

Natural Gas STAR International



Implementation Plan

Company Information

Company Name: _____

Gas Star Contact: _____

Title: _____

Address: _____

City: _____

Country: _____

Telephone: _____

Fax: _____

E-mail: _____

This implementation plan pertains to the company's operations in *(please specify country)** :

This implementation plan includes planned activities for the following facilities or locations:

The purpose of this Implementation Plan is to guide your company's participation in Natural Gas STAR International. Please evaluate the technologies and practices that your company is currently implementing as well as additional technologies and practices that, if implemented, would be beneficial to your company.

The Implementation Plan is designed to be a dynamic tool for Natural Gas STAR International partners to plan their Program activities. As company priorities and plans shift over time, the Implementation Plan may be revised or updated by submitting a new form to the Program.

Implementation Plan Elements

ELEMENT 1 – Evaluate Past and Current Reductions

Partners are encouraged to review current and past activities that have resulted in methane emission reductions. Reviewing these activities will help guide companies' participation in Natural Gas STAR International by creating a base of understanding of current activities to facilitate planning of future activities.



ELEMENT 2 - Emissions Reduction Technologies & Practices

Natural Gas STAR International partners reduce methane emissions throughout their operations by implementing a wide variety of technologies and practices. New partners are encouraged to evaluate and report current and new technologies or practices that cost-effectively reduce methane emissions. A list of technologies and practices that have been implemented by industry partners and reported to Natural Gas STAR is included in the appendix.

* Please submit a separate Implementation Plan for each country in which you plan to implement Natural Gas STAR International.

EPA Form No. 5900-106

ELEMENT 1

Evaluate Past and Current Reductions

A review of past and current methane emission reduction activities will help guide your company's participation in Natural Gas STAR International by creating a base of understanding of current activities to facilitate planning of future activities.

As a first step, many new partners find it useful to review and document past methane emissions reduction efforts. The process helps companies quantify the success of their past activities and target future emission reduction efforts.

Will you include past activities in your annual report? Yes No

If yes, please describe your company's plans for reviewing past emission reduction activities.



ELEMENT 2

Emissions Reduction Technologies & Practices

Your company may implement a variety of technologies and practices to reduce methane emissions. Please complete this form indicating which technologies and practices you are currently implementing and those you plan to implement in the future. For your reference, the appendix includes a list of proposed methane emission reduction technologies and practices and conversion factors.

Please fill out a separate page for each technology or practice your company plans to implement. (Please make additional copies, if necessary)

Technology or practice your company is currently implementing or will be implementing

Name of Technology or Practice (choose from the list in the appendix or describe your own):

Please provide a description of the technology or practice and how you plan to implement it (*including location or facility where you plan to implement it*):

At what scale will you be implementing this activity?

- Company Wide
- Pilot Project
- Other _____

Level of Implementation (*check one*):

- Number of units to be installed: _____ units
- Frequency of practice: _____ times/year



Additional Information on Anticipated Plans and Projects

If additional space is needed, please continue on the back.



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Additional Information on Anticipated Plans and Projects

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Appendix A-1

Methane Emission Reduction Technologies & Practices—Production Sector

The list below describes a variety of methane emission reduction technologies that Natural Gas STAR partners in the production sector have implemented and reported to Natural Gas STAR. **Sunset dates (i.e., the length of time a technology or practice can continue to accrue emission reductions after implemented) are one year in duration unless otherwise noted in parentheses.** An asterisk (*) indicates that a technical document related to the technology or practice is available online at epa.gov/gasstar/tools/recommended.html.

Compressors/Engines

- Automate compressor systems operation to reduce venting
- Catalytic converter installation (10 years)
- Convert to low pressure compressor starters (10 years)
- Eliminate unnecessary equipment and/or systems*
- Increase compression capacity to reduce venting/flaring
- Install automated air/fuel ratio controls (10 years)*
- Install electric compressors (10 years)*
- Install electric motors (10 years)
- Install electric motor starters (10 years)*
- Install lean burn compressor (10 years)
- Lower compressor purge pressure for shutdown
- Perform gas recovery using slipstream (10 years)
- Redesign blowdown/alter ESD practices*
- Reduce emissions when taking compressors offline*
- Reduce gas venting with fewer compressor engine startups and improved engine ignition*
- Replace compressor cylinder unloaders (10 years)*
- Replace gas starters with air or nitrogen (10 years)*
- Turbine fuel use optimization

Dehydrators

- Convert pneumatics to mechanical controls (10 years)*
- Install condensers on glycol dehydrators (10 years)
- Install flash tank separators on glycol dehydrators (10 years)*
- Reduce glycol circulation rates in dehydrators*
- Replacing glycol dehydrators with desiccant dehydrators (10 years)*
- Reroute dehydrator/tank vents to flare or station suction (10 years)*
- Reroute glycol skimmer gas*
- Shutdown glycol dehydrator stripping gas in winter
- Use rich glycol in glycol pumps

