Better Buildings®
U.S. DEPARTMENT OF ENERGY

All Systems Go: Innovative Projects in Traditional Industrial Systems

Wednesday, May 17

9:30-10:45 am

U.S. DEPARTMENT OF ENERGY

Panelists

- Fred Everett and Gregory Paul, C. F. Martin & Co.
- Sean West, United Technologies Corporation
- Philip Kauneckas, Intertape Polymer
- Bruce Lung, U.S. Department of Energy (Moderator)

Fred Everett and Gregory Paul

C. F. Martin & Co.

U.S. DEPARTMENT OF ENERGY

Innovative Projects in Traditional Systems
C. F. Martin & Co., Inc. Central Utility Plant

Better Buildings Summit

May 17, 2017

Cynthia McAllister Fred Everett Gregory Paul

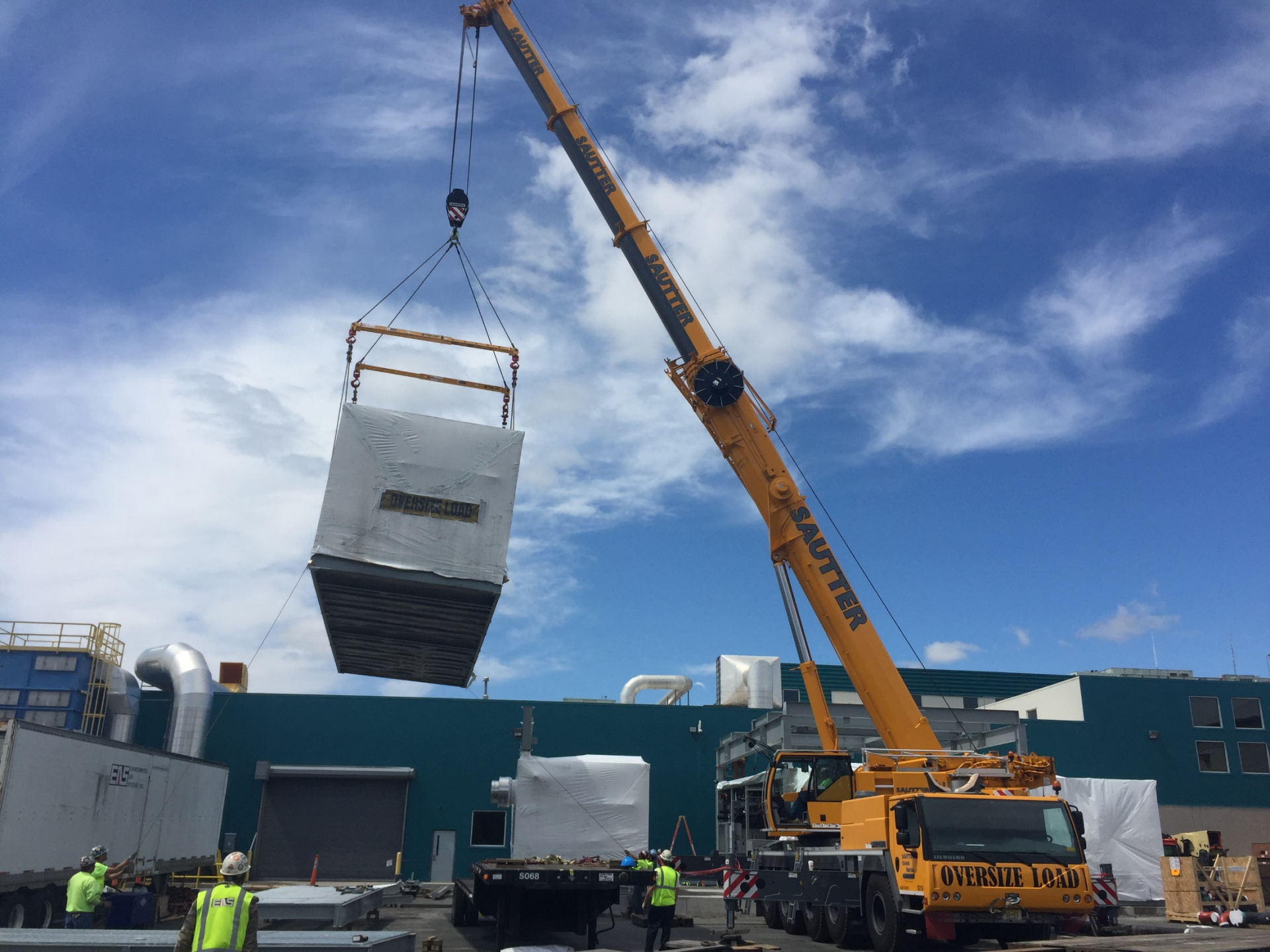
C. F. MARTIN & CO. INC.

