**Non-$CO_2$ Greenhouse Gases:** Nitrous Oxide

**Source/Sectors:** Energy/Mobile Combustion

**Technology:** Options for emission reduction related to mobile combustion (B.2.1)

**Description of the Technology:**
In the mobile combustion sector, $N_2O$ is emitted as a by-product of fuel combustion (USEPA, 2006a). The degree to which $N_2O$ emissions have increased (or decreased) from mobile sources depends upon factors such as driving practices (i.e., number of cold starts) and size, type, and age of the catalyst. The production of $N_2O$ emissions can increase up to a factor of 10 to 16 due to aging of the catalyst (de Jager *et al.*, 2001). $N_2O$ emissions from mobile sources for areas with a high number of road vehicles with emission controls, therefore, can be substantial (USEPA, 2006a). The technological options for reducing $N_2O$ emission from mobile sources include the following:

- Improve catalyst performance – In most of the existing catalytic converters, $N_2O$ is produced as a result of an incomplete reduction of $NO_x$ to NO. In the longer term it might be possible to develop a new type of catalytic converter that will also prevent $N_2O$ formation. However, this would require a significant R&D effort (de Jager *et al.*, 2001). $N_2O$ emissions increase with the age of the catalyst in the converter. Although increased rate of replacement of catalytic converters will reduce $N_2O$ emission, it is not a realistic measure because the cost would be prohibitively high (de Jager *et al.*, 2001). The catalyst performance can also be improved by having electrically heated catalyst, optimal positioning of the catalyst for accelerated heating, and catalytic insulation to keep catalytic converters hot for up to 24 hours. These technologies are already developed and mainly aim at reducing start-up emissions of $NO_x$ and VOCs, little or no attention has been paid in the development and testing with regards to emission reduction of $N_2O$ (de Jager *et al.*, 2001).
- Use of $N_2O$-decomposition catalyst – A future catalytic converter may consist of a traditional three-way catalyst (for $NO_x$ CO and VOC), followed by a $N_2O$-decomposition catalyst. But there are technical obstacles to overcome. At this point, it is doubtful that the problems can be solved in the next few decades (de Jager *et al.*, 2001; US Climate Change, 2005).
- Use of alternative technologies for $NO_x$-emission reduction – Use of the three-way catalysts is not the sole option for reducing $NO_x$ emissions. Increased use of low-VOC and low-$NO_x$ engines may replace the traditional three-way catalyst controlled engines. Consequently, $N_2O$ emissions from three-way catalysts can be avoided (de Jager *et al.*, 2001).
- Alternative fuel – Technological breakthroughs, such as fuel cell, will also greatly reduce the level of $NO_x$ emissions (Lucas *et al.*, 2006). Fuel substitutes, such as use of hybrid, electric, ethanol, and natural gas vehicles, will also reduce $N_2O$ emissions.

**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.

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