

Building Momentum: Scaling Whole-Building Energy Programs with Smart(er) Models

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Overview

Topics

- ❖ Whole building landscape
- ❖ Benefits/Barriers (more in paper)
- ❖ Participation/Design findings
- ❖ Modeling best practices
 - ❖ Learning models?
 - ❖ Best variables
 - ❖ Model types that work

Audience

- ❖ Program Administrators
- ❖ Implementation Contractors
- ❖ Evaluators
- ❖ Regulators
- ❖ Stakeholders/advocates

Acknowledgements: Independent Electrical System of Ontario's (IESO) Energy Performance Program (EPP), software builds with our sister firm enFluent, various evaluations.

Program Types and Characteristics

PROGRAM TYPE	KEY FEATURES	DIFFERENTIATORS
Strategic Energy Management (SEM)	Training + operational focus	Long-term engagement, behavioral + operational savings
Pay-for-Performance (P4P)**	Incentives for actual savings	Measure-agnostic, tied to metered performance
Custom Retrofit	Project-specific engineering	Tailored to complex sites, flexible scope
Deep Energy Retrofit	Large, integrated upgrades	High savings thresholds, often capital-intensive
Prescriptive Bundles	Standard measure packages	Easier path for smaller sites
Retro-commissioning (RCx)	Tune-ups + M&V	Low-cost improvements, system optimization

Whole Building Benefits and Barriers

❖ Benefits

- ❖ **Measure flexibility** – *any mix of strategies*
- ❖ **Performance incentives** – *only paid for measured savings*
- ❖ **Deeper savings** – *capture integrated measures*
- ❖ **Participation ease** – *participants choose project types and depth*

❖ Barriers

- ❖ **Technical** – *baseline modeling, non-routine energy events*
- ❖ **Market awareness** – *unfamiliar relative to traditional programs*
- ❖ **Data access** – *availability of smart meter data, data privacy*
- ❖ **Prescriptive perceptions** – *ordering off the menu is easy*

Design/Participation – Lessons Learned

❖ **Design/Program Delivery Model**

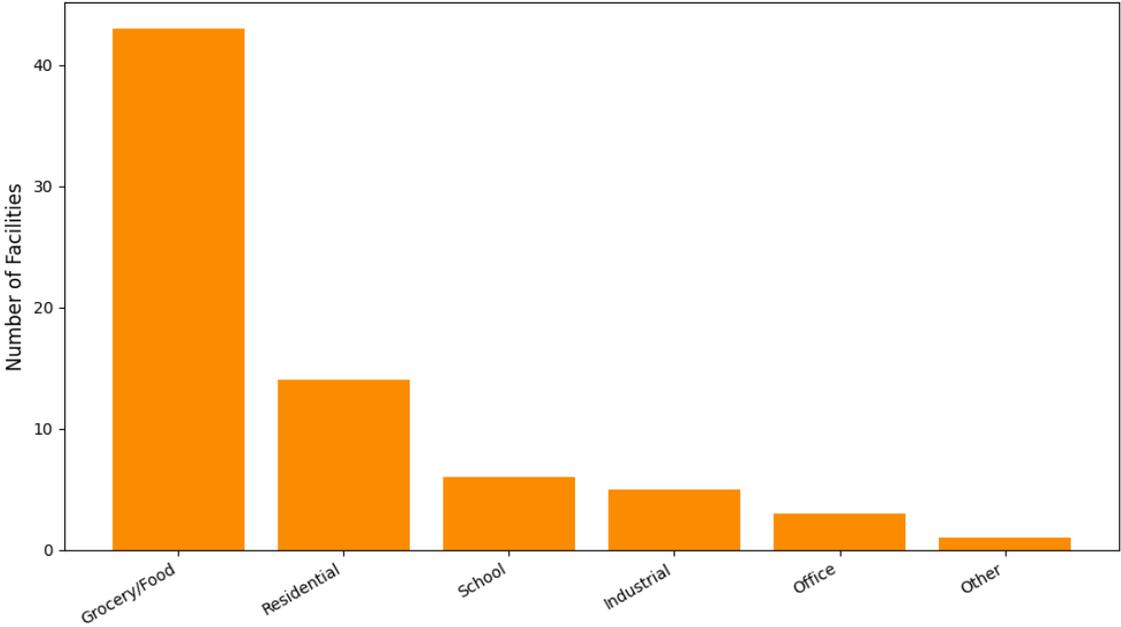
- ❖ **Turnkey** – one program contractor
 - ❖ Participants hiring contractors for baseline modeling limited program growth
 - ❖ Prior model led to redundancy and re-work - 3 baseline models with eval
- ❖ Programs still hire vendors to help plan projects/measures