C.F. MARTIN & CO. INC.
C.F. Martin & Co
EST. 1833

DEMAG

AMERICAN
CONCRETE FORM
HANDICAPPED
PARKING

ENS
ENS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OVERSIZE LOAD
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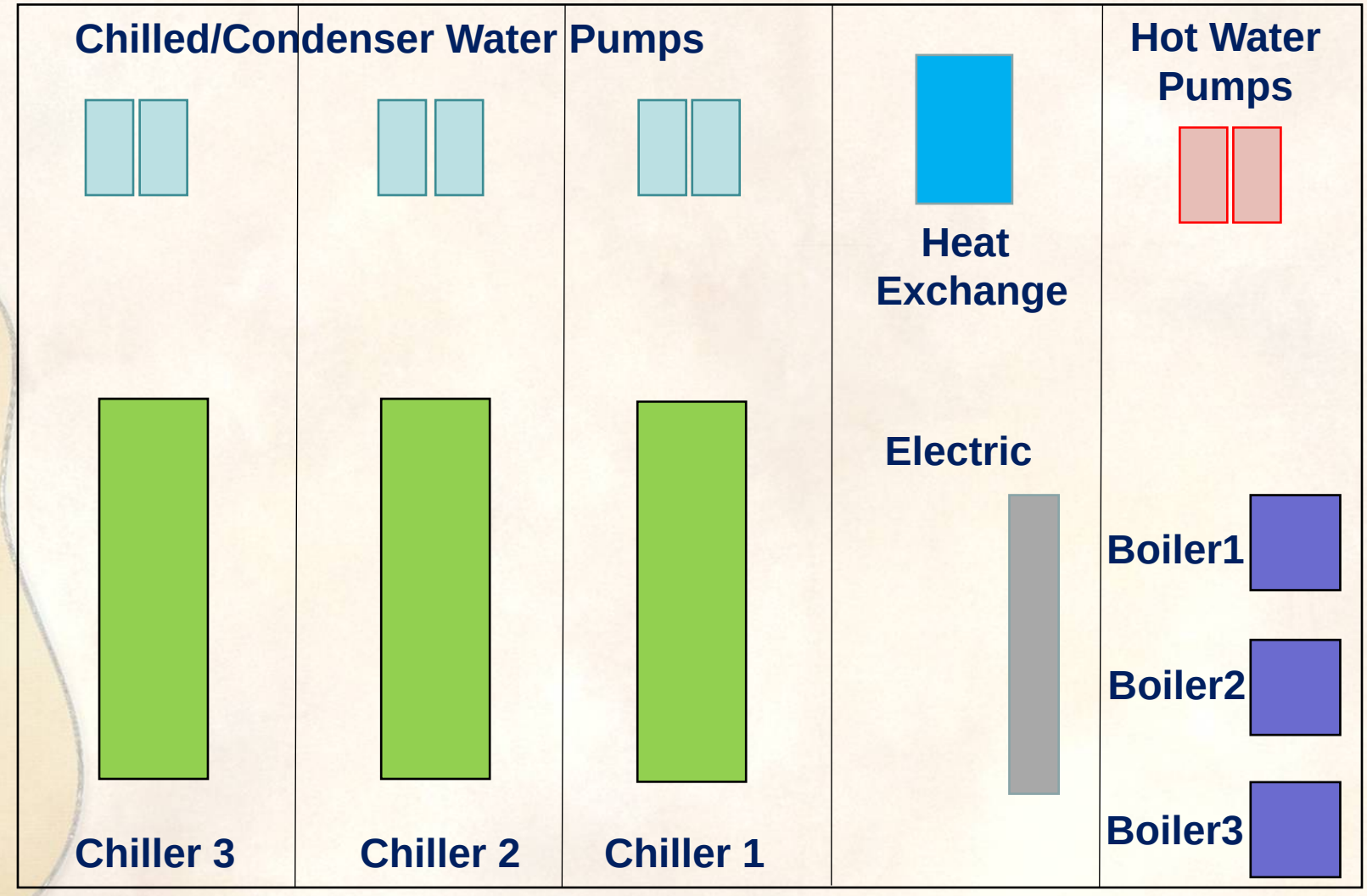
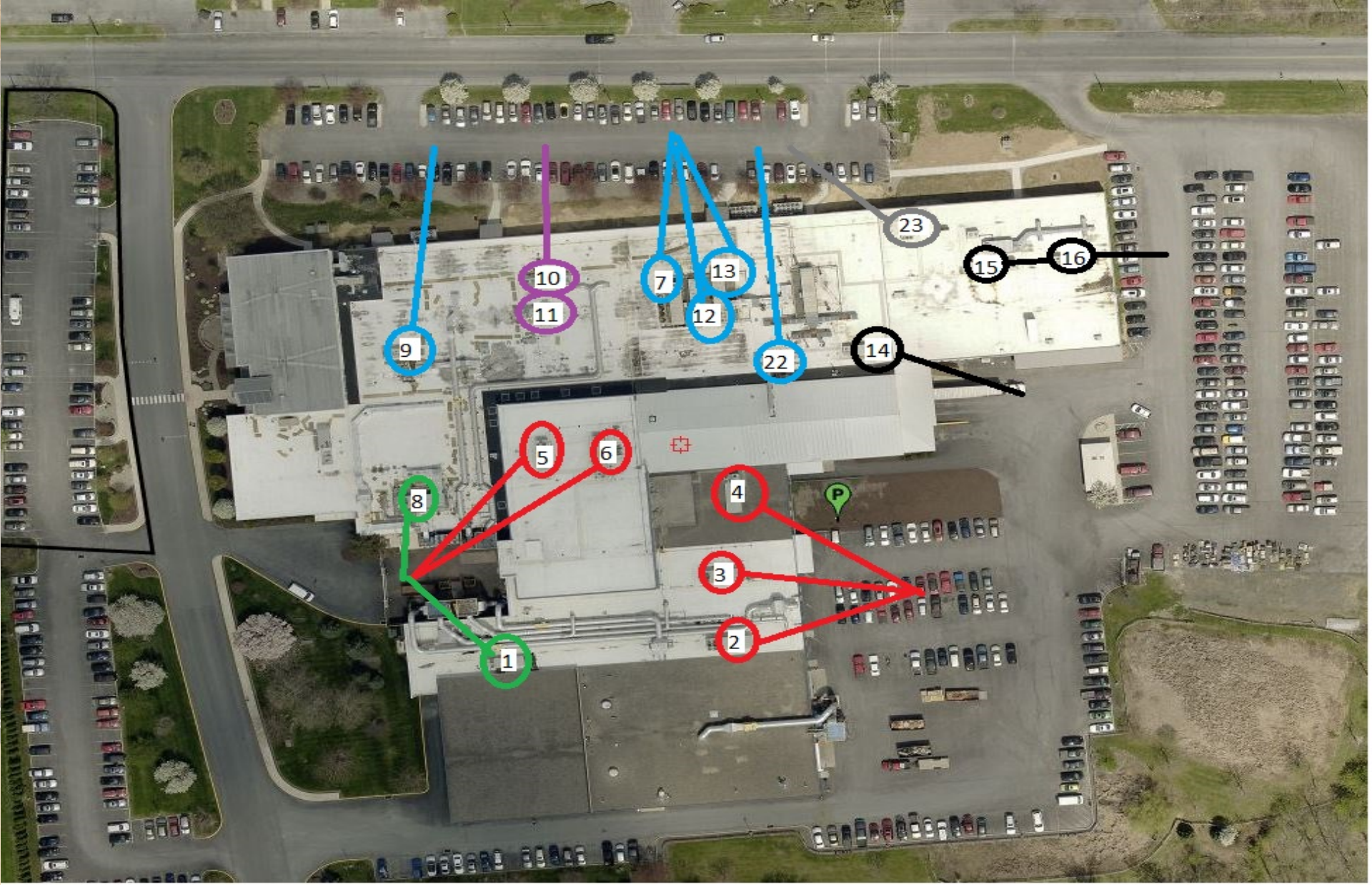
JCB
United Rentals
HYD OIL

Equipment Lineup





300ton = RED
240ton= BABY BLUE
200ton = PURPLE
180ton = GREEN

80ton = BLACK
70ton = GRAY

Questions?

