



Is Your Building Still Green on Day 366?

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Agenda...



- Sustainable Building Trends
 - 1. Able to be maintained at a certain rate or level.*
 - 2. Capable of being continued with minimal long-term effect on the environment.*
- Brandywine Realty Trust's Experience

Did You Ever Consider . . .



- Sustainable buildings are almost always automated buildings.
- The bulk of your energy conservation rests on four sensors:
 - CO₂ (Demand Control Ventilation)
 - Enthalpy (Outside Air Temperature & Relative Humidity)
 - Photocell (Light & Shades)
 - Rain (Irrigation)
- The decisions made on the data from these sensors are then executed through switches or actuators.
- Each of these components costs around \$300 (about the same as 3000 kWh of electrical consumption).
- You likely bought these through a low bid process.

What the Pros Know:

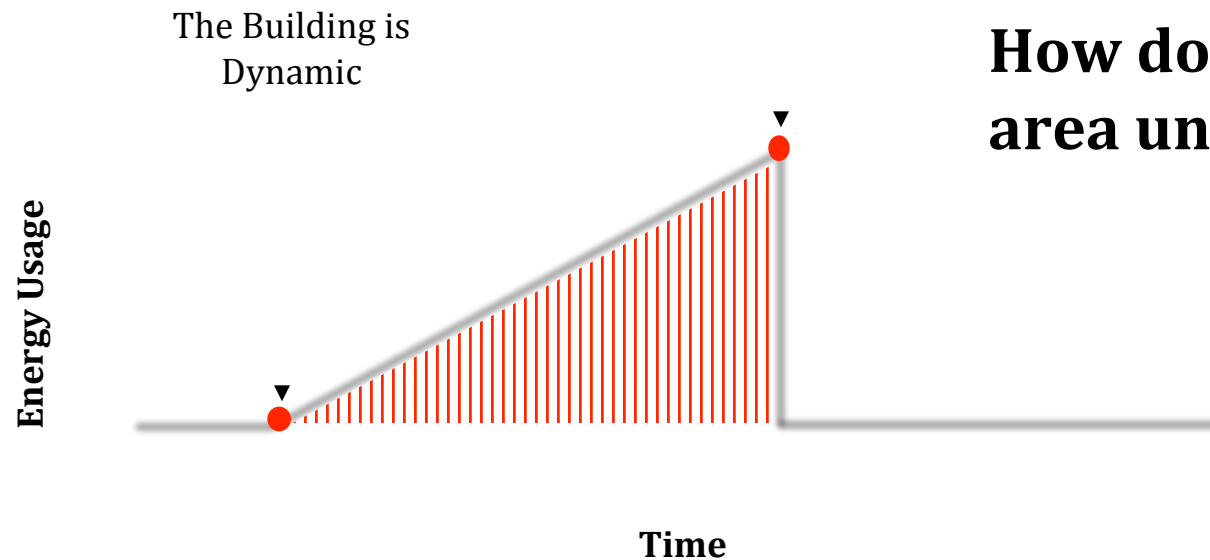


- CO₂ sensors typically have one, three, or five year calibration requirements.
- Humidity sensors are notoriously prone to drift.
- Birds think photocells were specifically designed for them to foul.
- Rain sensors are a favored home for spiders and dirt.
- Actuators and dampers are moving parts.

