

REDUCING EMISSIONS FROM NON-ROAD ENGINES

Reduce emissions to meet legislative and corporate targets with IPU's AtmoShield range.

WHY IPU?

Experience and expertise

IPU has 60 years' experience working with diesel engines, power generation and related technologies. We understand the industry, its applications and the pressures that face the companies in it. No other company is more aware of the technical and economic challenges associated with emissions solutions.

IPU's emissions team are proud of the many years of expertise they can demonstrate in reducing diesel engine emissions. Their commitment to reducing pollution pre-dates the recent raft of European and UK legislation.

IPU is the only company that can bring such valuable experience and vital expertise.

The UK's No. 1 solution

IPU exploits the best available technologies from around the world. We develop bespoke systems that match the needs of every site. We are not limited to a fixed product range with the inevitable compromises this imposes.

Our solutions help you to meet current and future regulatory limits, prove your compliance and satisfy your CSR targets.

IPU's award-winning AtmoShield solutions include exhaust gas treatments and gas-to-liquid fuel wrapped up with innovative finance options that make IPU solutions both affordable and practical.

Ethical and Meticulous

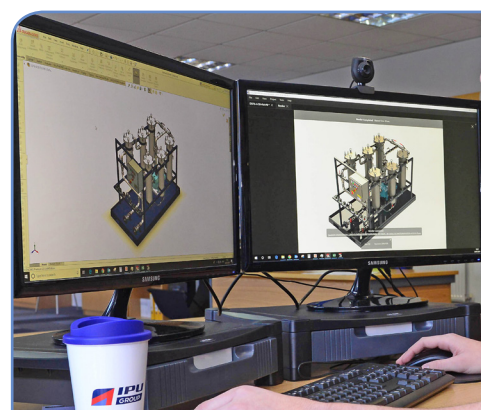
Many variables need to be considered when designing an emissions system. These include:

- The engine type, its fuel and operational profile.
- The site and the location of the engine.
- Regulatory or other targets.

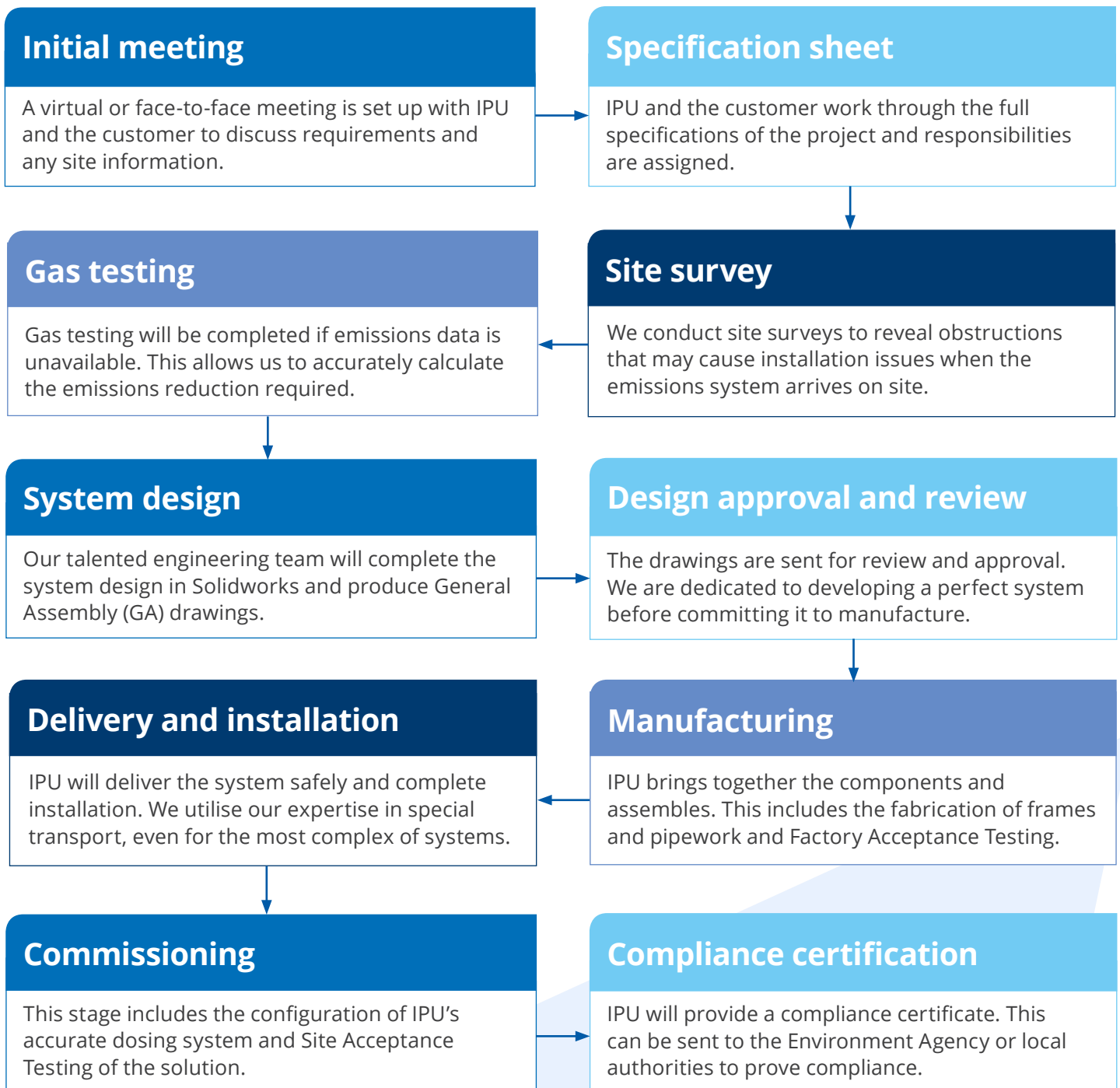
IPU guides its customers through every step of the process. We pride ourselves on the accuracy of our quotations and the diligence of our assessment processes.