Directed Inspection and Maintenance

- DI&M at compressor stations*
- DI&M: leak detection using IR camera/optical imaging*

- DI&M: leak detection using lower emission threshold
- DI&M: survey and repair leaks*

Pipelines

- Inject blowdown gas into low pressure mains or fuel gas system*
- Pipeline replacement and repair
- Use hot taps for in-service pipeline connections*
- Use pipeline pump-down techniques to lower gas line pressure before maintenance*

Pneumatics/Controls

- Capture/use gas released from gas-operated pneumatic pumps
- Convert gas pneumatic controls to instrument air (10 years)*
- Convert natural gas-driven chemical pumps (10 years)*
- Convert pneumatics to mechanical controls (10 years)*
- Identify and replace high-bleed pneumatic devices (7 years)*
- Install controllers on gas-assisted methanol pump (10 years)
- Install/convert gas powered separators to solar powered separators (10 years)
- Install no bleed controllers (10 years)
- Install non-venting dump controllers (10 years)
- Reduce gas pressure on pneumatic devices
- Reduce venting from unlit pilot: install electronic safety devices (10 years)*
- Replace bi-directional orifice meter with ultrasonic meters*
- Replace chemical pumps with electronic flow controllers (10 years)
- Use add-on controls to reduce emissions from pneumatics (10 years)

Tanks

- Change out vent pallet (10 years)
- Convert water tank blanket from natural gas to CO₂ (10 years)*
- Eliminate unnecessary equipment and/or systems*

Methane Emission Reduction Technologies & Practices—Production Sector

Tanks

- Install evactors (10 years)
- Install flash gas compressors (10 years)
- Install hydrocarbon liquid stabilizer (10 years)
- Install pressurized storage of condensate (10 years)*
- Install vapor recovery units (VRUs) on storage tanks (10 years)*
- Install VRUs on pipeline liquid/condensate tanks (10 years)
- Recover gas during condensate loading*
- Reduce excess blanket gas blow-by to the atmosphere
- Replace leaking above-ground tanks (10 years)
- Route gas to compressor suction/blowcase vessel (10 years)
- Use protective tank coatings to reduce leaks (10 years)

Valves

- Heat tracing to prevent control valves from freezing open
- Install BASO® valves (10 years)*
- Install plugs on valves and open ended lines (10 years)
- Test and repair pressure safety valves*

Wells

- Artificial lift: gas lift (10 years)
- Artificial lift: install plunger lifts (10 years)*
- Artificial lift: install pumpjacks or rod pumps on gas wells (10 years)*
- Artificial lift: install smart lift automated systems on gas wells (10 years)*
- Artificial lift: install velocity tubing strings (10 years)*
- Artificial lift: pressure swabbing
- Artificial lift: use capillary strings (10 years)
- Artificial lift: use compression (10 years)

- Artificial lift: use pumping unit (10 years)
- Artificial lift: use to reduce blowdown in gas wells (10 years)*
- Install automated shut-in cycle units to reduce well venting (10 years)
- Install flash tank separator on water gathering system (10 years)
- Install pumps for separators (10 years)
- Install snubbing unit at wellhead
- Install soap launcher/soap unit (10 years)
- Lower heater-treater temperature
- Optimize gas well unloading times
- Perform reduced emissions completions for hydraulically fractured natural gas wells*
- Route casinghead gas to VRU or compressor (10 years)*
- Use foaming agents to reduce blowdown frequency*

Other

- Capture and use waste heat to reduce gas usage and emissions
- Convert natural gas-fired generator to solar power (10 years)
- Flare reduction program
- Improve system design/operation
- Install flares (10 years)*
- Install pilotless burner controls (10 years)
- Install purge reducer on flare (10 years)
- Nitrogen rejection unit optimization*
- Recover gas from separators
- Re-inject gas for enhanced oil recovery
- Re-inject gas into crude
- Replace aged heaters with new efficient gas fired heaters (10 years)

Appendix A-2

Methane Emission Reduction Technologies & Practices— Gathering and Processing Sector

The list below describes a variety of methane emission reduction technologies that Natural Gas STAR partners in the gathering and processing sector have implemented and reported to Natural Gas STAR. **Sunset dates (i.e., the length of time a technology or practice can continue to accrue emission reductions after implemented) are one year in duration unless otherwise noted in parentheses.** An asterisk (*) indicates that a technical document related to the technology or practice is available online at epa.gov/gasstar/tools/recommended.html.

