

It's All About Energy

**MDC's On-Site Power Generation & Energy
Conservation Efforts at the Hartford, CT WPCF**

**Northeast Residuals & Biosolids Conference
Cromwell, CT
October 13, 2016**



Presentation Topics



- 💧 **MDC & Water Pollution Control Overview**
- 💧 **Electricity Use**
- 💧 **Drivers for Heat Recovery**
- 💧 **Implementation and Results**

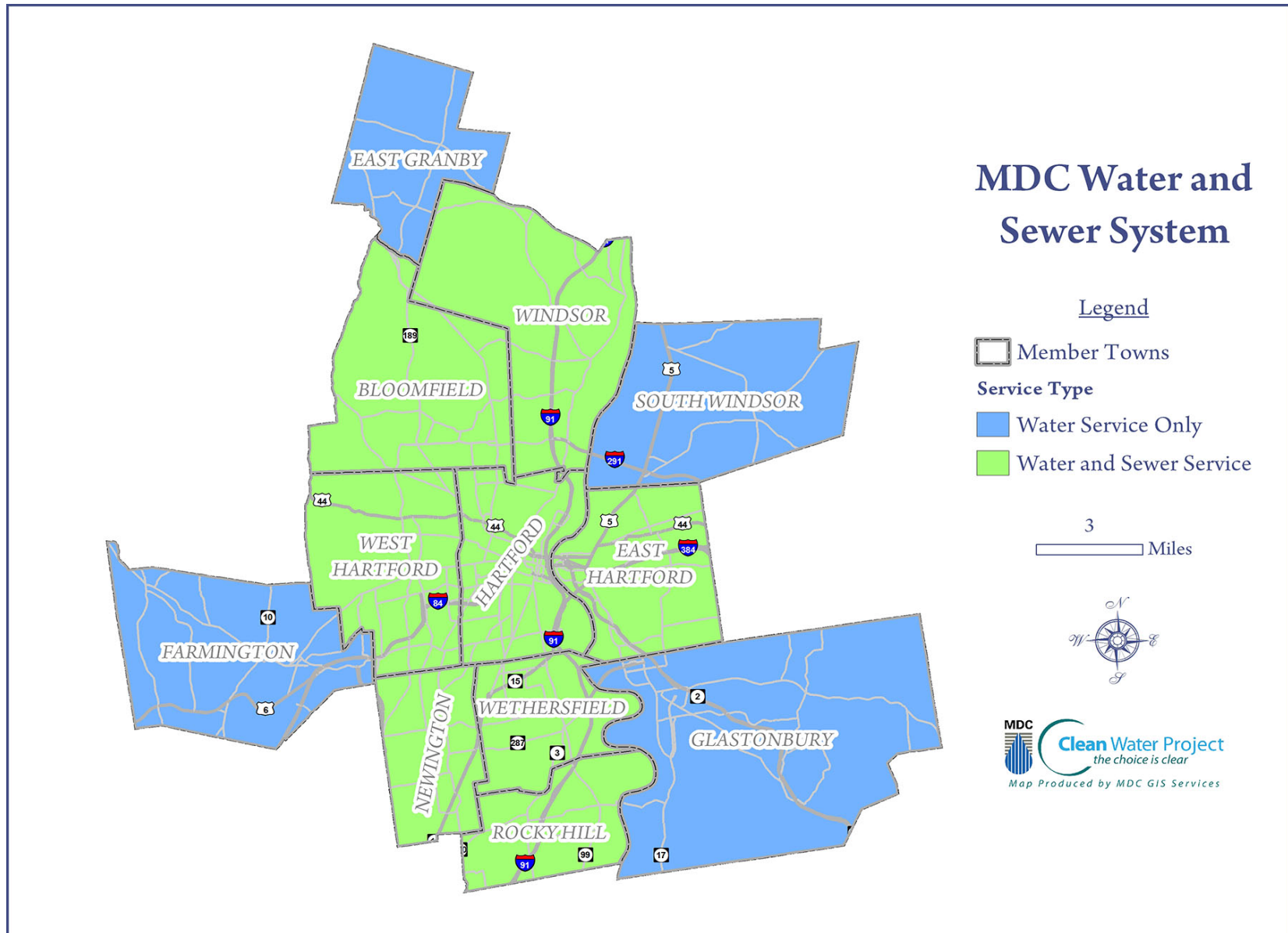


The Metropolitan District

- **Chartered by the Connecticut General Assembly in 1929**
- **Services provided to approximately 400,000 population**
 - **Water Supply – 40 billion gallons in 2 reservoirs**
 - **Water Treatment – 2 plants, 85+ MGD capacity**
 - **Water Distribution & wastewater Collection**
 - 2,700+ miles of distribution and collection system piping
 - 80+ water and wastewater pump stations
 - **Wastewater Treatment – 4 plants, 135 MGD capacity**
- **~530 employees with an annual operating budget of ~ \$140M**
- **Undertaking \$2.1B Clean Water Program to address SSOs and CSOs**



