



NMU Ripley Plant Biomass Unit Beginnings

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Heating the Midwest
Conference 2014

Ripley Combined Heat and Power Renewable Energy Plant



Pre Biomass Unit Plant

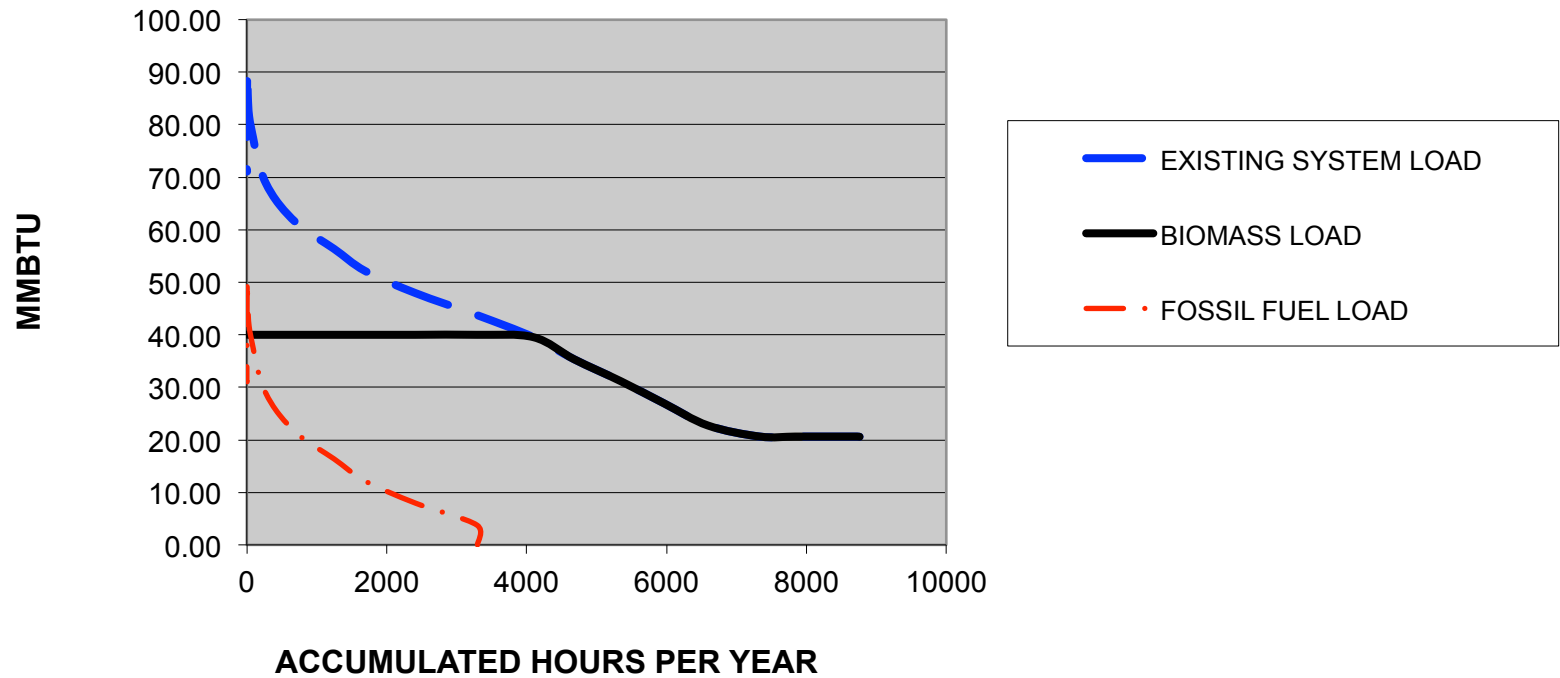
- **3 gas-fired steam units with fuel oil back-up**
- **each unit up to 70,000 lb steam/hr, 85 psi output**
- **each unit water-tube boiler**
- **Unit 2 built in 1965, Units 3 and 4 built in 2006**

