Reinhold Environmental Ltd.

2008 NOx-Combustion Round Table & Expo Presentation

February 4-5, 2008 in Richmond, VA

Mechanisms for Running the Boiler More Efficiently

Reinhold Environmental
NOx/Combustion Roundtable
February 4, 2008

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Manager of Engineering & Estimating

“Sub-Title”

How Does SCR Operation Impact Boiler Efficiency?

Outline

- The Past
- The Present
- Ground Rules
- The Problem
- Is There a Solution

In The Beginning...

Ozone Season Operation

In The Beginning...

Ozone Season Operation

Larger Units

In The Beginning...

Ozone Season Operation

Larger Units

Base Loaded

In The Beginning...

Ozone Season Operation

Larger Units

Base Loaded

~10 Years Later...

Year Round Operation

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Year Round Operation

Smaller Load Following Units

~10 Years Later...

Year Round Operation

Smaller Load Following Units

Higher % Operation at Reduced Loads

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Year Round Operation

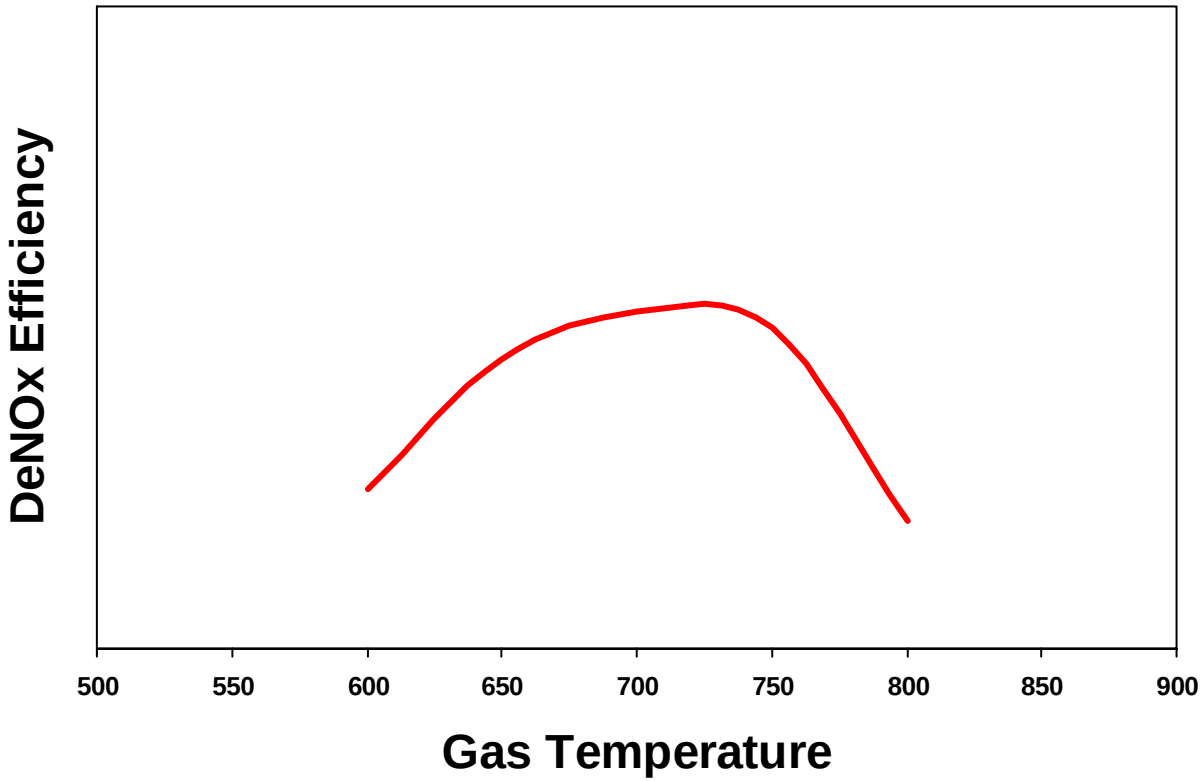
Smaller Load Following Units

Higher % Operation at Reduced Loads

The Ground Rules:

