

Application Note INCA

Biogas precision metering for engine-generator (genset) performance and CDM monitoring in a Palm Oil Mill Effluent (POME) digester plant



- Methane volume determination for CDM verification
- Process control of the biogas plant at the lagoons outlets (CH_4 , CO_2 , H_2)
- Process control of the gas cleaning plant (H_2S , O_2)



Project

POME and methane emission prevention

Palm Oil Mill Effluent (POME) is liquid waste from the oil extraction process. Due to anaerobic digestion the typically open pond digester systems release large amounts of methane to the atmosphere and thus contribute significantly to the green house effect. POME treatment in a biogas plant reduces plant footprint and gas for combustion in genset or flare neutralizes the green house effect.

Clean Development Mechanism (CDM) and Certified Emission Reduction (CER)

The anaerobic digestion method is recognized as a "Clean Development Mechanism" (CDM) under article 12 of the Kyoto protocol. A CER is a certificate which is issued every time the United Nations prevents one tonne of CO₂ equivalent being emitted through carbon projects registered with the CDM; an example is the conversion of the methane gas from palm oil mill digester systems into renewable energy. CERs can be held by governmental and private entities.

Biogas plant at Belitung palm oil mill

PT Austindo Aufwind New Energy (AANE) was formed in 2008 as an Indonesian-German joint venture between ANJ Agri Group and Aufwind Schmack Group. Starting 2011, AANE constructed a biogas plant at ANJ Agri's Belitung palm oil mill (fig. 1). The plant produces biogas from POME and thus generates Certified Emission Reductions (CER).

Rewarded sum depends on instrumentation

The number of certificates issued depends on how accurate and reliably the process of disposing methane is engineered and operated including gas analysis and volume flow monitoring. Any cognizable risks or uncertainties in the measuring process will reduce the amount of payment.

Therefore, **UNION Instruments**, a german company with extreme experience in biogas analysis, has been involved early with the project to engineer the entire measuring system and to deliver the key components.

Solution

System compliant to CDM

Some of the most relevant methodological tools for CDM projects are those for "Project emissions from Flaring" and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". They are applicable for a large range of projects and are key to successfully claiming carbon credits. Essentially they determine how the amount of destructured greenhouse gas is measured. Several options are available. UNION can provide solutions for all of them including "Option C", where the gas must be analyzed in its original wet condition!

Option C selected

This approach was chosen in Belitung as it is the most direct method - but also the most challenging one for gas analyzers. The main advantage of Option C is that it does not require a separate moisture sensor which saves cost and avoids additional measurement error. Note that most analyzers internally cool the sampling gas thereby reducing the moisture content. These analyzers cannot measure the wet gas directly. The UNION CDM solution is one of the few, if not the only sensor that is capable of doing this. Consequently, major parts of the system delivery have been (fig. 1 and 4)

- INCA1000, a UNION high performance gas analyzer especially designed for bigas applications, to monitor CH₄ very reliably and precisely
- A heated (> 55 °C) stainless steel analyzer cabinet to allow measurements on a wet basis
- A high performance ultrasonic flow meter to monitor the volumetric flow very reliably and precisely and without pressure loss loss (fig. 1 and 5)
- Materials for gas sampling, heated gas lines etc.

UNION-analyzer also for process control

UNION Instruments delivered a second INCA gas analyzer for process control, see fig. 2 and 3. This analyzer was equipped with an automatic sample stream switching system to serve the three measuring locations.



Fig. 1 Belitung plant with gas analyzer (yellow), mass flow meter (red) and gas sampling point (green)

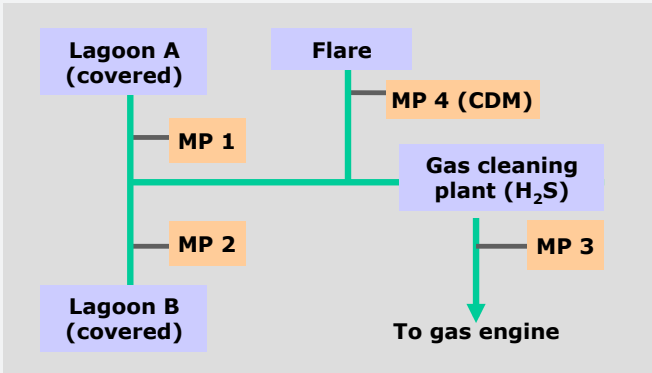


Fig. 2: Process flowchart with sampling points

Measuring location	Measured components	Application	Analyzer
MP 1	Outlet of lagoon A	Biogas plant pocess control	INCAXXXX with sample gas switching
MP 2	Outlet of lagoon B		
MP 3	After gas cleaning plant (Inlet of gas engine)	Desulfurization plant process control	INCA1000
MP 4	Base of the flare	CDM verification	