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

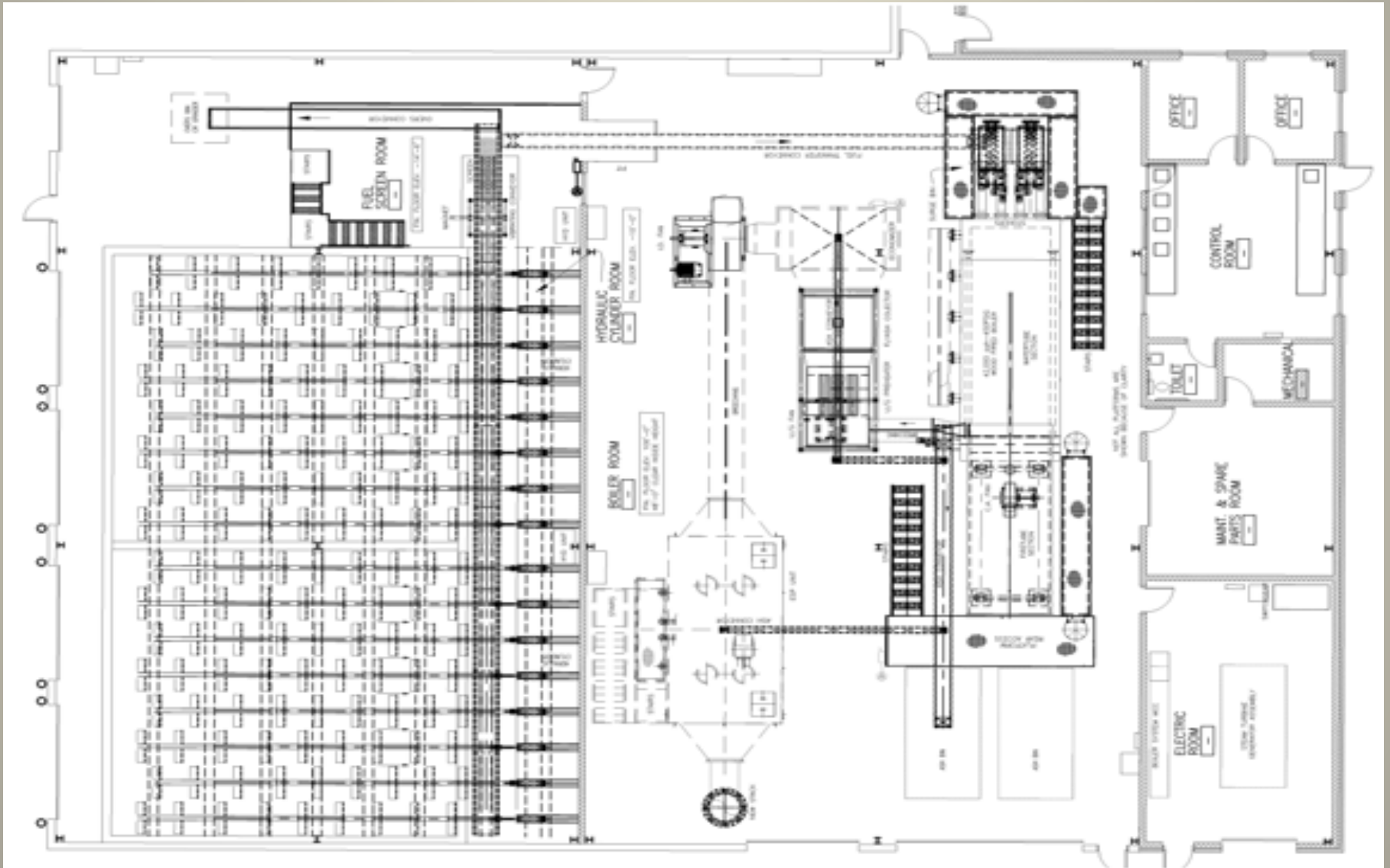
HEATING LOAD DURATION CURVE
Biomass Plant Expansion



