RefinARS - Absorption and recovery of sulphur from flue gas of the Fluid Catalytic Cracking (FCC), by a special reusable buffer
LIFE00 ENV/IT/000012

Project description

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Project description:

Background

Fluid Catalytic Cracking (FCC) is a process very frequently used in refineries in order to obtain light oils from heavy ones. FCC is based on a catalytic process. An essential phase of the process is the regeneration of the catalyst through a combustion of the carbon deposited on the surface of the catalyst. The carbon deposit contains sulphur, which, during combustion, is transformed into sulphur dioxide (SO2); the flue gas is therefore rich in SO2, a strong pollutant. To abate the sulphur dioxide some processes are available, using alkaline solutions of NaOH or CaOH to absorb SO2. This kind of process increases the environmental impact on water (sulphates and sulphites) and on soil (solid wastes to be disposed of).

Objectives

The problem faced by the project is the reduction of the overall environmental impact of the FCC process and the related treatment of flue gas. The general project objective is the demonstration of the feasibility of an innovative BAT for desulphurisation of flue gas, using an absorbing buffer which allows sulphur recovery and can be regenerated. Achieving this main objective means that a series of economic, industrial and environmental objectives need to be reached, as detailed under 'Expected results', below. The project was undertaken in the
Sannazzaro refinery plant, owned by E.N.I. The project intends to achieve a lower overall environment impact compared to current BATs for flue gas desulphurisation. The environmental advantages of the proposed process mainly include reduced amounts of solid residue, being 95 percent less than that generated by other wet processes; and the recovery of sulphur, which can be obtained with units normally available in oil refineries. Description The job consists mainly of testing and optimising the performance of a process for regenerating the buffer used to scrub the flue gas coming from a FCC unit. The project planned to construct a regeneration plant and connect it to an FCC plant, already existing in a refinery. Data was collected for comparison with the BATs applicable in the sector, defined in the refinery BREF documents by the IPTS of Seville: all the necessary chemical and environmental analyses will be carried out. At the end of the tests, a technical and economic comparison with sector relevant BATs was carried out, as well as an analysis of the overall environmental impact. Environmental relevance and dissemination plan The project has a direct relevance for 54 cracking plants and for 49 sulphur recovery plants throughout the EU. Findings can be applied also to other industries with similar emission problems (sulphuric acid production, metallurgy). For this reason an information/dissemination programme was planned, in order to reach potential interested parties at a local, regional, national and EU level. In particular public administrations and institutions were to be contacted as well as the interested industrial sectors. The project will be carried out in the Sannazzaro refinery, owned by ENI S.p.A. – Divisione Refinery & Marketing, and lasted 36 months. Expected results Successful achievement of the project objectives would mean a lower overall environmental impact, with reference to other well proven technologies for flue gas desulphurisation. In particular the following results were expected: - SO2 emission < 550 mg/Nm3 in flue gas (about 1/3 of the legal limit) - SO2 removal efficiency greater than 85 percent, with corresponding recovery of saleable S - 500 kg/day of solid waste, meaning no impact on transportation and on soil, for an industrial plant - negligible concentration of sulphates and sulphites in waste water - saving of 95 percent for absorbing solution replacement, and of 25 percent for energy, with reference to BATs using NaOH - saving of 40 percent in FCC operating costs, with reference to BATs using NaOH.

Results

The project achieved its objectives completely, with the following remarkable results: SO2 emissions: 250 mg/Nm3 in comparison with 550 mg/Nm3 (expected results) and 1.700 mg/Nm3 (BATs using NaOH) Solid waste production: 460 kg/day in comparison with 24.000 kg/day (BATs using NaOH) Concentration of sulphates and sulphites in waste water: 1 t/h of liquid waste in comparison with 9 t/h (BATs using NaOH) Absorbing solution saving: 97 percent Energy saving: 25 percent Operating costs saving: 40 percent Sulphur recovery: 96 percent In addition the plant demonstrated good performance stability, underlining the feasibility of the technology. The project demonstrated the possibility of incorporating the proposed technology into the BATs suggested by IPTS of Seville. The technology can be used both for the FCC plants, similar to that improved by the beneficiary (they are 53 in EU15 + Switzerland) and in other refineries (104 in EU15 + Switzerland). Other industry sectors such as metallurgy can also apply the technology. The possibility of updating EU environmental
policy and legislation in light of the introduction of the new proposed technology might also be assessed. The proposed technology is innovative, at least at industrial level: the only industrial plant now existing is that tested in the project. The main potential users are all the industries that have sulphur recovery problems and some engineering companies dealing with similar processes. The technology is highly reproducible: it is sufficient to contact the beneficiary and obtain the license to use the patent. However two limiting factors must be considered: - high investment costs - the presence of a plant recovering sulphur is essential, because it is necessary to find an exit for the removed SO2. However, if a refinery (or another actor) decided to implement such a plant, the financial saving would be so great that the high investment costs would be recovered in about five years. The project demonstrated the possibility of feeding the refinery plants with high sulphur content, without increasing the pollutant emissions; on the contrary, they were reduced. This means it is possible to: - obtain high added value refined products with poor raw materials; - maintain in operation many refineries that are now in economic difficulties or are facing closure because of their negative environmental impact. The project will continue, in the sense that the plant is an industrial plant in operation with good technical and economic performance. It is possible that other actors might soon decide to use the proposed technology: Valero Company, which owns some refineries in the USA, asked explicitly for a replication of the project in one of its refineries. The IPCC directive obliges the refineries to adopt the BAT by 30/10/2007. In addition the Autoil 2 Directive obliges the sulphur contents in petrol to be reduced by January 2009. But to produce low sulphur petrol the RefinARS methodology is very useful. In this context the application of the RefinARS methodology can now be fully implemented. This project has been awarded the title of "Best of the Best" from a shortlist of 21 "Best" LIFE Environment projects in 2005-2006

Top

Environmental issues addressed:

Themes

Air & Noise - Air pollutants
Environmental management - Cleaner technologies
Energy - Savings

Keywords

acid rain, treatment of gases, flue gas, pollutant elimination, oil refinery

Target EU Legislation

- Industry and Product Policy
Development of new legislation
Air
- Directive 84/360 - Combating of air pollution from industrial plants (28.06.1984)
- Directive 96/62 - Ambient air quality assessment and management (27.09.1996)
- Directive 1999/13 - Limitation of emissions of volatile organic compounds due to the use of organ ...
- Directive 2001/80 - Limitation of emission of certain pollutants into the air from large combusti ...
- Directive 2001/81- National emissions ceilings for certain atmospheric pollutants (23.10.2001)
- Development of new legislation

Natura 2000 sites

Not applicable

Beneficiaries:

Coordinator: E.N.I. Spa Divisione Refining and Marketing
Type of organisation: Public enterprise
Description: Energy company

Administrative data:

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Total budget: 8,767,105.00 €
EU contribution: 1,229,078.96 €
Project location: Lombardia(Italia)

Read more:

Project web site: Progetto Refinars