Sean West

United Technologies Corporation

U.S. DEPARTMENT OF ENERGY

United Technologies

DOE 2017 Energy Summit
Innovative Industrial Projects

Sean West
UTC
EH&S Associate Director

Environment, Health & Safety
United Technologies Corporation

UNITED TECHNOLOGIES

Agenda

1. UTC at a glance
2. Vacuum furnace operation
3. Energy saving recommendations

No technical data subject to the EAR or the ITAR

UNITED TECHNOLOGIES

2016 revenue $57.2B

United Technologies

Climate | Controls | Security

Heating, ventilating, cooling & refrigeration systems

Security & fire protection services

Otis

A United Technologies Company

Elevators, escalators, moving walkways, people movers & horizontal transportation systems

UTC Aerospace Systems

Industrial & aerospace systems

Pratt & Whitney

A United Technologies Company

Aircraft engines, gas turbines & space propulsion systems

No technical data subject to the EAR or the ITAR

2020 SUSTAINABILITY GOALS

Greenhouse gas reductions

This document contains no technical information subject to the ITAR or the EAR.

Energy Efficiency Project

Vacuum furnace operation

Issue Statement

- Vacuum furnaces identified as significant energy user at many UTC sites
- High levels of vacuum generated using diffusion pumps
- Pumps designed to operate continuously
- If pumps are shut down, oils cool and lose viscosity

Can the pumps be throttled back to save energy without losing oil viscosity?

This document contains no technical information subject to the ITAR or the EAR.

VACUUM FURNACE PROJECT

Energy Efficiency Project

Energy use

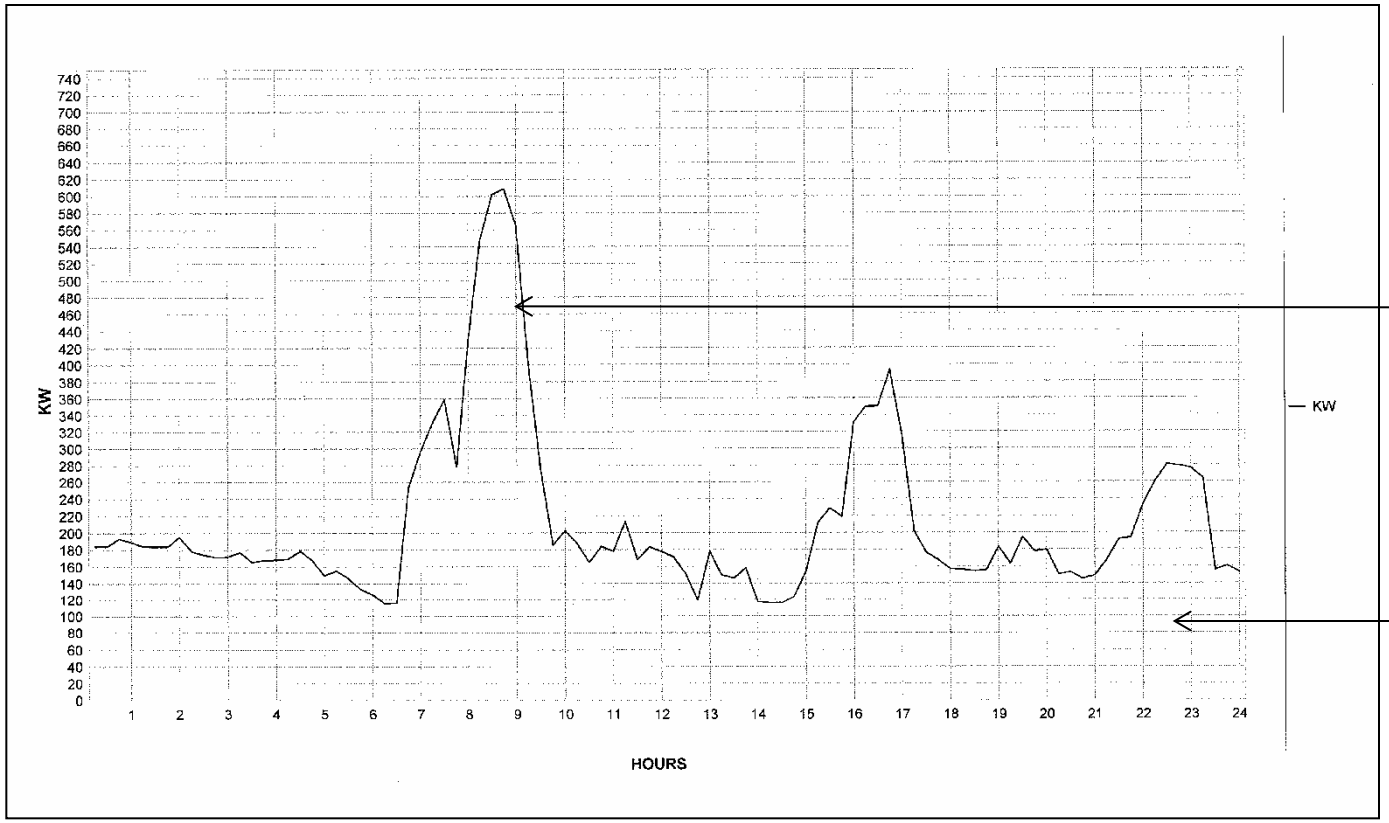
- Furnace heaters
- Vacuum pumps
- Cooling tower