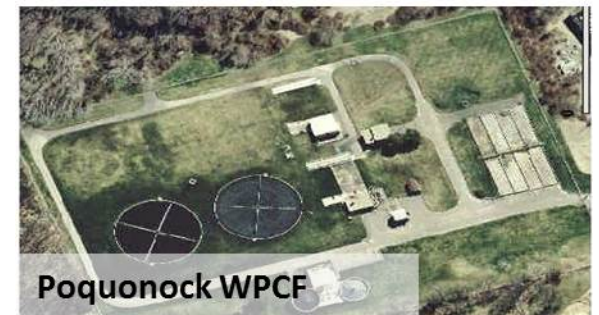
Map of Sewer Service Area





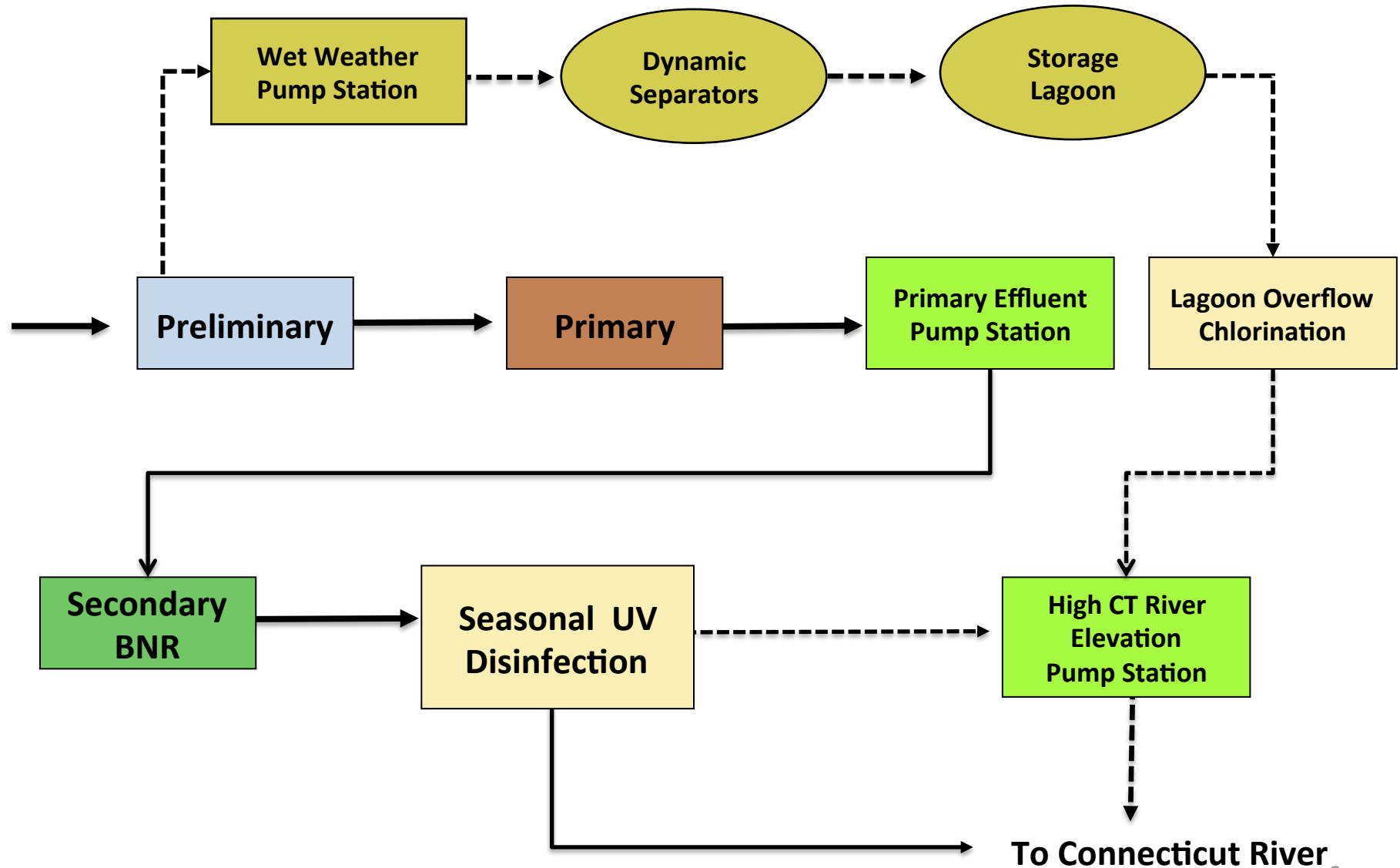
Water Pollution Control (WPC)

- 💧 **WPC operates 4 treatment facilities**
 - East Hartford – 12.5 MGD
 - Poquonock – 5.0 MGD
 - Rocky Hill – 7.5 MGD
 - Hartford – 80 MGD secondary & 30 MGD wet weather
 - Largest CT wastewater treatment plant
 - HWPCF average daily flow is 60 MGD
- 💧 **All WPC facilities operate continuously**
 - Hartford WPCF is staffed 24/7
 - Satellite plants only staffed M-F, 7:30 – 4:00, with weekend plant checks
 - Hartford staff monitors satellite plants via SCADA alarms



