

# Sensors and Environmental Compliance

Helping you to meet your environmental obligations

## Good Reasons for Environmental Controls

- Health protection
    - Asthma, allergies, cancer, . . .
  - Protection of Environment
    - Deforestation, water pollution, . . .
  - Climate protection
    - Global warming, desertification, . . .
- 
- Regulations on environmental protection and emission control can help to
    - Reduce emissions
    - Increase plant efficiency



# Emission Products from Combustion

| Component  | Source                                | Environmental Impact         |
|------------|---------------------------------------|------------------------------|
| $N_2$      | from combustion air (inert)           | -                            |
| $H_2O$     | from combustion air + reaction result | -                            |
| $O_2$      | unburned combustion air               | -                            |
| $CO_2$     | result of complete combustion         | greenhouse gas               |
| $CO$       | result of incomplete combustion       | toxic, inflammable           |
| $NO, NO_2$ | combustion of impurities in fuel      | very toxic, causes acid rain |
| $SO_2$     | combustion of impurities in fuel      | toxic, causes acid rain      |
| Dust       | result of combustion of solids        | cancerous                    |
| $C_nH_m$   | result of incomplete combustion       | cancerous                    |
| $HCl$      | combustion of impurities in fuel      | very toxic & corrosive       |
| $HF$       | combustion of impurities in fuel      | very toxic & corrosive       |
| $Hg$       | impurity in fuel                      | soil pollution               |

## Legislative Controls

Large Combustion Plant Directive – LCPD

2001/80/EC

SO<sub>2</sub>

NO<sub>x</sub>

Dust

Let's focus on  
one common  
component

Waste Incineration Directive – WID

2000/76/EC

SO<sub>2</sub>

NO<sub>x</sub>

CO

HCl

VOC

Dust

**NO<sub>x</sub> – *Where Does It Come From?***

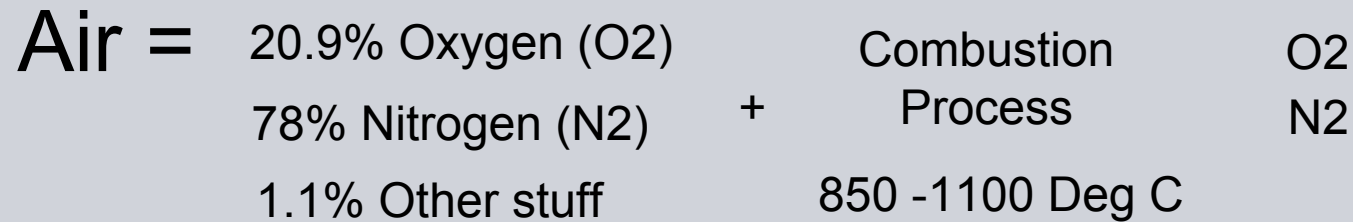
Air as a pollutant

*What??*

Run that one past me again!!

## NOx – *Where Does It Come From?*

Essentially, from the decomposition of air -



O O N N

NO

NO<sub>2</sub>

= Generic "NOx"

N<sub>2</sub>O

.....

