



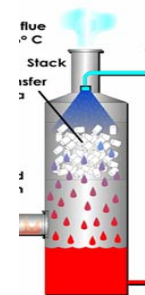
Condensing Economizers a Big Opportunity for Steam Plant Owners and Equipment Suppliers

Sponsored By:
Enbridge Gas Distribution Inc. and
The Energy Solutions Centre

Toronto

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Summary of the Opportunities



1. Enbridge Incentive Grants
2. The “Steam Saver” Program
3. The Steam Boiler Market – Ontario
4. Historic Gas Prices
5. Boiler Plant Projects
6. Useful Information

Industrial Incentive Grants – Who to Contact at Enbridge



- **Your Enbridge Energy Solutions Consultant.**

Or

Mr. Peter Goldman, Industrial Sales Manager
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1.) Enbridge Incentive Grants



- **Energy Assessments (Audits and Surveys)**
- **Project Implementation**
- **Technical Support**



Plant Energy Assessments How this program works



- For “standard” energy assessments, Enbridge defines test methods and report format.
- Energy Calculations are done according to recognized standards eg. ASME, NAIMA.
- Experienced contractors do assessments.
- Enbridge supplies test instruments and does the testing (eg. Combustion tests).

1.1) Standard Energy Assessments, Surveys and Tests



- Boiler Plant Performance Test and Audit (The “Steam Saver” Program)
- Process Heating Testing and Assessment
- Steam Trap Surveys
- Insulation Surveys
- Industrial HVAC Studies
- Metering, Monitoring and Targeting Studies

*Incentive Grant: (for customers with annual gas consumption > 2.5 MM CU M/Yr)
50% of study cost up to a maximum grant of \$ 10,000*

1.2) Special Studies



- **Process Integration Study (Pinch)**

Incentive Grant: 50% of study cost up to a maximum grant of \$ 30,000

- **Specific Project Engineering and Economic Feasibility studies**

Incentive Grant: 50% of study cost. Maximum to be determined based on savings potential.

1.3) Incentive Grants for Project Implementation



- **One-time incentive grants for implementation of one or two energy efficiency projects.**
- **\$ 0.05 per CU M of annual gas savings.**
- **CONDENSING ECONOMIZERS RECEIVE A GRANT OF \$ 0.10 PER CU M OF ANNUAL GAS SAVINGS.**
- **Maximum grant \$ 30,000 per CU M**
- **For 3 or more projects, the incentive grant is \$ 0.10 per CU M of annual gas savings.**
- **Projects can be bundled within one calendar year.**
- **Maximum grant of \$ 30,000 for a bundle of projects.**

2.) The “Steam Saver” Program



1. The Boiler Plant Performance Test and Audit
2. New Boiler Installations
3. Steam Trap Surveys
4. Combustion Tune-up Program
5. Metering and Energy Management (M & T)
6. Insulation Surveys
7. Boiler Plant Controls and Automation



3.) Steam Boiler Plants – The main target market for Condensing Heat Recovery



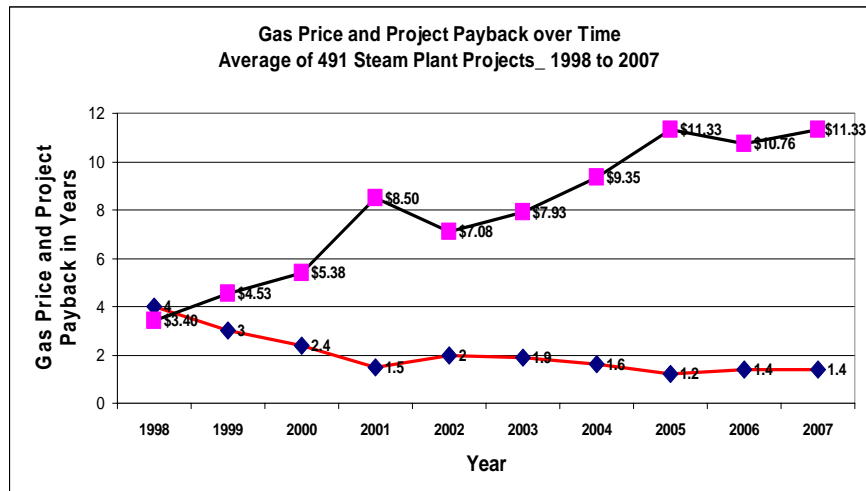
	Ontario	Canada
No. of plants of minimum size (see note1 and note 2)	1,000	2,500
No. of Boilers	3,300	8,250
No. of Coiled Tube Boilers	2,000	N.A.
Annual Gas Vol. CU M/Yr	5.0 Billion	12.5 Billion
Natural Gas Overall Market Share	65%	65%
Note 1: Min Plant Size = 3 Million CU M/YR of Gas Cons.	Note 2: Excludes Electric Utility Coal-fired Plants	

4.) The Price of Natural Gas is going up for the Average Industrial Customer



Year	Burner Tip Price of Natural Gas CU M/Yr	Average Payback on 491 Boiler Plant Projects (Yrs)
1998	\$0.12	4.0
1999	\$0.16	3.0
2000	\$0.19	2.4
2001	\$0.30	1.5
2002	\$0.25	2.0
2003	\$0.28	1.9
2004	\$0.33	1.6
2005	\$0.40	1.2
2006	\$0.38	1.4
2007	\$0.40	1.4

4.1 The Financial Payback is getting better for steam projects



5.) EE Projects Identified in 92 Detailed Boiler Plant Audits (excludes steam trap surveys)



Project Category	No. of Projects	Savings M CU M/Yr	Simple Payback (Yr)
1.) Combustion	89	13,310	0.5
2.) New Boilers	69	13,476	3.4
3.) Heat Recovery	137	32,859	0.9
4.) Operating	37	15,378	0.9
5.) Steam System	51	8,006	1.6
6.) HVAC	14	5,250	0.6
7.) Metering	20	3,320	1.5
8.) Insulation	20	5,008	1.5
9.) Other	54	10,598	0.2
Total	491	107,205	1.4

5.1) Standard Feed-water Economizers - An opportunity to Save 3% to 5%.



