CASE STUDY

Danish biogas plant preparing for dynamic $FeCl_2$ dosing

The operator of a Danish biogas plant is preparing to start dynamic $FeCl_2$ dosing to cost-optimise the plant's 3-stage desulphurisation process. Measuring in the wet and unprocessed biogas right after an anaerobic digester, a SulfiLogger™ H_2S sensor provides continuous H_2S data, enabling the operator to adjust the injection rate of $FeCl_2$ to match actual H_2S levels in the next stage of the project.

Background

A Danish biogas plant operator with an annual production of more than 5 million m^3 of biomethane wants to optimise his running costs for desulphurisation.

The plant's primary feedstock is chicken manure, hay and crops from nearby operations, and the sludge is used as fertilizer for the fields.

Although only a couple of years old, the plant is already highly successful and therefore in the process of being upgraded to increase the production capacity even further.

Desulphurisation setup

The biogas is purified via a 3-stage desulphurisation process. In the first stage, the operator doses $FeCl_2$ directly into each of the plant's five anaerobic digesters. Following this, the gas enters activated carbon filters for further gas desulphurisation before a membrane system upgrades the gas to biomethane for the natural gas grid. The operator currently monitors the H_2S levels in the process gas using a traditional multi gas analyzer installed just before the activated carbon filters. The multi gas analyzer provides spot measurements of conditioned gas at fixed intervals.

Purpose

With this project, the operator wants to dynamically adjust the $FeCl_2$ injection rate to optimise his cost of chemicals while maintaining the optimal lifespan on costly activated carbon filters and protecting the delicate membrane system from corrosion induced by H_2S spikes.

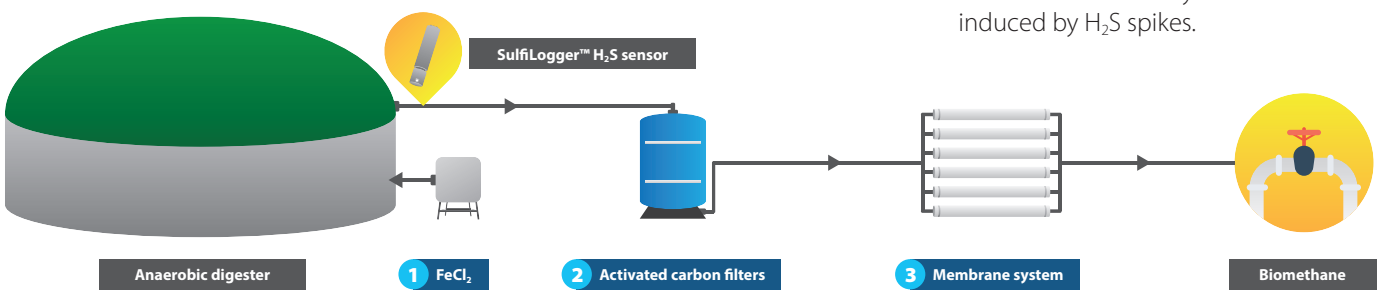

Figure 1: Overview of the 3-stage desulphurisation process at the biogas plant and the sensor's location in the setup.

Solution

An inline SulfiLogger™ H_2S sensor was installed in a side-stream right after one of the five digesters measuring directly in the wet and unconditioned biogas. The ATEX certified sensor provided continuous, online H_2S data via a cloud solution with data points updated every minute.

Results

The SulfiLogger H_2S sensor provided the plant operator with a complete overview of the real-time presence of H_2S after the digester. Disregarding the fluctuations, the H_2S levels in the gas coming out of the digester were generally quite low, suggesting the operator is dosing excessive quantities of $FeCl_2$ for long periods of time.

Perspectives

Sample-based H_2S analyzers do not provide an ideal input for dynamic chemical dosing in biogas, as they deliver a static snapshot rather than a full overview over time. By relying solely on sample-based measurements for adjusting chemical injection rates, biogas operators risk dosing either excessive quantities to match peak loads of H_2S or insufficient amounts minimising the lifespan of assets.

