Using Large-Scale Energy Simulation Tools to Improve Energy Efficiency Rollouts

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“I’ve Got a Portfolio…and now I Want to Rollout an IoT Strategy…”

- Canadian Bank with a portfolio of 1000+ locations across the entire country, including remote locations
- Data about the buildings primarily consisted of:
  - location
  - historical energy bills
- The vision of a powerful IoT strategy:
  - no vendor lock-in
  - cheap, commercial off-the-shelf devices
  - internet security a top concern
Before we release a large sum of money... a Proof of Concept...

- Bank Approves a Proof of Concept
  - Study a wide array of COTS IoT devices
  - Limit the study to a single ASHRAE Climate Zone
- We’ll Provide you with a small sample of Canadian Commercial Buildings...
  - Budget for 4 buildings
- Study goal: “Tell me what IoT technologies will work with the remainder of my building stock, given what we learn in this Proof of Concept?”
A Scalable Edge Network and Cloud Analytics Platform

IoT Solution

Network Diagram
Quick Overview of the Results

Sites Utilizing Natural Gas Heating
Sorted by Heating Bills Energy Use Intensity (EUI)

Typical POC Pre IoT Deployment 14 ekWh/ft².yr (48 kBtu/sf/yr)

Typical POC After IoT Deployment 9 ekWh/ft².yr (31 kBtu/sf/yr)
Crossing the Chasm

❖ Remember the study goal: “Where else will this technology work?”
❖ Becomes an exercise in picking new locations: Extrapolating from 4 Buildings -> 1000 buildings?
❖ Given Historical Energy Bills and Location Only
❖ Because it is a financial institution, there needed to be some sort of quantitative analysis of the proposal.
Picking New Locations: Finding The Right Selection of Candidates

Which of these should be chosen for the next set of candidates?

A Risk Mitigation Exercise

Two approaches:

1. Traditional Statistical Outlier Tests
2. Building Energy Simulation utilizing US Department of Energy research tools
Approaching the solution as a Multi-Variate Study

What if our Assumptions are Wrong?

FACTORS AFFECTING HEATING BILLS

Infiltration
- customer turnover
- envelope leakage

Equipment Failure
- Airside damper failure

Insulation
- More or less insulation
- More or less Windows
- Quality of the Window

Thermostatic Controls
- Occupant Behavior

Internal Loads
- Lights
- Plug Loads

Climate
- Building Location

Playing out all the assumptions….