

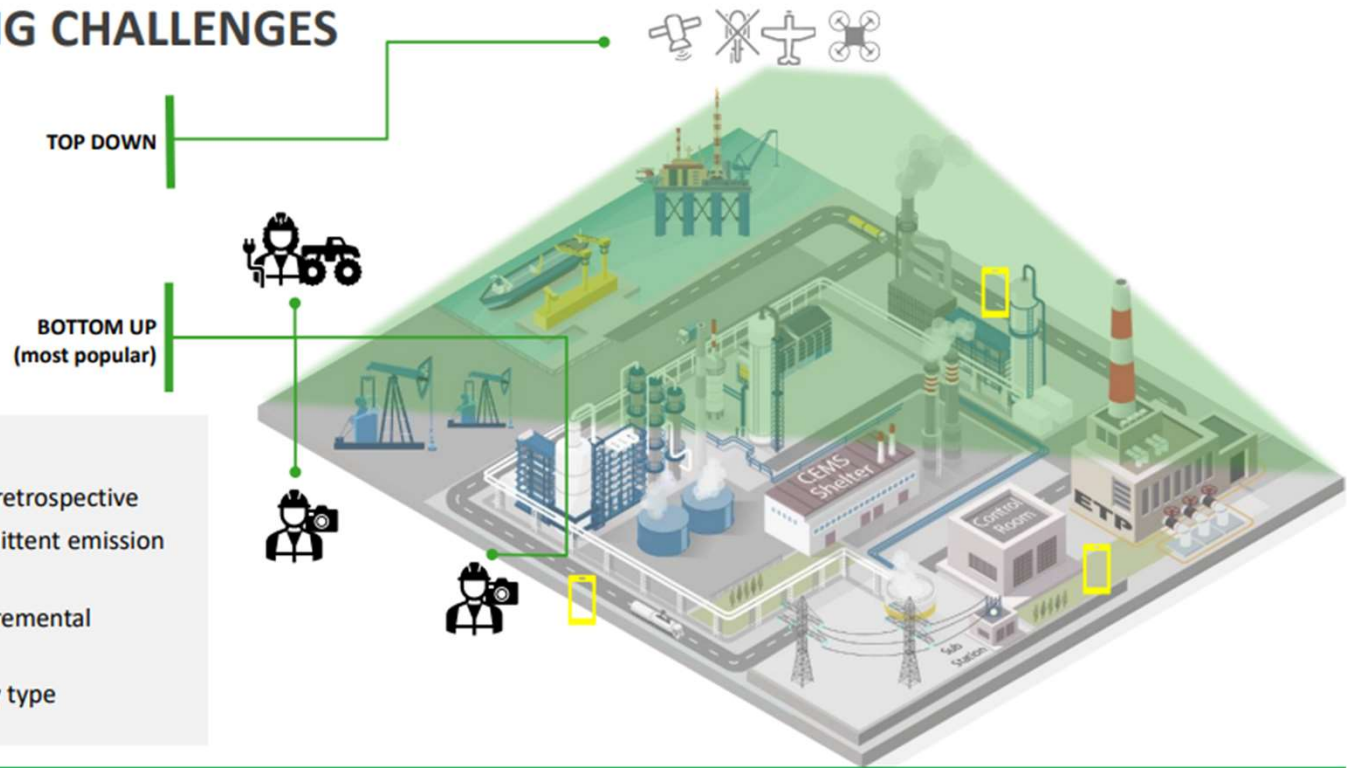
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METHANE MANAGER SOFTWARE CAN MONITOR FUGITIVE EMISSIONS IN REAL TIME,
PROVIDE ALARMS, AND PERMANENT RECORDKEEPING