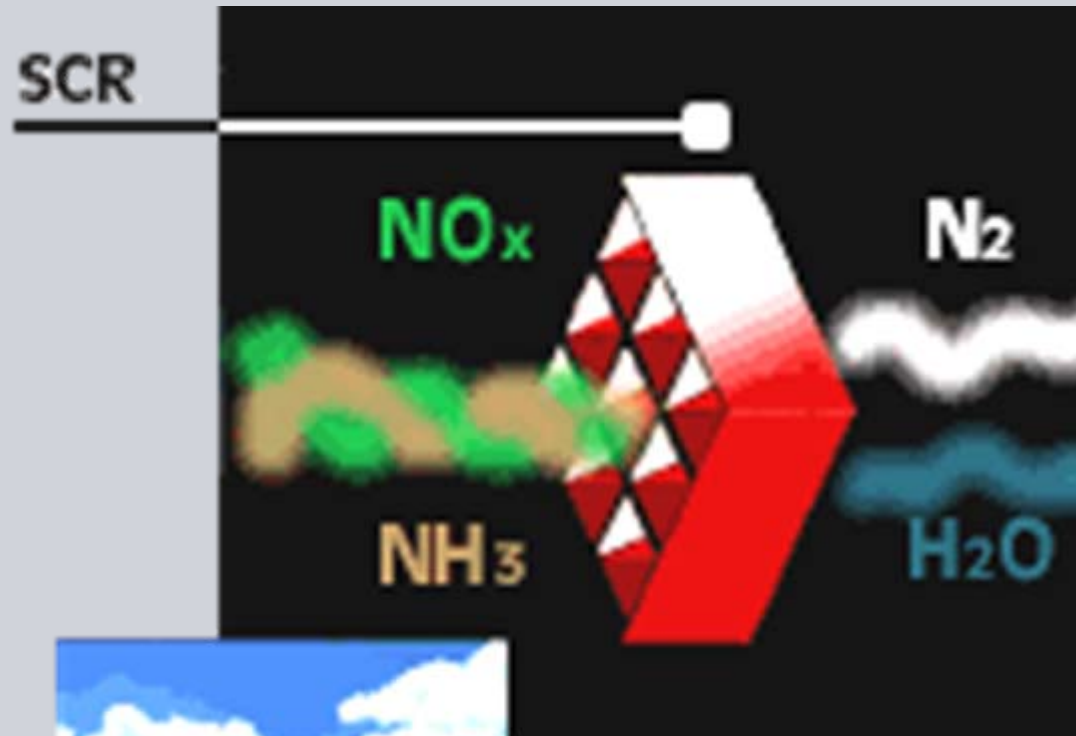
## NO<sub>x</sub> – *How Do We Get Rid Of It?*

Options:

|                            |       |   |
|----------------------------|-------|---|
| Reduce Peak Temperature    | ✗     | Dictated by Process                             |
| Reduce Residence Time      | ✗     | Dictated by Process                             |
| Improve Combustion Process | ✗ ½ ✓ | Low NO <sub>x</sub> Burner                      |
| Alternative Fuels          | ✗     | Dictated by Process                             |
| Abatement Methods          | ✓     | Selective Catalytic/<br>Non-Catalytic Reduction |

## NO<sub>x</sub> – The SCR / SNCR Abatement Process

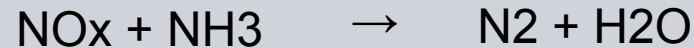
The Process:



The addition of Ammonia or Urea into the gas stream, with or without a catalyst

## NO<sub>x</sub> – The SCR / SNCR Abatement Process

The Chemistry:



By Selective Non-Catalytic Reduction:

typically Ammonium Hydroxide NH<sub>4</sub>OH

By Selective Catalytic Reduction:

Urea (NH<sub>2</sub>)<sub>2</sub>CO

Excessive or uncontrolled injection of abatement media can lead to

**Ammonia Slip**

## NOx – The SCR / SNCR Abatement Process

The Process:

Causes of Ammonia Slip -

- Wrong temperature for reaction
- Poor gas mixing
- Spent / damaged catalyst

Effects of Ammonia Slip -

- Ammonia release to atmosphere (irritant & pollutant)
- Deposition of Ammonia Salts on cold surfaces (maintenance)

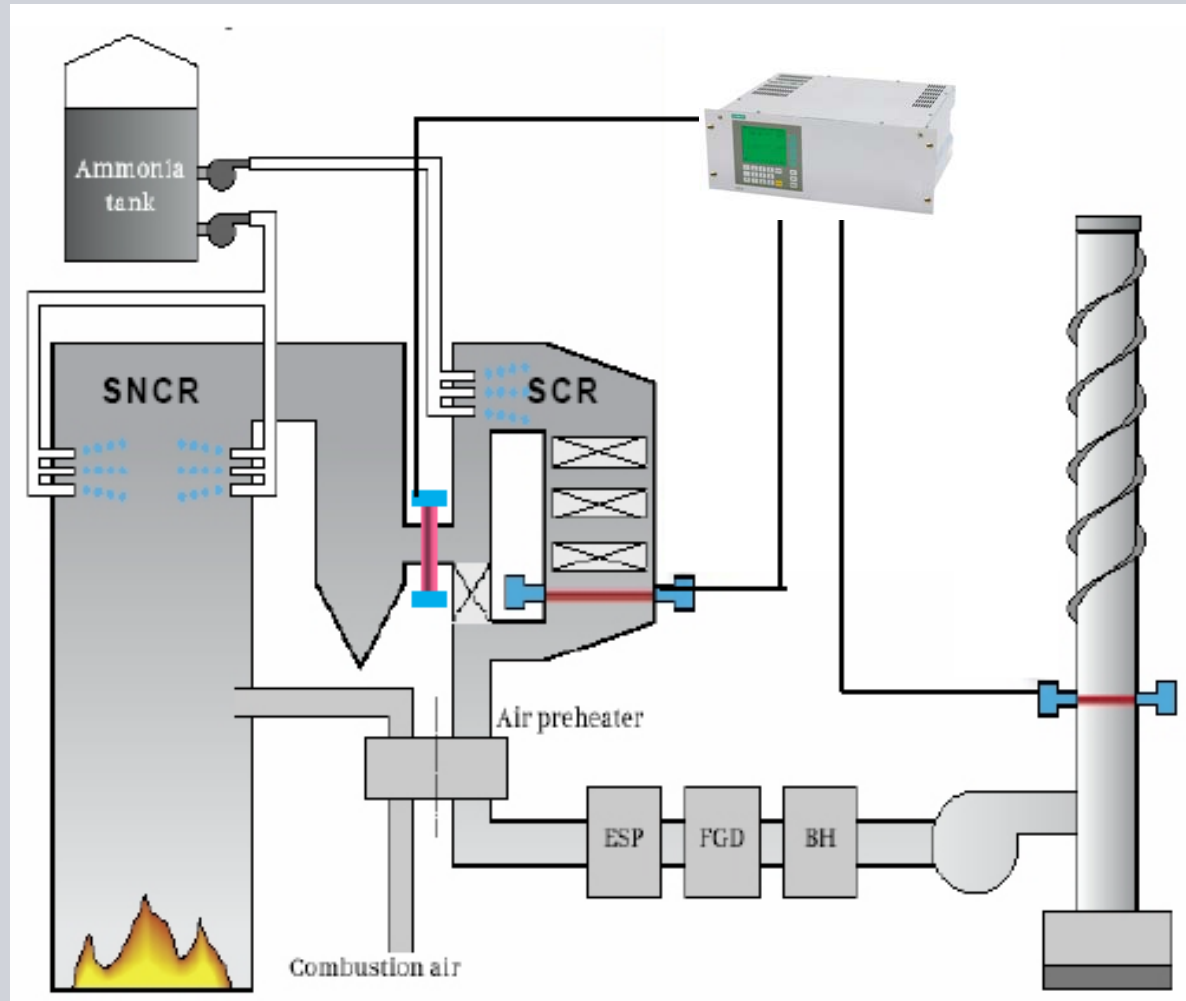
We need to reduce the release of un-reacted Ammonia

The use of fast response, insitu laser gas analyser for NH<sub>3</sub> slip control

# NOx – The SCR / SNCR Abatement Process

The Process:

A typical  
Incinerator



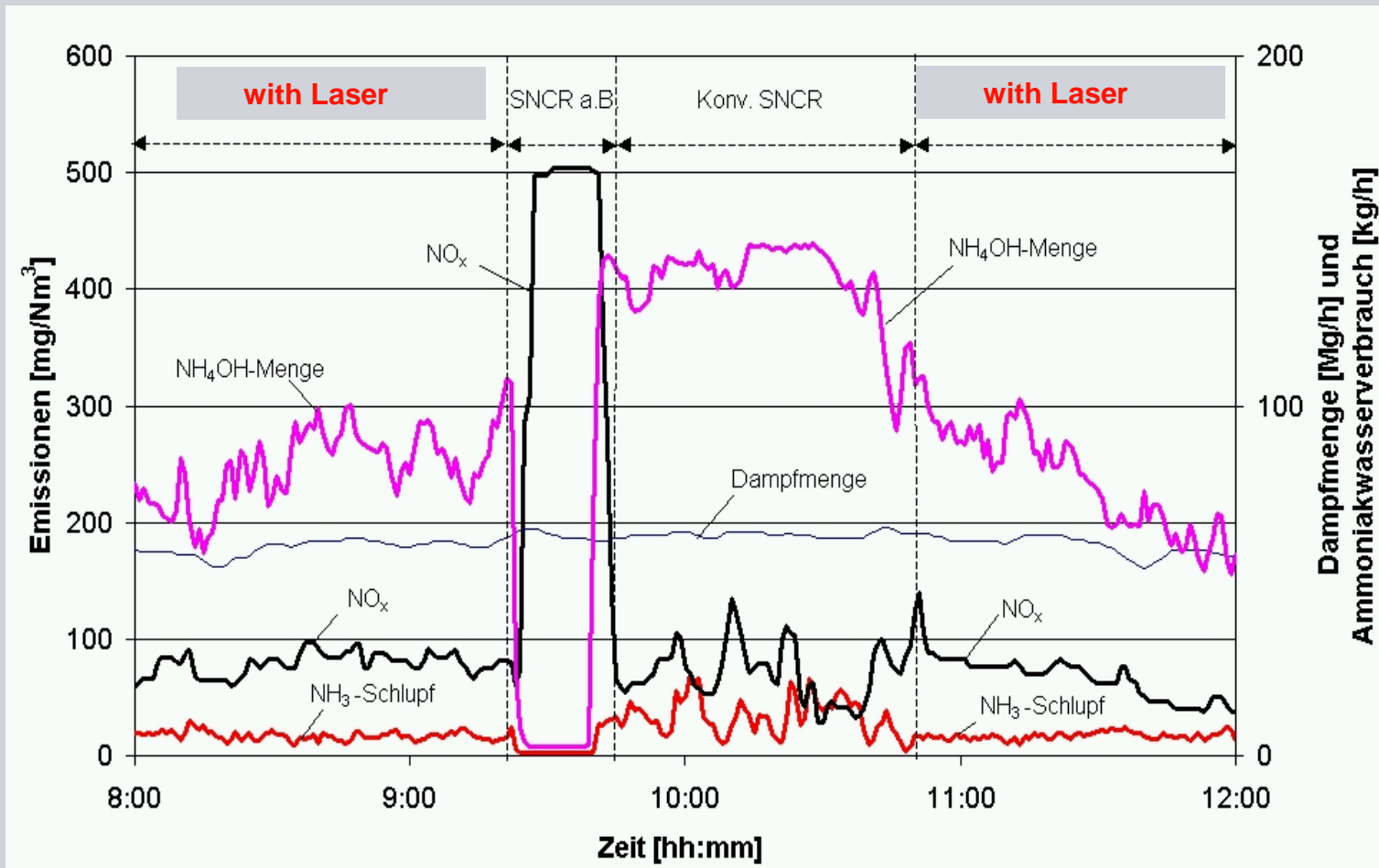
## NOx – The SCR / SNCR Abatement Process

Typical Insitu Laser Gas Analyser:



# NO<sub>x</sub> – The SCR / SNCR Abatement Process

The Results:



## **NO<sub>x</sub> – The SCR / SNCR Abatement Process**

The Benefits:

**Optimisation of SCR/SNCR DeNO<sub>x</sub> plant  
by fast in-situ control of NH<sub>3</sub> slip:**

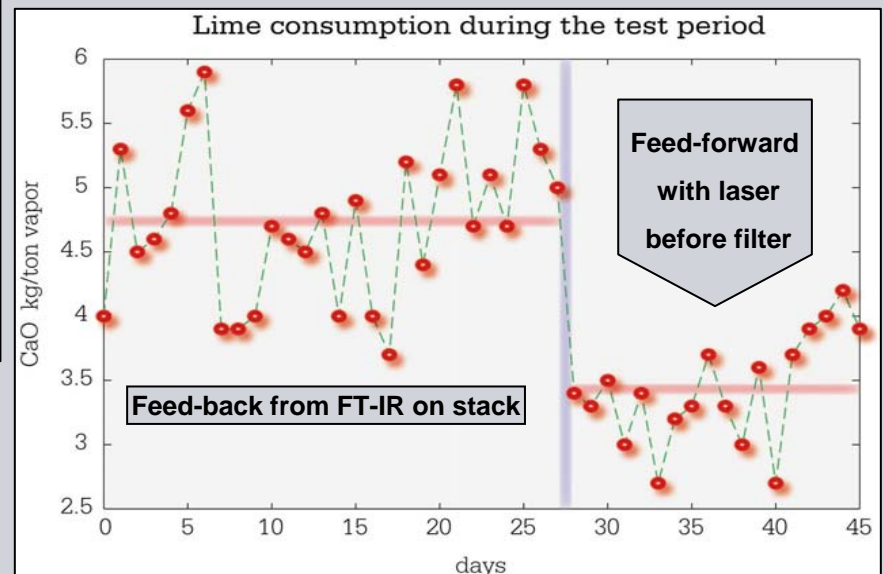
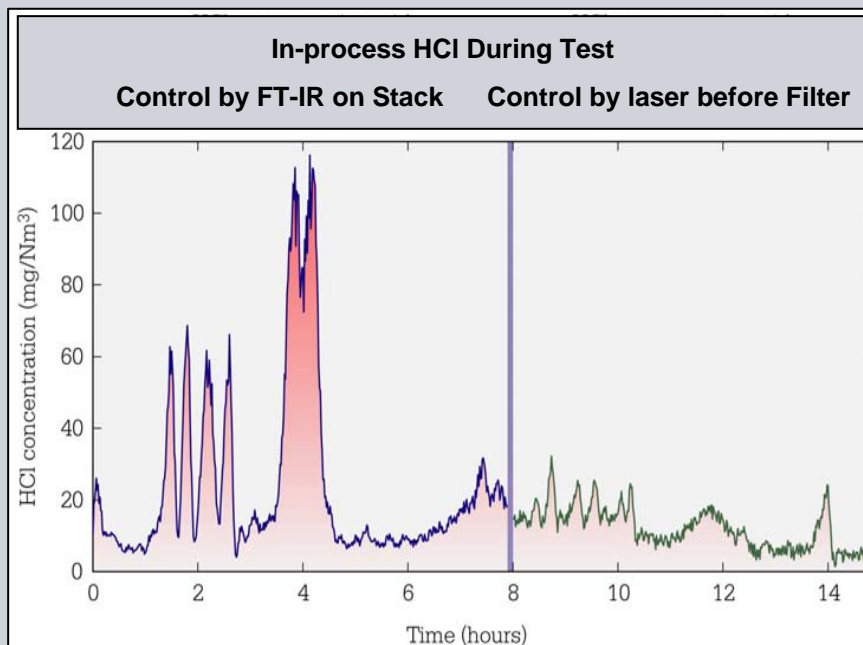
- Reduced NO<sub>x</sub> emissions**
- Reduced ammonia consumption by 25-30%**
- Reduced ammonia slip by 50-70%**
- Reduced ammonia salt formation on cold surfaces**
- Reduced plant maintenance**

