

## Energy Management Systems

*Nate Opperman, Systems Engineer, SAIC an ActOnEnergy Partner*

*Chris Durand, Energy Advisor, SAIC an ActOnEnergy Partner*

*Mary Bentsen, Training Coordinator, SAIC an ActOnEnergy Partner*



***ActOnEnergy.com***

## Practical Items

- If you can't hear me, please type a message in the **Chat** feature located on the right-hand side of your screen. You can also check the volume controls on your computer or adjust the WebEx controls.
- Be sure you have called in to the conference call. See the first message at the top of the "Chat" window for call-in information.
- Please type any questions you have during the presentation into the "Chat" feature located at the bottom, right-side of your computer screen.

### Quiz Questions:

#### What do you already know about Energy Management Systems?

1. Which of the following are types of Energy Management Systems?
2. What cash incentive does ActOnEnergy offer for natural gas savings realized by Energy Management System installations?
3. Which of the following are benefits of Energy Management Systems?



Mary: Before we get started, I'm going to ask you three questions to find out what you already know about Energy Management Systems. Once you have chosen your answers, click the submit button. You'll have about a minute to submit your responses.

1. Which of the following are types of Energy Management Systems?

- A. Direct Digital Control**
- B. Manual Control
- C. Hydraulic
- D. Relay**
- E. Pneumatic**
- F. Aquatic

2. What cash incentive does ActOnEnergy offer for natural gas savings realized by Energy Management System installations?

- A. \$1 per therm saved
- B. \$1.20**
- C. \$1.30
- D. \$1.40

3. Which of the following are benefits of Energy Management Systems? Energy Management Systems:

- A. Are relay driven
- B. Can only be used in industrial settings
- C. Allow for remote system access**
- D. Don't have utility submetering



Mary: Now I'll go over today's topics.

Today we're going to talk about how you can save energy with an energy management system, including the benefits of Energy Management Systems, the different types of Energy Management Systems available, specialty controls for industrial equipment, and how Energy Management Systems can save energy. The information presented today will help you understand how Energy Management Systems work, how you can save money by installing an Energy Management System, and whether an Energy Management System is right for you.

Now I'll introduce Nate Opperman, who is a Systems Engineer with SAIC, an ActOnEnergy partner. He's going to tell you about Energy Management Systems.

## What is an Energy Management System (EMS)?

- Combination of separate networks
  - Floor level
  - Building level
  - Management level



Nate: Good morning, everyone!

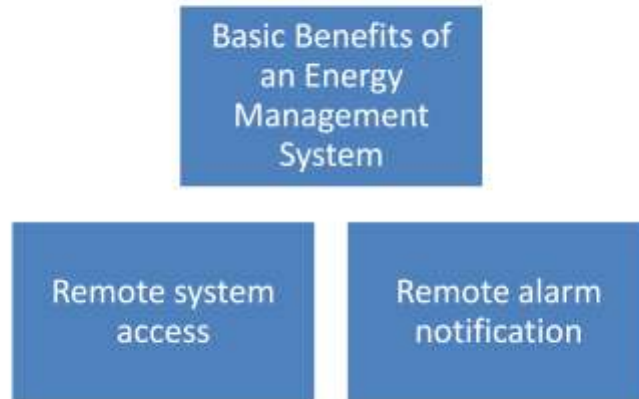
An Energy Management System is a:

Combination of separate networks

- Floor level
- Building level
- Management level

## Benefits of an Energy Management System (EMS)?

- Basic Benefits



Note:

Basic Benefits

- Remote system access
- Remote alarm notification

## Basic Functions of an EMS

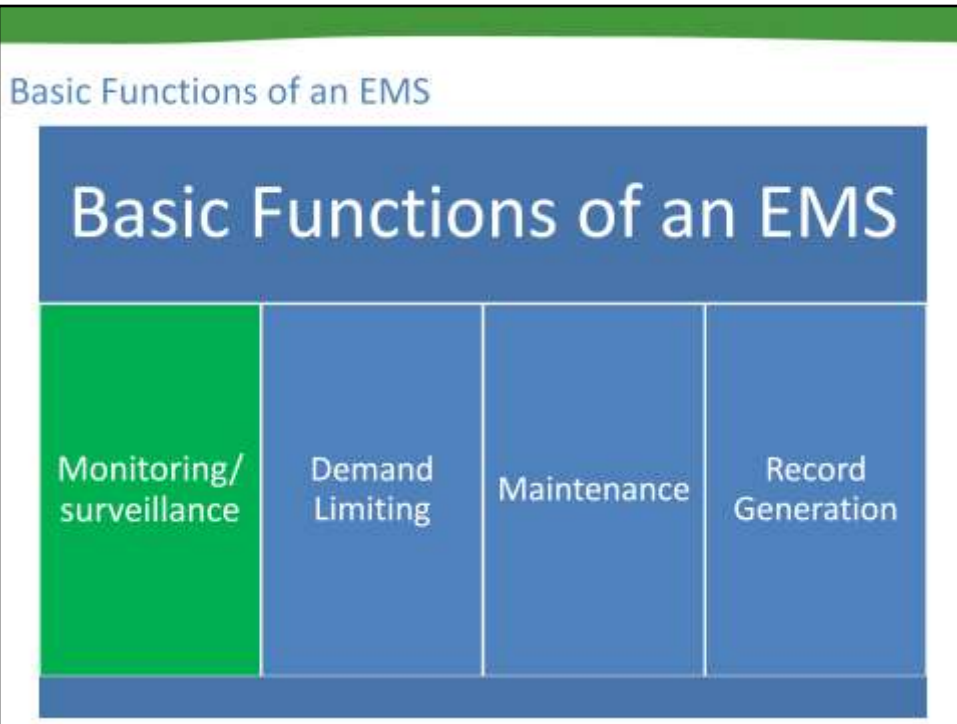
# Basic Functions of an EMS

Monitoring/  
surveillance

Demand  
Limiting

Maintenance

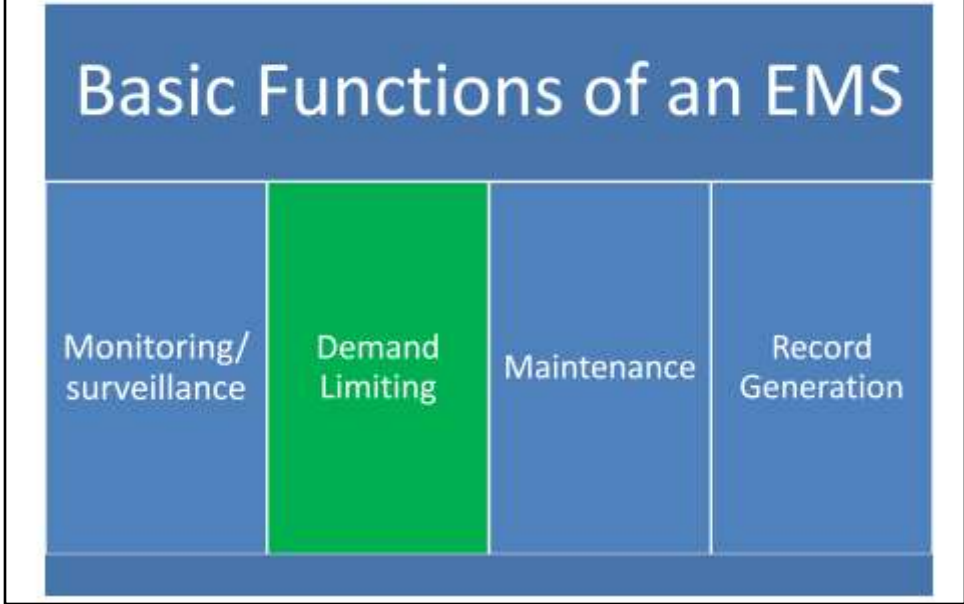
Record  
Generation



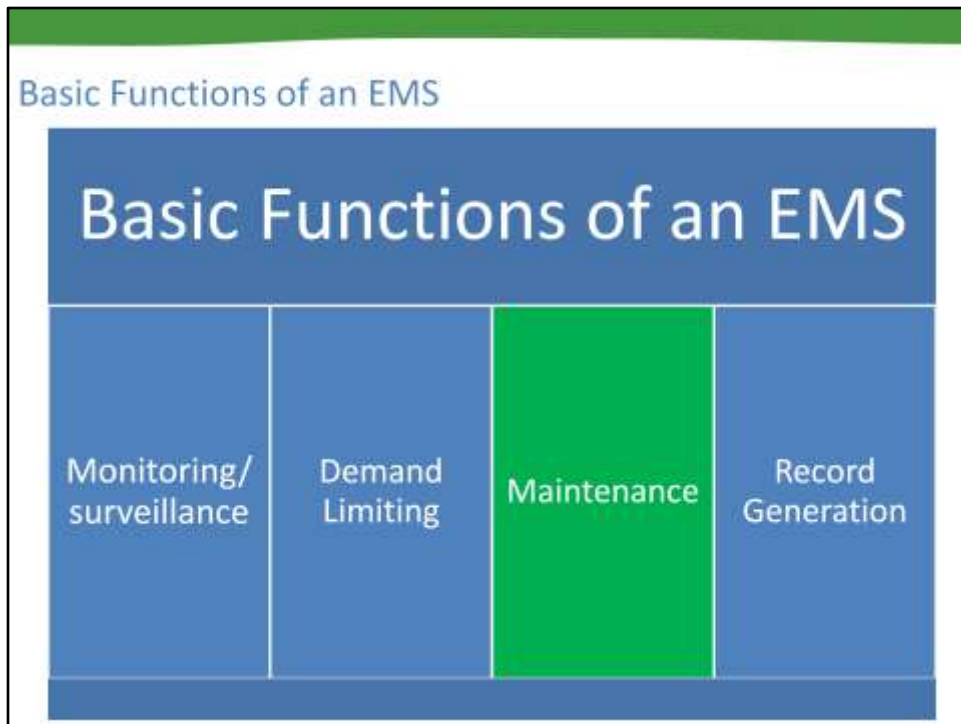
Nate: Monitoring/Surveillance

- Building Conditions
- Equipment Status
- Utility Submetering
- Climatic Data

Basic Functions of an EMS



Nate: Demand Limiting  
Load Scheduling  
Duty Cycling

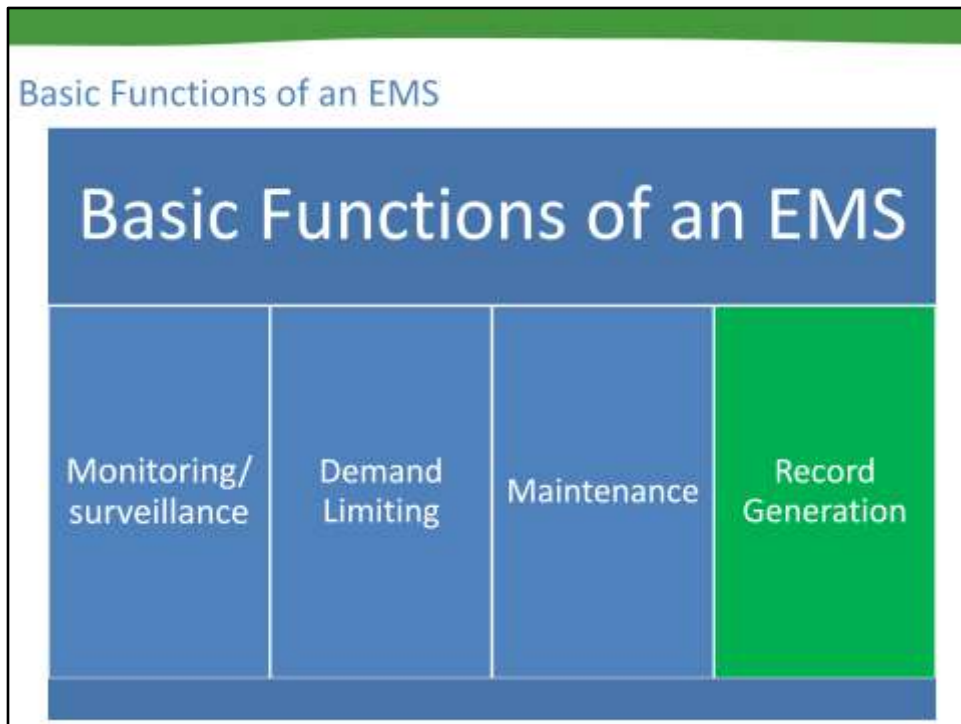


Nate: Maintenance

Remote operation and control of equipment

Generation of maintenance schedule

Diagnosing breakdowns



Nate: Record Generation

- Trends and operational logs

- Utility demand profile

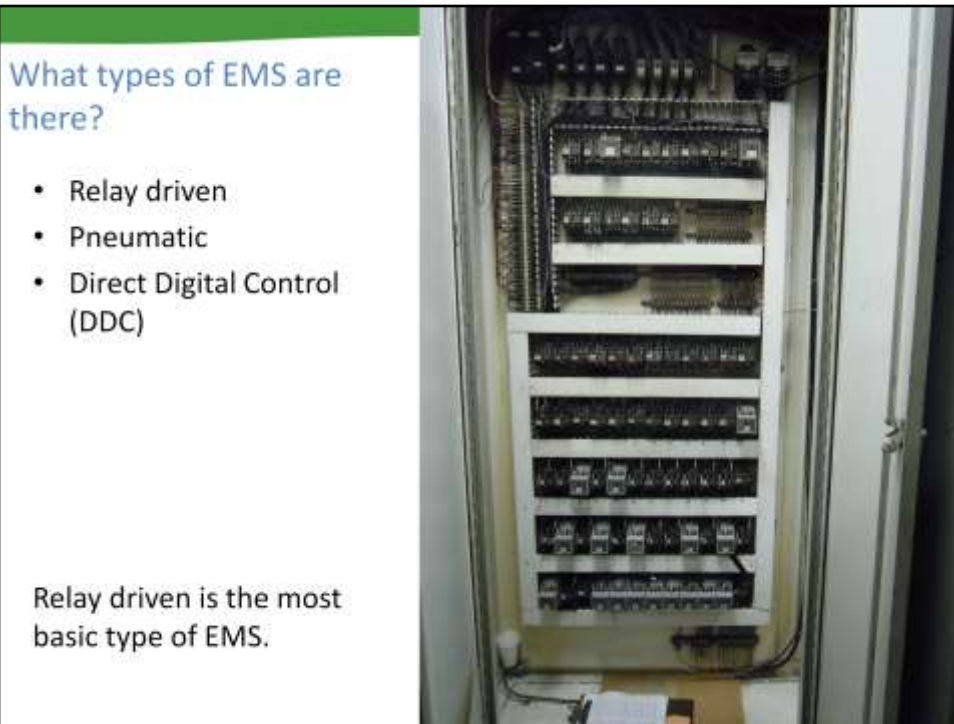
- Modification/replacement analysis

- Energy conservation documentation



**Do you have an existing energy  
management system?**

Mary: Do you have an existing energy management system?



Note: There are three types of EMS: Relay driven, Pneumatic, and Direct Digital Control (DDC)

The picture here is a relay-driven EMS, which is the most basic type of EMS.

## What Types of EMS Are There?

- Pneumatic