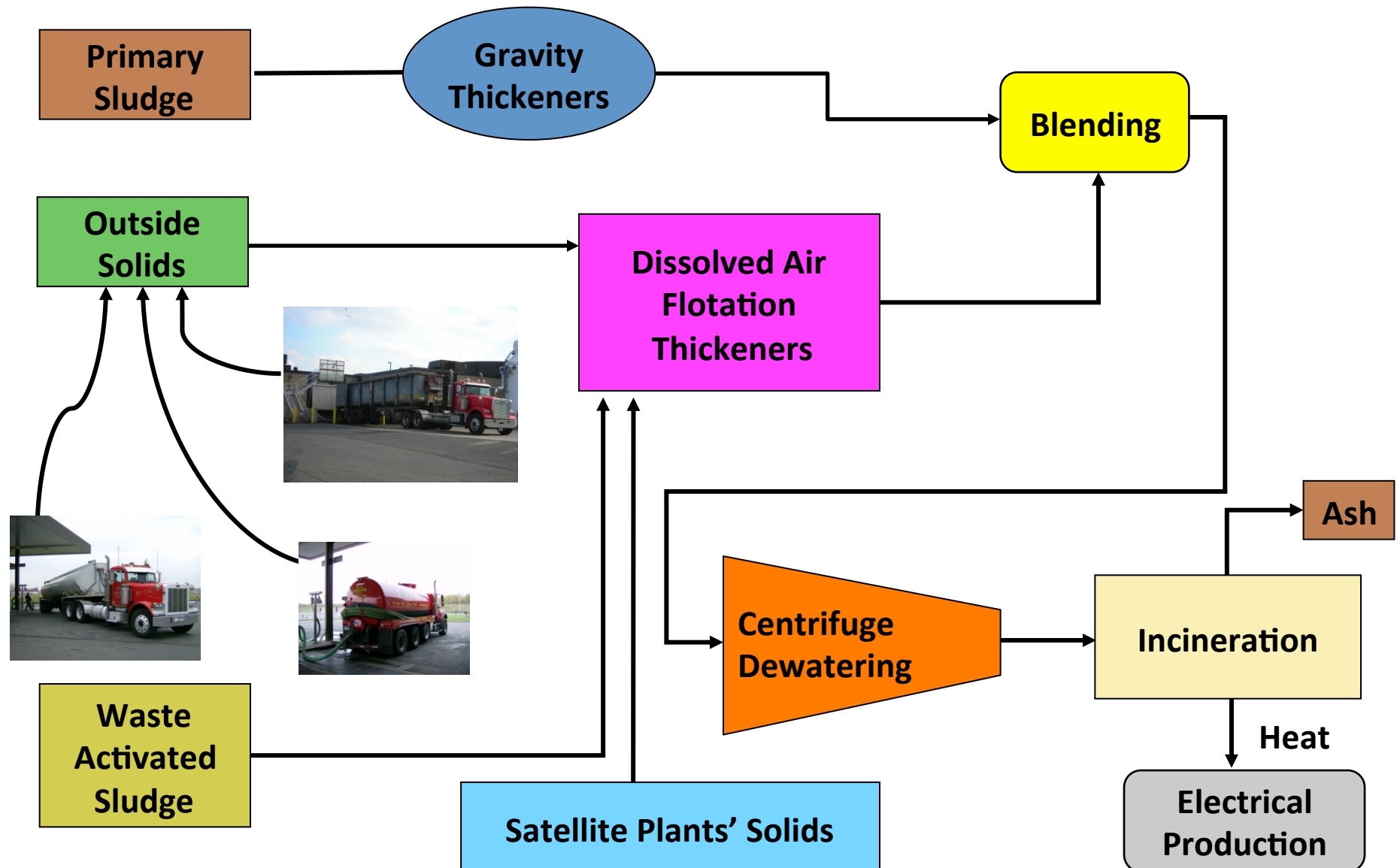


Hartford Liquid Treatment Process





Hartford Solids Treatment Process



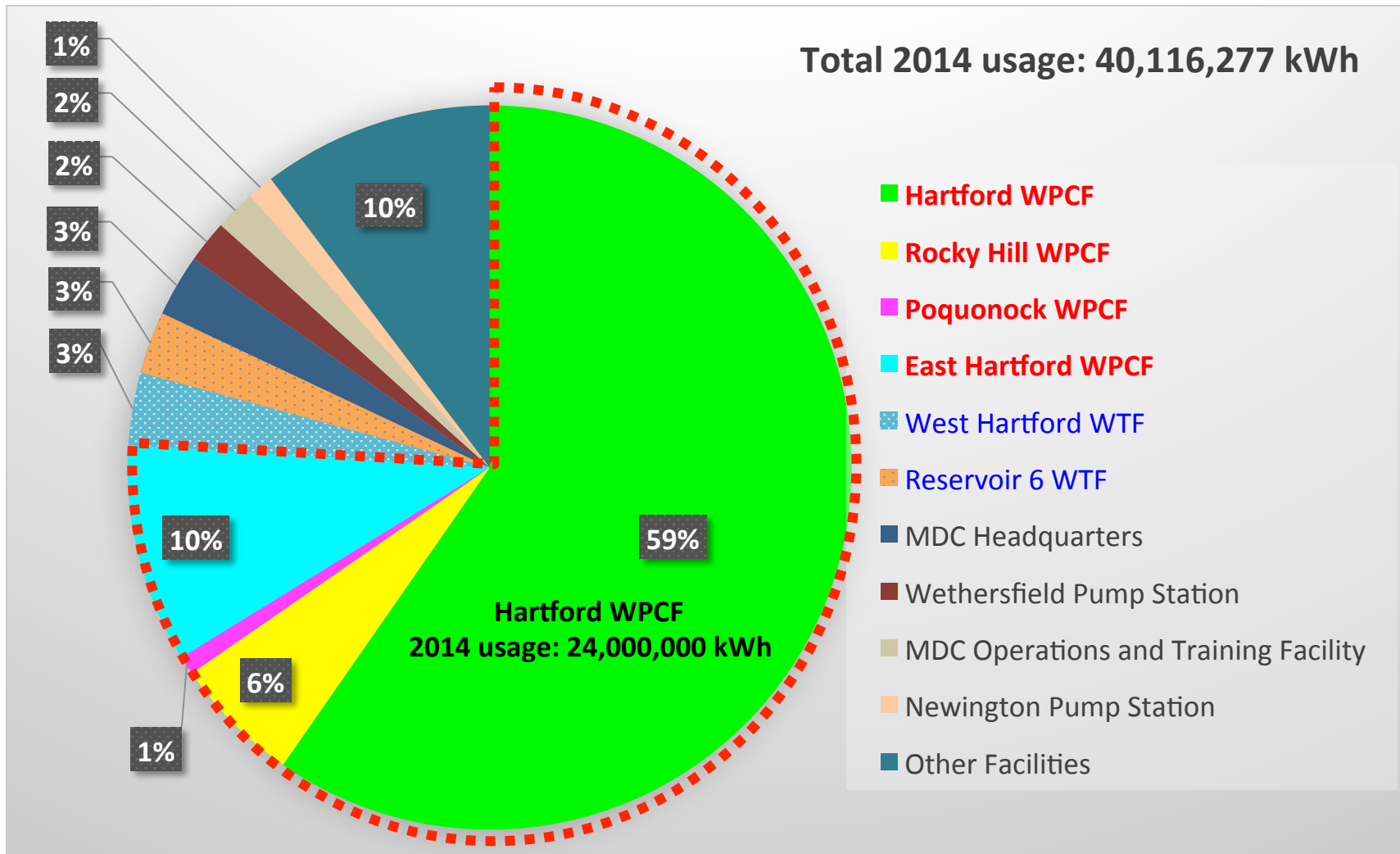


Solids Processing Challenges

- ◆ **The District's four WPCFs produce about 35 dry tons of sludge /day**
- ◆ **Operate a Regional Solids Receiving Facility – process between 35 and 50 dry tons of sludge /day from outside plant:**
 - Three satellites, two by force main
 - Cake
 - Thickened
 - Liquid
 - Septage
 - 454/industrial
- ◆ **Loadings are non-consistent, open 24/7**
- ◆ **Average more than 1,000 transactions per month**



