

Grand Haven Board of Light and Power

A photograph of the J.B. Sims Generating Station, a large industrial facility. The main building is white with green accents and has "MUNICIPAL POWER" written on its side. A tall, grey smokestack rises from the facility. In the foreground, there is a large pile of dark material, likely coal, and a red conveyor belt structure. The sky is clear and blue.

Condition Assessment for J.B. Sims Generating Station
February 14, 2018

Condition Assessment

- Started July 2017.
- Purpose:
 - Assess the overall condition of J.B. Sims Generating Station to maintain overall reliability of system performance.
- Targets:
 - Assess plant condition.
 - Develop long range capital plan to manage life cycle costs for future reliability.
 - Identify areas for improvements to heat rate performance.
 - Reduce unburned carbon.
 - Develop succession plan for plant staff turnover.

Condition Assessment Team

Erik Booth – Power Supply Manager

- Shiras Steam Plant, MBLP
 - 12 years
- Utility & Resource Planning, MBLP
 - 5 years
- State of Michigan, Licensed Professional Engineer
 - 12 years
- U.S. Army, Field Artillery

Allen Schalk – Electrical Supervisor

- J.B. Sims Generating Stations, GHBLP
 - 17 years
- Campbell Plant, Consumers Power
 - 6 years
- State of Michigan Licensed Electrician
 - 30 years
- U.S. Navy, Electrician.

Mike Kellogg – Operations Supervisor

- J.B. Sims Generating Station, GHBLP
 - 25 years
- Maintenance Supervisor
 - 5 years
- Lead Shift Operator
 - 8 years
- Plant Utility
 - 9 years
- U.S. Navy, Boiler Technician.

Adam McConnell – Maintenance Supervisor

- J.B. Sims Generating Station, GHBLP
 - 10 years
- Master Mechanic
 - 18 years
- U.S. Coast Guard, Chief Warrant Officer-Boatswain (Retired)

Resource Planning

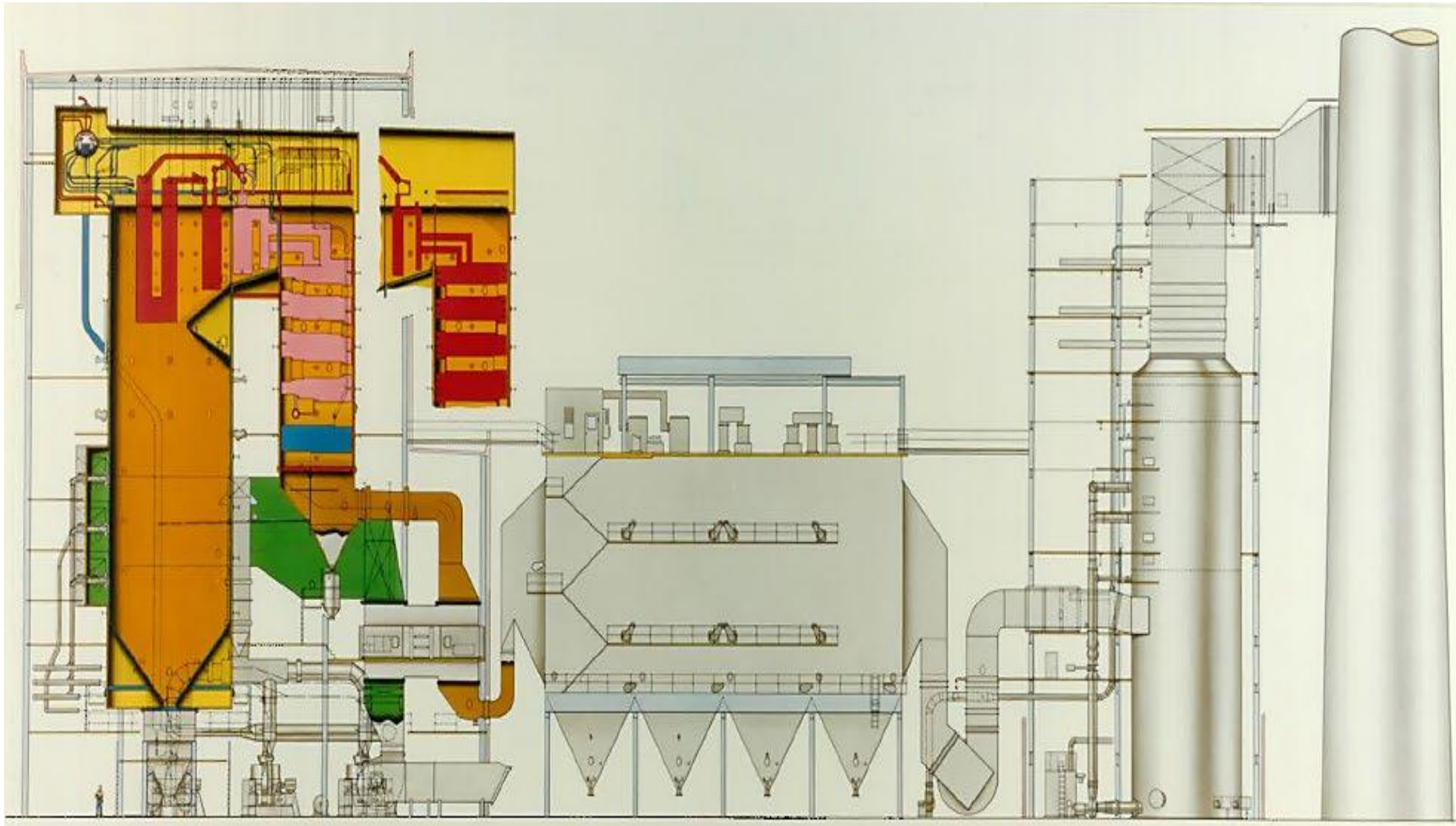
2012: Integrated Resource Plan (IRP)