  - Outdated
  - Maintenance issues



Note: Pneumatic  
Outdated, maintenance issues

## What types of EMS are there?

### Direct Digital Control (DDC)

- Most advanced and has the highest return on investment



Note: Direct Digital Control (DDC)

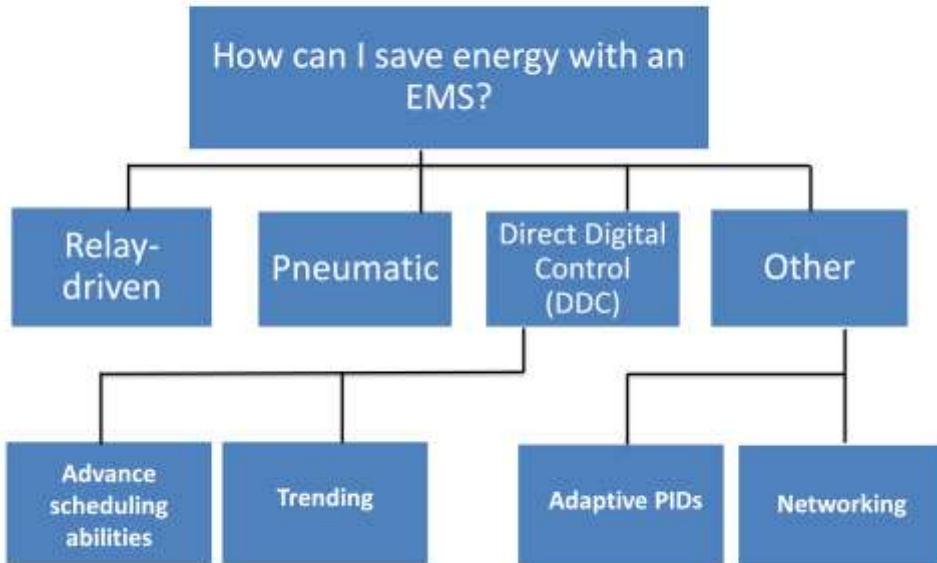
Most advanced and has the highest return on investment



**What type of Energy Management System do you have?**

Mary: What type of Energy Management System do you have?

## How can I save energy with an EMS?



## How can I save energy with an EMS?

### Relay driven EMS

- Options are limited to basic scheduling and equipment control

### Pneumatic EMS

- Scheduling
- Instrument feed back
- Utilizing basic Proportional Integral Derivative (PID) loops



Note: Relay driven EMS

- Options are limited to basic scheduling and equipment control

Pneumatic EMS

- Scheduling
- Instrument feed back
- Utilizing basic Proportional Integral Derivative (PID) loops

## How can I save energy with an EMS?

### DDC

- Access to advance scheduling abilities
  - On/Off with a multi event schedule, “warm up periods”, setback, demand load shedding

Note: DDC:

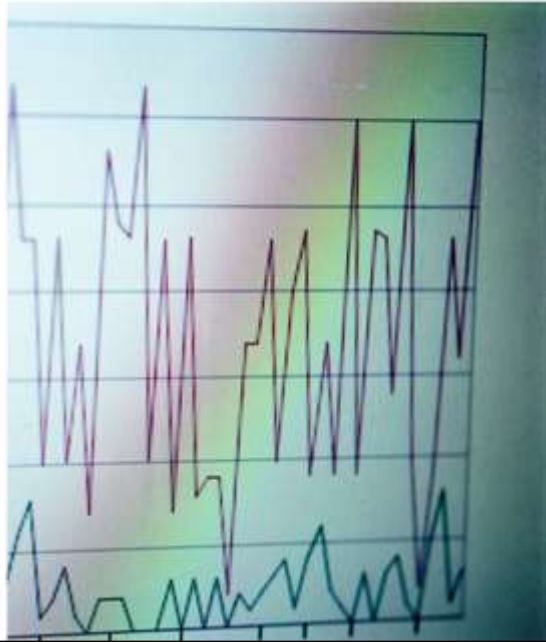
Access to advance scheduling abilities.