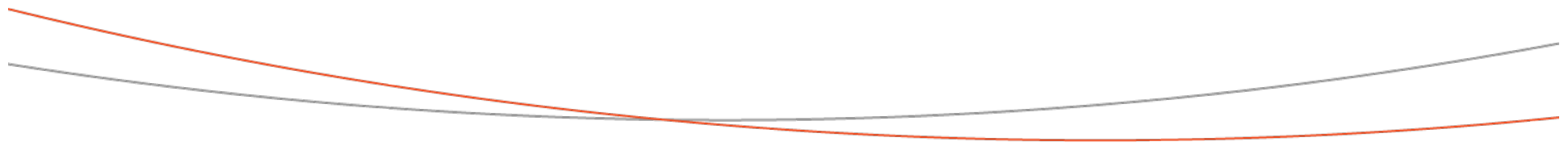
The Dynamic Model



*Hopefully the
Issue is Resolved*



**How do we reduce the
area under the curve?**





**Building
Awareness and
Response
Pyramid**

**Intelligent /
Performance-based
Services**

**Continuous
Commissioning**

Remote Monitoring

Measurement & Verification

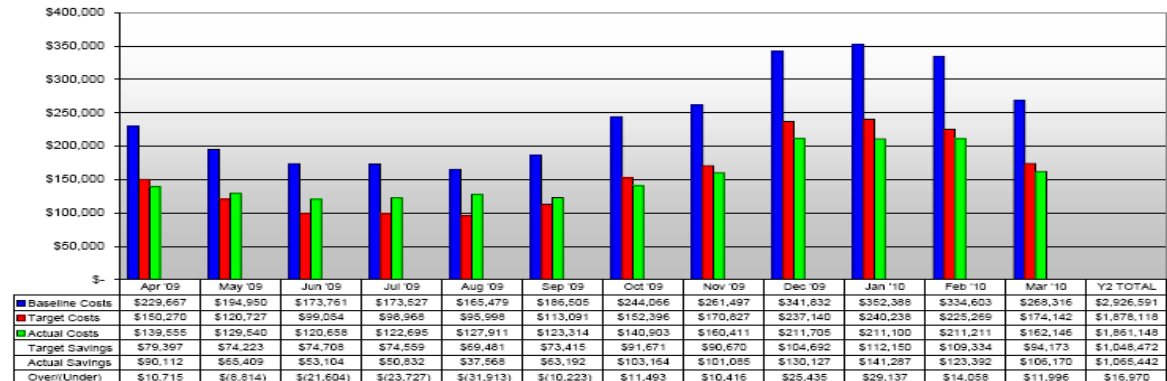
MEASUREMENT & VERIFICATION



- Periodic (quarterly, annually, etc...)
- Compares results of implemented Energy Conservation Measures (ECM) to baseline energy use.
- A reporting and compliance service.