&

CALCULATING: TOTAL EMISSIONS
MINUS SOLD METHANE
EQUALS
UNACCOUNTED FOR FUGITIVE EMISSIONS
WITH AN UNCERTAINTY

COMMON EXISTING CHALLENGES



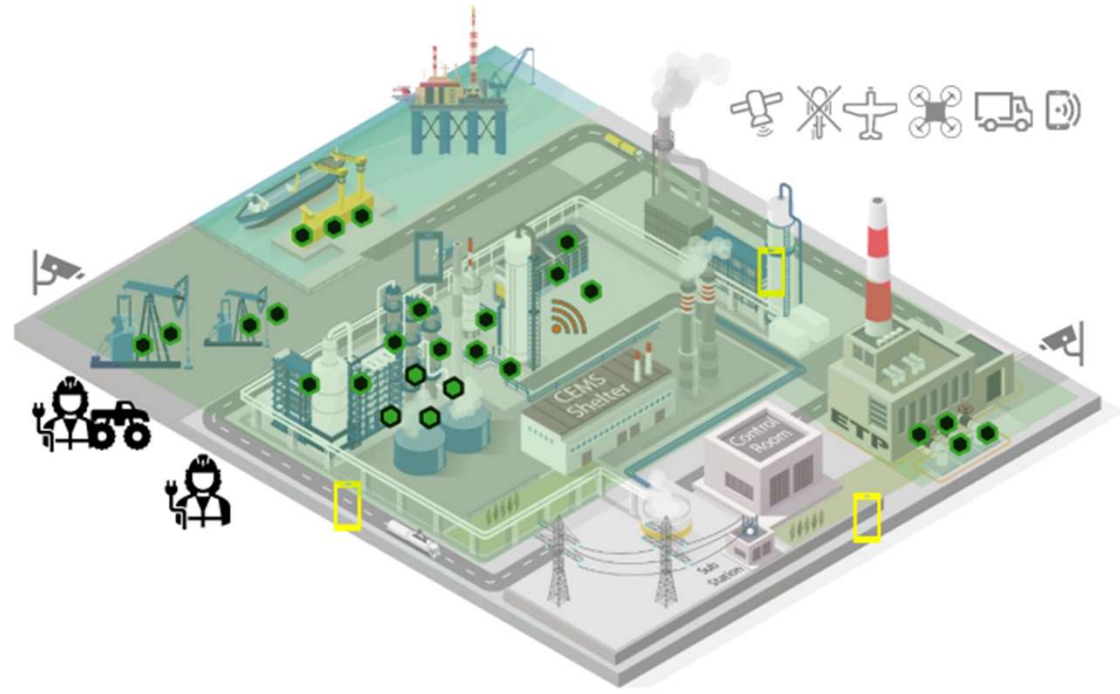
CHALLENGES

- Estimated inaccurate numbers only, retrospective
- Snapshot in time misses most intermittent emission events
- Labor & cost intensive to get any incremental improvement
- Limited ability to classify emission by type

