NMU Ripley Plant
Biomass Unit
Beginnings

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Heating the Midwest
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Ripley Combined Heat and Power Renewable Energy Plant
Pre Biomass Unit Plant

- 3 gas-fired steam units with fuel oil back-up
- each unit up to 70,000 lb steam/hr, 85 psi output
- each unit water-tube boiler
- Unit 2 built in 1965, Units 3 and 4 built in 2006

New Biomass Unit

- 1 woodchip-fired steam unit
- 42,000 lb steam/hr, 405 psi output
- firebox and hybrid boiler (water-tube and fire-tube)
- Commissioned August 2013
- 735 kW steam turbine/generator set
Projected Steam Load Duration Curve

HEATING LOAD DURATION CURVE
Biomass Plant Expansion

- **EXISTING SYSTEM LOAD**
- **BIOMASS LOAD**
- **FOSSIL FUEL LOAD**
42,000 pph Biomass Boiler

- Technology
  - 42,000 pph stoker boiler with ESP for particulate control
  - Double cyclone filter and air preheater
  - Economizer
  - 735 kW backpressure steam turbine generator

- Performance
  - Displaces up to 88% of steam generation for NMU
  - Natural gas supplement for peaking duty (not dual firing)
  - Displaces up to 15%* of electricity generation

- Operations
  - Energy engineer shared between plant and campus (3 years)
  - Truck-based preventive maintenance (3 years)
  - Operator training and sharing of best practices
General Arrangement
Fire Box and Boiler
Hybrid Boiler
water tube/fire tube interface
fire tube section endplate
Balancing act, more complicated with

1) solid fuel with variable heat content
2) turbine/generator set
First Year Tweaks
FUEL STREAM

1. Knee wall
2. Fuel supply
3. Conveyor fill indicator
4. Knife edge feeders
FIRE BOX/BOILER

1. Bottom ash scrapers trim
2. Flyash reinjection bypass
3. Boiler tuning for different fuels
4. Replace steam valves and flow meters for lower pressure drop
ASH COLLECTION/HANDLING

1. Better cooling for ESP transformer
2. Revised flyash conveyors
3. Ash dumpster gasket improvement and ratchet addition to doors
TURBINE

1. Expansion joint replacement
2. Correct bore size to prevent water in oil
3. Add oil breathers
4. Install permanent drain piping
OPERATIONS

1. Add 8\textsuperscript{th} operator
2. Shift operator task on campus to other staff
STAYED TUNED...

1. Specified fuel storage capacity and more
2. Fuel scrapers hydraulic pump isolation
3. Fuel supply (quality, price, delivery)
4. Bottom ash isolation
5. Overs chipper
6. Even up ash loading of dumpsters
7. Ash cooling (good news/bad news)
Questions?