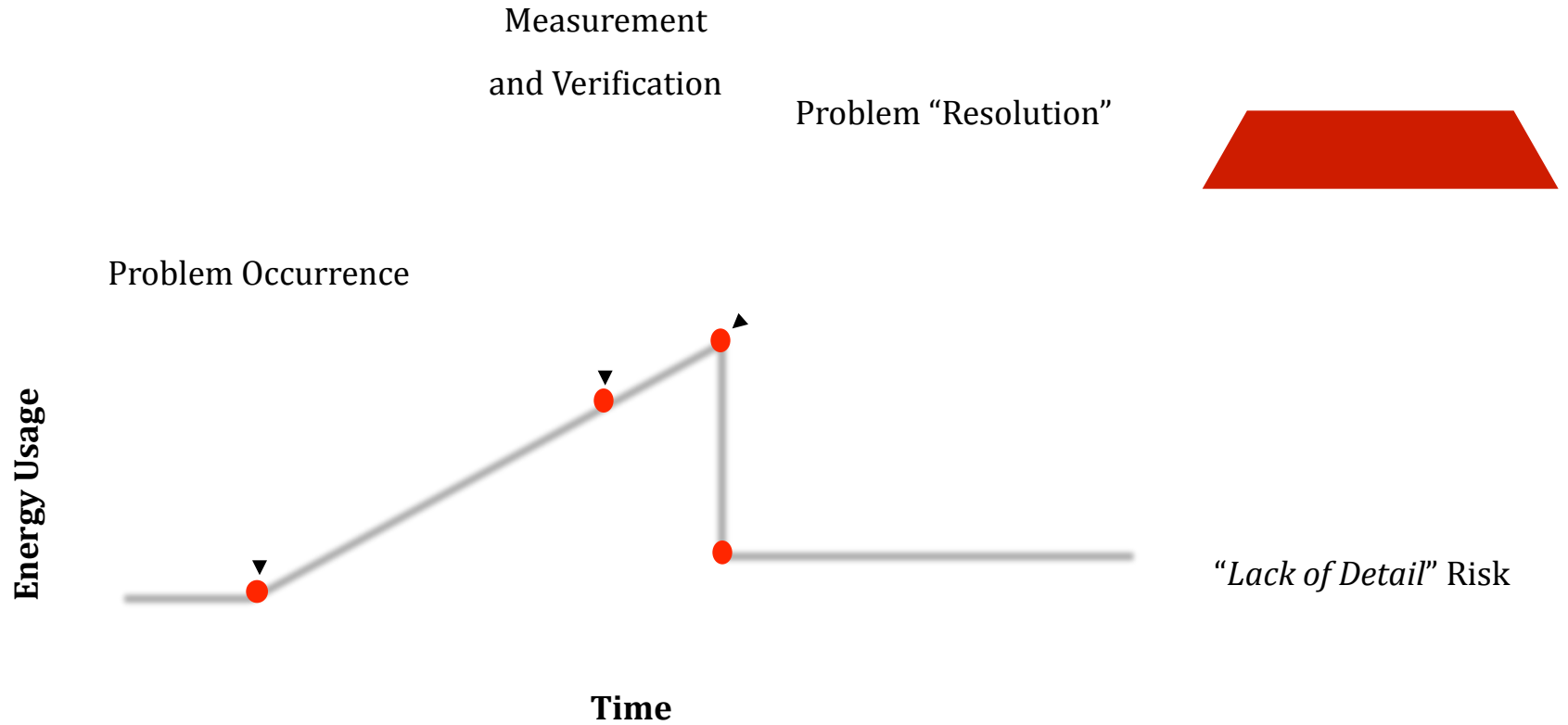


Sample Project- All Utilities Combined
Performance Summary
Year 2 Guarantee Period - 4/1/09 - 3/31/10



■ Baseline costs is the calculated costs from all utilities (electric, gas and steam) based on historic utility bill patterns.
 ■ Target is the predicted costs after measures are implemented.
 ■ Actual is the consumption for all utilities direct from the utility bills.
 All dollar calculations are made using the Base Utility Rates in the Contract (Exhibit E-om, Section B.6.0)
 Target = Baseline - Guaranteed Savings

MEASUREMENT & VERIFICATION



REMOTE MONITORING



- ***Alarm Management***
 - Centralized operations
 - Archived critical alarm history
 - *Notification*
- ***Alarm Response***
 - *Diagnosis* of alarms
 - Remote resolution
 - Intelligent mobilization of local resources

