

NRCan Boiler Efficiency Calculator

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ACKNOWLEDGEMENT

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PURPOSE

- Natural Resources Canada has developed an online Boiler Efficiency Calculator to help managers quickly analyze the efficiency of boiler operations associated with heating and steam plants fired by natural gas and fuel oil.

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PURPOSE

- By estimating the efficiencies of steam / hot water boilers, with input firing rates of 10 to 200 GJ/h (9.5 to 190 MMBtu/h), this online tool will help make informed decisions related to changes such as:
 - upgrading control systems
 - installing additional heat exchangers, economizers and air heaters
 - replacing existing systems with new, more efficient equipment.
 - improved operating practices and optimized set points

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DISCLAIMER

- The Boiler Efficiency Calculator (BEC) produces results which are based on simplifying assumptions, primarily with respect to fuel composition, and are only intended for general information purposes. The results should not be used to determine efficiency for contractual purposes, such as for boiler acceptance tests. The BEC is not intended to serve as a guide to be used in investment or other commercial activities. The authors and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, be it direct, consequential, financial or otherwise, arising from, or related to, the use of this information.

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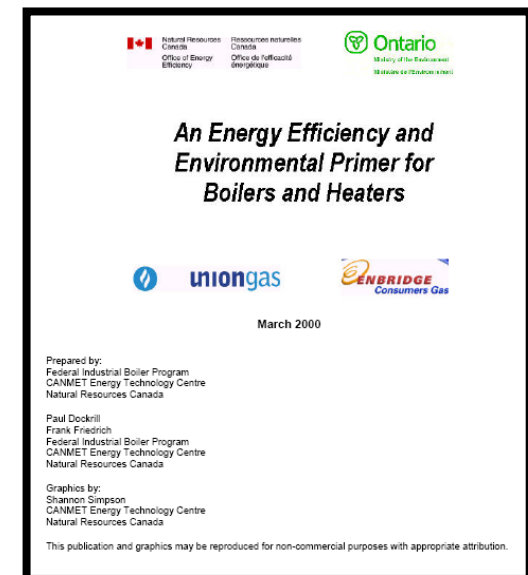
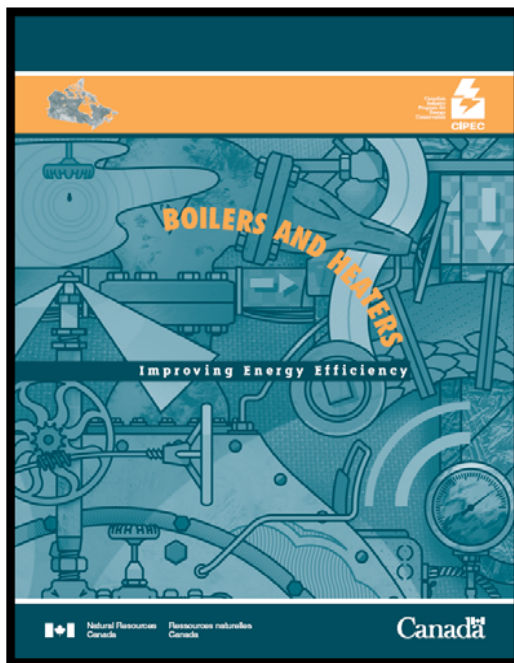
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BASIS OF CALCULATOR

- The American Society of Mechanical Engineers' Power Test Code for Steam Generating Units (PTC 4.1-1964, re-affirmed 1973, also ANSI PTC 4.1-1974, re-affirmed 1985).

http://www.energysolutionscenter.org/BoilerBurner/Eff_Improve/Index/Index_Boiler_Eff_Start.asp



<http://oee.nrcan.gc.ca/publications/infosource/pub/cipec/boilersheaters.pdf>

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STEP 1 - REGISTER

Contact Information

First Name*:

Last Name*:

Company*:

Title:

Address:

City*:

Province*:

Postal Code:

E-mail*:

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STEP 2 – LOG IN

Calculate Boiler Efficiency:

Password:



STEP 3 – ENTER DATA

Site / Boiler Info.

Capacity

Load %

Temperatures

Flue Gas Oxygen %

* denotes a required field

Step 1 - Select Fuel Type*

Refer to the [Ultimate Analysis](#) by fuel type.

Step 2 - Identify your Company & Boiler
This information will be displayed on the results page to identify the boiler system being tested.

