



COGEN is a state-of-the-art flowsheeting-type modeling software to simulate and optimize industrial cogeneration systems. By combining powerful diagnostic and optimization capabilities, COGEN can quickly identify and provide solutions to improve the performance and profitability of utility systems by taking into account a set of operational and design constraints.



COGEN SOFTWARE

Optimizing Cogeneration
Systems in Industrial
Processes

THE CHALLENGE FOR INDUSTRY

Industrial processes use large amounts of energy in the form of heat and electricity, accounting for a significant portion of industrial operating costs. Over the past few decades, industrial cogeneration has grown significantly to manage heat and electricity more efficiently in several industries, including pulp and paper, chemicals, steel, and oil and gas. Cogeneration is the simultaneous production of electricity and thermal energy from a single energy source. It offers a cost-effective way to increase profitability and reduce overall greenhouse gas emissions and effluents. However, finding the best design and operating

options for complex systems is challenging. To develop energy-efficient solutions, important questions must be answered:

- > What are the opportunities for improving the performance of industrial cogeneration systems?
- > What modifications can be made within practical and financial constraints?
- > How can utility systems be better designed and operated to reduce waste heat generation and increase profitability?



Natural Resources
Canada

Ressources naturelles
Canada

Canada

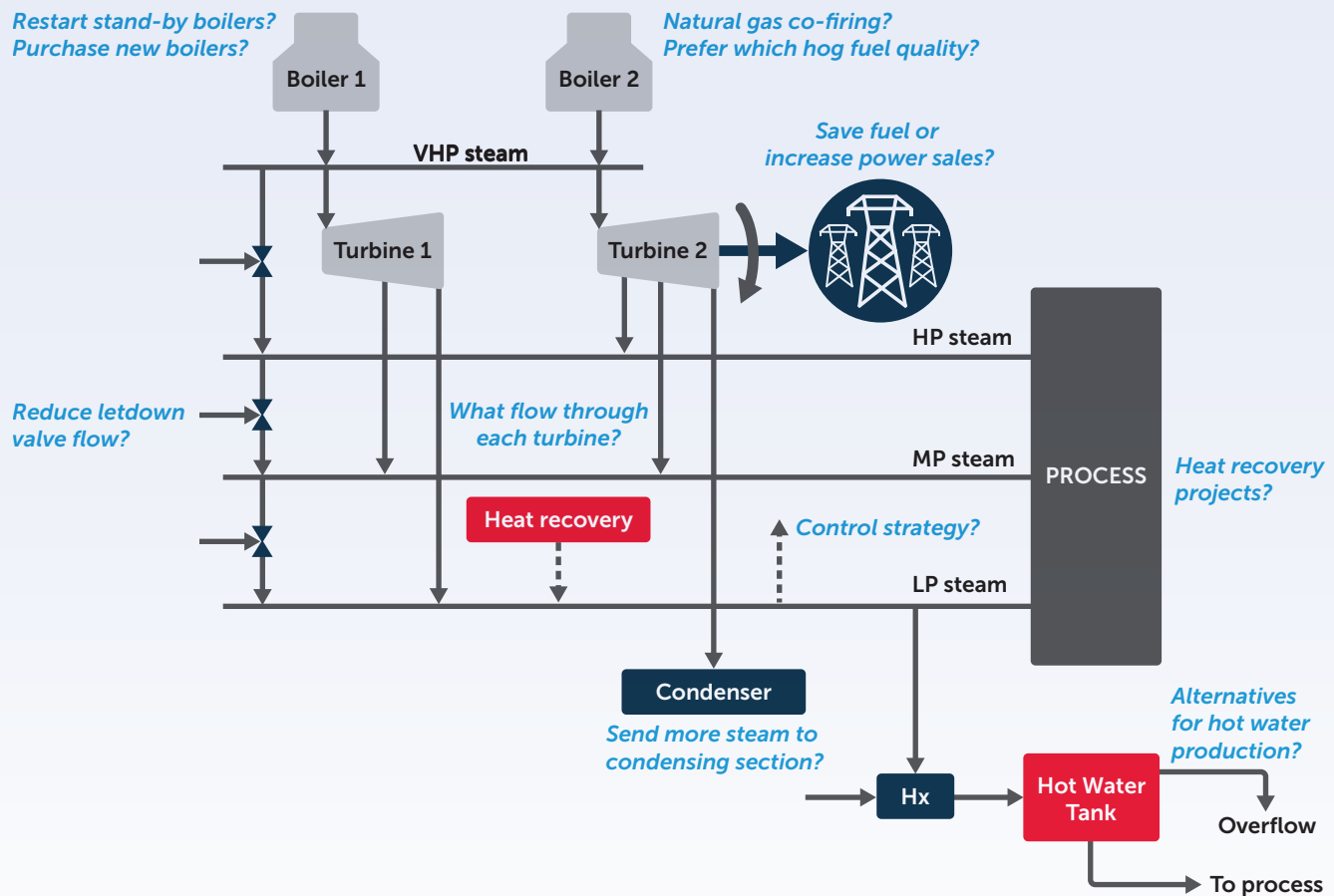
ANALYSIS FEATURES

- > Steam path and fuel blend optimization with trade-off between fuel savings and electricity sales
- > "What-if" scenarios such as:
 - Changes in topology
 - Equipment modifications
 - Contractual changes
 - Operational changes
- > Calculation of the real marginal cost of steam by fuel type, steam generator, pressure level, process steam demand and electricity price
- > Condensate recovery and management

THE INTEGRATED SOLUTION

COGEN enables the user to easily evaluate and improve the energy and economic efficiency of industrial cogeneration systems. The software includes a user-friendly graphical interface that helps to quickly identify existing inefficiencies and opportunities for optimizing heat and power production.

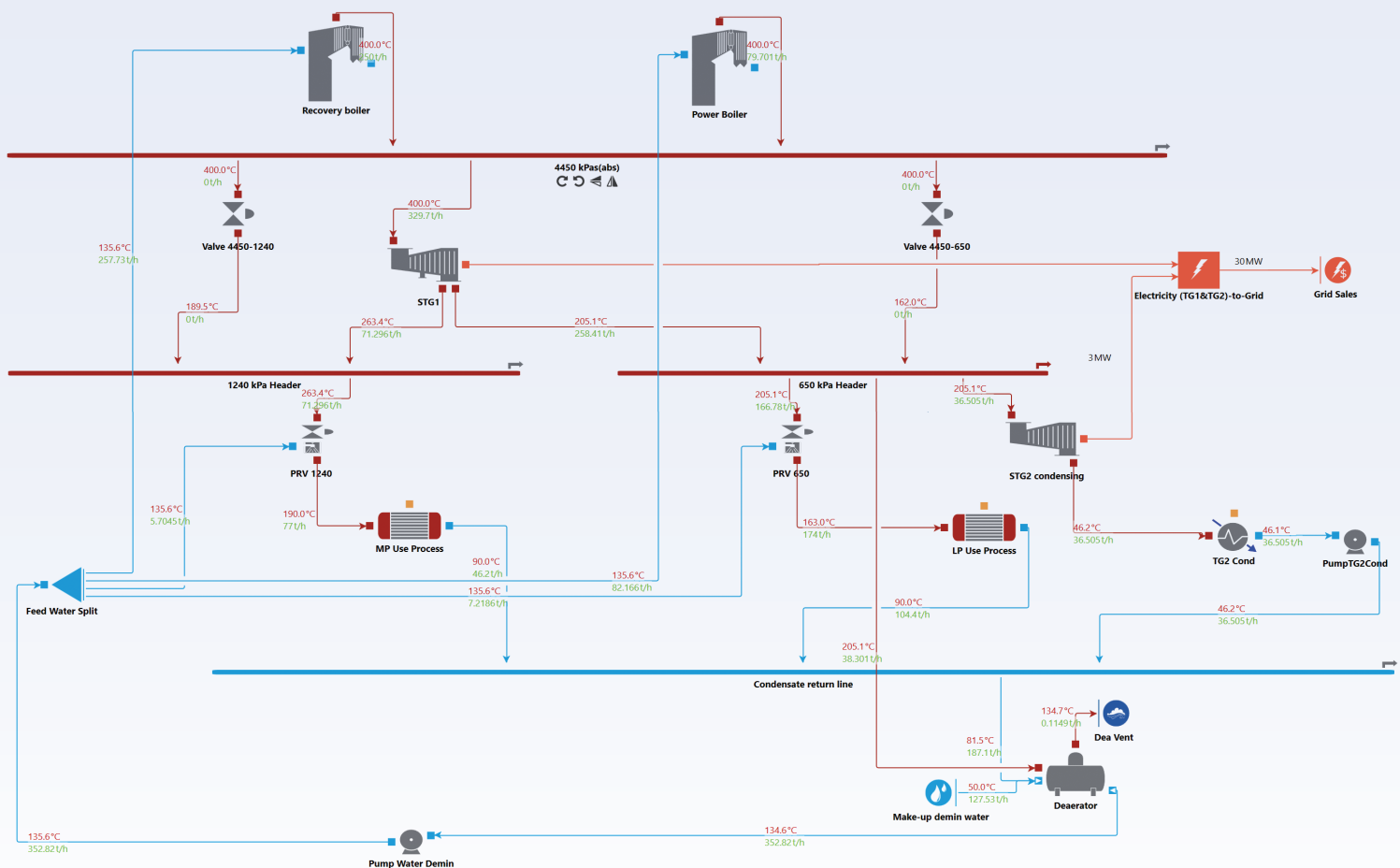
COGEN allows the user to determine the best cogeneration strategy for profitability



