# NATURAL GAS & PETROLEUM SYSTEMS: UPDATES UNDER CONSIDERATION FOR 2022 GHGI

Stakeholder Webinar September 15, 2021

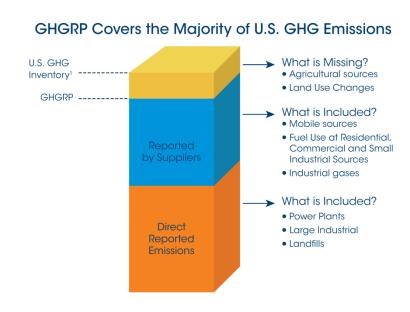
# 9/15 STAKEHOLDER WEBINAR AGENDA

- GHG Inventory Overview
- Abandoned Well Emissions
- Post-Meter Emissions
- Anomalous Leak Events
- Gas STAR / Methane Challenge Data in GHGI
- Other Activity Data
- Wrap Up

# GHG INVENTORY OVERVIEW

# EPA GHG DATA: U.S. GHG INVENTORY (GHGI) AND GHG REPORTING PROGRAM (GHGRP)

- Inventory of U.S. Greenhouse Gas Emissions and Sinks (GHGI) tracks total annual U.S. emissions across all sectors of the economy using national-level data
- GHGRP collects detailed emissions data from large greenhouse gas emitting facilities in the United States, as directed by the Clean Air Act
  - GHGRP covers most, but not all, U.S. GHG emissions
  - GHGRP does not include agriculture, land use, and small sources



Task	Inventory of U.S. GHG Emissions and Sinks	Greenhouse Gas Reporting Program
Find total U.S. emissions		
Review trend data for the	<b>1</b>	
past 20 years		
Browse a map to find		
largest emitters in your area		•
Compare facility emissions		4
across an industrial sector		<b>◆</b>
Find reported emissions by		4
state		✓

### **GHGI OVERVIEW**

#### GHGI

- Official U.S. Government data on national GHG emissions and sinks over time by gas, source/sink and economic sector
- CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>, and NF<sub>3</sub>
- Fulfills U.S. reporting commitment under the UNFCCC
- Covers a time series beginning with 1990

#### Oil and Gas in the GHGI

- Oil and gas in GHGI covers hundreds of types of emission sources
- Emissions calculated using GHGRP, research studies, national level activity data, etc.
- Annual stakeholder process to discuss new data and improvements to GHGI data
- Stakeholder website (<a href="https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systems">https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systems</a>)
  - Information on workshops and memos on updates under consideration
  - Full time series of data and information on methods

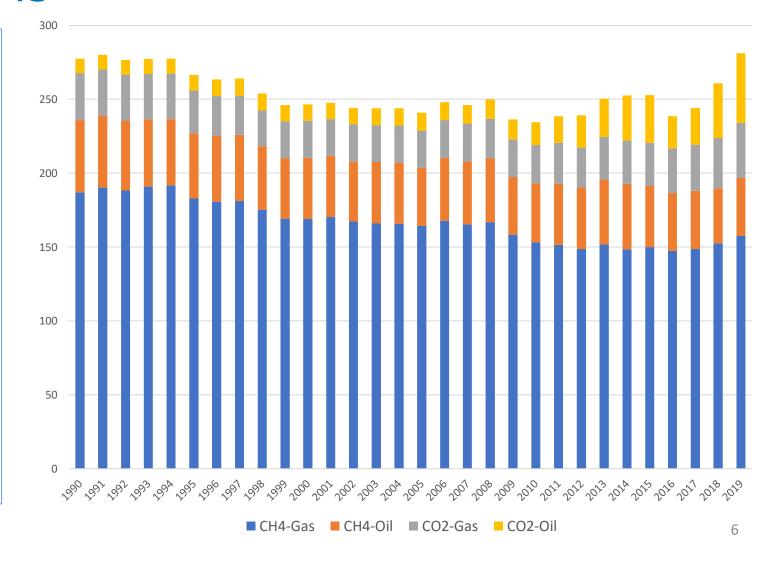
# TRENDS IN CH<sub>4</sub> AND CO<sub>2</sub> EMISSIONS FROM OIL AND GAS SYSTEMS

#### 1990-2019 Trends and Key Drivers

- CH<sub>4</sub>-decrease of 17%
  - Distribution (upgrades to pipeline and stations)
  - Transmission and storage (changes in compressor types)
- CO<sub>2</sub>-increase of 102%
  - Oil and gas production (increased flaring)