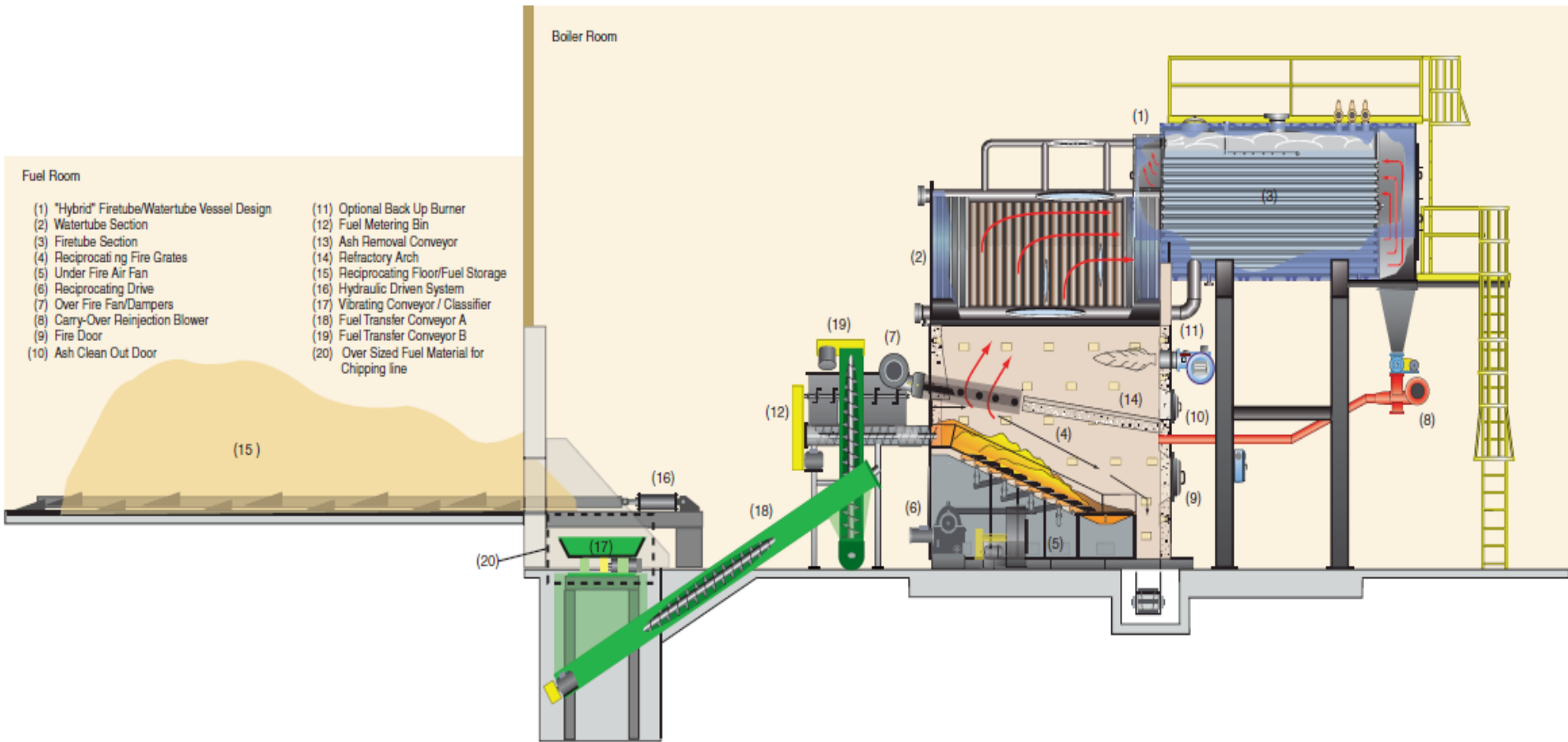
42,000 pph Biomass Boiler

- 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



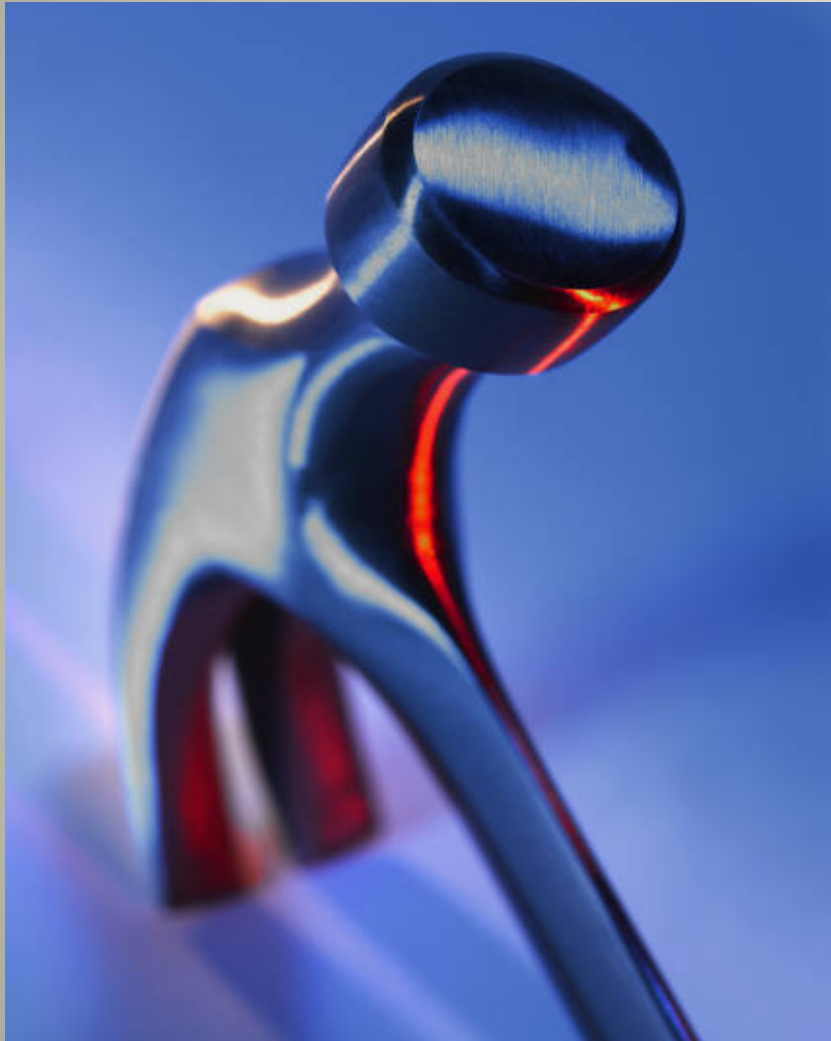
fire tube section endplate





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



FUEL PIT KNEE WALL



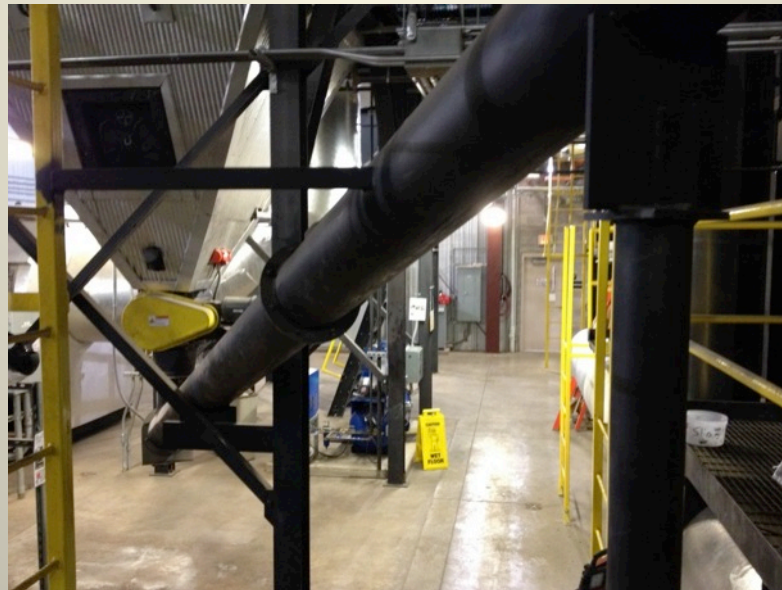
VIBRATING CONVEYOR LEVEL PADDLE



KNIFE EDGE FEEDER

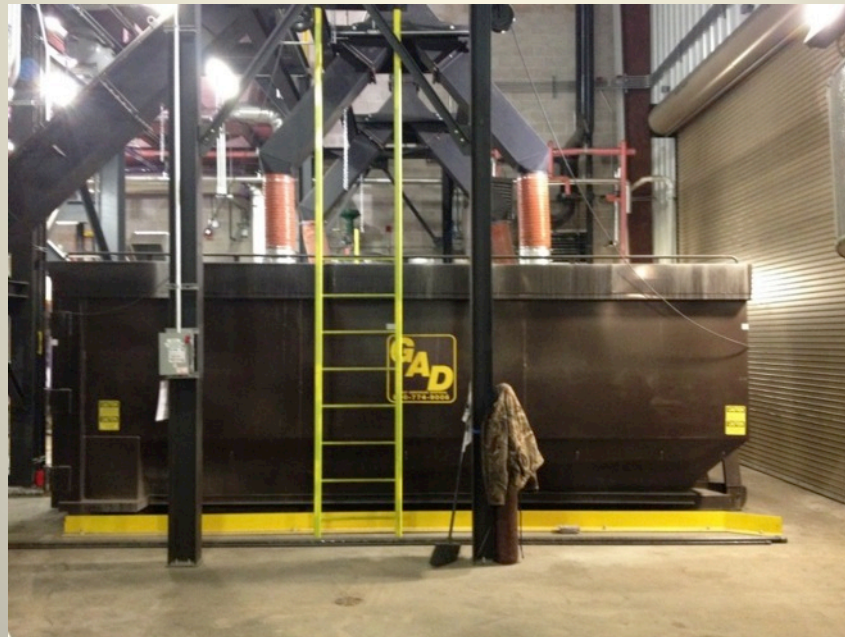
