PROJECT CAPABILITIES

BOILER CONVERSION TO BIOMASS BURNING

Scope of Service

Boiler owner/operators in recent years have been motivated to convert existing fossil fuel-fired boilers to burn some, or exclusively biomass fuels. Biomass fuels often provide lower fuel costs and lower flue gas emissions as well as being considered a “green” renewable resource. Whether the boiler currently burns exclusively fossil fuels or burns a combination of fossil and biomass fuels, JANSEN has the experience and capabilities to provide the necessary services to enhance biomass firing in most all boiler configurations.

A recommended phased approach to fuel conversion projects is listed below:

- Initial assessment of feasibility and required modifications to generate early budgetary costs.
- Engineering evaluation of existing boiler to determine the unit’s capabilities when operating with the new fuel (pressure parts, auxiliary and air pollution control equipment).
- Definition engineering to develop +/- 10% accuracy cost estimate.
- Engineering design, fabrication, and materials supply.
- Installation.
- Operator training and start-up assistance.

JANSEN has the capability and experience to carry out any or all of these steps.

Selected References (see next page)
Selected References

AES Corporation - Lufkin, TX
EPCOR Canada - Squamish, BC
Escanaba Green Energy - Escanaba, MI
Great River Energy - Elk River, MN
Hu Honua Bioenergy LLC - Hilo, HI
Minnesota Power - Duluth, MN
New Ulm Public Utility - New Ulm, MN
Packaging Corporation of America - Valdosta, GA
ReEnergy Holdings - Fort Drum, NY
Sonoco Products Co. - Hartsville, SC
Springs Global US, Inc. - Lancaster, SC
Turbine Diagnostics Services, Inc. - Forest City, NC
Weyerhaeuser Paper Company - New Bern, NC
Capacity, Operational Performance, Fuel Economy, and Emissions

Fuel economy, maximum availability, steam generating capacity, optimized emissions performance, and operating flexibility at the lowest cost are the key goals of biomass-fueled power boiler operation. JANSEN has conducted engineering evaluations for more than 200 biomass-fired boilers. We have assisted numerous mills with implementing operational and hardware changes to improve the performance and thermal efficiency, minimize fossil fuel co-firing, reduce landfill costs, and reduce air pollution emissions from their biomass boiler operations.

Scope of Services

- Waste fuels combustion problem solving (waste wood, bagasse, agro-waste, TDF, NCG, sludge, etc.).
- Improved performance and steam generating capacity from biomass.
- Application of advanced combustion technology.
- Reduced CO, VOC, NOₓ, SO₂, and particulate emissions.
- Computational Fluid Dynamics (CFD) modeling and analysis.
- Measurement and analysis of boiler circulation.
- Incineration of concentrated and dilute non-condensable gases (CNCG & DNCG), and sludges.
- Boiler MACT Compliance Review.

Selected References (see next page)
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**Selected References**
Many biomass fuel-fired boilers experience challenges that prevent higher biomass (i.e., wood and agricultural waste and/or sludge) fuel burning rates at significant lower operating cost. For example, the unit may experience high CO and VOC emissions and excessive carryover of fly ash, and/or may experience combustion instabilities with the need for continuous co-firing of auxiliary fossil fuel to sustain combustion.

All these problems are symptoms of poor combustion that is caused by ineffective overfire air (OFA) delivery. JANSEN’s modern, sidewall, high capacity OFA system has proven that these problems can be solved. Our sidewall OFA system creates a zone of turbulent mixing across the full furnace cross section in which fines and volatiles are rapidly burned.

A limited number of relatively large OFA nozzles are used. Because the patented JANSEN air nozzles have very low internal pressure losses, our OFA system can typically be installed without the need for new or modified forced draft (FD) fan(s). Installation time is during a five day outage.

Operational benefits (and associated economic and environmental impact) that are normally achieved are:

- Reduced reliance on auxiliary fuel to maintain combustion (lower auxiliary fuel cost).
- Ability to burn additional biomass fuel (lower auxiliary fuel cost).
- Reduced carryover of fly ash (lower landfill cost).
- Reduced carbon content in fly ash (improved thermal efficiency).
- Reduced excess air usage (improved thermal efficiency).
- Reduced CO, NOx, and VOC emissions (higher efficiency and improved emissions compliance).
- Reduced flue gas temperature into the superheater (less erosion/tube wastage).
- Improved combustion stability and reduced furnace puffing (this may be a safety issue).
- Efficient incineration of HVLC NCG.
- Boiler MACT Compliance.

Selected References (see next page)
### Selected References

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Purpose

All recovery boilers are designed individually and operated differently. In order to determine the feasibility of modernizing existing units for increased capacity, improved efficiency, extended service life, reduction in emissions of air pollutants, or other specific purposes, detailed knowledge is required about their specific arrangement and operational limitations. The performance evaluation, which includes a boiler field test, determines baseline conditions and provides a prediction of the expected results of an upgrade. JANSEN has carried out performance evaluations for more than 100 kraft recovery boilers, many of which have led to actual upgrades.

Scope of Services

The JANSEN performance and engineering evaluation is adapted to local conditions and the specific requirements of each assignment, and will normally include the following scope of services:

- Field test to collect current data and establish present performance and baseline conditions.
- Performance calculations under test conditions and projected future operation.
- Engineering evaluation of critical design and operating parameters affecting the proposed changes.
- Computational Fluid Dynamics (CFD) modeling and analysis.
- Steam/water circulation study.
- Determination of necessary boiler modifications to accomplish the desired objective.
- Budget cost and project time schedule estimates.

