



Cases for the integration of green gases in the Danish gas grid

Citis Workshop

08-11-2017

Agenda

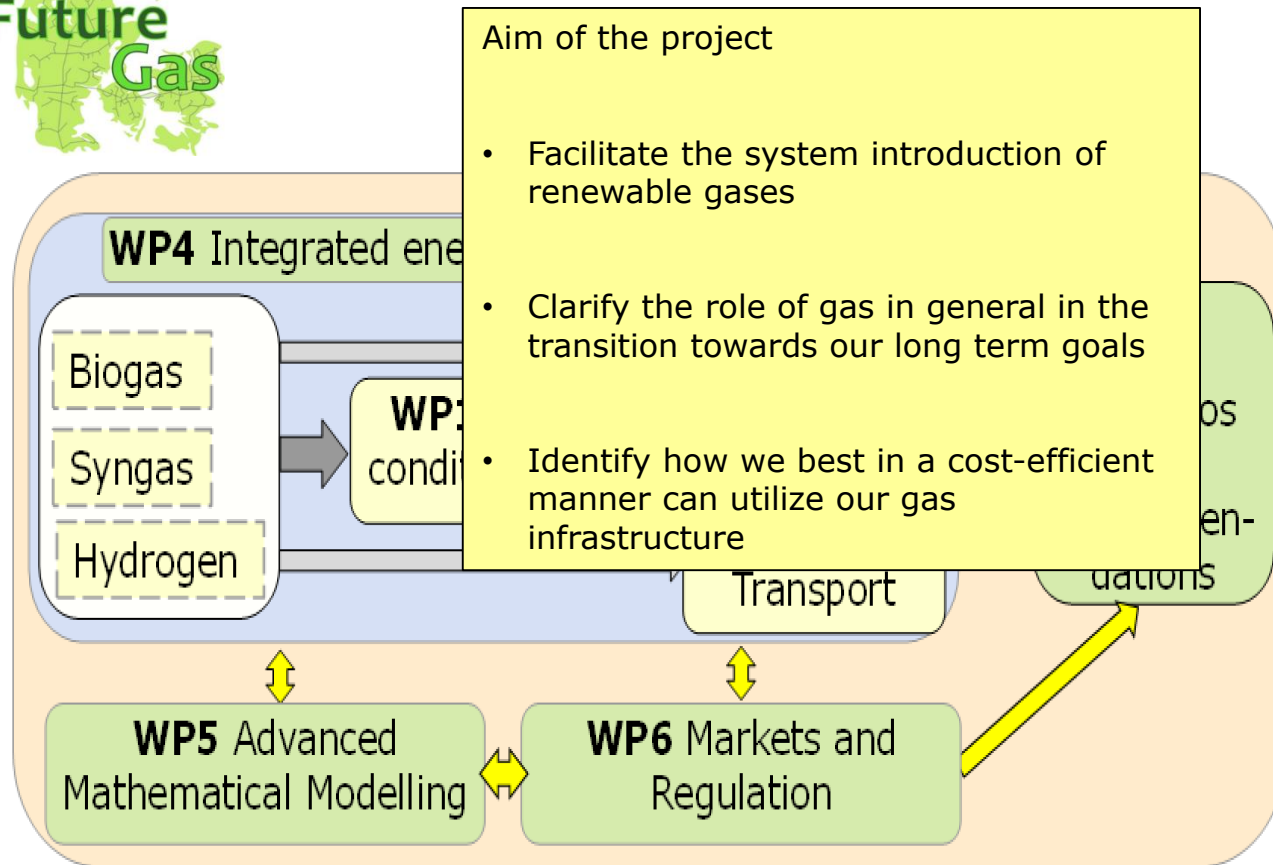
- FutureGas project
- WP6 and the innovation fond milestones
- Denmark's Renewable Energy Objective
- Technological cases for the integration of renewable gases into the danish energy system
- Survey and Discussion
- System case study: Oversupply of gas in the distribution grid
 - Background
 - Causes
 - Solutions
- Conclusion and Outlook



Integration of gas in the Energy System

- Power, District heating, Transport...

- **Cost-efficient integration of gasses based on renewable energy**
 - Biogas, SNG, hydrogen..
 - How are they best utilised – Upgraded/direct use
- **Gas in transport**
 - Experiences from Sweden
- **Modelling gas**
 - Balmorel, Sifre, advanced tools..
- **Regulation of gas**
 - Tariffs, taxes....



