Optimising building HVAC services through control

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What's keeping you up at night...?

- Owner-occupied
    - Occupant complaints and productivity concerns
    - Shortage of CapEx
    - Increasing energy costs
    - Ever stricter environmental rules
    - Shortage of trained building engineers
    - Difficult to implement improvements across portfolio of different building types and EMS vendors

What's keeping you up at night…?

- **Commercial Office**
  - Asset Value
  - Tenant complaints
  - Increasing energy costs
  - Ever stricter environmental rules
  - Shortage of trained building engineers
  - Difficult to implement improvements across portfolio of different building types and EMS vendors
  - Minimal available CapEx
  - Churn in portfolio ownership

What's keeping you up at night…?

- Education
    - Teacher and staff comfort complaints
    - Minimal available budget
    - Increasing energy costs
    - Ever stricter environmental rules
    - Building operators often not trained (i.e. janitor, secretary)
    - Difficult to implement improvements across campuses of different building types and EMS vendors

The solution: Building Optimization

Advanced, predictive energy management software to optimize and control HVAC operations and reduce energy costs for commercial buildings
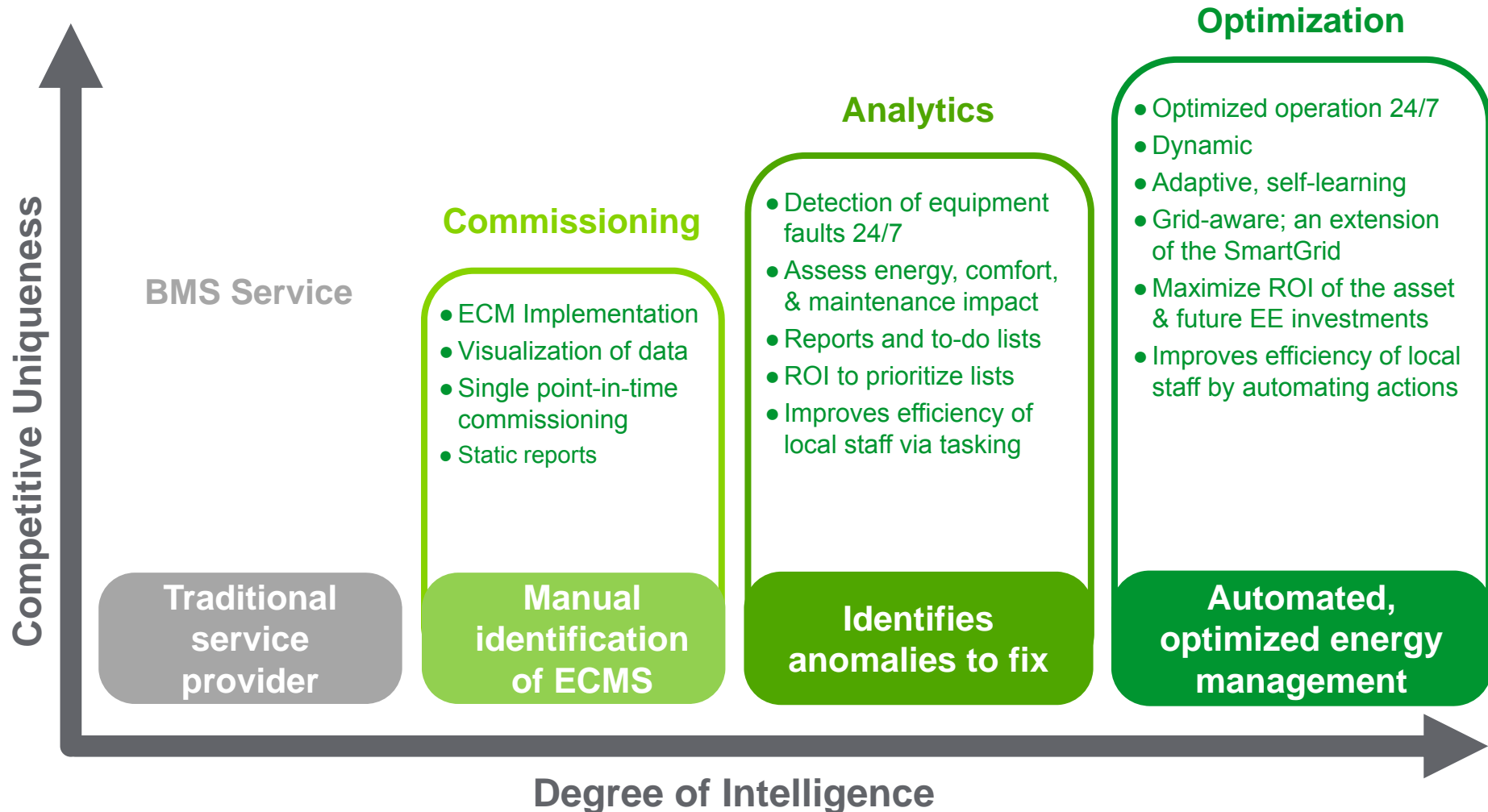
How:

- Software continuously monitors weather data, energy prices, and demand response (DR) events
- Makes small changes in HVAC operations that result in large energy savings without impacting comfort

How Building Optimization works

- Full optimization, full savings
  - Using the thermal model, thousands of alternative operating plans are produced for each operating day

  - The plan is selected based on your prioritized objectives: *cost*, *comfort*, or *consumption*, and incorporates information on predicted and actual site conditions including **weather**, **price** signals, and **demand response** signals

  - Monitors and re-optimizes every 10 to 45 minutes thereafter

Service Positioning

Competitive Uniqueness (vertical axis)

Degree of Intelligence (horizontal axis)

BMS Service

Commissioning
- ECM Implementation
- Visualization of data
- Single point-in-time commissioning
- Static reports

Analytics
- Detection of equipment faults 24/7
- Assess energy, comfort, & maintenance impact
- Reports and to-do lists
- ROI to prioritize lists
- Improves efficiency of local staff via tasking

Optimization
- Optimized operation 24/7
- Dynamic
- Adaptive, self-learning
- Grid-aware; an extension of the SmartGrid
- Maximize ROI of the asset & future EE investments
- Improves efficiency of local staff by automating actions

Traditional service provider

Manual identification of ECMS

Identifies anomalies to fix

Automated, optimized energy management

System optimization model

- Uses real-time weather forecast, tariff, and demand response events
- Leverages knowledge of building's thermal envelope
- Considers energy consumption and protects occupants' comfort
- Changes BMS set points and schedules through an intelligent, comfort-oriented supervisory control engine
- Customer can override at any time

Thermal Model

Weather

Tariffs
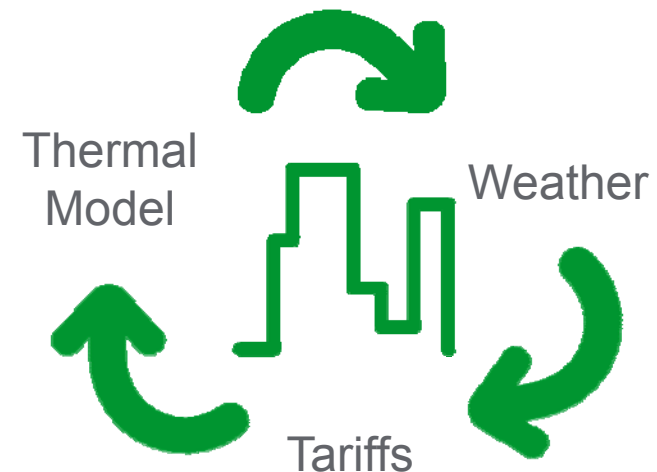
Making a good system better

Building Management System

- Initially commissioned to maintain comfort
- Requires continual re-tuning and operating schedule updates
- Focused on set points for temperature, pressure, etc.
- Alarms generated based on non-compliance with set points
- May lack on-site expertise

