

## ECO<sub>2</sub>PRO

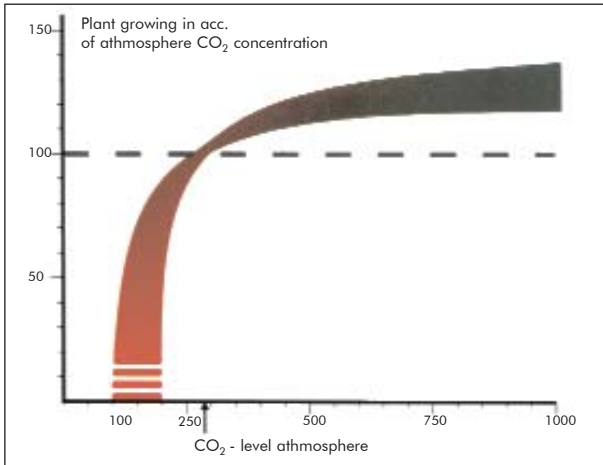
Catalyst Systems for Economical CO<sub>2</sub> - Production

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Steuler Anlagenbau GmbH & Co KG has developed a combined SCR-DeNOx/Oxidation catalyst system to purify exhausts from leanburn gas engines to a very high degree and maximize the CO<sub>2</sub> content in the exhausts.

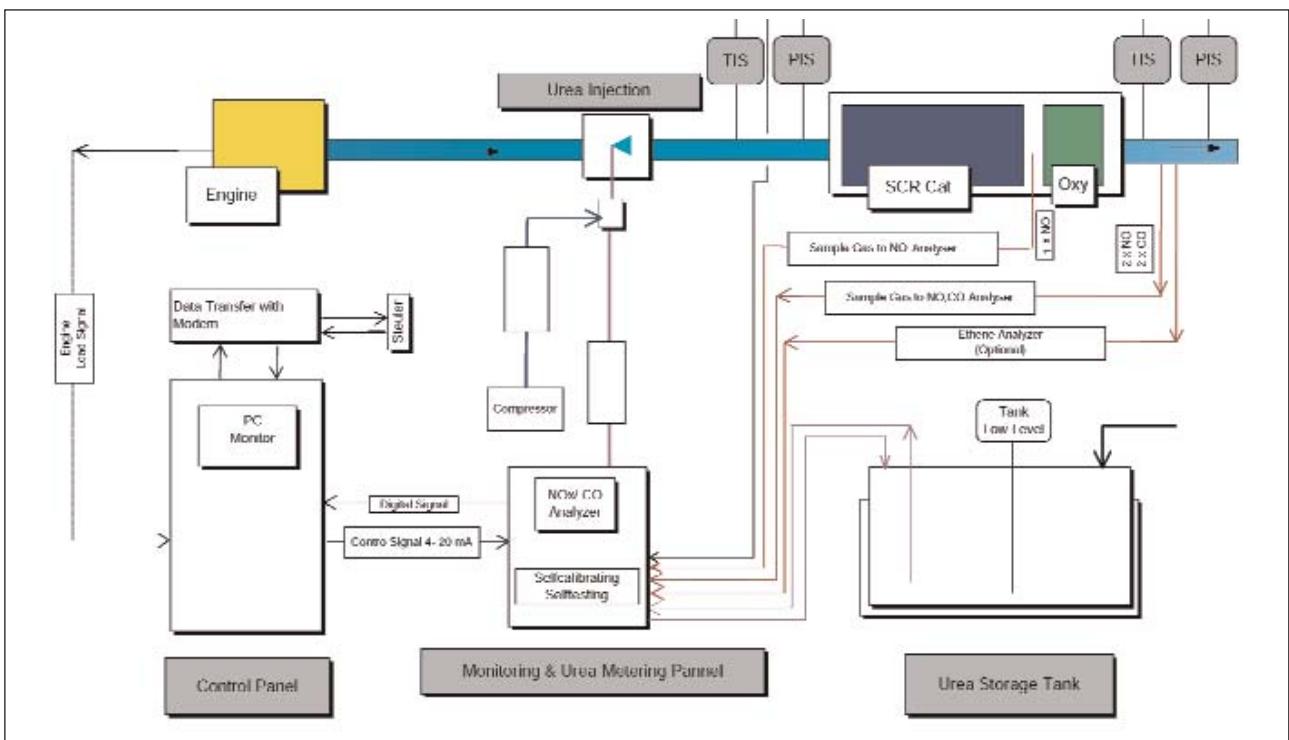
The user of a CHP unit (central heat and power unit) with a leanburn gas engine reduces his energy costs by recovering waste heat and electricity production. A gardener has the possibility to save additional profit by operating an ECO<sub>2</sub>Pro catalyst system through flooding his greenhouse with the purified exhausts and increasing the CO<sub>2</sub> concentration.