Deliverables and milestones

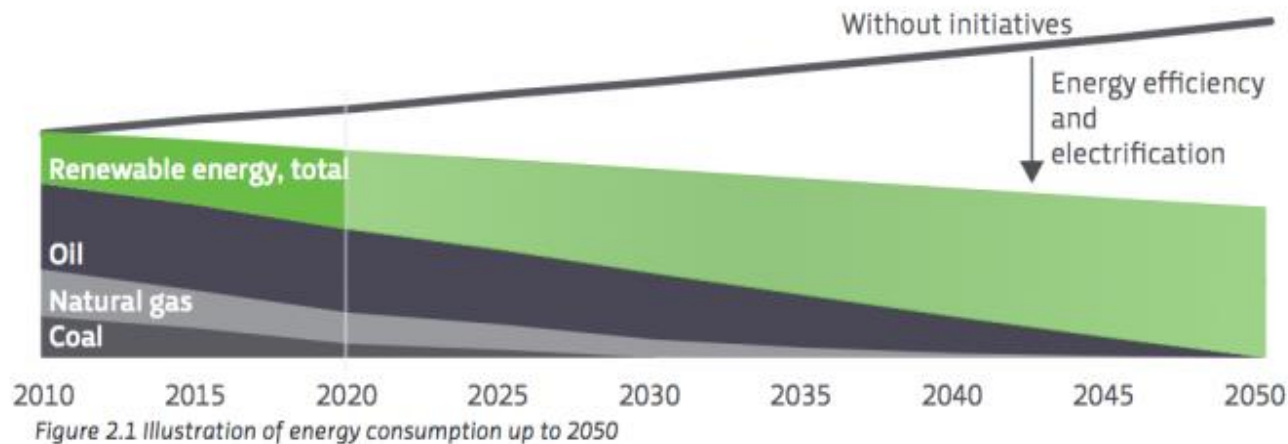
WP6 Markets and regulation		
6.1 Analyses of efficient tariff structures		
6.1.1 Overview over Danish and EU tariffs	Short report	M10
6.1.2 Identification of barriers for economic effectiveness	Short report	M14
6.1.3 Cases for improved tariff structures	Report	M17
6.2 Welfare economic analyses		
6.2.1 Overview over Danish and EU tax and subsidy schemes	Short report	M14
6.2.2 Identification of integrational barriers	Report	M18
6.2.3 Analyses of new tax and subsidy schemes based on welfare theory	Report/article	M26
6.3 Evaluation of market designs		
6.3.1 Review of existing market designs	Short report	M18
6.3.2 Options for market designs	Short report	M24
6.3.3 Cases for new market designs to integrate new types of gas	Report	M36
6.4 System consequences		
6.4.1 Identification of systems interactions (with 6.2.2)	Short report	M32
6.4.2 Modelling of regulation (together with and generating input to WP4)	Model (with WP4)	M36
6.4.3 Evaluation of systems consequences	Report	M40
6.5 Policy recommendations		
6.5.1 Applying model with regulation measures (with WP4)	Article	M40
6.5.2 Efficient policy measures	Report	M44

Milestones specifically to InnoFond

WP6 Markets and regulation – DTU-ME	
6.1 Analyses of new tax and subsidy schemes based on welfare theory (Task 6.2.3 - R/A M26)	At least 2-3 welfare-economic analyses of tax and subsidy schemes related to the gas system are finalised
6.2 Cases for new market designs to integrate new types of gas (Task 6.3.3 - R M36)	A minimum of 1-2 cases of new market designs are analysed and described
6.3 Modelling of regulation (together with and generating input to WP4) (Task 6.4.2 - M (with WP4) M36)	The existing modelling tool is developed to include economic regulation facilitating tests of different regulation scenarios.