Selected References (see next page)
Selected References

APRIL Group - Rizhao, China (2 units)
Alabama River & Pine Pulp Companies - Perdue Hill, AL
AssiDomän Sepap, Štetí - Czech Republic
Bahia Specialty Cellulose S.A. - Camaçari, BA, Brazil
Blue Ridge Paper - Canton, NC
Boise Cascade Canada Ltd. - Fort Frances, ON
Boise Cascade Corporation - DeRidder, LA
Boise Cascade Corporation - International Falls, MN
Boise Cascade Corporation - Jackson, AL
Boise Cascade Corporation - Rumford, ME
Boise Cascade Corporation - Wallula, WA
Boise Paper - St. Helens, OR (2 units)
Bowater Carolina - Catawba, SC
Bukocel - Hencovce, Slovakia
Cariboo Pulp & Paper - Quesnel, BC
Carter Holt Harvey Pulp & Paper Ltd. - Tokoroa, NZ
Cascade Pacific Pulp - Halsey, OR
Champion International Corporation - Quinnesec, MI
Champion International Corporation - Roanoke Rapids, NC
Champion Papel e Celulose Ltda. - Mogi Guaçu, S.P., Brazil
Clearwater Paper - McGehee, AR
Domtar Inc. - Lebel-sur-Quevillon, PQ
Domtar Papers - Cornwall, ON
E.B. Eddy Forest Products Ltd. - Espanola, ON
Eurocan Pulp & Paper Company - Kitimat, BC
Federal Paper Board Company, Inc. - Riegelwood, NC
Fletcher Challenge Canada Ltd. - Mackenzie, BC
Georgia-Pacific Cellulose - Crossett, AR
Georgia-Pacific Cellulose - New Augusta, MS
Georgia-Pacific Corporation - Ashdown, AR
Georgia-Pacific Corporation - Big Island, VA
Georgia-Pacific Corporation - Brunswick, GA
Georgia-Pacific Corporation - Camas, WA (2 units)
Georgia-Pacific Corporation - Cedar Springs, GA
Georgia-Pacific Corporation - Clatskanie, OR
Georgia-Pacific Corporation - Monticello, MS
Georgia-Pacific Corporation - Palatka, FL
Georgia-Pacific Corporation - Zachary, LA (2 units)
Graphic Packaging Inc. - West Monroe, LA
Gulf States Paper Corporation - Demopolis, AL
Howe Sound Pulp - Port Mellon, BC
Inland Paperboard and Packaging - Orange, TX
International Paper Company - Mansfield, LA (2 units)
International Paper Company - Pine Hill, AL
International Paper Company - Riegelwood, NC
International Paper Company - Svetogorsk, Russia (2 units)
Irving Pulp & Paper, Limited - Saint John, NB
Kimberly-Clark Corporation - Coosa Pines, AL
Kimberly-Clark Corporation - Terrace Bay, ON
Koch Cellulose - Brunswick, GA
Kruger Wayagamack Inc. - Trois Rivieres, PQ
Longview Fibre - Longview, WA
Mackenzie Pulp - Mackenzie, BC
MacMillan Bloedel Limited - Port Alberni, BC
Mead Corporation - Chillicothe, OH
Mead Corporation - Escanaba, MI
Mead Corporation - Kingsport, TN
MeadWestvaco - Covington, VA (2 units)
NewPage Corporation - Rumford, ME
NewPage Corporation - Wickliffe, KY
NewPage Corporation - Wisconsin Rapids, WI
Northern Pulp - New Glasgow, NS
Northwood Pulp & Timber Ltd. - Prince George, BC
Packaging Corporation of America - Counce, TN
Packaging Corporation of America - Valdosta, GA
Port Townsend Paper - Port Townsend, WA
Rayonier, Inc. - Jesup, GA (2 units)
Repap Manitoba - The Pas, MB
Rivenwood International - West Monroe, LA
RockTenn - Demopolis, AL
RockTenn - Fernandina Beach, FL (2 units)
RockTenn - Panama City, FL (2 units)
SAPPI Fine Paper North America - Cloquet, MN
SAPPI Fine Paper North America - Muskegon, MI
SAPPI Fine Paper North America - Skowhegan, ME
Scott Maritimes Limited - New Glasgow, NS
SCP - Ružomberok, Slovakia
Simpson Paper Company - Eureka, CA
Simpson Paper Company - Pasadena, TX
Skeena Cellulose, Inc. - Prince Rupert, BC
Skookumchuck Pulp - Cranbrook, BC
Smurfit-Stone Container Corporation - Brewton, AL
Stone-Consolidated Inc. - Portage du Fort, PQ
Stone Container (Canada) Inc. - New Richmond, PQ
Tasman Pulp and Paper Co. Ltd - Kawerau, NZ
Union Camp Corporation - Eastover, SC
Visy Pulp and Paper - Tumut, Australia
Western Pulp Limited Partnership - Squamish, BC
Western Pulp Limited Partnership - Port Alice, BC
Weyerhaeuser Corporation - Wickliffe, KY
Weyerhaeuser Paper Company - Kamloops, BC
Weyerhaeuser Paper Company - New Bern, NC
Weyerhaeuser Paper Company - Valliant, OK
Woodland Pulp - Baileyville, ME
Increased Capacity

Existing recovery boilers often have a potential for increased throughput, while meeting stringent air emission limitations, provided these units are upgraded with modern air and liquor delivery systems. Using the patented Jansen High Energy Combustion Air Nozzle™, JANSEN has retrofitted over 30 recovery boilers for this purpose. The capacity gains over previous operation have been in the range of 20% to 50% with TRS release well below 5 ppm. Additionally, both boiler pluggage and air emissions have decreased as a result of the improved combustion conditions.

Scope of Services

Typical upgrade engineering services from JANSEN include:

- CFD modeling to optimize design features of the modifications.
- Redesign of the air delivery and distribution system, including multi-level air supply, fans (if needed), ducting, ports, and air nozzles.
- Redesign of the liquor delivery and firing systems, including piping, liquor heaters, gun ports, and liquor nozzles.
- Redesign of boiler pressure parts (JANSEN has ASME S-stamp certification) and auxiliaries for improved operation, reduced pluggage, additional capacity, or other purposes.
- Implementation of DNCG incineration.

Selected References (see next page)
Selected References

Boise Cascade Corporation - International Falls, MN
Bowater Carolina - Catawba, SC
Clearwater Paper - McGehee, AR
Domtar Papers - Cornwall, ON
Fletcher Challenge Canada Ltd. - Mackenzie, BC
Georgia-Pacific Corporation - Big Island, VA (2 units)
Georgia-Pacific Corporation - Camas, WA
Georgia-Pacific Corporation - Clatskanie, OR
Georgia-Pacific Corporation - Monticello, MS (2 units)
Georgia-Pacific Corporation - Palatka, FL (1987)
Georgia-Pacific Corporation - Palatka, FL (2007)
Georgia-Pacific Corporation - Zachary, LA
MacMillan Bloedel Limited - Port Alberni, BC
Mead Paper - Chillicothe, OH
Mead Paper - Escanaba, MI (multiple phases)
NewPage Corporation - Wickliffe, KY
Packaging Corporation of America - Valdosta, GA
Rayonier, Inc. - Jesup, GA (2 units)
SAPPI North America - Skowhegan, ME (partial)
Simpson Tacoma Kraft Company - Tacoma, WA
Skeena Cellulose, Inc. - Prince Rupert, BC
Smurfit Cartón de Colombia - Cali, Colombia (2 units)
Smurfit Mocarpel - San Felipe, Venezuela
Smurfit-Stone Container Corporation - Brewton, AL (2 units)
Weyerhaeuser Paper Company - New Bern, NC
JANSEN uses Computational Fluid Dynamics (CFD) modeling software to analyze fluid flow patterns, fuel combustion processes, fuel capacity, emissions performance, and heat transfer profiles in various boiler-related equipment. The scope of services typically includes boiler data collection, set-up of a model to evaluate current performance, and the use of this model to evaluate conceptual improvements. CFD modeling by JANSEN is conducted in-house by JANSEN engineers.

Applications
Typical areas where JANSEN applies CFD modeling to predict, evaluate, and/or optimize performance of boiler equipment include:

- Modifications to the combustion air delivery system.
- Evaluation of temperature and oxygen distribution in combustion furnaces.
- Optimization of the liquor distribution in recovery boilers.
- Heat transfer analysis in superheaters, generating banks, and economizers.
- Analysis of flow pattern and particulate distribution in inlet ducting to precipitators.
- Evaluation of combustion conditions in waste fuel- and fossil fuel-fired boilers.
- Evaluation of boiler emissions performance (TRS, CO, VOC, SO₂, NOₓ, particulates).
- Spray cooler, scrubber, and cascade/cyclone evaporator performance predictions.
- Evaluation of DNCG and CNCG incineration.

