Measuring Methane in Cattle Using Laser Methane Detector

Better lives through livestock

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GMG Asia: Webinar on methane recording techniques
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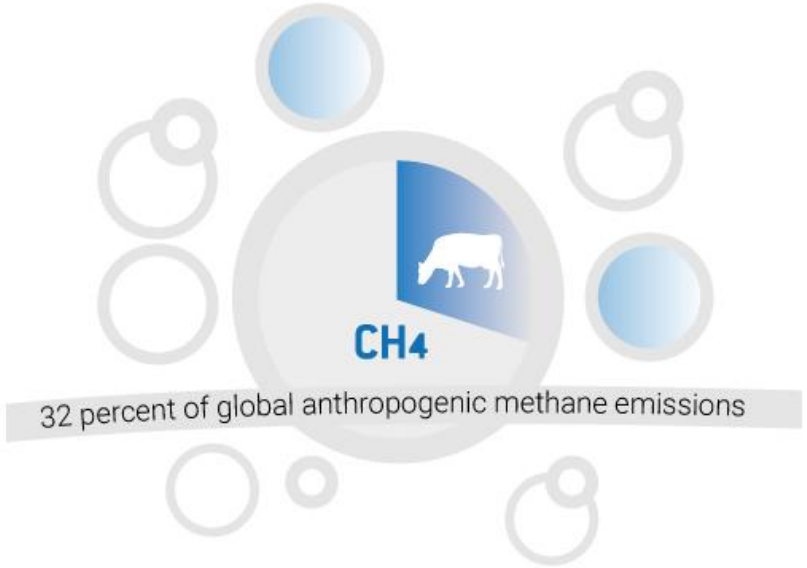
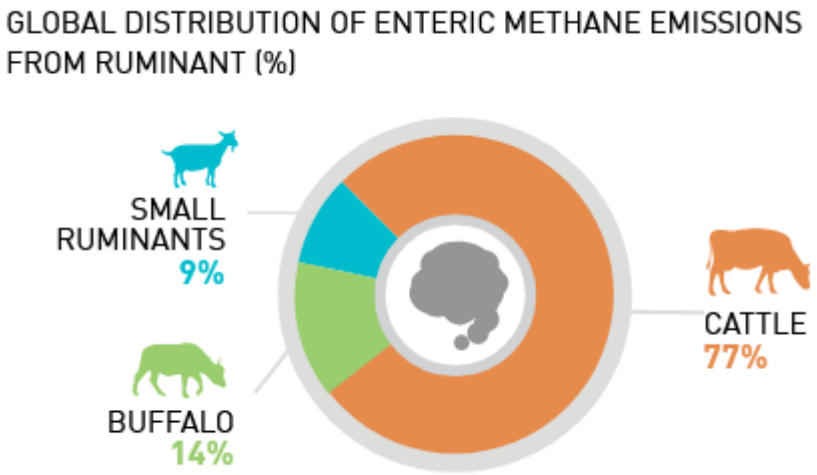
Enteric methane production





IPCC 2013

Measure to manage: Phenotyping enteric methane is essential for identifying low-emitting cows and developing effective mitigation and adaptation strategies.

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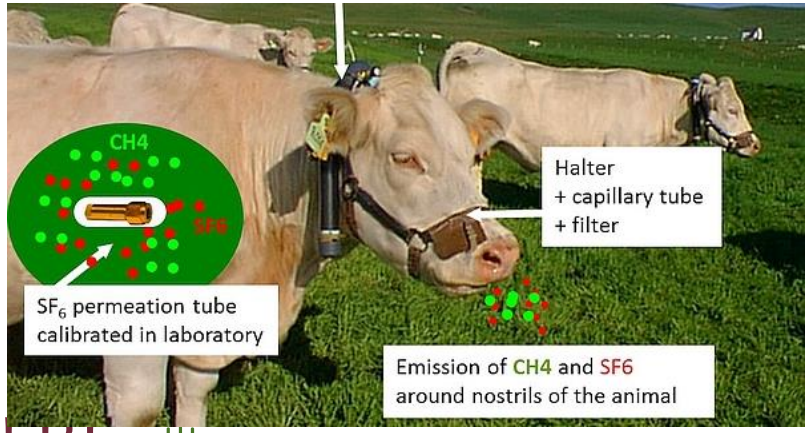
CH4 measuring technologies



