Non-CO₂ Greenhouse Gases: Methane

Source/Sectors: Natural Gas Systems (Production; Processing; Transmission)

Technology: Automated air/fuel ratio controls (A.1.2.1.15; A.1.2.3.13)

Description of the Technology:
In the United States and worldwide, many efforts have been made to identify and implement mitigation options to reduce methane emissions from the natural gas sector (USEPA, 2003). For example, the Natural Gas STAR program is a voluntary partnership between US EPA and the oil and gas industry to identify and implement cost-effective technologies and measures to reduce methane emissions. The measures to reduce methane emissions from the natural gas systems can be grouped into the following mitigation strategies: prevention, recovery and re-injection, recovery and utilization, and recovery and incineration (Hendriks & de Jager, 2001).

Natural gas-fueled internal combustion engines can provide continuous duty operations over a set range of air to fuel ratios (AFR). Fuel-rich conditions result in greater unburned fuel emissions (primarily methane) and higher CO emissions. Fuel savings and reduced associated emissions can be achieved by installing an automated AFR control system (USEPA, 2004).

Effectiveness: Good

Implementability: The greatest opportunities for system and efficiency improvements are on rich burn, high-speed, turbocharged engines (1,000 hp to 3,000 hp).

Reliability: Good. It was found that operators, in general, run engines in a rich-AFR state would provide the most reliability for field operations (USEPA, 2008).

Maturity: Good

Environmental Benefits: A partner of the Gas STAR program has reduced its fuel consumption by 18% to 24% by installing automated AFR controls on 51 selected engines in its Gulf of Mexico operations. It achieved an average emission reduction of 128 Mcf of methane per unit per year by reducing the engines’ fuel consumption (USEPA, 2008).

Cost Effectiveness: A partner of the Gas STAR program reported a reduction in fuel consumption in excess of 2,900 MMcf during a two-year period as the result of installing the REMVue technology on 51 engines, or an average of 78 Mcf per day per engine when adjusted for load. This represents a 39 percent increase in estimated fuel savings (based upon a sample inventory, which yielded a pre-job fuel savings estimate of 56 Mcf per day). The total reported cost was $6.1 million. Capital costs, including installation, ranged from $85,000 to $140,000 per unit, with the average cost for the last two years being $120,000 per installation. At a nominal value of $3 per Mcf, the fuel savings was more than $4.35 million for a calculated payout of 1.4 years (USEPA, 2008).

The partner found that the additional cost of operating the REMVue systems is offset by the reduction in engine maintenance costs. A reduction in NOₓ and CO₂ emissions are an added benefit of the system. A post-audit was conducted on 20 percent of the installed base in 2004. Among the engines that were revisited, there were some that were retrofitted as early as 2001. The post audit reviewed pre-, post- and post-post-values for fuel consumption, emissions reductions, availability, and economics based on a normalized gas price. The emissions reduction results showed that unburned hydrocarbons were down 3,549 tons per year, CO₂ emissions were down 2,309 tons per year, and CO
emissions were down 83,300 tons per year. There were no changes in NOx emissions. Availability increased 2.25 percent for the 12 months pre-installation versus 12 months post-installation.

- Capital Costs (including installation): >$10,000
- Operating and Maintenance Costs (annual): Installing system reduces maintenance costs
- Payback (Years): 1-3

**Industry Acceptance Level:** ChevronTexaco

**Limitations:** None reported. The technology can communicate/interface with most existing electronic control and telemetry systems.

**Sources of Information:**