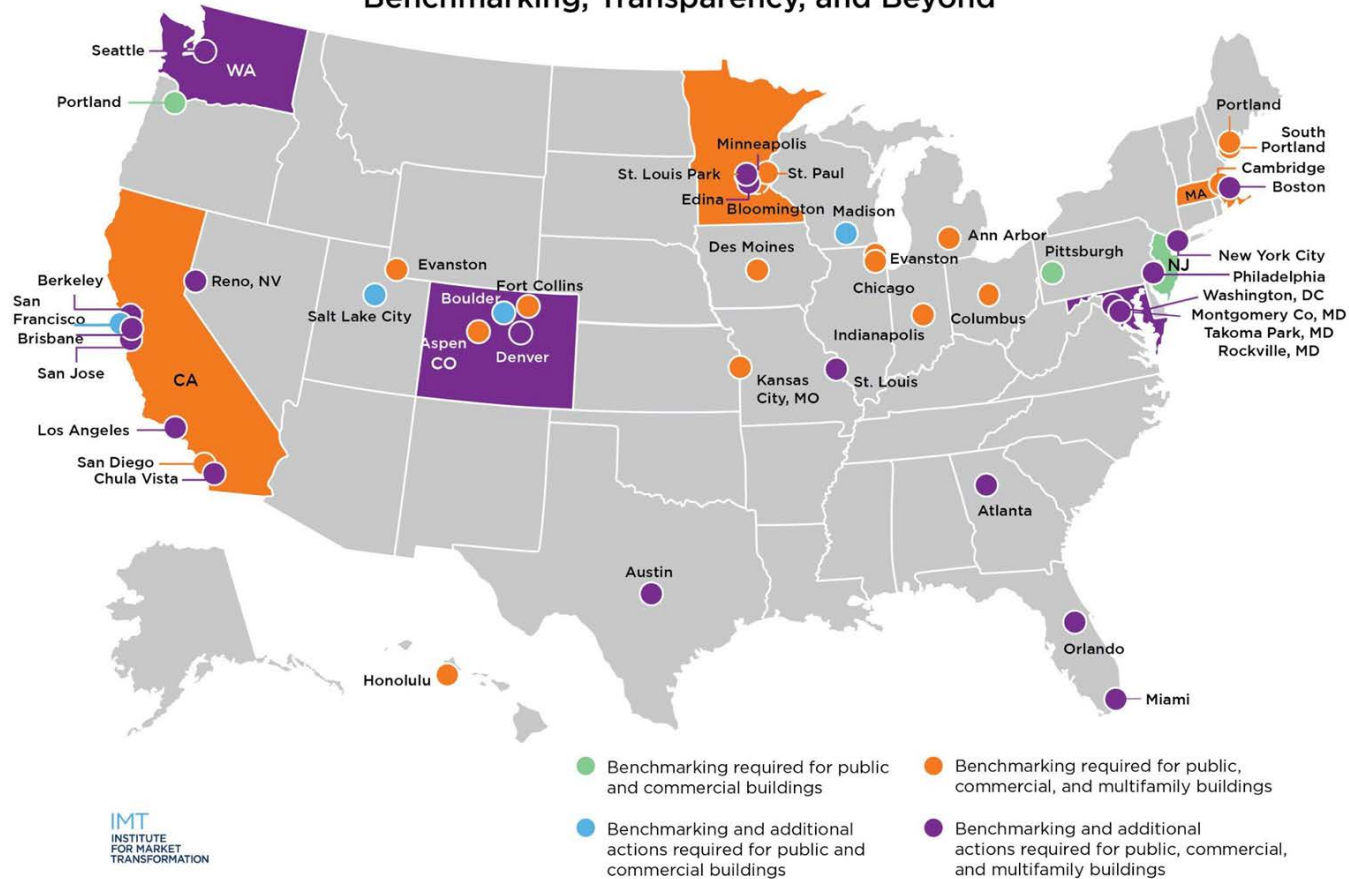
0.62, N/A
BETTER Inverse Model R² (Electricity, Fossil Fuel)

Meter Selection: All
01/01/2020 - 12/31/2020

07-21-2023 18:05 (15 minutes, 14 seconds)
Chapin, Alex Full Analysis ↗

Case Study – Washington, D.C.

U.S. City, County, and State Policies for Existing Buildings:
Benchmarking, Transparency, and Beyond



Conclusion

- BETTER provides insights for large building portfolios
- SEED connects with other tools to enable powerful insights and analyses
- Integrating SEED and BETTER connects real data with powerful insights for making energy-related decisions

Bibliography

Introduction and Basic Training for BETTER v 1.0.

https://better.lbl.gov/static/pdf/BETTER.Training.Slides_V.18.0_Analytical%20Methodology_08.10.2022.8a79b102eb73.pdf

DC Affordable Housing Retrofit Accelerator

<https://www.dcseu.com/retrofitaccelerator>

Questions?

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