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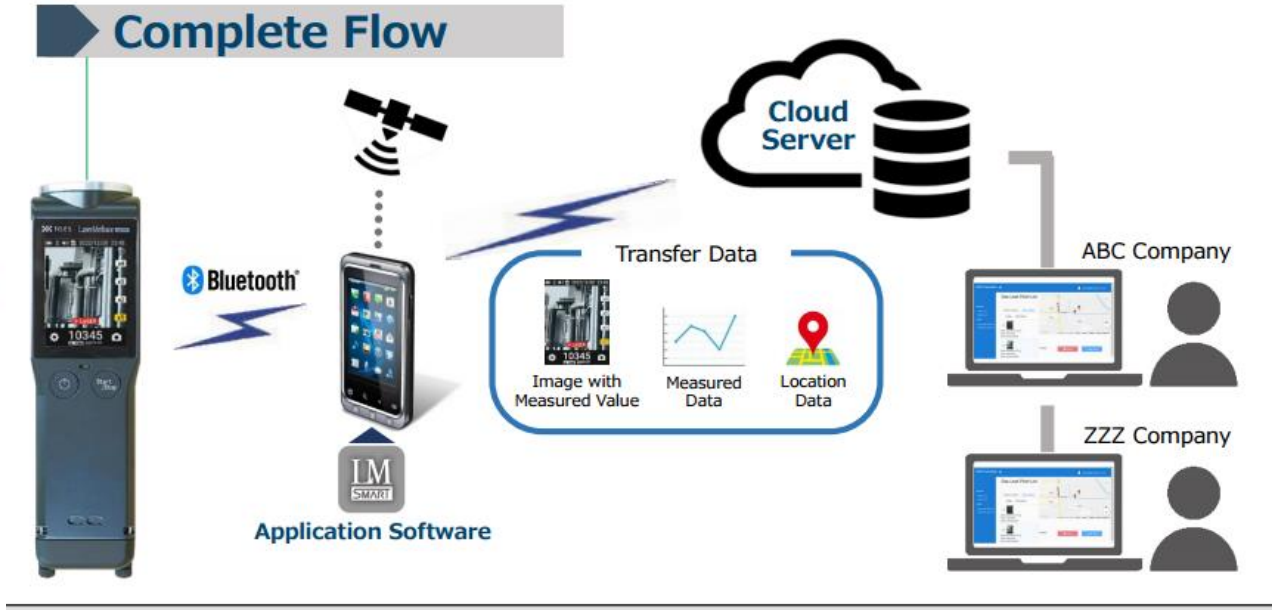
Laser Methane Detector

Tokyo Gas Engineering Solutions Corporation

- Laser methane mini
  - Software for Android Devices (GasViewer)

~ 13k USD

Laser Methane Smart



~ 9k USD

Data

No	yyyy/mm/	Intensity	Measured	Error	Location
1	20:20.8	395	16	1	http://ma
2	20:21.3	410	13	1	http://ma
3	20:21.8	325	8	1	http://ma
4	20:22.3	173	12	1	http://ma
5	20:22.8	278	28	1	http://ma
6	20:23.3	482	8	1	http://ma
7	20:23.8	283	18	1	http://ma
8	20:24.5	1069	8	1	http://ma
9	20:24.9	409	10	1	http://ma
10	20:25.4	310	9	1	http://ma

1: Values are measured normally.
5: 「Not enough reflection」 Value involving an error.
6: 「High density gas」 Value involving an error.
7: 「Too much reflection」 Value involving an error.

