WAGES in SPM 7.0

StruxureWare Power Monitoring v7

What is WAGES monitoring?

Water
Air
Gas
Electric
Steam

- The first step in gaining control of your energy costs is to measure all the Energy flowing through your system:
  - **Water** – reuse, chilled, process
  - **Air** – compressed
  - **Gas** – natural gas optimization
  - **Electric** – power distribution
  - **Steam** – process

What is WAGES monitoring?

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- Monitor and manage all your electric and piped utilities:
  - Proactively manage Energy cost and usage
  - Increase Energy efficiency and reduce emissions
  - Fully utilize Energy assets
  - Improve strategic decisions and Energy management best practices
  - Automate (previously) manual tasks
  - Improve Energy reliability and availability

Water

- Whether chill, condensate, makeup, or process, **Water** plays a critical role in nearly every industry
  - Chill water losses in buildings with metered supply and return flow can be determined by the differential flow. Pressure data can be used for diagnostics of the distribution system and/or diagnosis of building performance.
  - Sub-billing water and sewage by usage rather than square footage facilitates precise allocation of energy costs and deters excessive consumption.
  - Peak blowdown of cooling towers can be achieved by monitoring both the make-up water feed line and the blowdown line, yielding significant savings in both make-up water consumption and chemical costs.

Inefficient steam system operation is often expressed through increased make-up water consumption.

Boiler tube scale consisting of iron & silica as thin as 1/32” can result in up to 7% efficiency loss in a boiler.

Air

- Compressed **Air** is the most inefficient energy source utilized by industry.
    - 7HP of electrical energy to produce 1HP of compressed air
  - A major source of energy waste in compressed air systems is a loss of pressure due to short duration, high demand events. If air pressure drops below the minimum operating pressure of tools and equipment, efficiency declines exponentially.
    - A 10% pressure reduction in a compressed air system results in a 40% loss in work output!
  - Leaks are the greatest source of energy loss in compressed air systems, often accounting for between 20% and 50% of total air consumption!

@ 100 psi, one 1/16” diameter hole wastes 2,220,000 cubic feet of air per year. That’s 6,040 kWh of electricity!

Compressors operated according to trended demand profiles are up to 30% more efficient than compressors servicing unknown loads.

Gas

- Whether used in a process, as a feedstock, or as a fuel, **Gas** consumption and exhaust can have a significant impact on operating costs.
  - Coordination of gas consuming processes is critical to balancing supply with demand, reducing overall gas usage and avoiding unnecessary load factor charges.
  - Proper control of the air/fuel ratios through continuous measurement of gas and oxygen supplies can quickly improve efficiency, lower fuel consumption, improve product quality, or improve product yield.
  - Sub-metering individual gas processes provides accurate usage trends for cost allocation and provides the consumption data required to purchase cost effective gas contracts.

Minimization of gas consumption is generally dependent upon maximizing the efficiency of other dependent energies. Inefficient use of compressed air, steam, water and electricity often expresses itself through elevated gas usage.

Electricity

- Whether an industrial plant, educational facility, hospital, or data center, your operations demand plentiful, reliable electricity.
  - Allocating electrical costs to responsible parties provides an accurate assessment of costs and drives accountability to the user. Historically, sub-metering electrical service has reduced consumption by nearly 30%.
  - Sub-metering provides an accurate picture of electrical demand, enabling energy managers to cost-effectively balance electrical supply with known demands. By understanding the supply/demand relationship, energy managers can identify unused capacity as well as avoid unnecessary demand charges and penalties.
  - Electrical power quality issues such as harmonics and voltage irregularities not only adversely affect your operations, they often damage your power equipment, shortening its life.

Sub-metering generally yields a 4-8% reduction in costs through effective management of electrical loads and increased equipment utilization.

An additional 10% cost savings can be achieved through improved system reliability.

Steam

Water
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Gas
Electric
Steam

- **Steam** systems are often an operational constraint. Improving system coordination and performance increases overall capacity and reduces costs.
  - The effects of steam, hot wastewater, and condensate loss extend beyond energy costs. Makeup water must be chemically treated, at significant cost, to protect the boiler and piping systems.
  - Steam losses demand large amounts of makeup water which significantly lowers the temperature of the feed-water reaching the boiler, thereby increasing thermal stress and shortening its life.
  - Many steam systems devote the first 10 to 25 of their send-out to leaks and combustion inefficiencies. Monitoring and controlling these inefficiencies reduces fuel costs and allows steam energy to be applied to extending production.

Since head loss due to friction in a piping system is proportional to the square of the flow rate, a 20% reduction in flow rate results in a 36% reduction in friction loss.

Boiler “short cycling” can be identified and eliminated through comprehensive steam metering, saving thousands of dollars.

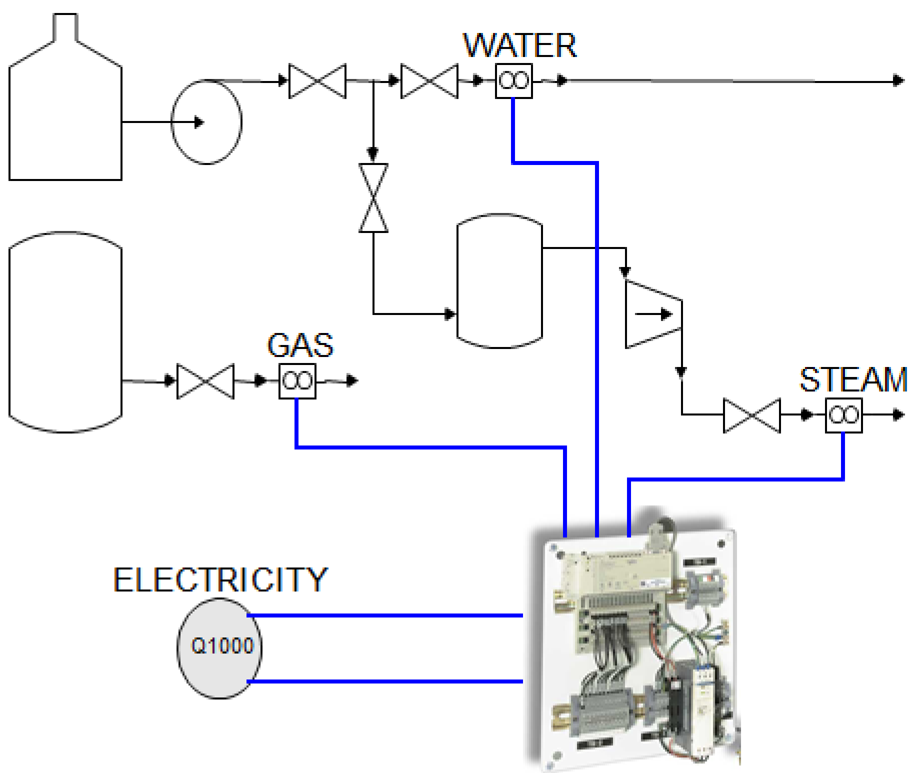
What’s good?