Selected References (see next page)
Selected References

Alabama River Pulp Company - Perdue Hill, AL
Appleton Papers - Roaring Spring, PA
APRIL Group - Rizhao, China
AssiDomän Sepap - Štětí, Czech Republic
Atlantic Power Corp. - Williams Lake, BC
Bahia Specialty Cellulose S.A. - Camaçari, BA, Brazil
Boise Cascade Corp. – Int'l Falls, MN (2 units)
Boise - DeRidder, LA (2 units)
Boise - Wallula, WA
Bukocel - Hencovce, Slovakia
CAIG, S.A., Ingenio Madre Tierra Santa Lucia, COTZ, - Guatemala (2 units)
Capital Power - Southport, VA
Clearwater Paper - Lewiston, ID
Clearwater Paper - McGehee, AR
Confidential Customer - Canada
Corn Products International - Winston-Salem, NC (2 units)
Covanta Energy - Hartford, CT
Daishowa America - Pt. Angeles, WA
Daishowa Marunbeni - Peace River, AB
Dominion Virginia Power - Altavista, VA
Dominion Virginia Power - Hopewell, VA
Dominion Virginia Power - Hurt, VA
Domtar Industries - Ashdown, AR (2 units)
Domtar Inc. - Nekoosa, WI
Domtar Inc. - Rothschild, WI (2 units)
Domtar Inc. - Windsor, PQ
Domtar Papers - Cornwall, ON
DTE Energy - Cassville, WI
Eurocan Pulp & Paper - Kitimat, BC
Evergreen Packaging - Canton, NC
FMC Corporation - Green River, WY
Georgia-Pacific Corporation - Brunswick, GA
Georgia-Pacific Corporation - Camas, WA (2 units)
Georgia-Pacific Corporation - Clatskanie, OR
Georgia-Pacific Corporation - Crossett, AR
Georgia-Pacific Corporation - Monticello, MS
Georgia-Pacific Corporation - New Augusta, MS
Georgia-Pacific Corporation - Old Town, ME
Georgia-Pacific Corporation - Palatka, FL (2 units)
Georgia-Pacific Corporation - Port Hudson, LA
Glatfelter - Chillicothe, OH
Graphic Packaging International - West Monroe, LA
Great River Energy - Elk River, MN
Harmac Pacific Inc. - Nanaimo, BC
Hitachi Zosen Inova - Norcross, GA
Inland Paperboard and Packaging - Orange, TX
International Paper Company - Augusta, GA (2 units)
International Paper Company - Bostad, LA
International Paper Company - Boganusa, LA (2 units)
International Paper Company - Cantonment, FL
International Paper Company - Corrigan, TX
International Paper Company - Courtland, AL
International Paper Company - Franklin, VA
International Paper Company - Georgetown, SC (2 units)
International Paper Company - Jay, ME
International Paper Company - Mansfield, LA (2 units)
International Paper Company - Orange, TX
International Paper Company - Pine Bluff, AR
International Paper Company - Pineville, LA
International Paper Company - Prattville, AL
International Paper Company - Sailliat, France
International Paper Company - Luiz Antônio, Brazil (2 units)
International Paper Company - Selma, AL
International Paper Company - Texarkana, TX
International Paper Company - Ticonderoga, NY
International Paper Company - Vicksburg, MS
KapStone Papers - Charleston, SC
Ketchikan Pulp Company - Ketchikan, AK
Kimberly-Clark Corporation - Everett, WA
Koch Cellulose - Brunswick, GA (2 units)
Kruger-Wayagamack, Inc. - Trois Rivières, QC
Longview Fibre - Longview, WA (2 units)
Louisiana-Pacific - Chetwynd, BC
Louisiana-Pacific - Roaring River, NC
Maine Energy - Biddeford, ME
Mead Paper - Chillicothe, OH
Mead Paper - Escanaba, MI
Mead Paper - Stevenson, AL
MeadWestvaco - Covingdon, VA (2 units)
MeadWestvaco - Phenix City, AL (2 units)
Minnesota Power - Duluth, MN (2 units)
Neucel Specialty Cellulose - Port Alice, BC (2 units)
NewPage Corporation - Escanaba, MI (3 units)
NewPage Corporation - Wickliffe, KY (2 units)
Packaging Corporation of America - Conque, TN
Packaging Corporation of America - Tomahawk, WI
Packaging Corporation of America - Valosta, GA (2 units)
Plum Creek - Columbia Falls, MT (2 units)
Process Equipment/Barron Industries - Pelham, AL
Rayonier, Inc. - Jesup, GA (3 units)
ReEnergy Holdings - Lyonsdale, NY
Riverside Forest Products - Armstrong, BC
RockTenn Company - Demopolis, AL (2 units)
RockTenn Company - Fernandina Beach, FL (2 units)
SAPPI North America - Cloquet, MN
SAPPI North America - Muskegon, MI (2 units)
SAPPI North America - Skowhegan, ME (3 units)
Simpson Tacoma Kraft Co. - Tacoma, WA (2 units)
Smurfit-Stone - Brewton, AL (2 units)
Smurfit-Stone - Hodge, LA
Smurfit-Stone - Missoula, MT
Smurfit-Stone - Stevenson, AL
Smurfit-Stone - West Point, VA
SP Newsprint - Newberg, OR
Stora Enso North America - Biron, WI
Tembec - Chetwynd, BC
Thilmany Paper - Kaukauna, WI
Veolia Dade County - Miami, FL
Veolia Waste-to-Energy - Burnaby, BC
Visy Pulp and Paper - Tumut, Australia
Von Roll America Inc. - East Liverpool, OH
Westvaco Corporation - Silsbee, TX
Westvaco Corporation - Wickliffe, KY
Weyerhaeuser Canada Ltd. - Prince Albert, SK
Weyerhaeuser Company - Columbus, MS
Weyerhaeuser Company - Kamloops, BC
Weyerhaeuser Company - Longview, WA
Weyerhaeuser Company - Springfield, OR
Weyerhaeuser Company - Valliant, OK
Wheelabrator Energy - Baltimore, MD
Wheelabrator Energy - Portsmouth, VA
Wheelabrator Inc. - Spokane, WA
Willamette Industries - Bennettsville, SC
Williamette Industries - Campti, LA
Xcel Energy - Ashland, WI
Boiler Circulation (Chemical Recovery, Biomass, and RDF/MSW Boilers)

Circulation of water through boiler tubes is necessary to prevent tube overheating and potential failure. The need to conduct a circulation study on a boiler is typically dictated because of any one, or combination of, the following reasons:

- To establish the maximum steaming rate at which circulation remains adequate.
- To determine pressure part modifications needed to support a significant increase in fuel burning rate.
- To evaluate the effect of changing boiler operating conditions (such as type of fuel or operating pressure) on circulation.
- To evaluate the effect of changing heating surfaces on circulation.
- To uncover factors causing repeat pressure part failures and/or tube overheating.
- To investigate the cause of excessive scale depositions inside tubing.

A valuable technique used by JANSEN during its analyses of circulation conditions is the application of Ultrasonic Flow Monitoring (UFM).

