METER AND BUILDING CONTROLS DATA

TO DRIVE OPIs AND KPIs

March 8, 2018

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METER DATA VERSUS BUILDING CONTROLS DATA

- A **meter** is a device that records utility consumption in intervals usually of an hour or less and communicates that information daily back to a central location for monitoring and billing.
- **Smart meters** enable two-way communication between the meter and the central system.

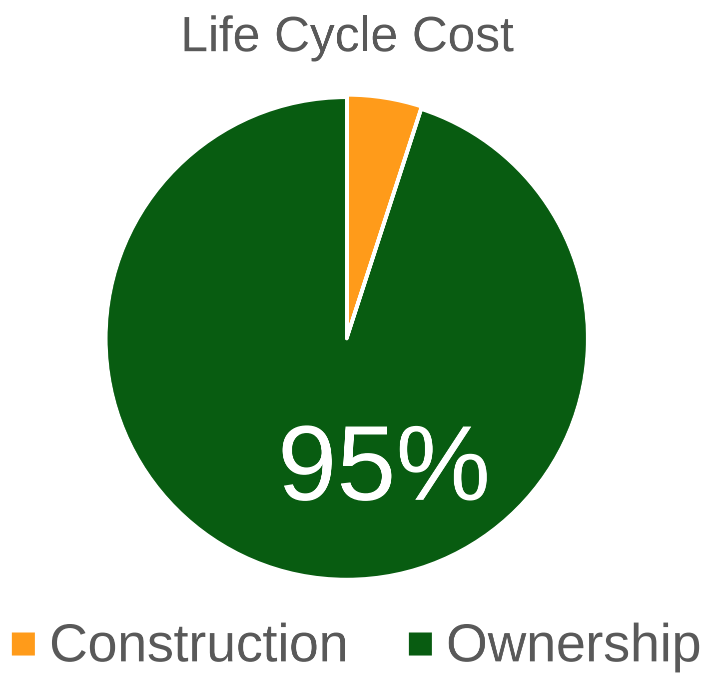
METER DATA VERSUS BUILDING CONTROLS DATA

- **Building automation** is the automatic centralized control of a building's heating, ventilating, air conditioning, lighting and other systems through a building management system and building automation system (BAS).
- Objectives: improved occupant comfort, efficient operation of building systems, reduction in energy consumption and operating costs, and improved life cycle of utilities.