- Study was conducted when Unit 3 was 29 years old.
- Expect long-term capital expenditures for boiler repairs and component replacements as Unit 3 reaches 35 to 40 operating years.
- Based on information available in 2011, capital investments were estimated to be a minimum of \$4 million in 2019.
- Capital investment could be higher than estimated. Report recommended additional analysis on high pressure steam systems and thickness testing on vessels to obtain a more accurate estimation.
- Conclusion was that the Present Value of Revenue Requirements (PVRR) will be less over the 20 year period if Sims is retired at the end of the useful life rather than extending the life of the plant.
- The Board followed up with a Natural Gas Generation Siting Study in 2014.
- No action was needed or required by the Board at the conclusion of the IRP but a decision will need to be made prior to 2019.

2018: Update

- Unit 3 is now 35 years old.
- Data gathered since the 2012 IRP has confirmed that the plant will need life extension investments for continued safe and reliable operation.
- Analysis gathered since the 2012 IRP has identified that the capital investments necessary are significantly over the projections made in the IRP.
- Systems evaluated since 2012 IRP include: Boiler, Air Pollution Control Systems, Electrical, and Balance of Plant Auxiliaries.
- Current power supply options available confirm that the PVRR will be less over the 20 year period if Unit 3 is retired at the end of the useful life.
- A decision needs to be made on Unit 3 so that a future power supply portfolio can be developed.

Condition Assessment of Sims Unit 3



Boiler: Life Extension

Thickness testing needs to be performed on steam drum.

Platen Primary Superheater bank has reached the end of useful life. Testing results in areas identified that some tubes are 50% of original design. B&W recommends replacing tubes that are 85% of required minimum wall thickness (0.325").

Front Water Wall: Boiler tubes are showing signs of wear and require non-destructive evaluation (NDE).

North and South Water Wall: Boiler tubes are showing signs of wear and need NDE.

Low NOx burners are cracked and have reached the end of their useful life.

Coal piping to burners are recommended for replacement.

C Pulverizer needs rebuild. A & B pulverizers have already failed and been rebuilt.

Expansion joints identified as needing replacement.

Top section of Reheat bank has been identified as needing replacement.