We will ask you to provide detailed information about your site, your engines and the way they are used. This information is vital to designing a system that suits your business.

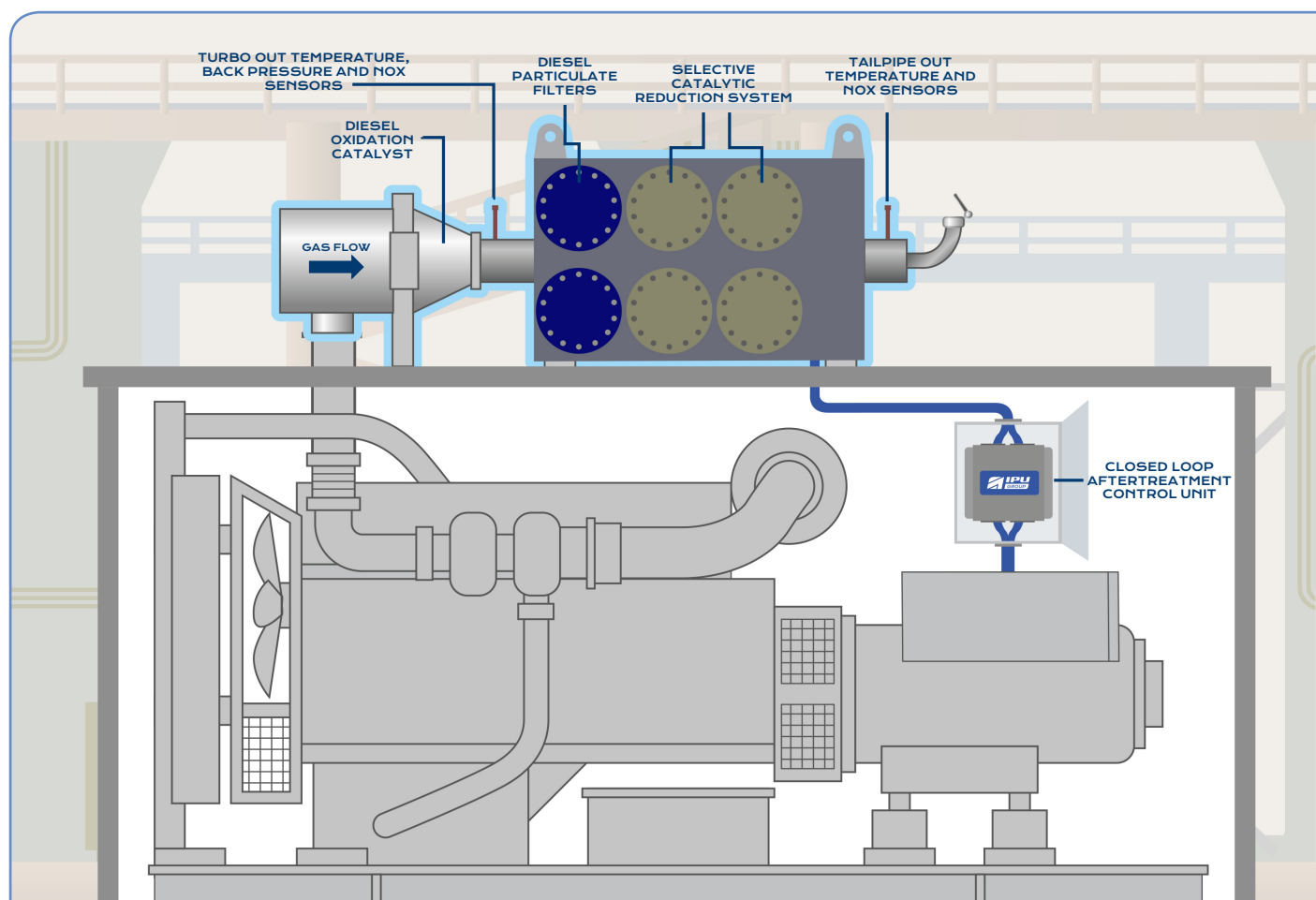
IPU has an ethical approach to business. We will not quote a low price to win a contract, only to inflate the price later. We will include all the foreseeable costs such as installation, delivery and sub-contract work.



THE IPU PROCESS



IPU ATMOSHIELD PRODUCT RANGE



IPU's AtmoShield family of products is specifically designed to reduce harmful emissions from engines. They can be used as individual elements or assembled as a package. The bespoke system is designed around the engine type and location and the regulatory targets that must be passed.

We do not offer a 'one size fits all' solution.

IPU can also complete your system with data-logging capabilities. Compliance to legislation can be proven at any time in easy-to-read reports that can be sent straight to the Environment Agency or your local authority.

For more information

Visit www.ipu.co.uk/emissions-solutions.