Selected References (see next page)
Selected References

Alabama River Cellulose - Perdue Hill, AL
Alberta-Pacific Forest Industries, Inc. - Boyle, AB
APRIL Group - Rizhao, China (2 units)
AssiDomän Sepap - Stetí, Czech Republic
Australian Paper - Morwell, Australia
AV Nackawic - Nackawic, NB
Bahia Specialty Cellulose S.A. - Camaçari, BA, Brazil
Blue Ridge Paper Company - Canton, NC
Boise Cascade Corp. - DeRidder, LA
Boise Cascade Corp. - International Falls, MN (2 units)
Boise Cascade Corp. - Jackson, AL
Boise Cascade Corp. - Rumford, ME
Boise Cascade Corp. - Wallula, WA (2 units)
Bowater Incorporated - Catawba, SC
BP Husky Refining LLC - Toledo, OH
Bukoza - Hencovec, Slovakia
Cargill - Uberlândia, Brazil
Cariboo Pulp & Paper Co. - Quesnel, BC
Carter Holt Harvey Pulp & Paper Ltd. - Tokoroa, NZ
Cascade Pacific Pulp - Halsey, OR
Champion International Corp. - Quinnesec, MI
Champion International Corp. - Roanoke Rapids, NC
Champion Papel e Celulose Ltda. - Mogi Guaçu, Brazil
Covanta Energy - Hartford, CT
Domtar Papers - Cornwall, ON
Domtar Inc. - Ashdown, AR
Domtar Inc. - Bennettsville, SC
Domtar Inc. - Kingsport, TN
Domtar Inc. - Lebel-sur-Quevillon, PQ
Donohue Forest Products Inc. - Port Alberni, BC
E.B. Eddy Forest Products Ltd. - Espanola, ON
Federal Paper Board Company, Inc. - Riegelwood, NC
Finch Paper LLC - Glens Falls, NY
Fletcher Challenge Canada - Mackenzie, BC
Fort James Corporation - Clatskanie, OR
Fraser Papers Inc. - Edmundston, NB
Fraser Papers Inc. - Park Falls, WI
Georgia-Pacific Corporation - Big Island, VA
Georgia-Pacific Corporation - Camas, WA
Georgia-Pacific Corporation - Cedar Springs, GA
Georgia-Pacific Corporation - New Augusta, MS
Georgia-Pacific Corporation - Palatka, FL
Georgia-Pacific Corporation - Wauna, OR
Glaffelter - Chiliocolate, OH
Graphic Packaging Inc. - Macon, GA
Graphic Packaging Inc. - West Monroe, LA
Grupo Cassa - Iztazu, El Salvador
Harmac Pacific Inc. - Nanaimo, BC
Hercules Pinova - Brunswick, GA
Howe Sound Pulp & Paper - Port Mellon, BC
Inland Paperboard & Packaging, Inc. - Orange, TX
International Paper Company - Luiz Antônio, Brazil
International Paper Company - Mansfield, LA (2 units)
International Paper Company - Pine Bluff, AR
International Paper Company - Pine Hill, AL (3 units)
International Paper Company - Pineville, LA
International Paper Company - Riegelwood, NC
International Paper Company - Svetogorsk, Russia (2 units)
Interstate Paper Company - Riceboro, GA
Irving Pulp & Paper - Limited - Saint John, NB
KapStone Paper - Roanoke Rapids, NC
Kimberly-Clark Forest Products Inc. - Terrace Bay, ON
Kimberly-Clark Nova Scotia Inc. - New Glasgow, NS
MacMillan Bloedel Limited - Port Alberni, BC
Mead Corporation - Chillicothe, OH
Mead Corporation - Escanaba, MI (2 units)
Mead Corporation - Kingsport, TN
MeadWestvaco - Phenix City, AL (2 units)
Minnesota Power - Grand Rapids, MN
Montenay Onyx - Burnaby, BC
NewPage Corporation - Rumford, ME
NewPage Corporation - Wisconsin Rapids, WI
New Ulm Public Utilities - New Ulm, MN
Northwood Pulp & Timber, Inc. - Prince George, BC
Packaging Corporation of America - Counce, TN
Packaging Corporation of America - Tomahawk, WI
Packaging Corporation of America - Valdosta, GA
Plainwell Paper Company - Anderson, CA
Pope & Talbot, Inc. - Halsey, OR
Rayonier, Inc. - Jesup, GA
ReEnergy Holdings - Lyonsdale, NY
Repap British Columbia Inc. - Prince Rupert, BC
Repap Manitoba - The Pas, Manitoba
Riverwood International Corporation - West Monroe, LA
SAPPI Fine Papers North America - Muskegon, MI
SAPPI Fine Papers North America - Skowhegan, ME
SCP - Ruzomberok, Slovakia
Simpson Paper Co. - Eureka, CA
Simpson Tacoma Kraft - Tacoma, WA
Smurfit Cartón de Colombia - Cali, Colombia (2 units)
Smurfit Mecarpel - San Felipe, Venezuela
SP Newsprint - Newberg, OR
Stone-Consolidated Corp. - Portage du Fort, PQ
Stone-Consolidated Corp. - Portage du Fort, PQ
Stora Enso North America - Wisconsin Rapids, WI
Tasman Pulp and Paper Company Ltd. - Kawerau, NZ
Western Pulp Limited Partnership - Squamish, BC
Westvaco Corporation - Covington, VA
Westvaco Corporation - Wickliffe, KY
Weyerhaeuser Canada Ltd. - Kamloops, BC
Weyerhaeuser Paper Company - Longview, WA
Weyerhaeuser Paper Company - New Bern, NC
Weyerhaeuser Paper Company - Oglethorpe, GA
Weyerhaeuser Paper Company - Port Wentworth, GA
Weyerhaeuser Paper Company - Springfield, OR (3 units)
PROJECT CAPABILITIES

ULTRASONIC FLOW MONITORING (UFM) OF BOILER CIRCULATION

Scope of Service

A valuable technique used by JANSEN during its analyses of circulation conditions is the application of Ultrasonic Flow Monitoring (UFM). UFM allows for direct water velocity measurements in selected downcomers and boiler furnace tubes without penetrating the pressure part boundary (as this is needed when using Pitot tubes). Therefore, UFM measurements require no boiler downtime.

UFM data provide invaluable input in the evaluation of boiler circulation conditions. The technique has been used successfully for making flow measurements on tubes and pipes with diameters from 2½ inch to 22 inch and water velocities from less than 0.1 ft/sec to over 14 ft/sec at temperatures up to 600°F.

For many applications, the UFM technique offers the following benefits and advantages:

- UFM instrumentation is clamped onto the outside of a tube rather than drilling and welding Pitot tubes.
- UFM instrumentation is mounted while the boiler is on-line.
- UFM instrumentation can be easily moved to different locations.
- UFM instrumentation makes a line-scan measurement across the pipe rather than a single point.
- UFM instrumentation can detect reversal of flow direction.
- UFM instrumentation can be calibrated mid-way during testing.
- UFM instrumentation can accurately measure flows as low as 0.1 ft/sec.

Selected References (see next page)
Selected References

Alabama River Cellulose - Perdue Hill, AL
APRIL Group - Rizhao, China (2 units)
AV Nackawic - Nackawic, NB
Bahia Specialty Cellulose SA - Camaçari, BA, Brazil
Boise - Jackson, AL
Boise - International Falls, MN
Boise Paper - Wallula, WA (2 units)
Bukoza - Hencovce, Slovakia
Carter Holt Harvey Pulp & Paper Ltd. - Tokoroa, NZ
Cascade Pacific Pulp - Halsey, OR
Champion International - Quinnesec, MI
Confidential Client - North America
Covanta Energy - Hartford, CT
Domtar Inc. - Ashdown, AR
Domtar Inc. - Bennettsville, SC
Donohue Inc. - St.-Félicien, PQ
Finch Paper LLC - Glens Falls, NY
Fraser Papers Inc. - Park Falls, WI
Georgia-Pacific - Camas, WA
Georgia-Pacific - New Augusta, MS
Georgia-Pacific - Wauna, OR
Glatfelter - Chillicothe, OH
Graphic Packaging Inc. - Macon, GA
Graphic Packaging Inc. - West Monroe, LA
Grupo Cassa - Izalco, El Salvador
Howe Sound Pulp & Paper - Port Mellon, BC
International Paper Company - Courtland, AL
International Paper Company - Luiz Antônio, Brazil
International Paper Company - Mansfield, LA (2 units)
International Paper Company - Pine Bluff, AR
International Paper Company - Pine Hill, AL (3 units)
International Paper Company - Pineville, LA
International Paper Company - Riegelwood, NC
International Paper Company - Svetogorsk, Russia (2 units)
KapStone Paper - Roanoke Rapids, NC
Louisiana Pacific - Samoan Rapids, NC
Mead Paper - Chillicothe, OH
Mead Paper - Escanaba, MI
MeadWestvaco - Phenix City, AL (2 units)
Minnesota Power - Grand Rapids, MN
Monterey Onyx - Burnaby, BC
New Ulm Public Utilities - New Ulm, MN
Northwood Pulp & Timber Ltd. - Prince George, BC
Plainwell Paper - Anderson, CA
Pope & Talbot - Halsey, OR
Rayonier Inc. - Jesup, GA
Rayonier Inc. - Fernandina Beach, FL
ReEnergy Holdings - Lyonsdale, NY
Rentech Energy Midwest Corporation - East Dubuque, IL
SAPPI Fine Papers - Muskegon, MI
SAPPI Fine Papers - Skowhegan, ME
Simpson Tacoma Kraft - Tacoma, WA
SP Newsprint - Newberg, OR
Stora Enso North America - Wisconsin Rapids, WI
Weldwood of Canada - Hinton, AT
Westvaco - Covington, VA
Westvaco - Wickliffe, KY
Weyerhaeuser Corporation - Longview, WA
Weyerhaeuser Corporation - Oglethorpe, GA
Weyerhaeuser Corporation - Port Wentworth, GA
JANSEN is a fully qualified engineering firm specializing in the design and specification of boiler pressure parts. Projects include redesign of heat transfer components using improved technology. These boiler components have included new generating banks, superheaters, water wall furnaces, and economizers. JANSEN holds an ASME Boiler and Pressure Vessel Code Section I "S" stamp for the design of power and recovery boilers and the NBIC “R” stamp.