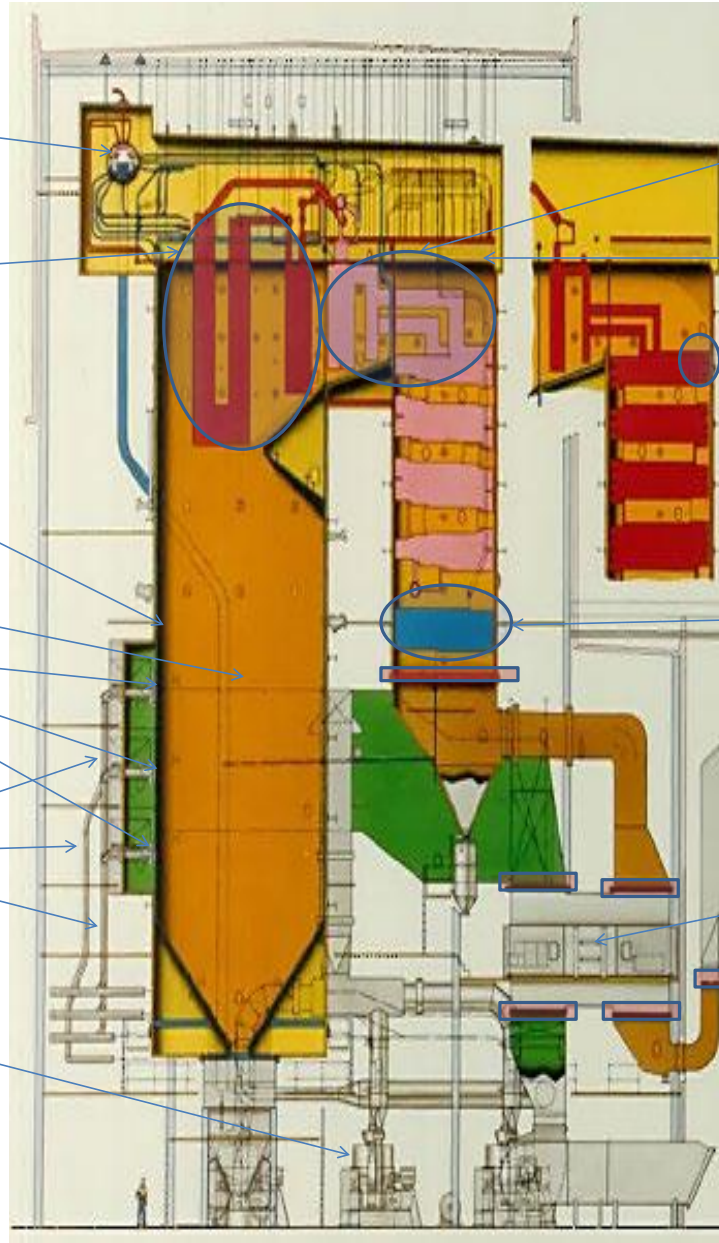
Previous boiler inspections have identified that roof seals have exceeded their useful life and will require replacement.

Flue gas path erosion on Secondary Superheat bank has been identified. May require action in the future.

Economizer has experienced significant corrosion and erosion of outside diameter surface. Additional NDE is needed to determine life span.

Hot end baskets and seals (lifting device controls) need replacement on air heater.

Note: **Safety Alert Warning** was issued by Babcock and Wilcox in October 2017 indicating graphitization of carbon-molybdenum steels for materials SA 209 and SA335 P1. These grade steels are contained in Sims Unit 3 superheater tubes, headers, and connections. Also contained in reheat tubes. Consulting with Babcock and Wilcox (OEM) on actions that should be taken.



Boiler Auxiliaries

Mechanical

- Primary Air Fans need rebuild.
- Coal bunker vessels need testing to determine structural stability.
- Coal feeders to pulverizer tubes are deformed and need replacing.
- Feedwater heater elements should be removed and inspected.
- Boiler feedpump Automatic Recirculation Control Valves (ARC) need replacement (2).
- Steam drum electronic relief valve (ERV) and controller (obsolete and requires replacement).
- Underground piping is failing on multiple systems (steam line, aux cooling, fire water, service water, high pressure ash system, City water line).

Electrical

- Test reports have identified that the six motor control centers require replacement.
- Boiler alarm system is obsolete and requires replacement.
- Burner management system is obsolete and requires replacement.
- Boiler controls are obsolete and require replacement.
- Protection relays have been recommended for replacement.
- Power supply to air quality controls and intake structure failing in areas.