- Tooling fixtures
- Furnace loading
- Furnace maintenance

This document contains no technical information subject to the ITAR or the EAR.

Vacuum Furnace Electric Profile

Auxiliary equipment consumes 2/3 of energy



Heat treat cycle

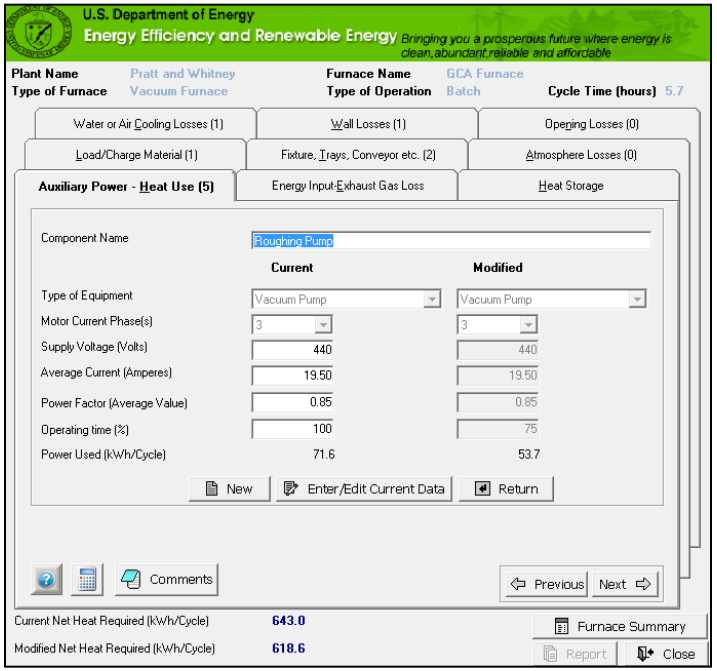
Base load, cooling tower fan and pump, vacuum pumps

No technical data subject to the EAR or the ITAR

DOE Process Heating In-Plant Training

Process heating assessment approach

1. Model furnace heat losses to simulate liner degradation
2. Model furnace operation to allocate energy consumption:
   - Vacuum pumps
   - Tooling fixture load
   - Cooling water
   - Actual parts heat load
3. Evaluate energy saving



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DOE Process Heating In-Plant Training

Recommendations

- Develop standard work instructions for auxiliary equipment shut down:
  - Use of pre-programmed Energy Savings mode during idle time.
  - Shut down vacuum pumps during cool down cycle.
  - Shut down of all auxiliary equipment when furnace is not in use.
- Reduce tooling fixture weight
- Multi-load furnace if possible
- Replace furnace liners

No technical data subject to the EAR or the ITAR

Diffusion Pump Heater Controls

Break a Leg project

Project scope:

Install contactors on diffusion pump heater circuit

When pump is in idle mode contactors disables 4 of the 6 electric heaters

Remaining 2 heaters stay on and keep the oil warm

Diffusion pump heater wiring

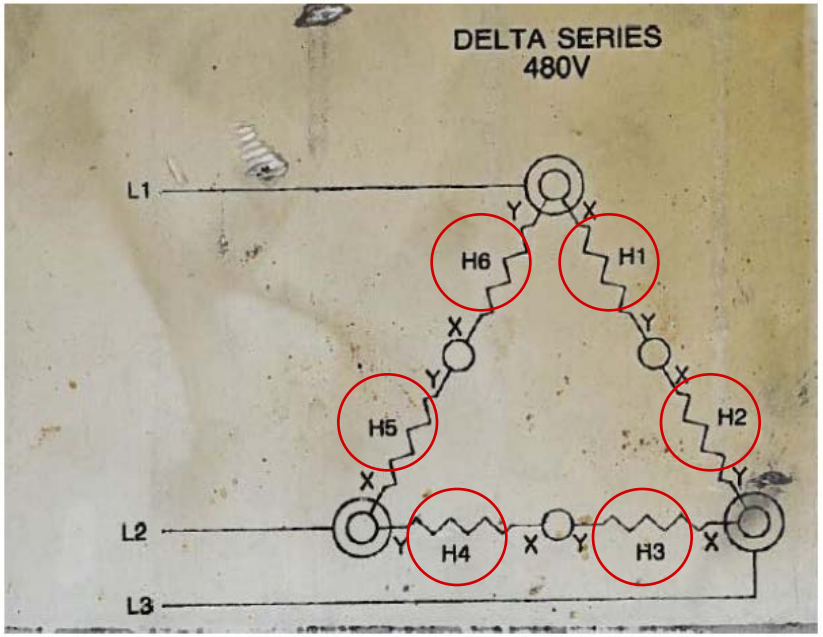

Figure 2: Diffusion pump heater wiring schematic

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Diffusion Pump Heater Controls

Actual results

Energy Savings

- Based on six furnaces (2 pumps per furnace); four electron beam welders (1 pump each)
- Data loggers used to measure energy savings

Pre-installation energy use = 1,241,000 kWh

Post-installation energy use = 888,000 kWh

Annual Savings estimate = 352,000 kWh

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Vacuum Furnace Tooling Fixture Replacement

Existing Graphite Plates

- Heavy and dangerous to move
- Brittle and prone to damage
- In need of replacement
- Contributes to high turn around time (up to 24 hours)

Recommendation

- Carbon-Fiber-Carbon (CFC) plates
- Durable
- Safer to handle
- Requires less time to heat and cool
  - ✓ Typical run: 5 => 4 hrs
  - ✓ Longer runs: 20 =>16 hrs

Actual Energy Savings (based on 3 furnaces
300,000 kwh's, $18K

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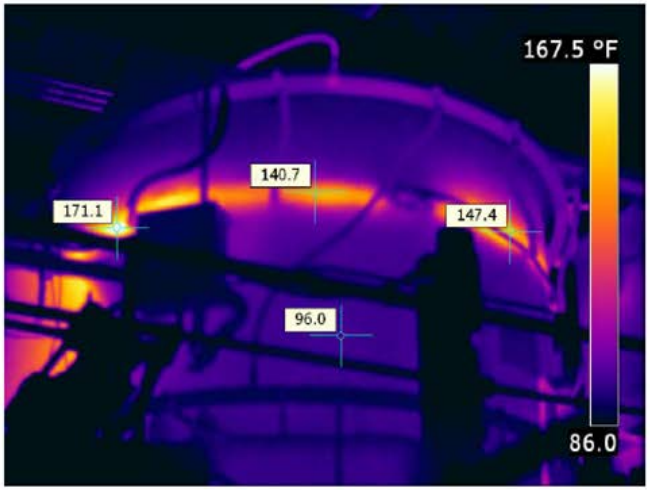
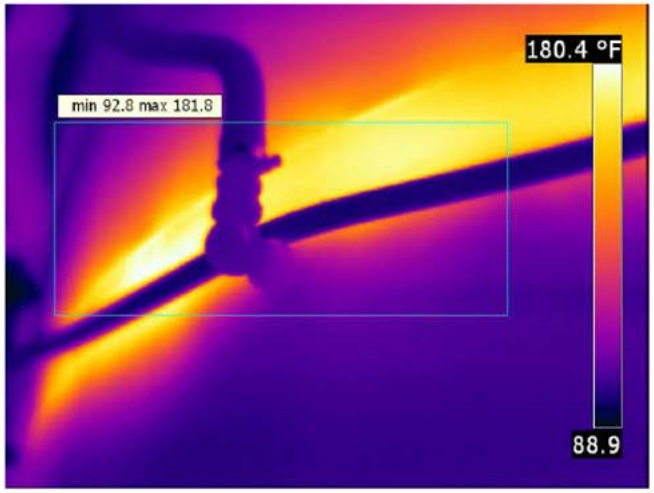
Furnace Liner Maintenance