WATCH THIS VIDEO SHOWING IPU'S ATMOSHIELD EMISSIONS SYSTEM IN ACTION AT A RECENT DEMONSTRATION EVENT:

www.ipu.co.uk/scr

KEY COMPONENTS

Selective Catalytic Reduction

A Selective Catalyst Reduction system (SCR) reduces NOx emissions. Exhaust gases are combined with urea (a reductant) and passed over a catalyst. Urea is 32% ammonia dissolved in purified water.

When urea passes over the SCR catalyst, a chemical reaction converts nitrogen oxide into less harmful nitrogen, water and sometimes carbon dioxide. This is then expelled through the exhaust.

98%
reduction
in NOx
emissions

Diesel Particulate Filters

A Diesel Particulate Filter (DPF) is an exhaust after-treatment device that acts as a physical barrier to remove particulate matter from exhaust gases. They offer greater particulate trapping and storage capacity over other filters because of their unique substrate coating exclusive to IPU.

The DPF will need to be regenerated as particulates accumulate in the filter. A heater can regenerate the DPF (active regeneration) or a Diesel Oxidation Catalyst (DOC) can provide assistance with passive regeneration.

95%
reduction
in particulate
matter

Diesel Oxidation Catalysts

A Diesel Oxidation Catalyst (DOC) oxidises carbon monoxide, gas-phase hydrocarbons, the soluble organic fraction (SOF) and the volatile organic compounds (VOC) of diesel particulate matter into carbon dioxide and water.

As well as providing passive regeneration for a DPF, it also converts NO to NO₂ and CO to CO₂. The working surfaces of a DOC are covered by active catalytic sites made from platinum group metals.

Gas-to-Liquid Fuel

Gas-To-Liquid fuel is a synthetic diesel alternative made from natural gas. It can be used in unmodified diesel engines. Broadly speaking, it brings a diesel generator's emissions down to the level of a gas genset. Depending on the engine type, it can reduce NOx emissions by up to 25%* and particulate emissions by up to 38%*.

It is admirably simple to deploy: stop buying diesel, start buying GTL. As a drop-in replacement to diesel, it can be implemented seamlessly without capital investment.

25%
NOx reduction
38%
PM reduction

Fuel-borne catalyst

IPU's fuel borne catalyst reduces the levels of particulates produced during the combustion process by up to 18%. It is dosed directly into the fuel tank.

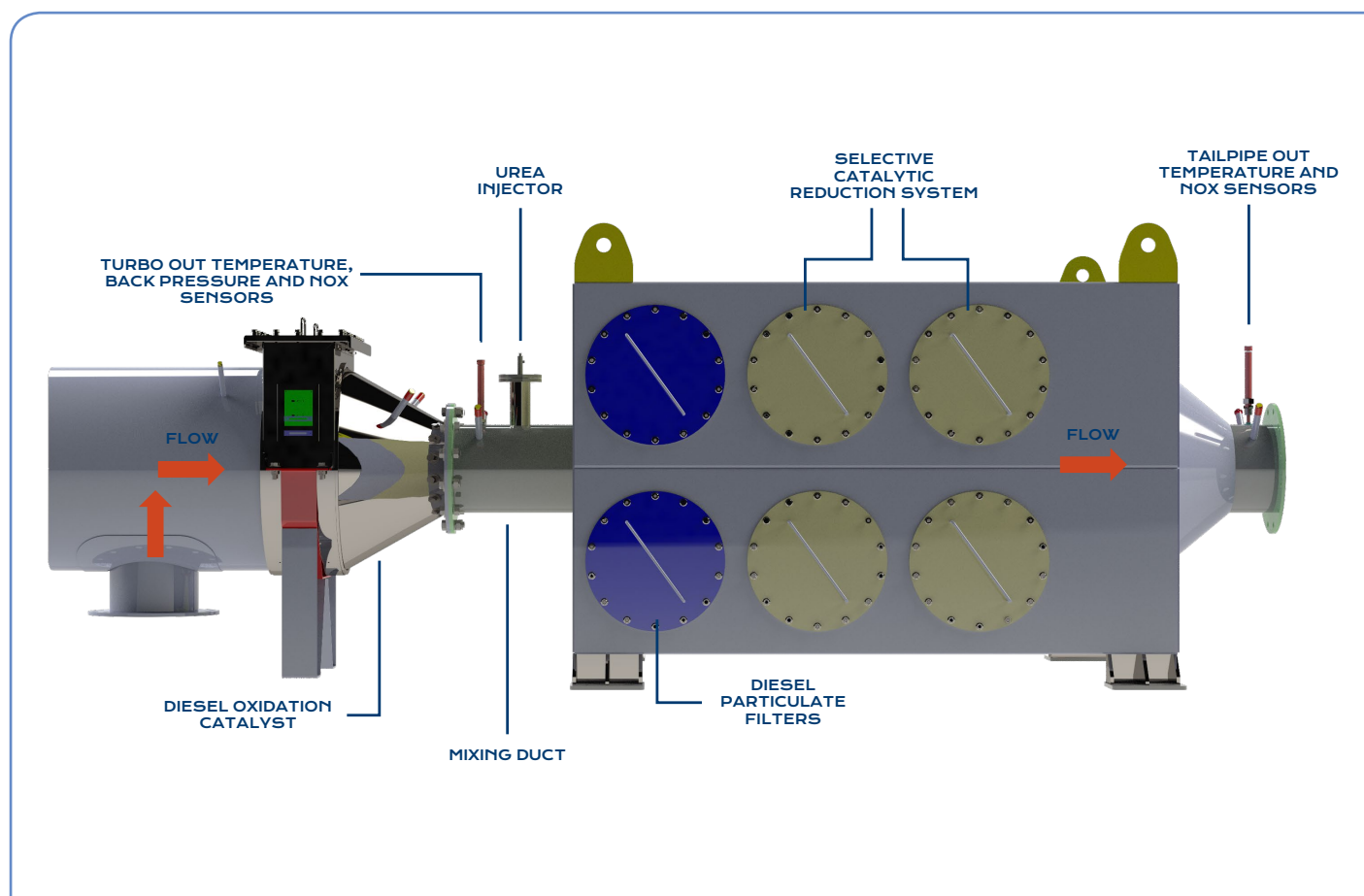
It lowers the temperature that exhaust gases need to reach to burn off trapped particulates in the DPF. Reducing the number of particulates captured will also help to extend the service interval of your DPF, reducing maintenance costs and downtime.