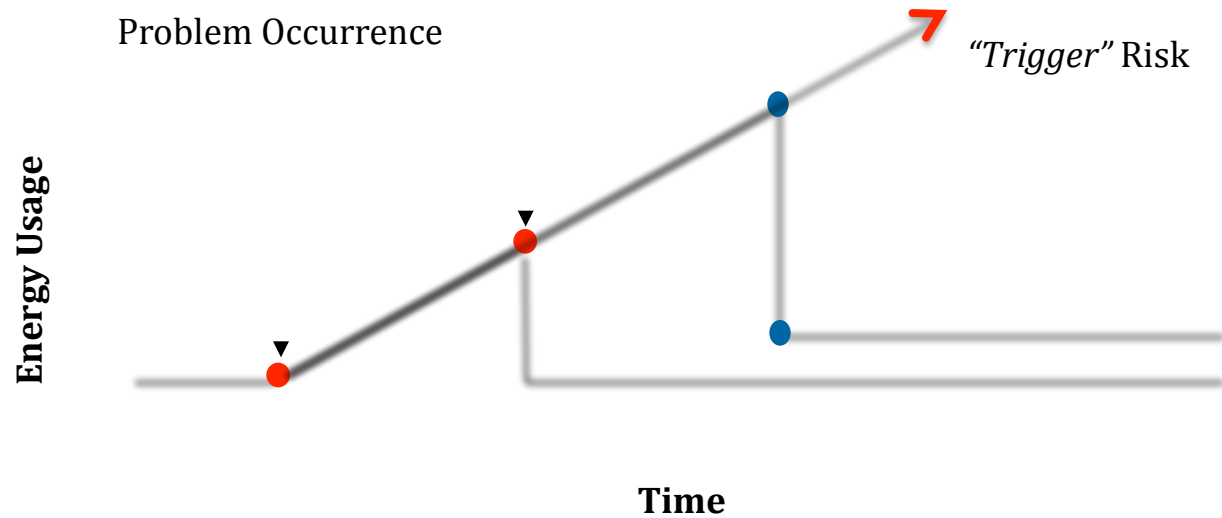


- Alarms based on energy usage can substantially impact demand charges.
- Alarms based on equipment behavior can impact consumption charges.
- Reviewing alarm history can provide clues to performance issues.

REMOTE MONITORING



Remote Alarm with
Immediate Resolution



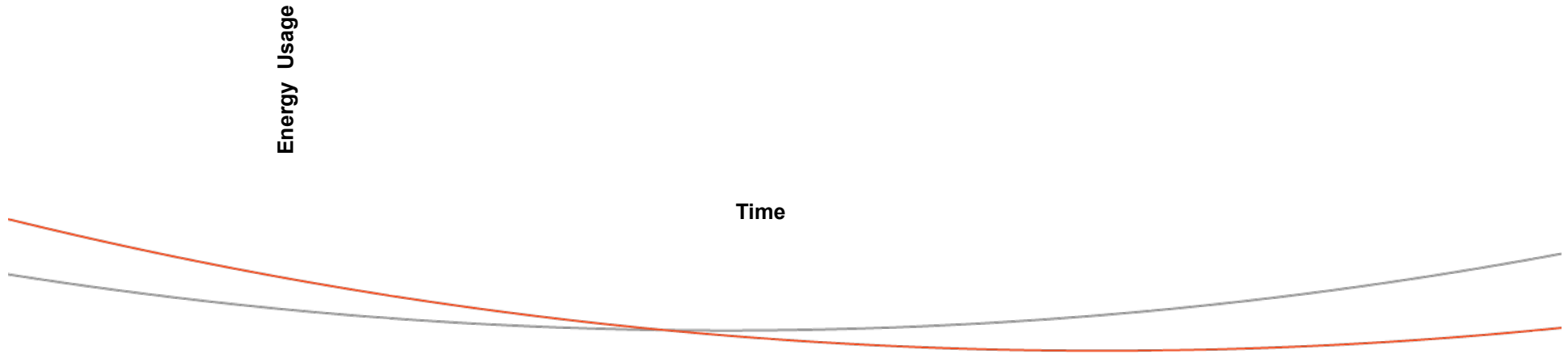
CONTINUOUS COMMISSIONING



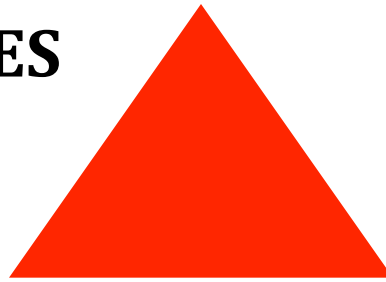
- Buildings are dynamic; conditions change *regularly*.
- Means different things to different people.
- Benchmark, optimize, repeat...
- Series of discrete improvement events that may be cumulative in their effects.
- Cyclical optimization service.