A reactor housing containing CER-NOx™ SCR NOx reduction catalyst and a downstream Oxidation catalyst to reduce CO and HC (specially Ethylene, C<sub>2</sub>H<sub>4</sub>, a strong plant poison) is installed in the engine exhaust gas system. By injecting aqueous urea solution into the exhausts upstream of the reactor housing, NOx, CO and HC/C<sub>2</sub>H<sub>4</sub> are removed from the exhaust gas. A by-product of the process is the increase of CO<sub>2</sub> levels in the exhausts. The purification of the exhausts offers the opportunity to use them as vegetation fertilizer to increase growth of crops in greenhouses.

The name Steuler is synonymous with quality in environmental protection and pollution control equipment markets worldwide. The ECO<sub>2</sub>PRO system is yet another product offering to improve the environment we live in. It is based on proven Steuler CER-NOx™ SCR and Oxidation Catalyst technology with long term experience in industrial application for more than 15 years.

The simplified process diagram attached shows the typical components of an ECO<sub>2</sub>PRO catalyst system.

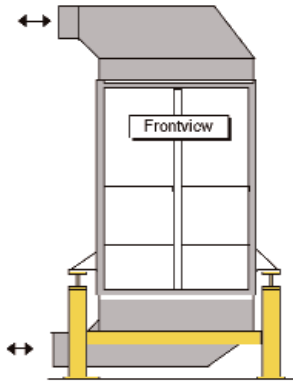


## An ECO<sub>2</sub>PRO Catalyst System is consisting of the following technical proven and reliable components:

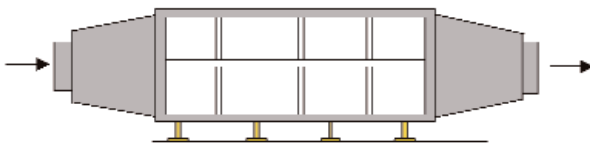
- **Reactor housing for horizontal or vertical arrangement with high activated and reliable SCR-/DeNOx- and Oxidation catalyst material**
  - ▶ "CERNOx" SCR catalyst bed, honeycomb block arrangement
  - ▶ "Oximat" Oxidation catalyst bed, honeycomb block arrangement
- **Urea metering and injection system with integrated gas mixer**
- **Process control panel with PLC, continuous process visualisation and telemetrics via modem for remote service and trouble shooting and several additional integrated safety functions**
  - ▶ Built-in modem for remote access via telephone or e-mail line offers unlimited system access to support the customer in operation, service and trouble shooting.
- **Emission monitoring station for NOx and CO in duplicate for most reliable process analysis, optionally with intergrated Ethylene analyzer**
- **Modular urea storage tank or optional urea mixing station for urea pellets**



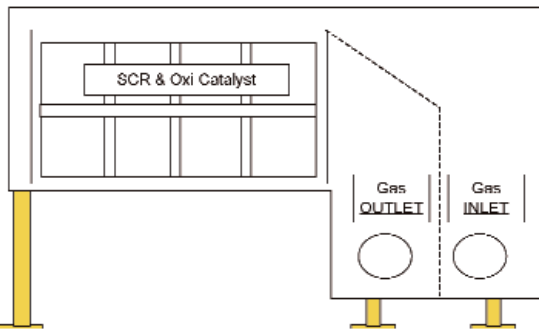
SCR/OXI Reactor Housing for Vertical Gas Flow



SCR/OXI Reactor Housing for Horizontal Gas Flow



Compact SCR/OXI Reactor Housing for Container

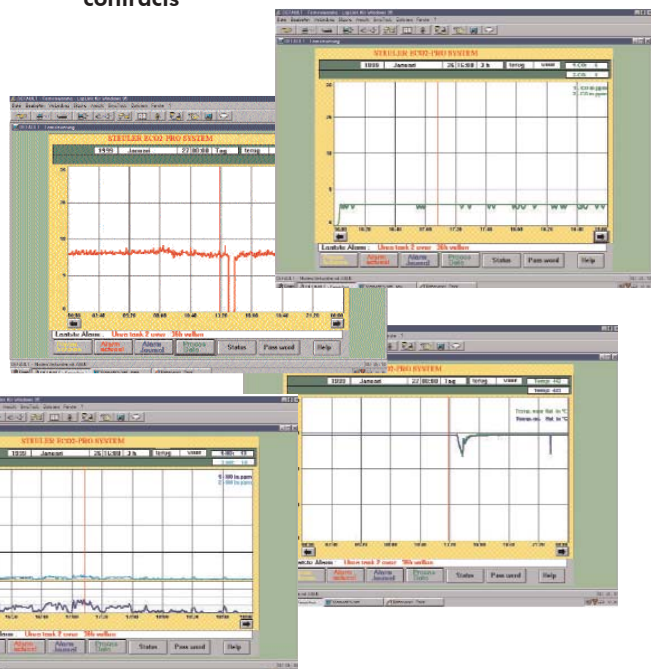
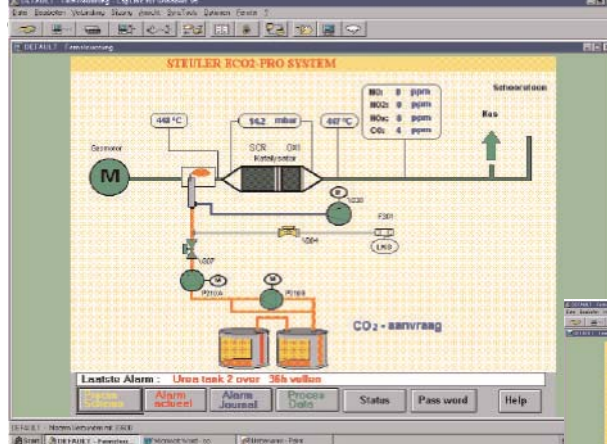


