Lost and Unaccounted for Gas in Massachusetts

A Study Prepared for:

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APPROACH

Top Down and Bottom Up Approaches

Top Down

Inputs/Receipts	−	Outputs/Deliveries +/- Adjustments	=	*Unaccounted For Gas (Fugitive Emissions plus Uncertainty)*
•Gate Station Receipts •LNG Send Out •Storage Withdrawals		•Customer Use •Company Use •Venting/Dig-Ins •Theft •Line Pack Changes •Meter Error •Billing Cycle Adjustments •Gas Storage •Compositional Corrections		•Uncertainty in measured values •Fugitive emissions from leaking components •Unaccounted for Sources due to lack on information

Bottom Up

Mains	+	Services	+	Meters	+	Meter and Regulating Stations	=	Lost Gas or Methane Emissions
• Pipeline Dig-ins • PRVs • Cast Iron • Cast Iron - Lined • Plastic • Protected Steel • Unprotected Steel		• Copper • Plastic • Protected Steel • Unprotected Steel		• Residential • Commercial • Industrial		• M&R >300 psig • M&R 100-300 psig • M&R <100 psig • Regulating >300 psig • Regulating >300 psig Vault • Regulating 100-300 psig • Regulating 100-300 psig Vault • Regulating 40-100 psig • Regulating 40-100 psig Vault • Regulating <40 (both)		

Lost Gas or Methane Emissions = Activity Factor (# of sources) x Emissions Factor (rate)

Results of Top Down and Bottom Up Analyses

Top Down

Division	Receipts (Mcf)	Fugitives + Uncertainty (Mcf)	Fugitives + Uncertainty (%)
Division 1	9,208,571	240,119	2.6%
Division 2	6,325,044	-10,113	-0.2%
Division 3	10,656,695	29,189	0.3%

Bottom Up

Division	Receipts (Mcf)	Lost Gas (Mcf)	Lost Gas (%)	Methane Emissions (Mcf)	Methane Emissions (%)
Division 1	9,208,571	165,402	1.8%	105,240	1.1%
Division 2	6,325,044	102,791	1.6%	70,518	1.1%
Division 3	10,656,695	63,970	0.6%	58,803	0.6%

Scaling Up Bottom Up Analyses for All of Massachusetts

ICF used measured or extrapolated Activity Factors for each source category to estimate the lost gas and methane emissions for all of Massachusetts.

Source	Type	Massachusetts	
		Lost Gas (Mcf)	Methane Emissions (Mcf)
Subtotals (by type)	Fugitive	6,960,696	5,379,928
	Vented	39,872	37,240
TOTAL		7,000,569	5,417,170

General Conclusions

- **It is important to understand how LAUF, lost gas, and methane emissions are estimated, and the uncertainties in the methods, if we are to use these as metrics in public policy.**
- **LAUF is a poor surrogate for emissions or lost gas, and if used for other purposes, should have a standard and comprehensive definition and method for calculation.**
- **The effectiveness of replacing cast iron and unprotected steel with plastic pipe to reduce emissions is clearly demonstrated in this study, as shown by the emissions estimates for Division 3.**
- **The accuracy of bottom-up methane emissions estimates is directly related to the accuracy and representativeness of emissions factors used. Currently available emissions factors have significant uncertainty.**

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