District Wide Electricity Usage

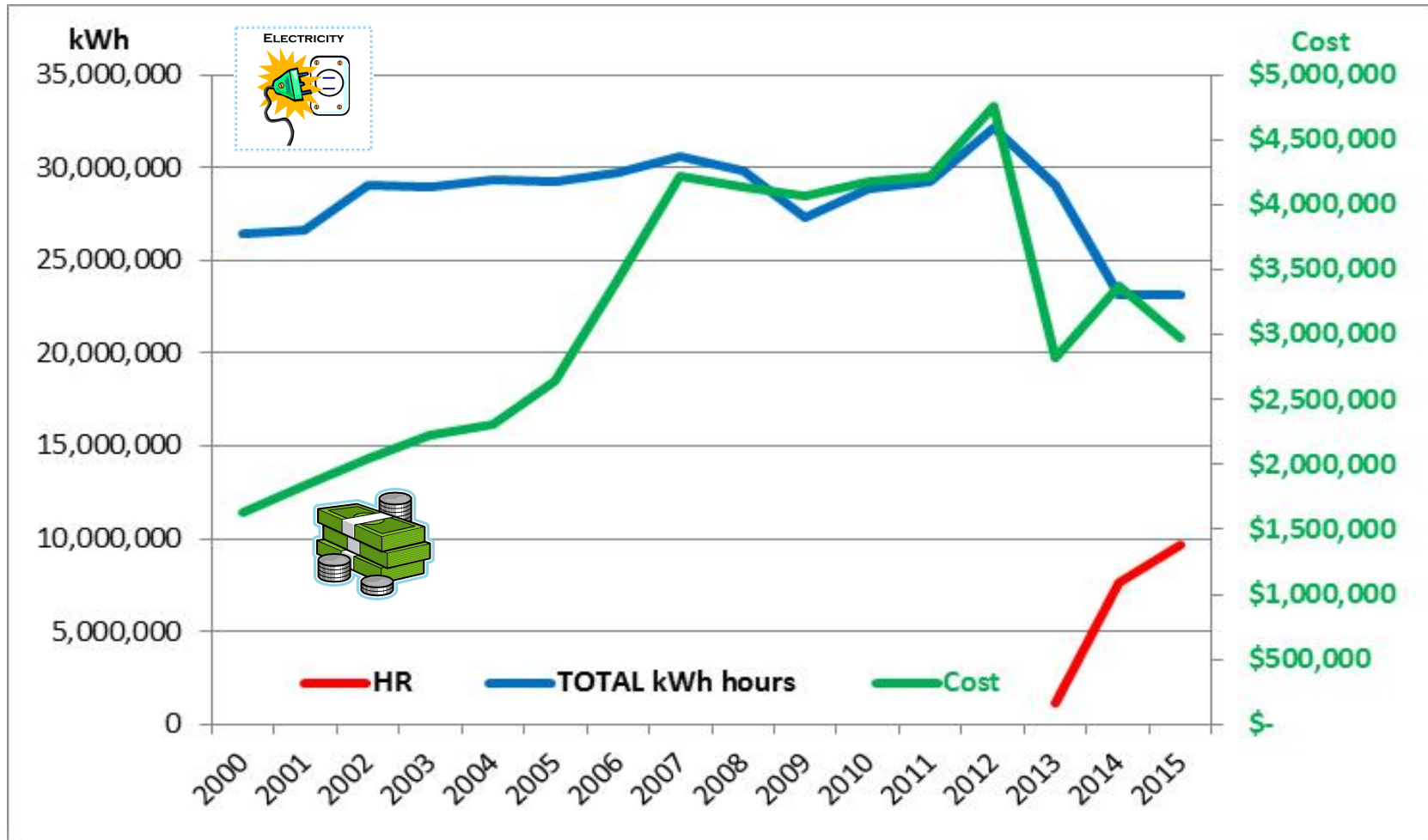


- 💧 Wastewater treatment is 76% of utility electricity usage
- 💧 Water treatment is 6%



Hartford WPCF Electricity Cost vs. Use

💧 Increasing energy costs drive the heat recovery project

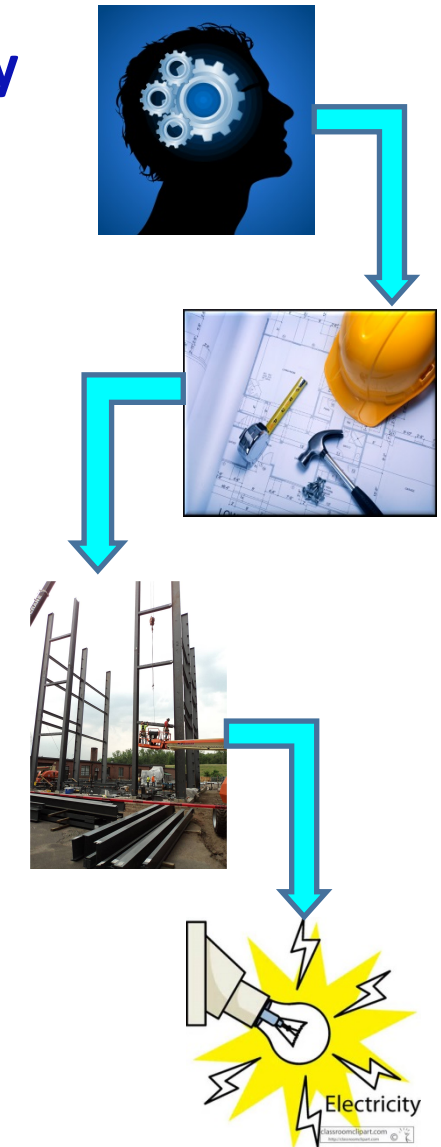


On an average day, the HWPCF uses enough electricity to light more than 35,000 one-hundred watt bulbs!



Heat Recovery Timeline

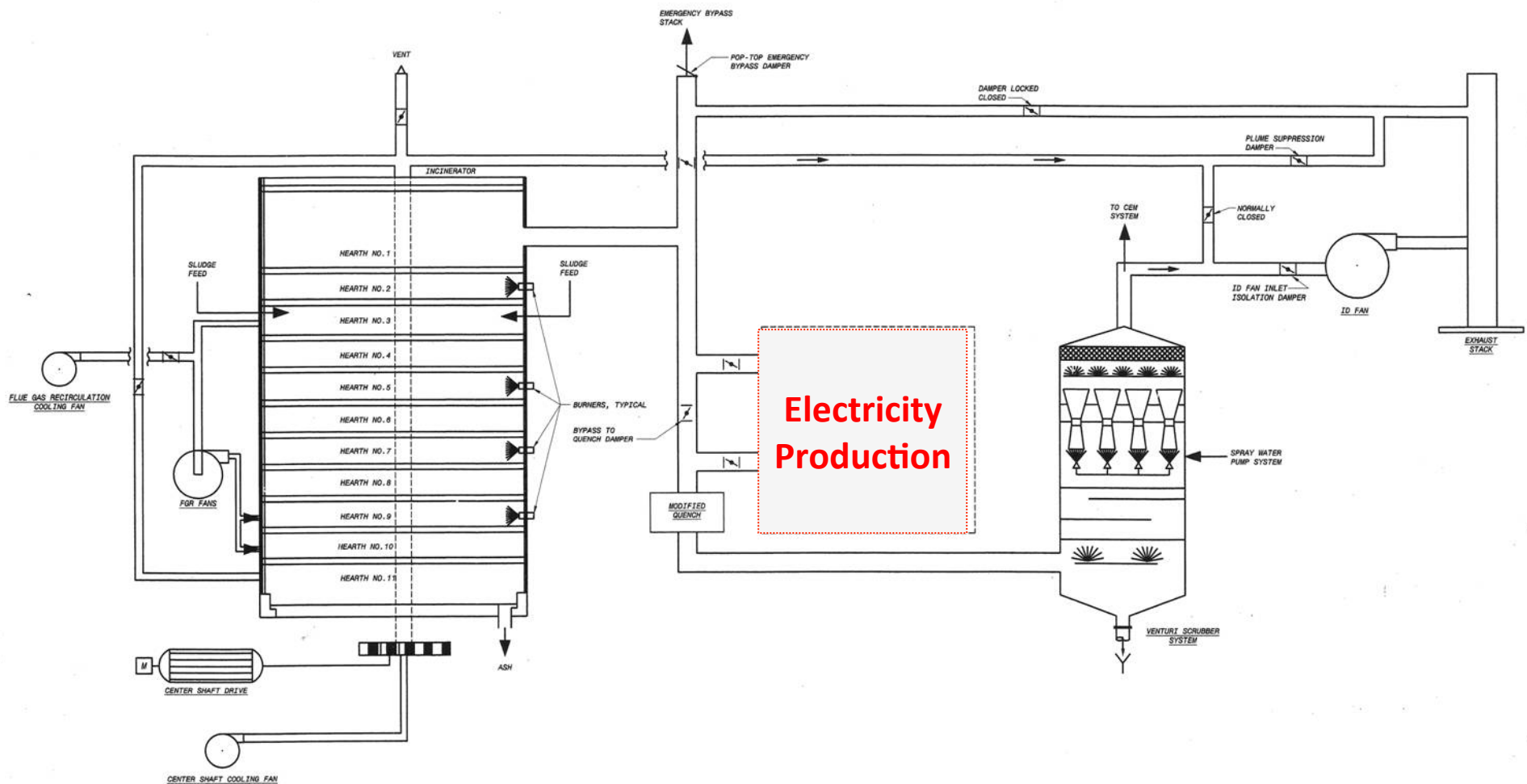
- 💧 Discussions and concepts about heat recovery started in early 2000's
- 💧 Energy costs continue to increase
- 💧 2009 Federal Stimulus – Shovel Ready Green Infrastructure
 - CT DEEP offers grants and low interest loans (ARRA)
 - Project must be designed, bid and awarded by Feb 2010
 - 15 months from notice to proceed
 - Project bid Dec 2009, awarded Jan 2010
- 💧 Construction 2010 – 2013, project combined with incineration upgrades
- 💧 MDC take full control January 2014