- A single system to monitor and analyze **all energy sources**
  - Identify system losses and inefficiencies.
  - Effectively Shift Utility Demand Patterns to Reduce Usage Costs and Penalties.
  - Utilize Optimum Fuel Sources by Time and Function.
  - WHAT does is cost to run a chiller?
- Supply-side analysis of **all energy sources**
  - Standardize Utility Usage Through Benchmarking.
  - Identify Unused Utility Capacity.
  - Control Energy Quality and Costs.
  - Avoid Energy Penalties
  - Analyze Production Costs

How does it work?

- a ‘sensor’ is used to input a ‘signal’ to a device or ‘meter’
  - CT’s / PT’s for an electric meter
  - Flow transducer for a gas meter
  - Chiller water flow and temp for a BTU Meter
- ‘meter’ is connected through a communication network to the SPM Software
- SPM Software adds the context
  - Units
  - Delta calc for cumulative
  - Sum for interval

Compensated vs. Uncompensated Inputs



- Compensated WAGES Inputs
  - Analog inputs for flow, temperature and pressure connect to a “Flow Computer” or Totalizer that produces a digital pulse or analog signal for input to the system.
- Uncompensated WAGES Inputs
  - Analog inputs for flow, temperature and pressure are directly connected to a 7550 RTU or PLC for custom logic/ complex algorithms to perform compensation calculations

Hardware options

Twido PLC

- Digital Inputs only (12, 28 or 44)
- Reliable data logging (via the EGX300)
- Logged data is passed to SPM (via EGX300)

EGX300
+
Twido PLC

ION RTU

- Both Digital Input (8/16) and Analog Input (4) options in a single device
- Reliable data logging onboard the device
- Logic and Arithmetic functions
- Onboard alarms for WAGES
- Modbus Mastering
- Custom displays

ION7550RTU

PM800 Input Metering

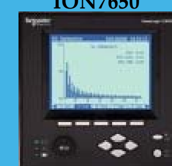
- Both Digital Input (4/8) and Analog Input (4) options in a single device
- Reliable data logging onboard the meter for Input Metering
- Onboard Alarms for WAGES

PM800 Series

Comprehensive ION Meter

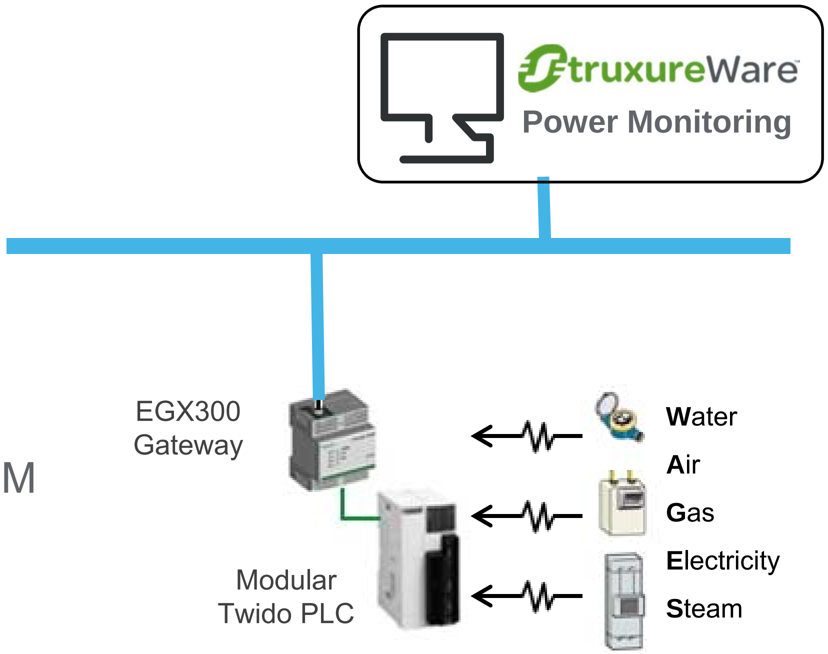
- Both Digital Inputs (8/16) and Analog Inputs (4) in a single device
- Reliable data logging onboard the device
- Logic and Arithmetic functions
- Onboard alarms for WAGES
- Modbus Mastering
- Custom displays
- ION7550/7650 meter provides extra electrical & PQ monitoring

ION7550
ION7650



Hardware architectures for WAGES

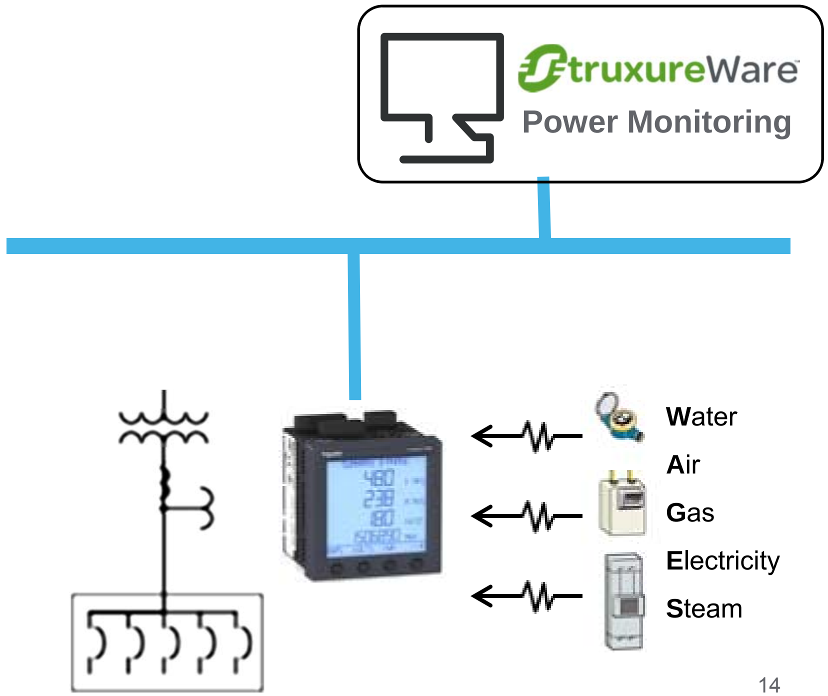
- **TWIDO PLC + EGX300**
  - Low cost alternative to using an ION7550 RTU device or ION meters
  - Expansion of the standalone EGX300 + Twido WAGES solution
  - Supports any flow meter or metering device with digital pulse outputs
  - Used for WAGES consumption reporting in Buildings and Industry



> Use ***TwidoSuite*** to program PLC
> Use ***ETL*** to extract/load the logs from EGX => SPM