Optimized for fixed point in time

Building Management System + Building Optimization

- Learning by listening - automatically learns actual building performance
- Continually learns and adapts to changes
- Maintains occupant comfort while reducing energy expense
- Building issues uncovered and diagnosed
- Automated software backed by experts assuring performance; providing guidance, 24/7/365

Continuous, predictive, automatic

Reduce total building energy use by 5-8%, which is up to 25% of HVAC energy

Intelligent automation

Automated HVAC energy optimization and demand response implemented quickly & cost effectively

Centralized expert support

Centralized system monitoring and evaluation to optimize operations

Transparent results

Advanced M&V methods and clarity delivers real-time results you can trust

Increase your building's rating

LEED EB Points

Energy & Atmosphere:
-Optimize energy performance (5)
-Existing building commissioning (6)
-Performance measurement (1)
-Emissions reduction reporting (1)

Innovation in Operations (2)

Indoor Environmental Quality:
-AQ best management practice (2)
-Occupant comfort-thermal comfort monitoring (1)

Regional Priority Credits:
-Specific credit (2)

Up to 20 LEED EB points

Energy Star

For average buildings…

$$1 = 1$$

% Energy Reduction   Energy Star Point

Up to 8 Energy Star points

Why Building Optimization?

- Reduces total building energy by 5% to 8%
  - 10% to 25% of HVAC energy use
- Control plus reports and graphs
- Positive ROI in months
- Lowers carbon footprint
- Increases value of portfolio
- Smart grid ready

- You don't pay unless there are results!

Case Study – Iconic US Class A Office

"Any reduction in energy must NOT impact tenant comfort or come at the expense of increased attention and efforts from the building engineers." - Customer

THE CHALLENGE

- Automate reduced energy consumption
- One of largest Gold LEED-EB buildings in US
- Top notch in-house engineering staff
- Very risk adverse operations staff

THE RESULT

- Saved over $1M (€745K) in utility costs in first two years
- Reduced CO_2 footprint by 440 tons
- Saving $3 (€2.25) in energy for every $1 (€.75) spent
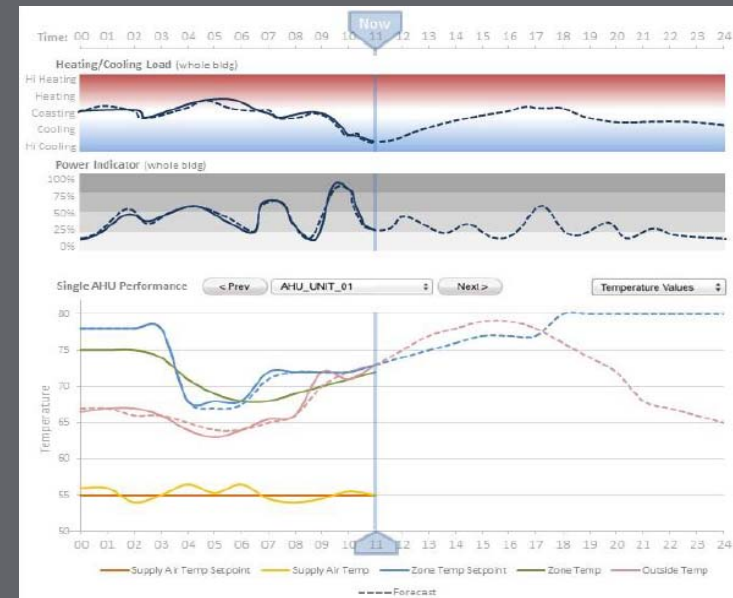
Case Study – US Electric Utility Customer