#### 2018-2019 Trends and Key Drivers

- CH<sub>4</sub>-increase of 4%
  - Oil and gas production (increase in emissions from pneumatic controllers)
- CO<sub>2</sub>-increase of 19%
  - Oil production (increased flaring of associated gas)



# ABANDONED WELLS

# ABANDONED WELLS - CURRENT GHGI METHODOLOGY

- Population of abandoned wells is estimated using Enverus and historical data (1.1 million historical abandoned wells)
- Abandoned well population is split into plugged and unplugged wells
  - Assume all wells are unplugged in 1950
  - Calculate year-specific fraction for 2016 forward from Enverus
  - Linearly interpolate between 1950 and 2016 values
- Region-specific plugged and unplugged EFs are applied to wells in the Appalachia region versus wells outside of Appalachia region

Year	Abandoned Well Count (millions)			Plugging Status (%)		Population Region	
	Total	Gas	Oil	Unplugged Plugged		Appalachia	Other
1990	2.37	0.32	2.05	81	19	26	74
2019	3.36	0.65	2.71	59	41	25	75

Regional EFs (g/h/well)	Unplugged	Plugged
Appalachian	31	0.36
Non-App.	10	0.002

# ABANDONED WELLS - ACTIVITY DATA UPDATES UNDER CONSIDERATION

- 1. Count of abandoned oil wells versus gas wells
- 2. Fraction of abandoned wells that are plugged versus unplugged

# ABANDONED WELL COUNTS UPDATE CONSIDERATIONS

- Restructured Enverus data leads to fewer abandoned wells classified as oil/gas wells and more classified as dry wells
- For the 2021 GHGI, the "production type" field was used to apportion the dry well population to oil and gas wells (in addition to GOR)
- EPA is considering relying only on GOR to classify abandoned wells as oil and gas wells, as was done in previous GHGIs

#### Abandoned Well Counts in Year 2019 from Enverus (Thousands of Wells)

Well Type	2021 GHGI <sup>a</sup>	Update Under Consideration for 2022 GHGIb
Oil Wells	1,025	<b>↓</b> 778
Gas Wells	339	<b>233</b>
<b>Dry Wells</b>	844	<b>†</b> 1,320
Total	2,208	2,331

- a. Wells are classified as oil and gas based on GOR analysis or production type.
- b. Wells are classified as oil and gas based on GOR analysis only.

# Abandoned Wells - Plugged vs. Unplugged Update Considerations

Restructured Enverus data led to two steps that must be reviewed in the current methodology:

- 1. Re-examine the well status codes that are assigned as plugged or unplugged
- 2. Reconsider how we use historical wells in the calculations for fraction of wells plugged and unplugged

### ABANDONED WELLS - PLUGGED VS. UNPLUGGED

## Changes with Restructured Enverus Data

- Additional well status codes
- "Inactive" and "Plugged and Abandoned" (P&A) populations reversed – P&A now highest

Well Status Code	Number of Wells in Enverus (Millions)	Percent of Wells in Enverus	Plugging Status Assignments Under Consideration for 2022 GHGI	Current Plugging Status Assignments	2018 GHGI Percent of Wells in Enverus
P&A (plugged and abandoned)	1.388	41%	plugged	plugged	20%
ACTIVE	0.873	26%	exclude	exclude	27%
INACTIVE	0.823	24%	unplugged	unplugged	42%
COMPLETED	0.101	3%	unplugged	n/a	n/a
SHUT-IN	0.066	2%	unplugged	unplugged	1%
DRILLED	0.063	2%	unplugged	n/a	n/a
ABANDONED	0.032	0.9%	unplugged	unplugged	1%
TA (temporarily abandoned)	0.012	0.4%	unplugged	n/a	n/a
DUC (drilled but uncompleted)	0.006	0.2%	exclude	n/a	n/a
ORPHAN	0.006	0.2%	unplugged	n/a	n/a
All Other Codes	0.010	0.3%	exclude	exclude	9%