SCR's prefer to operate at higher temperatures

Typical Catalyst Efficiency



SCR Flue Gas Temperature

Ideally: ***700 to 750 F***

Maximum: ***800 to 850 F***

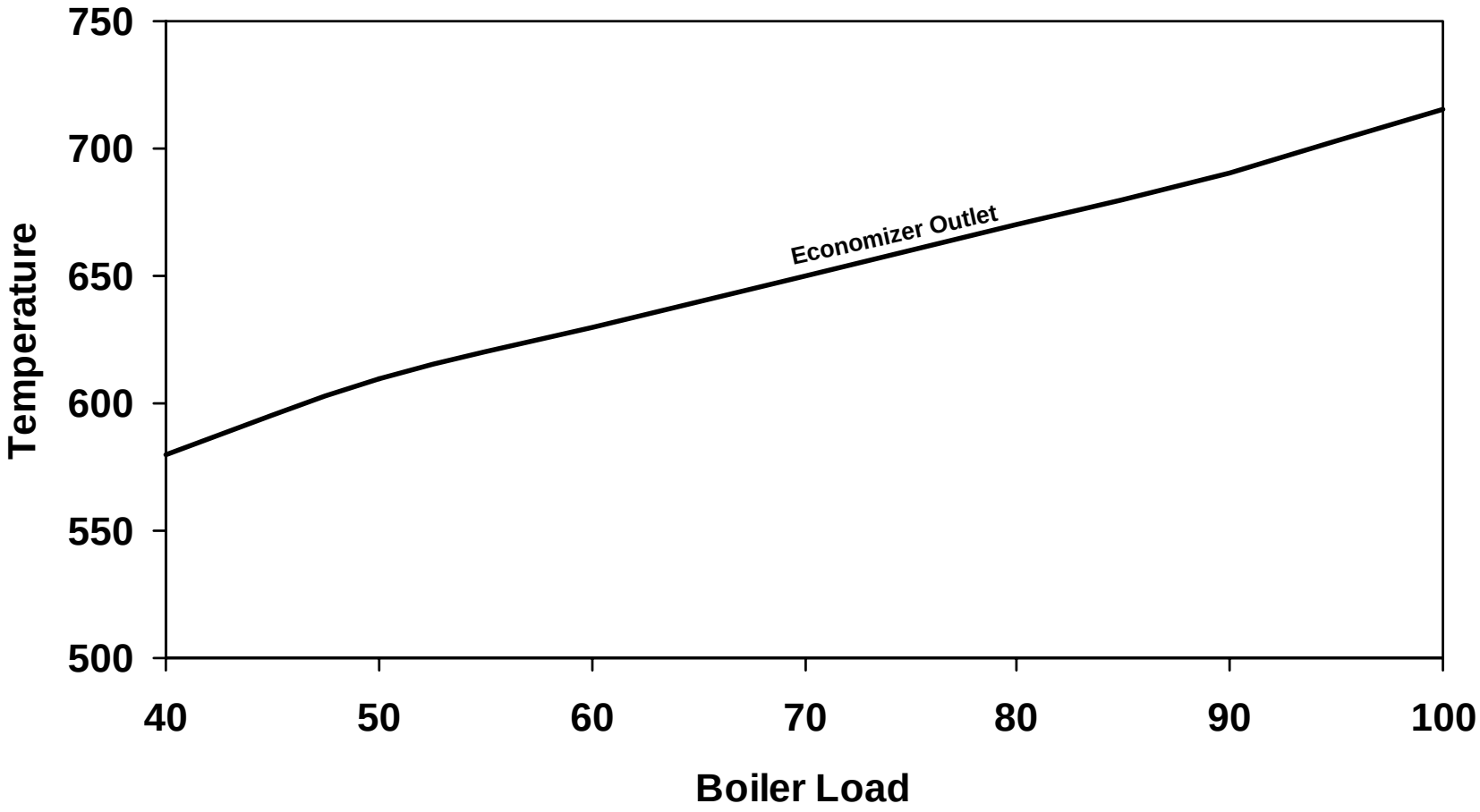
Minimum: ***Depends on fuel sulfur content; Higher sulfur, higher temp.***

The Ground Rules:

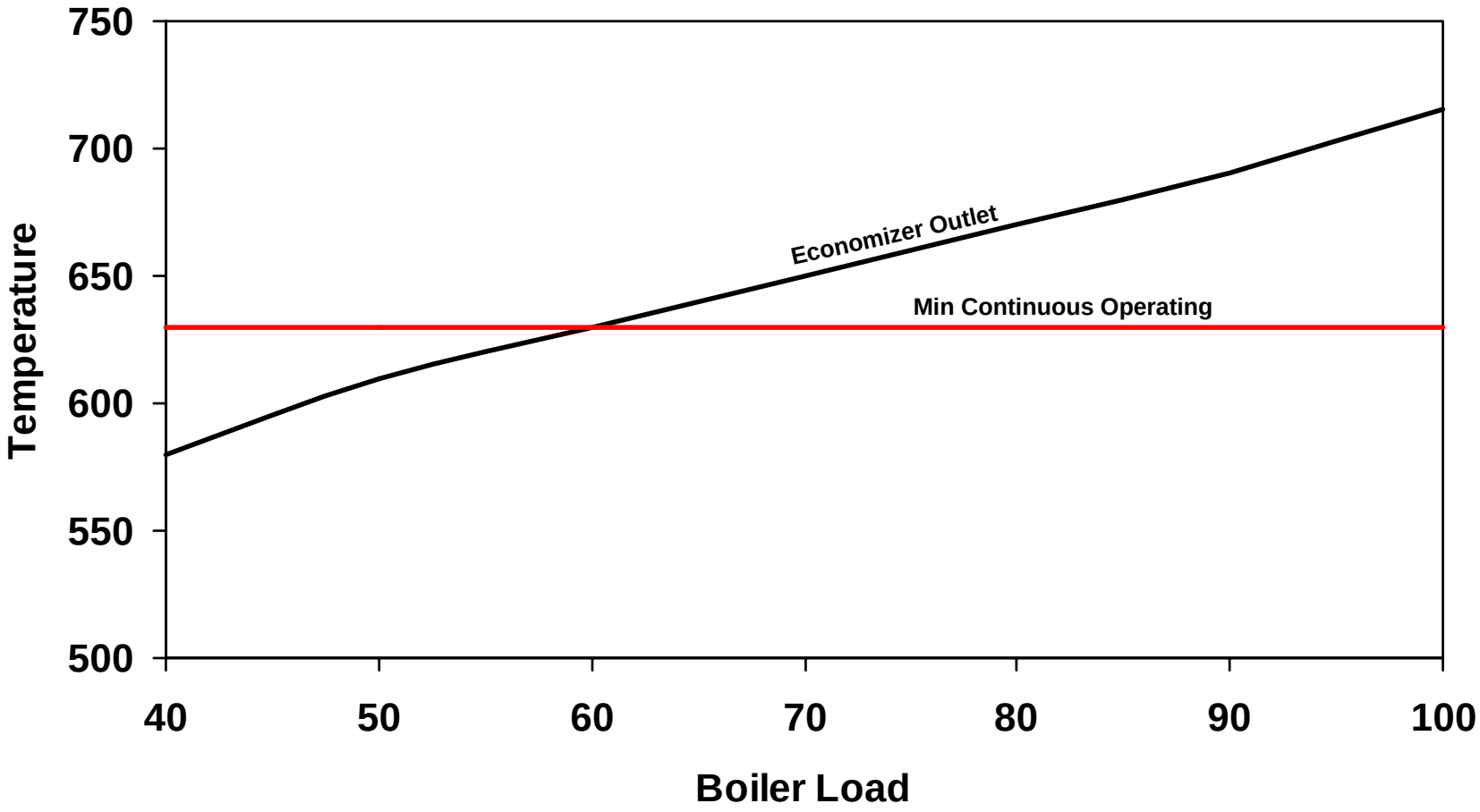
SCR's prefer to operate at higher temperatures