18%
reduction
of particulates
produced by
combustion

* Subject to engine type, age, duty cycle and other factors.



THE IPU DIFFERENCE



A Selective Catalytic Reduction (SCR) system is the heart of an emissions system.

In simple terms, an SCR system consists of:

- A hydrolysis mixing section: a long piece of piping that removes water from the urea and mixes it with exhaust gases.
- Urea injector(s): more than one may be required depending on the size and duty cycle of the engine.
- An SCR catalyst: this is where the chemical reaction of converting nitrogen oxide into less harmful nitrogen and water takes place.
- A control system: the control system monitors temperatures and outputs across the engine. Its readings are used to calculate the required dosage of urea.

But that's where the similarities between IPU's system and the competition end.

IPU's 'closed loop' architecture measures gas composition and temperature throughout the system.

It accurately and precisely adjusts the dosing rate of urea to reduce the lifetime costs of your system, cut the likelihood of urea blockages and reduce maintenance.

The 3rd generation airless dosing system reduces the possibility of urea oxidising in the dosing lines and crystallising.

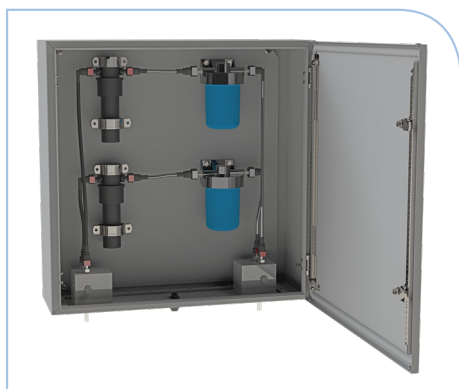
This would impair the exhaust and degrade the performance of both the SCR unit and the generator. On lesser systems, this results in substantial repair bills.

Our precise control of urea dosage dramatically reduces ammonia slip, the process where unreacted ammonia passes through the SCR unit into the atmosphere. This is a common fault in SCR systems that overdose urea to bring NOx levels down.

For more information

Visit www.ipu.co.uk/scr or call our friendly team on 0121 511 0400.

PRODUCT HIGHLIGHTS



Closed loop system

IPU uses a closed loop system incorporating a series of NOx and temperature sensors.

The control unit precisely governs the dosage of urea according to the detected level of engine emissions. Only a closed loop system can guarantee regulatory compliance while minimising urea costs.

Inferior systems without such intelligence resort to dumping urea into the exhaust. This is expensive, harmful to the environment and it does not guarantee compliance.



Exclusive catalyst substrates

IPU has the exclusive use of a unique substrate and specialist coatings.

This substrate is proven to capture a higher percentage of particulates than other solutions on the market.

This will be particularly important in Non-Road Mobile Machinery (NRMM) applications and Clean Air Zones where levels of particulate matter are closely monitored.



Bespoke software

Accurate monitoring and intelligent control lies at the core of an effective emissions control solution. The system will not work without an adequate brain.

IPU's bespoke software application provides real-time monitoring and the ability to log a complete history of events. These can be turned into easy-to-read reports to prove compliance with legislation.



Ammonia slip catalyst

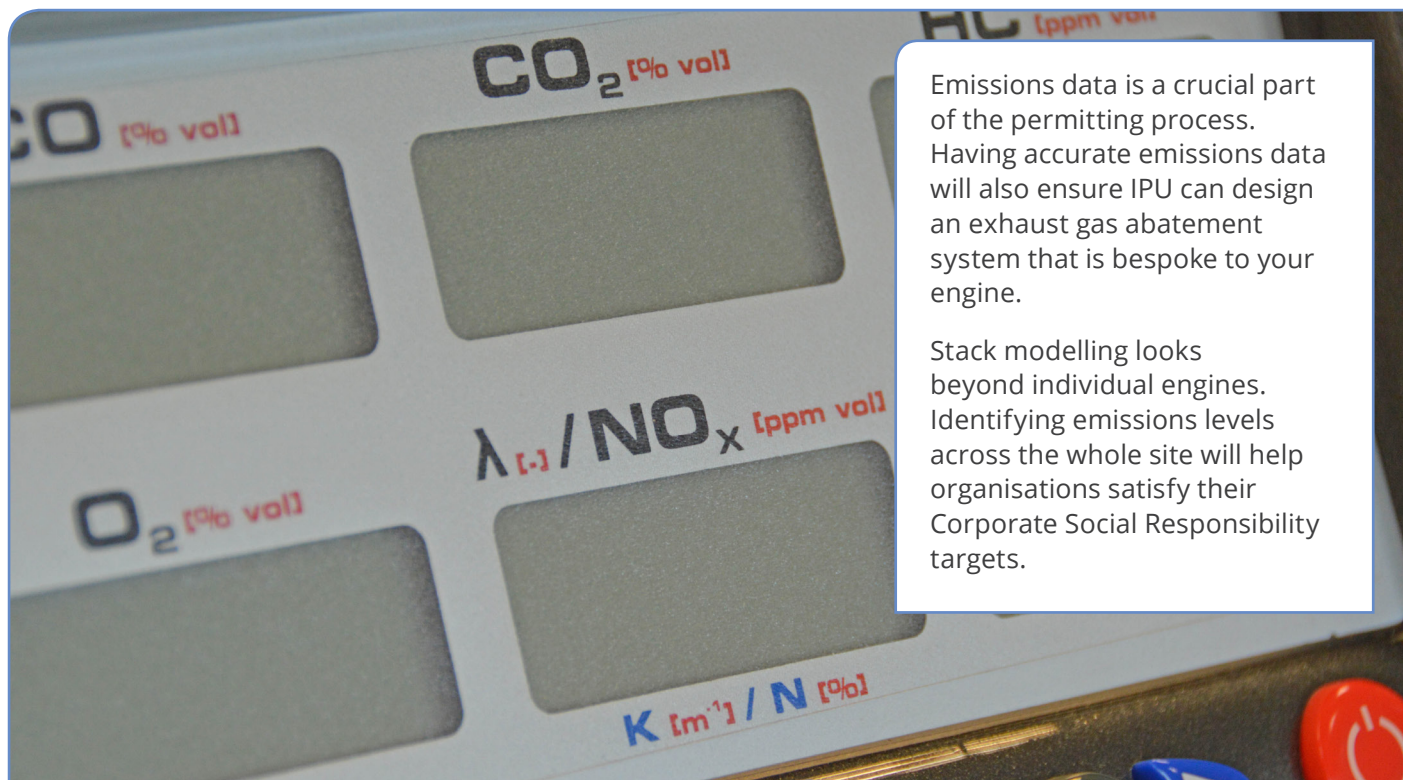
IPU offers an ammonia slip catalyst to prevent the release of unreacted ammonia to the atmosphere. In some circumstances, this ammonia can solidify, blocking the exhaust, as can be seen in the picture.

Ammonia slip is an extremely hazardous but common fault in SCR systems that overdose urea to bring NOx levels down.

300ppm of ammonia in the atmosphere is considered damaging to human health. 3,000ppm, the level that could be generated by a solid block of ammonia, could be fatal.

HOW ELSE CAN IPU HELP?

IPU provide total emissions solutions. This includes testing for accurate emissions data and ensuring your whole site is compliant.



Emissions data is a crucial part of the permitting process. Having accurate emissions data will also ensure IPU can design an exhaust gas abatement system that is bespoke to your engine.

Stack modelling looks beyond individual engines. Identifying emissions levels across the whole site will help organisations satisfy their Corporate Social Responsibility targets.

Gas Testing

IPU's gas testing service will generate accurate emissions data for submission to the Environment Agency for permitting purposes.

The latest emissions regulations¹ require that generators must have a permit, regardless of their location, application and workload. The current emissions levels of the generator have to be submitted with the permit application.

Engine datasheets may include some emissions values. The Environment Agency will accept this data, even if the engine has been in operation for more than 5 years (which can make the data less accurate).

However, engines manufactured prior to 2000 will not be emissions certified so it is unlikely the engine datasheet will include emissions data. Gas testing is essential in these cases.

For more information

Visit www.ipu.co.uk/gas-testing or call our friendly team on 0121 511 0400.

Stack Modelling

It will be particularly important to reduce emissions if your site sits in a Low Emissions Zone or near a sensitive area such as a hospital or school.

Although installing exhaust gas abatement will ensure the engine complies with regulations such as the Medium Combustion Plant Directive (MCPD), it does not necessarily mean the site as a whole will comply. Other factors, including central heating boilers, a busy car park and even a large workforce will alter emissions levels across the site.

Our stack modelling service assesses how emissions from all equipment and vehicles will interact with buildings, local terrain, meteorological conditions and transport routes. The final report details the environment conditions around your site and the actions you can take to reduce site emissions.

For more information

Visit www.ipu.co.uk/stackmodelling or call our friendly team on 0121 511 0400.

DOOR TO DOOR SERVICE



IPU's service does not stop once your system is manufactured and packed.

Our logistics team has decades of experience shipping bespoke systems across the globe. We have encountered the most remote locations and obscure sites.

We complete a site survey prior to delivery to identify issues that could complicate or delay the installation. These include restricted access for large vehicles, space for lifting and construction work on which our installation depends.

Once your system is installed, the commissioning phase calibrates the emissions system to your engine to ensure your specific emissions limit values are achieved.

Calibrating the dosing system on-site allows us to consider site conditions, including background NO_x, which can come from busy roads or other equipment on site.

