

Natural Gas STAR International



Annual Report 2013

Company Information

Company Name: _____

Contact: _____

Title: _____

Address: _____

City, State/Province: _____

Country: _____

Telephone: _____

Fax: _____

E-mail: _____

This report contains emissions reductions data for [*please specify country and business unit(s)*]:

Period of time covered by report:

From: _____ To: _____

International Annual Report Summary

Please provide information on the technologies and practices your company implemented and submit a report page for only those activities.

This package includes the following:

- Five Annual Reporting forms (please make additional copies, if necessary)
- Additional Program Accomplishments form
- Appendices including proposed methane emissions reduction technologies and conversion factors

Signature: _____

Date: _____



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OMB Control No. 2060-0328
Expires 09/30/2018

***Please submit a separate annual reporting form for each country for which you are reporting emissions reductions.**

In addition to reporting methane emissions reductions, you are welcome to include other information about your company's participation in Natural Gas STAR International in the "Additional Program Accomplishments" section of this form. Natural Gas STAR International will use any information entered in this section to recognize the efforts and accomplishments of outstanding partners.

EPA Form No. 5900-107

Methane Emission Reduction Technologies & Practices

Current Year Activities

A. Facility/location identifier information: _____

B. Activity description: Please provide a separate reporting form for each technology or practice implemented. If reporting a DI&M activity, please use a separate page for each location/facility surveyed.

Please specify the technology or practice that was implemented (choose from the list in the Appendix or describe your own):

Please describe how your company implemented this activity (including location or facility where implemented):

C. Industry Sector (please indicate in which industry sector you implemented this activity):

- Production (from underground to wellhead)
- Gathering and Processing (from gathering lines and processing plant to the point gas transfers to transmission pipelines)

- Transmission (transmission lines: from the point gas transfers to a transmission pipeline to the point gas transfers to city gate stations, including compressor stations along the transmission line(s))
- Distribution (gate stations to customer connections)

D. Level of Implementation (check one):

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

E. Are emissions reductions a one-year reduction or a multi-year reduction? One-year Multi-year

If Multi-year:

- Partner will report this activity once and let EPA automatically calculate future emission reductions based on sunset date duration*.
- Partner will report this activity annually up to allowed sunset date.

F. Methane emissions reduction: _____ Mcf

Please identify the basis for the emissions reduction estimate. If needed, attach calculations separately.

- Actual field measurement
- Calculation using manufacturer specifications/other source
- Other (Please specify)

**Because the implementation of some technologies reduces emissions for multiple years, Natural Gas STAR allows certain activities to count towards a company's emission reductions beyond the initial year of implementation. Natural Gas STAR designates the maximum length of time that these reductions may accrue as "sunset dates." Appendix A lists these sunset dates. Companies can report the corresponding methane emission reductions each year up to the allowable sunset date. Or, companies may wish to report reductions only once for the implementation year, and have EPA automatically apply the sunset date and count those emissions for the allowable number of years.*

G. Cost summary:

Estimated cost of implementing this activity (including equipment and labor): U.S. \$ _____

H. Total value of gas saved or other economic benefits (please describe):

U.S. \$ _____

Total value of gas saved (in U.S. Dollars) = Methane emissions reduction (in Mcf) x Gas value (in U.S. \$/Mcf)

I. To what extent do you expect to implement this activity next year?

Additional Comments:



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Previous Years' Activities

Use the table below to report any past implementation of this technology or practice, but not previously reported to Natural Gas STAR International.

Year	Frequency of Activity or # of Installations	Total Cost of Activity (incl. equipment and labor) (U.S. \$)	Estimated Reductions (Mcf/yr)	Value of Gas Saved (U.S. \$)

Comments/Additional Benefits: Please describe any additional economic, operational, environmental, or safety benefits achieved by implementing this technology or practice. Use the back of the page for additional space if needed.