Tg to SCR Drops as a function of load

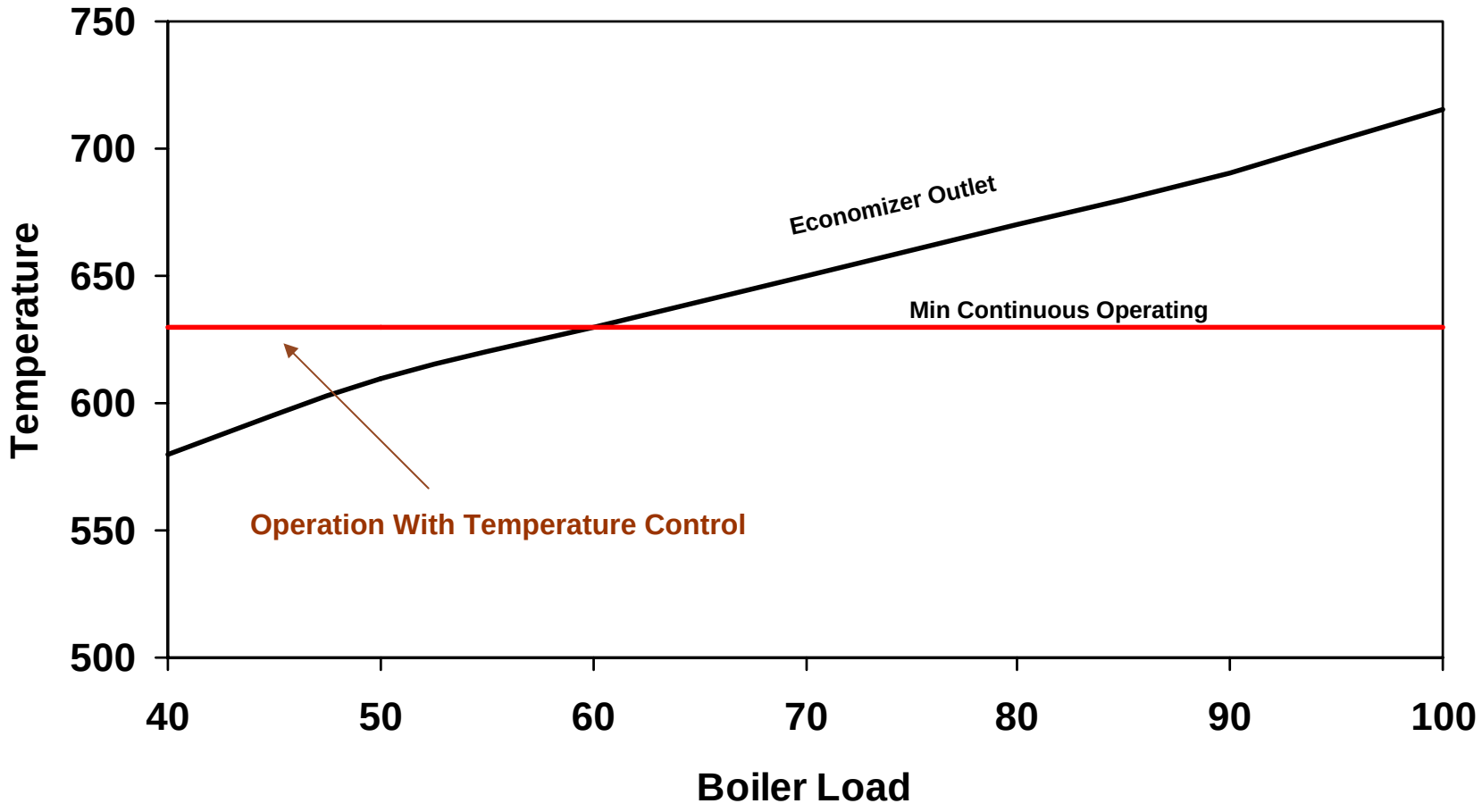
Typical SCR Operating Temperatures



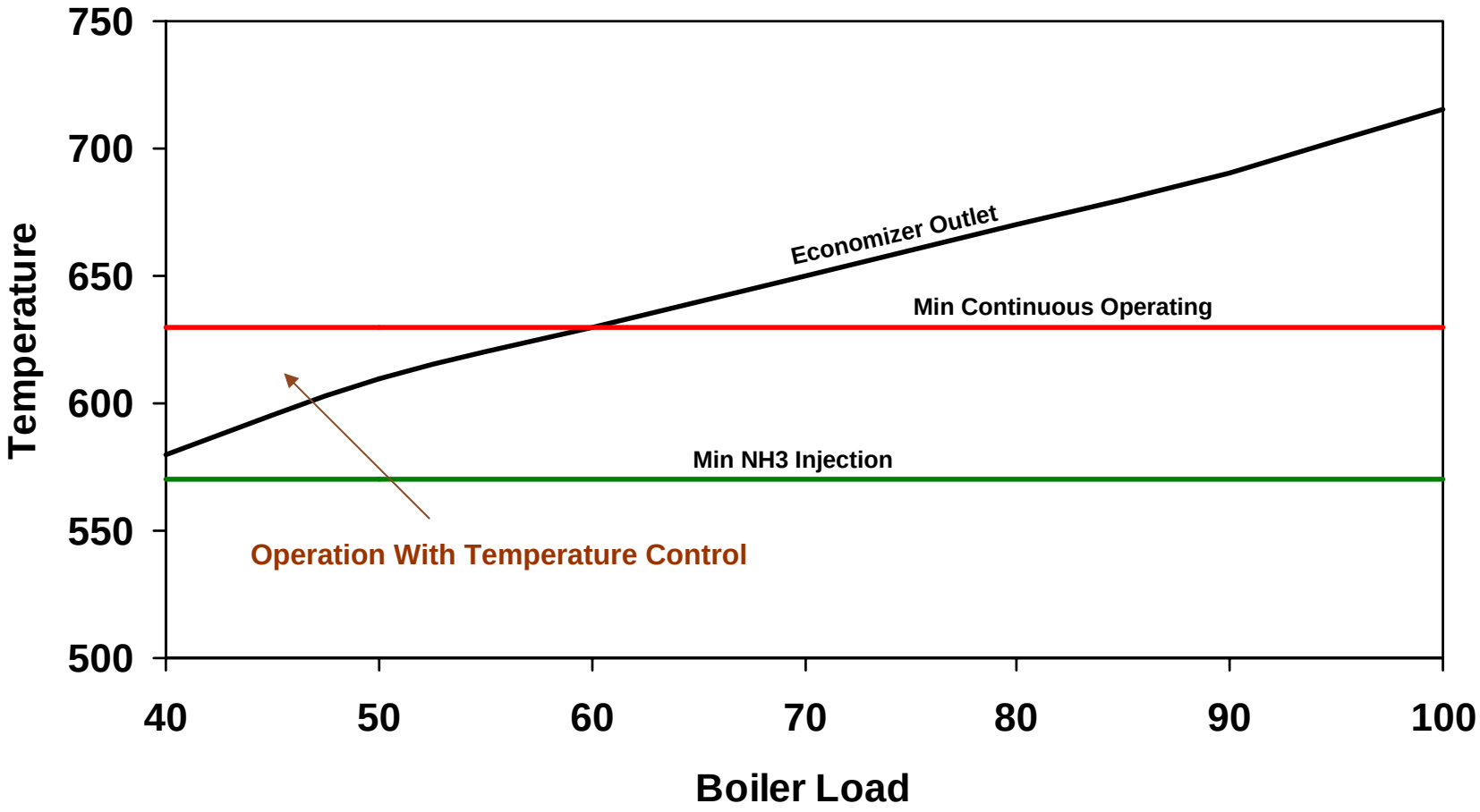