OPIs VERSUS KPIs

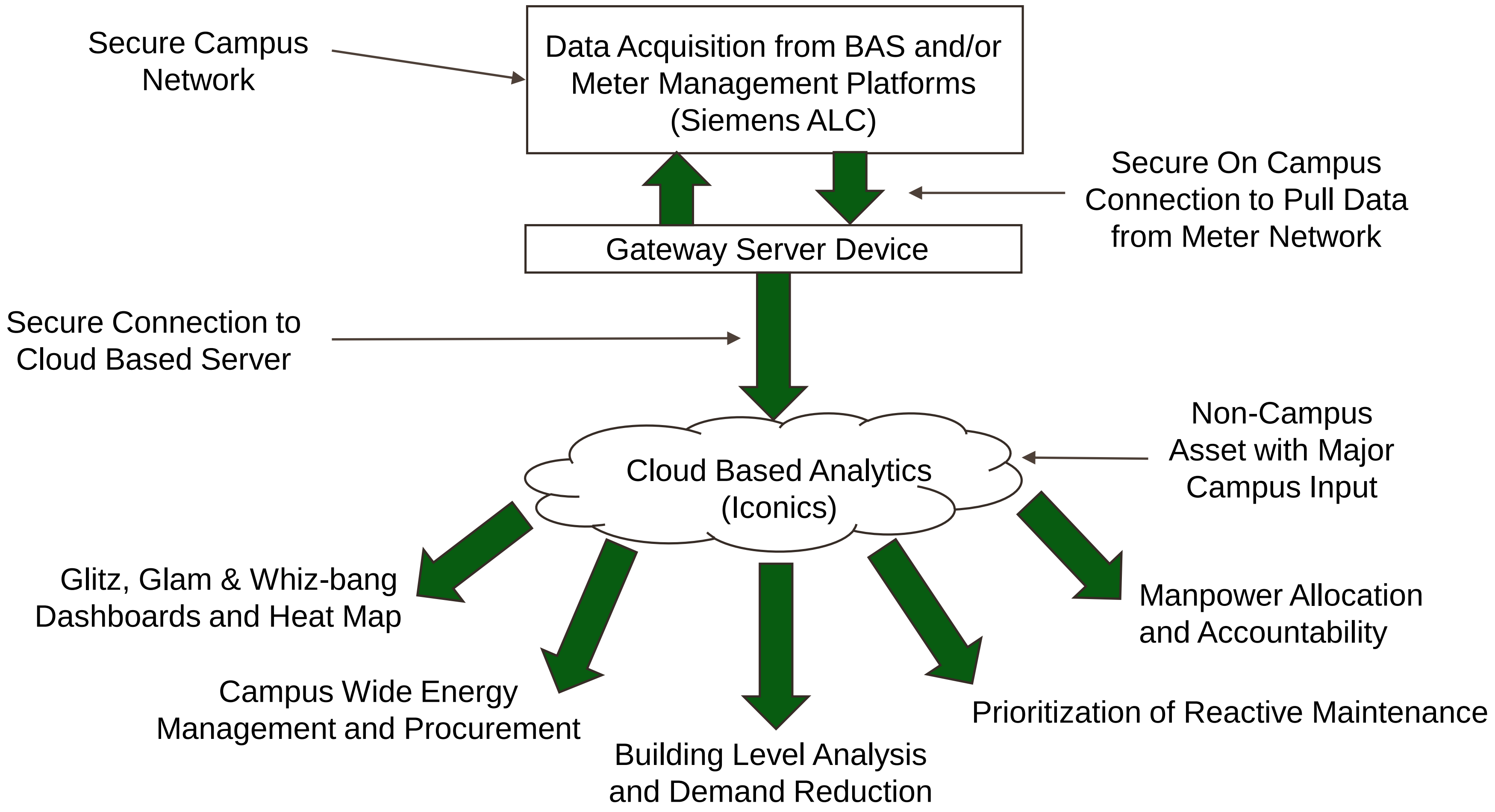
OPI	KPI
• Operating Performance Indicator	• Key Performance Indicator
• Inward facing	• Outward or external facing
• More detail and specific	• High level generality
• Narrow focus of information	• Broad focus of information
• Limited use of information	• Extended use of information
• Limited users of information	• Extensive users of information

COLLECTING DATA – THE *WHY*



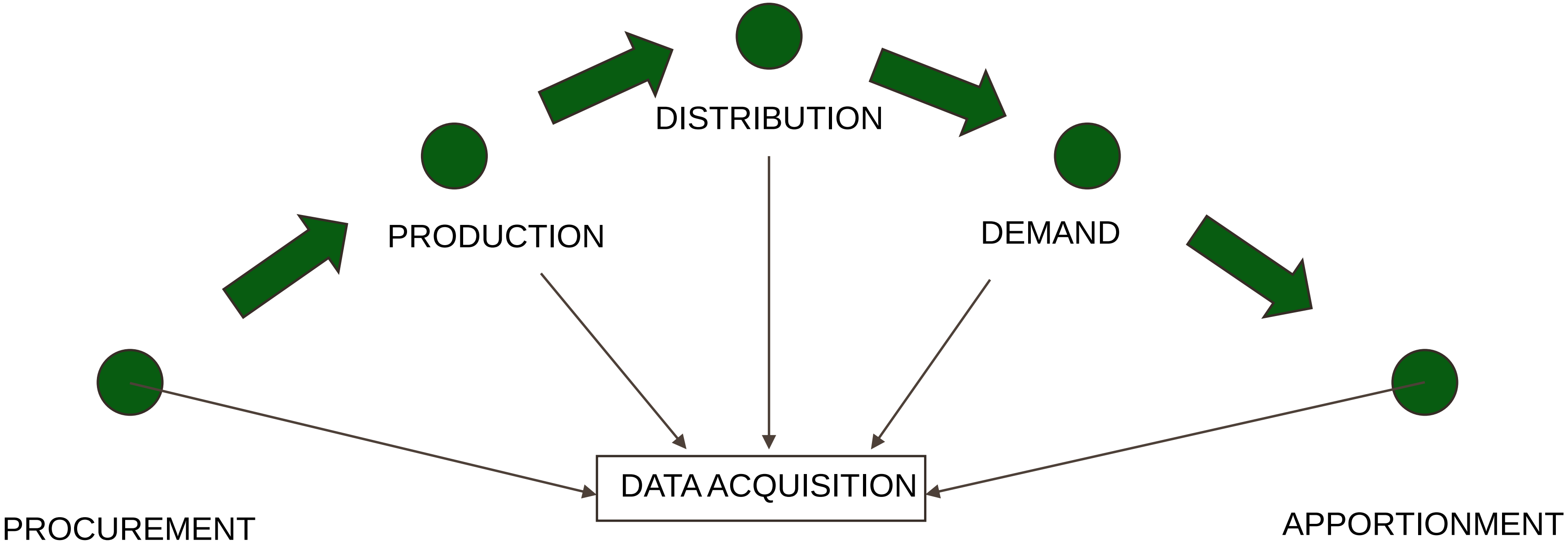
Source: US Federal Facilities Council Technical Report No. 142