Methane Emission Reduction Technologies & Practices

Current Year Activities

A. Facility/location identifier information: _____

B. Activity description: Please provide a separate reporting form for each technology or practice implemented. If reporting a DI&M activity, please use a separate page for each location/facility surveyed.

Please specify the technology or practice that was implemented (choose from the list in the Appendix or describe your own):

Please describe how your company implemented this activity (including location or facility where implemented):

C. Industry Sector (please indicate in which industry sector you implemented this activity):

- Production (from underground to wellhead)
 Gathering and Processing (from gathering lines and processing plant to the point gas transfers to transmission pipelines)

- Transmission (transmission lines: from the point gas transfers to a transmission pipeline to the point gas transfers to city gate stations, including compressor stations along the transmission line(s))
 Distribution (gate stations to customer connections)

D. Level of Implementation (check one):

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

E. Are emissions reductions a one-year reduction or a multi-year reduction? One-year Multi-year

If Multi-year:

- Partner will report this activity once and let EPA automatically calculate future emission reductions based on sunset date duration*.
 Partner will report this activity annually up to allowed sunset date.

F. Methane emissions reduction: _____ Mcf

Please identify the basis for the emissions reduction estimate. If needed, attach calculations separately.

- Actual field measurement
 Calculation using manufacturer specifications/other source
 Other (Please specify)

*Because the implementation of some technologies reduces emissions for multiple years, Natural Gas STAR allows certain activities to count towards a company's emission reductions beyond the initial year of implementation. Natural Gas STAR designates the maximum length of time that these reductions may accrue as "sunset dates." Appendix A lists these sunset dates. Companies can report the corresponding methane emission reductions each year up to the allowable sunset date. Or, companies may wish to report reductions only once for the implementation year, and have EPA automatically apply the sunset date and count those emissions for the allowable number of years.

G. Cost summary:

Estimated cost of implementing this activity (including equipment and labor): U.S. \$ _____

H. Total value of gas saved or other economic benefits (please describe):

U.S. \$ _____

Total value of gas saved (in U.S. Dollars) = Methane emissions reduction (in Mcf) x Gas value (in U.S. \$/Mcf)

I. To what extent do you expect to implement this activity next year?



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Additional Comments:

Previous Years' Activities

Use the table below to report any past implementation of this technology or practice, but not previously reported to Natural Gas STAR International.

Year	Frequency of Activity or # of Installations	Total Cost of Activity (incl. equipment and labor) (U.S. \$)	Estimated Reductions (Mcf/yr)	Value of Gas Saved (U.S. \$)

Comments/Additional Benefits: *Please describe any additional economic, operational, environmental, or safety benefits achieved by implementing this technology or practice. Use the back of the page for additional space if needed.*

Methane Emission Reduction Technologies & Practices

Current Year Activities

A. Facility/location identifier information: _____

B. Activity description: Please provide a separate reporting form for each technology or practice implemented. If reporting a DI&M activity, please use a separate page for each location/facility surveyed.

Please specify the technology or practice that was implemented (choose from the list in the Appendix or describe your own):

Please describe how your company implemented this activity (including location or facility where implemented):

C. Industry Sector (please indicate in which industry sector you implemented this activity):

- | | |
|--|---|
| <input type="checkbox"/> Production (from underground to wellhead)
<input type="checkbox"/> Gathering and Processing (from gathering lines and processing plant to the point gas transfers to transmission pipelines) | <input type="checkbox"/> Transmission (transmission lines: from the point gas transfers to a transmission pipeline to the point gas transfers to city gate stations, including compressor stations along the transmission line(s))
<input type="checkbox"/> Distribution (gate stations to customer connections) |
|--|---|

D. Level of Implementation (check one):

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

E. Are emissions reductions a one-year reduction or a multi-year reduction? One-year Multi-year

If Multi-year:

- Partner will report this activity once and let EPA automatically calculate future emission reductions based on sunset date duration*.
- Partner will report this activity annually up to allowed sunset date.

