



**APPA INSTITUTE FOR
FACILITIES
MANAGEMENT
PROVIDENCE, R.I.
SEPTEMBER 14, 2022**



DATA INTEGRATION FOR UTILITIES AND ENERGY



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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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TODAY'S PRESENTATION

- **Course Description:**
- **This course explores:**
 - We will discuss our needs for data, and how we can share our data with our institution's vast data resources. Facilities Management energy, maintenance, financial, space management and other data is fast becoming another sought-after campus utility that should be available to the entire institution in an integrated, globally acceptable manner. To do our jobs, it's not enough to just know how to use data applications, we need to understand how an integrated, easily accessible "data warehouse" can optimize the performance of those applications.
- **Learning Objectives:**
 1. Become familiar with database structures
 2. Become familiar with integrating databases
 3. Learn how this can be useful to those who work in FM
 4. Think about how to convert data into information
 5. Begin to think about how the various sources of data in your institution can be integrated and used.

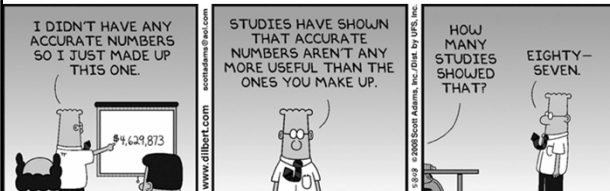
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PURPOSE OF TODAY'S PRESENTATION

- To provide a broad understanding of:
 - Data Warehouses/Data Marts
 - How to collect the data
 - How to convert data into information

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WORDS OF WISDOM



If you torture the data enough, it will confess to anything.

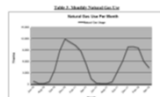
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DISCUSSION

- Create a report of energy consumption and cost for each building owned by your institution:
 - If served by a District Energy System or local system(s):
 - Chilled Water
 - Steam or Hot Water
 - Electricity
 - Water
 - Fuel-Gas/Oil/Coal
 - If served by the local utility
 - Electricity
 - Fuel-Gas/Oil/Coal
 - Water
 - This year versus last year information:
 - Consumption and cost
 - Hours used and weekly schedule
 - Average number of occupants, i.e. staff, students, faculty
 - Square footage of building including classification(s), i.e. instructional space, administrative, research, housing, etc.
 - Departmental ownership
 - Weather, e.g. average temperatures, % sun, etc.
 - HVAC system type

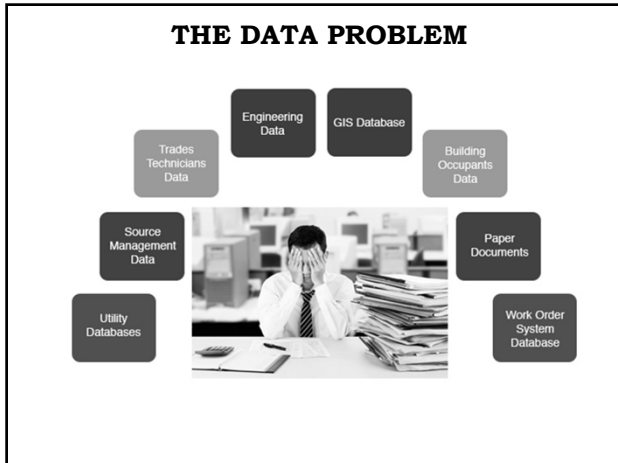
Table 1: Energy Consumption Data

Building	Year	Electricity (kWh)	Gas (therms)	Water (gallons)	Chilled Water (MBtu)	Steam (MBtu)
Building A	2013	120,000	50,000	10,000,000	200,000	0
Building B	2013	80,000	30,000	8,000,000	150,000	0
Building C	2013	150,000	60,000	12,000,000	250,000	0

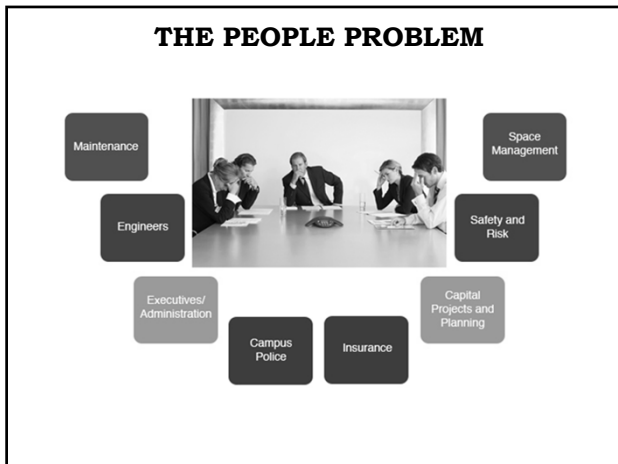


WHERE WOULD YOU GET THE INFORMATION TO PRODUCE THIS REPORT?

