

# Selective Catalytic Reduction (SCR)



*NOx Abatement  
Systems – meeting  
emission compliance  
for off-highway  
engines*



*Over 350MW of SCR systems for diesel and gas engines across Australia, Asia and USA.*

## The leading SCR experts

Exhaust Control Industries (ECI) provides emission control solutions to industries where diesel or gas engines are used. We tailor a solution to exceed your site, environmental licence, or governing body requirements. Leaders in the industry since 1982, we have installed over ten thousand engine emission reduction products worldwide.

ECI's highly developed and proven Selective Catalytic Reduction (SCR) solution for NOx Abatement Systems can reduce NOx emissions by over 95 per cent.

Our SCRs are designed, manufactured, tested and serviced in Australia.

ECI's SCR NOx Abatement system meets today's regulations for existing engine installations and prepares companies for future regulations on new installs, as stringent air policies and regulations for

standby and prime power generation, marine, rail and industrial engines evolve and change.

Our SCRs are widely used in power stations and hyper scale centre applications. They are also used for reducing emissions from industrial, chemical processes and diesel operations.

### Our unique SCRs are designed to:

- Accommodate additional catalyst rows, so you can remain compliant when future emission targets change.
- Lower operating costs, saving you money each year with technology that lowers urea consumption and ammonia slip.
- Provide easy access for maintenance with swing away doors, so you reduce downtime and servicing costs



*ECI's SCR control technology can reduce NOx emissions by up to 95%.*

## The science of cleaning our air

The emissions from generators and engines typically contain NOx. NOx is a generic term for Mono-nitrogen oxides NO and NO2 (Nitric Oxide and Nitrogen Dioxide).

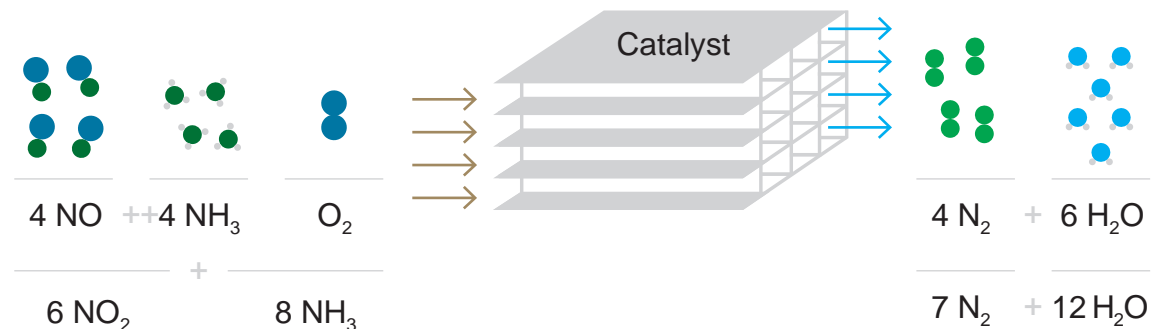
It is produced during combustion from the reaction of nitrogen and oxygen gases at high temperatures and is the precursor to the brown haze of smog across cities, toxic pollution.

In the lower atmosphere, NOx combines with reactive organic gases in the presence of sunlight to form ground-level ozone, which is the primary component of urban smog. Nitric oxide and nitrogen dioxide are components of acid rain.

SCR reduction works by combining precise liquid urea/ammonia (NH3) and oxygen (O2) with NOx in the exhaust gas to form molecular nitrogen (N2) and water (H2O).

SCR control technology, in conjunction with various oxidation catalysts, reduces emissions by providing measurable reductions in oxides of nitrogen (NOx), as well as carbon monoxide (CO), Volatile Organic Compounds (VOC) and Global Warming Potential (GWP).

Reaction formula for the SCR catalytic converter



The reaction products of the SCR catalyst are nitrogen & water.

*Unique benefits  
and features deliver  
operational cost savings*



## ECI's customised SCR solution

### Components of our typical SCR system:

- Reactor housing with option for more catalyst rows
- Davit lifting arm for bespoke door swing away system
- Catalyst blocks for NOX reduction
- Optional Oxidation Catalyst or Particulate Catalyst, depending on fuel source or emission targets
- Urea Injection dosing and mixing duct, urea metering pump and control, and urea storage tank and accessories
- Imbedded exhaust thermocouple and gas pressure transducers for process monitoring and control
- Thermal insulation of mixing ducts, reactor housing and pipe runs
- All-in-One PLC, ideal for regional and remote areas closed loop control panel with climate control
- Optional air compressor
- Two forms of control: Continuous Emission Monitoring System (CEMS) or Predictive Emission Monitoring System (PEMS)
- Can integrate with BMS via Modbus port
- Controller fitted with an HMI, allowing full local visibility of SCR operation - can be expanded through TCP/IP to live visible on the SCR HMI screen in your BMS Control Room
- Optional ECI remote access which enables 24hr live worldwide engineering and technical support
- Live data logging, auditing and reports for a minimum of five years