Company Name

Boiler Name

Boiler Serial Number

Maximum Capacity Rating (MCR):*

Select one of the following:* lb/h (steam boilers, unit in lb/h)
 MMBtu/h (high temp. water generators, unit in millions of Btu/h)

Check this box to calculate the efficiency with an [economizer](#)
The calculator will display both results to determine the benefits of an economizer

Step 3 - Input Your Test Data
Enter data for up to five test points over the boiler operating range:

	Test	1	2	3	4	5
Unit Load * (0% - 100%)	%	<input type="text" value="20"/>	<input type="text" value="40"/>	<input type="text" value="60"/>	<input type="text" value="80"/>	<input type="text" value="100"/>
Boiler Exit Flue Gas Temperature (FGT) * (°C: 32 - 310) (°F: 0 - 500)	<input checked="" type="radio"/> °F <input type="radio"/> °C	<input type="text" value="235"/>	<input type="text" value="240"/>	<input type="text" value="245"/>	<input type="text" value="250"/>	<input type="text" value="265"/>
Economizer Exit Flue Gas Temperature (EFGT) * (°C: 32 - 310) (°F: 0 - 500)	<input checked="" type="radio"/> °F <input type="radio"/> °C	<input type="text" value="115"/>	<input type="text" value="120"/>	<input type="text" value="125"/>	<input type="text" value="130"/>	<input type="text" value="140"/>
Combustion Air Temperature (CAT) * (°F: 21 - 212) (°C: -2 - 100)	<input checked="" type="radio"/> °F <input type="radio"/> °C	<input type="text" value="82.5"/>	<input type="text" value="82.5"/>	<input type="text" value="82.5"/>	<input type="text" value="82.5"/>	<input type="text" value="82.5"/>
%Oxygen in Flue Gas * (0% - 21%)	<input type="radio"/> O _{2wet} <input checked="" type="radio"/> O _{2dry}	<input type="text" value="4"/>	<input type="text" value="3.5"/>	<input type="text" value="3"/>	<input type="text" value="2.5"/>	<input type="text" value="2"/>
Unaccounted Losses (Lu) * (0% - 10%)	%	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>



STEP 4 – CALCULATED RESULTS

Boiler Efficiency Calculator Results

Shows Benefit of an Economiser.

Radiation Losses Relatively Constant, thus Higher % at Lower Input. Estimated from ABMA Data.

Unaccounted Losses Normally ~ 0.1% for Natural Gas.

[Plot Graph](#)
[Generate Excel File](#)
[Print Report](#)

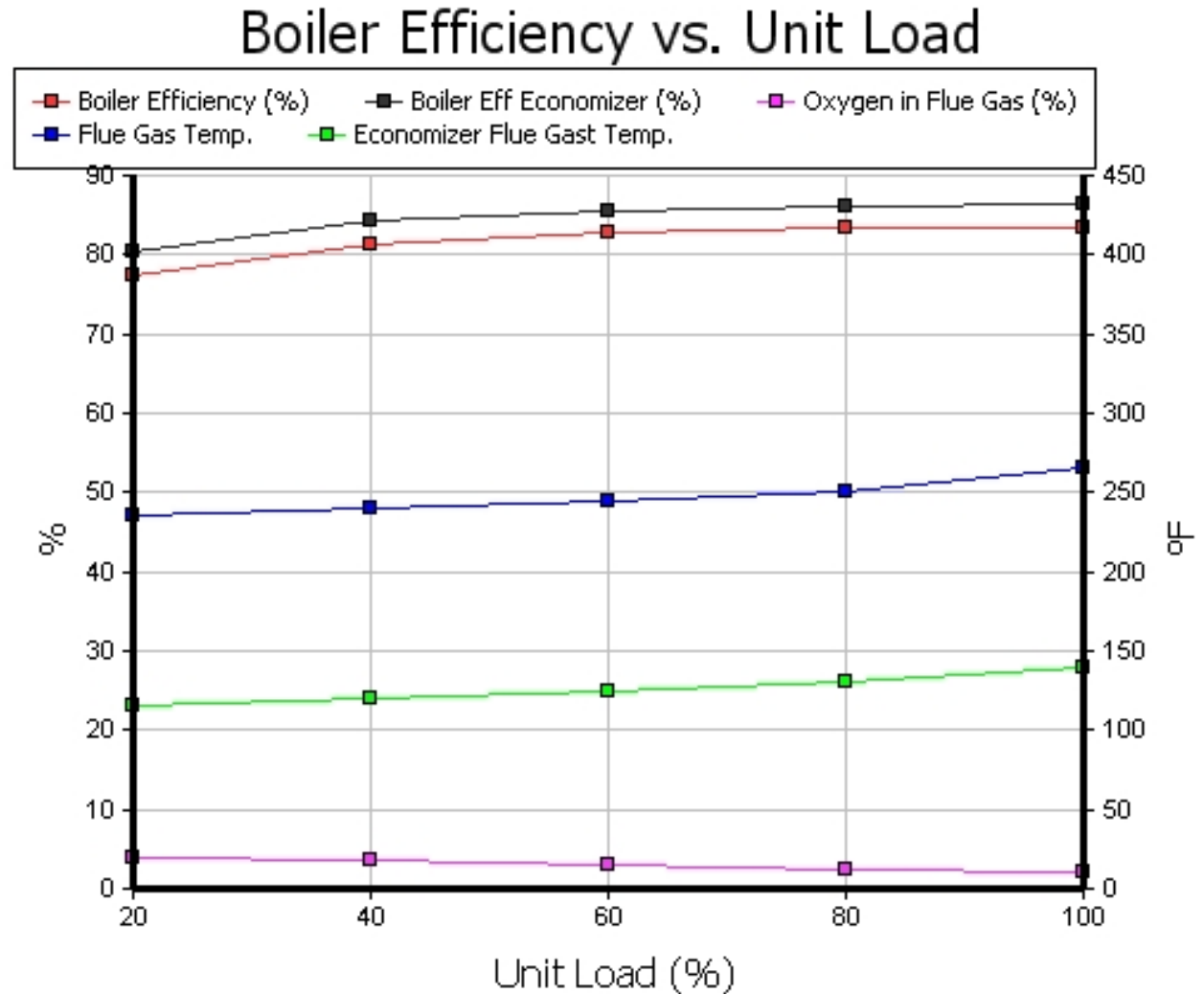
Company Name: **CanmetENERGY**
 Boiler Name: **Blaster 5000**
 Boiler Serial Number: **abc-xyz**
 Fuel Type: **Natural Gas**