Hardware architectures for WAGES

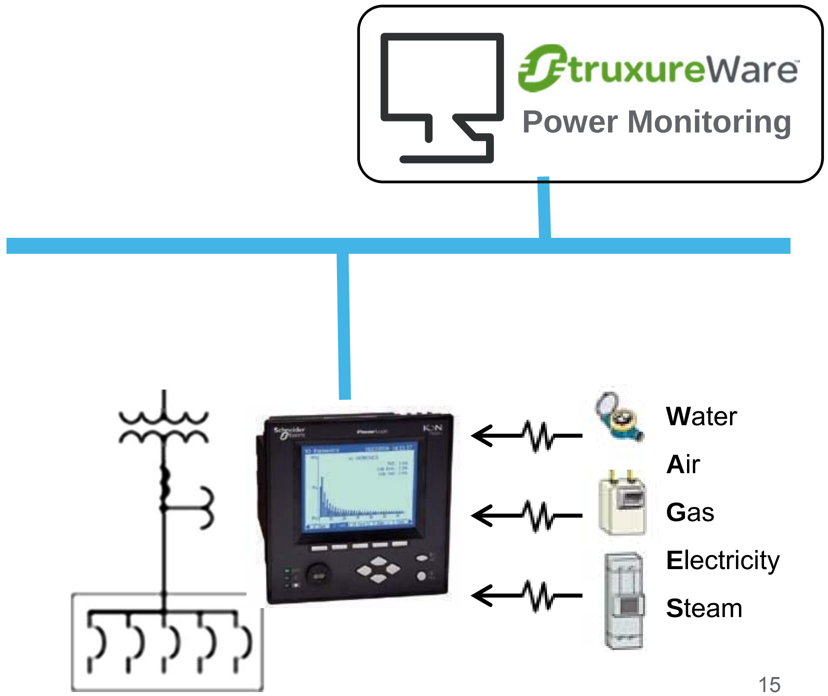
- **CM and PM meter "Input Metering"**
  - Connect downstream flow/pulse/gas meters to inputs on CM or PM meters
  - Configure the CM or PM meters to calculate and log WAGES measurements using the "Input Metering" feature of the advanced meters
  - ION:E 6.0 and SPM7 comes with CM and PM meter drivers that support WAGES measurements calculated by "Input Metering"



> Use ***ION Setup*** to program input metering

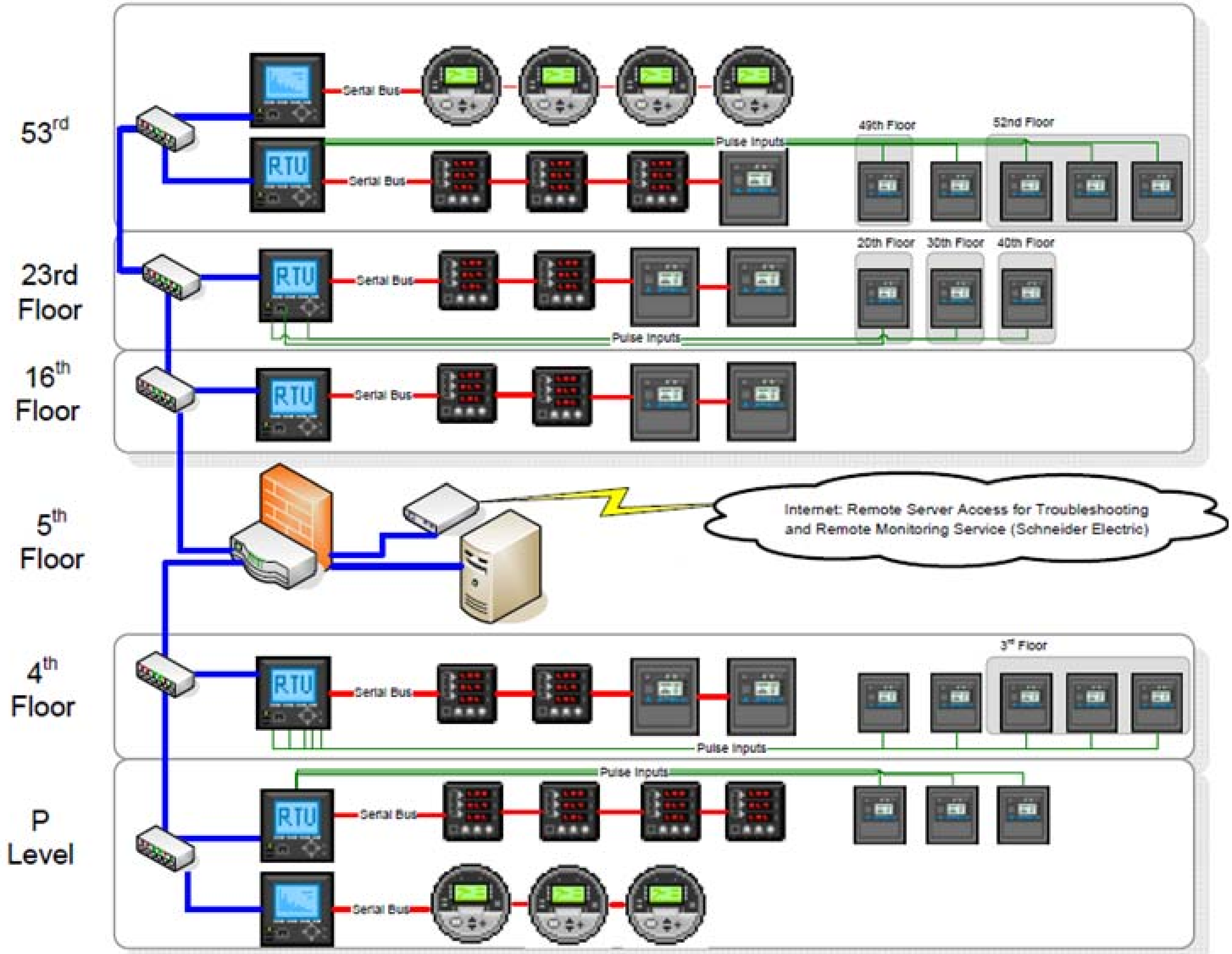
Hardware architectures for WAGES

- **ION7550RTU or ION meters**
  - Connect downstream flow/pulse/gas meters to inputs on ION devices
  - Configure ION devices to calculate and log WAGES measurements using ION Technology (pasting in ION module frameworks with ION *Designer* tool)