# ABANDONED WELLS - PLUGGED VS. UNPLUGGED (CONT.)

Year	Well Status Code Assignment (Current or Update Under Consideration)	Includes Historical Well Counts in Calculation?	Plugged Fraction	Unplugged Fraction
Year 2018 (2020 GHGI)	Current	No	34%	66%
Year 2019	Current	No	60%	40%
Year 2019 (2021 GHGI)	Current	Yes, assume all are unplugged	41%	59%
Year 2019	Update Under Consideration	No	56%	44%
Year 2019	Update Under Consideration	Yes, assume all are unplugged	38%	62%

# ABANDONED WELLS - STAKEHOLDER QUESTIONS

- 1. To estimate the population of abandoned wells from Enverus data, EPA seeks feedback on using only GOR to determine oil and gas wells (as opposed to GOR plus the "production type" field).
- 2. EPA seeks feedback on the plugging status assignments under consideration.
- 3. EPA seeks feedback on the assumption that the 1.1 million historical abandoned wells that are not captured in Enverus are unplugged wells. EPA also seeks feedback on alternative approaches and/or data sources to estimate the fraction of plugged and unplugged abandoned wells.
- 4. For the time series of the national fraction of plugged and unplugged wells, EPA seeks feedback on removing the fractions calculated from previous Enverus datasets for the years 2016-2018 and using only the fractions based on the restructured Enverus data (beginning in year 2019)?

# POST-METER EMISSIONS

### Post-Meter - Background

- GHGI does not currently estimate post-meter emissions.
- Post-meter emission sources include leak emissions from residential and commercial appliances, industrial facilities and power plants, and natural gas fueled vehicles.

IPCC Post-meter categories	Emission Source Details
Appliances in Commercial & Residential Sectors	Leakage from house piping and appliances, including home heating, water heating, stoves, BBQ/grills
Leakage at Industrial Plants and Power Stations	Leakage from internal piping
Natural gas-fueled vehicles	Leakage from vehicles with alternative fuels produced from natural gas e.g., LNG, CNG, RNG

# Post-Meter – Emission Factor Considerations

#### Residential

Data Source	CH₄ EF	EF Units	Includes App Leaks?	Includes Passive House Leaks?
IPCC (2019)	4.0	Kg/appliance	Yes	Unspecified
Fischer et al. (2018)/CARB	2.54	Kg/NG House	Yes	Yes
Merrin and Francisco (2019)	0.43	Kg/NG House	Yes	No
Lebel et al. (2020)	1.42	Kg/NG water heater	Water heaters only	No

# Post-Meter – Emission Factor Considerations (cont.)

#### **Commercial**

Data Source	CH <sub>4</sub> EF	EF Units
IPCC (2019)	4.0	Kg/appliance

#### **Industrial Plants and EGUs**

Data Source	CH <sub>4</sub> EF	EF Units
IPCC (2019)	11,326.7	Kg/BCF
2021 Germany GHGI	7,702.2	Kg/BCF

#### **NG Vehicles**

Data Source	CH <sub>4</sub> EF	EF Units
IPCC (2019)	0.33	Kg/vehicle

# Post-Meter – Residential Activity Data Considerations

- Data available from American Housing Survey (AHS, U.S. Census Bureau) and Residential Energy Consumption Survey (RECS, EIA).
  - AHS national summary data are reported biennially (starting in 1973).
  - RECS data are only available for 7 years in the 1990-2020 time-series (i.e., 1990, 1993, 1997, 2001, 2005, 2009, and 2015).
- Both datasets contain number of housing units using NG for specific end use purposes (e.g., space heating, water heating, cooking).
- Natural gas appliance counts are not available in the AHS and RECS data.

# Post-Meter - Residential Activity Data

Voor	RECS (million housing units)		AHS (million housing units)		
Year	Total Units	NG Units	Total Units	NG Units	
1990	94.0	57.7	Not Available	Not Available	
1993	96.6	58.4	94.7	65.6	
1997	101.5	61.9	99.5	60.5	
2001	107.0	66.9	106.3	83.1	
2005	111.1	69.5	108.9	86.6	
2009	113.6	69.2	111.8	86.2	
2015	118.2	68.6	118.3	80.3	
2019	Not Available	Not Available	124.1	84.7	

# Post-Meter – Commercial Activity Data Considerations

- Data available from Commercial Buildings Energy Consumption Survey (CBECS, EIA).
  - CBECS data are only available for 5 years in the 1990-2020 time-series (i.e., 1992, 1995, 1999, 2003, and 2012).
- CBECS data contain number of commercial buildings using NG for specific end use purposes (i.e., space heating, water heating, and cooking).
- Natural gas appliance counts are not available in the CBECS data.
- National count of commercial NG meters are available in the GHGI (used for other emission sources).

