Efficiency Works™

Estes Park | Fort Collins | Longmont | Loveland

HVAC technologies for big savings

Demand control ventilation and the HVAC VFDs

May 15, 2019

Housekeeping

Safety and reminders

In case of emergency: Exit down the stairs and out the front door to the parking lot.

Restrooms are located on the first floor. Go down the stairs and look for signs to either the left or the right (bathrooms are located in both directions).

Efficiency Works™

Efficiency Works Business

Upcoming events

“A new way with new construction” – Platte River HQ campus tour

June 26, 11:00 a.m. – 1:30 p.m.

Platte River headquarters in Fort Collins

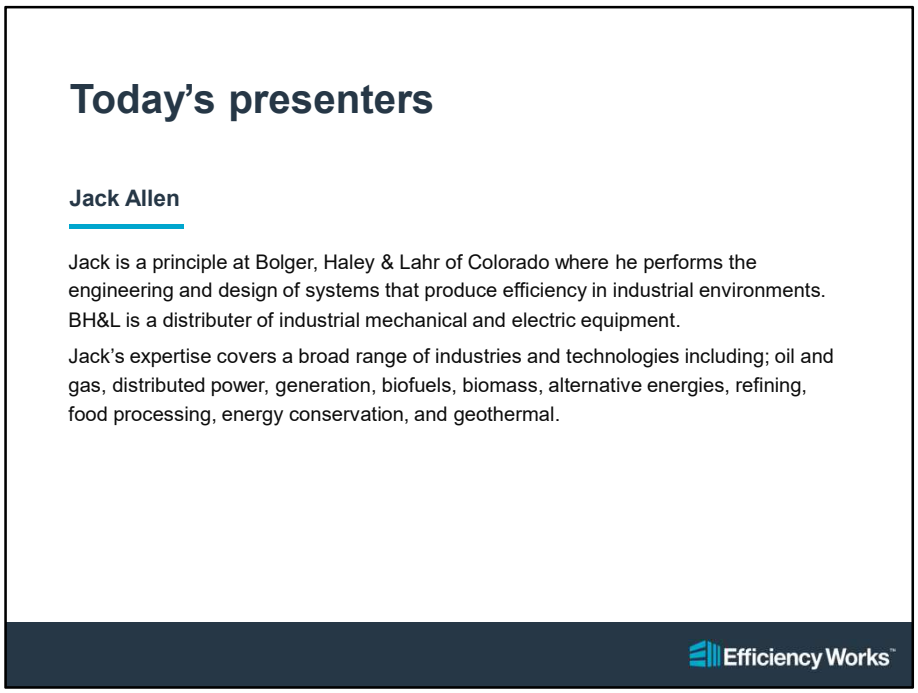
Maximize participation in Efficiency Works Business

July 17, 8:30 – 10:00 a.m.

Loveland Public Works Upper Conference Room

Register to attend at efficiencyworks.org/resources/events

Efficiency Works™



Jack has over thirty years' experience in alternative power generation, energy conservation, renewable energy, industrial process optimization. Jack's expertise covers a broad range of industries and technologies including; oil and gas, distributed power generation, biofuels, biomass, alternative energies, food processing, energy conservation, geothermal, Controls integration in both commercial and industrial markets.

Today's presenters

Adam Zipperer

Adam is an engineer with Platte River Power Authority, working with the Efficiency Works business programs. He focuses on HVAC, commissioning, new construction, and large/custom projects for commercial and industrial customers. Prior to his work at Platte River, Adam designed and commissioned large mechanical systems, including central chiller and boiler plants, chemical and biological research laboratories, and other air handling systems.

Efficiency Works™

Efficiency Works cooling rebates

Measure	Description	Incentive	
Advanced RTU Controller	Add-on control system (hardware and software) for an existing RTU that implements integrated economization, variable fan speed control, and demand control ventilation (DCV). Examples include (but are not limited to) Transformative Wave Catalyst and Bes-Tech Digi-RTU.	$2,000	per unit
Outside Air Economizer	Add an economizer to an existing unit where an economizer previously did not exist. Doesn't qualify if there is an existing economizer.	$250	per unit
Evaporative Cooling	Direct, Indirect, or Direct/Indirect (IDEC). Continuous water 'bleed' systems for sediment control DO NOT qualify. A maintenance plan is required including winterization, startup, and guarantees for air quality (e.g. bacteria, mold).	$0.20	per cfm
Evaporative Condensing	Evaporative media or mist to pre-cool air entering the condenser of a rooftop unit (RTU) or air-cooled chiller. In the unlikely event that the evaporative equipment damages a condenser or part of a condenser and it is less than 15 years old, the manufacturer shall replace the condenser or damaged part of the condenser and pay for the cost of the study to determine the cause of failure.	$100	per ton

