



ENERGY PIPELINE

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Could a nanosatellite monitor greenhouse emissions from oil, gas facilities in the DJ?

BY GARY BEERS • FOR ENERGY PIPELINE

CANADA'S OIL SANDS INNOVATION ALLIANCE (COSIA) NEEDS MORE PRECISE AND FREQUENT DATA ON GREENHOUSE GASES

Alberta was the first jurisdiction in North America with mandatory greenhouse gas emission reduction targets for large emitters across all economic sectors (Oil Sands and EHG Emissions Fact Sheet, Public Works and Government Services Canada, 2013). Under the Copenhagen Accord, activities that develop and transport natural resources in this region committed to reduce greenhouse gas emissions by 17 percent below 2005 levels by 2020.

Many oil sand operators realized they needed more precise measurements of total emissions — more frequently and more safely — than current methods to effectively take steps to reduce emissions on an areawide basis before 2020 (LOOKNorth, GHS Satellite Solutions). This view was shared by other emitters — power generation, mining and waste management companies.

To meet this need, GHGSat (Montreal, Quebec) designed the world's first satellite for measuring greenhouse gases, such as methane and carbon dioxide, and air quality emissions, such as sulfur dioxide and nitrogen oxides. With the support of COSIA, LOOKNorth, various academic institutions, and environmental agencies, GHGSat built and tested the satellite before implementing an 18-month demonstration program.

JUNE 21, 2016 - FIRST SATELLITE LAUNCHED TO MEASURE EMISSIONS FROM INDIVIDUAL INDUSTRIAL FACILITIES



An Indian Polar launch vehicle placed the nanosatellite, about the size of a microwave oven, in orbit at an altitude of approximately 310 miles (CLAIRE's Launch, GHGSat). This 33-pound instrument orbits the earth every 90 minutes; however, any single point on the earth's surface can be measured every two weeks.

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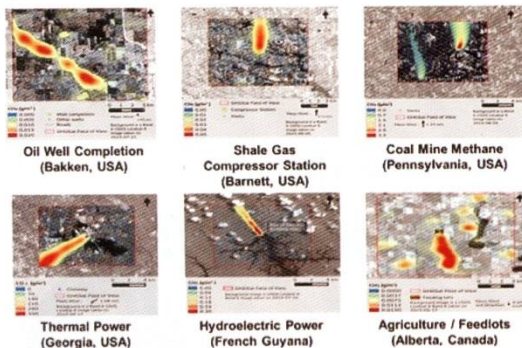
The satellite, nicknamed CLAIRE, measures the gas fingerprints of carbon monoxide and methane using imaging spectrometers and other sensors. In a few seconds, over 200,000 atmospheric measurement around an industrial facility can be made from CLAIRE. The sensors can measure emission gases in areas of 5 square miles at a resolution of up to 160 feet.

CLAIRE is expected to operate for five years before burn-up in the atmosphere.

JUNE 21, 2017 – RELEASE OF SAMPLE IMAGERY FROM FIRST YEAR OF OPERATION



For over 50 years, GARY BEERS, has worked in numerous fields of environmental science as a consultant, regulator and educator. This career included senior management position with major consulting, nonprofit and public organizations. He has founded several successful firms to capture emerging resource management markets. One of his latest ventures, EnviroScienceINFO, provides content for public media.



A nanosatellite, nicknamed CLAIRE, measures the gas fingerprints of carbon monoxide and methane using imaging spectrometers and other sensors. These images show the Rocky Mountain region.

During the first year in orbit, imagery from CLAIRE was restricted to qualified users.

During the initial demonstration period, CLAIRE was directed to measure emissions from hundreds of facilities and activities, for example:

- oil and gas facilities
- hydroelectric facility under construction (Africa)

- release of bottom water from large reservoir which released methane from decomposition
- landfill (Japan)
- power station (Russia)
- cement plant (Africa)
- animal feedlot
- coal mine (Australia)

Examples of the mapped emissions for six facilities are provided in Figure 2.

Public releases of CLAIRE's imagery has occurred at several events and many images are available on GHGSat's website (www.ghgsat.com). GHGSat is reviewing CLARIE's output with several facility operators. However, detailed evaluations of the emission maps and applications to improve management of greenhouse gas emissions at a specific facility have not been widely released. At the 2017 Global Petroleum Show (Calgary, Canada), GHGSat was the winner of the Environmental Excellence award which recognized any efforts, initiatives or technological development that have minimized or eliminated environmental footprint of the oil and gas industry.

The success of CLAIRE has prompted GHGSat to build two additional tiny satellites which incorporate the lessons learned from the initial demonstration year, improve performance and provide additional capacity.

KICKSTARTER CAMPAIGN: \$100,000 FOR DEMONSTRATION TARGETING YOUR INDUSTRIAL SITE

GHGSat launched a kickstarter campaign to fund CLAIRE's design, development and testing. Remaining funds for specific demonstrations of CLAIRE's abilities were limited to a few projects.

Efforts have been underway to obtain funds for additional demonstrations. The proposal is that \$100,000 will pay for a demonstration using a single site or facility. The demonstration will involve taking carbon dioxide and methane measurements over a year for a total of 13 to 26 measurements

(A Tiny Canadian Satellite Is Going to Watch the World's Climate Offenders", Motherboard, M Braga, November 2015).

It would be interesting to have a demonstration project for one of the oilfields in the Rocky Mountain region, given the imagery from facilities in the Bakken and Barnett shale regions (Figure 2).

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