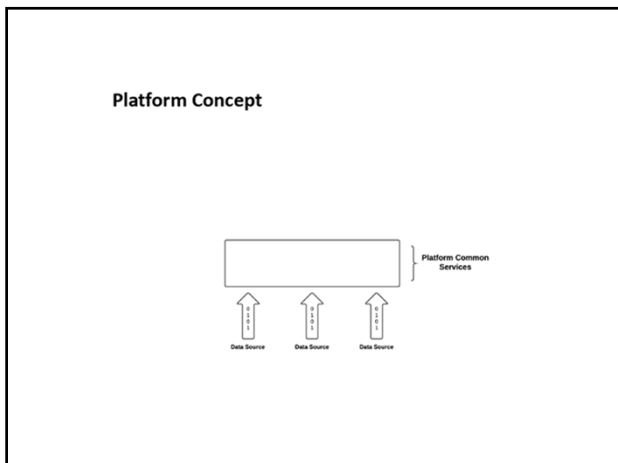
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Platform Concept



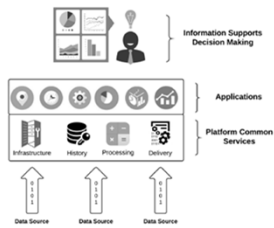
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Platform Concept



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Platform Concept



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Benefits of Connected Systems



Generation Facility

- View key plant data outside the control room without affecting production
- Remote assistance for inexperienced operators with unique and challenging situations



Customer (building operator)

- Understand energy usage and invoicing
- Relate external data to usage (like weather data)
- Integrate building automation system (BAS) data into a single dashboard



Mobile Worker

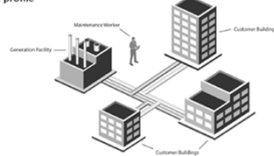
- Save time and money by automating meter-reads
- Have access to customer operations data any-time, anywhere.

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Benefits of Connected Systems

District Energy System Operator

- Improve accuracy and timeliness of billing
- Assist customers develop energy saving strategy
- Provide customers access to real-time and historical operations data without a security risk
- Incorporation of 'meta-data' allows customers to rank themselves against others of their same profile



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Utilities & Energy Management Information System (UEMIS):

Convert DATA into INFORMATION
Convert INFORMATION into KNOWLEDGE

- Gather dispersed and disparate utility related data from multiple sites, multiple suppliers and different types of equipment.
- Validate the data and manage missing or erroneous data.
- Convert the raw data into usable management information, particularly meaningful Key Performance Indicators (KPIs).
- Generate meaningful, added-value reports that include the analysis of trends and exceptions.
- Distribute the analyses and reports across multiple sites, internally and externally, in a timely fashion.

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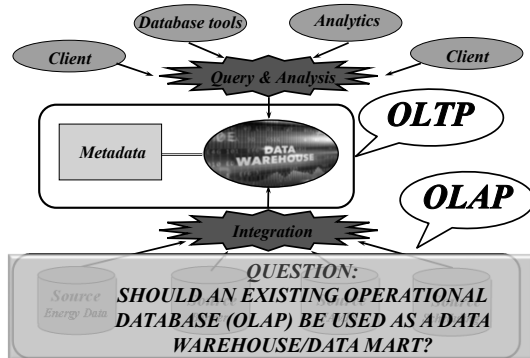
INTEGRATE THE DATA

Data Warehouse operates on an enterprise level and contains all data used for reporting and analysis, while **Data Mart** is used by a specific business department and is focused on a specific subject (business area).

- Aggregate data into a single centralized repository available to all authorized stakeholders
- Integrate the data into consistent subject categories based on how users refer to them
- Apply consistent value representation, units, and descriptors to the data

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DATA WAREHOUSE/DATA MART ARCHITECTURE



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QUERY THE DATA

- Use IT database management tools to create “views” of data organized for use by reporting software (clients).
- Apply analytics, e.g. machine learning methods, artificial intelligence (AI), etc. to extract information from data subsets

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CONVERT DATA TO INFORMATION

- Microsoft Office
- Third party reporting tools and applications
- Analytics, AI
- Web applications

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GROUP DISCUSSION

- What data is collected by other functions in your organization that you can/want to use?
- What data is collected institutionally that can be used to meet your needs?
- What formats does the data require, i.e. spreadsheet, dashboard, formal reports, etc.?
- How can we convert the data into information in the required format(s)?

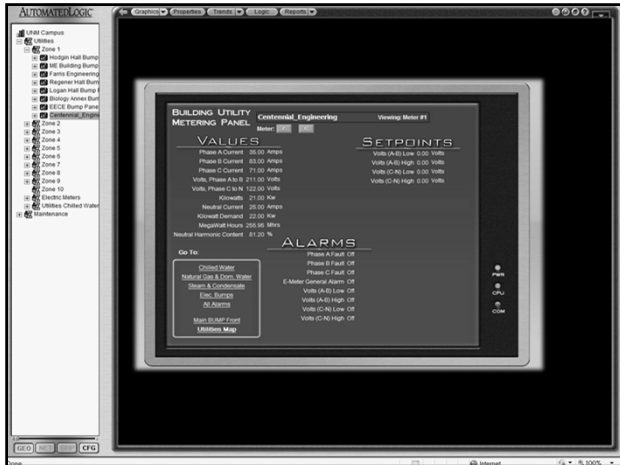
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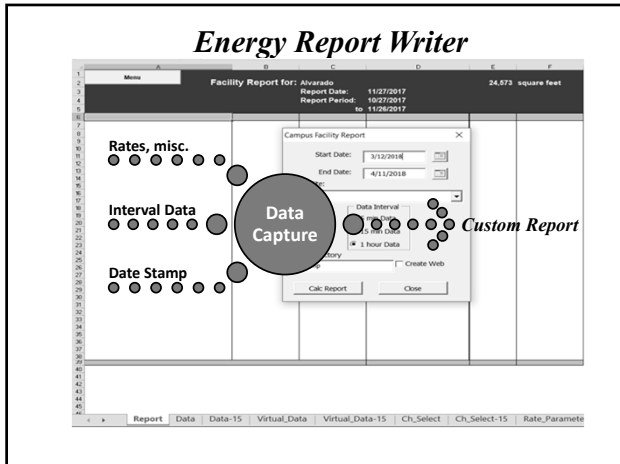
EXAMPLE APPLICATIONS