Hot spots may indicate liner degradation.

Heating cycle may be take longer

Furnaces are designer to operate within strict temp. parameters

No technical data subject to the EAR or the ITAR

Vacuum Furnace Operation

In-Plant Energy Saving Opportunities

- Install diffusion pump controls if not already included in OEM control package
- Reduce tooling fixture for weight reduction
- Inspect and replace furnace liner as recommended
- Maximize furnace loading to decrease the number of cycles

No technical data subject to the EAR or the ITAR

Q&A

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Environment, Health & Safety
United Technologies Corporation

Philip Kauneckas

Intertape Polymer

U.S. DEPARTMENT OF ENERGY

Building Energy Efficiency into New Plant Design

Presented by
Philip Kauneckas
pkauneck@itape.com

2017 Department of Energy Summit
Washington, DC
May 17, 2017

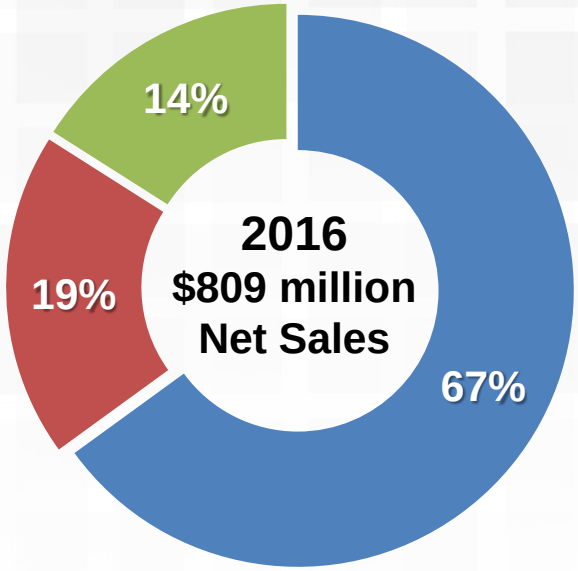
Better Plants CHALLENGE
U.S. DEPARTMENT OF ENERGY

www.itape.com

ENERGY STAR AWARD 2017
PARTNER OF THE YEAR
Sustained Excellence

Company Profile

- The second largest tape manufacturer in North America
- Employs ~2,200 people
- Approximately 61% of sales from products with a Top 2 market position in North America



Check out our corporate video on YouTube™

IPG at a Glance - Channels

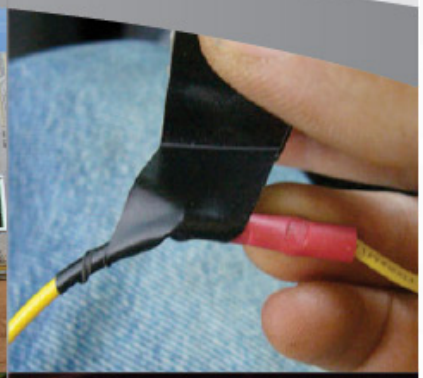
Better Plants CHALLENGE
U.S. DEPARTMENT OF ENERGY