- On/Off with a multi event schedule, “warm up periods”, setback, demand load shedding.

## How can I save energy with an EMS?

Trending of multiple points on a DDC system

- Trending allows for maintenance to pinpoint problems and help locate issues with existing equipment
- Trending also allows for company-wide setpoints to be monitored and enforced to provide more savings



Note:  
DDC

Trending of multiple points on a DDC system

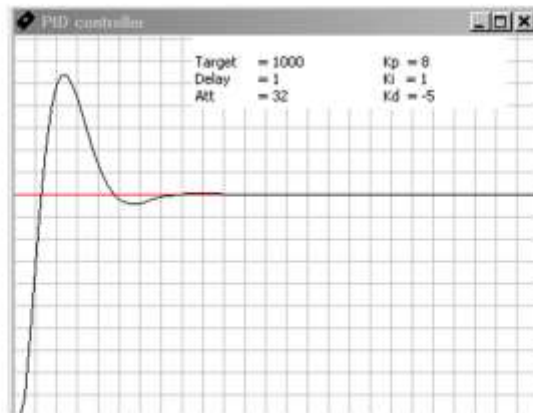
Trending allows for maintenance to pinpoint problems and help locate issues with existing equipment

Trending also allows for company wide setpoints to be monitored and enforced to provide more savings

## How can I save energy with an EMS?

Utilizing adaptive PIDs on inlet vanes, Variable Frequency Drives (VFDs), hot water and chilled water valves, etc.

- By taking advantage of PIDs equipment will use less energy by easing into the setpoint of temperature.



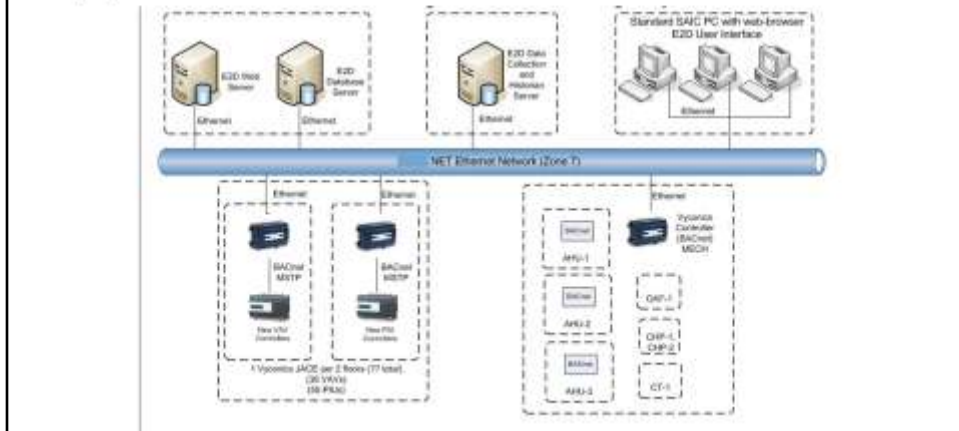
Note: Utilizing adaptive PIDs on inlet vanes, Variable Frequency Drives (VFDs), hot water and chilled water valves, etc.

By taking advantage of PIDs equipment will use less energy by easing into the setpoint of temperature.

## How can I save energy with an EMS?

Networking chillers, boilers and HVAC equipment together so the system will work as one

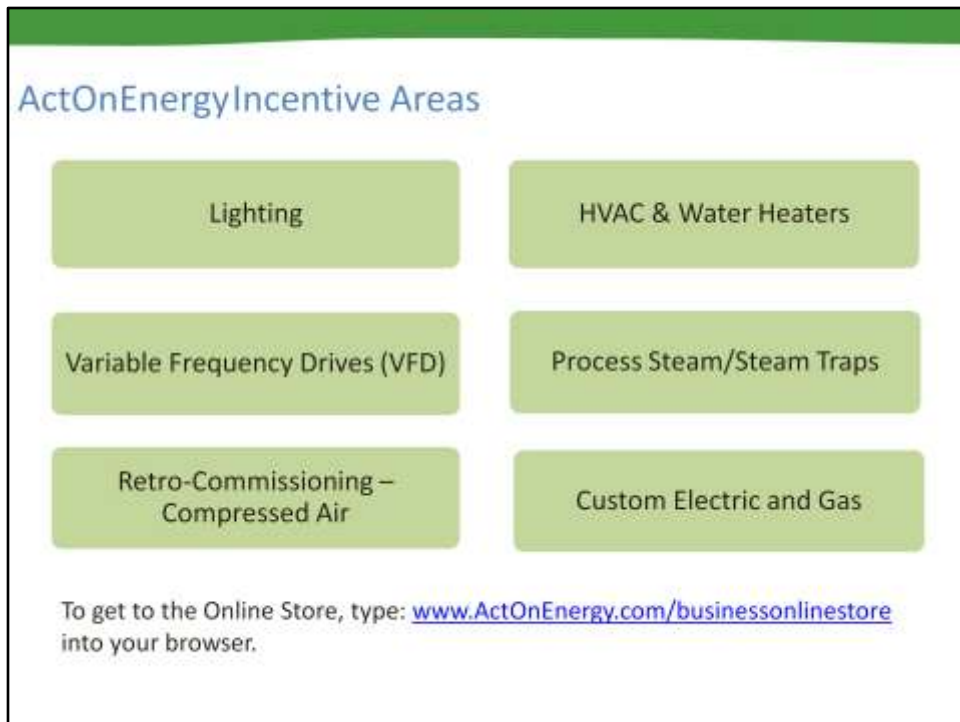
- By having a balanced system employee discomfort is minimized, and equipment load is reduced



Nate: Networking chillers, boilers and HVAC equipment together so the system will work as one.