Operating time

eneloop Standard 2.5hours

eneloop Pro 3.5hours

eneloop Lite 1.3hours

LaserMethane SMART

Special Battery Pack 4hours

LaserMethane mini

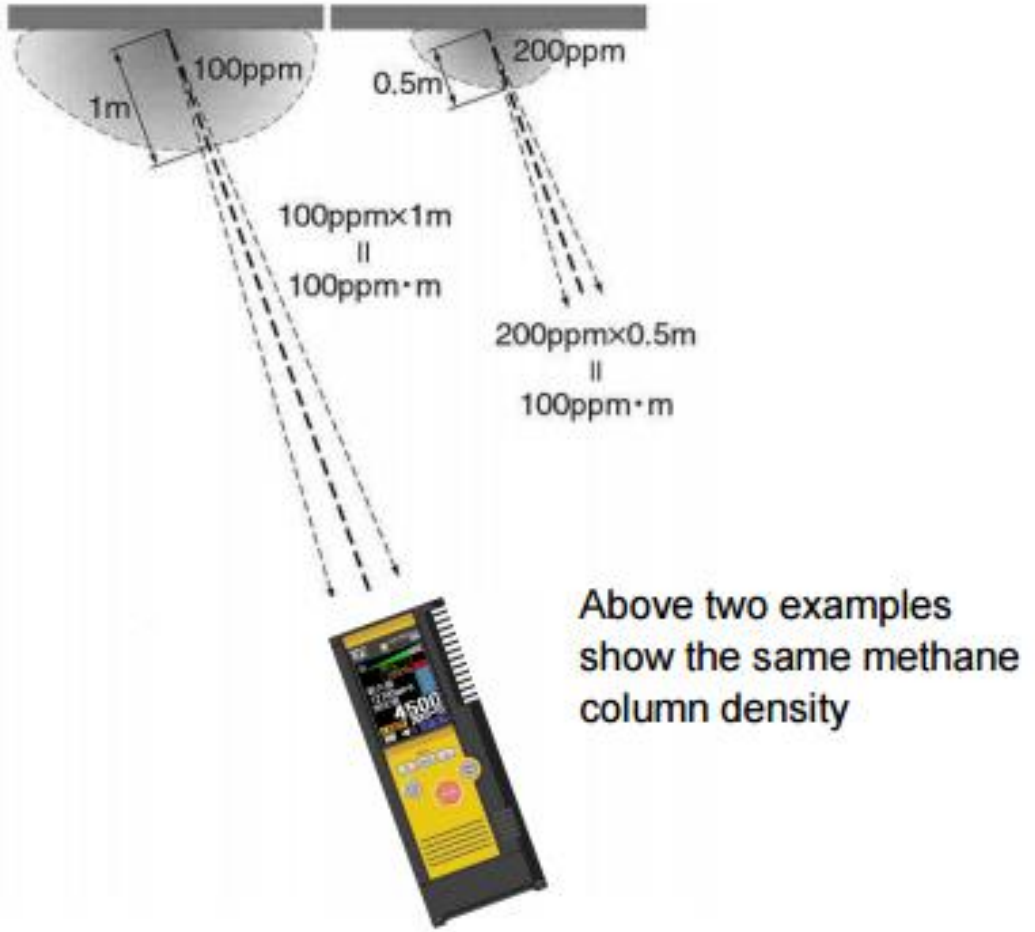
Note) These are reference values at 25°C.

Commercial Batteries (4 Pieces)

Battery pack: 1 pc.

Intensity and distance

- Light reception intensity bar
  - Be sure to measure when the reception intensity is indicated in green.



Proxy-Based Methods

- Milk Mid-Infrared Spectroscopy (MIR)

Principle: Predict CH_4 emission based on spectral properties of milk components

Advantages:

- Non-invasive and high-throughput
- Leverages routine milk testing data

Limitations:

- Indirect—requires calibration with direct CH_4 data

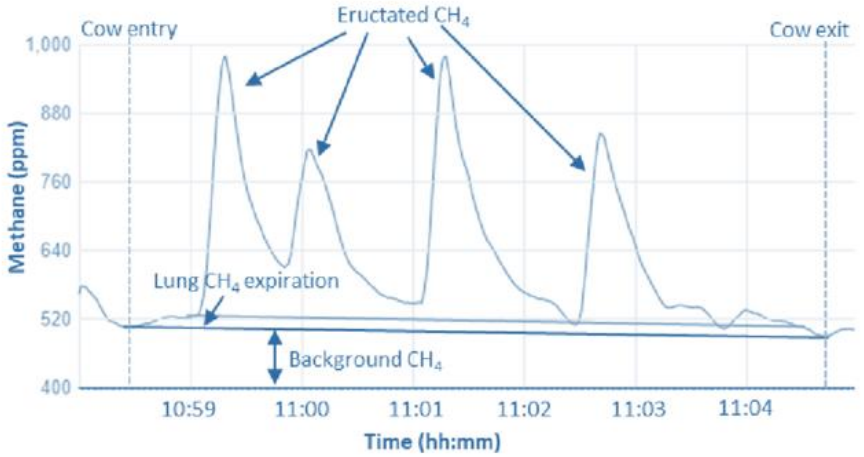
Indirect prediction of methane using MIR