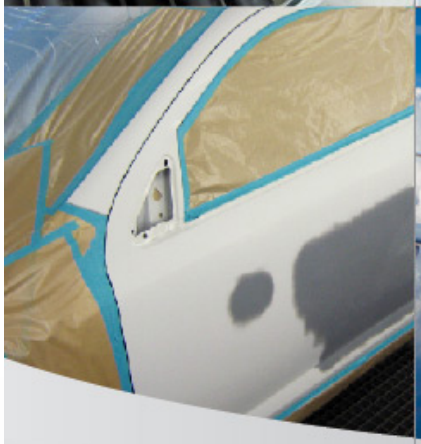
Industrial Packaging

Consumer

Building & Construction

Electrical





Automotive Aftermarket

Aerospace

Industrial MRO

Coated Products

Achievements

ISO 14001:2004
Environmental Management System

2014 & 2015
ENERGY STAR Partner of the Year

2016 & 2017 ENERGY STAR Partner of the Year – Sustained Excellence

10 Plants Achieved ENERGY STAR Challenge for Industry
(to reduce energy intensity by 10% within 5 years)

2016 NASCAR Green E3 Challenge (Danville, VA plant)

ENERGY STAR AWARD 2017 PARTNER OF THE YEAR Sustained Excellence

ENERGY STAR AWARD 2015 PARTNER OF THE YEAR

ENERGY STAR AWARD 2016 PARTNER OF THE YEAR Sustained Excellence

ENERGY STAR AWARD 2014 PARTNER OF THE YEAR

NASCAR GREEN CHALLENGE VIRGINIA — ECONOMY ENERGY ENVIRONMENT

US EPA ACHIEVER ENERGY STAR CHALLENGE FOR INDUSTRY

Better Plants CHALLENGE U.S. DEPARTMENT OF ENERGY

ipg

Building Energy Efficiency into New Plant Design

- Greenfield manufacturing facility in Cabarrus County, North Carolina, with a goal to increase the manufacturing capacity of our growing water-activated tapes business.
- Corporate Energy Team held brainstorming session to incorporate energy efficiency into initial design
  - Followed up with Corporate Engineering
    - Project Manager is CEM!
  - Include energy efficiency into design specifications
  - Forecasted energy consumption per production targets

Midland, NC Plant

- Utilized checklists from past audits and assessments
- Discussion included
  - Utility rates
    - Contracts, metering, utilization and load factor
  - Building and facility
    - Metering
    - Lighting and HVAC
    - Building temperature
  - Equipment and process
    - Shut down capabilities
    - VFDs
    - Insulation
    - Heat recovery
    - System design
    - Best practices from other plants

Key Ideas Specified in Design, Big Wins!

- Water & Sewer process meters (data & utility rates)
- LED Lighting with motion sensors (turn down/turn off)
- Programmable T-stats (turn down/turn off)
- Equipment Supply Fan VFD's (two 125 h.p.)
- Proper steam boiler sizing (avoid short cycling)
- High turn down ratio boilers (steam and hot oil)
- Steam mass flow meter (data & utility rates)
- Electricity, Process sub-metering (data & utility rates)
- Liquid cooled VFD air compressors (two 100 h.p.)
- Servo motors utilized in place of air cylinders (no C.A.)
- Avoid Venturi vacuum systems (no C.A.)

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Compressed Air Design

- Installed two 75 HP air cooled compressors with VSDs
- 3 receiver tanks – 1 wet, 2 dry
  - 1,000 gal & 600 gal dry tanks on either end of building to balance system

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Hot Oil Boiler

- Added economizer to boiler
- Higher turn down ratio (8:1)
- Designed to run at lower temperature
  - MW plant: 480 degrees
  - MN plan: 400-425 degrees
- All pumps on VFDs

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Steam Boiler

- Actuated damper control instead of mechanical
- System designed for process
  - MW plant: 150 hp & 80 hp
  - MN plant: 40 hp
  - All steam goes into glue making process (no recovery)

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Process Equipment

- Laminator
  - Actuated dampers to control drying
  - Moisture meters for process control and drying efficiency
- Converting
  - Servo driven linear guides vs pneumatic cylinders
    - Upgrade from MW equipment & eliminate use of compressed air
- Motors
  - Almost 100% of process motors have VFDs
- Lighting
  - LEDs with occupancy sensors
  - Zone controlled lighting in production areas – turn off/turn down program

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Future Steps at Midland, NC Plant

- Energy efficiency education and awareness in on-boarding/orientation process for all employees
- Use ENERGY STAR & DOE Tools to build energy program
- Implementation of IPS
  - Engage employees and create culture of continuous improvement
- Add to monthly corporate utility report
  - Set up energy intensity metric
- Attend Annual IPG Energy Summit
  - Plant energy coordinator added to Corporate Energy Team
  - Professional development

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Thank You

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