Fig. 3: Application details (to fig. 2)



Fig 4: INCA1000 in steel cabinet

INCA 1000 dual wavelength gas analyzer for Biogas plants

INCA1000 (fig. 4) is part of UNION Instruments extensive line of process gas analyzers and is especially engineered and designed for use in biogas plants. It features i.a. UNIONs unique dual-wavelength NDIR mesuring technology which allows an efficient compensation of cross sensitivities and also reveals other sensor failures. Further more, INCA1000 uses automatic calibration with air and calibration gas. Cross sensitivity, caused by overlapping spectral areas, is a deciding issue in assessing accuracy and confidence level of gas analysis results. If a calibration gas is used which contains e.g. higher hydrocarbons as in-purities, cross sensitivity will cause incorrect results: an analyzer without compensation will report lower concentration values than actually exist with a negativ impact to CDM rewards (see last page).

Gas Mass Flow Meter

The FLOWSIC600 (SICK AG, fig. 5) is an ultrasonic gas flow meter for high requirements including legal-for-trade applications. The compact design with concealed cabling provides a robust, trouble-free low-maintenance system. The sealed ultrasonic transducers allow metering in dry, wet or corrosive gases. Due to the direct path layout, the signals are not reflected inside the device and thus not influenced by contaminations; resulting in a high long-term stability and accuracy.

Control System

The measuring system (analyzer and flow measurement) has been engineered and manufactured by UNION Instruments. The data logging for CDM relevant parameters can be set to 1s, 10s and 60s increments; 60s are the maximum increment allowed under the applicable CDM flaring tool. The system was then integrated as sub-system into the control system (Siemens AG, fig. 6).



Fig. 5: FLOWSIC600 gas flow meter



Fig 6: View to control system with flare

Conclusions

- **Palm oil mills**, while being a growing economic factor in many countries, contribute considerably to the green house effect by means of methane gas emission from the liquid waste. This effect can be compensated by collecting and upgrading the waste gas to biogas. This is an emission reduction process and will be rewarded by CERs.
- **The rewarded sum** depends on the measured amount of upgraded methane and the confidence level in the overall performance of the measuring system applied. The better measuring technology and instrumentation are judged during the yearly CDM certification, the less reduction from the 100 % reward sum will happen.
- **UNION Instruments** is in a position to serve this methane-upgrading market with know-how and instrumentation: In-depth knowledge in NDIR and other gas detection technologies, experience from many hundreds of installations and distinct capability to engineer application-specific systems.
- **Engineering companies or system houses** in the particular countries may cooperate with UNION Instruments by integrating INCA gas analyzers or pre-engineered measuring systems including gas mass flow meters (different types available) in their own deliveries to biogas plants.



UNION Instruments, customer support

UNION Instruments

UNION Instruments GmbH is a German manufacturer of instruments and systems in gas measurement technology with broad experience and international market focus.

Founded already in 1919, UNION is well known as leading supplier of systems to determine and monitor the energy content of gases (Calorimetry). Companies involved in metal or glass production and power generation including Natural Gas use UNION's equipment worldwide and trust in its outstanding operating reliability.

Since the 1970s, the product range expanded to gas analysis to determine and monitor the composition of gases. From the beginning of Biogas to be recognized as alternative source of energy, UNION Instruments intensively supports this new industry with gas analyzers (INCA series). The analyzers are especially developed and engineered to meet the requirements of this growing industry including use for verification. Hundreds of INCA analyzers are in use in biogas plants and prove constantly their high quality and reliability.

The market presence of UNION Instruments is constantly growing: In addition to Europe, special emphasis is placed on Asia and USA with a network of distributors which is actually very much expanded.



Worldwide presence



UNION Instruments GmbH

Zeppelinstraße 42
76185 Karlsruhe
Germany
Alfstraße 28-30
23552 Lübeck
Germany

Phone +49 (0) 721 680381 0
Fax +49 (0) 721 680381 33
info@union-instruments.com
www.union-instruments.com