	All data			Feeding status data		
	N	R	RMSE	N	R	RMSE
MIR + body weight+ milk + fat% + prot%	479	0.45	103.3	296	0.52	104.5
MIR	620	0.40	111.9	296	0.52	110.6

Number of records needed for prediction

Average Records	accuracy	RMSE
1	0.24	168
2	0.28	149
3	0.29	133
4	0.37	124
5	0.39	122
6	0.45	116
7	0.47	116
8	0.45	109
9	0.45	107
10	0.45	106
11	0.46	105
12	0.45	106

Duration: 5-10 min



Background methane : Correcting the methane measurement for the background data

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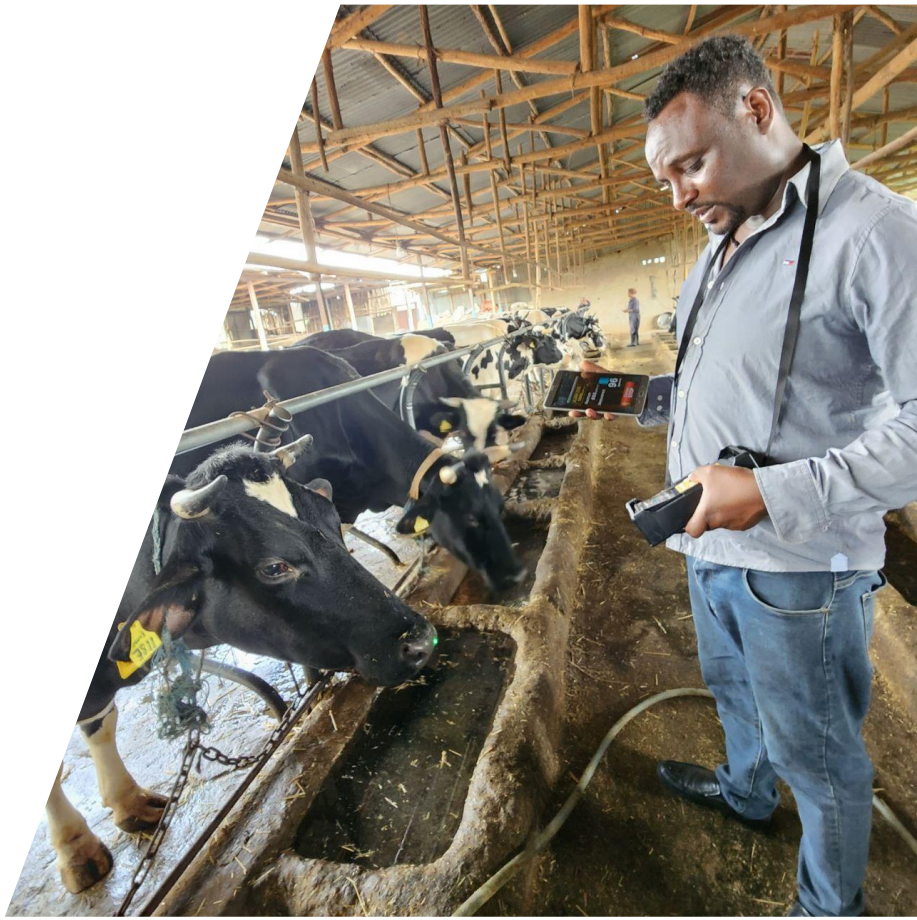
Prediction inside cow status recordings

cowStatus	nAnim	nRec	accuracy
Feeding	410	2302	0.49
Ruminating	587	6437	0.33
Sleeping	185	555	0.33
Standing idle	345	2913	0.26
Drinking	12	18	0.21



Advantage and Limitation of LMD

Advantage	Explanation
Non-invasive	Reduces stress; allows repeated measures
Portable	Suitable for field/smallholder conditions
Real-time output	Immediate emission profiling
Cost-effective	Affordable compared to chambers
Flexible use	Across activities and environments
Data integrable	Links with MIR/genomics databases
Safe operation	No harm to animals or users

Limitation	Explanation
Environmental sensitivity	Wind, humidity, and temperature affect readings.
Measure concentration	Records ppm·m, not actual CH_4/day emission.
Movement effects	Animal or operator movement causes variation.
Needs repeated measures	Several readings required for accuracy.
Background interference	Nearby methane sources distort results.
Missing Data Linkage	Not linked with animal id

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