### Post-Meter - Commercial Activity Data

#### **Summary of CBECS Data (1000s)**

	1992	1995	1999	2003	2012
All commercial buildings	4,806	4,579	4,657	4,645	5,557
Commercial buildings using natural gas as fuel for the following end uses:					
Primary space-heating energy source	2,276	2,106	2,189	1,999	2,322
Water-heating energy source	1,647	1,577	1,520	1,445	1,758
Cooking energy source	431	448	505	457	740
Cooling energy source	106	65	142	17	12
Estimated Appliance Count	4,460	4,196	4,356	3,918	4,832
Commercial Meter Count – 2021 GHGI	4,409	4,636	5,010	5,152	5,356
Estimated Appliances/Commercial Meter (fraction)	1.0	0.9	0.9	0.8	0.9

# Post-Meter – Industrial Plants and EGUs Activity Data Considerations

 Annual national natural gas consumption data for industrial and electricity generation sectors are available from EIA's Monthly Energy Review.

#### **Natural Gas Consumption (BCF)**

Year	Industrial	Electric Power
1990	8,255	3,245
1995	9,384	4,237
2000	9,293	5,206
2005	7,713	5,869
2010	8,112	7,387
2015	9,098	9,613
2018	10,112	10,590
2019	10,268	11,288
2020	10,086	11,616

# Post-Meter – NG Vehicles Activity Data Considerations

- Vehicle population estimates are available from EPA's Motor Vehicle Emission Simulator model (MOVES) and EIA's Alternate Fuel Data Center contains the Alternate Fuel Vehicle Inventory (AFVI).
  - MOVES3 counts are available for 1990 and 1999-2020.
  - AFVI covers 2004-2019.
- MOVES3 CNG vehicle counts include buses, refuse trucks, single-unit and combination trucks (i.e., heavy-duty trucks). DOES NOT include passenger vehicle counts.
- AFVI contains annual vehicle counts for CNG, LNG, and RNG vehicles.
  - Data are only available for cities participating in DOE's Clean Cities Coalition Network

### Post-Meter - NG Vehicles Activity Data

Year	MOVES3	Clean Cities AFVI
1990	6	Not Available
1999	10,139	Not Available
2000	13,063	Not Available
2004	22,364	76,257
2005	23,695	51,144
2010	30,708	46,321
2012	37,925	62,932
2014	50,317	71,784
2015	60,132	111,623
2018	89,033	89,043
2019	98,535	110,777
2020	107,519	Not Available

# Post-Meter – Preliminary estimates (metric tons CH<sub>4</sub>)

Year	Residential	Commercial	Industrial Plants & EGUs	Natural Gas Vehicles
1990	164,784	16,945	130,251	0.002
2000	185,705	20,043	164,232	3.9
2010	198,253	21,206	175,553	9.2
2015	203,986	21,815	211,942	18.0
2018	213,121	22,073	234,483	26.7
2019	215,119	22,187	244,160	29.6

# Post-Meter - Stakeholder Questions

- 1. EPA seeks information on additional emission factor and activity data sources to be considered for post-meter emissions.
- 2. EPA seeks stakeholder feedback on time series data for post-meter emission sources. Are data available that would allow the GHGI to reflect changes over time in average emissions per emission source for post-meter?

# ANOMALOUS LEAK EVENTS

### BACKGROUND

- IPCC 2019 Refinements and "Anomalous Leak Events"
  - "Anomalous leak events" can occur across natural gas and petroleum systems and can have highly variable emissions
  - It is good practice to quantify and report such emissions whenever possible
  - No method is provided; instead events need to be evaluated on a case-bycase basis
- Data are available for 2 large U.S. production segment blowout events
- EPA could use this data to include an estimate for anomalous leak events
- Additionally, smaller blowout and release events occur and the GHGI currently includes an estimate for events occuring in oil production

### CURRENT GHGI METHODOLOGY

- Onshore Production
  - Large anomalous leak events are not captured
    - One such event is captured in the storage segment (Aliso Canyon event)
  - Well blowout emission estimates are currently included for <u>oil</u> wells only and well release emission estimates are not included
    - Activity data is the number of blowouts per year
      - Activity data estimated using the count of wells drilled annually and a frequency of 1 well blowout per 300 wells drilled
    - Emission data is an estimated volume of 2.5 MMScf Methane released per blowout event, from an Industry review panel convened in the 1990s