Typical SCR Operating Temperatures



Typical SCR Operating Temperatures



Typical SCR Operating Temperatures



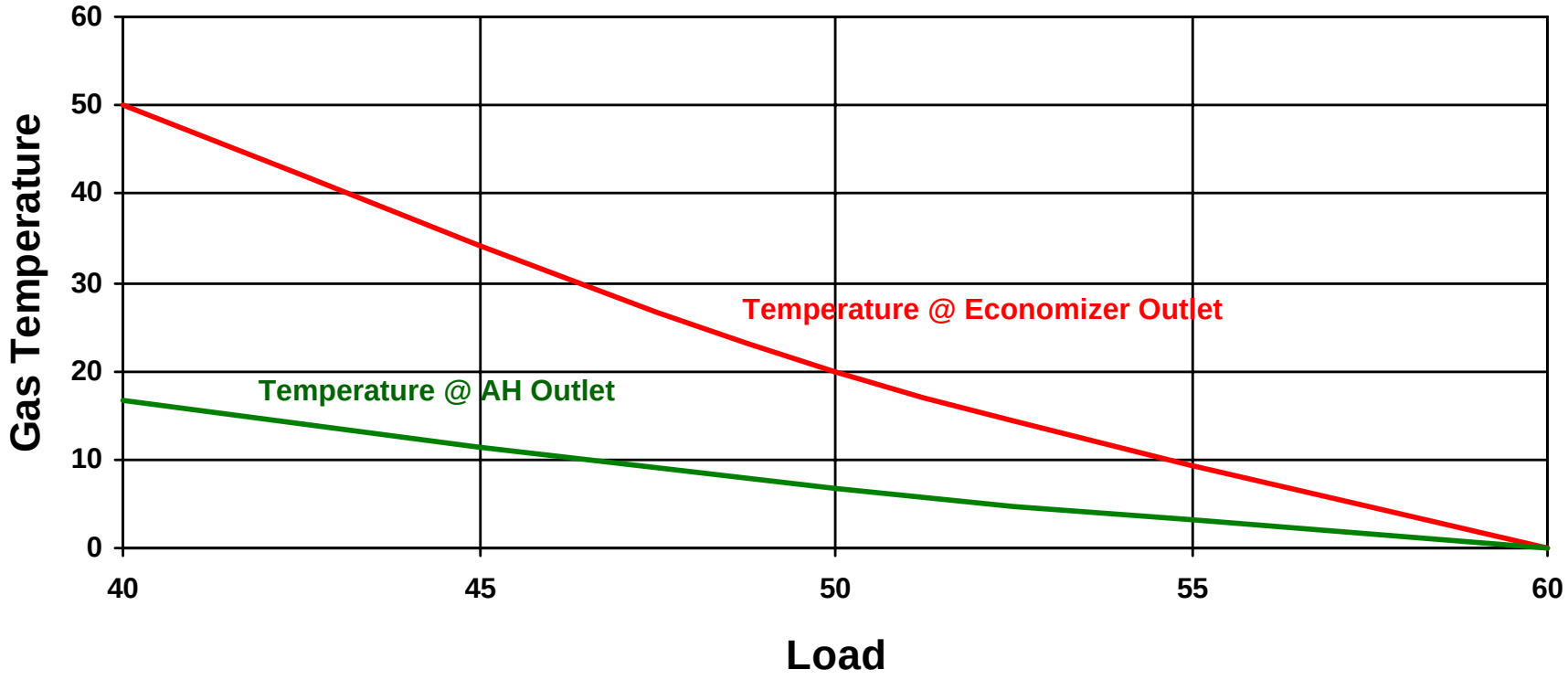
The Ground Rules:

SCR's prefer to operate at higher temperatures

Tg to SCR Drops as a function of load

60F Increase In Economizer Outlet Temp = 20F Increase At AH Outlet

Changes Due to Temperature Control



The Ground Rules:

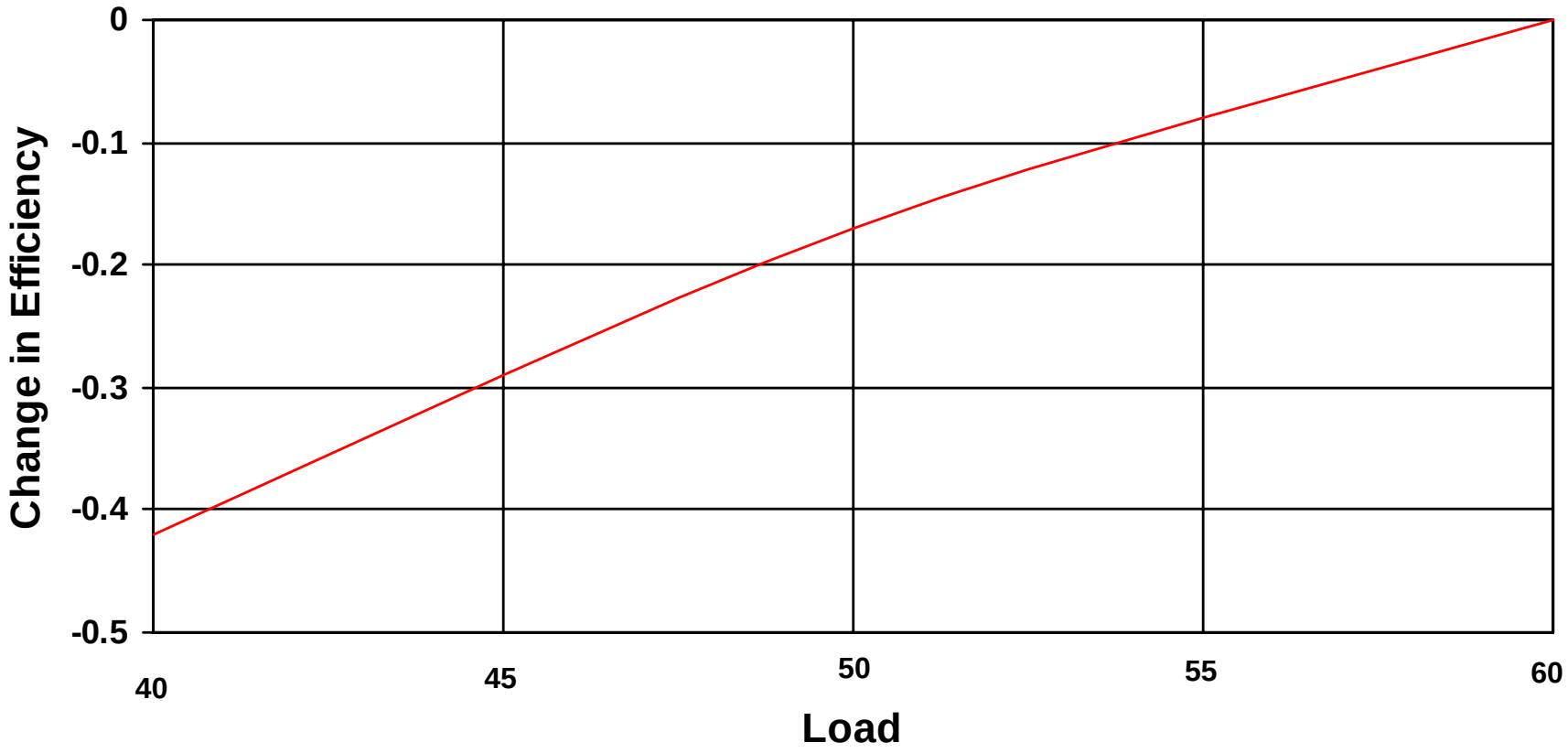
SCR's prefer to operate at higher temperatures

Tg to SCR Drops as a function of load

60F increase in econ outlet temp = 20F increase at AH outlet

20F increase in AH outlet temp = 0.5% efficiency loss

Change in Boiler Efficiency With Temperature Control



What's The Answer?

