



Methane Emissions Monitoring

TotalEnergies and ZX Lidars

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Introduction

TotalEnergies and ZX Lidars Drive Targeted, Accurate Methane Monitoring with drone and wind Lidar technology

TotalEnergies, in partnership with ZX Lidars, is leading the charge in methane emissions monitoring and reduction. Utilising modern, proven technology and rigorous methodologies, the initiative aims to meet and exceed new stringent EU regulations, highlighting the companies' commitment to operational excellence and environmental responsibility.



1 Understanding Emissions

Methane (CH₄) emissions are recognised as a key priority in the natural gas industry, spanning production, processing, transmission, and distribution. These emissions result from intentional venting and unintentional leaks, occurring during normal operations, routine maintenance, fugitive leaks, and system malfunctions. Methane emissions are notably more potent than Carbon Dioxide (CO₂) in terms of their greenhouse gas effect, being over 25 times more potent and effective at trapping heat in the atmosphere. However, unlike atmospheric CO₂ which can contribute to global warming for centuries, CH₄'s impact is approximately one decade. This makes methane management an obvious target in relation to climate change as the benefits in reduction are seen far earlier.

The European Union (EU) has introduced the first EU-wide legislation to cut the methane footprint in Europe and its global supply chains. This legislation mandates operators to measure, monitor, report, and verify methane emissions according to the highest standards and take necessary actions to reduce them. Regular surveys to detect and repair methane leaks are also required, marking a significant step toward reducing net greenhouse gas emissions by at least 55% by 2030.

Methane emissions can be estimated using bottom-up approaches, which involve multiplying activity data by standardised emission factors, or top-down methods, which measure atmospheric methane concentrations using remote, airborne or satellite sensors multiplied by low level wind measurements, or mesoscale forecasts. In all cases, these estimates are subject to uncertainty due to the variability of emissions sources and accuracy of wind data, wind speed and direction being by far the most sensitive in relation to certainty. Satellites have enhanced our understanding of emissions, enabling detection and quantification of major leaks, however they are generally targeted at larger areas and leaks. To obtain the highest certainty of wind measurement, the wind should be measured as close to the point of sampling as possible.

2 Taking a Leadership Role

TotalEnergies aims to achieve near-zero methane emissions. Between 2010 and 2020, TotalEnergies has halved its methane emissions by targeting key sources such as flaring, venting, fugitive emissions, and incomplete combustion, and by reinforcing design criteria for new facilities. By 2025, the company aims to reduce methane emissions by 50% and by 80% by 2030, compared to 2020 levels.

To support this ambition, TotalEnergies employs the AUSEA (Airborne Ultralight Spectrometer for Environmental Applications) technology, developed in cooperation with the French National Centre for Scientific Research (CNRS) and the University of Reims Champagne-Ardenne. The AUSEA comprises a drone-mounted ultralight CO₂ and CH₄ sensor, featuring a diode laser spectrometer capable of detecting and quantifying methane emissions with high accuracy (> 1 kg/h).



The technology represents a significant advancement in emissions monitoring. Its ability to detect and quantify both methane and carbon dioxide with high precision is crucial for accurate emissions reporting. Drone mounting means that the sensors can be mobilised to the ideal measurement locations which previously would have been hard to reach locations, making it highly effective for comprehensive site assessments.

In 2022, TotalEnergies conducted an extensive detection campaign, covering 95% of its operated upstream emissions with over 1,200 AUSEA flights across eight countries.

“TotalEnergies is committed to moving towards Zero Methane. Considered to be currently the most accurate technology in the world to detect and measure methane emissions, AUSEA will help us to refine our emissions calculations, and to take stronger measures to reduce our emissions even further in order to achieve the targets we have set”, said Namita Shah, President, OneTech of TotalEnergies.





3 Striving for Best in Class

To enhance the accuracy of emissions data, TotalEnergies has integrated ground-based wind Lidar 'ZX 300' from UK-based OEM ZX Lidars within their monitoring methodology. The ZX 300 wind Lidar provides high-quality wind data, essential for accurate methane flux calculations. This collaboration has significantly improved the precision of emissions monitoring, supporting TotalEnergies' goal of reducing methane leakage.

The ZX 300 wind Lidar is a state-of-the-art vertical profiling device that measures wind speed, direction, and shear profile up to 200 meters above ground level. Key capabilities include:

- ▲ **High Precision:** The Lidar captures detailed wind profiles, providing accurate data on wind speed and direction at various heights. This is crucial for precise calculation of methane flux, as wind data directly influences the accuracy of emissions measurements. Its accuracy has been demonstrated extensively in the wind energy industry and is accredited by leading certification body DNV.
- ▲ **Rapid Deployment:** The ZX 300 can be quickly set up at drone launch sites, ensuring timely and relevant wind data collection.
- ▲ **Operational Efficiency:** Continuous wind monitoring supports drone operations, including safe launch and landing, with measurements uniquely covering ground level up to 300 metres above the deployment site.
- ▲ **Durability and Reliability:** Designed for robust field conditions, the ZX 300 operates effectively in various environments, making it ideal for extensive monitoring campaigns in all weather conditions and environments.
- ▲ **Integration with Emissions Monitoring:** By providing accurate wind data at the same heights and times as drone measurements, the Lidar ensures that methane emissions data is highly reliable and precise.

"The ZX 300 wind Lidar's precise wind measurements are integral to our emissions monitoring strategy, essential lever to reach our methane reduction targets," emphasized TotalEnergies.