Installing Electricity Production

- Heat recovery basically put an electrical generation process in a “wide spot” in the incinerator exhaust piping to generate electricity



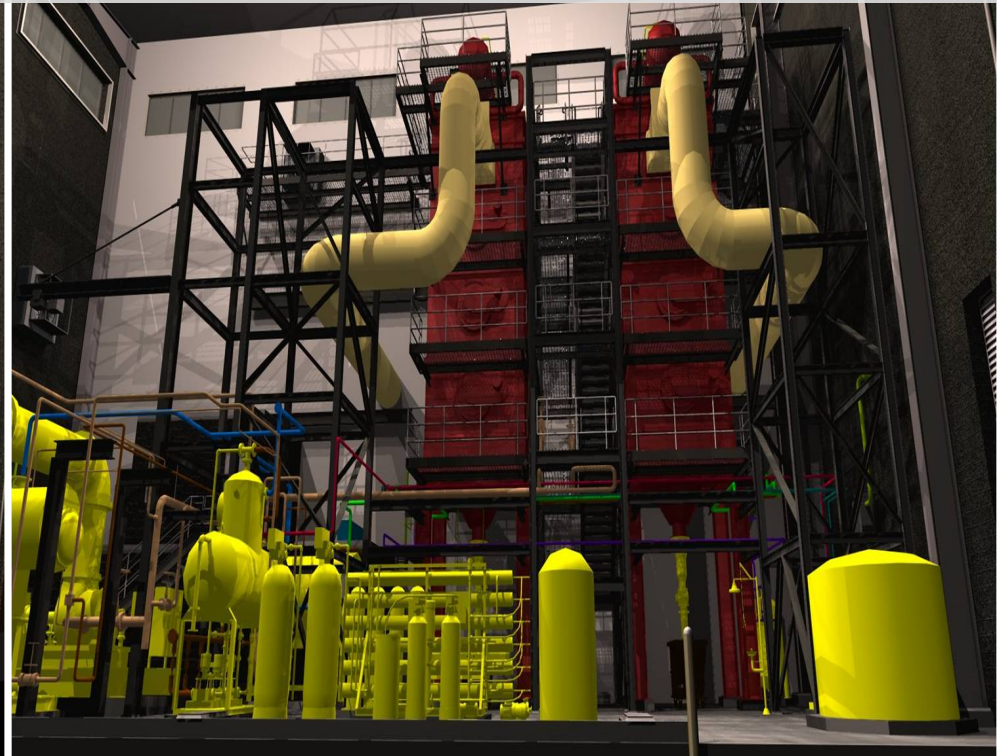
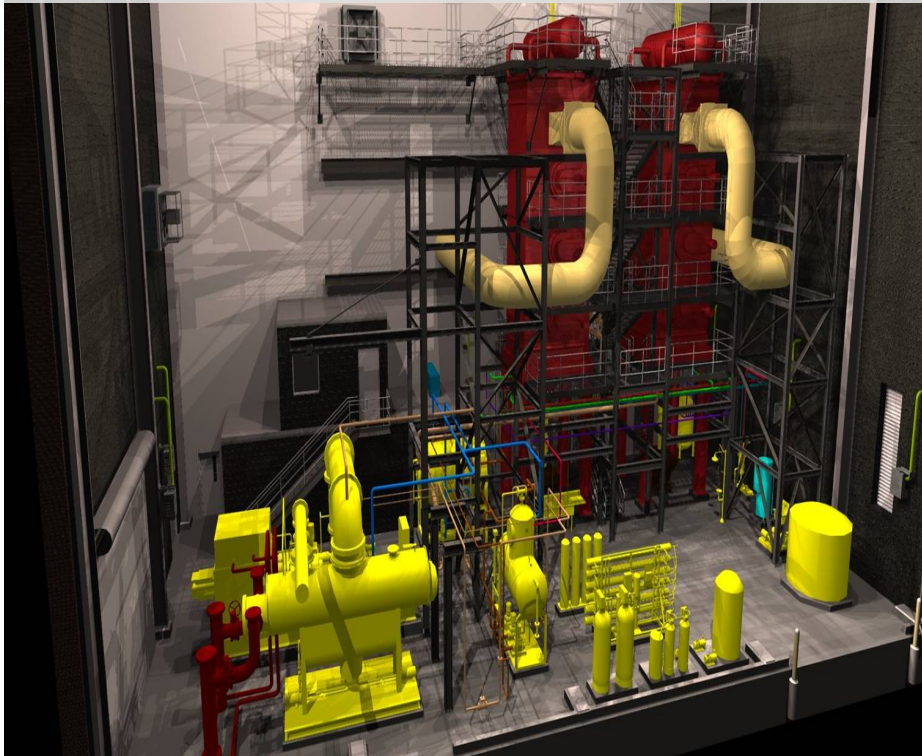


Energy Sustainability at HWPCF

Heat Recovery

- 💧 Use heat from incineration to generate up to 40% of our own energy.
- 💧 Biosolids provide a 'green' renewable source of energy

Black & Veatch 3D design





Site Visit Critical for Success

- **New Haven, CT completed design-build HR project**
 - Several issues arise and consistent operations proves challenging
 - New Haven staff shares multiple lessons learned with MDC that are incorporated into our project
 - Boiler orientation - use vertical boiler tubes to minimize ash deposit
 - Boiler materials
 - Facility layout for ease of operation and maintenance
 - Boiler warming system to minimize cold end corrosion of boiler tubes
 - Soot blowers installed instead of sonic horns
 - Ash collection systems installed at bottom of boilers
 - Interconnect agreement with electricity provider nearly a start-up show-stopper
- **MDC uses NH experience to make a better project**



Main Components

💧 Heat recovery & steam production

- Incineration gas into boilers at approximately 1,200°F.
- Exhaust leaving the Boilers is approximately 400°F
- Two boilers, each produce up to 26,000 lbs/hr. of 400 PSI steam
- Condensate recovery