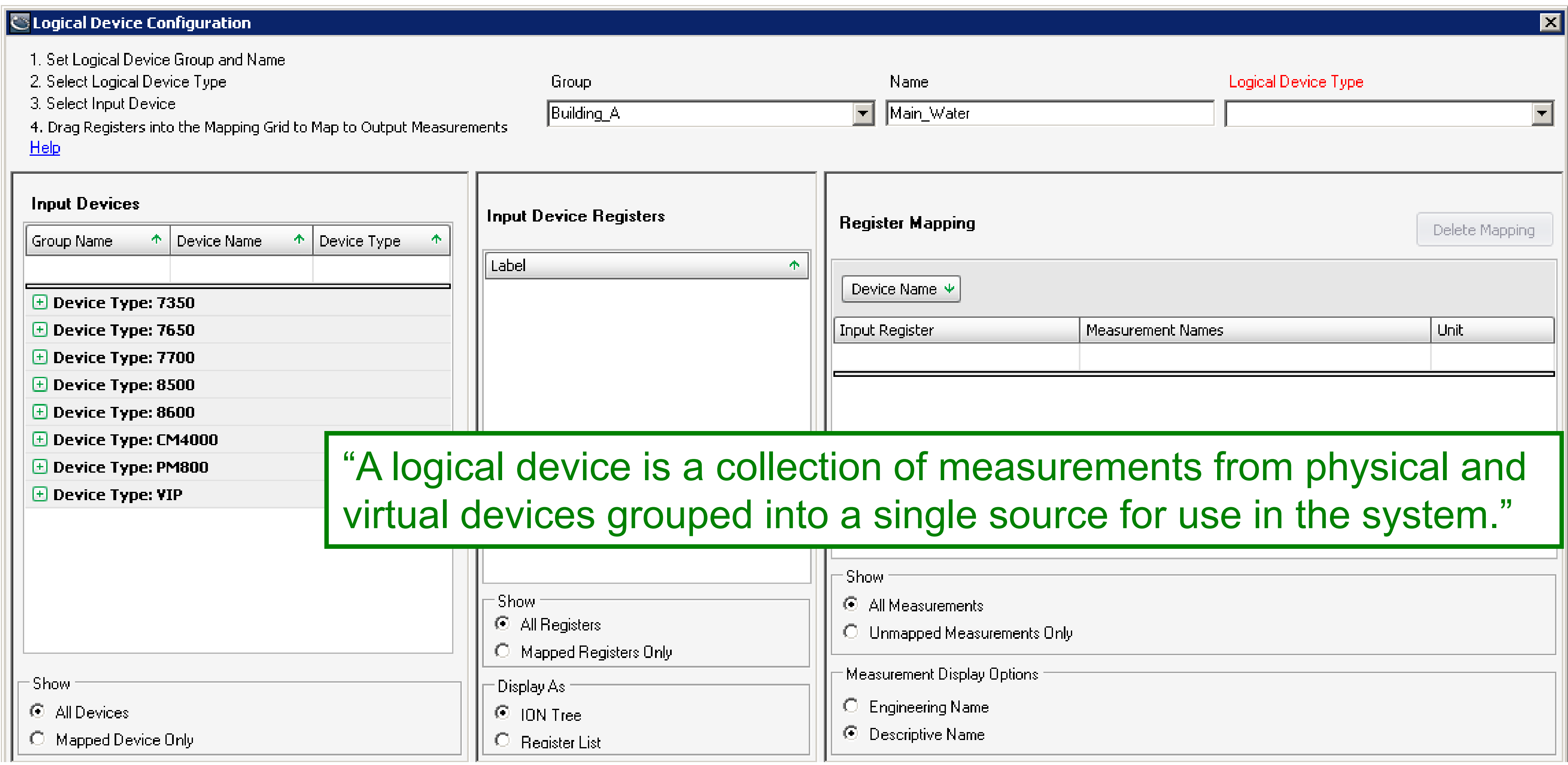
> Use ***ION Designer*** to program ION devices

WAGES Example Architecture



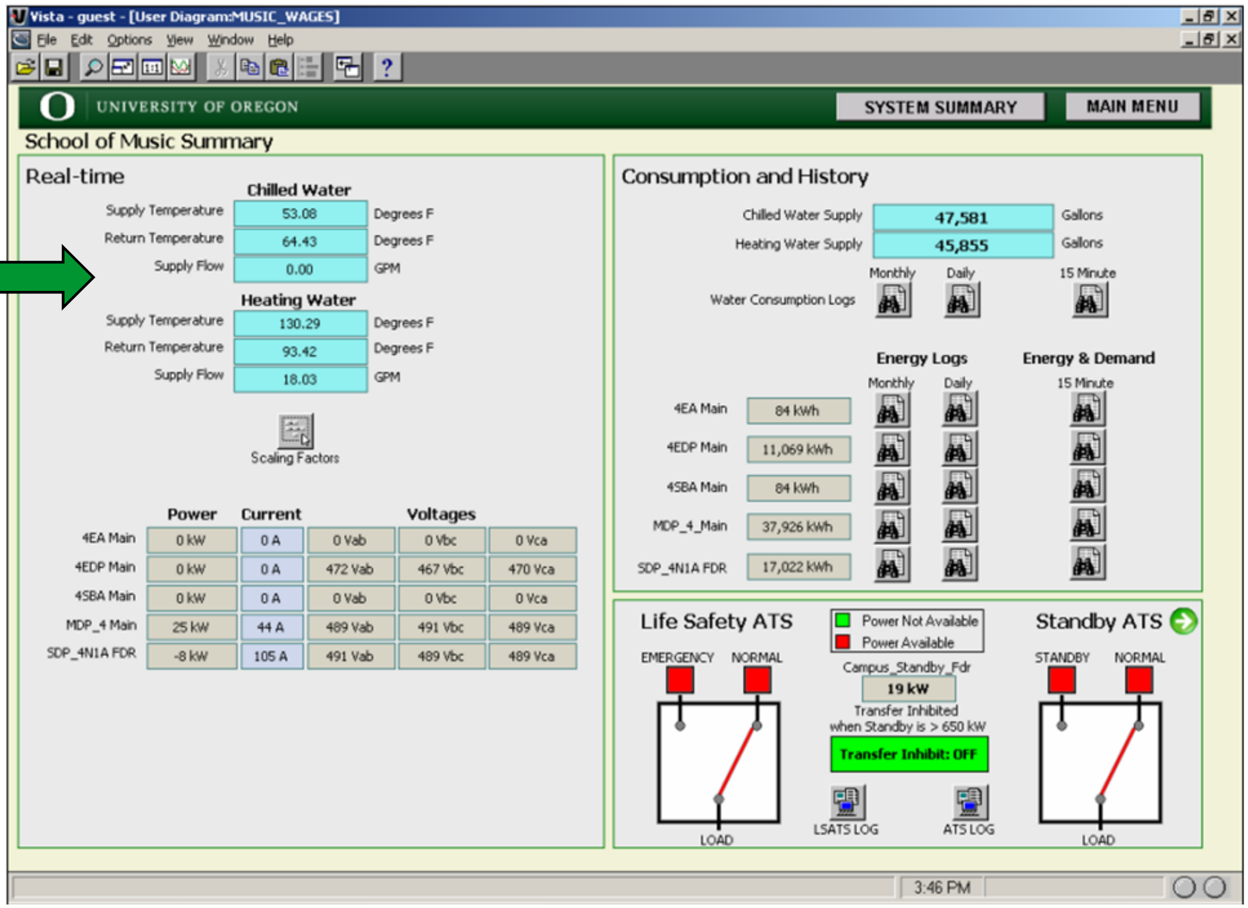
Logical Devices

- SPM 7.0 contains a Logical Device Editor – a simple tool to create custom (and logical!) monitoring points for WAGES inputs.