By having a balanced system employee discomfort is minimized, and equipment load is reduced

Now I'll introduce Chris Durand from SAIC, and ActOnEnergy partner and he's going to tell you about the cash incentives available from ActOnEnergy for Energy Management Systems.

A graphic titled "ActOnEnergy Incentive Areas" with a green header bar. It features six light green rounded rectangular boxes arranged in a 3x2 grid. The top row contains "Lighting" and "HVAC & Water Heaters". The middle row contains "Variable Frequency Drives (VFD)" and "Process Steam/Steam Traps". The bottom row contains "Retro-Commissioning – Compressed Air" and "Custom Electric and Gas". Below the grid, there is a line of text: "To get to the Online Store, type: [www.ActOnEnergy.com/businessonlinestore](http://www.ActOnEnergy.com/businessonlinestore) into your browser."/>

ActOnEnergy Incentive Areas

- Lighting
- HVAC & Water Heaters
- Variable Frequency Drives (VFD)
- Process Steam/Steam Traps
- Retro-Commissioning – Compressed Air
- Custom Electric and Gas

To get to the Online Store, type: [www.ActOnEnergy.com/businessonlinestore](http://www.ActOnEnergy.com/businessonlinestore) into your browser.

Chris: Ameren Illinois' ActOnEnergy program offers cash to customers to be more energy-efficient. Energy-efficient upgrades not only lower your energy bills, they can also reduce maintenance costs, improve comfort, provide precise control and extend equipment life. The Ameren Illinois' ActOnEnergy initiative helps businesses use less energy and save more money.

The ActOnEnergy programs include electric and gas incentives, where the cash incentive is paid to you after you complete the project. There are also energy-saving products available at the ActOnEnergy Online Store, where the incentive is built into the price. The Online Store is located at [www.ActOnEnergy.com/businessonlinestore](http://www.ActOnEnergy.com/businessonlinestore).

## ActOnEnergy Cash Incentives

Cash incentives for EMS are available under Custom Program

- \$0.05/(annual kWh saved) for lighting components
- \$0.07/(annual kWh saved) for all other components (HVAC, equipment control, etc.)
- \$1.20/(annual therm saved) for natural gas savings

Chris: Cash incentives for EMS available under Custom Program

- \$0.05/(annual kWh saved) for Lighting components
- \$0.07/(annual kWh saved) for all other components (HVAC, equipment control, etc.)
- \$1.20/(annual therm saved) for natural gas savings

Now I'm going to hand this back to Nate who's going to present a couple of examples where Energy Management Systems were installed.

## Example of EMS: Industrial

Typical industrial building with 8 AHUs, door heaters, lighting control, and a large industrial chiller

- Installed multiple DDC and supporting equipment.
- Price for the project was quoted at \$750,125
- Payback was calculated at less than 7 years
  - Payback was large due to the industrial facility not being scheduled and operating large motor loads.
- ActOnEnergy cash incentive would be about \$100,000

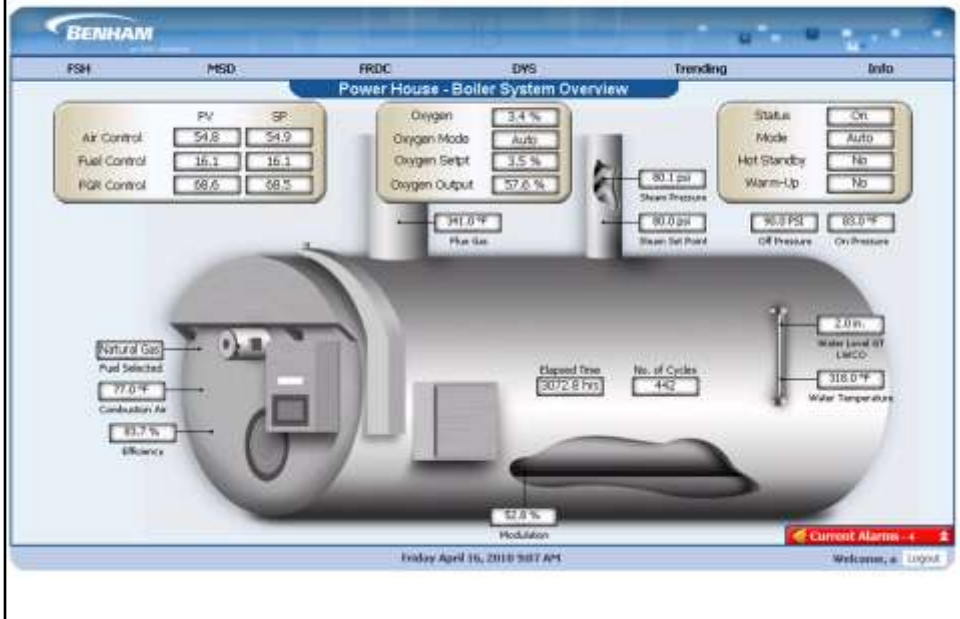


Note: Industrial:

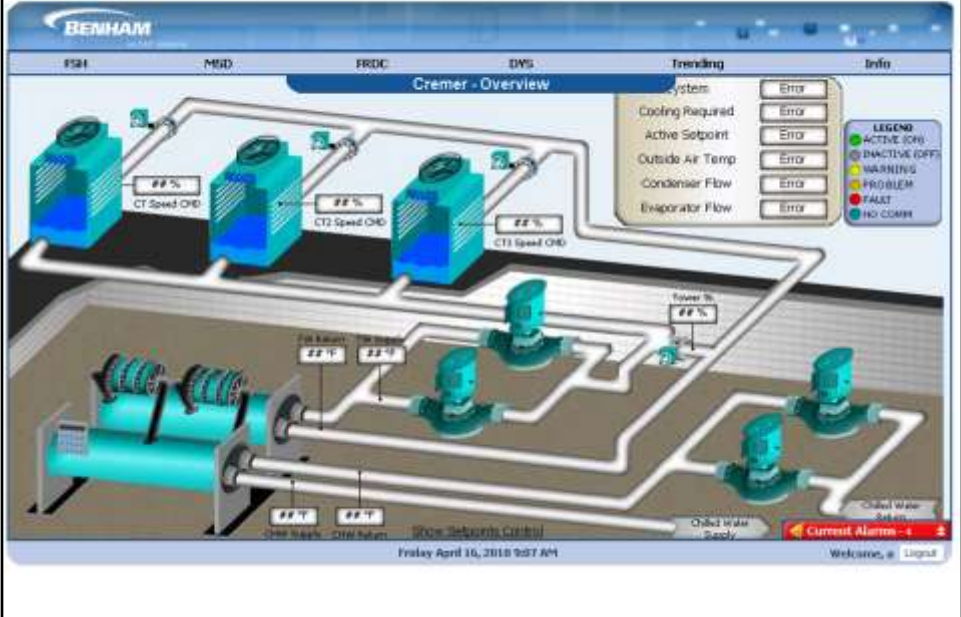
Typical industrial building with 8 AHUs, door heaters, lighting control, and a large industrial chiller