- Approximately 30% of existing steam boilers do not have standard feed-water economizers.
- Coiled tube boilers have hot stacks.
- Many existing economizers are "out of order" (bypassed).
- Dampers stuck open or closed.
- Corrosion Failures.
- Freezing Failures.
- No Thermometers on stack or feed-water line.
- Thermometers not working.



5.2) Condensing Economizers A Few Market Factors



- In Ontario today there are approximately 25 Condensing Economizers in Operation.
- This figure exclude greenhouses (small imported Economizers)
- Some of these economizers date back to the late 1980's and early 1990's.
- A Hot Water Heat Sink is Required. This narrows the prospects down to those with high make-up rates > 50%, or cold water process loads.
- Laundries, food and beverage, textile dyeing, greenhouses, etc.
- Low end (small sized plants) product not available yet.
- Major educational campaign required, many steam plant customers do not understand this technology.

5.2) Condensing Economizers Bob's Forecast – Ultimate Potential-Ontario_Plants larger than 1000 BHP total rated capacity.



- In Ontario, 10% of Steam Boiler Plants have economic feasibility (< 3Yr Payback)
- **Total No. of Units = 10% X 1000 Plants = 100 Units**
- **Total Annual Savings = 10% X 10% X 5000 Million CU M/Yr**
= 50 Million CU M/Yr .
- **Total annual Savings = \$ 0.40 X 50 Million = \$20 Million/Yr**

6.) Useful Information - DOE “Best Practices Steam Program” Tip Sheets



Energy Tips – Steam

Steam Tip Sheet #248 • August 2007

Industrial Technologies Program

Suggested Actions

- Determine your boiler capacity, average steam production, combustion efficiency, stack gas temperature, annual hours of operation, and annual fuel consumption.
- Identify in-plant uses for heated water, such as boiler makeup water heating, preheating, domestic hot water or process water heating requirements.
- Determine the thermal requirements that can be met through installation of a condensing economizer. Determine annual fuel energy and cost savings.
- Obtain an installed cost quotation for and determine the cost-effectiveness of a condensing economizer. Ensure that system changes are evaluated and modifications are included in the design (e.g., mist eliminator, additional water treatment, heat exchangers). Simple paybacks for condensing economizer projects are often less than two years.

Consider Installing a Condensing Economizer

The key to a successful waste heat recovery project is optimizing the use of the recovered energy. By installing a condensing economizer, companies can improve overall heat recovery and steam system efficiency by up to 10%. Many boiler applications can benefit from this additional heat recovery such as district heating systems, wallboard production facilities, greenhouses, food processing plants, pulp and paper mills, textile plants, and hospitals. Condensing economizers require site-specific engineering and design, and a thorough understanding of the effect they will have on the existing steam system and water chemistry.

Use this tip sheet and its companion, *Considerations When Selecting a Condensing Economizer*, to learn about these efficiency improvements.

A conventional feedwater economizer reduces steam boiler manufacturing heat from the flue gas to the boiler feedwater the lowest temperature so which flue gas can be cooled is condensation and possible stack or stack liner corrosion.

The condensing economizer improves waste heat recovery below its dew point, which is about 135°F for products of combustion. The economizer recovers both sensible heat from the flue gas and latent heat from the condensing flue gas water vapor (See Table 1). All hydrocarbon quantities of water vapor as a combustion byproduct. The reactants and combustion products for the stoichiometric case (CH₄), the primary constituent of natural gas. When it is burned, it produces two molecules of water vapor. We found that every pound of methane fuel (4 of water vapor, which is about 12% of the total exhaust)



Energy Tips – Steam

Steam Tip Sheet #258 • July 2007

Industrial Technologies Program

Suggested Actions

- Determine your boiler capacity, combustion efficiency, stack gas temperature, annual hours of operation, and annual fuel consumption.
- Identify in-plant uses for low-temperature heated water (plant space heating, boiler makeup water heating, preheating, or process requirements).
- Verify the thermal requirements that can be met through installing a condensing economizer, and potential annual fuel energy and cost savings.
- Determine the cost-effectiveness of a condensing economizer, ensuring that system changes are

Considerations When Selecting a Condensing Economizer

Boilers equipped with condensing economizers can have an overall efficiency that exceeds 90%. A condensing economizer can increase overall heat recovery and steam system efficiency by up to 10% by reducing the flue gas temperature below its dew point, resulting in improved effectiveness of waste heat recovery.

This tip sheet is a companion to one entitled *Consider Installing a Condensing Economizer*, and discusses two types of condensing economizer: indirect and direct contact.

An indirect contact condensing economizer (see Figure 1) removes heat from hot flue gases by passing them through one or more shell-and-tube or tubular heat exchangers. This economizer can heat fluids to a temperature of 200°F while achieving exit gas temperatures as low as 75°F. The indirect contact economizer is able to preheat water to a higher outlet or process supply temperature than the direct contact economizer. The condensing economizer must be designed to withstand corrosion from condensed water vapor produced by the combustion of hydrocarbon fuels such as natural gas or light oils. The condensed water vapor is acidic and must be neutralized if it is to be discharged into the sewer system or used to generate steam.

6.1) Some Useful Websites



- www1.eere.energy.gov/industry
- www.oee.nrcan.gc.ca
- www.pipeinsulation.org
- www.heatsponge.com
- www.cleanboiler.org