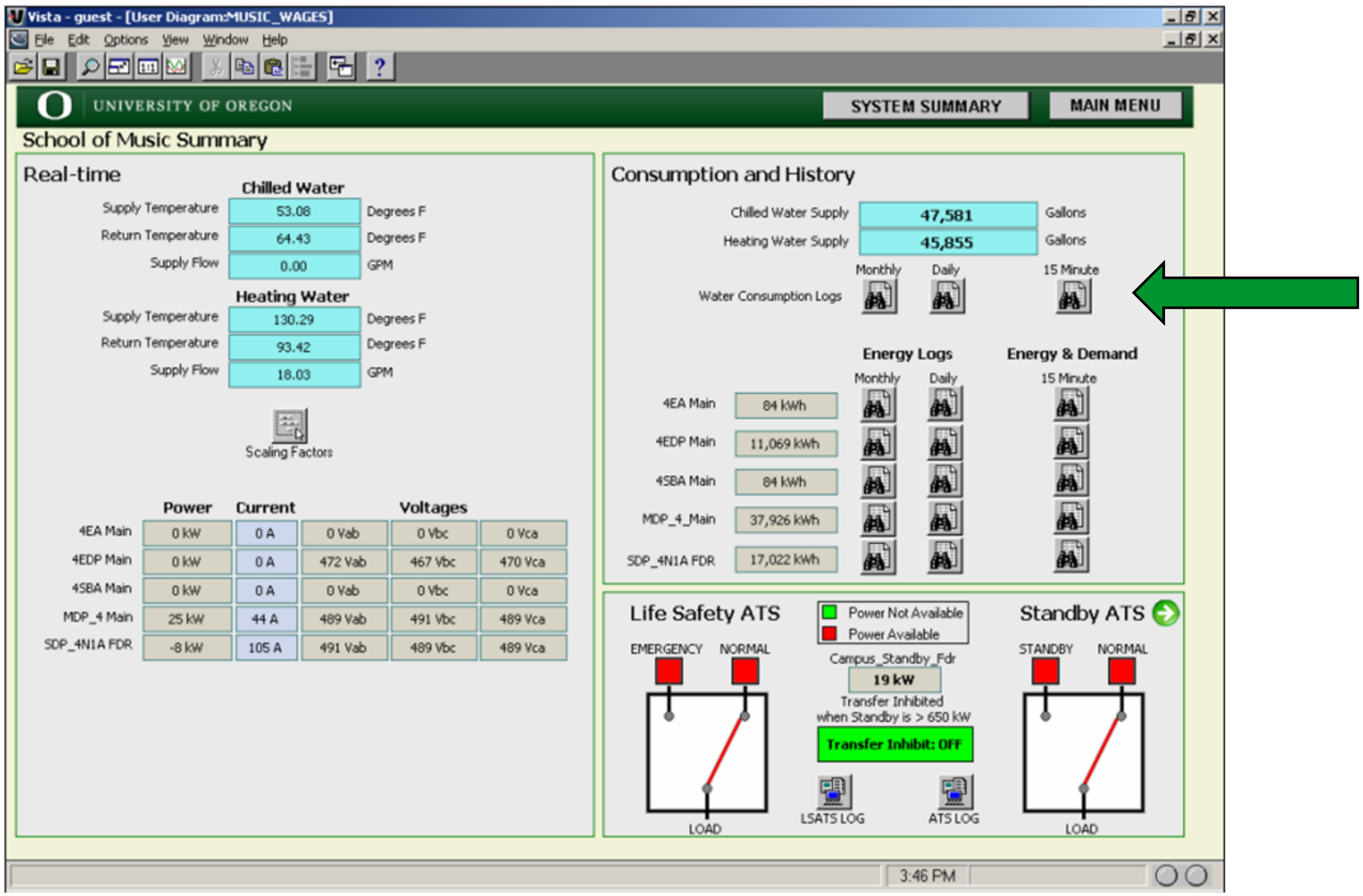
WAGES in Diagrams

- Vista diagrams using “logical” WAGES device names
  - Viewing real-time WAGES parameters
    - E.g. Flow rates, temperature, real-time energy consumption

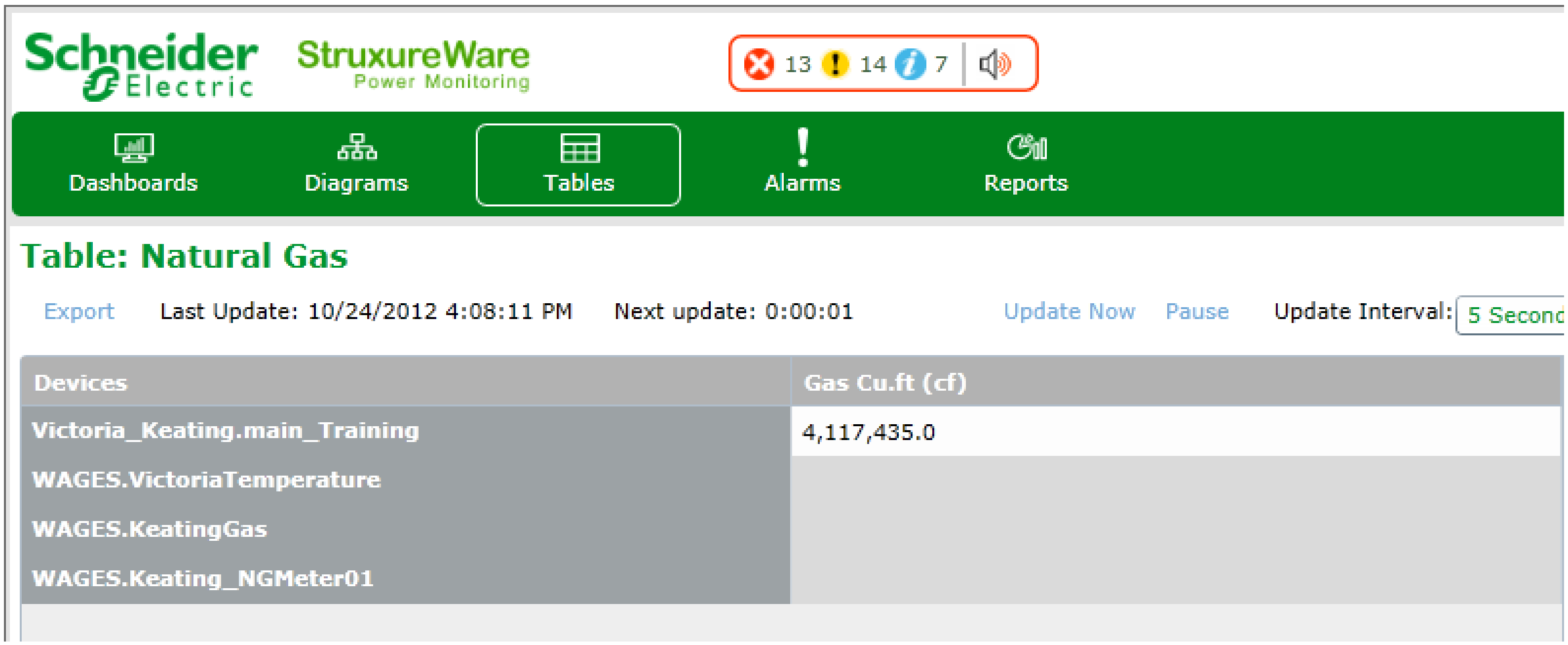


WAGES in Diagrams

- Vista diagrams using "logical" WAGES device names
  - View WAGES consumption history
    - E.g. Monthly, Weekly, Daily or 15 minute energy consumption history