💧 Electrical production

- Turbine, reduction gearbox & generator
- Electrical connection to plant's main electrical distribution
- Produce up to 2 MWs

💧 Water treatment

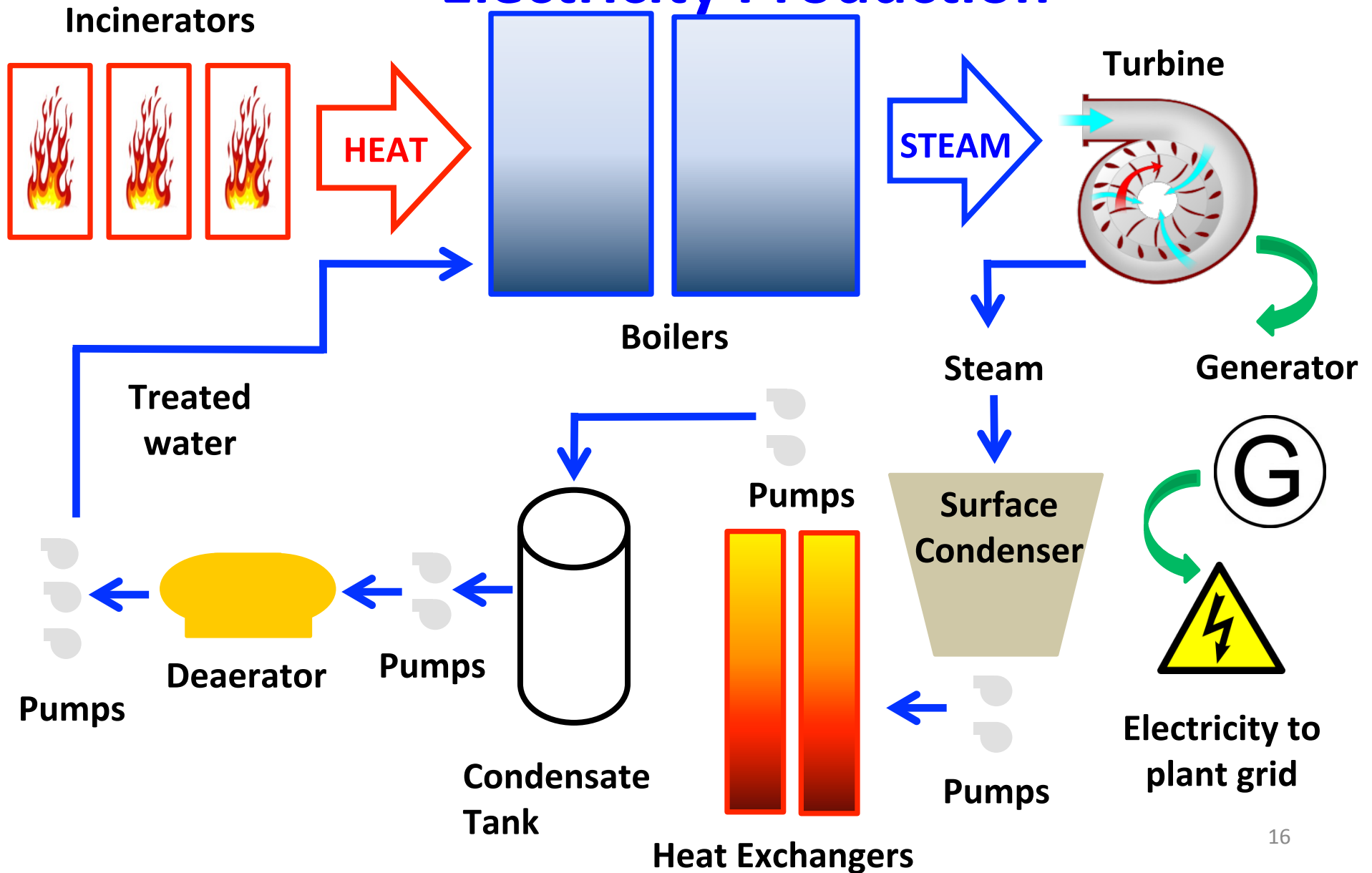
- Vital for peak performance

💧 Automation

- System is completely automated
- Connected to plant SCADA system

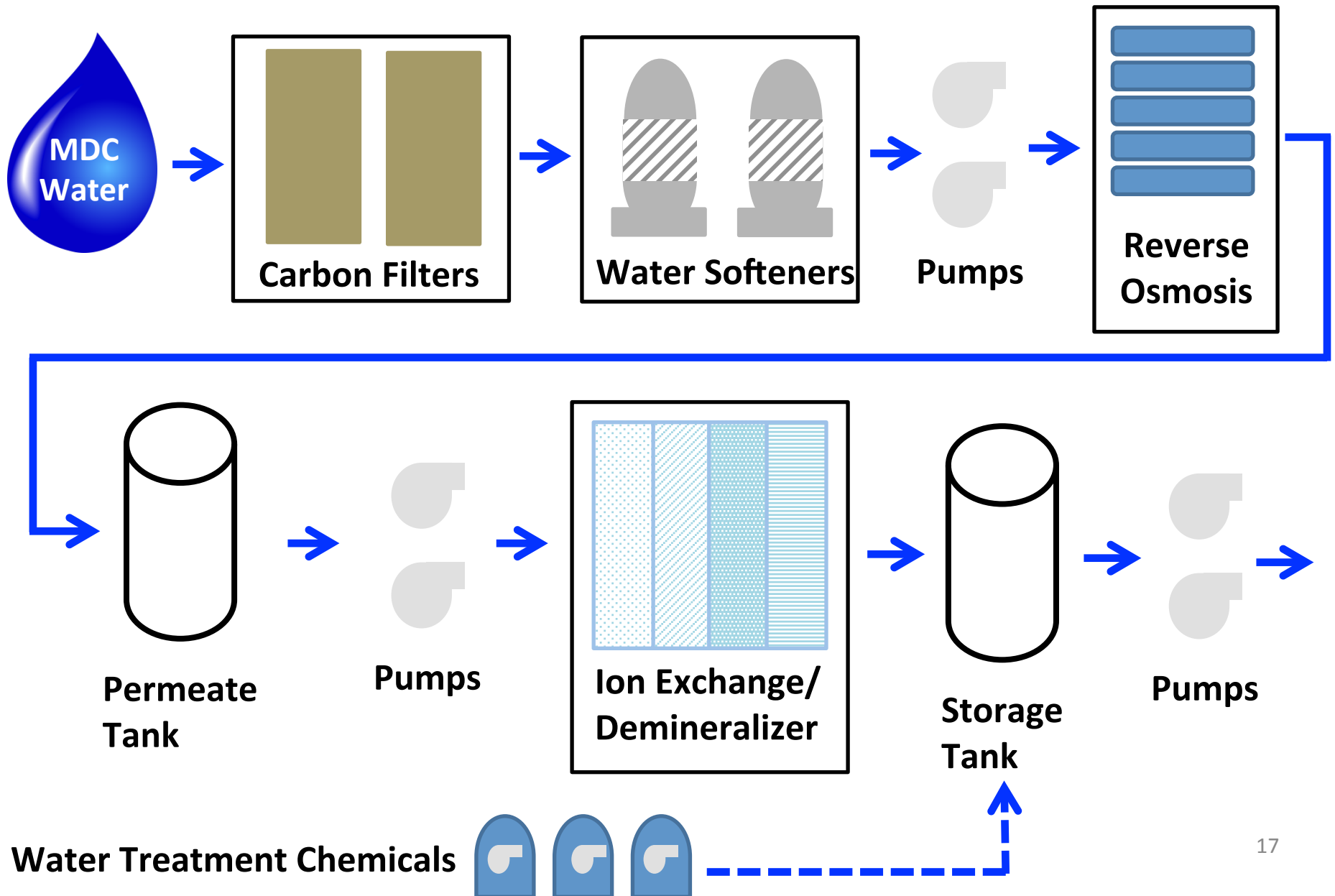


Heat Recovery & Electricity Production



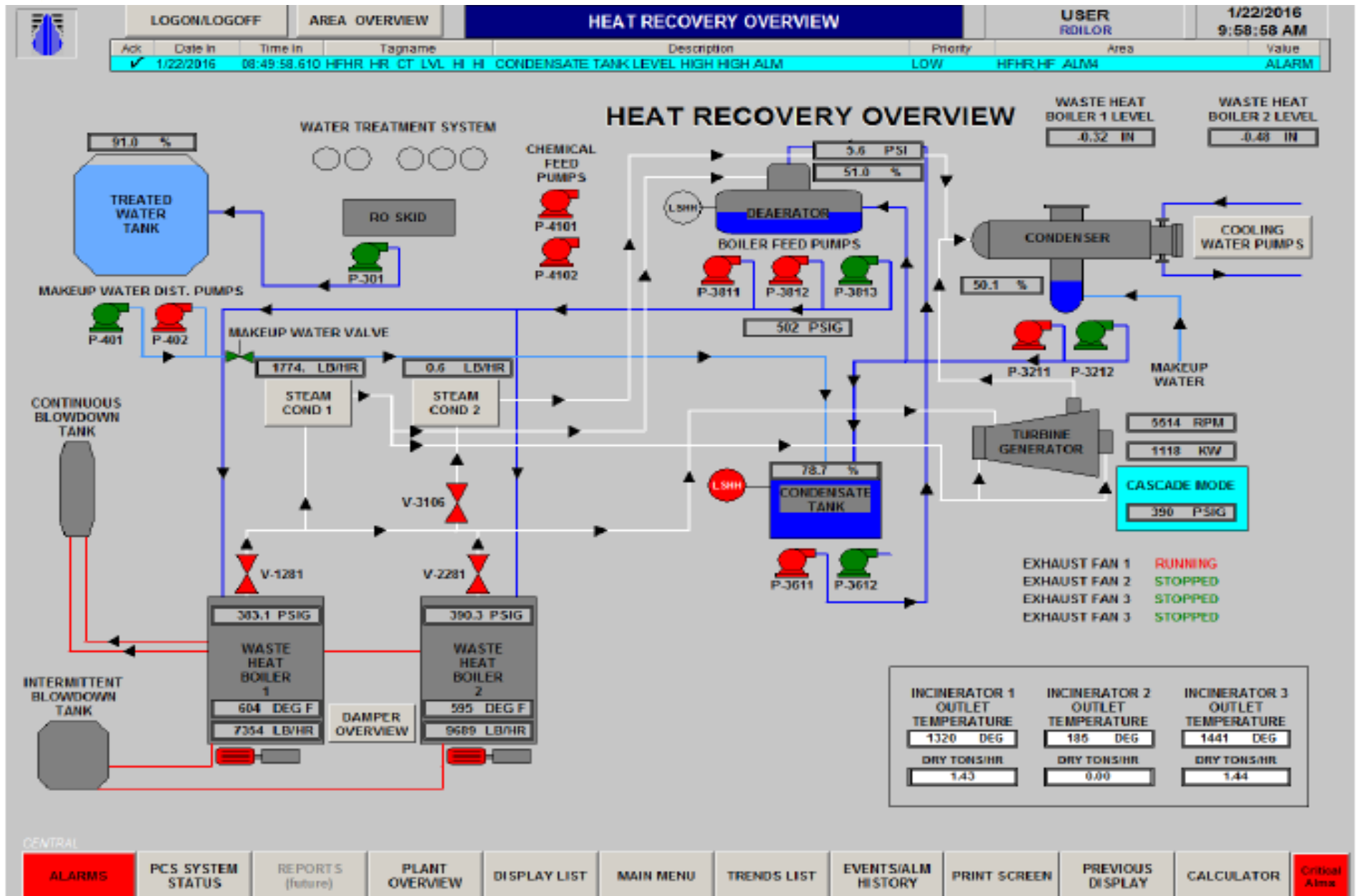


Water Treatment System





Heat Recovery Main SCADA Screen





Operational Lessons Learned

- 💧 **Team approach worked very well – key to success**
- 💧 **Staff consistency & engagement**
 - Staff engaged in design, testing, SOPs development & maintenance
- 💧 **Used project as opportunity to change solids processing into 24/7 operation – major plant-wide benefits**
- 💧 **Don't underestimate the training schedule – it's not another clarifier – 20+ classes**
- 💧 **Communication vital**
- 💧 **Development of SCADA early in project helped transition to operations**
- 💧 **Long-term operations & maintenance support is critical**
- 💧 **A few critical spare parts are necessary**



Results? Success!

- ◆ Safety record has been outstanding – no reportable injuries sustained in 2+ years of operation
- ◆ HWPCF staff took over the facility on Jan 1, 2014
 - In 2014 produced **7.6 million kWhs**, valued at ~ \$1M! (\$0.13/kWh, all in)
 - In 2015 produced **9.7 million kWhs**, valued at ~ \$1.3M!