Any Solution Will Be Site Specific

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Dependant On:

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Fuel Characteristics

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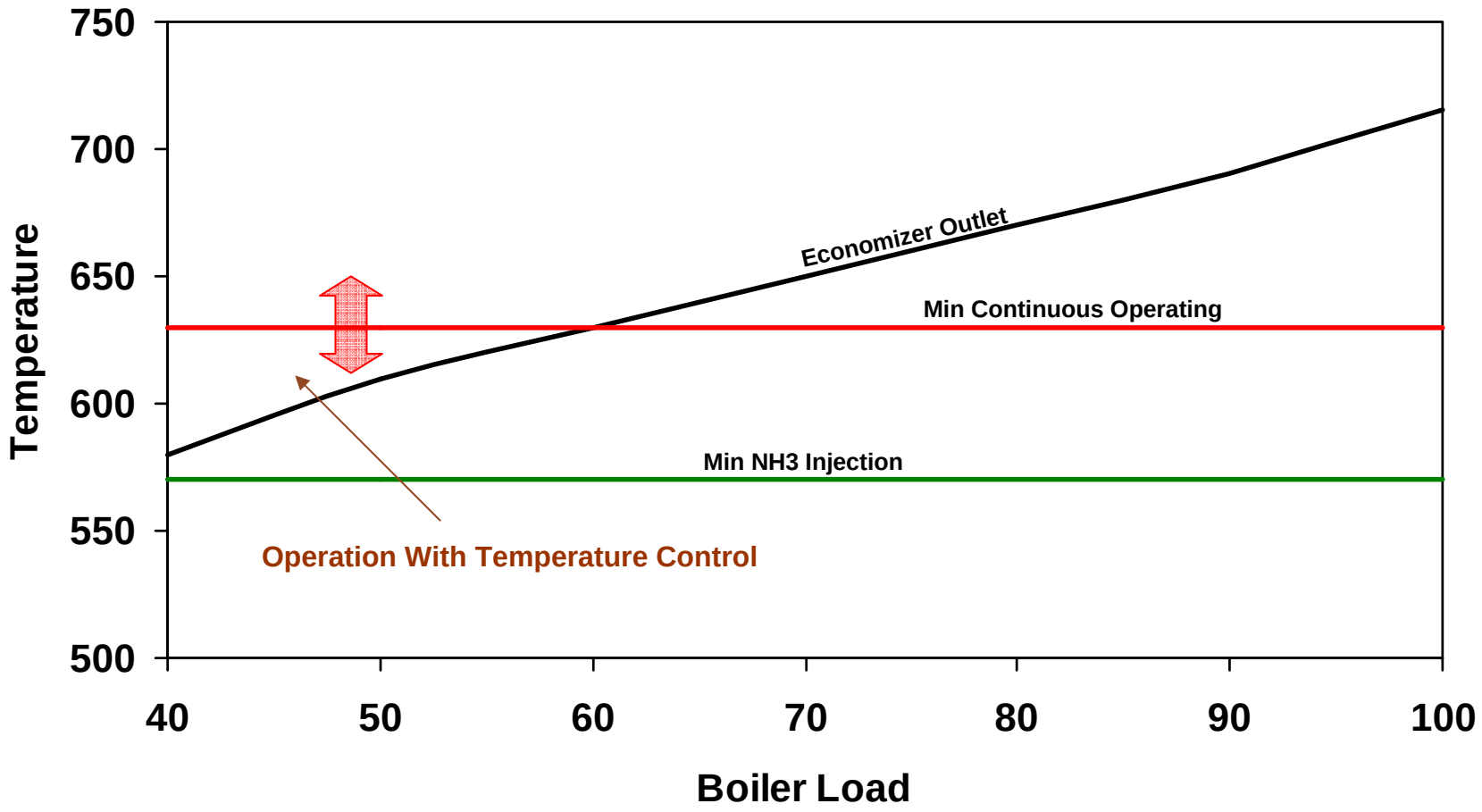
Specifically the minimum continuous operating temperature is a function of the %S

Typical SCR Operating Temperatures



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Boiler Operating Characteristics

