



SoCalGas Comments in response to July 8, 2019 Public Meeting: The Role of the Industrial Sector in Meeting California's Carbon Neutrality Goals

Appendix B:

Existing Energy Efficiency and Emerging Technologies

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1. Existing Technology – Energy Efficiency

SoCalGas offers a variety of energy-efficiency incentives designed and proven to save industrial customers energy and money such as those discussed below.

A. Industrial Infrared Ribbon Combi-burner

This burner technology combines traditional flame technology with infrared technology. The combined burner focuses the flame of a standard natural gas burner onto a ceramic tile that has microscopic holes in it, converting the heat into infrared energy. This technology has wide application for industrial heating processes and financial incentives for adoption is available via SoCalGas' energy efficiency rebate program.

B. Pyrogel Pipe Insulation

This versatile and durable type of pipe insulation is used in wide range high-temperature applications at commercial and industrial facilities. This includes project and maintenance work at refineries, petrochemical, and gas processing plants as well as for industrial heating processes with its greatest benefit for large bore piping. Financial incentives for adopting this technology is available via SoCalGas' customized energy efficiency program.

C. GEM Steam Trap

The GEM steam trap uses a venturi orifice design eliminating moving parts. It uses the difference in density between steam and condensate with the condensate passing through the orifice plate much more slowly than steam. This effectively keeps the steam on the heat transferring side of the equipment resulting in better thermal efficiency. Having no moving parts increases reliability and greatly decreases failure rate thus also reducing maintenance. This technology has wide application for industrial heating processes and financial incentives for adoption is available via SoCalGas' customized energy efficiency program.

2. Emerging Technology

SoCalGas' RD&D program typically works as an upstream feeder for the Emerging Technologies Program (ETP), operating under the Energy Efficiency Program (EEP). ETP validates the new and commercialized products and feeds them to SoCalGas' new measure development team for EEP incentive and rebates. ETP has funded numerous emerging technologies that show potential for GHG emissions reductions as well as other benefits. Below are brief descriptions for eight sample emerging technology projects.

A. Transport Membrane Condenser

The National Energy Technology Laboratory, in partnership with the Gas Technology Institute and Media & Process Technology, Inc., developed a nanoporous ceramic membrane device that condenses water and recovers heat from flue gas. This innovative technology has been tested in

various boilers and configurations and has been shown to be effective at heat and water recovery with an estimated 8% reduction in GHG emissions with the additional benefit of water savings.

B. Warm Mix Asphalt

An additive to asphalt mixes lowers the melting point of traditional hot mix asphalt thus asphalt can be produced at lower temperatures (30-120 °F lower) than traditionally. This reduces paving costs, extends the paving season, improves asphalt compaction, and allows for longer transport distances. GHG emissions reductions are estimated at approximately 30% while also reducing volatile organic compound emissions improving worker conditions by reducing exposure to emissions, fumes, and odors. This product would be advantageous in public, industrial, and commercial paving applications.

C. Small-medium Size Combined Heat and Power (CHP)

Small to medium CHP (up to a few hundred kW) offers customers distributed electricity generation and heat that can shave off-peak electricity demand. This type of CHP uses steam turbines or ultra-low emission engines and provides for heat recovery of otherwise wasted energy, typically up to 30% of total fuel input with the same percent estimated GHG emissions reductions. Customers with steady hot-water demand, such as gymnasiums, aquatic sports centers, and food processing plants can benefit the most from this technology.

D. Low-temperature Flue-gas Heat Recovery & Power Generation

An estimated 20% reduction in GHG emissions can be realized through the use of low-temperature flue-gas heat recovery and power generation. This is accomplished by recovering low-temperature waste heat (under 1,000 °F) using the organic Rankine cycle. This cycle uses an organic, high-molecular mass fluid with liquid-vapor phase change, or boiling point, occurring at a lower temperature than the water-steam phase change.¹ Waste heat recovery is an important development field for the organic Rankine cycle.