IPU completes the process by accurately measuring engine emissions to prove compliance. We will provide compliance certificates that can be submitted to the Environment Agency.



SEE OUR SYSTEM IN ACTION

IPU host regular demonstration events at our HQ in West Bromwich. See our system in action and talk to our emissions experts.



Seeing is believing. That is why we are inviting you to come and see the emissions system we manufacture.

Our demonstration events are fully interactive and provide you with the ideal forum to quiz IPU on everything about emissions and share ideas and opinions with a knowledgeable audience.

The event lasts about 3-4 hours. It is a mix of a presentation discussing legislation and emissions technology, open dialogue and a live demonstration of our exhaust aftertreatment system in action. We will showcase how low we can get the levels of NO_x and particulate matter on our 1991 genset.



REGISTER YOUR INTEREST FOR IPU'S NEXT EMISSIONS DEMO DAY:

www.ipu.co.uk/demoday

FINANCE OPTIONS

It could be dangerous to let a budget limit interfere if your organisation faces a deadline to meet a critical performance target. You might miss vital revenue or face a painful non-conformance penalty.

You can install equipment when you need it with IPU's finance options. You can hit your targets, conform to regulations or generate the revenue you need. Your CapEx budget is unaffected.

Financing the purchase lets you spread the cost of the new system over several years. 5 years makes the monthly payments more manageable. 2 years makes the payment cycle shorter.

IPU are an appointed representative of GCN Finance. We are authorised to quote a wide variety of leasing options to ensure engines can continue to run without having to buy an emissions solution outright.

There are significant financial benefits to leasing equipment:

- Equipment can be acquired when needed, not when budgets allow.
- Cash stays in the business; it is not tied up in an asset.
- Leasing converts one large capital expenditure into smaller monthly payments.

- Lease rental and lease purchase are 100% tax deductible. Payments are written off against the company's tax bill.
- Lease rental equipment does not appear on the company's balance sheet.
- No depreciation appears on the company's balance sheet for equipment under lease rental.
- Equipment enhancements and expansions can be incorporated into lease rental agreements.

IPU offer 2 types of lease agreement:

- Lease Rental.
- Lease Purchase.

	Lease Rental	Lease Purchase
Immediate delivery and use of equipment	Yes	Yes
Tax deductible	Total project value	Total project value
Upgrade equipment during lease	Yes	No
Add equipment during lease	Master Lease agreement	No
Asset and depreciation on balance sheet	No	Yes
Maintenance costs in rental agreement	Maintenance Inclusive agreement	Yes
Total VAT payable on installation	No	Yes
Own asset at end of agreement	No	Yes
Deposit required	No	Yes

WHAT IS THE LATEST LEGISLATION?

Emissions legislation has changed. The introduction of the Medium Combustion Plant Directive, the Non-Road Mobile Machinery Regulation and Clean Air Zones makes compliance essential.



The Medium Combustion Plant Directive (MCPD)

The MCPD is EU legislation that became UK law in December 2017.

The MCPD (Directive (EU) 2015/2193) covers diesel engines between 1 and 50 MWth capacity (described as medium-sized engines).

EU statistics estimate there are 143,000 medium-sized combustion plants in the EU. They represent a significant source of nitrogen oxide (NOx) and particulate matter (PM) emissions. The MCPD regulates NOx closely and monitors emissions of carbon monoxide (CO).

The MCPD imposes a NOx limit of 190mg/Nm³ @ 15%O₂ to all combustion plants or generators in the 1 to 50 MWth range.

Plants that come into operation after 20 December 2018 are classified as "new plant" by the MCPD. Its

emissions limit values (ELVs) apply as soon as the plants start operating.

Older plants are classified as "existing plant" by the MCPD. They have to conform to its ELVs by 2025 or 2030 depending on their size.

In the UK, the emissions landscape is complicated by Capacity Market considerations. Plants that supply power to the UK grid have different compliance requirements and time-scales. These vary according to how many hours the plant operates per annum, its output capacity, when it starts operating and its type of Capacity Market contract. IPU will help to establish how these complex regulations apply to you.