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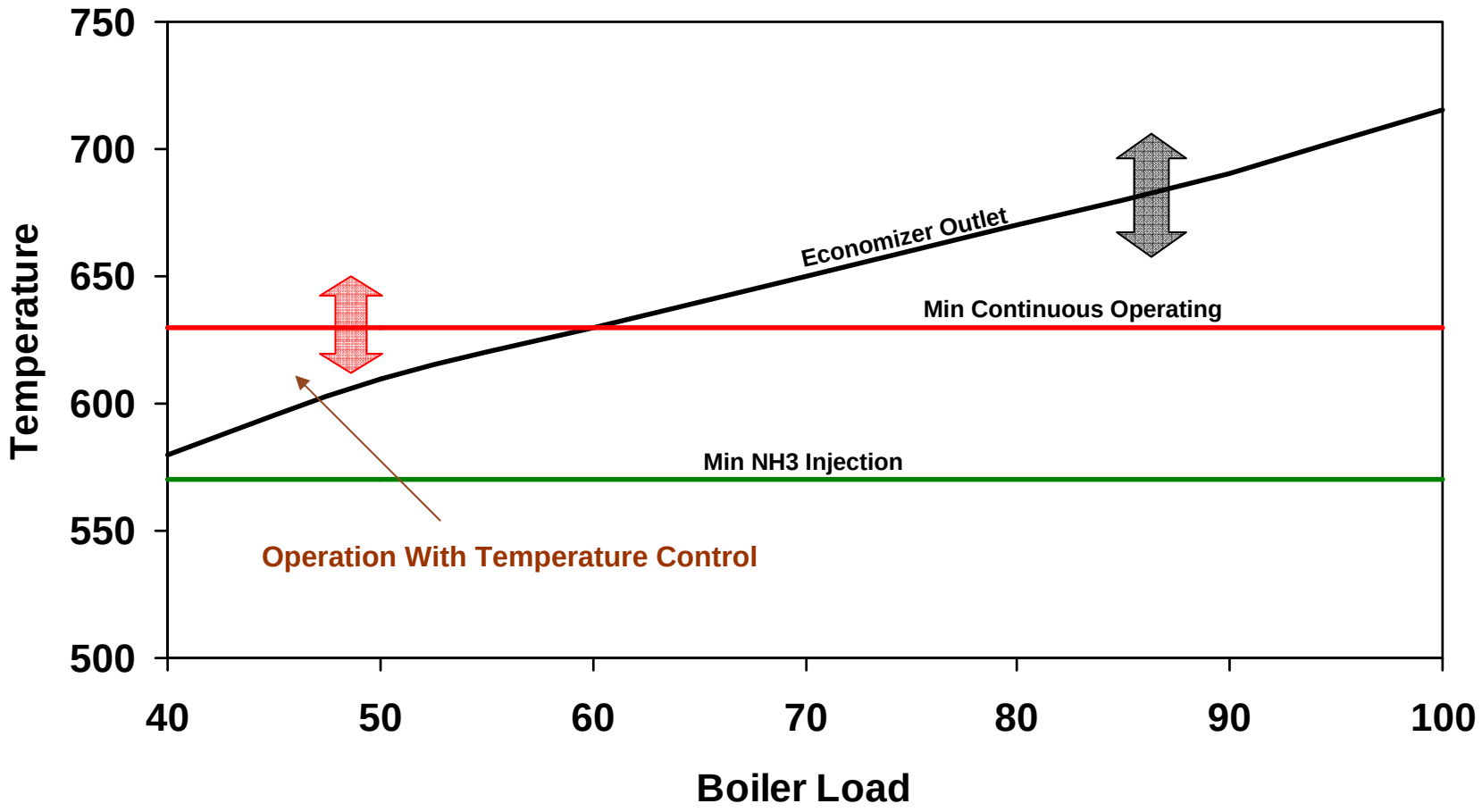
Boiler Operating Characteristics

What is the characteristic curve of Economizer outlet temperature vs load?

What is the practical minimum cold end temperature for the AH?

Typical SCR Operating Temperatures



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Dependant On:

- Fuel Characteristics
- Boiler Operating Characteristics

Load Patterns

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Dependant On:

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Load Patterns

How often does the unit operate below the minimum continuous operating temperature?

What is the duration of operation below this temperature?

What's The Answer?

Any Solution Will Be Site Specific

Dependant On:

- Fuel Characteristics
- Boiler Operating Characteristics
- Load Patterns

The Expensive Solution

Install Economizer Surface Downstream of the SCR

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Economics Will Work Only If Operation Is Required For Prolonged Periods Considerably Below The Minimum Continuous Operating Temperature

Emerging Solution

Limited Duration Operation Below The Minimum Continuous Operating Temperature Followed By Operation Well Above The Minimum Continuous Operating Temperature.

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Requires Testing In Cooperation With Your Catalyst Supplier.

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There Is Published Evidence That Suggests The ABS Will Revolitalize

Summary

Current Requirements Will Require More Operation At Lower Loads

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Controlling The Gas Temperature Usually Results In Reduced Boiler Efficiency

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Options To Improve This Situation Are Limited And Site Specific

Summary

- Current Requirements Will Require More Operation At Lower Loads
- Low Load Operation Usually Requires Controlling The Gas Temperature To The SCR
- Controlling The Gas Temperature Usually Results In Reduced Boiler Efficiency
- Options To Improve This Situation Are Limited And Site Specific

Questions?

The End

Thank You