- Installed multiple DDC and supporting equipment.
- Price for the project was quoted at \$750,125
- Payback was calculated at <7 years
  - Payback was large due to the industrial facility not being scheduled and operating large motor loads.
- If this project had qualified for Ameren Illinois ActOnEnergy cash incentives, the incentive would be approximately \$100,000

# Example of EMS: Industrial



# Example of EMS: Industrial



# Example of EMS: Industrial

**BENHAM**  
Active EMS

FSH - MSD - FRDC - DHS - Trending - Info

### Cremer - Chiller Detail

**Chiller**

System	Error	Chiller Status	Error
Chiller	Error	Run Command	Error
OWT Allow Cooling	Error	Outside Air Temp	Error
Cooling	Error	Active Setpoint	Error
Actual Capacity	Error	Power Factor	Error

**Alarms**

Warnings	Error
Problems	Error
Faults	Error

**LEGEND**

- ACTIVE (ON) - Green
- INACTIVE (OFF) - Grey
- WARNING - Yellow
- PROBLEM - Orange
- FAULT - Red
- NO COMM - Blue

**Diagram Labels:** TW Return, TW Supply, Tower Water Supply, Tower Water Return, Chilled Water Return, Chilled Water Supply, Chiller Supply, Chiller Return

Friday April 10, 2010 9:57 AM

Current Alarms - 4

Welcome, a Logout

## Example of EMS: Commercial

- A 75,265 square foot office building has 3 VAV AHUs
- These units had old pneumatic controls with inlet vanes and inefficient 10 and 5 horsepower fans
- Replaced the motors, change the inlet vanes over to VFDs and add DDC to the 3 AHUs
- Total cost were calculated to be \$65,715
- Total savings calculated at \$12,760.19 per year
- Simple payback is 5.15 years



### Nate: Commercial

A 75,265 sq foot office building has 3 VAV AHUs these units had old pneumatic controls with inlet vanes and inefficient 10 and 5 horsepower fans. Total cost to replace the motors, change the inlet vanes over to VFDs and add DDC to the 3 AHUs. Total cost were calculated to be \$65,715. Total savings calculated at \$12,760.19 per year simple payback is 5.15 years.

If this project had qualified for Ameren Illinois ActOnEnergy cash incentives, the incentives would be approximately \$10,000.

# Example of EMS: Commercial


Northpointe


HVAC
Trending
Scheduler
EZD
Facility



**HVAC-7 Controls:**  
 Occ Cool SP 74 °F  Set  
 Occ Heat SP 70 °F  Set  
 Unocc Cool SP 82 °F  Set  
 Unocc Heat SP 60 °F  Set

HVAC-7	
Mode	Auto
Occupied	Active Setpoints
	Cool: 74 °F
	Heat: 70 °F
Unoccupied	Active Setpoints
	Cool: 82 °F
	Heat: 60 °F

**LEGEND:**  
● ACTIVE (ON)  
○ INACTIVE (OFF)  
● WARNING  
● FAULT  
● NO COLEM

Floor 1 Floor 2

Current Alarms - 0

Tuesday September 27, 2011 8:28 AM
Welcome, mathhewson [Logout](#)

# Example of EMS: Commercial

HVAC
Trending
Scheduler
E2D
Facility

## HVAC 17

FAN RUNNING
OCCUPIED

COOL HEATING
COOL COOLING

ALARM ACTIVE
WIRELESS OFFLINE

**LEGEND**

- ACTIVE (ON)
- INACTIVE (OFF)
- WARNING
- FAULT
- NO COMM

Unit Mode:  Auto

Fan Mode:  Auto

Space Temp: 74 °F

Unit Setpoint Control		
Occupied Cooling	74 °F	Set
Occupied Heating	70 °F	Set
Unoccupied Cooling	82 °F	Set
Unoccupied Heating	60 °F	Set

Unit Mode Control	
Off	Auto
Cool	Heat

Unit Status Control	
Occupied	Unoccupied

Fan Mode Control	
On	Auto
Smart	

Current Alarms: 0

Tuesday September 27, 2011 8:28 AM
Welcome, watheswa [Logout](#)

# Example of EMS: Commercial

Northpointe
SAIC

INAC
Trending
Scheduler
E3D
Facility

**HVAC Tabular**

Unit ID	Location	Status	Occupied	Space Air Temp	Occ Cooling SP	Occ Heating SP	Unocc Cooling SP	Unocc Heating SP	Unit Mode	Fan Mode
HWAC1	Warehouse - B3	●	●	54 °F	34 °F	30 °F	62 °F	60 °F	Auto	Auto
HWAC2	Warehouse - B6	●	●	73.8 °F	34 °F	30 °F	62 °F	60 °F	Cool	Auto
HWAC4	Warehouse - B10	●	●	34 °F	34 °F	30 °F	62 °F	60 °F	Auto	Auto
HWAC5	Warehouse - B14	●	●	34 °F	34 °F	30 °F	62 °F	60 °F	Auto	Auto
HWAC3	Warehouse - B17	●	●	35 °F	35 °F	33 °F	62 °F	61 °F	Auto	Auto
HWAC6	Warehouse - E20	●	●	73.3 °F	35 °F	30 °F	62 °F	61 °F	Auto	Auto
HWAC7	Warehouse - E20	●	●	73.8 °F	34 °F	30 °F	62 °F	60 °F	Auto	Auto
HWAC8	Warehouse - H20	●	●	74.1 °F	34 °F	30 °F	62 °F	60 °F	Auto	Auto
HWAC9	Warehouse - H17	●	●	74.1 °F	35 °F	32 °F	62 °F	61 °F	Auto	Auto
HWAC10	Warehouse - H14	●	●	74.9 °F	35 °F	32 °F	62 °F	61 °F	Auto	Auto
HWAC11	Warehouse - G20	●	●	73.8 °F	34 °F	30 °F	62 °F	60 °F	Auto	Auto
HWAC12	Warehouse - H6	●	●	74.1 °F	34 °F	30 °F	62 °F	60 °F	Auto	Auto
HWAC13	Warehouse - H3	●	●	73.9 °F	35 °F	32 °F	62 °F	61 °F	Auto	Auto
HWAC14	Warehouse - E3	●	●	75.7 °F	32 °F	30 °F	62 °F	60 °F	Auto	Auto