The use of organic fluid, allows Rankine-cycle heat recovery from lower temperature sources such as biomass combustion, industrial waste heat, and textile/fabric drying. It can also be applied to heat and power plants (e.g. small scale cogeneration plant on a domestic water heater), or to industrial and farming processes such as organic products fermentation, hot exhausts from ovens or furnaces (e.g. lime and cement kilns), flue-gas condensation, intercooling of a compressor, condenser of a power cycle, etc.² The low-temperature heat is converted into useful work that can be converted into electricity thus offsetting power requirements from the grid with an estimated reduction in GHG emissions of 20%. Multiple U.S. manufactures have developed and are exporting this technology and products to Asia and Israel.

¹ Wikipedia Website. Organic Rankin Cycle. Available at: https://en.wikipedia.org/wiki/Organic_Rankine_cycle

² EnerCoss Website. Organic Rankin Cycle (ORC) Technology. Available at: <https://enercoss.com/the-organic-rankine-cycle/>

E. Combination Burner Retrofit for Tunnel Bakeries

Premix burners³ with porous, stiff open-cell structures, known as sponge, can reduce both energy use and pollutant emissions. Premixed flames have the potential to significantly reduce NOx emissions in comparison to traditional diffusive open-flames; however, they may also have instability issues. Using a porous inert sponge with a premixed burner can ensure more stable combustion, thus flame stability and lower pollutant emissions.⁴

Traditional open-flame type bakeries can reduce fuel; and NOx, carbon monoxide (CO), and GHG emissions by an estimated 15% through use of tighter staged burner-control incorporating sponge premix burners, while also improving product quality.

F. Wireless Steam Trap Monitoring & Alert Systems

The U.S. Department of Energy reports that a large percentage of fuel burned by manufacturers is used to produce steam at pressure. Steam is used to heat raw materials and treat semi-finished products as well as used as a power source for equipment, as well as for building heat and electricity generation.⁵ Thus, steam system improvement, especially reductions in trap failures, can reduce fuel usage, increase efficiency, and reduce production costs.⁶ One steam management system is the use of steam-trap alert systems and automating (including use of wireless technology enables faster diagnosis and response to equipment leak failure resulting in an estimated 5% reduction GHG emissions.

G. Carbon Monoxide-based Combustion Optimizer Controller + Oxygen Trim Controller

It is important to control boiler operations to minimize energy losses. Traditional oxygen-trim systems can be enhanced with a CO-based controller, because its sensitivity band is narrower than that of oxygen. Precision control using CO feedback can reduce GHG emissions by 3% of large loads such as with large utility boilers, municipal sewage treatment plants, and oil recovery steam generators that typically have tariffs not covered by California energy efficiency programs.

H. Smart Pumps

All major pump manufacturers now offer smart pumps with self-contained performance curves, sensors, and electronically-commutating motor controls. This eliminates the need for costly

³ Ribbon burner definition and demonstration: <https://www.youtube.com/watch?v=f8mYUzButFQ> and <https://www.youtube.com/watch?v=YoYZHmhMcFs>

⁴ResearchGate. *Flame Stabilization and Emissions of a Natural Gas/Air Ceramic Porous Burner*. January 2008. Available at:

https://www.researchgate.net/profile/Neda_Djordjevic/publication/250356892_Flame_Stabilization_and_Emissions_of_a_Natural_GasAir_Ceramic_Porous_Burner/links/597f41c7458515687b4a5b1d/Flame-Stabilization-and-Emissions-of-a-Natural-Gas-Air-Ceramic-Porous-Burner.pdf

⁵ ue Systems Inc. *Why do Steam Traps Fail*. Available at: <http://www.uesystems.com/resources/articles-and-announcements/why-do-steam-traps-fail>

⁶ Forbes Marshall Website. Available at: <https://www.forbesmarshall.com/North-America>

external sensors and integration of external-variable frequency drives. Significant saving in pumping energy and reduction of distribution losses along with estimated GHG emissions reductions ranging from 10-80% may be realized from smart pump use in the right applications with variable loads such as hot water, process fluids, and cold/chilled water circulation systems, or booster systems.