FIRE BOX/BOILER

- 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

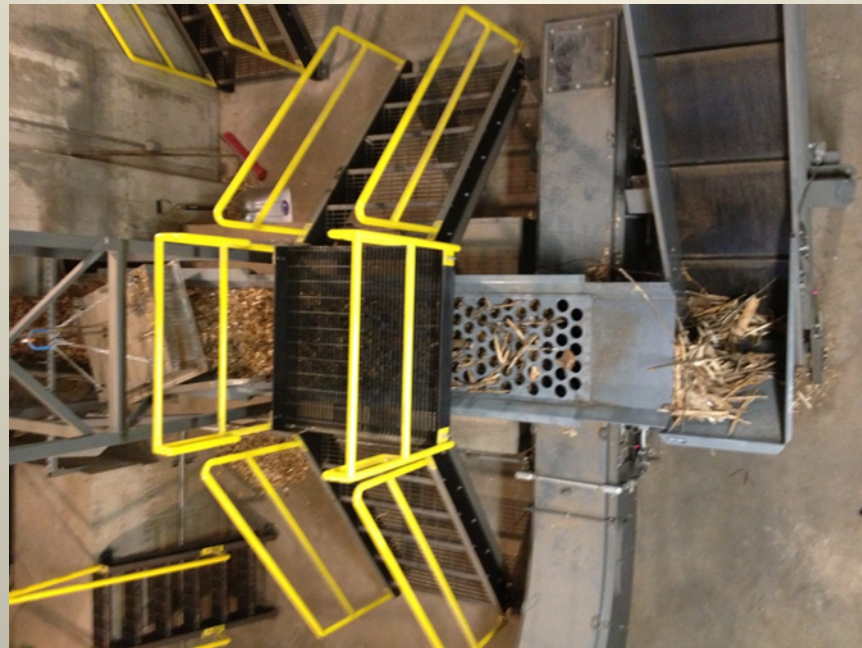


OPERATIONS

1. Add 8th 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?