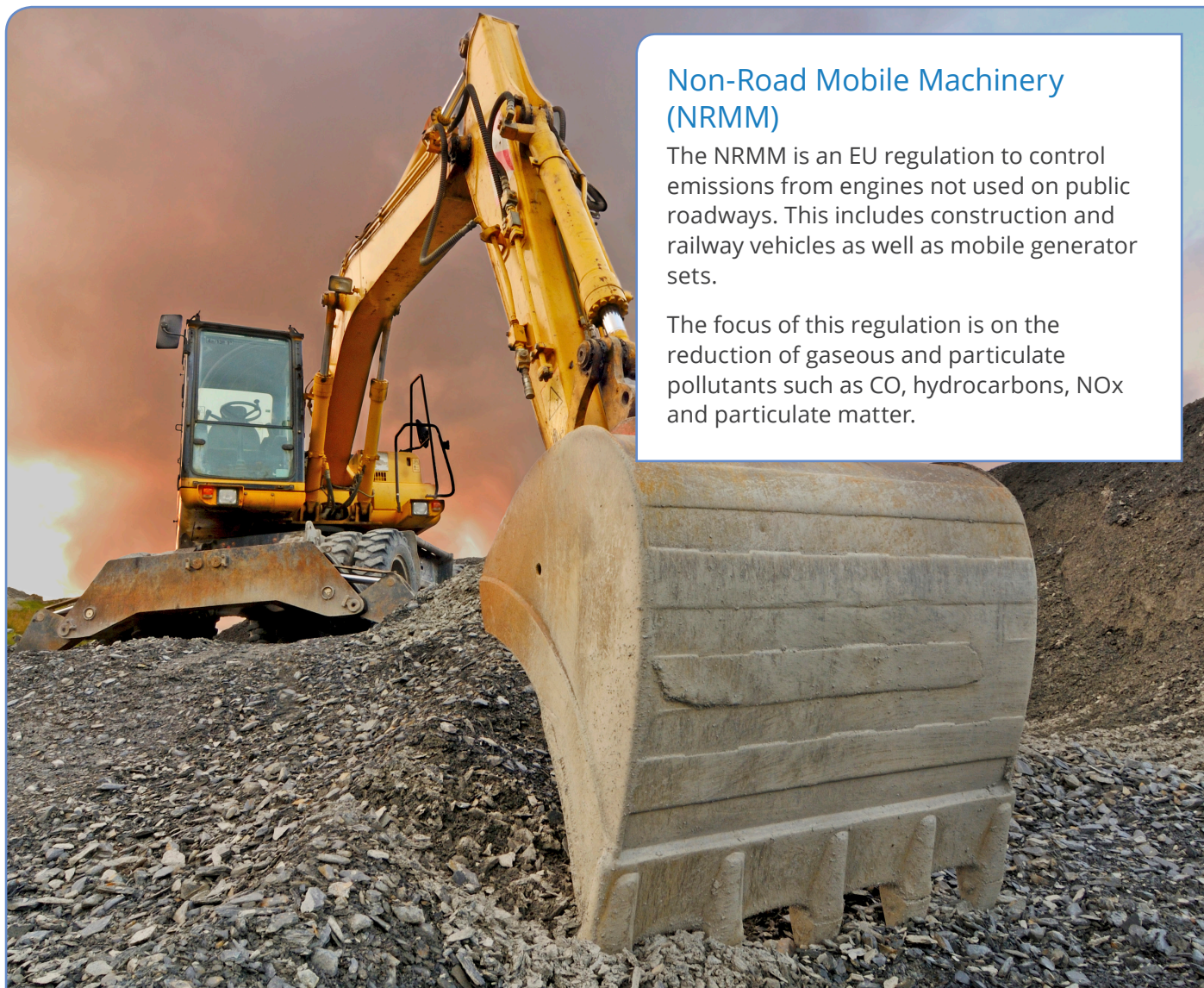
DOES THE MCPD AFFECT YOU? GET YOUR BESPOKE REPORT HERE:

www.ipu.co.uk/mcpd

Non-Road Mobile Machinery (NRMM)

The NRMM is an EU regulation to control emissions from engines not used on public roadways. This includes construction and railway vehicles as well as mobile generator sets.

The focus of this regulation is on the reduction of gaseous and particulate pollutants such as CO, hydrocarbons, NOx and particulate matter.



Non-Road Mobile Machinery (NRMM)

Non-road mobile machinery has been identified as a major contributor to poor air quality in densely populated cities such as London.

Particular focus is being placed on the following emission types under the NRMM regulations: nitrogen oxide (NOx), particulate matter (PM), carbon monoxide (CO) and hydrocarbons (unburned fuel).

Trailer-mounted generator sets, rental sets and any other set that is not permanently installed needs to comply with the NRMM regulations if their output is between 19 and 560 kW.

Generator sets that are permanently installed on a site are exempt from the NRMM regulations.

Engines between 56 and 130 kW have to comply with NRMM targets before the deadline of January 2020. Emissions limits for engines in this category are:

- Nitrogen oxide (NOx): 0.40g/kWh
- Particulate matter (PM): 0.015g/kWh
- Carbon monoxide (CO): 5.00g/kWh
- Hydrocarbons: 0.19^cg/kWh

Engines with outputs below 56 kW or above 130 kW needed to comply by January 2019.

For more information

Visit www.ipu.co.uk/nrmm or call our friendly team on 0121 511 0400.



Clean Air Zones

Local councils use Clean Air Zones to target emissions that are of special concern to the communities they serve.

Visible black smoke (i.e. particulate matter) is a good example. The MCPD does not impose a limit but it is a frequent source of public complaints. Clean Air Zones give councils the power to address it.

Within Clean Air Zones:

- Local authorities consider the impact of engines and the measures that can be taken to safeguard local air quality.
- Businesses requiring a back-up power supply are urged to use generators with low emissions levels. The businesses are asked to keep testing hours to the minimum required to ensure the generators' safe running.

London's Low Emissions Zone in Central London evolved into an Ultra-Low Emissions Zone in April 2019. This trend for local emissions limits will spread to another 5 cities by 2020:

- Birmingham
- Derby
- Nottingham
- Leeds
- Southampton.