Air Emission Equipment: Life Extension

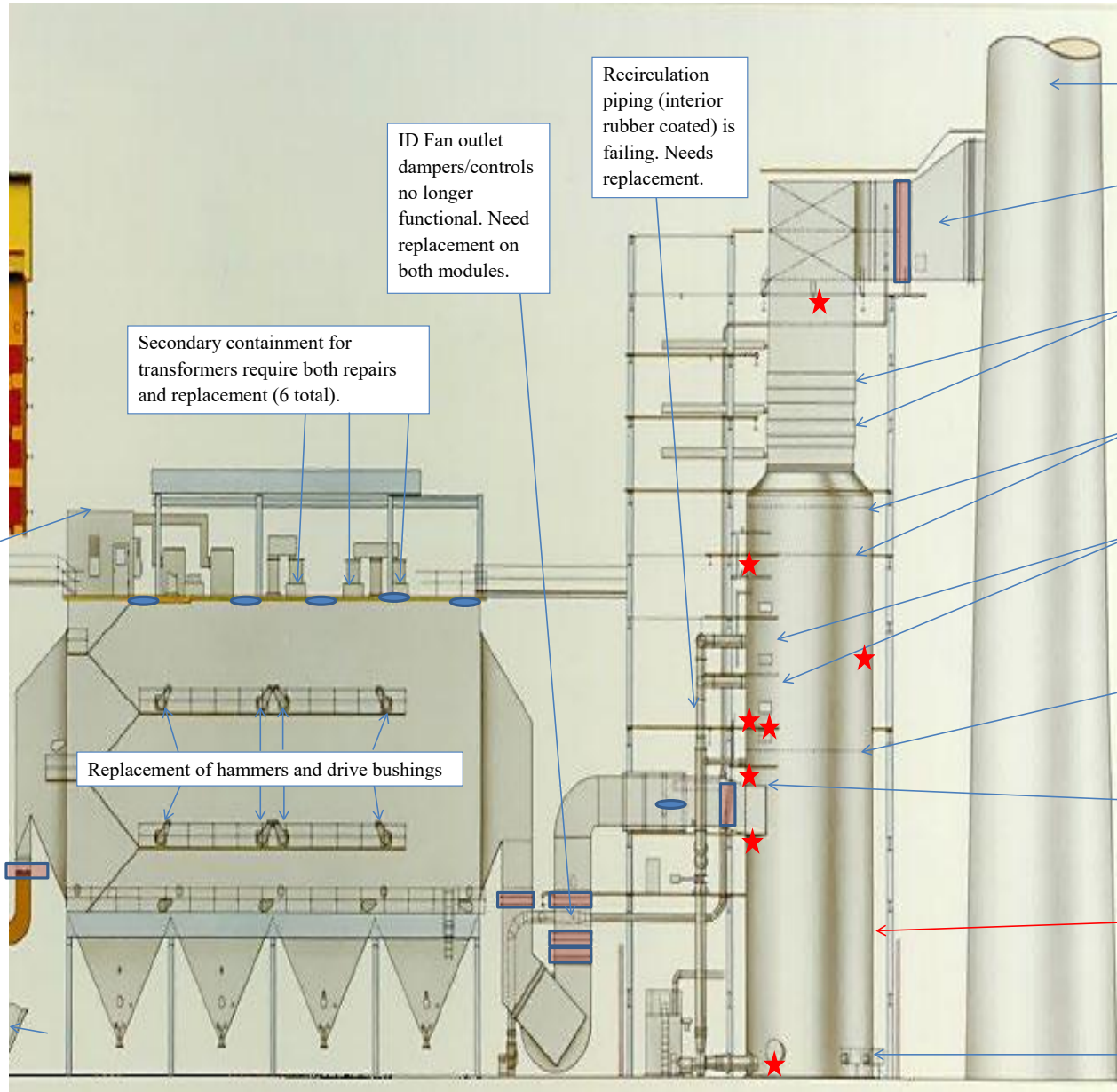
AQCS Auxiliary Equipment not shown:

- Thickner suction line to pumps needs replacement.
- Relining thickner tank.
- River water pump need replacement.
- Lime dust collectors need replaced.
- Vacuum filter vats need replacement.
- Replacement of hydrover to mechanical exhauster.

Voltage controls are obsolete and no longer supported. Controls need upgrading.

Manway access portals that need replacement for continued access (leaking and corroded).

Expansion joints identified as needing replacement.



