In today’s utility and industrial sectors, there are many drivers forcing boiler owners to reduce emissions from their power and steam generation facilities. Although regulatory targets may still be uncertain, it is certain that NO<sub>x</sub> requirements are becoming more stringent. Owners must select NO<sub>x</sub> control technologies that meet individual emission requirements while being cost effective.

Fuel Tech offers a wide range of NO<sub>x</sub> reduction and emission control technologies that may be implemented as standalone processes integrated as an I-NO<sub>x</sub> system to maximize performance while limiting balance-of-plant impacts. This wide range of capabilities allows Fuel Tech to approach each application as a solutions provider rather than an equipment supplier.

Fuel Tech’s I-NO<sub>x</sub>™ Integrated NO<sub>x</sub> system combines proven technologies for cost-effective NO<sub>x</sub> control from the point of combustion to the stack. These combined technologies may be applied as a retrofit solution for existing units or may be new generating units, capable of NO<sub>x</sub> exceeding 80%.

The front end of the I-NO<sub>x</sub> solution utilizes Fuel Tech’s proven combustion systems including Low NO<sub>x</sub> Burners (LNBs), burner modifications, and over-fire air (OFA) systems. These combustion solutions are built upon using our post combustion NO<sub>x</sub> control products which include urea based Selective Non-Catalytic Reduction (SNCR) along with urea and ammonia based Selective Catalytic Reduction (SCR) systems.

The distinguishing features that set Fuel Tech’s I-NO<sub>x</sub> technology apart is our process experience and state-of-the-art design capabilities that allow us to understand the working relationships of the combined NO<sub>x</sub> reduction technologies. These capabilities also allow us to evaluate each application and tailor a solution that maximizes the contribution of each technology in our suite of offerings without pushing any one process to the point that it impacts boiler operation or negatively impacts another NO<sub>x</sub> reduction process downstream.

Components of an I-NO<sub>x</sub> system

- **I-NO<sub>x</sub> combines commercially proven technologies**
- **80+% NO<sub>x</sub> Reduction**
- **Proven Mercury Oxidation of 90+% with one catalyst layer**
- **Minimize capital cost vs. conventional SCR**
- **Minimizes SO<sub>2</sub> to SO<sub>3</sub> conversion rates**
The I-NO\textsubscript{X} system offers significantly lower capital costs than traditional SCR\textsubscript{s} and provides the option of a staged capital investment.

SCR process design is the most critical step to successful SCR performance. Maximizing SCR performance and minimizing its impact on plant operations requires a thorough understanding of each application. For each project, Fuel Tech reviews potential fuels and fuel blends and the expected operating conditions and then utilizes its experience and design expertise to provide the best possible ASCR design. Fuel Tech has many tools to provide the most efficient design for our ASCR systems. Our experimental model studies combined with Computational Fluid Dynamics (CFD) modeling provide insight into the flue gas parameters and flow conditions to develop the optimum duct configuration for the ASCR. Fuel Tech works with industry leading catalyst suppliers to determine the appropriate catalyst type and formulation for any given application.

Corrective devices such as turning vanes, large particle ash (LPA) screens, static mixers, and the GSG\textsuperscript{TM} Graduated Straightening Grid are the devices to implement an ASCR that meets its performance goals. These important design steps help ensure trouble-free ASCR operation and maximize catalyst life.
The scope of supply for Fuel Tech’s I-NOx systems include design, engineering, procurement, delivery, and startup of the following:

- Combustion modifications in the form of LNB, and OFA
- Urea based NOX.OUT® and HERT™ SNCR Systems
- Advanced SCR Systems and Components
- Modeling and Process Design with performance guarantees
- Static Mixer
- LPA Screen
- GSG™
- AIG
- ULTRA™ System – Urea Conversion for SCR Reagent Feed
- Catalyst specification and supply
- SCR Reactor design and supply
- System startup, optimization, and training services

An I-NOx™ system combines NOX reduction technologies specific to your system - at 30-70% of the high capital cost of conventional SCR!

The ammonia injection grid (AIG) is used to feed aqueous or anhydrous ammonia to the catalyst to ensure proper coverage to react with NOx within the catalyst. Proper mixing of flue gas constituents and temperatures along with proper flow and velocity profiles to maximize NOx reduction and to minimize ammonia slip emissions.

The ASCR technology component of an I-NOx system incorporates a high performance SCR reactor where space permits. By utilizing an integrated technology approach, the catalyst quantity, weight, and space requirements can be minimized, potentially leading to the elimination of new foundations and the need to install new “steel to grade”.

I-NOx systems can be retrofitted into the footprint of an existing plant.
With the concept of a single layer of catalyst, the ASCR system has the added benefit of minimizing the rate of SO$_2$ to SO$_3$ conversion which is a precursor to ammonium sulfate/bisulfate formation in the air preheater.

This low conversion rate allows for a broader unit operating range and fuel flexibility. In addition, the reduced volume of catalyst demands less time for the replacement outage requirement and can typically be performed over a short outage. This single layer catalyst has been proven to oxidize 90+% mercury in the flue gas for capture with a Flue Gas Desulphurization (FGD) scrubber.

Fuel Tech’s extensive experience base and financial status allow us to offer single source responsibility. System installation and installation management services are also available to meet customer needs. Our integrated I-NO$_x$ systems may be applied to retrofit and new boiler applications, and our experience includes, SCR design and consulting support covering more than 50,000 MWs, and over 20,000 MWs of AIG Grid Tunings.

Fuel Tech’s I-NO$_x$ system is a combination of technologies that provide cost effective NO$_x$ reduction and flexibility in meeting rapidly changing regulatory and public policy drivers. I-NO$_x$ can be implemented in stages over time, providing financial advantages of both lower total installed capital costs and the ability to stage capital expenditures.

### Fuel Tech I-NOx Competencies:

- Experienced process design capabilities with performance guarantees
- 100+ LNB and OFA systems
- 550+ total SNCR and SCR systems
- Specification development for SCR catalyst, internals, ductwork, and sub-systems
- Process expertise on combining technologies
- Performance analysis and optimization
- SCR and Catalyst management services
- Single source responsibility

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