	Test	1	2	3	4	5
% CO ₂ in Flue Gas	%	9.14	9.42	9.70	9.98	10.26
Dry Flue Gas (DG)	lb/lb fuel	19.44	18.88	18.35	17.86	17.39
Excess Air (EA)	%	20.73	17.63	14.70	11.92	9.29
Boiler Efficiency (100-Lt)	%	77.47	81.44	82.74	83.38	83.52
Boiler Efficiency with Economizer (100-Lte)		80.44	84.34	85.58	86.15	86.35
Losses						
Dry Flue Gas Loss (Ldg)	%	3.11	3.12	3.13	3.14	3.33
Dry Flue Gas Loss with Economizer (Ldg)		.66	.74	.82	.89	1.05
Flue Gas Loss due to moisture (Lh)	%	10.42	10.44	10.46	10.48	10.55
Flue Gas Loss due to moisture with Economizer (Lh)		9.89	9.92	9.94	9.96	10.00
Stack Losses (Ls) (Ls = Ldg + Lh)	%	13.53	13.56	13.59	13.62	13.88
Stack Losses with Economizer (Ls) (Ls = Ldg + Lh)		10.56	10.66	10.76	10.85	11.05
Radiation and Convection Loss (Lr)	%	8.00	4.00	2.67	2.00	1.60
Radiation and Convection Loss with Economizer (Lr)		8.00	4.00	2.67	2.00	1.60
Unaccounted Losses (Lu)	%	1.00	1.00	1.00	1.00	1.00
Unaccounted Losses (Lu)		1.00	1.00	1.00	1.00	1.00
Total Losses (Lt) (Lt = Ls + Lr + Lu)	%	22.53	18.56	17.26	16.62	16.48
Total Losses with Economizer (Lt) (Lt = Ls + Lr + Lu)		19.56	15.66	14.42	13.85	13.65



STEP 5 – OUTPUT RESULTS

A Graph Can be Plotted & Printed



STEP 5 – OUTPUT RESULTS

Save Data in Excel Format

Boiler Efficiency Calculator Results

Excel file: [oee62162257.xls](#)

To download the above Excel file, right click on the file name and select "Save As".

[< Back](#)

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WEB SITE



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Commercial and Institutional Organizations

Boiler Efficiency Calculator

Natural Resources Canada has developed an online Boiler Efficiency Calculator to help managers quickly analyze the efficiency of boiler operations associated with heating and steam plants fired by natural gas and fuel oil.

By estimating the efficiencies of steam boilers and high temperature water generators, such as those used in central heating and industrial steam generation (with input firing rates of 10 to 200 GJ/h), this online tool will help companies make informed decisions and investments that lead to performance optimization, such as:

- upgrading control systems
- installing additional heat exchangers, economizers and air heaters
- replacing existing systems with new, more efficient equipment.

Boiler Efficiency Calculator
About the Calculator
Register
Energy Losses
Methodology
Boiler Economizers
Sample Output
Contact Us

Calculate Boiler Efficiency:

Password:



There are numerous energy losses from a boiler. While most of them are minor, and comprise about 1% or less of fuel input, there are two or three major losses that typically represent 10 to 20 % of fuel input. The Boiler Efficiency Calculator focuses on these latter losses and the factors that contribute to them.

KEY FACTS

- **What are the key inputs and outputs of the specific tool?**
 - **As Shown in Previous Slides.**
- **For which applications/situations/uses is this tool best suited?**
 - **Before & After Comparisons Based on Measurements.**
- **What is the value of this tool for programs?**
 - **Determine Efficiency Improvements & Fuel Cost Savings, Estimate Simple Payback Period.**

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