COLLECTING DATA – THE *HOW*



COLLECTING DATA – THE *WHERE*

Connecting the energy dots



"Information is not knowledge. Let's not confuse the two."
"There is a penalty for ignorance. We are paying through the nose."
"When we cooperate, everybody wins."
W. Edwards Deming

USING DATA – THE *WHO*

Data Utilization	Functional Use	Indicator
Senior Management	Campus level functional awareness	KPI
Physical Facilities Management	Manpower allocation and accountability	OPI
Energy Procurement	Purchased utilities analytics and budgets	KPI
Building Level Demand Reduction	Identification of focus areas	OPI
Staff Level Maintenance	Prioritization and completion of work orders	OPI
Deferred Maintenance Planning	Repair/replace decision	OPI

Diverse utilization requires diverse reports, analytics and visualization

OPI DEVELOPMENT – STEAM CONDENSATE TEMPERATURE

DATA REPORTING

- Key meter data or BAS operating parameters – *steam condensate volume and temperature*
- Establish performance expectations – *Condensate temperature should be less than 150°F*
- Assumption:
  - High steam condensate temperature is an indicator of poorly performing steam consuming assets within a building (traps, heat exchangers, etc.) resulting in inefficient (wasted) steam use

OPERATIONAL PERFORMANCE INDICATORS

- **Percent (%)** of buildings operating with condensate temperature greater than 150°F?
- **Duration** that buildings' condensate temperature has been above 150°F?
- **Amount** of energy/money wasted or lost?

Leverage the data available!

OPI DATA REPORT – STEAM CONDENSATE TEMPERATURE

STEAM CONDENSATE	0 gal.						
						METRIC 1	METRIC 2
Meter	**Bldg GSF**	**Gals**	**Lbs**	**Lbs/GSF**	**SC Avg Temp**	**Days on List**	**Cumulative $**
Bldg A	60,490	16,283	132,706	2.19	166°F	1	$21
Bldg B	77,766	64,918	529,082	6.80	107°F	0	0
Bldg C	73,114	351	2,861	0.04	60°F	3	0
Bldg D	243,059	51,988	423,702	1.74	185°F	8	$148

<100°F >150°F

DATA ANALYTICS: RETURN ON ALLOCATED RESOURCE

Bldg. D: 423,702lbs of condensate
@ 35°F of excess (wasted) heat
= 14.82957 MMBtu
@ Cost of Steam @ $10/MMBtu
= ***$148.30 LOST OPPORTUNITY***

Corrective Cost Assumptions:
Labor Cost @ $30/hr.
Material Cost @ $15 @ 50% of labor
= $45/Hour

Steam Condensate Temperature
→ Direct correlation
→ Simplistic calculation
→ Quantifiable savings