### **AVAILABLE DATA**

- Well Blowout Emissions Quantification:
  - Several studies on large well-related events were reviewed including events in Belmont, OH and Victoria, TX
  - A combination of ground-level and satellite measurements were used to develop event-specific emissions estimates
  - These events had emissions quantities ranging from 4,830 –60,000 MT CH4;
     and durations of 20 days
- Well Release Emissions Quantification:
  - Did not identify any source of emissions data including quantification of well releases

### AVAILABLE DATA: BELMONT EVENT

- Gas well blowout in early 2018 in Belmont County, OH
- Emissions event lasted for 20 days
- Satellite measurements of total column CH<sub>4</sub> from the spaceborne Tropospheric Monitoring Instrument (TROPOMI) combined with downwind measurements and transport modeling were used for emissions quantification
  - Satellite measurements are highly dependent on meteorological conditions; only 2 days of the blowout met the criteria for use in emissions quantification (low cloud cover and low ambient aerosols; at least ¼ of the blowout region was covered);
  - Downwind measurement data was only available for one day;
  - The  $13^{th}$  day of the event had both downwind measurements and satellite measurements which were used to simulate the blowout plume in the Weather Research Forecasting model resulting in an estimated hourly emission rate of  $120 \pm metric$  tons/hr;
  - The  $13^{th}$  day was assumed to be representative of the emissions over the duration of the event to provide an estimated  $60,000 \pm 15,000$  metric tons released

### AVAILABLE DATA: VICTORIA EVENT

- Gas well blowout in the Eagle Ford Shale at a surface site consisting of four horizontally drilled wells
- Event lasted for 20 days; on the 14<sup>th</sup> day of the event the wellhead was capped and gas was diverted to an open pit where it was flared.
- Emissions were estimated 10 separate times by synthesizing multiple satellite measurements including those from:
  - TROPOspheric Monitoring Instrument (TROPOMI);
  - GHG-Sat-D satellite;
  - Visible Infrared Imaging Radiometer Suite (VIIRS) instrument (CH<sub>4</sub> concentrations inferred from the radiant heat of flaring); and
  - PRecursore IperSpettrale della Missione Applicativa (PRIMSA) satellite imaging spectrometer.
- Emissions were quantified using the synthesized satellite measurements and simulation tools (e.g., Weather Research and Forecasting Chemistry; Integrated Methane Enhancement Algorithm) to provide an approximate 4,800 ± 980 metric tons CH₄ released.

### AVAILABLE DATA: SMALLER BLOWOUTS AND RELEASES

- Well Blowout and Release Activity Data:
  - Several sources of data which could be used to estimate the frequency of well blowouts and well releases were identified for offshore and onshore wells including Texas Railroad Commission Event Reporting and New Mexico's Incident Database
  - A summary of the estimated frequencies from these sources is shown below

Emission Source	Blowout Frequency		Release Frequency			
Onshore gas/oil well	1.56E-04	per well drilled	1.19E-03	per well drilled		
New Mexico Incident Database						
Onshore gas/oil well	5.00E-04	per well drilled	N/A, Included in blowout			

### UPDATES UNDER CONSIDERATION

- Include reporting of large well blowout events (e.g., Belmont, OH;
   Victoria, TX) based on published emissions, to be consistent with IPCC guidance on "large anomalous leak events"
  - EPA has utilized this approach in the past (e.g., Aliso Canyon)
  - The approach used for exceptional well blowouts could be applied to other exceptional events if data are available
- Update activity data and emissions for smaller onshore oil and gas well blowouts and releases based on event frequency information from state data bases (e.g. Texas RRC), and apply current GHGI EF (2.5 MMscf/event) for oil well blowouts for all events

# REQUESTS FOR STAKEHOLDER FEEDBACK

- EPA seeks stakeholder feedback on the inclusion of anomalous leak events.
  - EPA also seeks information on other identified well blowout events, including those that may have occurred earlier in the 1990-2020 GHGI time series.
  - EPA seeks stakeholder feedback on appropriate data for incorporation, including on measurement methods, detection approaches, etc.
  - EPA seeks stakeholder feedback on approaches for estimating emissions from anomalous leak events where measurement data are unavailable.
- EPA seeks general stakeholder feedback on the inclusion of estimates for smaller blowouts at gas wells and well releases at oil and gas wells.

