CEN pre-normative survey on gas quality

SFGas GQS Simple Scenario Assessment

European Engine Power Plants Association EUGINE

Power plants using reciprocating gas engines are important “end users” of the gas grid. The gas quality is of essential importance for the safety, environmental performance and efficiency of these gas engine power plants. Against this background, EUGINE is pleased to contribute to the work undertaken by the CEN SFGas WG "Pre-normative Study of H-Gas Quality Parameters" and more specifically to the present “simple scenario assessment survey”.

Like the rest of the energy system, the gas system is under transformation: the connection of national grids to a European grid in order to improve the security of supply, the availability of LNG and increasing amounts of “green gases” (i.e. biogas, biomethane, hydrogen) all have an impact on the gas composition in the pipelines. The impact of these changes on the end users needs to be considered carefully, to avoid unwanted impacts. These unwanted impacts can include effects due to Wobbe number and MN changes or effects due to contaminants that may be present in alternative gas sources.

The decarbonisation of the European energy system will lead to a phasing out of fossil fuels. Replacing natural gas by renewable gases will be one of the key factors of success for the European gas grid, but also for engine power plants. The necessary adaption of the engine power plant technology is in progress but requires considerable efforts.

Asset categories:

Engine power plants can be split into many different categories of assets. However, for the purpose of the scenario assessment requested, it is essential to distinguish between

- already installed power plants (designed and built on the basis of an agreed gas quality),
- plants that can be built today with existing technology and
- plants that will include technology which is under development now

Furthermore, it is of importance, if plants are optimised for a specific narrow gas range and a MN of 80+, providing the highest efficiency, or if they are designed for the ability to handle a wider range of gas compositions, which normally results in lower MN <80 and has the consequence of reducing efficiency and/or output.

Importance of different gas quality parameters

It is understood, that at this stage the study focuses on the Wobbe Index (WI) range and the speed of variations within this range (i.e. rate of change). However, defining a WI range also has an impact on other parameters of the gas quality. For engine power plants the key concern is less the absolute WI value, but rather the width of the WI range, the Rate of Change, the steepness of the gradient and especially the methane number (MN). We refer to the Euromot position paper regarding the correlation between WI and MN for typical gas composition.

Impact on installed engine power plants

The existing plants have all been designed for operation in a rather stable environment with no major changes of the gas quality. Widening the range of gas qualities provided by the grid causes challenges regarding many of the covered areas as outlined by our sister association Euromot in their answer to the assessment. The estimated number of affected engines is in the range of tens of thousands of units in Europe. Most plants would need expensive retrofits including expensive analysers and conditioning equipment, which would make the operation of most plants uneconomical and lead to the closing of such plants. For the smaller ones the challenge is bigger than for the larger ones.

Impact on new plants built with state-of-the-art technology

New gas engine installations can be designed for a lower MN to cope with the higher WI, but gas engines designed for a low MN will exhibit a lower efficiency. Because gas engines will run always on lower efficiency even if the gas will be supplied with a higher MN later on, there will be an impact on the profitability of the plant over the whole lifetime. The lower efficiency results in a higher fuel consumption of up to 4 to 5 % with corresponding higher CO_2 emissions compared to optimised engines with a high MN.

Impact of new plants based on technology under development

The engine power plant manufacturers are working intensively on developing even more flexible power plants – also with regard to the fuel flexibility. Especially the technology of power-to-gas and the burning of a growing share of hydrogen are challenges in the focus of the industry. Instrumentation is the current challenge to wider fuel flexibility. The engine power plant industry is determined to provide solutions that match the growing share of hydrogen and biomethane. The content of those elements in the gas grid, the change in gas composition, the mixing and rate of change needs more study work beyond the current survey.

Contribution to the simple scenario assessment survey

After consideration of the simple scenario assessment survey and internal discussions, EUGINE would like to share the following comments:

- **On the various scenarios for Wobbe Index range**:
  - **Scenario 0**: no significant effect expected as long gas composition stays within current range. If, the full range of legal Wobbe Index would be applied, scenario 0 could cause serious problems.
  - **Scenario 1, 2 & 4:** assuming a negative correlation of WI and Methane Number as outlined in the Euromot position, gases at the WI_{max} would cause output, efficiency, safety and emissions challenges for all existing assets. Newly built plants could be adjusted to the wide WI range, but would as a consequence operate with a lower efficiency as well as higher carbon emissions and by this risk to not be an attractive solution for the operators.
  - **Scenarios 3 & 5:** There are no major effects expected, as with the currently typical gas composition the related methane number would probably be sufficiently high. Scenario 5 is most preferable for gas engines

- **On the Wobbe Index Rate of Change (RoC):**
  For the proper functioning of engine power plants, the WI rate of change is an even more important criterion than the WI range. Larger state-of-the-art engine power plants may cope with some changes to the gas composition, meaning a gradual rate of change of around 1,5 MJ/m^3/minute. However, as a sensitive technology, engine power plants may be negatively affected by the so-called “plug flow” and cannot cope with any steep modification going beyond the above-mentioned value. The rate of change on the methane number and calorific value is also affecting the engine control. A ROC of 5-units in MN/minute can be considered as a maximum ROC. It is important noting that this limit value refers to the change at the engine power plant, i.e. where the customer pipe starts (not as a limit value for the plant of the gas pipeline operator) and for state-of-the-art engines only.

EUGINE would like to thank you for taking these elements into consideration and remains at your disposal for any question related to the CEN gas quality normative activities.

About EUGINE

EUGINE is the centre of knowledge for engine power plant technology and electricity market design. Its members are the leading European manufacturers of engine power plants and their key components. They provide forward-looking solutions for flexible electricity generation.

Contact

Brussels Office
Boulevard Reyers 80
1030 Brussels - Belgium
Phone: +32 (0)2 706 8297
E-mail: info@eugine.eu

Head Office
Lyoner Str. 18
60528 Frankfurt am Main - Germany
Phone: +49 (0)69 6603 1936
E-mail: info@eugine.eu

Visit www.eugine.eu for more information

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