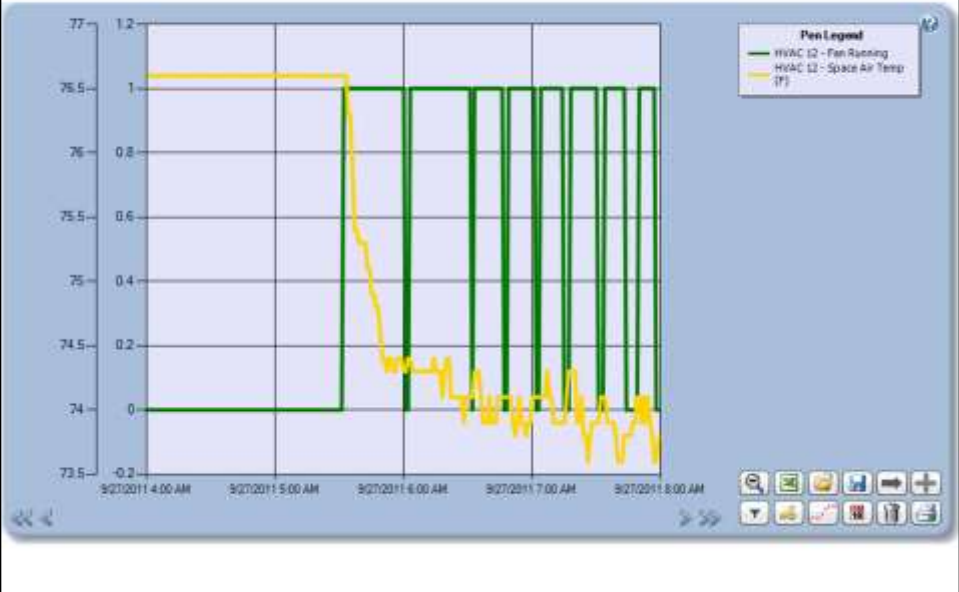
● ACTIVE (OCC)
● INACTIVE (OFF)
● MAINTEN
● FAULT
● NO COMM

Tuesday September 27, 2011 8:28 AM

Current Alarms - 9

Welcome, mathuser
Logout

# Example of EMS: Commercial



# Example of EMS: Commercial

The screenshot displays the BENHAM Scheduler v. 2.3 interface. The main window is titled "Northpointe - HVAC" and shows a schedule for "September 27, 2011". The interface is divided into several sections:

- Left Navigation Panel:** Contains a tree view with "Northpointe" expanded to show "HVAC", which is further expanded to "Office", "Security", and "Warehouse".
- Main Content Area:** Displays three horizontal bar charts for "Office", "Security", and "Warehouse". Each chart shows a 24-hour timeline with colored segments representing equipment states. To the right of each chart are three colored boxes (pink, green, pink) with time values: Office (00:00, 05:30, 17:30), Security (00:00), and Warehouse (00:00, 05:30, 16:30).
- Right Panel:** Includes an "Overview" section with a warning message: "The Day view of a schedule gives you access to the events for each Group of equipment for the selected day. Changes saved to today's schedule may affect equipment states." Below this is a "How To..." section with a list of actions: "Edit Day Event", "Add Day Event", "Delete Day Event", and "Copy & Paste Schedules". At the bottom of the right panel is a "Legend" section with a key: a green box for "On/Standby" and a pink box for "Off/Standby".

# Example of EMS: Commercial



# Example of EMS: Commercial

Heat Pumps
Boiler
MAU-1
Trimming
Scheduler
EZD
Facility

Floor 5

**HP-561 Controls**

Occ Cool SP 72°F  Set

Occ Heat SP 68°F  Set

Unocc Cool SP 62°F  Set

Unocc Heat SP 65°F  Set

Occupied    Unoccupied

**HP-561**

Mode: Auto

Active Sp: Occupied

Cool: 72°F

Heat: 68°F

**LEGEND**

- ACTIVE (ON)
- INACTIVE (OFF)
- WARNING
- FAULT
- NO-COMM

**F** Space Temperature

Bas.1 Bas.2 Bas.3 Bas.4 Floor 5

Tuesday September 27, 2011 8:34 AM

Current Alarms - 0

Welcome, mathewson    [Logout](#)

## Example of EMS: Hotel



Nate: 49 rooms with 49 existing external thermostats for 49 ductless splits. After installing room thermostats with unoccupied temperature setback and temperature setpoints that are enforced by an EMS. Figuring that the rooms are unoccupied during the week from the hours of 8am to 4pm and during the weekend and holidays from 9am to 8pm. A total amount of energy saved comes to 457,516 kw. Which figures to be \$40,911 per year. The implementation cost is figured to be around \$35,000 (high estimation) with a simple payback of .9 years.

This example is a pure theoretical example we have not had a chance to actually implement this, but the savings should be close and payback under 5 years.

Now Chris is going to provide you with an example of an energy management system in a retail store.

## Example of EMS: Retail Store

- System to control HVAC setpoints, ventilation, and duty cycling
- System also controls lights and light levels
- Uses temperature, CO2 readings, photo sensors, and hours of operation inputs to continually assess and adjust HVAC and lighting
- Price for the project was \$24,577
- Payback was calculated at 3.3 years without incentive
- ActOnEnergy cash incentive of \$5,842.38 brought payback down to 2.5 years
  - This cash incentive would have been larger using gas incentives that are currently available



### Chris: Retail store

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  - This cash incentive would have been larger using gas incentives that are currently available

## Getting Started



Chris: You may be wondering how to get started on an Energy Management Systems project. There are several options.