Efficiency Works™

Campus-wide distributed BAS systems

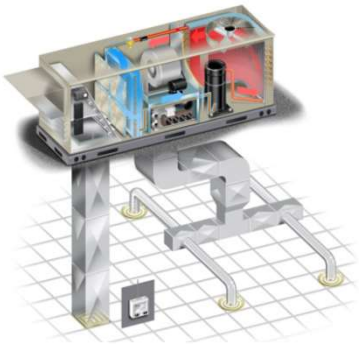
Johnson Controls

Honeywell
THE POWER OF CONNECTED

SIEMENS

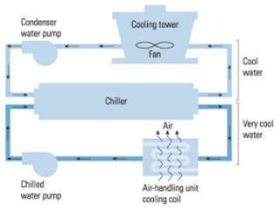
Efficiency Works™

System by system controllers



Efficiency Works™

VFD based controllers

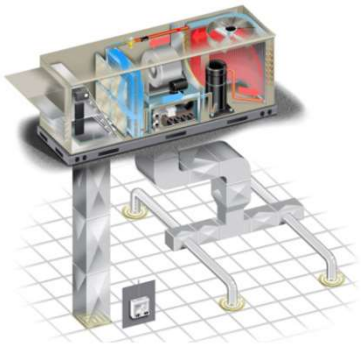


Danfoss

VACON® DRIVEN BY DRIVES

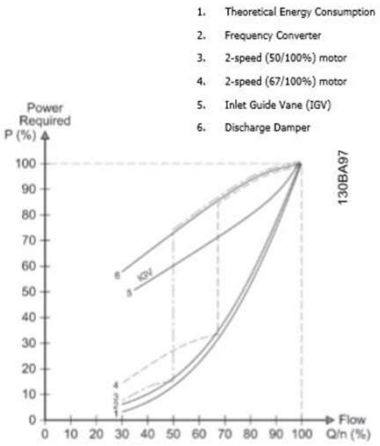
EATON Powering Business Worldwide

ABB



Efficiency Works™

How do VFDs save money & energy



- Variable torque loads – fans & pumps
  - Power use is a nonlinear equation
  - Varies by the cube or the percent full speed
    - At 50 percent speed or 30hz power use is .5 x .5 x .5 = .125 or 12.5 percent of FLA
    - At 80 percent speed or 48hz power use is .8 x .8 x .8 = .512 or 51.2 percent of FLA
- Constant torque loads – compressors
  - Power use is a linear equation
  - Plus the energy loss through the drive

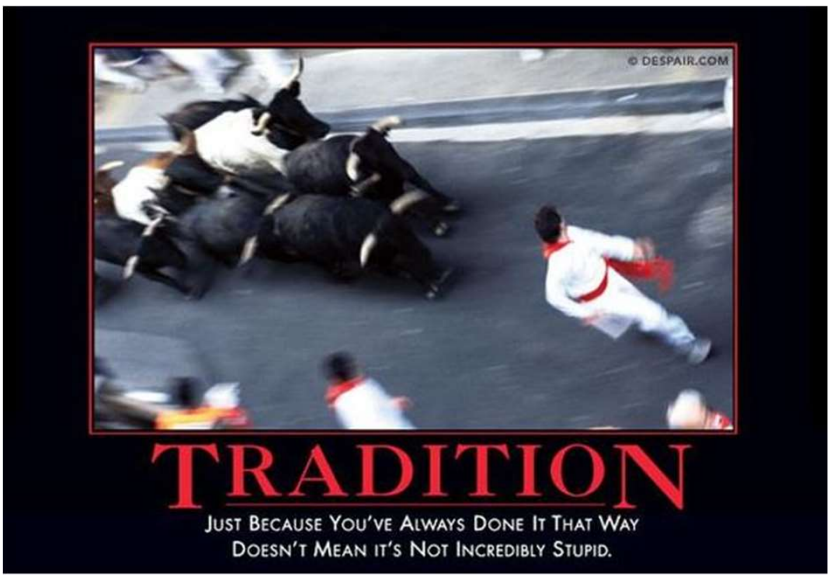
Efficiency Works™

The basics

How to save energy with HVAC systems

- ✓ Pay attention to / manage time of use
- ✓ Reduce the amount of air/water moved
- ✓ Reduce the amount of air/water needed to be heated/cooled
- ✓ Manage the delta T of the air/water being heated or cooled
- ✓ Move air/water more efficiency through the system