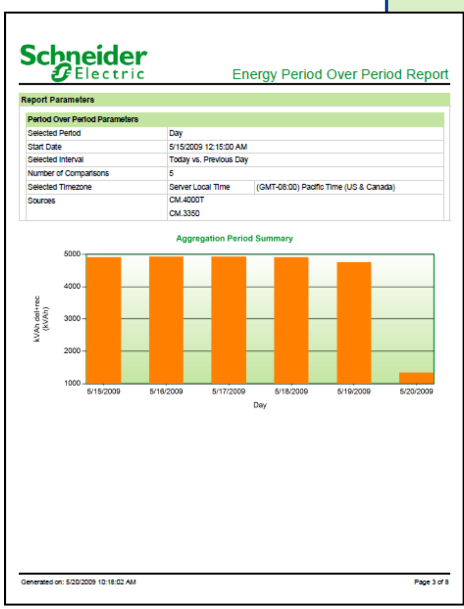
WAGES in Tables

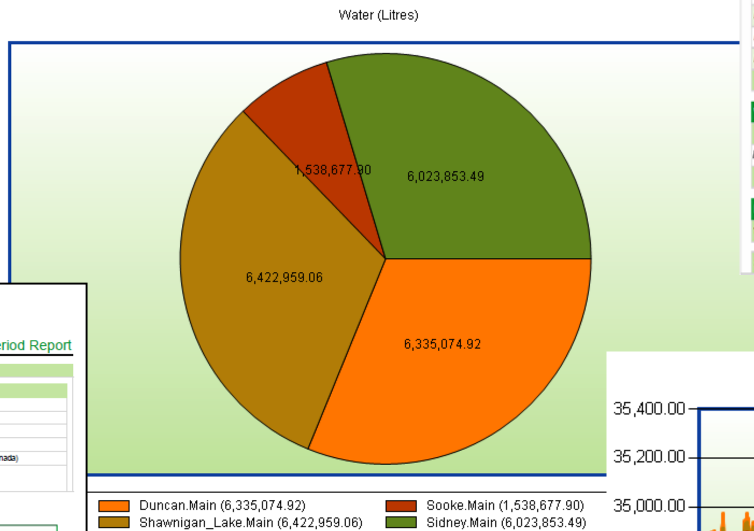


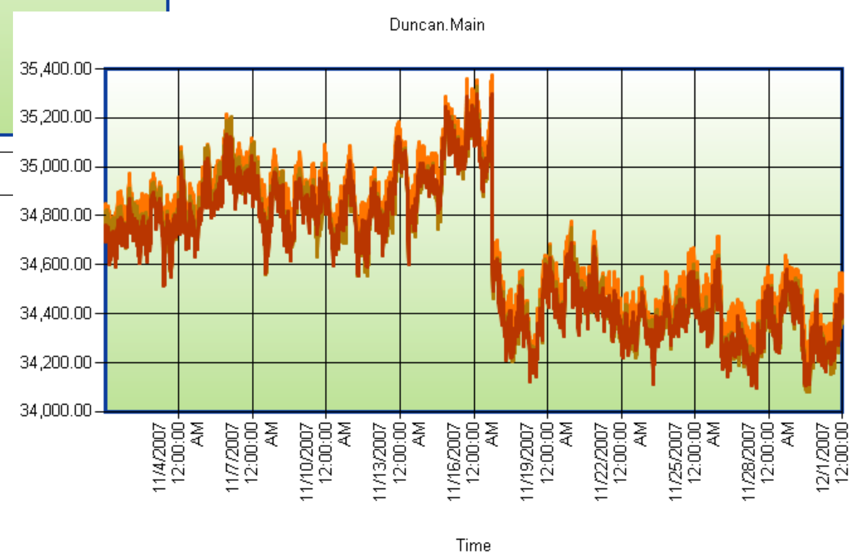
WAGES in Reports

- Energy Cost Report
- Energy Period Over Period Report
- Energy by Shift Report
- Trend
- Tabular

All Meters				
Energy Cost				
		Total	Unit Cost	Cost for Tariff
kVAh del+rec		25,125	$0.07	$1,758.75
kVAR sd del-rec		-17	$0.80	($42.46)
			SubTotal	$1,716.29
Demand Cost				
	Timestamp of Peak	Max Value	Unit Cost	Cost for Tariff
kVAh del+rec	9/21/2008 11:00 PM	25,598	$0.06	$1,535.88
kVAR sd del-rec	9/4/2008 7:00 PM	-45	$0.07	($113.50)
kVAh del+rec	9/21/2008 11:00 PM	54,148	$0.06	$3,248.88
kVAR sd del-rec	8/31/2008 11:15 PM	0	$0.07	$0.00
			SubTotal	$4,671.26
WAGES Cost				
		Total	Unit Cost	Cost for Tariff
Natural Gas		834	$1.20	$1,000.80
			SubTotal	$1,000.80
Extra Fee				
fee label				$7.99
SUBTOTAL				$7,396.34

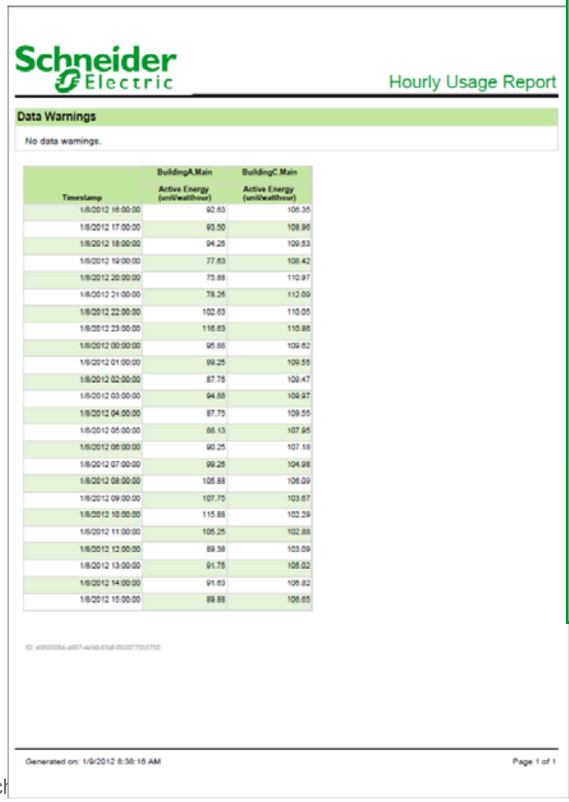






WAGES in Reports

- New energy summary report templates for WAGES usage reporting
  - Hourly Usage
  - Single Device Usage
  - Multi Device Usage



Schneider Electric — Hourly Usage Report

Data Warnings

No data warnings.