### Benefits and Features

- Scalable for changing emission targets with a reactor housing that accommodates additional catalyst rows
- Easy access for maintenance with bespoke door swing-away system
- Broad temperature ranges from 300°C to 500°C
- Compatible with various fuel types, including contaminated fuels with up to 3.5% Sulphur
- Bespoke options are available in the design of diameter, length, cell density and loading to suit site spatial
- Ongoing maintenance and emissions testing services available
- Individual commissioning to meet your environmental targets
- Australian-based applications engineers
- Urea supply available as solution or urea pellets
- Global remote access to PLC controls, ideal for remote and regional areas
- Individual engine and site commissioning, technical training, handover and operation manuals
- System design flexibility for standby and prime power generation, marine, rail, mining and plant applications
- Lowest ammonia slip in the industry, without the need for ammonia reduction catalyst

*ECI customised SCR  
emissions treatment  
solutions suitable for  
all NOx reduction targets*

**Power Generation, Co-generation  
and Tri-generation solutions for:**

- Hospitals and healthcare facilities
- Commercial and government buildings
- Data Centres
- Grid and water utilities
- Environmentally sensitive areas
- High density residential near combustion engines

**SCR and CO2 Enhancement for:**

- Food and Beverage
- Hothouses and food growing areas
- Aquaculture power in proximity to growing ponds/pens

**SCR solutions for other engine applications:**

- Rail and locomotive
- Marine power generation
- Bespoke Mining

**SCR solutions for alternative fuels:**

- Diesel & Biodiesel blends
- Heavy fuel oil
- Natural gas
- Waste gases, including landfill gas
- Digester gas & Biogas

**Applications**

The fitting of a post-combustion NOx control system on either diesel engines, gas-fired engines or turbines has resulted in major reductions in NOx in urban environments.

Oxidation Catalysts and Particulate Catalysts can further reduce carbon monoxide (CO), non-methane hydrocarbons (NMHC) and particulate matter (PM).

The ECI SCRs can be retrofitted onto existing installed engines or built into new emission reduction solutions.

SCR treatments are used in urban areas, universities, datacentres, power stations, commercial and residential buildings, and critical infrastructure. Providing regulatory compliance up to Tier 4 standard, when fitted with an ECI Diesel Particulate Filter.



Eco2-Pro SCR & CO2 Capture/Distribution



*ECI provides a safer workplace for your employees, local communities, animals, beverage and food growing areas, and the environment.*



## Emissions reduction benefits everyone

### Pollution Control and Safety

In June 2012, the International Agency for Research on Cancer (part of the World Health Organisation) updated diesel engine exhaust to the classification 'carcinogenic to humans (Group 1)'. This is the highest classification and indicates that diesel exhaust damages the DNA, or genetic material in body cells in a way that leads to cancer. The Group 1 classification places diesel exhaust alongside toxins such as asbestos, benzene, formaldehyde and arsenic.

### The following substances, present in diesel exhaust, have the following effects:

- Ozone (precursors, NOx and VOC): Eye and respiratory irritants, asthma exacerbation, bronchitis and irreversible lung damage
- Oxides of nitrogen: Respiratory irritant, immunosuppressant, and asthma exacerbation
- Carbon monoxide: Headaches, irritability, impaired judgement and memory, breathlessness, aggravation of angina and other cardiovascular diseases, developmental toxicity and death
- Particulate Matter (soot): Respiratory irritant with higher levels associated with increased incidence of cardiovascular and lung failure

### Exposure to diesel exhaust can have immediate harmful health effects:

- High levels of NOx can interfere with lung and respiratory function in humans and animals
- Long term, high NOx levels over time can cause death. In Europe, NOx (including nitrogen dioxide) is responsible for 14% of the deaths caused by long term exposure to air pollution
- High levels of NOx will cause plants to produce less food or even cause plants to die
- High levels of NOx cause acid rain that results in the weathering of rocks, building materials and metal corrosion

Those most vulnerable are children whose lungs are still developing and the elderly who may have other existing health problems.

ECI's constant testing, research and development ensures cutting-edge designs produce the maximum reduction in harmful pollutants into the lower atmosphere.

Exhaust Control Industries (ECI) is contributing to the efforts to meet emission target levels and achieve reductions in emissions. ECI provides full support to governments and local industry around Australia and throughout Southeast Asia and the Indo Pacific Regions.

