

Case Study

Use CFD to develop optimization solutions to reduce O&M cost for sorbent injection system at Waste to Energy combustion facility

Facility:	Waste To Energy Plant
Location:	North Lincolnshire, United Kingdom
Unit Type:	13.5MWe Stoker-fired Furnace
Fuel Type:	Meat and Bone Meal [MBM]



Project Objective

Industrial boilers burning solid fuels in the UK are commonly equipped with DSI sorbent injection systems to remove SO₂ and HCl emissions to meet emission regulations. However, some of these systems have not been optimized for best efficiency when installed. This project aimed at using proprietary CFD simulation to develop optimization solutions to reduce sorbent cost while complying with emission limits.

Plant and Furnace Description

The power plant is a 13.5MWe stoker combustion facility burning Meat and Bone Meal [MBM]. The boiler was originally designed for burning chicken litter but then converted to burn MBM after the BSE epidemic at the end of the 1980's/early1990's with a sodium bicarbonate (SBC) injection system with baghouse to control SO₂ and HCl emissions to below 50 and 10 mg/Nm³ respectively. After nearly two decades operation, the plant operators have noticed that the SBC injection rate has increased and wanted to pursue optimization solutions to reduce sorbent cost.

The unique CFD tool used in this study is based on ANSYS

Key Dates:

- Feasibility Study:	Dec-2018
- Project Award	May-2019
- Commissioning:	Sept-2019
- Performance Test:	Oct-Dec-19

Project Scope

Ammegen engineers first performed a feasibility study. In this study, a proprietary CFD simulations have been applied to the existing flue gas system to remove SO₂ and HCl using SBC. Based on the baseline results, Ammegen proposed several injection design changes and used CFD simulations to determine their respective SO₂ and HCl removal efficiency and sorbent savings. The final retrofit proposal involved relocating the existing injection lances to an upstream location and increasing a single lance to a two lance injection system. Ammegen was then contracted to proceed with engineering, fabrication, installation and commissioning for the final design suggested by the CFD. With the support of the plant, the entire project was executed successfully within about a year.

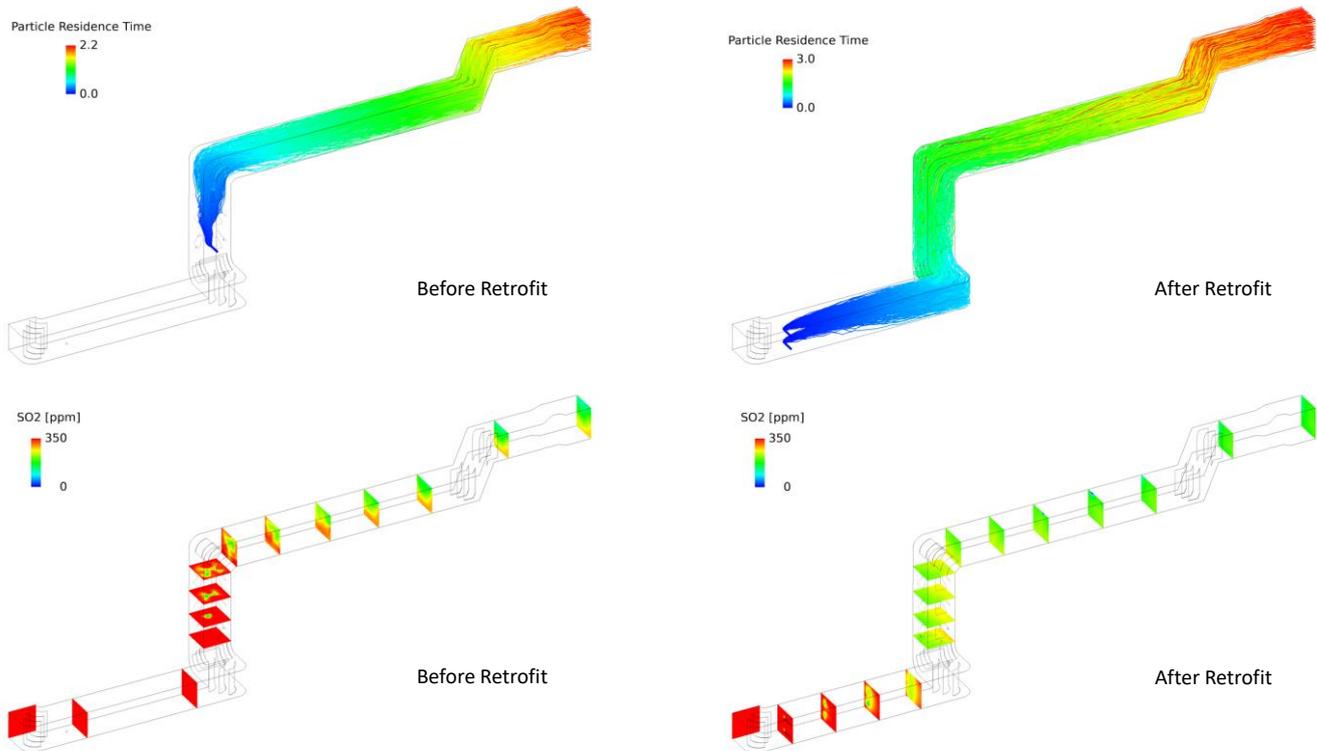
Project Highlights:

- Ammegen's first UK DSI sorbent injection project to meet IED compliance
- CFD-derived solutions
- Achieved **>10%** sorbent cost savings while maintaining SO₂ and HCl emission limits
- Payback within **12-15 months**
- Project was delivered as a full Engineering, Procurement & Construction (**EPC**) contract
- Low capital and operational costs compared to alternative solutions



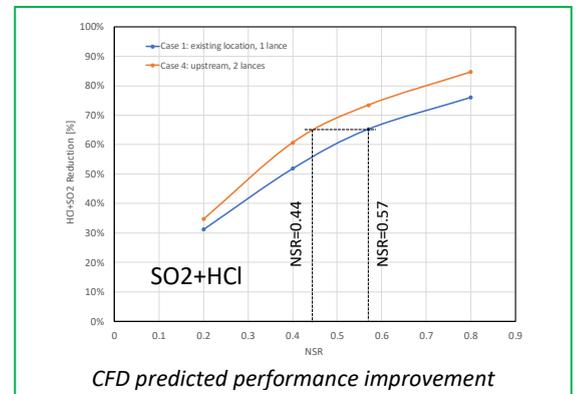
CFD Simulations

The unique CFD tool used in this study is based on ANSYS FLUENT commercial package and integrated with proprietary chemical submodels to evaluate the sorbent flow dynamics as well as reaction characteristics with flue gas species. The retrofit options proposed in this study reflected our intensive experience in sorbent injection applications in the U.S. market. CFD simulations demonstrated that, increasing from 1 to 2 lances and relocating injection lances to upstream location improves the SO₂/HCl removal efficiency, which leads to 10%-15% sorbent savings while in compliance with SO₂/HCl limits.



Project Performance

	Sorbent Usage [Tones/MWh]	Sorbent Savings [%]
Before Modification	0.026	-
After Modification – Oct-2019	0.023	12%
After Modification – Nov-2019	0.0253	3%
After Modification – Dec-2019	0.0197	24%
After Modification – Average	0.0227	13%



About AMMEGEN LIMITED

AmmeGen Limited is a joint venture combining the strengths of Greenbank Group (UK) and Reaction Analytic Solutions Corporation (USA) to bring performance enhancement and advanced air pollution control solutions to the global market for the reduction of NO_x, CO, SO₂, SO₃ and HCl. This includes both pre- and post combustion technologies.

We have a proven record in the development and delivery of combustion technologies for the global market and a reputation for on-time delivery of projects. With over 18 years of computational fluid dynamic experience, AmmeGen can accurately model a wide range of plant systems, from fuel delivery, burner design, furnace combustion optimization, and flue gas duct design, to proprietary chemistry modelling and sorbent/reagent reactions. Our experts have research driven experience in developing over 90 models on a wide variety of boiler configurations and fuel types. Our customers draw on our reputation for continual technological refinement and bespoke solutions.

We deliver a unique portfolio of combustion improvement products and technologies, together with a wide range of technical solutions, aimed at increasing efficiency and reducing greenhouse emissions at small and large thermal power generating plants. In short, our services and equipment offer the customer a sustainable model of plant optimization. Our integrated solutions empower the customer to manage and monitor their own plant, with ongoing support and spares.