Timestamp	BuildingA.Main Active Energy (unit/watthour)	BuildingC.Main Active Energy (unit/watthour)
1/8/2012 16:00:00	92.63	106.35
1/8/2012 17:00:00	93.50	108.96
1/8/2012 18:00:00	94.25	109.83
1/8/2012 19:00:00	77.63	108.42
1/8/2012 20:00:00	75.88	110.97
1/8/2012 21:00:00	78.25	112.09
1/8/2012 22:00:00	102.63	110.05
1/8/2012 23:00:00	116.63	110.86
1/8/2012 00:00:00	95.88	109.62
1/8/2012 01:00:00	89.25	109.55
1/8/2012 02:00:00	87.75	109.47
1/8/2012 03:00:00	94.88	109.97
1/8/2012 04:00:00	87.75	109.55
1/8/2012 05:00:00	88.13	107.95
1/8/2012 06:00:00	90.25	107.18
1/8/2012 07:00:00	99.25	104.98
1/8/2012 08:00:00	106.88	106.09
1/8/2012 09:00:00	107.75	103.67
1/8/2012 10:00:00	115.88	102.29
1/8/2012 11:00:00	105.25	102.88
1/8/2012 12:00:00	89.38	103.09
1/8/2012 13:00:00	91.75	106.02
1/8/2012 14:00:00	91.63	106.82
1/8/2012 15:00:00	89.88	106.65

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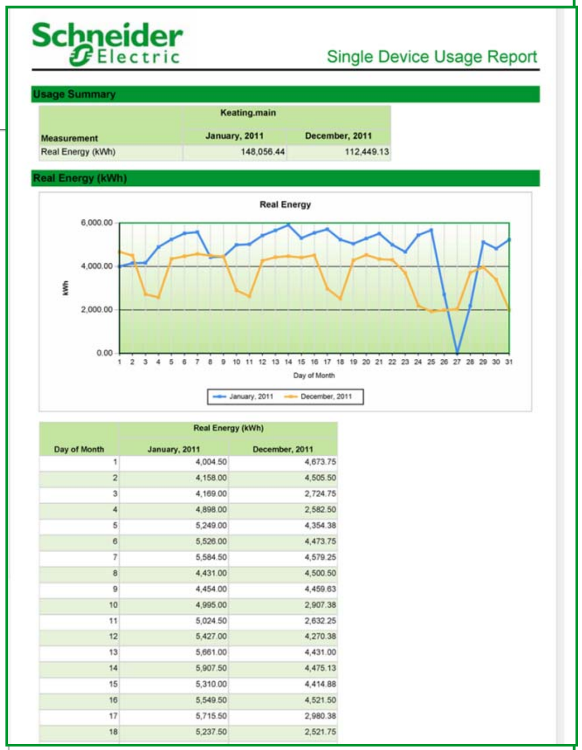


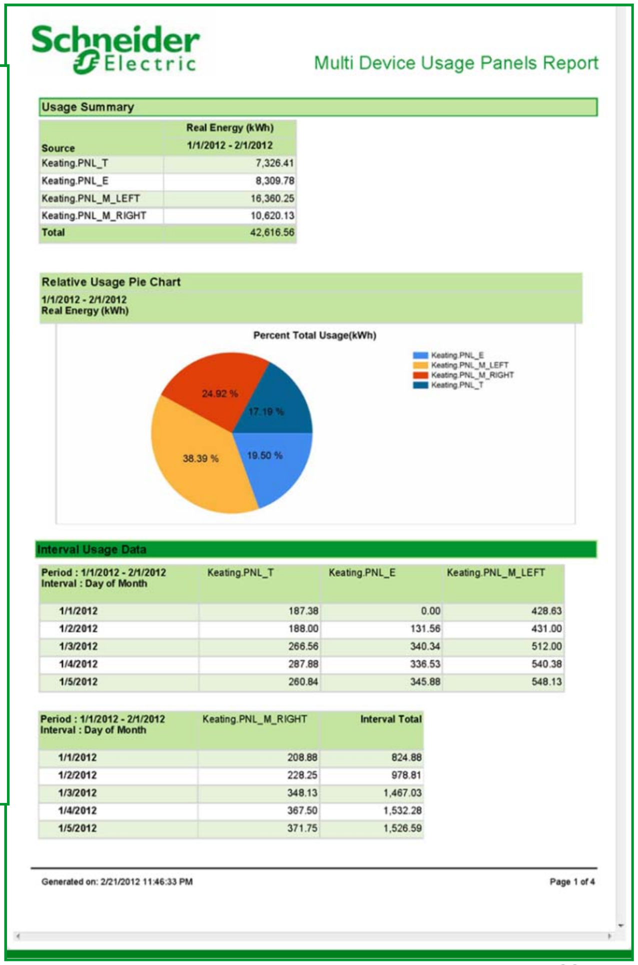
Schneider Electric — Single Device Usage Report

Usage Summary

Measurement	Keating.main January, 2011	Keating.main December, 2011
Real Energy (kWh)	148,056.44	112,449.13

Real Energy (kWh)

Day of Month	Real Energy (kWh) January, 2011	Real Energy (kWh) December, 2011
1	4,004.50	4,673.75
2	4,158.00	4,505.50
3	4,169.00	2,724.75
4	4,898.00	2,582.50
5	5,249.00	4,354.38
6	5,526.00	4,473.75
7	5,584.50	4,579.25
8	4,431.00	4,500.50
9	4,454.00	4,459.63
10	4,995.00	2,907.38
11	5,024.50	2,632.25
12	5,427.00	4,270.38
13	5,661.00	4,431.00
14	5,907.50	4,475.13
15	5,310.00	4,414.88
16	5,549.50	4,521.50
17	5,715.50	2,980.38
18	5,237.50	2,521.75



Schneider Electric — Multi Device Usage Panels Report

Usage Summary

Source	Real Energy (kWh) 1/1/2012 - 2/1/2012
Keating.PNL_T	7,326.41
Keating.PNL_E	8,309.78
Keating.PNL_M_LEFT	16,360.25
Keating.PNL_M_RIGHT	10,620.13
Total	42,616.56

Relative Usage Pie Chart
1/1/2012 - 2/1/2012
Real Energy (kWh)

Interval Usage Data

Period : 1/1/2012 - 2/1/2012 Interval : Day of Month	Keating.PNL_T	Keating.PNL_E	Keating.PNL_M_LEFT
1/1/2012	187.38	0.00	428.63
1/2/2012	188.00	131.56	431.00
1/3/2012	266.56	340.34	512.00
1/4/2012	287.88	336.53	540.38
1/5/2012	260.84	345.88	548.13

Period : 1/1/2012 - 2/1/2012 Interval : Day of Month	Keating.PNL_M_RIGHT	Interval Total
1/1/2012	208.88	824.88
1/2/2012	228.25	978.81
1/3/2012	348.13	1,467.03
1/4/2012	367.50	1,532.28
1/5/2012	371.75	1,526.59

