Non-CO₂ Greenhouse Gases: Nitrous Oxide

**Source/Sectors:** Energy/Stationary Combustion

**Technology:** Options for emission reduction related to stationary combustion (B.2.2)

**Description of the Technology:**
Stationary combustion includes all the combustion activities except waste incineration, transportation (mobile combustion), and biomass burning for non-energy purposes. For stationary sources, nitrous oxide may result from the incomplete combustion of fuels (USEPA, 2006a).

Emission concentrations of N₂O from burning of fossil fuels in stationary combustion processes are low, typically 1 to 2 ppmV for coal-fired plants and 1 ppmV or less for oil- and gas-fired plants. Sources with higher emission concentrations are flue gases from fluidized bed combustion (FBC), flue gases from the selective non-catalytic reduction (SNCR) process, and combustion of wood, waste, and other biomass (de Jager et al., 2001). Technological options for emission reduction of N₂O may be categorized into three groups: (1) reduced emissions from fluidized bed combustion; (2) use of selective catalytic reduction; and (3) fuel shift and reduction in fossil fuel consumption (de Jager et al., 2001; de Soate, 1993; EC, 2001).

- Fluidized bed combustion (FBC) – Fluidized bed combustion has a higher energy conversion than conventional pulverized fuel combustion, and it has lower NOₓ emissions due to a lower combustion temperature. However, the lower combustion temperature, between 800 and 900 °C, leads to higher N₂O emission concentrations, in the range of 30-150 ppmV. Several technological measures to reduce N₂O emissions are potentially available: (1) optimizing operating conditions, (2) using reversed air staging, (3) use of afterburner, (4) use of catalytic reduction, and (5) use of pressurized fluidized bed (de Jager et al., 2001; IEA, 2000). It was estimated in an EU report, for applications of these technologies at FBC facilities, the cost is approximately $59/MT₇CO₂-Eq. for installing the gas afterburner, $51/MT₇CO₂-Eq. for reverse air staging, and $170/MT₇CO₂-Eq. for “optimized” operating conditions coupled with the use of catalytic control (IEA, 2000). It should be noted that these cost estimates were based on a very limited set of studies.

- Use of selective catalytic reduction – Use of selective non-catalytic reduction (SNCR) for reducing NOₓ emissions requires higher operating temperatures, but it also creates N₂O emissions. An alternative NOₓ abatement system may be selective catalytic reduction (SCR), which is considered preferable with regards to N₂O emission reduction; however, the specific cost of NOₓ abatement of SCR is twice as expensive than the cost of SNCR (de Jager et al., 2001). It should be noted here that some consider SCR effective in reduction of N₂O emissions while the others hold an opposite view (USEPA 2006a; Smit et al., 2001).

- Fuel shift and reduction of fuel consumption – A shift from coal to oil or gas would result in lower N₂O emissions from fuel combustion. Reduction in fossil fuel consumption can be achieved, for example, by applying energy-efficiency improvement measures, applying energy saving measures, and increasing use of renewable energy. A shift to non-fossil energy source will further reduce the emissions. However, it is very unlikely that these options will be implemented as part of a N₂O abatement option (de Jager et al., 2001; IEA, 2000).

**Effectiveness:** Low

**Implementability:** Low
Reliability: Low

Maturity: Low

Environmental Benefits: It reduces nitrous oxide emission.

Cost Effectiveness: Low

Industry Acceptance Level: Low

Limitations: Most of these technological options are still in the development stage.

Sources of Information:


