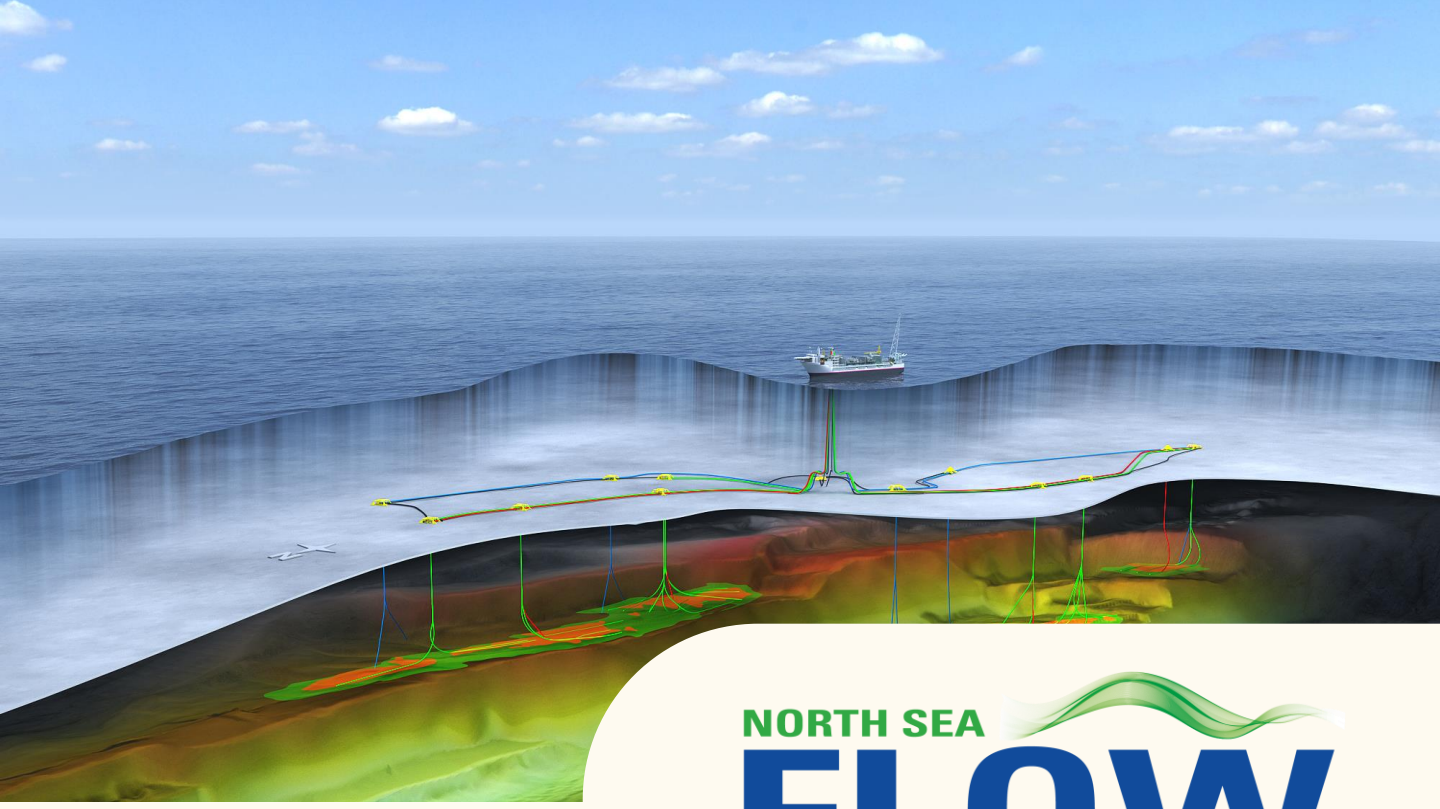

NORTH SEA
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Addressing CCS Flow Assurance and Measurement Challenges: Determination of Water Content in Gaseous Streams

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Short bio presenter: Dr. Edris Joonaki is Fluid Properties Expert & Technical Lead at TÜV SÜD UK National Engineering Laboratory (NEL). His research works have won several research funds as well as numerous UK and international awards. Since joining NEL, he has actively been involved in different projects related to the fluid properties and associated uncertainties in testing facilities. His research is currently focused on addressing flow assurance challenges in CCS and oil & gas industries, and thermodynamics and properties of Hydrogen and CO_2-rich streams.

Introduction

The concentration of water in gas streams is of significance across the energy sector, including oil and gas, carbon capture and storage (CCS), and hydrogen containing systems. When natural gas and carbon dioxide are transported in pipelines, alterations in temperature or pressure could lead to water-condensing phenomena resulting in flow assurance challenges, such as corrosion and clathrate hydrates formation. The dehydration of natural gas and CCS streams must therefore be a key process in any natural gas or blue hydrogen processing plants.

Methods

Different Equations of State (EoSs) have systematically been employed, and their key parameters have been optimised using the experimental data for accurate prediction of the water contents of studied gas streams.

Results and Discussion

Figure 1 depicts the experimental and modelling results obtained for the water contents of CO_2-containing natural gas, CO_2/CH_4, and CO_2/C_2H_6 mixtures at a variety of temperatures and pressures using several EoSs. As can be seen, there is very good agreement between the experimental results and some of the modelling outputs obtained.

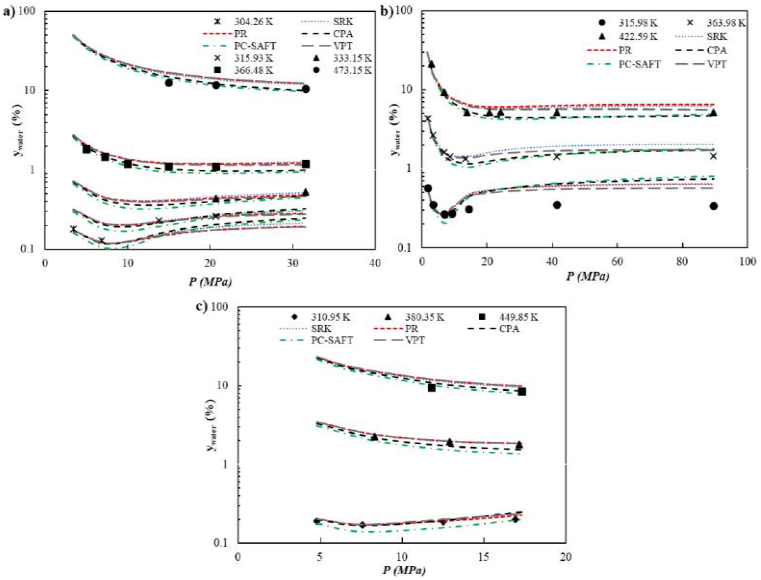

Figure 1. Modelling and experimental results of water content of a) $CO_2 + CH_4$ (30 mol%), b) $CO_2 + C_2H_6$ (5 mol%), and c) a natural gas quaternary system at different pressures and temperatures using various EoSs. Experimental data are from Ref.1.

Conclusions

The outcome of this study, through raising awareness of the limitations of determining water content in these gas streams, could address condensed water induced flow assurance and metering challenges, lowering capital cost and associated operational risk.

References

[1] Fouad, Wael A., Matt Yarrison, Kyoo Y. Song, Kenneth R. Cox, and Walter G. Chapman. "High pressure measurements and molecular modelling of the water content of acid gas containing mixtures." *AIChE Journal* 61, no. 9 (2015): 3038-3052.