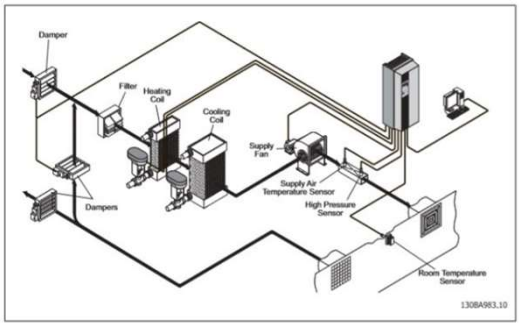
Efficiency Works™


© DESPAIR.COM
TRADITION
JUST BECAUSE YOU'VE ALWAYS DONE IT THAT WAY
DOESN'T MEAN IT'S NOT INCREDIBLY STUPID.

Energy savings

Constant volume air handling system

- Time of day scheduling
- Convert to variable air volume
- Economizer
- Demand based ventilation
- Carbon fan blades
  - Be patient, it's coming



Efficiency Works™

Time of day scheduling
- Set back t-stat or TOD schedule
- Pre-cool before peak of day

Convert to variable air volume
- Fix the disch. air temp DAT
- Use t-stat – vary fan speed

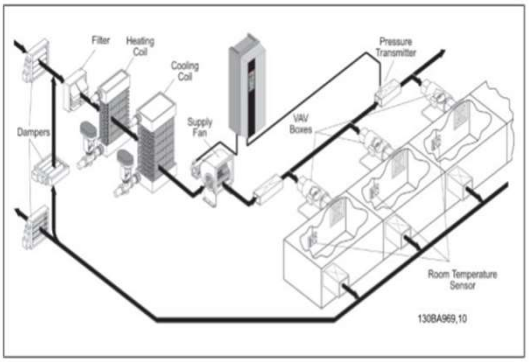
Economizer
- Outdoor air temp OAT
- Mod OA damper
- OAT is between X°F-Y°F
- Mod. OAD to maintain DAT

Demand based ventilation
- Mod OA damper
- CO2 and/or VOC sensor
- Mod. OAD to meet CO2/VOC set point

Energy savings

Variable air volume systems

- Time of day scheduling
- Supply duct pressure control
- Economizer
- Demand based ventilation
- Carbon fan blades
  - Be patient, it's coming



Efficiency Works™

Time of day scheduling
- Set back t-stat or TOD schedule
- Pre-cool before peak of day

Supply duct pressure control
- Press. Xmitter – 2/3's down duct
- Use PT to vary fan speed

Economizer
- Outdoor air temp OAT
- Modulating OA damper
- OAT is between X°F-Y°F
- Mod. OAD to maintain DAT

Demand based ventilation
- Mod OA damper
- CO2 and/or VOC sensor
- Mod. OAD to meet CO2/VOC set point

Energy savings

Pumping systems

- Pressure based control
- Duplex control / lead-lag
  - Don't use lead-lag control
  - Modulate motors to maintain pressure set point
  - Two pumps at 50 percent speed use 75 percent less energy than one pump at full speed
- Empellers
  - Double check the pump curve

Efficiency Works™

Pressure based control
- Press. Xmitter – 2/3's down piping system
- Use PT – vary pump speed to maintain pressure set point

Duplex control / lead-lag
- Ok, ok – I ignored the pump curve, still two pumps at 65 percent speed uses 45 percent less energy than one pump at full speed

Energy savings

Fans

- Alternative material fans
  - Carbon or other polymers
- Lighter weight that formed aluminum fans
- Do not distort over time
- Hold balance of the product lifetime
- Custom blade design cuts through air more efficiently
- Reduce motor load by 12 – 18 percent

3	4	5	6	7	8	9	12	16
								
1162	1162	1127	1162	1168	1248	1182	1262	1357
45 3/4	45 3/4	45 3/8	45 3/4	46	49 1/8	45 9/16	49 11/16	53 7/16

Efficiency Works™

Same CFM flow at lower RPM’s

Questions?

