METHANE FROM FLARING TOOLKIT

Measure Efficiency: Predictive Feedback and Control

Summary

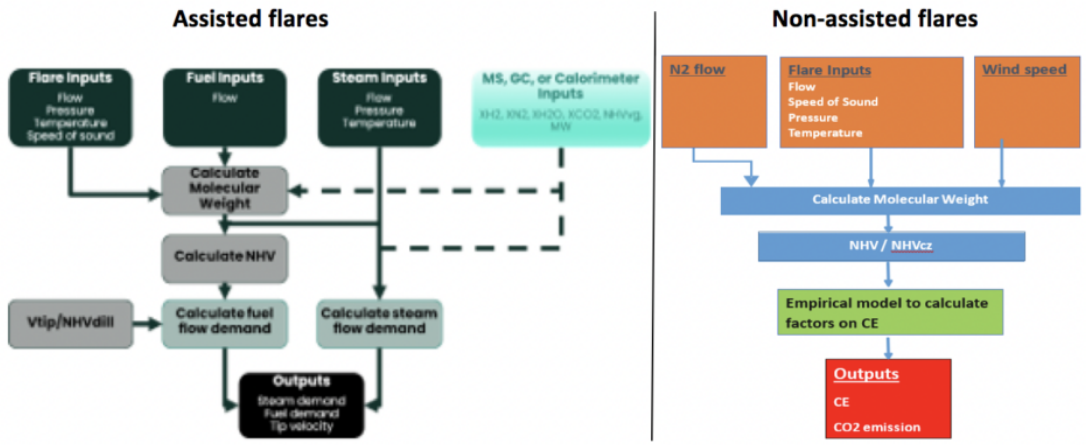
Predictive analytics describes the process by which measured parameters and models are combined to derive information on flare efficiency. They are analogous to Predictive Emissions Monitoring (PEMS) systems used to track emissions of pollutants such as NOx from gas turbines. For flares, predictive analytics system uses a method based on a and Computational Fluid Dynamics () studies with input data coming from flare gas composition, flow rates, flare design and environmental factors such as wind speed. Predictive systems has the advantage of being permanently installed, providing continuous and near real-time feedback on flare performance, allowing adaptations to be made to maintain efficient combustion. Currently available systems are independent of flare vendor and control system provider.

Analytics work as a reporting and monitoring tool, but have also been successfully deployed with feedback loops for the management of flares by moderating steam and air assist gases. Their use for methane management

remains an area of technology development.

How it Works

- It collects and calculates all influencing parameters such as gas at the (NHVcz calculated from the MW of the gas mixture itself derived from the speed of sound measured by any), flow rate, pressure, temperature, vent gas exit velocity, flare tip diameter, crosswind, nitrogen purge rate and gas analysis (if available).
- The algorithms are based on existing experimental studies, such as TCEQ 2010 flare study where samples of the flare plume were extracted after combustion and analysed to measure both CE% and DRE%. This also served as the basis of the EPA properly designed and operated flares that the model uses as well. ?
- CFD studies have been conducted to run simulations using * (EDC) and Probability Density Function* (PDF) and have shown strong correlation. The numerical models can be used in combination with the other parameters for both assisted and non-assisted flares. For assisted flares the system automatically provides DCS steam and fuel gas flow set points.
- Provides a real-time CE calculation.
- For optimal performance, it is required to have available process data to pre-program the system for any type of flares even if fine tuning occurs at site during start up and commissioning.



US Patent 10,746,400: Flare Management System and an Associated Method thereof - August 18, 2020

Advantages

- ☑ The CE range is 50%-99.8% with an absolute error of 1.05% for CE% ? 95%
- ☑ Easy to implement and set up, easy to tune to wide variety of flares

- [x] Flow meter vendor agnostic
- [x] Can work locally and/or be cloud based for unmanned assets
- [x] When there is a single flare boom with a single flame, it distinguishes LP flare from HP flare
- [x] Works with onshore and offshore facilities
- [x] Field proven with installations Downstream (33), Midstream LNG (4), Upstream (2) since 2017
- [x] Provides data on multiple flare parameters, such as flow rate, temperature, pressure, MW
- [x] Underlying measured parameters each have an estimate of uncertainty

Limitations

- [x] Requires an ultrasonic flowmeter on the flare line to feed data to the system
- [x] Inferred measurement (but verified with available online analyzers in Downstream facilities)
- [x] Validation relative to reference methods, such as , is complex
- [x] Not fully deployed for methane management

Go Deeper

- EPA: Parameters for Properly Designed and Operated Flares
- TCEQ study 2010
- Baker Hughes

Case study

Awaiting entry

Can I measure flare efficiency?

Measure Efficiency: Flare Simulations

Control strategies: Predictive Feedback and Control

Measure Efficiency: Drone equipped with single methane sensor

Measure Efficiency: Aerial measurement of flare efficiency

Measure Efficiency: Extractive method for determining flare efficiency