**Scope of Service**

- Performance testing
- Analysis of heating surface requirements
- Process design engineering
- Detail drawings and specifications for fabrication and construction
- Engineering, Procurement, and Construction (EPC) scope of supply.
- Startup services

**Selected References (see next page)**
Selected References

Bowater Inc. - Catawba, NC
Cariboo Pulp & Paper - Quesnel, BC
Domtar Industries - Kamloops, BC (2 units)
Fletcher Challenge Canada Ltd. - Mackenzie, BC
International Paper Company - Ticonderoga, NY
International Paper Company - Vicksburg, MS
Kimberly-Clark Forest Products, Inc. - Everett, WA
Kimberly-Clark Forest Products, Inc. - Terrace Bay, ON
Mead Paper - Escanaba, MI
Minnesota Power - Duluth, MN (2 units)
Montenay Inc. - Burnaby, BC
Packaging Corporation of America - Valdosta, GA (2 units)
Simpson Tacoma Kraft - Tacoma, WA
Skeena Cellulose Inc. - Prince Rupert, BC
Smurfit Cartón de Colombia - Cali, Colombia
Western Pulp Limited Partnership - Port Alice, BC
Weyerhaeuser Paper Company - Campti, LA
Weyerhaeuser Paper Company - New Bern, NC
PROJECT CAPABILITIES

SUPERHEATER CAPACITY & PERFORMANCE UPGRADES

- Chemical Recovery Boilers
- Biomass Boilers
- Waste Fueled Boilers (MSW and RDF)

Scope of Services

The performance and reliability of superheaters plays a critical role in overall plant efficiency and in-house power generation. With increased fuel and power costs, more emphasis is placed on maximizing in-house power generation. In recent years, Jansen has completed projects of the following nature to improve the operating performance, capacity, and reliability of superheaters in existing waste fueled boilers:

- Corrosion analyses (see Capabilities Reference Sheet C-14).
- Metallurgical upgrades to improve corrosion resistance.
- Design and supply of additional heating surface to increase final steam temperature.
- Modify steam flow pattern to minimize pressure loss across the superheater.

Selected References (see next page)
Selected References

Cariboo Pulp & Paper - Quesnel, BC
International Paper Company - Ticonderoga, NY
International Paper Company - Vicksburg, MS
Kimberly-Clark - Everett, WA
Montenay Inc. - Burnaby, BC (3 units)
Packaging Corporation of America - Valdosta, GA
Simpson Tacoma Kraft - Tacoma, WA
Sonoco Products Co. - Hartsville, SC
Western Pulp Limited - Port Alice, BC
Weyerhaeuser Company - Campti, LA
PROJECT CAPABILITIES

BOILERS IN ENERGY-FROM-WASTE INDUSTRY

- Municipal Solid Waste (MSW)
- Refuse Derived Fuel (RDF)
- Tire Derived Fuel (TDF)

Scope of Services

Typical waste fuels in this industry are municipal solid waste (MSW), refuse derived fuel (RDF), and tire derived fuel (TDF). Jansen has completed the following projects for customers in the Energy-from-Waste (E-f-W) industry.

- General troubleshooting and problem root cause analyses.
- Superheater corrosion analyses.
- Feasibility studies for boiler fuel conversion (from prior fuel to MSW/RDF/TDF).
- Review of process design factors, pressure part evaluations, and circulation studies.
- Computational Fluid Dynamics (CFD) modeling of combustion performance and heat transfer characteristics.
- ASME Code “S” pressure part design (furnace, superheater, generating bank, and/or economizer).
- Pressure parts supply, fabrication, and installation.
- Efficient combustion air delivery systems, i.e., overfire air (OFA) upgrades.

Selected References (see next page)
Selected References

Consumat Recomp - Bellingham, WA
Covanta Energy - Harrisburg, PA
Connecticut Resource Recovery Authority (CRRA) - Hartford, CT (3 units upgraded)
EnergyAnswers Corporation - Albany, NY
EnergyAnswers Corporation - Agawan, MA
Exeter Energy - Sterling, CT
Great River Energy - Elk River, MN
Green Island Energy Limited - Vancouver, BC
Hitachi Zosen Inova - Norcross, GA
Maine Energy Recovery Company - Biddeford, ME
Montenay Power - Miami Dade County, FL
Montenay Power - Burnaby, BC
Montenay Power - York, PA
ReEnergy Holdings - Albany, NY
ReEnergy Holdings - Black River, NY
ReEnergy Holdings - Kenansville, NC
The Barlow Group - Harrisburg, PA
Veolia Dade County - Miami, FL
Veolia Pinellas - St. Petersburg, FL
Veolia Waste-to-Energy - Burnaby, BC
Von Roll America, Inc. - East Liverpool, OH
Wheelabrator Technologies - Auburndale, FL
Wheelabrator Technologies - Baltimore, MD
Wheelabrator Technologies - Hampton, NH
Wheelabrator Technologies - Hudson Falls, NY
Wheelabrator Technologies - North Broward, FL
Wheelabrator Technologies - Portsmouth, VA (4 units upgraded)
Wheelabrator Technologies - Spokane, WA
Xcel Energy - Red Wing, MN
Because of Cluster Rule legislation, many kraft mills in North America collect and incinerate dilute non-condensable gas (DNCG).

These dilute non-condensable gases (DNCG) are collected from various sources such as washers, deckers, chip bins, liquor tanks, sewers, and many others. They contain small amounts of TRS and volatile organics, with moist air making up over 95% of the DNCG. As a less expensive alternative to purchasing a dedicated incinerator, this stream can be conveniently combined with balance of combustion air in a power boiler (at the level of overfire air) or recovery boiler (secondary/tertiary air levels). More and more mills are disposing of concentrated NCG (CNCG) in boilers as well.

Mills are faced with making informed decisions where and how to inject the NCG stream safely in an existing boiler and in a manner that will not detrimentally affect normal boiler operation.

Scope of Services
- Help select boiler(s) best suited for disposal of DNCG and/or CNCG stream (i.e., specific power or recovery boiler).
- Evaluate impact of NCG injection on boiler efficiency, normal fuel burning capacity, air emissions, corrosion factors, safety, and potential odor problems.
- Determine best location and method of injection of the NCG stream into the furnace in order to assure rapid and complete thermal oxidation.
- Define NCG injection conditions consistent with BLRBAC Recommended Good Practices.
- Define potential secondary (pay-back) benefits of DNCG injection (i.e. combustion air delivery upgrade).
- Develop budgetary estimate or Class 10 cost to design, supply, and install boiler modifications for the injection of the DNCG stream.