ID Fan outlet dampers/controls no longer functional. Need replacement on both modules.

Recirculation piping (interior rubber coated) is failing. Needs replacement.

Secondary containment for transformers require both repairs and replacement (6 total).

Replacement of hammers and drive bushings

No known issues with chimney however stack inspection is scheduled for fall 2018.

Exhaust gas ductwork rotted on both modules and needs replacement.

Reheat sections on both modules past useful life. Replacement needed for continued snow melt.

Chevron primary and secondary moisture separators past useful life (damaged) on both modules. Requires replacement.

Quench spray header on module A past useful life (damaged). Requires replacement.

Absorption trays past useful life on both modules (damaged). Requires replacement.

Awning on module B requires replacement.

Both module vessels have failed in multiple locations (see red stars). Unknown as to extent of available life but at minimum modules need to be relined.

Mixers on A module have reached end of useful life. Requires replacement.

Turbine: Life Extension

Specification
Type: Tandem Compound 2-Casing Double-Flow
Exhaust, Reheat, Condensing Type
Rated Output 65000 kW
Turbine Inlet Steam Pressure 1465 Psia
Turbine Inlet Steam Temperature 1000° F
Reheat Steam Temperature 1000° F
Turbine Exhaust Pressure 2.5 in Hg abs
Rated Speed 3600 rpm

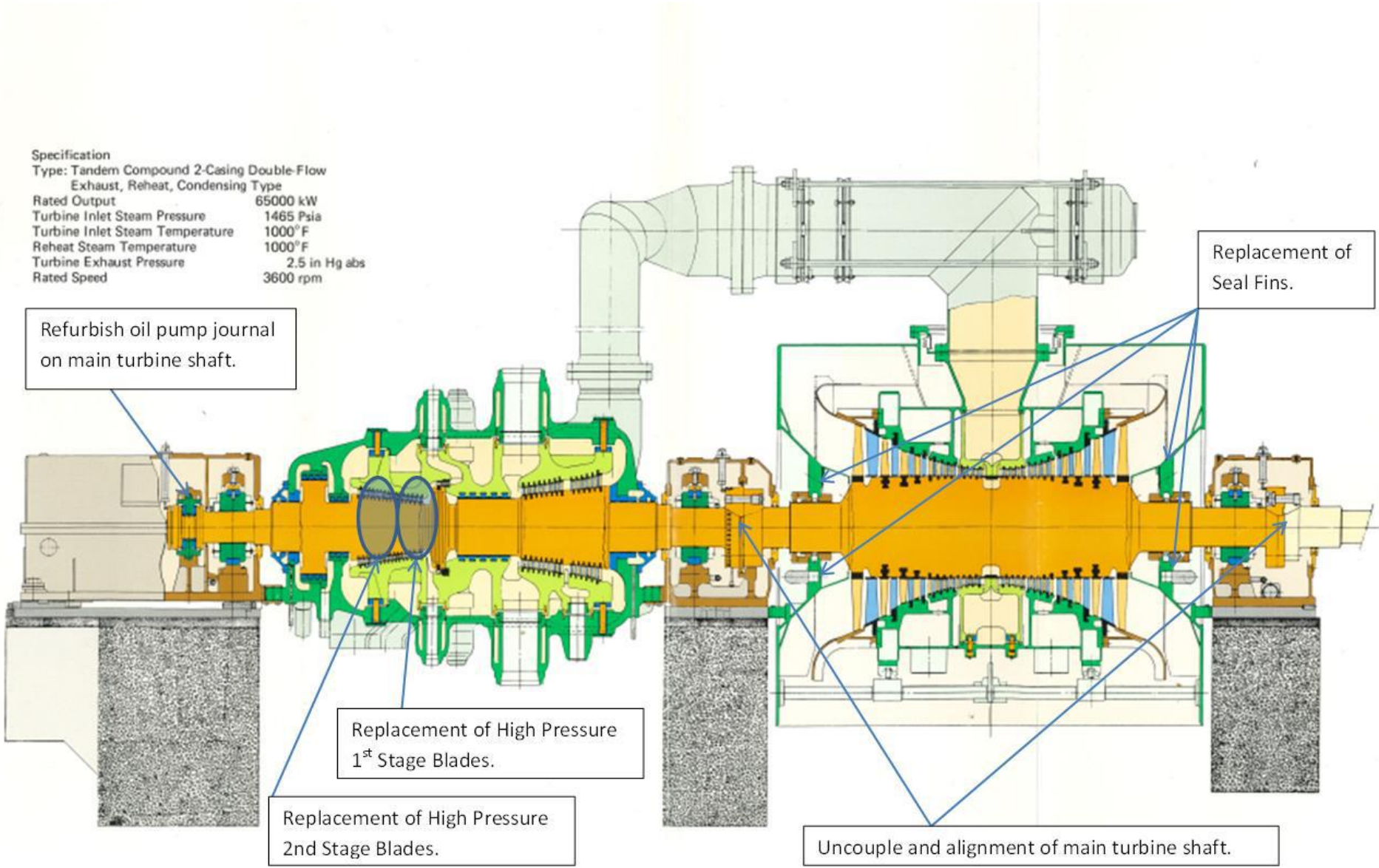
Refurbish oil pump journal
on main turbine shaft.