## GAS STAR / METHANE CHALLENGE DATA IN GHGI

#### GAS STAR AND METHANE CHALLENGE REDUCTIONS - BACKGROUND

- Most GHGI emission source methodologies have been updated to a "net" methodology – use EFs based on GHGRP subpart W data or methane emissions studies
  - For those sources, we do not adjust calculated emissions with reduction data
- Certain GHGI emission sources rely on a "potential" methodology
  - Potential emissions estimated using 1996 GRI/EPA study data
  - Net emissions then estimated by subtracting voluntary reductions (i.e., Gas STAR and Methane Challenge) from potential emissions
  - Gas STAR reductions for 2013 inventory year are used in recent GHGIs as proxy data for 2014-2019

#### GAS STAR REDUCTIONS - CURRENT GHGI

#### 2019 Production Segment Reductions (mt CH<sub>4</sub>)

Source	Reductions
Gas Engines	139,167
Compressor Starts	512
Other	104,624
Total	244,304

#### 2019 Transmission and Storage Segment Reductions (mt CH<sub>4</sub>)

Source	Reductions
Pipeline Leaks	1,213
Dehydrator Vents	2,819
Engines	126,910
Station Venting	136,856
Total	267,799

## GAS STAR REDUCTIONS – UPDATE CONSIDERATIONS

- Entire Gas STAR reductions data set (1990-2019) reassessed
- Assigned Gas STAR reductions for Production, Transmission and Storage, and Distribution segments to GHGI emission sources
  - Kept reductions related to GHGI sources with "potential methodology"
  - Removed all reductions related to GHGI sources with "net methodology"
- Applied short-term reductions for year of implementation only
- Assessed applying long-term reductions in implementation year and subsequent 7 or 10 years (i.e., used sunset dates consistent with Gas STAR program) versus applying to all subsequent years (the current GHGI approach)

## METHANE CHALLENGE REDUCTIONS - UPDATE CONSIDERATIONS

- Methane Challenge (MC) reductions data available for 2016-2019
- Assigned MC reductions to GHGI emission sources
  - Most MC reductions related to GHGI sources with "net methodology" and were excluded
  - MC reductions were used for two GHGI sources in the Distribution segment where a "potential methodology" is used

## GAS STAR AND METHANE CHALLENGE REDUCTIONS - PRODUCTION SEGMENT

#### 2019 Emissions and Reductions (mt CH<sub>4</sub>)

GHGI Emission Source	GHGI Potential Emissions	Gas STAR Reductions	GHGI Net Emissions	Current GHGI Net Emissions
Compressors	67,025	0	67,025	NA
Compressor Blowdowns	2,588	0	2,588	NA
Compressor Starts	5,790	1,839	3,952	5,278
Dehydrator Vents/ Kimray Pumps	96,321	7,104	89,217	NA
Engines	251,054	13,338	237,716	111,886
Equipment Leaks	203,137	84	203,053	NA
Produced Water	187,070	0	187,070	NA
Total	812,985	22,365	790,620	568,681

NA = Current GHGI net emissions cannot be calculated due to use of "other" reductions which are not specific to a source

### GAS STAR AND METHANE CHALLENGE REDUCTIONS – TRANSMISSION AND STORAGE SEGMENT

#### 2019 Emissions and Reductions (mt CH<sub>4</sub>)

GHGI Emission Source	GHGI Potential Emissions	Gas STAR Reductions	GHGI Net Emissions	Current GHGI Net Emissions
Dehydrator Vents	2,527	1,330	1,197	-292
Engines	286,961	80,067	206,894	160,051
Pipeline Leaks	3,302	590	2,712	2,088
Station Venting	184,404	19,312	165,092	47,548
Total	477,194	101,299	375,895	209,395

## GAS STAR AND METHANE CHALLENGE REDUCTIONS – DISTRIBUTION SEGMENT

#### 2019 Emissions and Reductions (mt CH<sub>4</sub>)

GHGI Emission Source	GHGI Potential Emissions	Gas STAR Reductions	Methane Challenge Reductions	GHGI Net Emissions	Current GHGI Net Emissions
Pressure Relief Valve Releases	1,268	0	47	1,221	1,268
Pipeline Blowdowns	4,445	748	192	3,505	4,445
Mishaps (Dig-ins)	69,287	828	0	68,459	69,287
Total	75,000	1,576	239	73,185	75,000

## GAS STAR AND METHANE CHALLENGE REDUCTIONS - STAKEHOLDER QUESTIONS

- 1. Are there any Gas STAR activities identified as having a potential methodology that should be considered to have a net methodology?
- 2. Are there other data sources available to quantify emissions or reductions for the identified sources?