Selected References (see next page)
Selected References

Appleton Papers - Roaring Spring, PA
Bowater, Inc. - Calhoun, TN
Bowater, Inc. - Catawba, SC
Canfor PGP&P - Prince George, BC
Domtar, Inc. - Windsor, PQ
Eddy Specialty Papers - Espanola, ON
Georgia-Pacific Corporation - Camas, WA
Georgia-Pacific Corporation - Clatskanie, OR
Georgia-Pacific Corporation - Monticello, MS
Georgia-Pacific Corporation - Old Town, ME
International Paper Company - Franklin, VA
International Paper Company - Pensacola, FL
International Paper Company - Texarkana, TX
MeadWestvaco Corporation - Covington, VA
MeadWestvaco Corporation - Luke, MD
MeadWestvaco Corporation - Phenix City, AL
Roseburg Forest Products - Dillard, OR
Roseburg Forest Products - Weed, CA
Simpson Tacoma Kraft - Tacoma, WA
Westvaco - Evadale, TX
Weyerhaeuser Company - Oglethorpe, GA
Weyerhaeuser Company - Plymouth, NC
Willamette Industries - Hawesville, KY
PROJECT CAPABILITIES

DISPOSAL OF DNCG IN RECOVERY/POWER BOILERS
USING JANSEN HIGH ENERGY COMBUSTION AIR NOZZLES™

Injection of dilute non-condensable gases (DNCG) in existing boilers using the Jansen High Energy Combustion Air Nozzles™ can be practiced in different ways:

- In a recovery boiler, global mixing of the DNCG stream with all secondary and/or tertiary air through all new nozzles. On a power boiler, global mixing with all overfire air (OFA).
- Local mixing of the DNCG stream with air to selected new nozzles on the secondary and/or tertiary air levels, or OFA.
- Separate injection (using blower), without air mixing, through a selected number of new nozzles.

The benefits of installing Jansen air nozzles for DNCG disposal in the recovery/power boiler are many:

- Work includes initial process evaluation to determine best location and method of injection.
- Injection method, system, and nozzles are custom designed for each application.
- Nozzle has clean, open discharge with high jet velocity, and no back flows or tube impingement.
- Nozzle tips are corrosion resistant.
- Rapid combustion of DNCG components; no emissions excursions.
- Boiler stability is not affected.
- Nozzles have shown no/low maintenance.
- System has easy shut-off capability.

Selected References (see next page)
Selected References

Appleton Papers - Roaring Spring, PA
Bowater, Inc. - Calhoun, TN
Bowater, Inc. - Catawba, SC (2 units)
Canfor PGP&P - Prince George, BC
Georgia-Pacific Corporation - Camas, WA
Georgia-Pacific Corporation - Clatskanie, OR
Georgia-Pacific Corporation - Old Town, ME
International Paper Company - Texarkana, TX (2 units)
Mead Paper - Escanaba, MI
Mead Paper - Chillicothe, OH
Stone Container - Portage-du-Fort, PQ
Westvaco Corporation - Silsbee, TX
Weyerhaeuser Company - Campti, LA
Excessive tube metal wastage in recovery and other waste fuel boiler superheaters due to fireside corrosion has often become troublesome as mills attempt to increase boiler firing capacity. Firing boilers at higher rates has, in some cases, led to higher final steam temperature and excessive superheater metal temperatures, which can accelerate corrosive metal loss. JANSEN has developed an engineering analysis approach that helps to predict where corrosion problems may occur and provides the means to design solutions to overcome these problems. The analysis includes collecting boiler operating data, obtaining process samples for chemical analysis, reviewing superheater geometry and metallurgy, and a comprehensive heat transfer analysis.

**Scope of Service**

- Prediction of tube metal temperatures to identify areas most vulnerable to corrosive attack.
- Identification of process parameters to maintain tube metal temperatures at safe levels, i.e., final steam temperature and pressure, attemperator water flow rates, firing capacity, flue gas conditions, deposit characteristics, etc.
- Allow redesign of superheater tube layout and metallurgy to avoid exposure of tube metal to excessive temperatures and heat fluxes.

**Selected References (see next page)**
Selected References

Bahia Specialty Cellulose S.A. - Camaçari, BA, Brazil
Boise Cascade Corporation - Rumford, ME
Georgia-Pacific Corporation - Zachary, LA
Great River Energy - Elk River, MN
Ketchikan Pulp Company - Ketchikan, AK
Kimberly-Clark Forest Products Inc. - Everett, WA
Kimberly-Clark Forest Products Inc. - Terrace Bay, ON
Maine Energy - Biddeford, ME
Mead Paper Corporation - Chillicothe, OH
Montenay Power - Miami, FL
Montenay Power - York, PA
Montenay Inc. - Burnaby, BC
Scott Maritimes Limited - New Glasgow, NS
University of Washington - Seattle, WA
Visy Pulp & Paper - Tumut, Australia
Westvaco Corporation - Covington, VA
Western Pulp Limited Partnership - Port Alice, BC
Western Pulp Limited Partnership - Squamish, BC
Wheelabrator Energy - Spokane, WA
Willamette Industries - Hawesville, KY
Background
Many plants are facing stricter NOx emission limitations from boiler stack gases in the near future. Often, NOx emissions must be reduced by more than 50% from current levels.

Jansen’s Approach to Solving NOx Issues
1. Understanding the customer’s goals
2. Understanding the local environmental permitting constraints.
3. Evaluating the current boiler operation to:
   a. Determine current NOx creation mechanism
   b. Analyze the physical arrangement of the combustion system; size of furnace, location of existing burners and air supply
   c. Determine operating strategy/control, fuel splits, load variability
   d. Establish fuel properties
4. Perform Computational Fluid Dynamics (CFD) modeling to predict effectiveness of types of solutions.
5. Evaluating types or combination of NOx reduction solutions for most viable and cost effective solutions. Determine capital cost and operating costs as well as “side effects” of proposed solutions.
6. Providing operating recommendations and hardware alterations that best meet the customers’ goals. Where appropriate, possible solutions may include:
   - Staged combustion/overfire air
   - Low excess air
   - Fuel rich secondary combustion (reburning)
   - Urea/ammonia injection (SNCR)
   - Flue gas recirculation (FGR)
   - Low NOx burners
   - Automatic combustion controls
7. Design and supply specific NOx reduction technology and equipment.

Selected References (see next page)
Selected References

Boise - International Falls, MN
Boise - Wallula, WA
Clearwater Paper - Lewiston, ID
Dominion Virginia Power - Altavista, VA
Dominion Virginia Power - Hopewell, VA
Dominion Virginia Power - Southampton, VA
Domtar, Inc. - Ashdown, AR
Georgia-Pacific Corporation - Camas, WA
Georgia-Pacific Corporation - Crossett, AR
International Paper Company - Roanoke Rapids, NC
International Paper Company - Texarkana, TX
International Paper Company - Ticonderoga, NY
Kapstone Papers - Longview, WA
MeadWestvaco Corporation - Covington, VA
MeadWestvaco Corporation - Phenix City, AL
Rayonier, Inc. - Jesup, GA
Simpson Tacoma Kraft - Tacoma, WA
Smurfit-Stone Container Corporation - Hodge, LA
Smurfit-Stone Container Corporation - Missoula, MT
Smurfit-Stone Container Corporation - Stevenson, AL
Stora Enso North America - Wisconsin Rapids, WI
Veolia Waste-to-Energy - Burnaby, BC
Weyerhaeuser Company - Valliant, OK
Wheelabrator Technologies, Inc. - Baltimore, MD
Wheelabrator Technologies, Inc. - Hudson Falls, NY
Scope of Service

In addition to the kraft process, JANSEN possesses extensive experience with design and operation of sulfite (ammonia and MgO) and soda based recovery boilers. Our services include the following activities:

- Field testing to collect operating data and establish performance and baseline conditions.
- Performance calculations for ammonia and MgO sulfite liquor boilers.
- Performance calculations for soda liquor boilers.
- Engineering evaluation of critical design and operating parameters.
- Steam/water circulation study.
- Determination of conceptual boiler modifications.
- Budget cost and project time schedule estimates.
- Design/supply SSL burning capacity upgrade.
- Operator training seminars.

