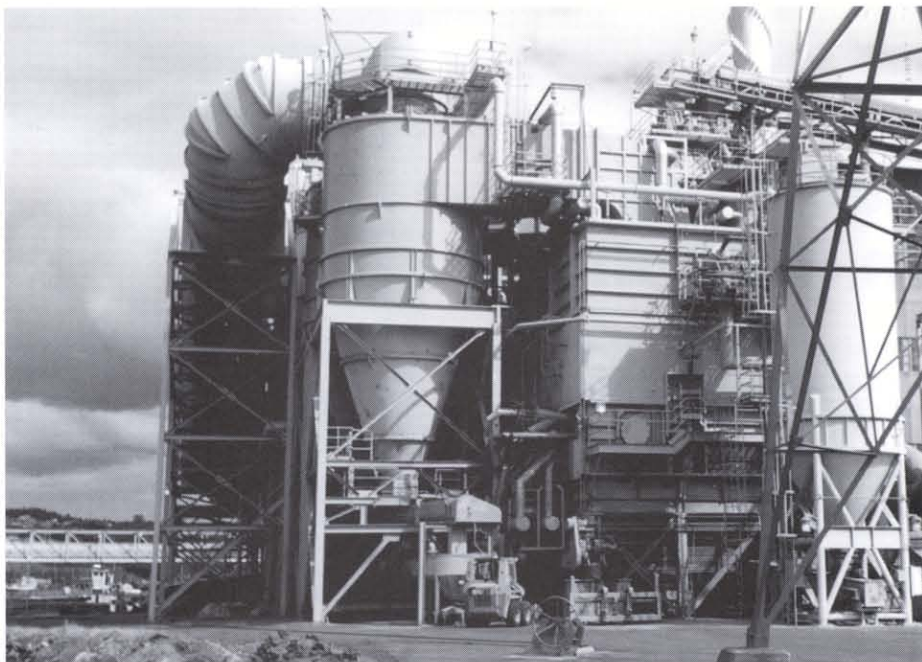


Tacoma Public Utilities Power up Fluidized Bed Combustor



Tacoma Power Utilities No. 2 combustor and associated equipment.

In the fall of 1993, JANSEN evaluated the performance of two fluidized bed combustors and heat recovery units operated by Tacoma Public Utilities.

The two units were designed to burn a combination of wood waste, coal, and refuse-derived fuel (RDF). The design combined steam flow was 528,000 lb/hr, producing 50 MW from two turbine generators. Historically, the plant was never able to achieve these levels, on average, only 170,000 lb/hr steam flow and 16

MW power generation resulted from each unit.

The performance evaluation confirmed that the heat transfer surface area throughout the unit was inadequate to generate the design steam flow while staying within fluidized bed and flue gas temperature limits.

In order to reach the design steam flow, JANSEN determined that additional heat transfer would be required in the fluid bed, the combustor vapor space, superheater, and economizer.

A less expensive alternative was developed that would increase the heat transfer surface in the bed and achieve a steam flow rate 210,000 lb/hr from the No. 2 unit. This design was installed in the summer of 1995. The table below summarizes operating data from before and after the pressure part modifications were made.

Besides the ability to generate 20% to 30% more steam and electrical power, the unit has shown great improvements in thermal and electrical efficiency.

Combustor No. 2 Operating Data Before and After Upgrade to the In-Bed Heat Transfer Surface

| Data | Units | Before Upgrade (11/15/93) | After Upgrade (7/26/95) |
|------------------------------------|-----------|------------------------------|----------------------------|
| Steam Flow | lb/hr | 156,000 | 202,000 |
| Power Generation | MW | 13 | 16 |
| Stack Oxygen | % (dry) | 9.1 | 6.7 |
| Fluid Bed Temperature | °F | 1474 | 1450 |
| Vapor Space Temperature | °F | 1595 | 1694 |
| Superheater Inlet Temperature | °F | 1503 | 1631 |
| Superheater Outlet Temperature | °F | 1128 | 1282 |
| Generating Bank Outlet Temperature | °F | 756 | 878 |
| Economizer Outlet Temperature | °F | 359 | 430 |
| CO | ppm (dry) | 18 | 0.6 |
| NO _x | ppm (dry) | 118 | 115 |
| SO ₂ | ppm (dry) | - | 33 |
| Fluid Bed Pressure Drop | in. wg | 32 | 32 |