# OTHER ACTIVITY DATA - ENVERUS MIDSTREAM - UNDERGROUND NG STORAGE WELLS

#### Enverus Midstream - Background

- Enverus provides information on midstream operations
- Enverus midstream data reflect current operations only and cannot be used to develop estimates of activity data in previous years
- Initially reviewing the following activity data:
  - Gathering and Boosting (G&B) and Transmission
    - Compressor Stations
    - Pipeline Miles
  - NG Processing Plants

#### Enverus Midstream - G&B

- G&B Stations
  - Enverus: operational stations
  - GHGI: scales year 2016 estimate from Zimmerle et al. 2021 G&B study using ratio of gas production in 2016 and gas production in year of interest
- Gathering Pipeline Miles
  - Enverus: operational natural gas pipelines
  - GHGI: uses GHGRP subpart W gathering pipeline miles as-reported

Source	G&B Stations	Gathering Pipeline Miles
Enverus	3,634	434,076
GHGI (Year 2019)	7,494	381,909

#### ENVERUS MIDSTREAM - TRANSMISSION

- Compressor Stations
  - Enverus: operational stations
  - GHGI: uses GHGRP subpart W station counts multiplied by a scaling factor (scaling factor developed using 2012 data)
- Transmission Pipeline Miles
  - Enverus: operational natural gas pipelines
  - GHGI: PHMSA natural gas pipeline miles

Source	Transmission Compressor Stations	Transmission Pipeline Miles
Enverus	2,212	317,904
GHGI (Year 2019)	2,196	302,252

#### Enverus Midstream - Processing Plants

- Enverus: operational processing plants
- GHGI: Oil & Gas Journal, 2014 data used for 2014 - present

Source	Processing Plants
Enverus	1,021
GHGI (Year 2019)	667

Enverus Processing Plant Type	Number of Plants
Processing Plant	1,021
Treating Facility	168
Cryogenic	127
Central Processing Facility	67
Fractionator	55
Production Facility	43
Dehydrator	29
Processing Plant/Fractionator	25
All Other Processing Plant Types	79
Total Processing Plants	1,614

#### Underground NG Storage Well Counts

- EPA received a comment during 2021 GHGI stakeholder process recommending use of PHMSA for national storage well counts
- PHMSA provides counts, by field type, for 2017 forward
- Current GHGI estimate well counts by scaling 1992 count (17,999 wells)
  using the ratio of residential gas consumption
- For 2022 GHGI, EPA considering using PHMSA counts for 2017 forward

Well Count Data	2017	2018	2019	2020
PHMSA Total	14,266	14,205	14,071	13,983
Depleted Field	12,422	12,353	12,231	12,145
Aquifer	1,721	1,729	1,718	1,716
Salt Dome	123	123	122	122
Current GHGI	16,936	19,181	19,250	n/a

## ACTIVITY DATA UPDATES— STAKEHOLDER QUESTIONS

- 1. EPA seeks feedback on using Enverus data to estimate the national number of processing plants, G&B stations, gathering pipeline miles, and transmission compressor stations.
- 2. EPA seeks feedback on using PHMSA storage well counts for recent years (2017 forward), retaining the 1990-1992 well counts, and applying linear interpolation for intermediate years.

#### WRAP-UP

#### PROVIDING STAKEHOLDER FEEDBACK

- EPA memos will be posted online with additional details and specific stakeholder feedback requests
- <a href="https://www.epa.gov/ghgemissions/stakeholder-process-natural-gas-and-petroleum-systems-1990-2020-inventory">https://www.epa.gov/ghgemissions/stakeholder-process-natural-gas-and-petroleum-systems-1990-2020-inventory</a>
- Submit feedback via email: GHGInventory@epa.gov
- Next stakeholder webinar will be held in November
  - EPA invites stakeholders to present on data or other information relevant to the EPA GHG data for oil and gas
  - To request to present at the workshop, please contact <a href="mailto:ghginventory@epa.gov">ghginventory@epa.gov</a> with information on the topic area for the presentation