



# Natural Gas STAR International



**Methane to Markets**

# 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.



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## **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.

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\* 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

<p>Name of Technology or Practice (choose from the list in the appendix or describe your own):</p>	<p>Please provide a description of the technology or practice and how you plan to implement it (<i>including location or facility where you plan to implement it</i>):</p>
<p>At what scale will you be implementing this activity?</p> <p> <input type="checkbox"/> Company Wide  <input type="checkbox"/> Pilot Project  <input type="checkbox"/> Other _____         </p>	<p>Level of Implementation (<i>check one</i>):</p> <p> <input type="checkbox"/> Number of units to be installed: _____ units  <input type="checkbox"/> Frequency of practice: _____ times/year         </p>



**Additional Information on Anticipated Plans and Projects**

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



## ELEMENT 2

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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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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.



## 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](http://epa.gov/gasstar/tools/recommended.html).

#### Compressors/Engines

- Automate compressor systems operation to reduce venting\*
- Catalytic converter installation (10 years)
- Convert engine starting to nitrogen and/or CO<sub>2</sub> rich gas (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 control systems (10 years)\*
- Install electric compressors (10 years)\*
- Install electric motors (10 years)
- Install electric 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\*
- Replace compressor rod packing systems\*
- Replace gas starters with air (10 years)\*
- Replace ignition/reduce false starts\*
- Turbine fuel use optimization

#### Dehydrators

- Install condensers on glycol dehydrators (10 years)
- Install/convert gas-driven chemical pumps to electric, mechanical, or solar pumps (10 years)\*
- Install desiccant dehydrator (10 years)\*
- Install flash tank separators on glycol dehydrators (10 years)\*
- Reduce glycol circulation rates in dehydrators\*
- Reroute dehy./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 system\*
- Pipeline replacement and repair
- Use fixed/portable compressors for pipeline pumpdown\*
- Use hot taps for in-service pipeline connections\*

#### Pneumatics/Controls

- Capture/use gas released from gas-operated pneumatic pumps
- Convert gas-driven chemical pumps to instrument air (10 years)\*
- Convert gas pneumatic controls to instrument air (10 years)\*
- Convert gas pneumatic controls to mechanical controls (10 years)\*
- Identify and replace high-bleed pneumatic devices (7 years)\*
- Install/convert gas powered separators to solar powered separators (10 years)
- Install controllers on gas-assisted methanol pump (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)
- Consolidate crude oil production and water storage tanks (10 years)\*
- Convert water tank blanket from natural gas to CO<sub>2</sub> (10 years)\*
- Install evactors (10 years)

## Methane Emission Reduction Technologies & Practices—Production Sector

### Tanks

- Install flash gas compressors (10 years)
- Install hydrocarbon liquid stabilizer (10 years)
- Install pressurized storage of condensate (10 years)\*
- Install vapor recovery units (VRUs) (10 years)\*
- Install vapor recovery units on pipeline liquid/condensate tanks (10 years)\*
- Recycle line recover gas during condensate loading\*
- Reduce excess blanket gas blow-by to the atmosphere
- Replace leaking aboveground tanks (10 years)
- Use protective tank coatings to reduce leaks (10 years)

### Valves

- Heat tracing to prevent control valves from freezing open
- Install plugs on valves and open ended lines (10 years)
- Reduce venting from unlit pilot: install BASO valves (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\*
- 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)
- Optimize nitrogen rejection unit to reduce methane in N<sub>2</sub> reject stream\*
- 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](http://epa.gov/gasstar/tools/recommended.html).