F. Methane emissions reduction: _____ Mcf

Please identify the basis for the emissions reduction estimate. If needed, attach calculations separately.

- Actual field measurement
- Calculation using manufacturer specifications/other source
- Other (Please specify)

*Because the implementation of some technologies reduces emissions for multiple years, Natural Gas STAR allows certain activities to count towards a company's emission reductions beyond the initial year of implementation. Natural Gas STAR designates the maximum length of time that these reductions may accrue as "sunset dates." Appendix A lists these sunset dates. Companies can report the corresponding methane emission reductions each year up to the allowable sunset date. Or, companies may wish to report reductions only once for the implementation year, and have EPA automatically apply the sunset date and count those emissions for the allowable number of years.

G. Cost summary:

Estimated cost of implementing this activity (including equipment and labor): U.S. \$ _____



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H. Total value of gas saved or other economic benefits (please describe):

U.S. \$ _____

Total value of gas saved (in U.S. Dollars) = Methane emissions reduction (in Mcf) x Gas value (in U.S. \$/Mcf)

I. To what extent do you expect to implement this activity next year?

Additional Comments:

Previous Years' Activities

Use the table below to report any past implementation of this technology or practice, but not previously reported to Natural Gas STAR International.

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Comments/Additional Benefits: Please describe any additional economic, operational, environmental, or safety benefits achieved by implementing this technology or practice. Use the back of the page for additional space if needed.

Methane Emission Reduction Technologies & Practices

Current Year Activities

A. Facility/location identifier information: _____

B. Activity description: Please provide a separate reporting form for each technology or practice implemented. If reporting a DI&M activity, please use a separate page for each location/facility surveyed.

Please specify the technology or practice that was implemented (choose from the list in the Appendix or describe your own):

Please describe how your company implemented this activity (including location or facility where implemented):

C. Industry Sector (please indicate in which industry sector you implemented this activity):

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- Transmission (transmission lines: from the point gas transfers to a transmission pipeline to the point gas transfers to city gate stations, including compressor stations along the transmission line(s))
 Distribution (gate stations to customer connections)

D. Level of Implementation (check one):

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

E. Are emissions reductions a one-year reduction or a multi-year reduction? One-year Multi-year

If Multi-year:

- Partner will report this activity once and let EPA automatically calculate future emission reductions based on sunset date duration*.
 Partner will report this activity annually up to allowed sunset date.

F. Methane emissions reduction: _____ Mcf

Please identify the basis for the emissions reduction estimate. If needed, attach calculations separately.

- Actual field measurement
 Calculation using manufacturer specifications/other source

**Because the implementation of some technologies reduces emissions for multiple years, Natural Gas STAR allows certain activities to count towards a company's emission reductions beyond the initial year of implementation. Natural Gas STAR designates the maximum length of time that these reductions may accrue as "sunset dates." Appendix A lists these sunset dates. Companies can report the corresponding methane emission reductions each year up to the allowable sunset date. Or, companies may wish to report reductions only once for the implementation year, and have EPA automatically apply the sunset date and count those emissions for the allowable number of years.*



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Other (Please specify)

G. Cost summary:

Estimated cost of implementing this activity (including equipment and labor): U.S. \$ _____

H. Total value of gas saved or other economic benefits (please describe):

U.S. \$ _____

Total value of gas saved (in U.S. Dollars) = Methane emissions reduction (in Mcf) x Gas value (in U.S. \$/Mcf)

I. To what extent do you expect to implement this activity next year?

Additional Comments:

Previous Years' Activities

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Comments/Additional Benefits: Please describe any additional economic, operational, environmental, or safety benefits achieved by implementing this technology or practice. Use the back of the page for additional space if needed.

Methane Emission Reduction Technologies & Practices

Current Year Activities

A. Facility/location identifier information: _____

B. Activity description: Please provide a separate reporting form for each technology or practice implemented. If reporting a DI&M activity, please use a separate page for each location/facility surveyed.