*Not all SCR systems are the same, all our systems are custom built in Australia to meet engine, customer and emission requirements.*

## Reduced emissions and lower operating costs

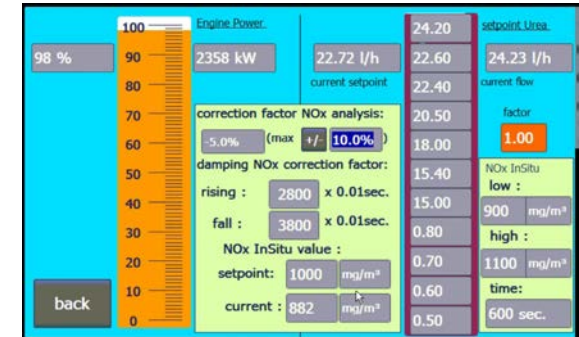
ECI's SCR System provides long-term operating cost savings throughout the lifetime of your asset.

This is achieved via a) the onboard CEMS feedback, b) your emissions target, and c) the live monitoring of the engine load.

This forms the critical closed loop control, a monitoring system that enables ECI's SCR System to respond and adapt swiftly, reducing exhaust emissions with minimal urea consumption.

ECI's all-in-one control panel requires one single-phase electrical connection. All cabinet components, such as pumps, regulators and touch screen, are pre-wired to Australian Electrical Standards, simplifying and reducing the cost of installation.

Due to our sophisticated closed-loop control system being engineered and specifically commissioned to the application, our SCR technology results in ultra-low urea consumption and ammonia slip, in comparison to other available systems.



ECI is the only company with full SCR capability; from inhouse design, fabrication, PLC control, delivery and installation. Our systems are supported locally with our technical and commissioning team providing customised installation and operating support.



*Regulated, real-time emissions monitoring.*

## SCR CEMS Control Cabinet – Closed Loop Controls

The SCR Continuous Emissions Monitoring System (CEMS) All-in-One (AiO) Control Cabinet regulates and monitors the urea metering injection control system via PLC. The information is displayed with process flow visualisation containing detailed real-time SCR operating parameters. The SCR CEMS AiO Control Cabinet is configured with minimum five-year data storage and networking capabilities, such as an ethernet interface, and offers integration with customer site SCADA system via Modbus (serial Modbus or Modbus over IP).

The ECI CEMS SCR AiO Control Cabinet basis for the dosing process is the engine load signal. Depending on the engine load, a defined quantity of urea is added in compliance with the load table. The standard is the operating mode load table and analysis. This allows the analyser to adjust the load table, as required. The exact amount of urea to be injected is determined by a control loop utilising the continuously monitored value of remaining NOx downstream of the catalyst bed. The injected quantity is monitored continuously by an inductive flow meter. The quantity is injected via a frequency-controlled diaphragm dosing pump. ECI simply requires 4-20 mA load signal from the engine or installation.

The ECI CEMS SCR AiO Control Cabinet has three compartments in a common wall or floor mounted enclosure. The first compartment is dedicated to control appliances, including PLC, VFD Frequency drive, power supplies, all electrical line protective devices and field wiring terminal blocks. The second compartment is dedicated to the exhaust gas sample conditioning and sensing components. The base of the Control Cabinet contains the urea metering devices, including the urea fine metering pump, electro-magnetic inductive urea fine flow meter, urea system pressure valves, pressure transducers, compressed air pressure regulator, compressed air control valve, and urea/air process control motorised ball valve.

All components in the SCR AiO Control Cabinet are internally pre-piped and pre-wired in accordance with current UL508A and current EN-VDE regulations.

ECI's AiO Control Cabinet is pre-fitted with a suitable air conditioner unit. It is designed for indoor, wall or floor mounting, and must be installed in a suitable environment. Ambient temperatures are critical to maintain ideal operational conditions and longevity of the equipment. The AiO Control Cabinet is pre-wired and is supplied (installed) ready for customer connections, SCADA and mains electrical supply.