Using the novel SulfiLogger™ H_2S sensor, biogas operators can optimise H_2S mitigative actions for lower running costs and improved asset management.

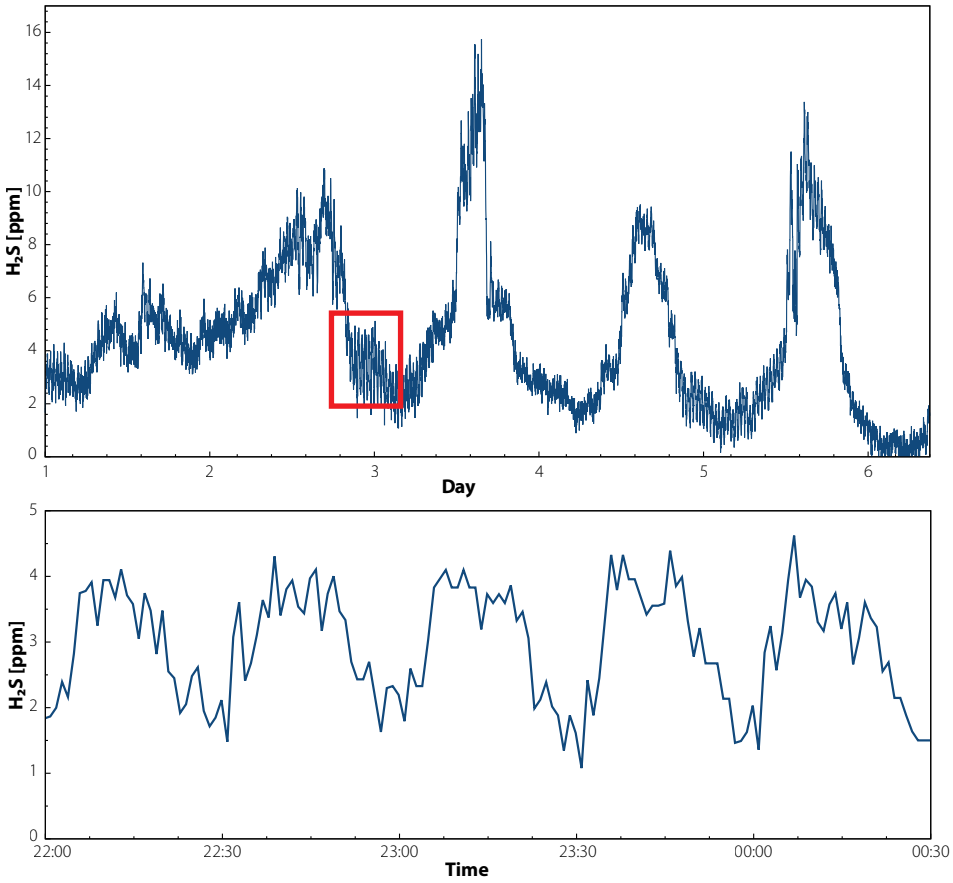

Figure 2: H_2S readings from the SulfiLogger™ H_2S sensor measuring right after an anaerobic digester. The top graph shows the full 5 day data set, while the bottom graph highlights a period of 2½ hours at the end of the second day (marked in red).

Both graphs show frequent process-induced fluctuations in the H_2S levels in the gas coming out of the digester. The half-hourly fluctuations shown in the bottom graph are caused by the mixer turning on and off.

About the SulfiLogger™ H_2S sensor

The SulfiLogger™ H_2S sensor is an inline H_2S sensor for continuous, online monitoring of unprocessed biogas. It is well suited for installation in various placements in biogas plants, as the sensor measures in high humidity – it can even measure in water, and as it requires no addition of oxygen or any other pre-treatment of the gas.

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