Selected References (see next page)
Selected References

AV Cell - Atholville, NB
Cosmo Specialty Fibers - Cosmopolis, WA
Fraser Papers, Inc. - Edmundston, NB
Georgia-Pacific Corporation - Big Island, VA
Ketchikan Pulp Company - Ketchikan, AK
Kimberly-Clark Corporation - Everett, WA
Mead Corporation - Kingsport, TN
Neucel Specialty Cellulose - Port Alice, BC
Rayonier, Inc. - Fernandina Beach, FL
Tartas S.A. - Tartas, France
Tembec Inc. - Temiscaming, PQ
Western Pulp Limited Partnership - Port Alice, BC
Weyerhaeuser Paper Company - Cosmopolis, WA
Scope of Service

In addition to the stoker fired waste fuel boilers, JANSEN conducts evaluations on Bubbling Fluidized Bed (BFB) and Circulating Fluidized Bed (CFB) boilers. Our services include the following:

- Field testing to collect operating data and establish performance and baseline conditions.
- Engineering evaluation of critical design and operating parameters.
- Analysis of erosion factors.
- CFD modeling.
- Fuel conversion to biomass burning.
- Steam/water circulation analysis.
- Determination of conceptual boiler modifications.
- Budgetary cost estimates.
- Addition of in-bed heating surfaces.
- Over-bed combustion air delivery.
- Incineration of HVLC and LVHC NCG.

Selected References (see next page)
Selected References

Boise Cascade - Rumford, ME
Bowater, Inc. - Calhoun, TN
Catalyst Papers - Port Alberni, BC
Domtar, Inc. - Hawesville, KY
Domtar, Inc. - Kingsport, TN
Georgia-Pacific - Clatskanie, OR
International Paper Company - Courtland, AL
Mondi SCP - Ružomberok, Slovakia
ReEnergy Holdings - Black River, NY
Sonoco Products Co. - Hartsville, SC
Tacoma Public Utilities - Tacoma, WA
Thailand Biomass Boilers - Thailand
Services in Canada

Since our inception in 1976, JANSEN has completed numerous projects in all Canadian Provinces where pulp mills are located. The type of project and scope of work included:

- Boiler Conversion to Biomass Burning (see Capabilities C-01)
- Biomass Boiler Evaluations (see Capabilities C-02)
- Biomass Boiler Combustion System Upgrades (see Capabilities C-03)
- Recovery Boiler Performance and Engineering Evaluations (see Capabilities C-04)
- Recovery Boiler Capacity Upgrades (see Capabilities C-05)
- Computational Fluid Dynamics (CFD) Modeling (see Capabilities C-06)
- Boiler Circulation Studies (see Capabilities C-07)
- Ultrasonic Flow Monitoring (UFM) of Boiler Circulation (see Capabilities C-08)
- Boiler Pressure Part Design (see Capabilities C-09)
- Superheater Capacity & Performance Upgrades (see Capabilities C-10)
- Boilers in Energy-from-Waste Industry (see Capabilities C-11)
- Evaluation Disposal of DNCG and CNCG in Existing Boilers (see Capabilities C-12)
- Superheater Corrosion Prevention (see Capabilities C-14)
- NOx Emissions Reduction (see Capabilities C-15)
- Sulfite (SSL) and Soda Liquor Recovery Boilers (see Capabilities C-17)
- Fluidized Bed Boilers Bubbling/Circulating (BFB/CFB) (see Capabilities C-18)

Selected References (see next page)
Selected References

Alberta Pacific Forest Industries, Inc. - Boyle, AB
Atlantic Power Company - Williams Lake, BC
AV Cell - Atholville, NB
AV Nackawic - Nackawic, NB
AV Terrace Bay - Terrace Bay, ON
Boise Cascade Canada - Fort Frances, ON
Canfor Intercon - Prince George, BC
Canfor Northwood - Prince George, BC
Canfor PGP - Prince George, BC
Carriboo Pulp & Paper - Quesnel, BC
Catalyst Paper - Crofton, BC
Catalyst Paper - Port Alberni, BC
Corner Brook Pulp & Paper - Corner Brook, NF
Daishowa Marubeni - Peace River, AB
Domtar Papers - Cornwall, ON
Domtar, Inc. - Kamloops, BC
Domtar, Inc. - Lebel-sur-Quevillon, PQ
Domtar, Inc. - Windsor, PQ
Donahue Forest Products Inc. - St. Félicien, PQ
E.B. Eddy Forest Products - Espanola, ON
EPCOR Canada - Squamish, BC
Eurocan Pulp & Paper Company - Kitimat, BC
Fletcher Challenge - Crofton, BC
Fletcher Challenge - Mackenzie, BC
Fraser Papers Inc. - Edmundston, PQ
Fraser Papers, Inc. - Plaster Rock, NB
Harmac Pacific Inc. - Nanaimo, BC
Howe Sound Pulp & Paper - Port Mellon, BC
Irving Pulp & Paper Ltd. - Saint John, NB
Kimberly-Clark Forest Products, Inc. - Terrace Bay, ON
Kimberly-Clark Nova Scotia, Inc. - New Glasgow, NS
Kruger Wayagamack Inc. - Trois Rivières, PQ
Louisiana Pacific - Chetwynd, BC
MacMillan Bloedel Ltd. - Port Alberni, BC
Mackenzie Pulp - Mackenzie, BC
Montenay Power - Burnaby, BC
Neucel Specialty Cellulose - Port Alice, BC
Northern Pulp - New Glasgow, NS
Northwood Pulp & Timber Ltd. - Prince George, BC
Repap Manitoba - The Pas, MB
Scot Maritimes Ltd. - New Glasgow, NS
Skeena Cellulose Inc. - Prince Rupert, BC
Skookumchuck Pulp - Cranbrook, BC
Spruce Falls Inc. - Kapuskasing, ON
Stone Consolidated Corp. - Fort Frances, ON
Stone Container Canada Inc. - New Richmond, PQ
Stone Container Canada Inc. - Portage du Fort, PQ
Tembec, Inc. - Chetwynd, BC
Tembec, Inc. - Temiscaming, PQ
Tolko Manitoba - The Pas, MB
Tolko/Riverside FP - Armstrong, BC
Veolia Waste-to-Energy - Burnaby, BC
Weldwood of Canada - Hinton, AB
Western Pulp Limited Partnership - Port Alice BC
Western Pulp Limited Partnership - Woodfibre, BC
Weyerhaeuser Canada Ltd. - Kamloops, BC
Weyerhaeuser Canada Ltd. - Price Albert, SK
Overseas Projects

Since our inception in 1976, JANSEN has completed a variety of projects overseas in Europe, Central and South America, Asia, and the South Pacific. The type of project and scope of work included:

- Biomass Boiler Evaluations (see Capabilities C-02)
- Biomass Boiler Combustion System Upgrades (see Capabilities C-03)
- Recovery Boiler Performance and Engineering Evaluations (see Capabilities C-04)
- Recovery Boiler Capacity Upgrades (see Capabilities C-05)
- Computational Fluid Dynamics (CFD) Modeling (see Capabilities C-06)
- Boiler Circulation Studies (see Capabilities C-07)
- Ultrasonic Flow Monitoring (UFM) of Boiler Circulation (see Capabilities C-08)
- Superheater Corrosion Prevention (see Capabilities C-14)
- Sulfite (SSL) and Soda Liquor Recovery Boilers (see Capabilities C-17)
- Fluidized Bed Boilers Bubbling/Circulating (BFB/CFB) (see Capabilities C-18)
- Recovery Boiler Audits
- Recovery Boiler Operations Training Seminars