"Resource" Risk



INTELLIGENT SERVICES



INTELLIGENT SERVICES



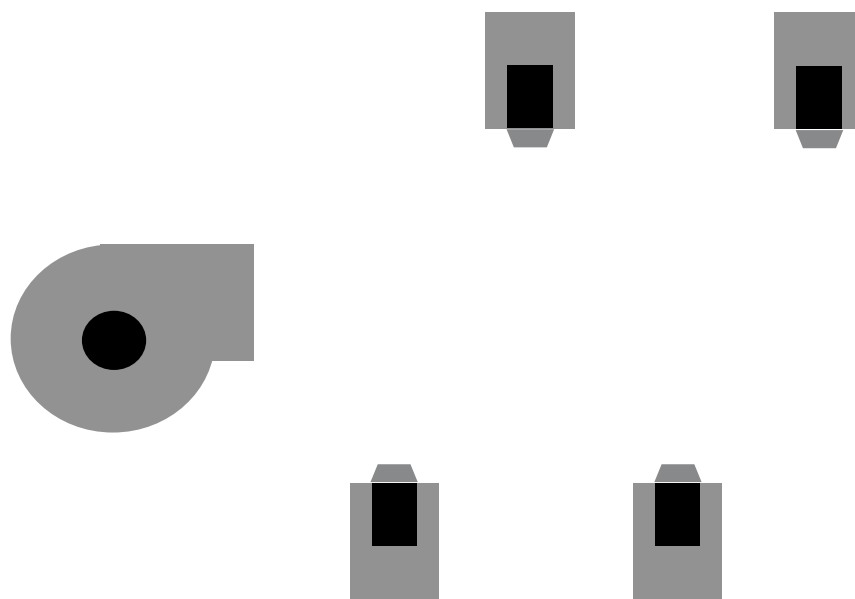
It's sort of like physics . . .

- Entropy is real! Not only are you changing the building, mysterious forces are conspiring against you (Heisenberg, Bohr, etc...). Accept the fundamental uncertainty of both quantum mechanics and building behavior.
- Intelligent services = warp speed continuous commissioning + remote monitoring + trending + data mining + forecasting
 - Get it right:
 - Initial audit to gather, archive and analyze data.
 - Analytics are used to identify suspect building behavior.
 - Fieldwork to define and document suspect behavior, diagnose and correct deficiencies, and make improvements.
 - Keep it right:
 - Gather and archive data on an continuous basis.
 - Immediately report future suspect behavior.
- Advanced heuristics identify trends and deviations
- A pro-active, automated monitoring, repair, and reporting service.



Example

- Relatively new commercial construction.
- LEED-NC
- Utilized fan pressure optimization...immediately following construction...

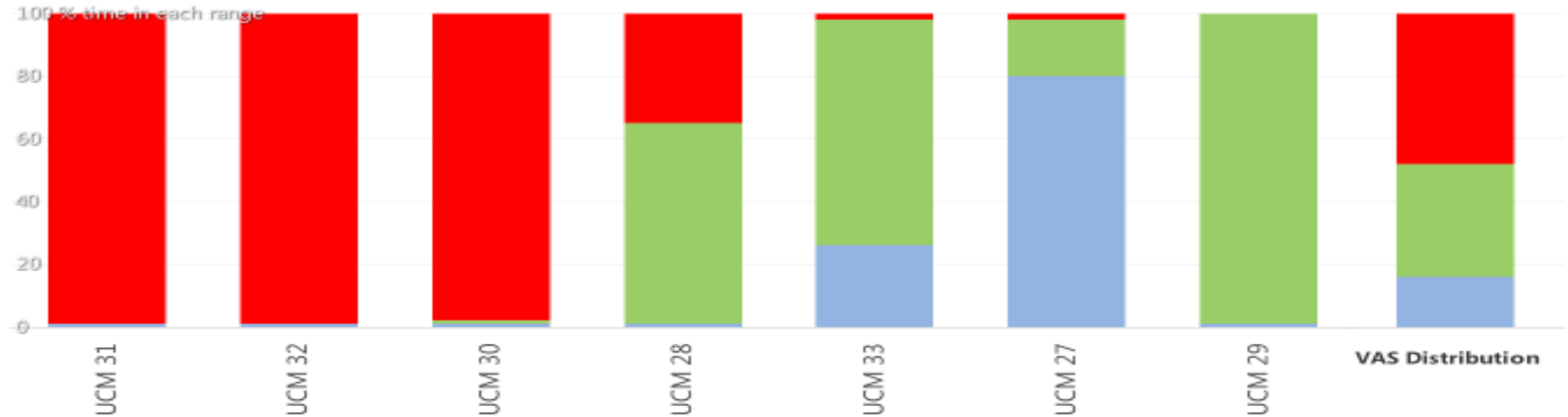





AHU-6 VAS



Individual VAV Box Position Proportion

26-Jul-2012 12:00 AM - 01-Aug-2012 11:59 PM



-  Above Control Range
-  Upper Control Range
-  Lower Control Range

UCM 31: The terminal unit is unable to maintain its airflow set point, damper is continuously at 100% open.

