SMARTSim - Gas Quality Tracking in Distribution Grids

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SmartSim

Target:

Selective billing of end customers In case of multi-point injection

Solution:

Determine CVs by flow simulation

Costly propane admixture can be avoided in case of biomethane injection





SmartSim Software Grafical User Interface with Integrated Calculation Kernel





Project Implementation

prestudy

- grid simulation (e. g. for 1 year period)
- evaluation of results

validation

- field test
- uncertainty evaluation

implementation

- automated interface to billing system
- operation/billing



PRESTUDIE RESULTS LUND



topology - simplification of lund city grid



topology – example for simplification



- All elements within the polygon are deleted
- A new exit node with total demand of all customers is generated
- To obtain the grid volume volumes of all deleted pipes are assigned to pipe 1
- To match transit times through a reduced section length and diameter of pipe 2 correspond to path with lowest pressure loss (here drawn in yellow)



topology lund city grid - simplified



- simplified topology contains finally 165 nodes, 164 pipes and 2 controller
- therefore are 4 entry and 51 exit points



Simulation scenario: virtual biogas plant Dalby

Assumptions

- biogas plant in Dalby with around 60 GWh per year
- constant injection of 600 m³/h biogas
- constant calorific value of 10.7 kWh/m³
- injection to 10 bar grid
- in regard to energy balance injection of Nöbbelöv is reduced



Upcoming questions

- How is the biogas distribution in the grid?
- How can we ensure a correct energy billing?



SmartSim – the simulation tool





typical supply situation in summer 2012 (June)



typical flow situation in summer 2012 (June)

Samstag, 02. Juni 2012





example exit point Dalby (Dal 1) – eastern grid



e.or

example exit point Gas. / Vip. - western grid



example exit point Maskinvägen (Ra 2) – western grid



example exit point Tulpanvägen (Mö 2) – western grid



typical supply situation in Winter 2012 (December)



typical flow situation in winter 2012 (December)

Tuesday, 11. December 2012





example exit point Dalby (Dal 1) - eastern grid



example exit point Gas. / Vip. - western grid



-11

example exit point Södra verket - western grid



2.0

example exit point Tulpanvägen (Mö 2) – western grid

Conclusions and outlook

- Input data and topology are prepared for use with SmartSim for 2012.
- The gas grid of Lund is successfully simulated for this period.
- A virtual biogas plant with 60 GWh per year is assumed injecting in the 10 bar grid section near Dalby.
- A Calorific value for each exit point is determined as monthly average.
- Gas quality tracking with SmartSim makes it possible to avoid cost intensive propane admixture of biogas in future.
- This also reduces the CO₂ fingerprint of the biogas plant and makes the gas "greener"
- In a next project phase simulation results should be verified by measurements . . .