Selected References (see next page)
Selected References

APRIL Group - Rizhao, China (2 boilers evaluated)
Asia Pulp & Paper - Perawang and Lontar, Indonesia
AssiDomän Sepap - Štětí, Czech Republic
Australian Paper Maryvale Mill - Morwell, Australia
Bahia Specialty Cellulose S.A. - Camaçari, Brazil
BTG Slovensko (Chemes) - Hummene, Slovakia
Bukocel - Hencovce, Slovakia
CAIG, S.A., Ingenio Madre Tierra - Santa Lucia, COTZ, Guatemala
Caracol Knits - San Pedro Sula, Honduras
Cargill - Minga Guazú, Paraguay
Cargill - Primavera do Leste, Brazil
Cargill - Três Lagoas, Brazil
Cargill - Uberlândia, Brazil
Carter Holt Harvey Pulp & Paper Ltd. - Tokoroa, New Zealand
Carvajal – Cali, Colombia
Champion Papel e Celulose Ltda. - Mogi Guaçu, Brazil
Cofely - GDF Suez - Saillat, France
Grupo Cassa - Izalco, El Salvador
Hyne Timber - Queensland, Australia (2 plants evaluated)
International Paper Company - Luiz Antônio, Brazil (2 units)
International Paper Company - Saillat, France
International Paper Company - Svetogorsk, Russia (2 units evaluated)
Mondi SCP - Ružomberok, Slovakia (2 units)
Portucel - Cacia, Portugal
Smurfit Cartón de Colombia - Cali, Colombia (2 units upgraded)
Smurfit Mocarpel - San Felipe, Venezuela
Suzano Papel e Celulose - Suzano, Brazil
Tartas S.A. - Tartas, France
Tasman Pulp and Paper Co. Ltd - Kawerau, New Zealand
Thailand Biomass Boilers - Thailand
Visy Pulp and Paper - Tumut, Australia
Approach in Addressing Boiler MACT and CISWI Compliance

**Step 1 - Problem Definition**

a. Determine classification of facility and boiler(s).
b. Establish emissions limits that pertain to the boiler(s) classification.
c. Review current and historical emissions data relating to MACT and CISWI regulations.
d. Provide recommendations to obtain missing information.
e. Provide operational tuning of the unit.
f. Identify boiler emissions that will require remediation.
g. Provide potential solutions/options based on available information.

**Step 2 - Solution Creation**

a. Determine feasibility of changing the boiler’s classification to avoid or alleviate modifications required to meet MACT or CISWI.
b. Further develop potential solutions/modifications needed to meet emissions limits.
c. Identify the most cost effective solution (± 30% cost estimate).
d. Assist customer in preparing submittal to permitting agency.

**Step 3 - Solution Implementation**

a. Develop appropriations grade cost estimate (±10%), if necessary.
b. If requested, implement the solution design/supply or design/supply/construct project.
   Work with “teaming partners” to offer complete solution.

Selected References (see next page)
Selected References

Alabama River Cellulose LLC - Perdue Hill, AL
Avista Corporation - Kettle Falls, WA
Boise Building LLC - Medford, OR
Brunswick Cellulose, Inc. - Brunswick, GA
Clearwater Paper - Lewiston, ID
Evergreen Packaging - Canton, NC
Georgia-Pacific - Big Island, VA
Georgia-Pacific - Crossett, AR
Georgia-Pacific - Toledo, OR
Georgia-Pacific Wood Products LLC - Dudley, NC
Georgia-Pacific Wood Products LLC - Duluth, MN
Georgia-Pacific Wood Products LLC - Emporia, VA
Georgia-Pacific Wood Products LLC - Hawthorne, FL
Georgia-Pacific Wood Products LLC - Jarratt, VA
Georgia-Pacific Wood Products LLC - Roxboro, NC
Glatfelter - Chillicothe, OH
International Paper Company - Augusta, GA
International Paper Company - Pine Hill, AL
International Paper Company - Selma, AL
Kimberly-Clark - Chester, PA (4 units)
Kimberly-Clark - Everett, WA (4 units)
Kimberly-Clark - Loudon, TN
Longview Fibre - Longview, WA
Louisiana-Pacific - Roaring River, NC
MeadWestvaco - Phenix City, AL
NewPage Corporation - Wisconsin Rapids, WI (2 units)
Packaging Corporation of America - Tomahawk, WI
Packaging Corporation of America - Valdosta, GA
Plum Creek - Columbia Falls, MT
Rayonier - Jesup, GA (3 units)
Resolute Forest Products - Catawba, SC
RockTenn - Hodge, LA
RockTenn - Panama City, FL (2 units)
RockTenn - Stevenson, AL
Smurfit-Stone Container Corp. - Fernandina Beach, FL
Weyerhaeuser - Oglethorpe, GA
Wheelabrator Technologies, Inc. - Auburndale, FL
PROJECT CAPABILITIES

BOILER CONVERSION TO NATURAL GAS (CO-) FIRING

Scope of Service

In recent years, boiler owner/operators have become motivated to add or expand natural gas (co-)firing capability to existing coal-, oil-, and biomass-fired power boilers, and recovery boilers. The driving forces behind this interest are 1) the current low cost for natural gas, 2) combustion challenges that are sometimes experienced with burning existing solid fuels and 3) difficulties achieving Boiler MACT emissions compliance.

Services that JANSEN provides:

- Initial assessment of feasibility, technical practicality, and definition of required modifications to generate budgetary project costs.
- Engineering evaluation of existing boilers to determine the units’ capacities and capabilities when operating on natural gas fuel (pressure parts, fans, etc.).
- Assistance in making informed decisions on where to place the burners, burner sizing, and burner NOx generation.
- Steam/water side circulation study and combustion CFD modeling while (co-)firing natural gas.
- Definition engineering to develop +/- 10% accuracy level cost estimate.
- Engineering design, fabrication, and materials supply, including gas burners.
- Operator training and start-up assistance.

Selected References (see next page)
Selected References

Appvion, Inc. - Roaring Spring, PA
AV Nackawic - Nackawic, NB
Domtar Inc. - Nekoosa, WI
International Paper - Ticonderoga, NY
Minnesota Power - Duluth, MN (2 units)
NewPage Corporation - Rumford, ME
Packaging Corporation of America - Tomahawk, WI
Packaging Corporation of America - Valdosta, GA
Rayonier, Inc. - Jesup, GA
SAPPI - Skowhegan, ME
JANSEN is a fully qualified engineering firm specializing in the design and specification of boiler pressure parts. Projects include redesign of heat transfer components using improved technology. These boiler components have included new generating banks, superheaters, water wall furnaces, and economizers. JANSEN holds an ASME Boiler and Pressure Vessel Code Section I "S" stamp for the design of power and recovery boilers and the NBIC "R" stamp.

**Economizer Supply Scope of Service**

- Initial feasibility study and quantification of payback potential.
- Benchmark performance testing.
- Evaluation of impact on boiler performance (steam flow and temperature).
- Analysis of heating surface requirements.
- Process design engineering.
- Specifications for fabrication and construction.
- Feedwater piping.
- Sootblowers and piping.
- Structural implications, hoppers, and breeching.
- Installation drawings.
- Engineering, Procurement, and Construction (EPC) scope of supply.
- Construction observation and startup services.

**Selected References (see next page)**
Selected References

Domtar Industries - Kamloops, BC (2 units)
GP Cellulose - Brunswick, GA
Minnesota Power - Duluth, MN (2 units)
Packaging Corporation of America - Valdosta, GA
Simpson Tacoma Kraft - Tacoma, WA
Skeena Cellulose Inc. - Prince Rupert, BC