ROAR Breakeven Analysis:
$148.30/$45 = **3.30 Hours**

OPI DEVELOPMENT – CHILLED WATER DELTA T

DATA REPORTING

- Key meter data or BAS operating parameters – *chilled water delta T, flow, and ton-hrs.*
- Establish performance expectations – *Delta T should be greater than 10°F*
- Assumption:
  - *Low delta T at the building level is an indicator of poorly performing cooling or air conditioning assets within a building (cooling coils, economizers, etc.) resulting in inefficient (wasted) chilled water use*

OPERATIONAL PERFORMANCE INDICATORS

- **Percent (%)** of buildings operating with a chilled water Delta T of less than 10°F?
- **Duration** that buildings' Delta T has been below 10°F?
- **Amount** of energy/money wasted or lost?

Leverage the data available!

OPI DATA REPORT – CHILLED WATER DELTA T REPORT

CHILLED WATER										
Meter	Bldg GSF	Weeks Gals	Gals Seasonal Avg.	% Variance	Week's TonHrs	kBTU/GSF	GPM	Supply Temp	Return Temp	Delta T
Bldg. B	77,766	63,892	110,019	-42%	494	0.08	6	78	80	2
Bldg. D	243,509	1,083,264	800,856	35%	2,507	0.12	254	45	46	1
Bldg. E	74,482	525,696	548,217	-4%	3,522	0.57	50	45	50	10
Bldg. F	108,000	1,806,656	1,615,969	12%	6,982	0.78	176	45	51	6

DATA ANALYTICS: RETURN ON ALLOCATED RESOURCE

Bldg. F: 6°F Delta T

6,982 Ton-Hrs. with 176 GPM flow

Savings = $502.70 @ $0.072/ton-hr.

Factors to Consider

- Pumping lots of water with ineffective thermal transfer
- Low return temperature impacts chiller performance
- In a office type building with return air and economizer, what requires this amount of cooling… ***IN JANUARY?***

- *Actual Root Cause: The building control technician eliminated use of the economizer feature on two (2) large air handler units unless the outside air temperature was below -20 degrees.*

Chilled Water Delta T

→ Indirect correlations

→ Complicated calculations

→ Challenging to quantify savings

DATA CORRELATION: RETURN ON ALLOCATED RESOURCE

Bldg. D: 1°F Delta T

2,507 Ton-Hrs. with 254 GPM flow

Savings = $180.50 @ $0.072/ton-hr.

Why Care?

- Pumping lots of water with ineffective thermal transfer
- Low return temperature impacts chiller performance
- Bldg. D condensate temp is high.
- Simultaneous heating and cooling?

Opportunities

- Elimination of simultaneous heating and cooling has combined saving potential of $328.80
- Additional efficiency gains of correcting both problems in the same maintenance trip

Simultaneous Heating and Cooling?

→ Indirect correlations

→ Complicated calculations

→ Challenging to quantify savings

REAL TIME METER MONITORING, ANALYTICS AND VISUALIZATION

PHASE 1: BUILDING LEVEL, CAMPUS-WIDE

- Step A: Implementation of two utilities (steam condensate and chilled water)
- Step B: Add three more utilities (steam, electric and domestic water)
- Step C: Graphical visualization of data for KPI transparency (campus and building EUIs)

PHASE 2: 24/7/365 REAL TIME SITUATIONAL AWARENESS

- Step A: Campus-wide visualization at central plant (steam, chilled water and domestic water)
- Step B: Auto-generated notification process (response team identification and communication)

PHASE 3: BUILDING LEVEL, DISCRETE SYSTEMS

- Step A: Identification and prioritization of critical assets (all inclusive analysis)
- Step B: System (by system) specific parameters and rule development and implementation

RETURN ON RESOURCE ALLOCATION

- Internal Staff Allocation
  - Projected ROI from auto-generated report process = 1.12-2.8 years
- Purchased Utilities Allocation
  - Projected ROI from reduction in energy costs = 0.25-0.50 years

SUMMARY

- Translation: Converting ones and zeros into meaningful investment and action
- Ownership: Functionally-aligned and assigned
- Governance: Roles and rules
- Transparency: Data sharing

THANK YOU

Questions?

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