Compressors/Engines

- Eliminate unnecessary equipment and/or systems*
- Install automated air/fuel ratio controls (10 years)*
- Install electric compressors (10 years)*
- Install electric motor starters (10 years)*
- Redesign blowdown/alter ESD practices*
- Reduce emissions when taking compressors offline*
- Replace compressor rod packing systems*
- Replace gas starters with air or nitrogen (10 years)*

Dehydrators

- Convert pneumatics to mechanical controls (10 years)*
- Install condensers on glycol dehydrators (10 years)
- Install flash tank separators on glycol dehydrators (10 years)*
- Reduce glycol circulation rates in dehydrators*
- Replace glycol dehydration units with methanol injection (10 years)*
- Reroute dehydrator/tank vents to flare or station suction (10 years)*
- Reroute glycol skimmer gas*

Directed Inspection and Maintenance

- DI&M: aerial leak detection using laser and/or infrared technology*
- DI&M at compressor stations*
- DI&M at gas plants and booster stations*
- DI&M: inspect/repair compressor station blowdown valves*
- DI&M: leak detection using IR camera/optical imaging*
- DI&M: leak detection using ultrasound*
- Improve measurement systems to track gas loss

Pipelines

- Pipeline replacement and repair
- Recover gas from pipeline pigging operations*
- Revise pigging schedule to reduce methane emissions
- Use composite wrap repair*
- Use hot taps for in-service pipeline connections*

- Use inert gases and pigs to perform pipeline purges*
- Use of improved protective coating at pipeline canal crossings (10 years)
- Use pipeline pump-down techniques to lower gas line pressure before maintenance*

Pneumatics/Controls

- Capture and use waste heat to reduce gas usage and emissions
- Convert gas pneumatic controls to instrument air systems (10 years)*
- Install back-up power at booster sites to prevent venting (10 years)
- Install no bleed controllers (10 years)
- Use add-on controls to reduce emissions from pneumatics (10 years)

Tanks

- Direct liquids at compressor suction to pipeline (10 years)
- Install hydrocarbon liquid stabilizer (10 years)
- Install pressurized storage of condensate (10 years)*
- Install vapor recovery units (VRUs) on storage tanks (10 years)*
- Install VRUs on pipeline liquid/condensate tanks (10 years)
- Reduce excess blanket gas blow-by to the atmosphere
- Reduce vapors vented out of drip tanks
- Route inlet flash vapors to station suction (10 years)

Valves

- Convert gas operated valves to hydraulic operation (10 years)
- Heat tracing to prevent control valves from freezing open
- Rupture pin shutoff device to reduce venting (10 years)
- Test and repair pressure safety valves*
- Test gate station pressure relief valves with nitrogen

- Install flares (10 years)*
-

Methane Emission Reduction Technologies & Practices—Gathering and Processing Sector

Other

- Convert natural gas-fired generator to solar power (10 years)
- Nitrogen rejection unit optimization*
- Process/re-route acid gas to reduce venting

Appendix A-3

Methane Emission Reduction Technologies & Practices—Transmission Sector

The list below describes a variety of methane emission reduction technologies that Natural Gas STAR partners in the transmission sector have implemented and reported to Natural Gas STAR. **Sunset dates (i.e., the length of time a technology or practice can continue to accrue emission reductions after implemented) are one year in duration unless otherwise noted in parentheses.** An asterisk (*) indicates that a technical document related to the technology or practice is available online at epa.gov/gasstar/tools/recommended.html.

Compressors/Engines

- Automate compressor systems operation to reduce venting
- Eliminate unnecessary equipment and/or systems*
- Install automated air/fuel ratio controls (10 years)*
- Install electric compressors (10 years)*
- Install electric motors (10 years)
- Install electric motor starters (10 years)*
- Install lean burn compressor (10 years)
- Lower compressor purge pressure for shutdown
- Redesign blowdown/alter ESD practices*
- Reduce emissions when taking compressors offline*
- Reduce natural gas venting with fewer compressor engine startups and improved engine ignition*
- Replace compressor cylinder unloaders*
- Replace compressor rod packing systems*
- Replace gas starters with air or nitrogen (10 years)*
- Replace wet compressor seals with dry seals (10 years)*
- Use of turbines at compressor stations (20 years)

Dehydrators

- Convert pneumatics to mechanical controls (10 years)*
- Install condensers on glycol dehydrators (10 years)
- Install flash tank separators/controls on transmission sector glycol dehydrators (10 years)*
- Reduce glycol circulation rates in dehydrators*
- Replace glycol dehydrator with separator & in-line heaters (10 years)
- Reroute dehydrators/tank vents to flare or station suction (10 years)*
- Reroute glycol skimmer gas*

Directed Inspection and Maintenance

- DI&M: aerial leak detection using laser and/or infrared technology*
- DI&M at compressor stations*
- DI&M at remote sites*

- DI&M: inspect/repair compressor station blowdown valves*
- DI&M: leak detection using IR camera/optical imaging*
- DI&M: leak detection using ultrasound*
- DI&M: survey and repair leaks*