A high level of IT security and maintaining occupant comfort with 74°-75° F (23°C-24°C) internal temperature were achieved throughout the optimization and demand response events.
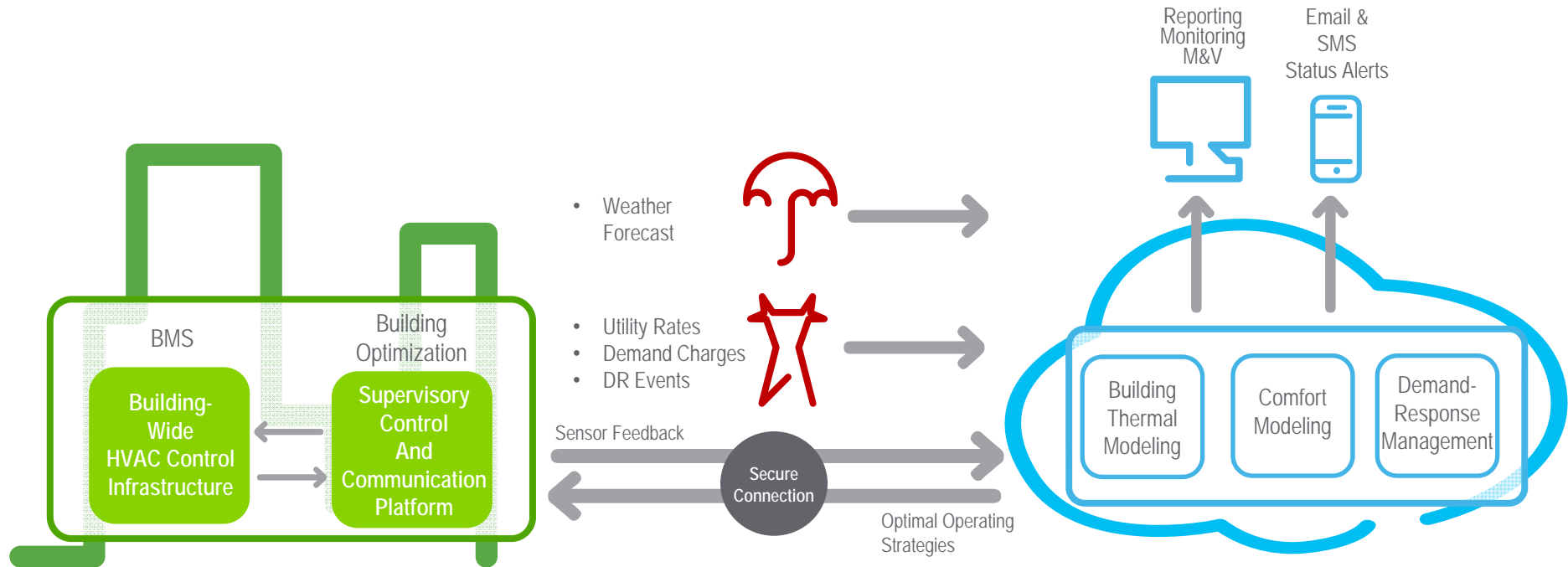
THE CHALLENGE

- Reduce energy consumption and peak-power demand response (DR)
- Office building (270,000 ft^2; 25,084m^2) located in extreme desert climate
- Average high temperature range: 101° to 104° F; 110° F (38°-40° C; 43° C) during the summer

THE RESULT

- Up to 20% daily reduction in total HVAC energy use
- Projected annual energy savings of 449,851 kWh or $45,000 (€33,790)
- DR savings: 13.7% of chiller load; summer-time load shed is expected to reach 12% to 15%

Technical system architecture

Reporting
Monitoring
M&V

Email &
SMS
Status Alerts

BMS

Building
Optimization

**Building-
Wide
HVAC Control
Infrastructure**

**Supervisory
Control
And
Communication
Platform**

- Weather
  Forecast

- Utility Rates
- Demand Charges
- DR Events

Sensor Feedback

Secure
Connection

Optimal Operating
Strategies

Building
Thermal
Modeling

Comfort
Modeling

Demand-
Response
Management

Only critical points
mapped to Building
Optimization comm
device, stores last set
points as fail-safe if
cloud connection lost

Experts monitor/assess
HVAC system; provide
guidance & additional
system tuning; can
assist with DR event
participation

Building model
incorporates utility
rates & weather to
determine ideal set
points, recalculates
every 15-60 min.