Estes Park | Fort Collins | Longmont | Loveland

Building tune-up program

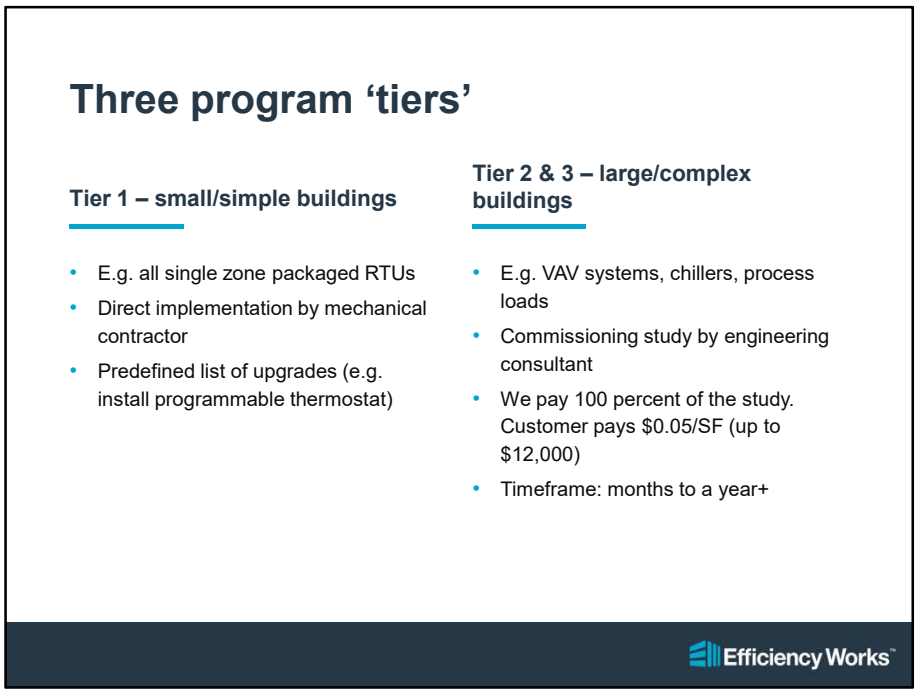
Adam Zipperer

Program overview

Tuning up/commissioning HVAC systems

- Low-cost upgrades (payback <2 years)
- Reduced energy bills (5-15 percent)
- Reduced maintenance costs
- Better system control
- Improved comfort

Efficiency Works™



Closed ‘pools’ of consultants/contractors for each tier

Direct implementation

Tier 1

Cost: We pay $0.15/square foot, customer pays $0.05/square foot
Timeframe: weeks
Performance: <1 project/year
Forecast: currently re-designing program

Efficiency Works™

Tier 1 revamp

Program changes

Why: Increase participation and savings

What: Better align with contractors existing business models (closer to maintenance/service contract model). Less documentation

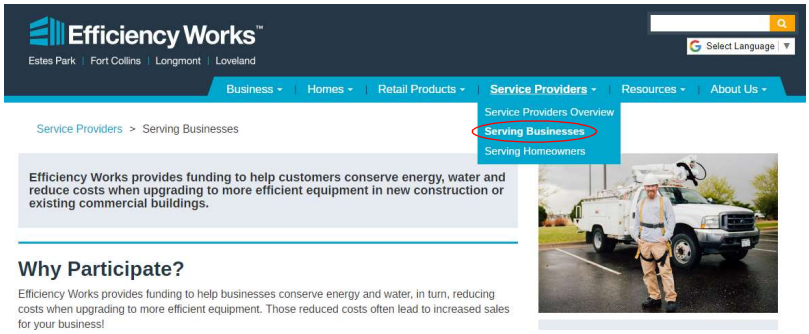
When: Later 2019

Efficiency Works™

Become A Service Provider

Go to efficiencyworks.org, serving businesses, Trade Ally
https://efficiencyworks-ta.tradeally.com/tradeally/public/join.do

Submit portfolio of related experience



Participation

How to enroll your building

- ✓ Get a FREE efficiency assessment
- ✓ Apply to the Building Tune Up program
- ✓ Select a service provider

Efficiency Works™

Thank you!

Questions?

Efficiency Works™

Estes Park | Fort Collins | Longmont | Loveland