Legislation will require empirical and accurate data for total methane emissions

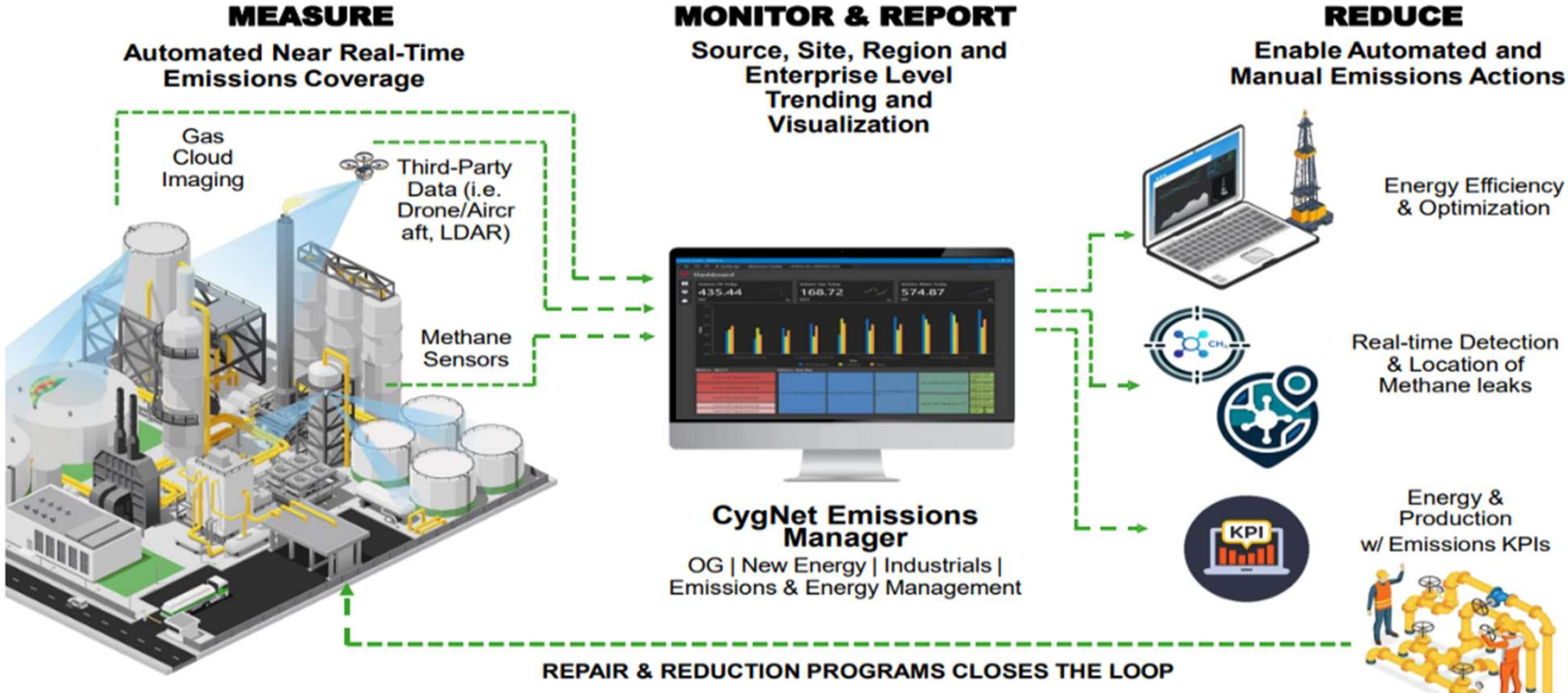
FOCUS ON THE HEART OF THE PROCESS

- Continuously **MEASURE**
- Continuously **MONITOR**
- Near real-time **REPORTING**
- Emissions **REDUCTION**



Driving a Programmatic Approach to Decarbonization

Real Time Detection and Location of Methane Leaks with Permanent Recordkeeping



CAPABILITIES



Automated data collection & validation

Ingestion from disparate sources, data validation across enterprise



Enterprise-wide visualization

Visual Intelligence screens from unit to site to enterprise



Simplified Reporting
Out-of-box Scope 1, 2 and 3 GHG Emissions Report



Near real-time emissions

Calculations on large datasets, Emissions Factor Library



Emissions Reduction Insights

Direct Measurements, Soft Sensors & Seamless integration with Reduction technologies



Leak Detection & Location

Accurately identify and pinpoint methane gas leaks with precision.

EXPECTED BENEFITS

GLOBAL COMPLIANCE

Meets Global Safety Standards: Ensuring reliability and performance across various conditions

REAL-TIME MONITORING

Timely Intervention to Mitigate Emissions: Minimizing environmental impact.

INCREASED ASSET LIFESPAN

Preventative Maintenance: Extending equipment life with early detection and timely repairs.

REGULATORY COMPLIANCE

Avoidance of Fines and Penalties: Staying ahead of regulations to avoid costly fines, particularly for methane emissions.

ENHANCED INSIGHTS

Streamlined Emissions Oversight: Precise leak detection, accurate monitoring, and real-time data for dynamic environmental impact reduction.

MULTIPLE DEVELOPERS OF METHANE MANAGER SOFTWARE FOR WELL SITE FUGITIVE EMISSIONS

Various software packages exist for fugitive methane emissions. Software provides real time recordkeeping for methane emissions. Software data on methane emissions cannot be deleted or modified by site personnel, except by Network Administrator or the like.

American based Weatherford / Honeywell –Methane Manager

<https://www.honeywell.com/us/en/press/2024/05/honeywell-and-weatherford-partner-to-deliver-a-new-emissions-management-solution-for-the-oil-and-gas-industry>

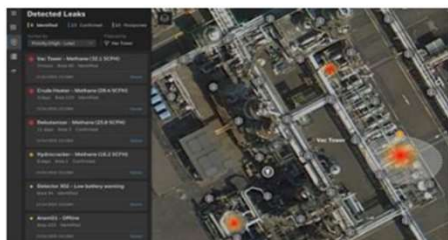
Highwood Emissions

<https://highwoodemissions.com/>

Schlumberger – Champion X

<https://www.championx.com/products-and-solutions/emissions-technologies/continuous-emissions-monitoring-soofie/>

TYPICAL METHANE MANAGER SYSTEM



SITE LEVEL LEAK DETECTION

Faster leak detection helps personnel identify and fix leaks prior to regulated LDAR surveys, thereby lowering facility emissions while decreasing chance of non-compliance.



ENTERPRISE-LEVEL GHG EMISSIONS MONITORING & REPORTING

Continuous methane emissions monitoring helps identify and pinpoint emissions sources at the enterprise, plant, unit, and equipment level.



SINGLE POINT OR SWARM DEPLOYMENT FOR YOUR DATA INGESTION NEEDS

Monitor a known emissions source point – or conflate coverage in high congestion areas.



CONTEXTUALIZE METHANE DATA

with an anemometer's atmospheric data to discern the difference between process venting and fugitive emissions.

Conclusion:

Methane Management software exists on the market. Software can monitor fugitive emissions in real time, provide alarms, and permanent recordkeeping. Methane manager software can close snapshots in time that miss intermittent methane events. Methane manager software continuously monitors, measures, and provides near real time reporting. Methane management software can accurately pinpoint methane gas leaks with precision with notifications/alarms when emission events happen. Methane manager software provides permanent record keeping of fugitive methane emissions.