Setting the Generator





Setting Boilers





Steam Blow – Clean Out Prior to Start-Up





Steam Blow – Clean Out Prior to Start-Up





WHR Building

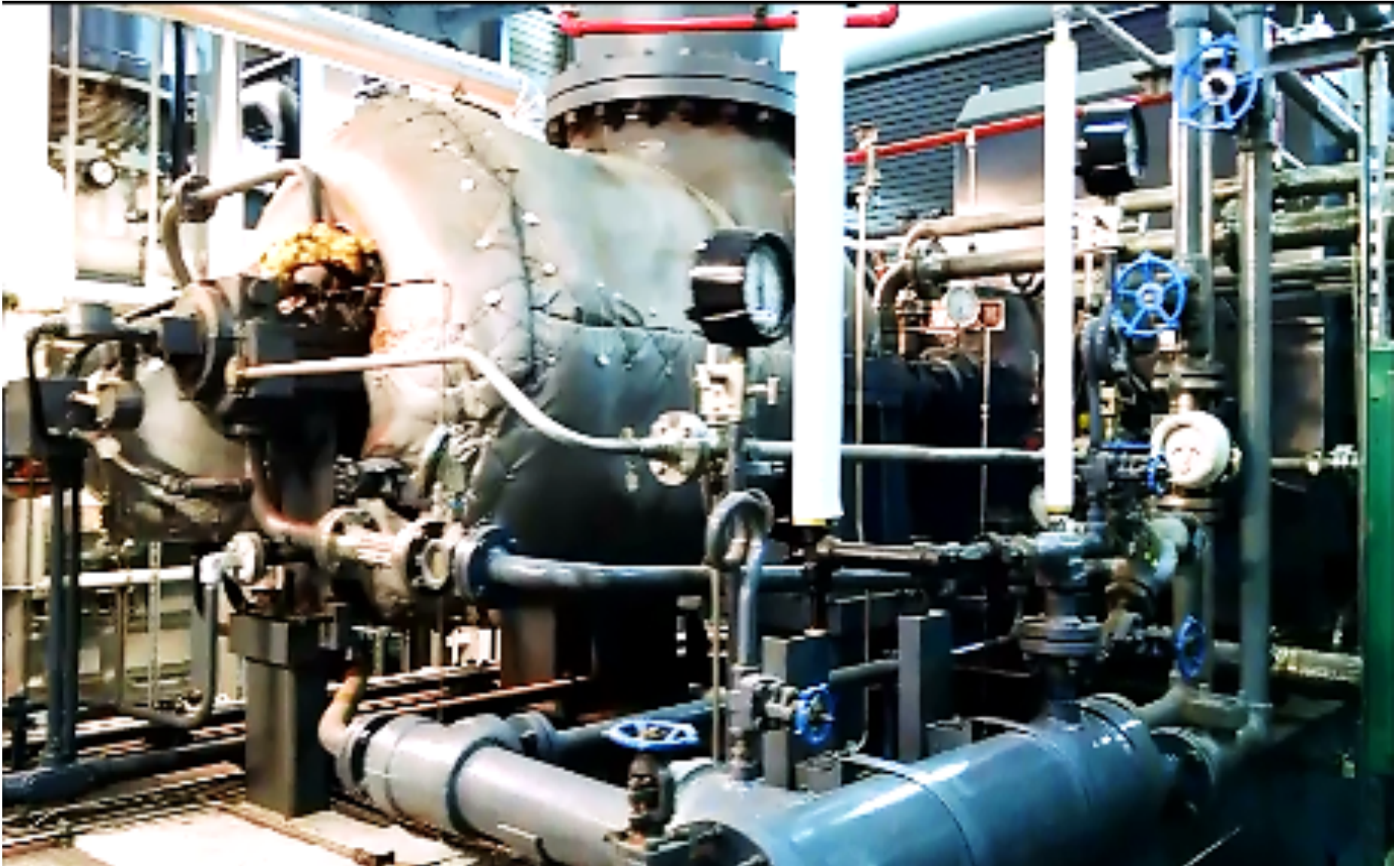




Boilers



Turbine & Generator





Water Treatment

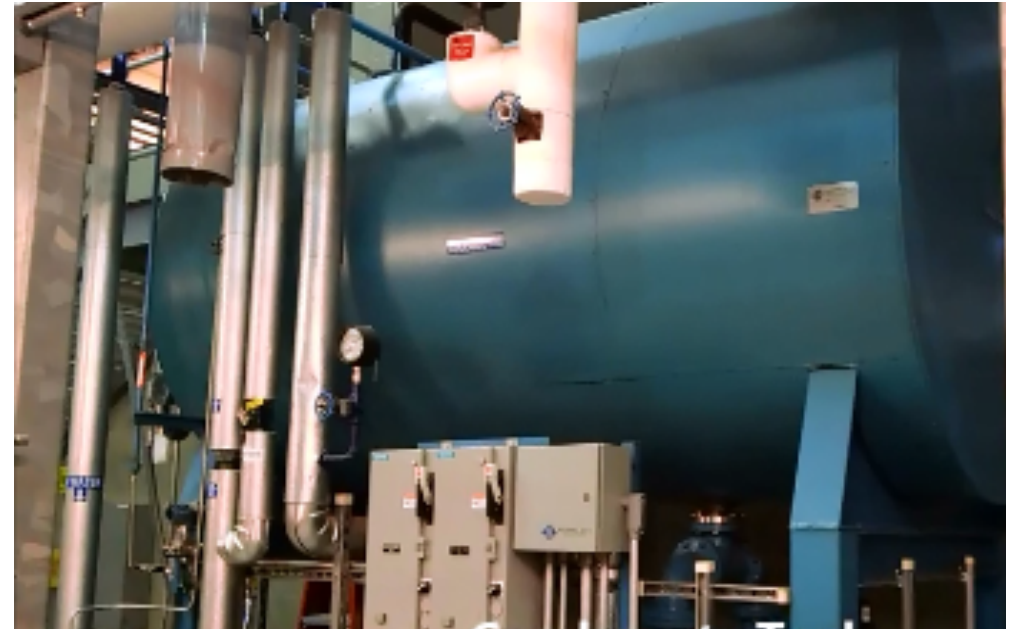




Boiler Water System



Surface Condenser



Condensate Tank



Deaerator



Electrical Room



Control Room





Staff is Ultimate Driver for Success

- 💧 **Ultimately the people involved make it successful**
- 💧 **Many thanks to:**
 - Jeff Bowers, Superintendent
 - Mike Zabilansky, Project Engineer
 - Mike Meany, Construction Inspector
 - Bruce Lundie, HWPCF Shift Supervisor
 - Jose Jurado, HWPCF Crew Leader
 - Gary Dougenik, I&C Tech



Energy Efficiency Initiatives

- 💧 **Making our own power is only part of the success story, using less energy is also critical.**
- 💧 **Energy efficiency initiatives include:**
 - Plant wide power factor improvements to address kVA billing
 - Replace 3,000 Hp blowers with 1,250 Hp units
 - High efficiency pumps, VFDs & controls in all instances of construction (RAS, WAS, centrifuge feed, plant water, etc.
 - Centrifuge controls
 - Influent pumps at new headworks facility
 - Upgrade DO controls for better nitrogen removal (saves \$ on CT DEEP Nitrogen Trading program) and reduced energy
 - Multiple lighting efficiency projects
- 💧 **Make maximum use of Eversource Energy Efficiency rebate program. To date have received nearly \$2M in rebates.**
- 💧 **Looking into Renewable Energy Credits (RECs)**



Questions?

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