UCM 32: The terminal unit is unable to maintain its airflow set point, damper is continuously at 100% open.

UCM 30: The terminal unit is unable to maintain its airflow set point, damper is continuously at 100% open.

UCM 28: The terminal unit is unable to maintain its airflow set point, damper is continuously at 100% open.

UCM 33: No exceptions noted.

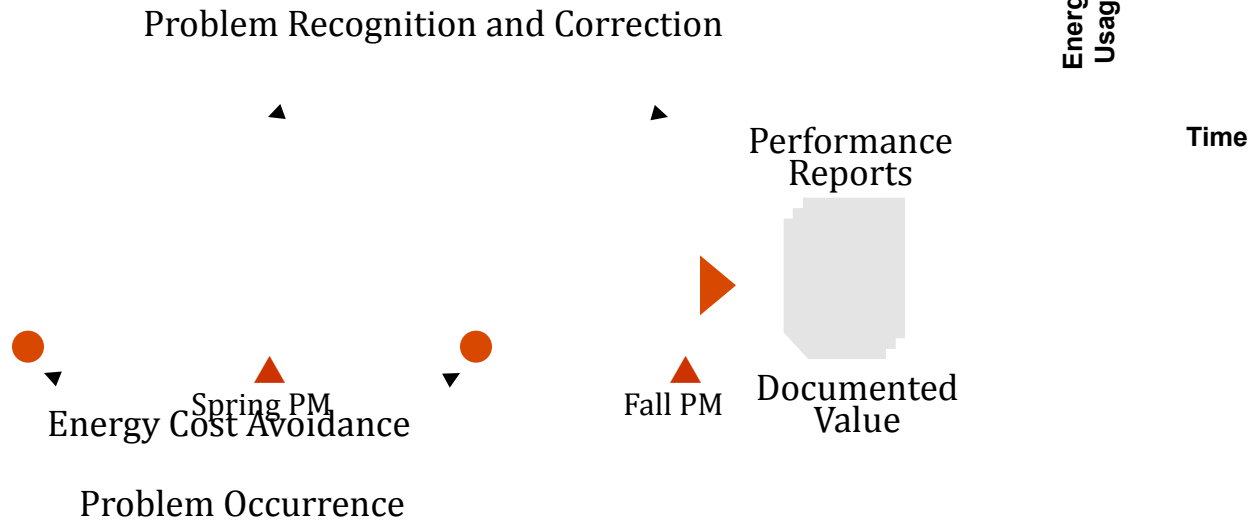
UCM 27: No exceptions noted.

UCM 29: Missing airflow data during assessment period.

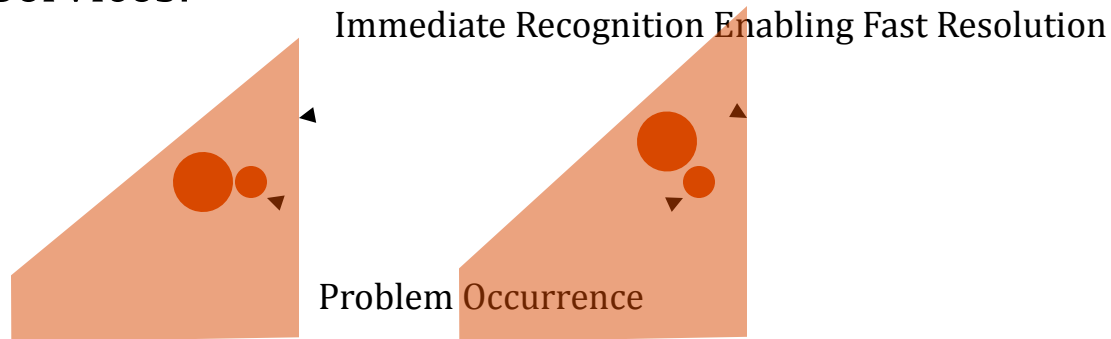
INTELLIGENT SERVICES



Current Model:



Intelligent Services:





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