CALCULATING UNACCOUNTED FOR FUGITIVE METHANE PER WELL

CALCULATING METHANE EMISSIONS –

STEP 1 – CARB to phase out/eliminate separators in lieu of Multi-Phase Flow Meter (MPFM) Technology

MPFM Overview -

- Reduce flanges by 90%
- Reduce emissions by 67-90% per case study with MPFM vs separators
- Provides digital real time data on oil, gas & water flowing from well, vs monthly manual samples
- **Can calculate with an uncertainty TOTAL METHANE coming to the surface from the ground**
- MPFM's are less expensive to purchase and maintain versus separators

STEP 2 – Obtain data of methane sold into the market

STEP 3 – Total Methane minus 'Methane sold into the market' equals unaccounted for methane per site



TYPICAL DATA OUTPUT FROM MPFM ON GAS TRAVELING THROUGH MPFM

Component	MW (lb/lbmole)	Well_1	Well_4	Well_8	Well_14	Well_17
Nitrogen	28.01	0.0284	0.0284	0.0151	0.0109	0.0156
CO2	44.01	0.0019	0.0030	0.0039	0.0047	0.0047
H2S	34.08	0.0000	0.0000	0.0000	0.0000	0.0000
Methane	16.04	0.2305	0.2835	0.3519	0.4022	0.4479
Ethane	30.07	0.0996	0.0930	0.1448	0.1556	0.1655
Propane	44.10	0.0939	0.0832	0.0933	0.0845	0.0974
i-Butane	58.12	0.0135	0.0122	0.0121	0.0112	0.0119
n-Butane	58.12	0.0504	0.0504	0.0454	0.0375	0.0408
i-Pentane	72.15	0.0151	0.0157	0.0123	0.0105	0.0103
n-Pentane	72.15	0.0281	0.0279	0.0237	0.0216	0.0194
NBP[18]155*	117.31	0.0772	0.0762	0.0601	0.0575	0.0426
NBP[18]240*	134.37	0.1050	0.0882	0.0720	0.0711	0.0493
NBP[18]343*	159.78	0.0700	0.0681	0.0490	0.0450	0.0354
NBP[18]446*	182.75	0.0565	0.0520	0.0387	0.0319	0.0227
NBP[18]548*	217.09	0.0462	0.0415	0.0299	0.0228	0.0150
NBP[18]644*	240.61	0.0357	0.0330	0.0231	0.0158	0.0106
NBP[18]744*	264.03	0.0250	0.0220	0.0150	0.0107	0.0073
NBP[18]832*	306.07	0.0116	0.0120	0.0052	0.0037	0.0025
NBP[18]1087*	687.95	0.0075	0.0069	0.0030	0.0019	0.0008
NBP[18]1258*	863.25	0.0040	0.0028	0.0016	0.0009	0.0003
		1.0000	1.0000	1.0000	1.0000	1.0000

Hypo Name	Normal Boiling Point (°F)	MW (lb/lbmole)	Liquid Density (lb/ft3)	Tc (°F)	Pc (psig)	Vc (ft3/lbmole)	Accentricity
NBP[18]155*	155.38	117.3051	45.8688	483.5301	487.5202	5.4442	0.2281
NBP[18]240*	239.54	134.3732	47.8739	581.8296	431.3318	6.6217	0.2924
NBP[18]343*	342.51	159.7792	50.1463	692.6305	360.8882	8.4468	0.3811
NBP[18]446*	445.50	182.7515	52.2299	798.5861	306.6102	10.4495	0.4779
NBP[18]548*	548.19	217.0888	53.6707	894.9050	255.5879	12.9040	0.5921
NBP[18]644*	643.98	240.6123	55.2525	984.8089	221.7716	15.2117	0.7027
NBP[18]744*	743.51	264.0293	56.9441	1077.4366	194.8570	17.6305	0.8241
NBP[18]832*	832.31	306.0688	58.4312	1159.3391	175.4436	19.8188	0.9379
NBP[18]1087*	1087.28	687.9531	60.1776	1359.9817	107.8939	31.0053	1.3496
NBP[18]1258*	1258.17	863.2532	61.2983	1493.8253	76.6095	41.8234	1.6248

Manufacturers could easily create dashboards that show Total Methane with an uncertainty entering the surface, and California has records of methane sales, thus leaving unaccounted for methane to be reconciled with fugitive emissions

CONCLUSION:

In order to understand the magnitude of methane emissions, for the first time we are discovering technology exists to measure Total Methane coming from the ground and entering the surface. Combined with production accounting that states methane sold into the market, regulators can calculate unaccounted for methane emissions with an uncertainty.

No true fugitive emission regulation can exist without understanding the magnitude of the problem. Multi-Phase flow meters provide this solution of measuring methane entering the surface, and simultaneously reduce emissions by 67-90% per Case Study. Multi-Phase flow meters provide real time data of flow, can eliminate separators at well sites, and are less expensive to install and maintain versus separators. A commonsense approach is to instill digital solutions onto well sites with a statute that limits separation units to ten flanges.