#### Compressors/Engines

- Convert engine starting to nitrogen and/or CO<sub>2</sub> rich gas (10 years)\*
- Eliminate unnecessary equipment and/or systems\*
- Install automated air/fuel ratio control systems (10 years)\*
- Install electric compressors (10 years)\*
- Install electric starters (10 years)\*
- Redesign blowdown/alter ESD practices\*
- Reduce emissions when taking compressors offline\*
- Replace compressor rod packing systems\*
- Replace gas starters with air (10 years)\*

#### Dehydrators

- Install condensers on glycol dehydrators (10 years)
- Install/convert gas-driven chemical pumps to electric, mechanical, or solar pumps (10 years)\*
- Install flash tank separators on glycol dehydrators (10 years)\*
- Reduce glycol circulation rates in dehydrators\*
- Reroute dehy./tank vents to flare or station suction (10 years)\*
- Replace glycol dehydration units with methanol injection (10 years)\*
- Reroute glycol skimmer gas\*

#### Directed Inspection and Maintenance

- DI&M at compressor stations\*
- DI&M at gas plants and booster stations\*
- DI&M: aerial leak detection using laser and/or infrared technology
- 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 inert gases and pigs to perform pipeline purges\*

- Use fixed/portable compressors for pipeline pumpdown\*
- Use hot taps for in-service pipeline connections\*
- Use of improved protective coating at pipeline canal crossings (10 years)\*

#### 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) (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\*

#### Other

- Convert natural gas fired generator to solar power (10 years)
- Install flares (10 years)\*
- Optimize nitrogen rejection unit to reduce methane in N<sub>2</sub> reject stream\*
- 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](http://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 control systems (10 years)\*
- Install electric compressors (10 years)\*
- Install electric motors (10 years)
- Install electric 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 frequency of engine starts with gas\*
- Replace compressor cylinder unloaders\*
- Replace compressor rod packing systems\*
- Replace gas starters with air (10 years)\*
- Replace ignition/reduce false starts\*
- Replace wet compressor seals with dry seals (10 years)\*
- Use of turbines at compressor stations (20 years)

#### Dehydrators

- Install condensers on glycol dehydrators (10 years)
- Install flash tank separators/controls on Tran. sector glycol dehydrators (10 years)\*
- Install/convert gas-driven chemical pumps to electric, mechanical, or solar pumps (10 years)\*
- Replace glycol dehydrator with separator & in-line heaters (10 years)\*
- Reroute dehy./tank vents to flare or station suction (10 years)\*
- Reroute glycol skimmer gas\*

#### Directed Inspection and Maintenance

- DI&M at compressor stations\*
- DI&M at remote sites\*
- DI&M: aerial leak detection using laser and/or infrared technology
- 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 fixed/portable compressors for pipeline pumpdown\*
- Use hot taps for in-service pipeline connections\*
- Use inert gas/pigs for pipeline purges\*

#### Pneumatics/Controls

- Convert gas-driven chemical pumps to instrument air (10 years)\*
- Convert gas pneumatic controls to instrument air (10 years)\*
- Identify and replace high-bleed pneumatic devices (7 years)\*
- Install no bleed controllers (10 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)\*

#### 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 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](http://epa.gov/gasstar/tools/recommended.html).

#### Compressors/Engines

- Eliminate unnecessary equipment and/or systems\*
- Install electric starters (10 years)\*
- Redesign blowdown/alter ESD practices\*
- Reduce frequency of engine starts with gas\*
- Replace compressor rod packing systems\*
- Replace ignition/reduce false starts\*

#### Dehydrators

- Reroute dehy./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: survey and repair leaks
- DI&M: increase frequency of leak surveys\*
- 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 fixed/portable compressors for pipeline pumpdown\*
- Use hot taps for in-service pipeline connections\*
- Use no-blow insertion fittings

#### Pneumatics/Controls

- Convert gas-driven chemical pumps to instrument air (10 years)\*
- Convert gas pneumatic controls to instrument air (10 years)\*
- Convert gas pneumatic controls to mechanical controls (10 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 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:

Roger Fernandez  
The Natural Gas STAR Program  
Team Leader  
Phone: (01) (202) 343-9386  
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Email: [fernandez.roger@epa.gov](mailto:fernandez.roger@epa.gov)

#### Standard Mail:

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Washington, DC 20460  
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#### Express/Overnight Mail:

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The Natural Gas STAR Program  
U.S. EPA (6207J)  
1310 L Street, NW  
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