## Energy Assessment

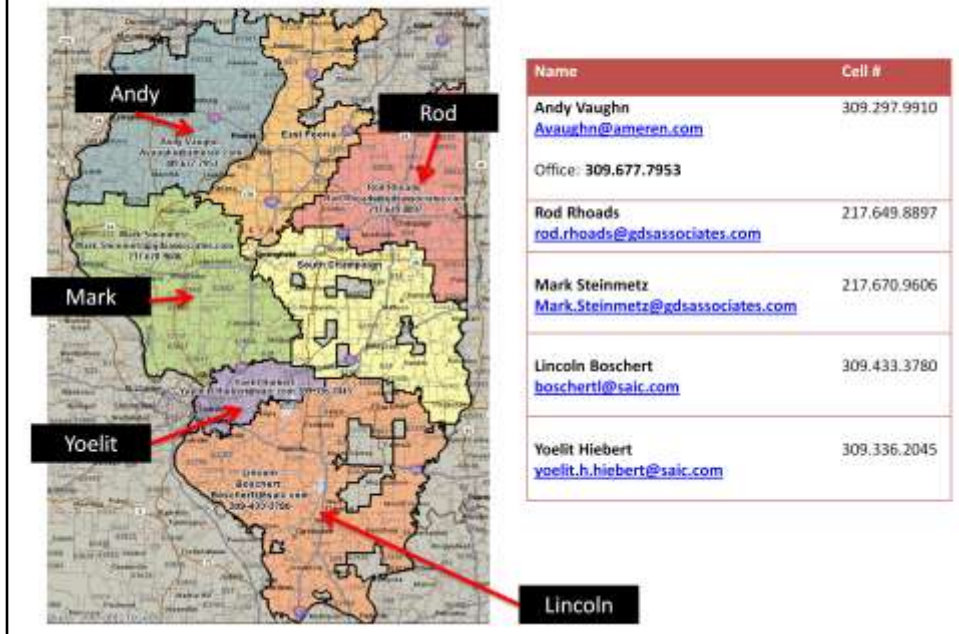
Smart Energy Design Assistance Center (SEDAC)

Energy Assessments

<http://smartenergy.arch.uiuc.edu/energy-assessment.html>

Chris: The first way is to conduct an energy assessment to determine where you are using the most energy and ways to be more energy-efficient. The Smart Energy Design Assistance Center is one resource for energy assessments.

## Energy Advisors



Chris: You can also contact an Energy Advisor. This map shows which Energy Advisors cover each territory in Illinois. Contact the Energy Advisor for your territory to speak with someone from the ActOnEnergy program about your energy-efficiency project.

The screenshot shows the ActOnEnergy website interface. At the top, there's a green header with the text 'Getting Started'. Below that is the ActOnEnergy logo and a search bar. A navigation bar includes links for 'FOR MY HOME', 'FOR MY BUSINESS', 'FOR CONTRACTORS', 'FOR HOBS', and 'MORE RESOURCES'. The main content area features a green box announcing 'Custom gas incentives increased 30%!' and a section titled 'Custom Incentives' with a call to action: 'Click here to find a Program Ally service provider.' A red arrow points from this call to action to a link in the left sidebar. The sidebar contains various program categories like 'Business Incentive Programs', 'Data & Demand Control', 'Smart Office', 'Smart Homes', 'Cool IT Solutions', 'Business Programs Only', 'Energy Savings Programs', 'Energy Efficiency Programs', and 'Education & Training'. Below the sidebar is a calendar icon showing '15'.

Chris: Another way to get started is to contact a Program Ally to help you apply for an Energy Management System project. Program Allies have been trained in how the program works and have experience in conducting projects with the ActOnEnergy program. You can find a list of Program Allies on the ActOnEnergy Website.

I would also suggest you visit the ActOnEnergy website for more information about all of the energy and gas savings opportunities the program offers. This is where you can find Custom applications, sector-specific applications, and the Online Store.

A slide titled "ActOnEnergy Contacts" with a green header bar. The slide lists contact information for ActOnEnergy, including website, phone, fax, email, and two individuals: Rod Rhoads and Geoff Brigham.

**ActOnEnergy Contacts**

- Website: [ActOnEnergy.com](http://ActOnEnergy.com)
- Phone: 1.866.800.0747
- Fax: 1.309.677.7950
- Email: [ActOnEnergyBusiness@Ameren.com](mailto:ActOnEnergyBusiness@Ameren.com)
- Rod Rhoads:
  - [rod.rhoads@gdsassociates.com](mailto:rod.rhoads@gdsassociates.com) or 1.217.649.8897
- Geoff Brigham:
  - [gbrigham@ameren.com](mailto:gbrigham@ameren.com) or 1.309.677.7955

Chris: There are several ways to get information about the ActOnEnergy program:

Website: [ActOnEnergy.com](http://ActOnEnergy.com)

Phone: 1.866.800.0747

Fax: 1.309.677.7950

Email: [ActOnEnergyBusiness@Ameren.com](mailto:ActOnEnergyBusiness@Ameren.com)

Rod Rhoads: [rod.rhoads@gdsassociates.com](mailto:rod.rhoads@gdsassociates.com) or 1.217.649.8897

Geoff Brigham: [gbrigham@ameren.com](mailto:gbrigham@ameren.com) or 1.309.677.7955

Now, I'll turn this back over to Mary.

## Quiz Questions:

### What do you already know about Energy Management Systems?

1. Which of the following are types of Energy Management Systems?
2. What cash incentive does ActOnEnergy offer for natural gas savings realized by Energy Management System installations?
3. Which of the following are benefits of Energy Management Systems?



Mary: Now it's time to take the final quiz to see what you learned today. These are the same questions you saw at the beginning of the presentation. I will give you a moment to submit your answers. Once you have chosen your answers, click the submit button. You'll have about a minute to submit your responses.

1. Which of the following are types of Energy Management Systems?

- A. Direct Digital Control**
- B. Manual Control
- C. Hydraulic
- D. Relay**
- E. Pneumatic**
- F. Aquatic

2. What cash incentive does ActOnEnergy offer for natural gas savings realized by Energy Management System installations?

- A. \$1 per therm saved
- B. \$1.20**
- C. \$1.30
- D. \$1.40

3. Which of the following are benefits of Energy Management Systems?

- A. Are relay driven

- B. Can only be used in industrial settings
- C. Allow for remote system access**
- D. Don't have utility submetering

Questions?