ZX 300's integration into TotalEnergies' emissions monitoring strategy is a testament to the growing role of advanced remote sensing technologies in environmental management. The ZX 300's ability to provide precise wind data at multiple heights enhances the accuracy of emissions calculations by ensuring that wind conditions are accurately factored into the data. This integration not only supports regulatory compliance but also drives continuous improvement in emissions reduction strategies, in a smart, modern approach.





4 Future Directions

Looking ahead, the continued development and refinement of emissions monitoring technologies will be critical to achieving global climate goals. Innovations in sensor accuracy, data integration, and automation will further enhance the effectiveness of these systems, enabling more precise and comprehensive emissions management.

As regulatory frameworks evolve, become more stringent and more globalised, the ability to demonstrate compliance through robust, verifiable data will become increasingly important. Technologies like AUSEA and ZX 300 will play a crucial role in meeting these requirements, providing the data needed to support regulatory reporting and drive continuous improvement in emissions reduction.

For TotalEnergies', the adoption of AUSEA and ZX 300 technologies underscores its commitment to leadership in environmental performance. By setting ambitious methane reduction targets and investing in cutting-edge monitoring technologies, the company has positioned itself as leader in the transition to a low-carbon economy.

For the broader industry, TotalEnergies' initiatives serve as a benchmark for best practices in emissions monitoring and reduction. The successful implementation of these technologies provides a model that other companies can emulate, or utilise, contributing to broader efforts to mitigate climate change and improve environmental performance across the sector.

5 Conclusion

The European Union's new legislation represents a significant step towards reducing methane emissions globally. By setting stringent standards for imported energy, the EU aims to achieve substantial emissions reductions beyond its borders. TotalEnergies', leveraging state-of-the-art technology and rigorous monitoring practices, is at the forefront of this critical effort.

“For the Oil & Gas industry, cutting methane emissions from operations is a priority as technologies are available. The first step is to measure emissions, asset by asset. TotalEnergies is taking a concrete step to encourage the whole industry to aim for zero methane emissions”, said Patrick Pouyanné, Chairman and CEO of TotalEnergies.

As the global energy sector increasingly focuses on sustainability, collaborations like that between TotalEnergies' and ZX Lidars highlight the importance of leveraging innovative technologies to meet environmental goals. The success of these initiatives will play a critical role in shaping the future of energy production and environmental stewardship.

The deployment of these advanced technologies aligns with broader industry trends towards digitalisation and automation in environmental monitoring. By providing real-time, accurate data, these systems enable operators to make informed decisions quickly, enhancing both operational efficiency and environmental performance.

TotalEnergies' and ZX Lidars exemplify a modern approach to tackling methane emissions, demonstrating leadership and innovation in the global drive towards net zero.

About Us

In 2003 we released the first commercial wind lidar, pooling decades of fibre laser research from the science, security and energy industries. Designed specifically for the wind industry our Lidar has paved the way for many of the remote sensing devices seen in the market today. Our original lidar technology continues to innovate with world firsts such as taking measurements from a wind turbine spinner and being the first to deploy an offshore wind lidar, both fixed and floating. Our Lidars have also now amassed millions of hours of operation across 10,000+ deployments globally spanning two decades of commercial experience. Some of our proudest achievements are listed below; these are the earliest reported examples that we are aware of from open publications.

- 2003** - The first wind lidar to make upwind measurements from a turbine nacelle
- 2004** - The first and original commercially available lidar for the wind industry
- 2004** - The first wind lidar to investigate the behaviour of turbine wakes
- 2005** - The first wind lidar to be deployed offshore on a fixed platform
- 2007** - The first wind lidar to take measurements from a turbine spinner
- 2008** - The first wind lidar to be signed off against an industry-accepted validation process
- 2009** - The first wind lidar to be deployed offshore on a floating platform
- 2010** - The first wind lidar to re-finance and re-power a wind farm
- 2011** - The first wind lidar to be proven in a wind tunnel
- 2012** - The first wind lidar to be used with very short masts and secure project financing
- 2012** - The first wind lidar to be accredited for use with no or limited on-site anemometry for project financing by DNV GL
- 2014** - The largest batch of single-type lidar verifications against an IEC met mast
- 2015** - The first lidar designed specifically for offshore use, with the longest warranty available - 3 years as standard
- 2016** - The first wind lidar to support safe lifting on a jack-up vessel
- 2016** - The first wind lidar SCADA integrated on operational wind farms in replacement of site met masts
- 2017** - The first wind Lidar to be installed across a wind farm on a Lidar-per-turbine basis, uniquely mapping wakes across a wind farm
- 2018** - The first wind Lidar to satisfy all criteria for IEC Classification
- 2019** - The first wind Lidar to take wind measurements from a drone
- 2020** - The first wind Lidar to be accepted for bankable energy assessments in complex terrain standalone (without a met mast)
- 2021** - The first wind Lidar to attract more than £150bn+ of investment into wind energy projects
- 2022** - The first wind Lidar to be fully integrated into a retrofit wind turbine controller for Lidar Assisted Control
- 2023** - ZX Lidars moves to Willow End!

UNITED KINGDOM

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Our Products & Services



ZX300

Onshore vertical
profiling wind Lidar



ZX300M

Floating & platform-
mounted vertical
profiling wind Lidar



ZXTM

Turbine-mounted
horizontal profiling
wind Lidar



**ZX Measurement
Services**

Wind Data
as a Service