# Other Opportunities with Laser Gas Analyser

Dynamic Control of HCl Gas Scrubbing: → Less emissions

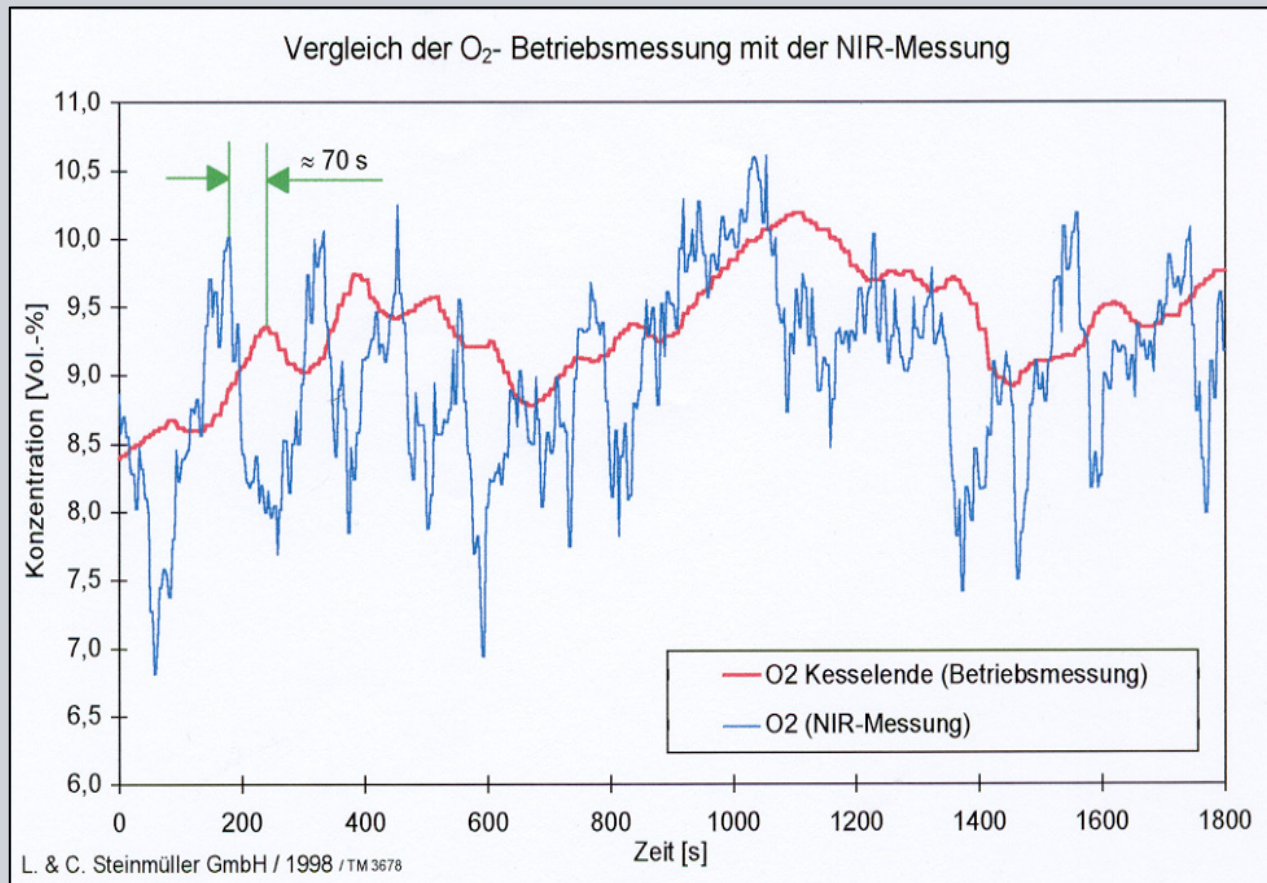
→ Optimisation of maintenance and replacement cycles

→ Less lime consumption by 20 - 30 %



## Other Opportunities with Laser Gas Analyser

Effective Oxygen Trim for Combustion Control:

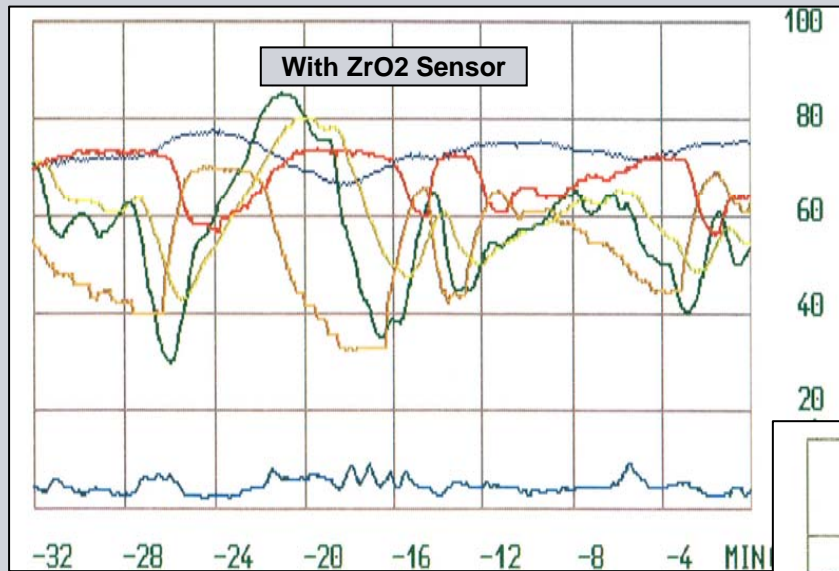


→ Approximately 70s time delay with ZrO<sub>2</sub>

→ Better resolution of process changes with laser

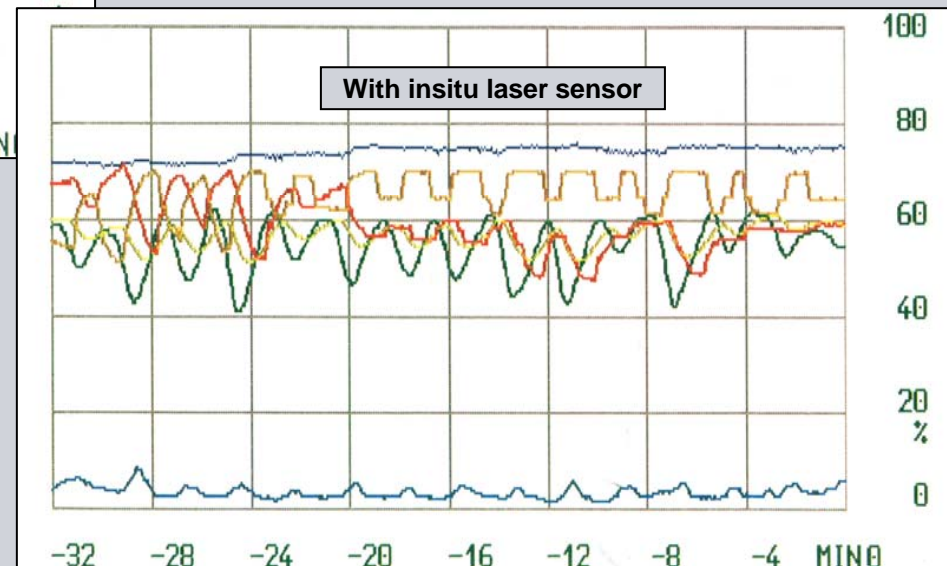
## Other Opportunities with Laser Gas Analyser

Effective Oxygen Trim for Combustion Control:



- ➔ Less excess air of approx. 10 %
- ➔ Better energy efficiency
- ➔ Reduced HT corrosion
- ➔ More stable steam production

- steam production
- primary air
- secondary air
- O<sub>2</sub>
- CO



Thanks for your attention

Questions??

## Thank You

|              |  |
|--------------|--|
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