CAPABILITIES

- > COGEN includes simple and detailed models for cogeneration-related equipment
 - Boilers, steam and gas turbines, pumps, fans, heat exchangers, etc.
 - Detailed models that rigorously simulate the operation of equipment at part-load
- > Complex topologies (i.e. steam, condensate, fuel, air, electricity) can be modeled in detail
- > User-defined equations can be used to model specific system and equipment characteristics
- > World-class solvers are used to solve complex, large-scale problems that are either linear or non-linear
- > User-friendly interface that allows for quick evaluation of existing and retrofitted (or upgraded) cogeneration systems through a drag-and-drop interface and flowsheet visualization tools

User-friendly interface for modeling and optimizing complex industrial cogeneration systems



Sample results: Summary of main operating and financial results, hog boiler results, and condensing turbine results

CHP System		
Execution status		
Last time solved		2018-01-19 13:25:54
Feasibility heuristic status		Failed
Global optimization status		Successful
Time limit reached for feasibility heuristic		No
Time limit reached for global optimization		No
Key results		
Net annualized cost	M\$/year	-1.44
Total operating cost	M\$/year	10.99
Total capital cost	M\$	0.90014
Total annualized capital cost	M\$/year	0.23745
Total revenue	M\$/year	12.66
Total steam generation	Mt/year	0.82859
Total fuel heat rate	MWh/year	740224
Total CO ₂ emissions	Mt/year	0.21159
Total electricity generation	MWh/year	117887
Total user defined cost	M\$/year	0
Annualized operating cost		
Capital cost		
Annualized capital cost		
Revenue		
Steam generation		
Fuel flow		
Fuel heat rate		
CO₂ emissions		
Electricity generation		
Vented steam and purged water		

Hog Boiler

This equipment contains 0 constraint(s)

Key Characteristics (last results)

Boiler efficiency	75	%
Steam pressure	4205.8	kPa(g)
Steam temperature	393.3	°C
Steam generation (mass)	268.09	t/h
Steam generation (volumetric)	17969	m ³ /h
Fuel heat rate	867.16	GJ/h
CO ₂ emissions	49.441	t/h
Flue gas temperature	362.2	°C
Flue gas dewpoint	58.7	°C

Comments

No comments

Condensing Turbine

This equipment contains 1 constraint(s)

Key Characteristics (last results)

Isentropic efficiency	74.959	%
Actual stream rate	4.3178	kg/kWh
Inlet pressure	4205.8	kPa(g)
Exhaust pressure	-94.43	kPa(g)
Exhaust temperature	38.8	°C
Exhaust water fraction	8.9332	%
Shaft power output	23.042	MW

Comments

No comments

CanmetENERGY's Systems Analysis Software

To allow for effective transfer to industry, CanmetENERGY is developing innovative software solutions that reflect the most recent advancements from our research activities.



COGEN

For maximizing efficiency and revenues from cogeneration systems



INTEGRATION

For optimizing heat recovery in plants



EXPLORE

For improving process operation with the power of advanced data analysis



I-BIOREF

For assessing the economic viability and environmental impacts of biorefinery technologies

For more information about COGEN, please contact us:
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