Replacement of High Pressure
1st Stage Blades.

Replacement of High Pressure
2nd Stage Blades.

Replacement of
Seal Fins.

Uncouple and alignment of main turbine shaft.



Capital Life Extension Investments

System	5 Year Planning
Turbine	\$1,239,600
Boiler	\$1,966,400
Air Pollution Control Equipment	\$6,525,000
Electrical	\$3,851,415
Auxiliary Equipment	\$1,250,000
Environmental	\$750,000
<i>Total</i>	<i>\$15,582,415</i>

Important to note that numbers above are only for capital life extension projects that have been identified through reports or analysis as being required and either quotes or reasonable budget projections are available. Numbers do not include increased operations and maintenance costs.

How big is the Scrubber Vessel Issue?



T.E.S Filer City
Manistee, MI
Scrubber Vessel Failure
(2002)

- Both vessels partially collapsed.
- Failure could have damaged surrounding structures
 - (boiler house, chimney, lime silo, fly ash silos, lime slurry tank).
- Resulted in significant amount of downtime.

Sims – Flue Gas Scrubber

Largest Unknown in Condition Assessment



- 2012 IRP indicated that Sims vessel integrity should be evaluated.
- Cost of Flue Gas Scrubbers in 1984: \$8.1 million (equivalent to \$19.1 million in 2017).
- Problem with repairs is that vessels were erected first and housing was built around them making it difficult to make large scale repairs.

Recommendation:

Adjust operating schedule and minimize investments for retirement of Unit 3 by June 2020.

- Consistent with Board approved Key Policy Statements dated: 10/31/2014 and 8/27/2015.
- Following Board approved Strategic Plan to create a diversified power supply portfolio.
- Consistent with the projections of the 2012 Integrated Resource Plan.
- Known capital investments for life extension have exceeded benefit of future service life.
- Other power supply options exist that would lower the present value of revenue requirements which will allow the BLP to be more competitive in the future against other utilities that are increasing their rates.
- Use what would have been spent on Unit 3 capital projects and take savings in annual energy costs to build a diversified power supply portfolio. One component in the portfolio may include construction of a new peaking power facility which was suggested in 2012 IRP (likely to be located on Harbor Island).
- Utilize the upcoming 35% workforce turnover in the utility over the next 5-7 years to allow for a natural reduction in workforce instead of termination of employees.
- Bottom Line: The Board of Light and Power has to be competitive to keep our customers in the future. Otherwise, we risk losing them.

Conclusion

Moving Forward

- Work with MPPA to adjust run schedule over the next 2 ½ years, limit future coal purchases, and evaluate bilateral agreements during increased downtimes.
- Convert coal inventory back to cash.
- Avoid the 2020 turbine overhaul.
- Avoid any further retubing sections of the boiler.
- Avoid rebuilding scrubber vessels.
- Avoid upgrading obsolete boiler & scrubber controls.

Justification

- Known capital improvement program is greater than 37% the cost of building a new peaking power plant.
- Annual cost of continued Sims operation is significantly higher than both the cost to purchase power from the grid with transmission and annual cost of operating a natural gas peaking facility.
- Energy and Capacity market prices are very attractive. Take this opportunity and use them to get ahead of the curve.