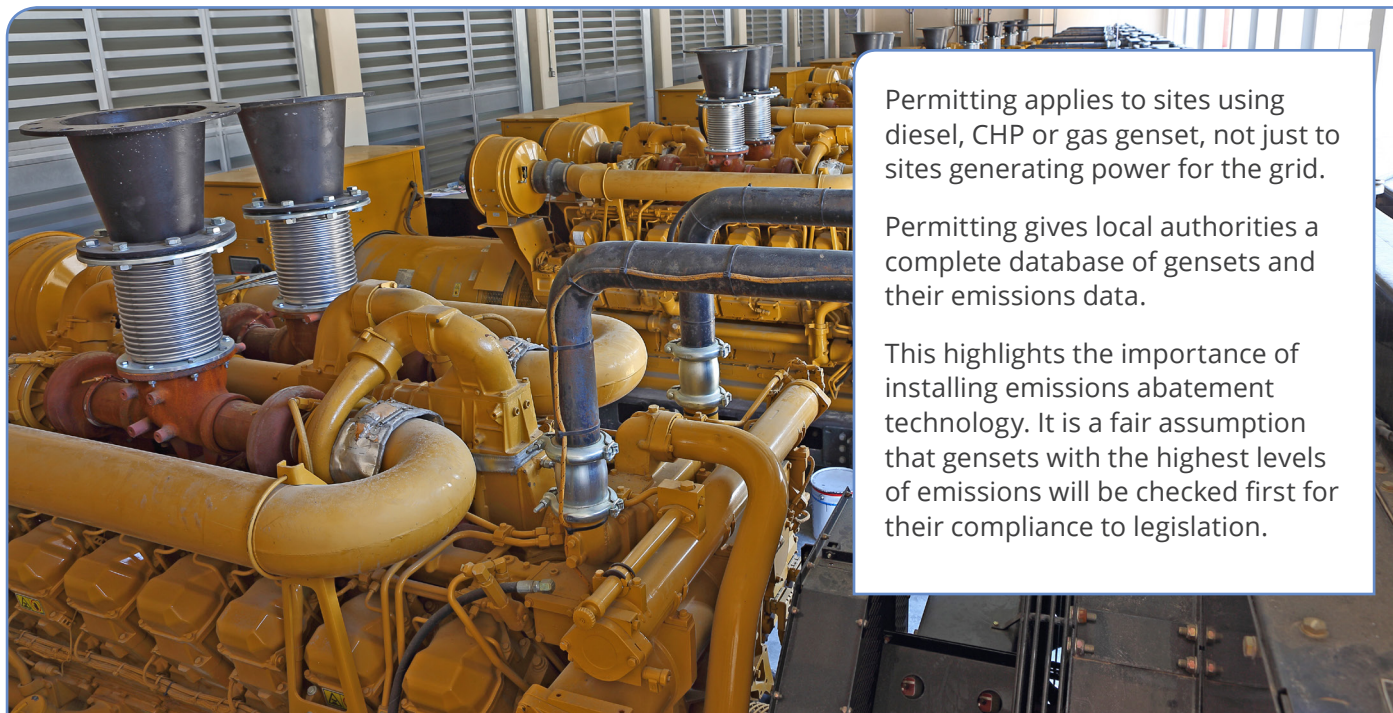
Local authorities will introduce many more Clean Air Zones across the UK in the near future.

For more information

Visit www.ipu.co.uk/caz or call our friendly team on 0121 511 0400.

IS YOUR SITE PERMIT UP TO DATE?

The landscape for sites operating gensets is changing. All diesel gensets (regardless of their application or emissions)* must have a permit from the Environment Agency before they can run.



Permitting applies to sites using diesel, CHP or gas genset, not just to sites generating power for the grid.

Permitting gives local authorities a complete database of gensets and their emissions data.

This highlights the importance of installing emissions abatement technology. It is a fair assumption that gensets with the highest levels of emissions will be checked first for their compliance to legislation.

As part of The Environmental Permitting (England and Wales) (Amendment) Regulations 2018**, all generators must have a permit. It will be an offence for any person or company to operate a diesel genset without the correct permit.

There are different deadlines for permits depending on the type of generator:

- Any new Medium Combustion Plants must be permitted before any fuel is burned. Emissions should be tested and proven compliant within 4 months of the permit's date of issue.
- New power generation equipment used in the capacity market will need a permit by August 2019.
- 5-50MW generators with emissions above 500mg/m³ which operate more than 50 hours per annum must have applied for a permit by 31st October 2019.

The permit type is determined by the capacity, emissions and operating hours of the generator. The Environment Agency has confirmed that permits will fall into 3 categories:

- Standard Rules permits.
- Simple bespoke permits.
- Complex bespoke permits.

The Environment Agency is working to complete bespoke applications within 12 weeks of receiving a fully completed application. Standard Rules applications may take less time.

The permitting process is comprehensive and time-consuming. Charges apply. A full list of charges can be found on the GOV.UK website.

* Excludes generators that are used strictly for emergency purposes and run for less than 50 hours per year for testing purposes.

** For Northern Ireland: The Pollution Prevention and Control (Industrial Emissions) (Amendment) Regulations (Northern Ireland) 2018. For Scotland: The Pollution Prevention and Control (Scotland) Amendment Regulations 2017.



THE COMPANY YOU WANT TO DO BUSINESS WITH

IPU helps businesses reach the profitability and efficiency they seek.

For nearly sixty years, we have delivered the expert assistance and customer service that lets our domestic and international customers excel in their industries.

We support businesses in sectors including power-generation, oil & gas, marine, IT & telecoms, manufacturing and government.

Our industry experience, competitive pricing and superb support let us evolve from a regular supplier to become the company our customers *want* to do business with.



For more information, please visit:
IPU.CO.UK/EMISSIONS-SOLUTIONS

For further details, please contact:
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