- Convert INFORMATION into KNOWLEDGE
 - Operational and Decision Support
 - Analytics, AI, Fault Detection
 - Reporting

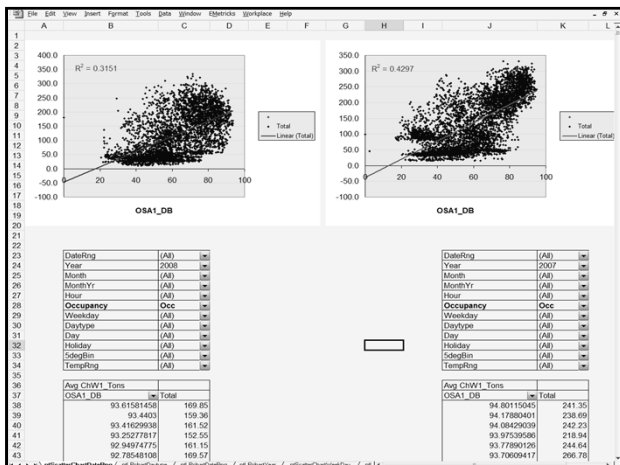
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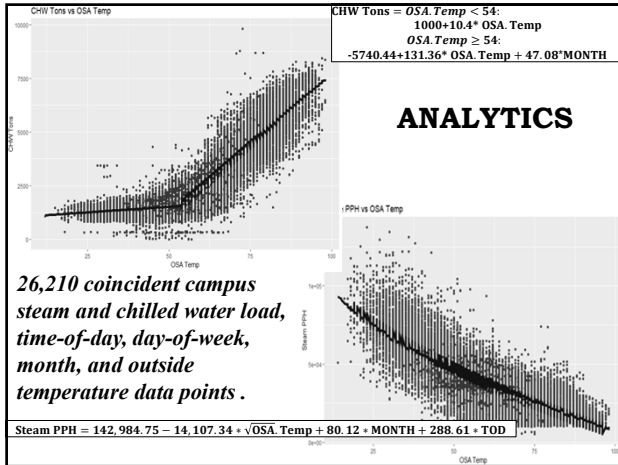
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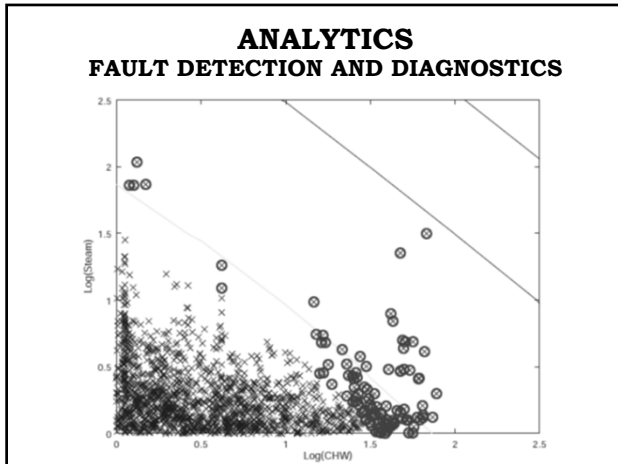
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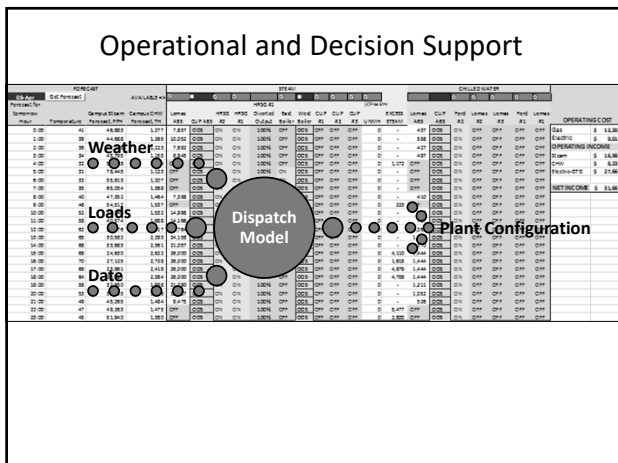
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**THIS CONCLUDES THE
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EDUCATION SYSTEMS COURSE**