Please specify the technology or practice that was implemented (choose from the list in the Appendix or describe your own):

Please describe how your company implemented this activity (including location or facility where implemented):

C. Industry Sector (please indicate in which industry sector you implemented this activity):

- Production (from underground to wellhead)
 Gathering and Processing (from gathering lines and processing plant to the point gas transfers to transmission pipelines)

- Transmission (transmission lines: from the point gas transfers to a transmission pipeline to the point gas transfers to city gate stations, including compressor stations along the transmission line(s))
 Distribution (gate stations to customer connections)

D. Level of Implementation (check one):

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

E. Are emissions reductions a one-year reduction or a multi-year reduction? One-year Multi-year

If Multi-year:

- Partner will report this activity once and let EPA automatically calculate future emission reductions based on sunset date duration*.
 Partner will report this activity annually up to allowed sunset date.



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F. Methane emissions reduction: _____ Mcf

Please identify the basis for the emissions reduction estimate. If needed, attach calculations separately.

Actual field measurement

Calculation using manufacturer specifications/other source

Other (Please specify)

**Because the implementation of some technologies reduces emissions for multiple years, Natural Gas STAR allows certain activities to count towards a company's emission reductions beyond the initial year of implementation. Natural Gas STAR designates the maximum length of time that these reductions may accrue as "sunset dates." Appendix A lists these sunset dates. Companies can report the corresponding methane emission reductions each year up to the allowable sunset date. Or, companies may wish to report reductions only once for the implementation year, and have EPA automatically apply the sunset date and count those emissions for the allowable number of years.*

G. Cost summary:
Estimated cost of implementing this activity (including equipment and labor): U.S. \$ _____

H. Total value of gas saved or other economic benefits (please describe):
U.S. \$ _____

Total value of gas saved (in U.S. Dollars) = Methane emissions reduction (in Mcf) x Gas value (in U.S. \$/Mcf)

I. To what extent do you expect to implement this activity next year?

Additional Comments:

Previous Years' Activities

Use the table below to report any past implementation of this technology or practice, but not previously reported to Natural Gas STAR International.

Year	Frequency of Activity or # of Installations	Total Cost of Activity (incl. equipment and labor) (U.S. \$)	Estimated Reductions (Mcf/yr)	Value of Gas Saved (U.S. \$)

Comments/Additional Benefits: *Please describe any additional economic, operational, environmental, or safety benefits achieved by implementing this technology or practice. Use the back of the page for additional space if needed.*



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Additional Program Accomplishments



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The Natural Gas STAR International Program will use any information entered here to recognize the efforts and achievements of outstanding partners.

Please include any additional information you would like to share about your company's participation in Natural Gas STAR International. Examples may include:

- Activities to strengthen your program (e.g., training/education, innovative technologies or activities, pilot projects, employee incentive programs).
- Efforts to communicate your participation and successes (e.g., internal newsletters, press releases, company website).
- Participation in Natural Gas STAR International program activities (e.g., contributions to case studies, presentation at workshops).

Additional Accomplishments:

(Please use the back of the page for additional space if needed.)



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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. You may use this list as a guide when completing your annual report. **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)



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Tanks

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

- Install flash tank separator on water gathering system (10 years)
- Install pumps for separators (10 years)
- Install snubbing unit at wellhead

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 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)



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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. You may use this list as a guide when completing your annual report. **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)



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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
- 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

Methane Emission Reduction Technologies & Practices— Gathering and Processing Sector

(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)
- **Other**
- Convert natural gas-fired generator to solar power (10 years)
- Install flares (10 years)*

Valves

- Convert gas operated valves to hydraulic operation (10 years)
- Nitrogen rejection unit optimization*
- Process/re-route acid gas to reduce venting



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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. You may use this list as a guide when completing your annual report. **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)*



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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



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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. You may use this list as a guide when completing your annual report. **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



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Appendix B

Conversion Factors

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

Gas Conversions

Please report methane 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

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