❖ ***Program Participation/Targets***

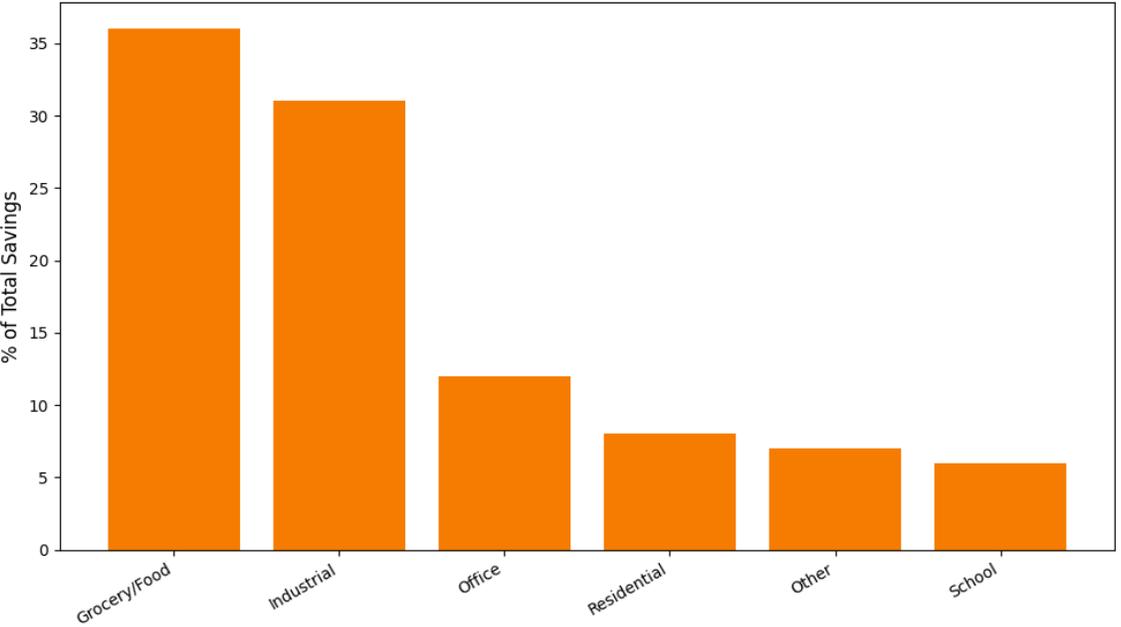
- ❖ **Anchor client** – some free ridership risk
- ❖ **Grocery/Food** – easy modeling, multi-site (economies of scale)
- ❖ **Industrial/heavy manufacturing** – consider alternate program path
 - ❖ Non-uniform modeling
 - ❖ Often weather agnostic

2024 EPP Program Participation

Distribution of EPP Participants by Building Type (2024)



Energy Savings by Facility Type (2024)

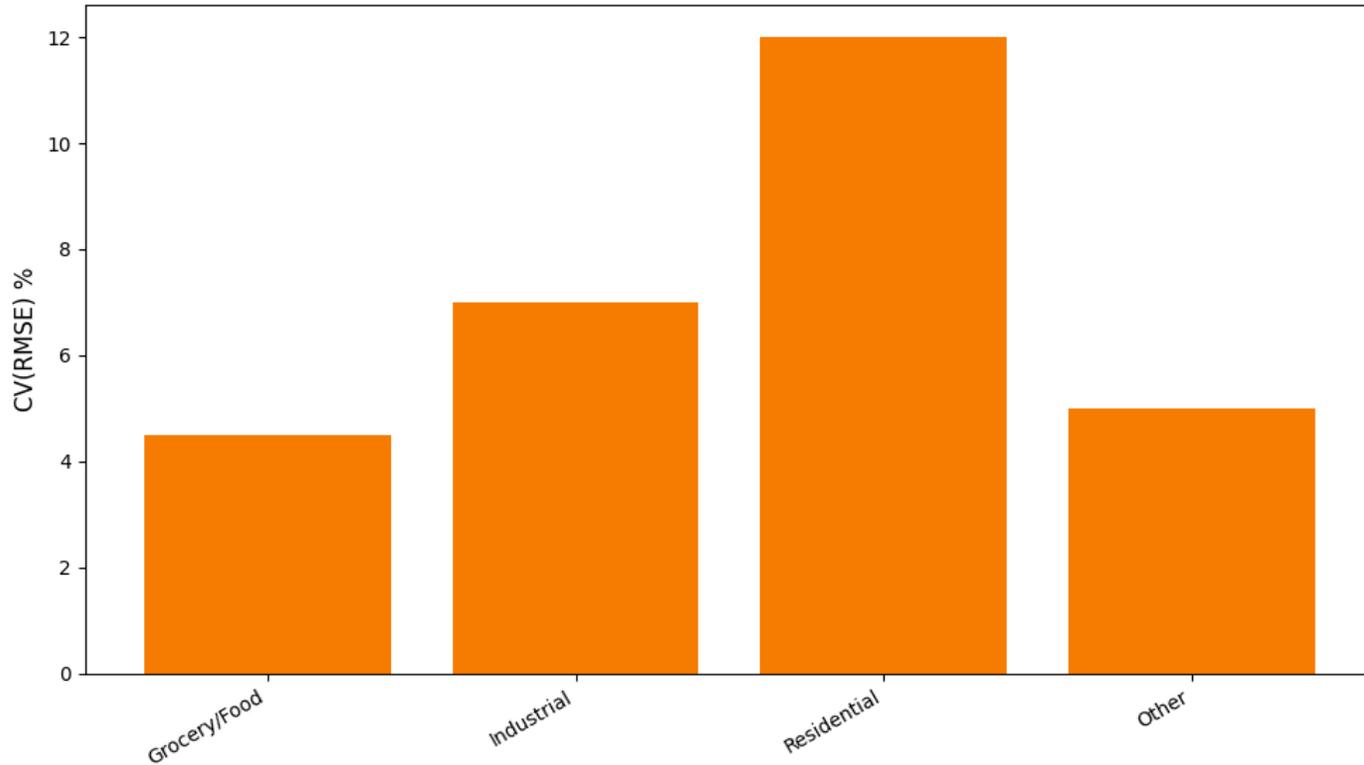


Model Inputs Best Practices

VARIABLE	# INPUTS	DESCRIPTION
Degree days/hours	2	Optimized temperature setpoints for a specific site
Holidays	1	Holiday indicator
Temperature splines	6-8	Linear temperature spline buckets
Month	11	Month indicators
Peak periods	1	Indicator for peak demand time
Time of week	167	Hour of the week indicator
Production/Occupancy	1	Occupancy or production data
Squared temperature*	1	Alternative temperature variable
Day of week/weekend*	2-6	Captures dynamics outside time of week
Cooling season*	1	AC load bump indicator
Feature Generation (PCA reductions)	Varies	Clustering

Model Inputs - Performance

Baseline Energy Model CV(RMSE) by Building Type



BUILDING TYPE	AVERAGE R-SQUARED
Grocery/Food	90%
Residential	90%
Industrial	86%
Other	89%
All Building Types	90%

Summary

- ❖ **Start with Anchor Clients** – Engage large participants with multiple facilities to scale quickly.
- ❖ **Prioritize Multi-Site Participants** – Chains and portfolios offer repeatable modeling and outreach.
- ❖ **Outsource Modeling Tasks** – Use third-party vendors for baseline modeling and data handling.
- ❖ **Standardize Modeling Inputs:**
 - ❖ Use consistent variables (e.g., temperature, time-of-week).
 - ❖ Site-specific data (e.g., occupancy) improves accuracy.
 - ❖ Temporal inputs help during peak periods.
- ❖ **Target Grocery/Food Stores** – Reliable savings, low model variance, high participation potential.
- ❖ **Be Cautious with Industrial Sites** – Require custom models, complex operations, high savings potential.
- ❖ **Use Scalable Tools** – Open-source libraries (Python, R) streamline implementation.

Keep the conversation going!

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