Pipelines

- Inspect/repair valves during pipeline replacement*
- Pipeline replacement and repair
- Recover gas from pipeline pigging operations*
- Reduce/downgrade system pressure
- Reduced emissions through third-party damage prevention
- Use composite wrap repair*
- Use hot taps for in-service pipeline connections*
- Use inert gas/pigs for pipeline purges*
- Use pipeline pump-down techniques to lower gas line pressure before maintenance *

Pneumatics/Controls

- Convert gas pneumatic controls to instrument air (10 years)*
- Convert natural gas-driven chemical pumps (10 years)*
- Install no bleed controllers (10 years)
- Identify and replace high-bleed pneumatic devices (7 years)*
- Reduce meter run blowdowns
- Replace bi-directional orifice meter with ultrasonic meters*
- Use add-on controls to reduce emissions from pneumatics (10 years)

Tanks

- Install flash gas compressors (10 years)
- Install vapor recovery units on pipeline liquid/condensate tanks (10 years)*

Methane Emission Reduction Technologies & Practices—Transmission Sector

Valves

- Close valves during repair to minimize blowdown*
- Design isolation valves to minimize gas blowdown volumes (10 years)*
- Move in fire gates at compressors (10 years)*
- Test and repair pressure safety valves*
- Use of YALE closures for ESD testing*

Wells

- Switch from underbalanced to overbalanced drilling in gas storage field

Other

- Convert natural gas-fired generator to solar power (10 years)
- Improve system design/operation
- Inject blowdown gas into low pressure mains or fuel gas system*
- Install flares (10 years)*
- Replace aged heaters with new efficient gas fired heaters (10 years)
- Require improvements in quality of gas received

Appendix A-4

Methane Emission Reduction Technologies & Practices—Distribution Sector

The list below describes a variety of methane emission reduction technologies that Natural Gas STAR partners in the distribution sector have implemented and reported to Natural Gas STAR. **Sunset dates (i.e., the length of time a technology or practice can continue to accrue emission reductions after implemented) are one year in duration unless otherwise noted in parentheses.** An asterisk (*) indicates that a technical document related to the technology or practice is available online at epa.gov/gasstar/tools/recommended.html.

Compressors/Engines

- Eliminate unnecessary equipment and/or systems*
- Install electric motor starters (10 years)*
- Redesign blowdown/alter ESD practices*
- Reduce natural gas venting with fewer compressor engine startups and improved engine ignition*
- Replace compressor rod packing systems*

Dehydrators

- Reroute dehydrator/tank vents to flare or station suction (10 years)*

Directed Inspection and Maintenance

- DI&M at compressor stations (non-mainline transmission)*
- DI&M at gate stations and surface facilities*
- DI&M: increase frequency of leak surveys*
- DI&M: survey and repair leaks*
- Improve measurement systems to track gas loss

Pipelines

- Identify and rehabilitate leaky distribution pipes
- Insert gas main flexible liners (10 years)*
- Reduce/downgrade system pressure
- Reduced emissions through third-party damage prevention
- Use hot taps for in-service pipeline connections*
- Use no-blow insertion fittings
- Use pipeline pump-down techniques to lower gas line pressure before maintenance*

Pneumatics/Controls

- Convert gas pneumatic controls to instrument air (10 years)*
- Convert natural gas-driven chemical pumps (10 years)*
- Convert pneumatic devices to mechanical/electronic (10 years)*
- Identify and replace high-bleed pneumatic devices (7 years)*
- Use add-on controls to reduce emissions from pneumatics (10 years)

Valves

- Install excess flow valves (10 years)*
- Install overpressure protection system (10 years)
- Test and repair pressure safety valves*
- Test gate station pressure relief valves with nitrogen

Other

- Convert natural gas-fired generator to solar power (10 years)
- Improve system design/operation
- Inject blowdown gas into low pressure mains or fuel gas system*
- Install flares (10 years)*
- Re-inject CNG cylinder test gas
- Retighten LNG pump seals
- Use automated systems to reduce pressure

Appendix B

Conversion Factors

Please see below for a variety of conversion factors that might be useful when completing your Implementation Plan. Please contact Natural Gas STAR if you have questions about this information.

Gas Conversions

Please report emissions reductions to Natural Gas STAR International in thousand cubic feet (Mcf).

1 Cubic foot of methane	= 1,014.6 Btu
1 Btu	= 0.000986 Cubic feet of methane
1 Cubic foot	= 0.02832 Cubic meter
1 Cubic meter	= 35.312 Cubic feet
1 Mile	= 1.609 Kilometer
1 Kilometer	= 0.6214 Mile
1 Btu	= 251.996 Calories
1 Calorie	= 0.00397 Btu
1 Btu	= 1055.056 Joules
1 Joule	= 0.00095 Btu

Please send completed forms to:

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