## Tier 4 retrofit programs for existing applications or integrate into pre-packaged solutions.

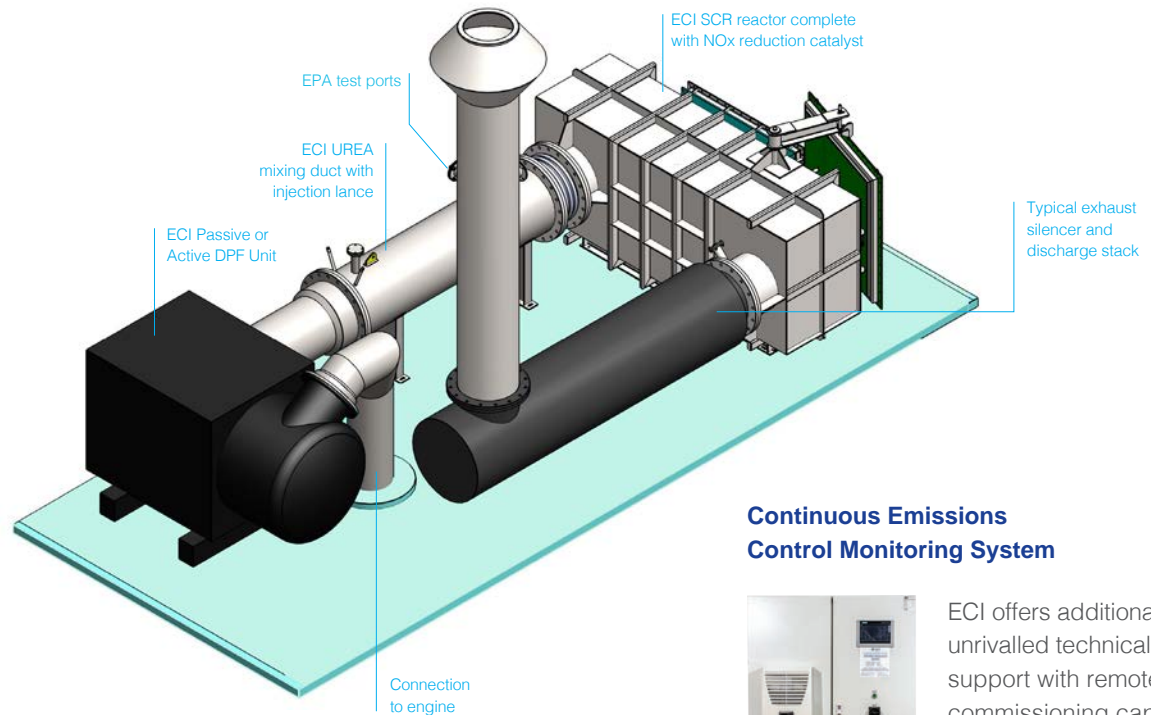
An ECI Tier 4 system combines a Selective Catalytic Reduction (SCR) system, Diesel Particulate Filter (DPF) and Diesel Oxidation Catalyst (DOC).

ECI technologies are designed to meet strict regulations, meeting all local clean energy regulator requirements.

ECI offers unrivalled technical support with remote commissioning capability, real time diagnostics, and preventative maintenance programs.



### ECI Tier 4 Package



### Continuous Emissions Control Monitoring System

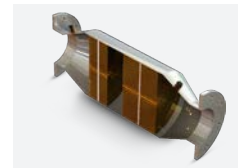


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### ECI Emission Treatment Options



Diesel Oxidation Catalyst



Diesel Particulate Filter



Catalytic Diesel Particulate Filter



Selective Catalytic Reduction

*Minimise emissions,  
increase plant production,  
reduce your environmental  
impact, and increase  
utilisation levels to 95%.*

## ECO2-Pro Systems for Greenhouses



The Economic carbon Dioxide Production (ECO2-Pro) System fits to a Combined Heat and Power (CHP) station, purifying exhaust gases and releasing the remaining carbon dioxide into the greenhouse atmosphere.

ECO2-Pro Systems reduce nitrogen oxide (NO), carbon monoxide (CO) and ethene pollutants from engines and promotes growth in plant crops with continual CO<sub>2</sub> production.


ECO2-Pro Systems provide a low-cost way to increase plant production whilst regulating the environment in greenhouses.

The energy gained in the use of engine CHP stations in greenhouses can be used in various ways to operate farms:

- Electrical Energy - artificial lighting with excess electricity fed back into the power grid.
- Thermal Energy - the heat serves the purpose of efficiently supplying heat to the greenhouse.
- CO<sub>2</sub> Fertilisation - CO<sub>2</sub> from the purified engine exhaust gas is used effectively to stimulate plant growth and increase yields up to 40%.

ECO2-Pro System has an enormously high utilisation level (95%) ensuring that growers can run operations effectively and minimise their environmental footprint.





*Australian designed, manufactured and tested,  
ECI's SCR systems reduce emissions to meet today's  
regulations and their unique design and application  
caters for future requirements.*



## Exhaust Control Industries Pty Ltd

**Head Office** 29-33 Fonceca Street,  
Mordialloc, Victoria, 3195 Australia

**T**+61 3 9588 2233 **F** +61 3 9588 2567

**E** [eci@exhaustcontrol.com.au](mailto:eci@exhaustcontrol.com.au) **ABN** 60 606 757 724

**Brisbane** 31 Flanders Street,  
Salisbury Queensland 4107

**Singapore** 159F Tampines Road,  
Singapore 535159

### Toll Free

Australia 1800 730 158

Indonesia +0018 030 612 026

Asia +800 400 010 10



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