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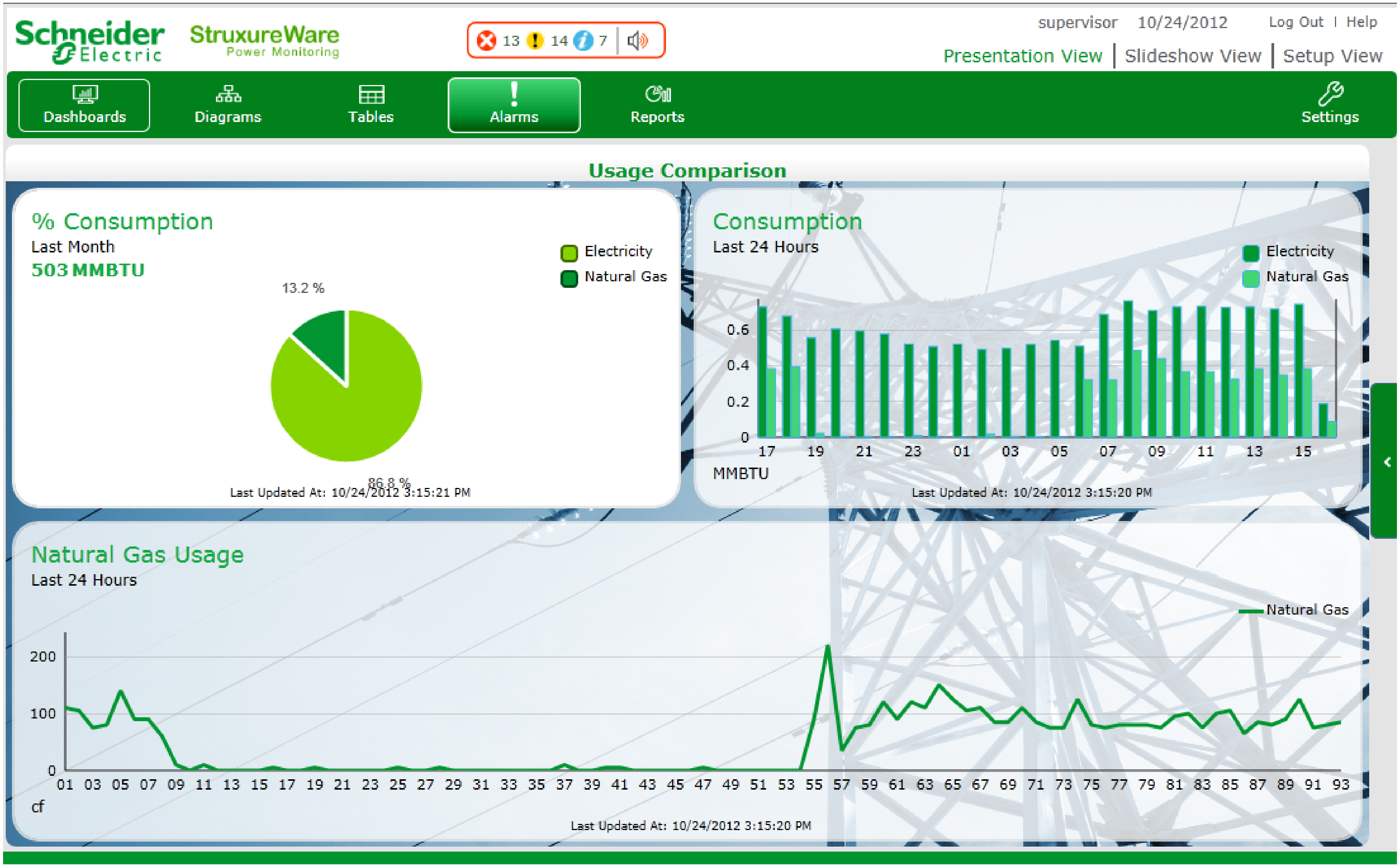
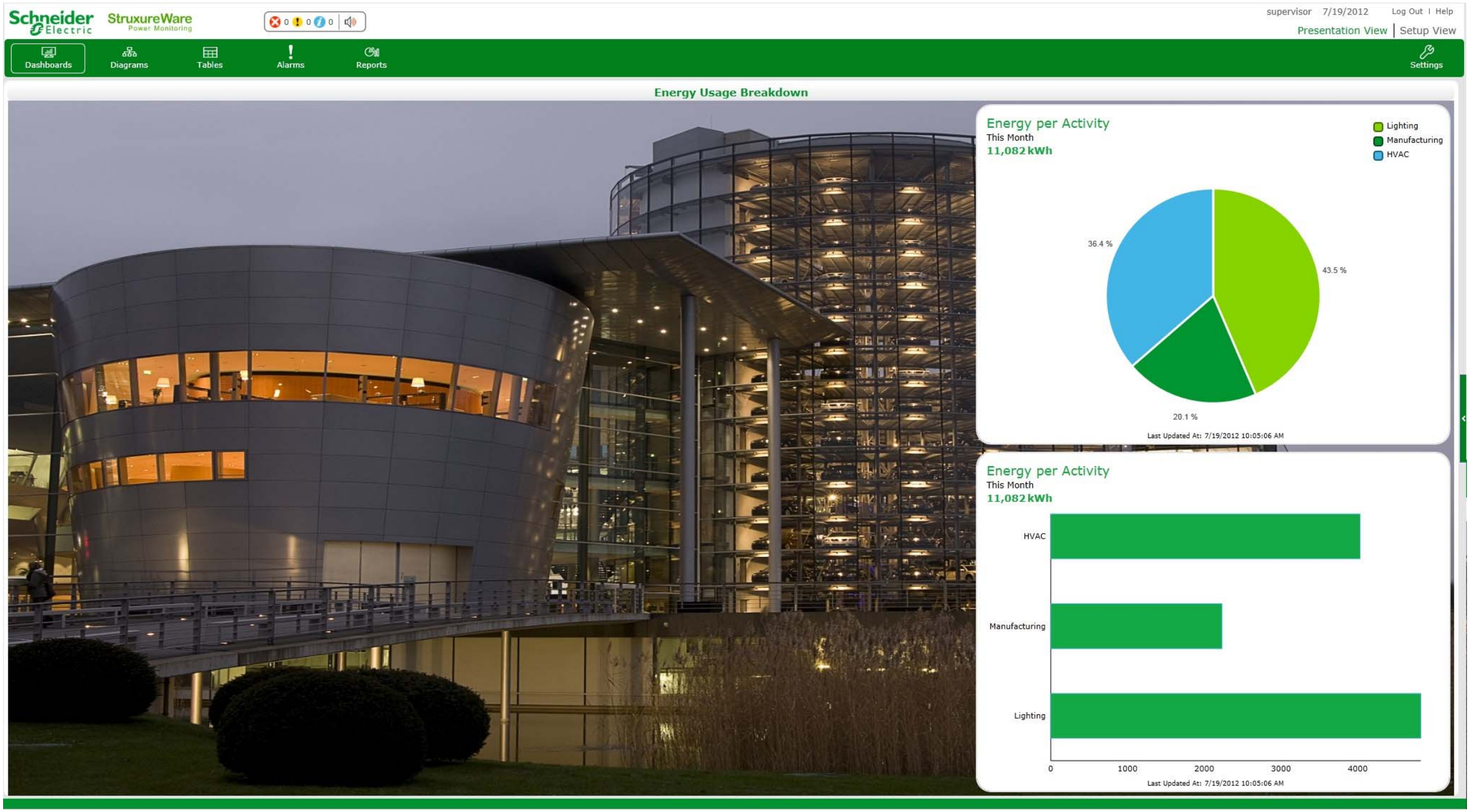
WAGES in Dashboards



WAGES in Dashboards



Visualizing the Right Information

- You can create slideshows showing WAGES data, and can display these on floor level kiosks so building occupants can see their own consumption patterns.