## Features and benefits of the ECO<sub>2</sub>PRO Catalyst Technology can be summarized as follows:

- High catalytic efficiency at relative low temperatures
- Wide temperature operating window between 350 to 500 °C
- Maximum system reliability due to extended catalyst warranties, i.e. :
  - ▶ 20.000 operating hours / 3 years max. for SCR-/DeNO<sub>x</sub> catalysts
  - ▶ 16.000 operating hours / 2 years max. for Oxidation catalysts
- High energy rendement of CHP because of low pressure drop across catalysts
- System is very easily to retrofit to existing CHP sites because of :
  - ▶ Modular standard design of all components
  - ▶ horizontal or vertical reactor arrangement of catalyst reactor housing
  - ▶ low specific investment cost
  - ▶ short delivery lead time and short assembly time at the site
- Ridgid honeycomb catalyst design, resulting in high resistance against vibration, mechanical/ temperature shocks and pulsation from engine misfiring
- Catalyst material insensitive against masking and poisoning from compounds contained in exhausts such as heavy metal, Ph, Zn and other residuals from engine lube oil
- Very high sound absorption capacity across catalyst bed
- Complete recycling of all catalyst material by the end of its useful lifetime
- System check-out, commissioning and training of operators ( System assembly optional )
- System documentation
- General Option: Long term service and maintenance contracts

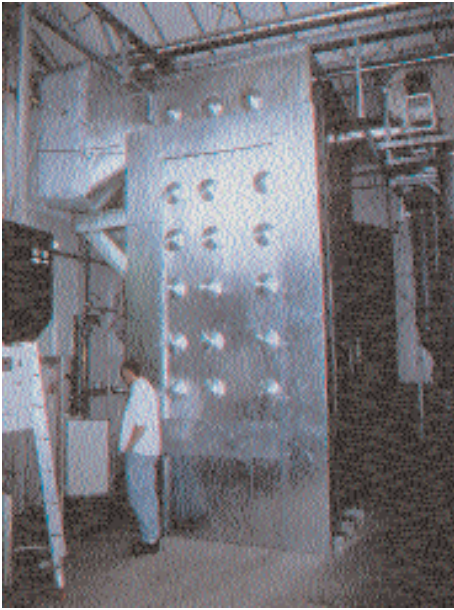
## ECO<sub>2</sub>PRO Prozess Visualization

Monitoring and control system for full-automatic system operation incl. continuous emission monitoring, process visualization based on personal computer and data



Visualization shows status of the system and all important process parameters, for example NO and CO (optionally ethylene), exhaust gas temperature, pressure drop etc.

# ECO<sub>2</sub>PRO



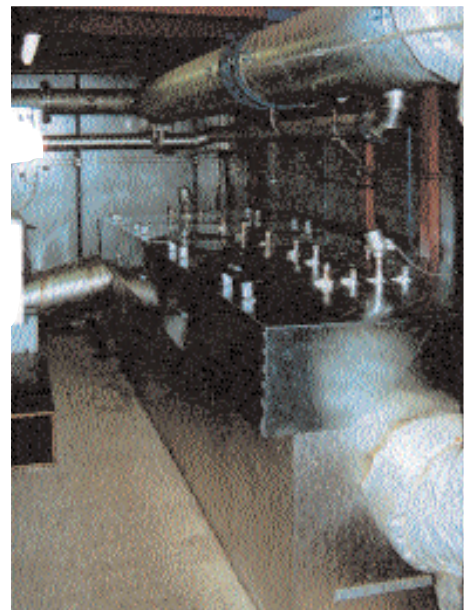
ECO<sub>2</sub>PRO Reactor (2 MW Unit) vertical arrangement



Overview of the modular ECO<sub>2</sub>PRO arrangement concept



Monitoring and Control Panel



ECO<sub>2</sub>PRO Reactor (300 KW Unit) horizontal arrangement inside of a CHP-Container



Fully Insulated ECO<sub>2</sub>PRO Reactor Housing (1 MW Unit) horizontal arrangement



Modular Urea Storage Battery Tank 2 x 1 m<sup>3</sup> Capacity, Double Wall Design

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