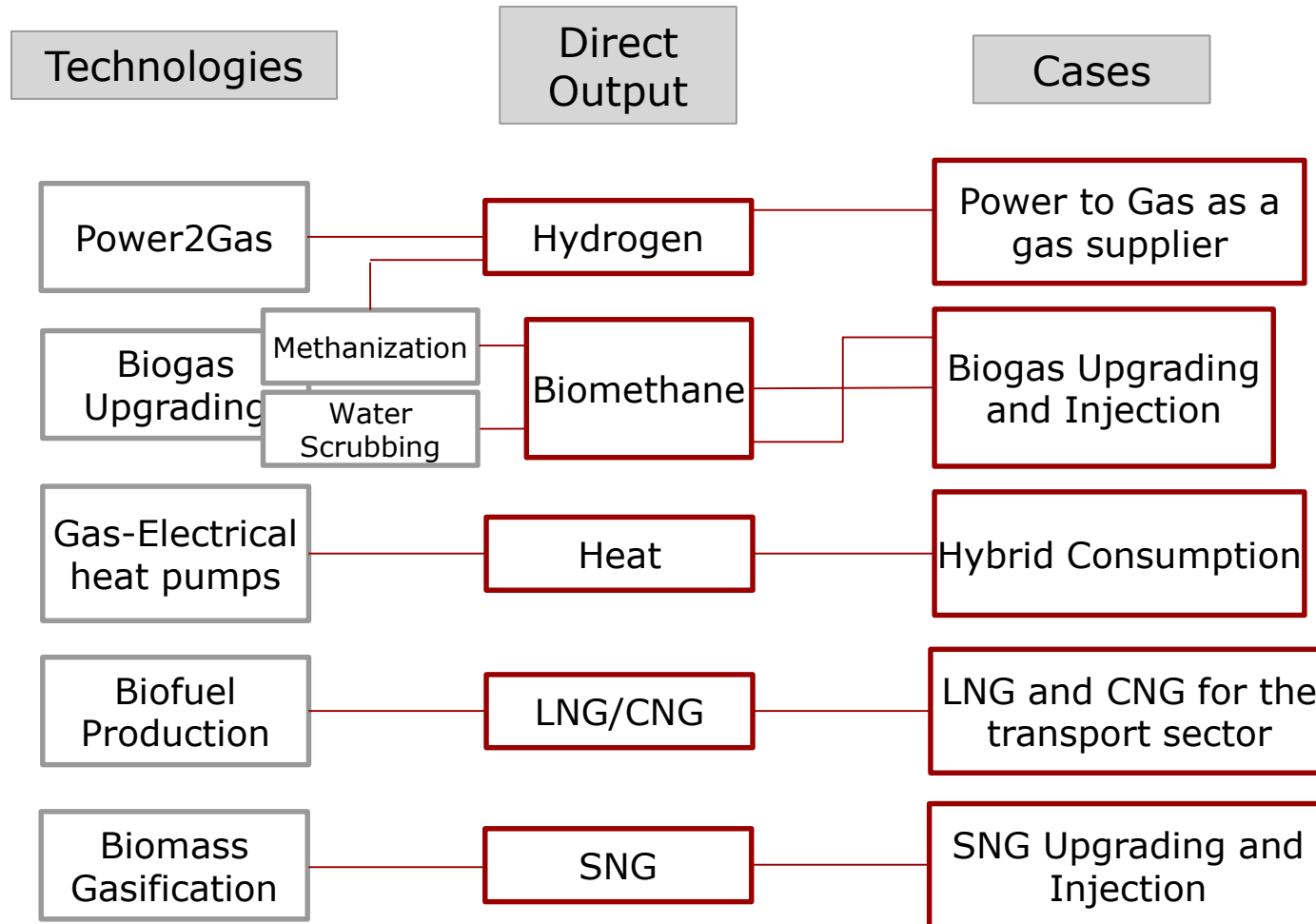
Main Objective: Fossil free until 2050

- Sustainable biomass, biogas and some waste-based energy from decentralised power plants to serve as back-up when wind power availability is low
- Intelligent electricity storage systems including electric car batteries, heat pumps and demand side management measures
- Electricity transmission between neighbouring countries.



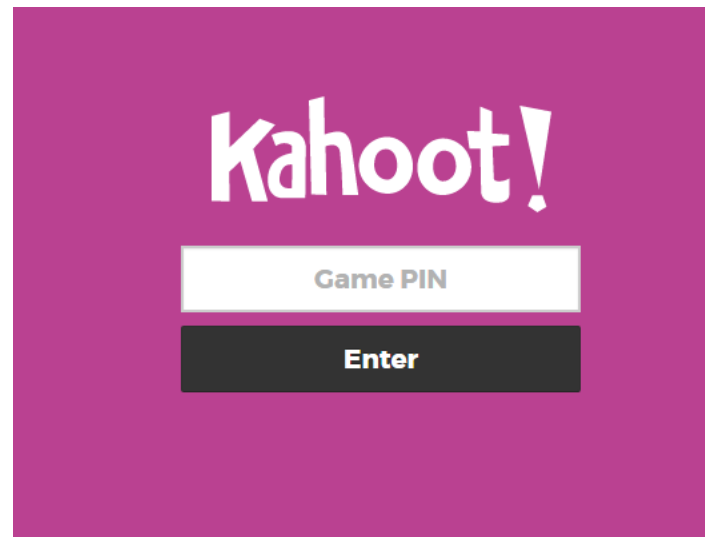
Source: Greenpeace.org

Case studies- Technology related



Survey and Discussion:

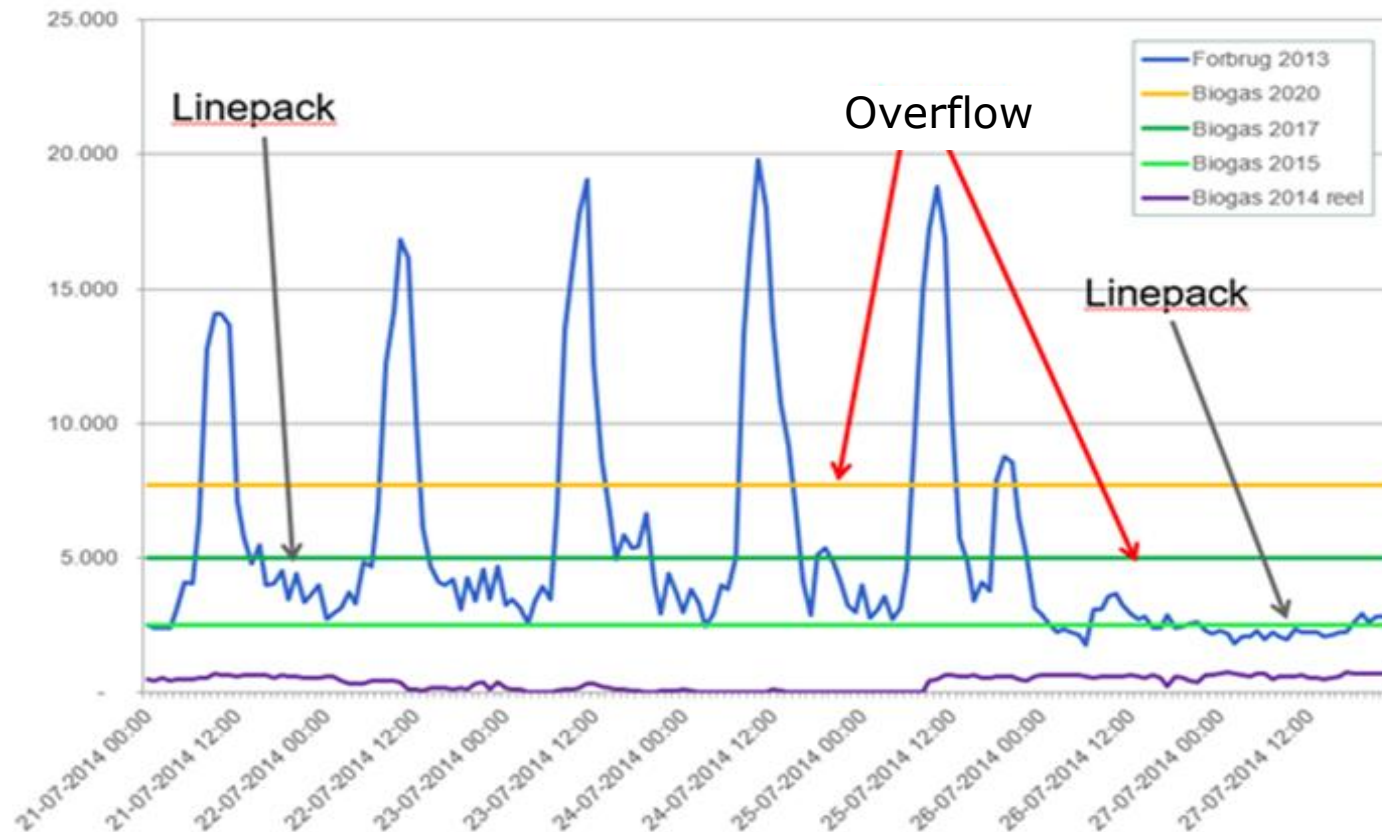
www.kahoot.it





System Case study: Oversupply in the gas distribution grid

Temporary local excess supply of renewable gas Background



Situation of overflow occurred in the distribution grid, during the summer holiday season as a result of local imbalances between the production of biomethane and natural gas sales

Causes

- Increasing gas supply, due to the injection of upgraded biogas

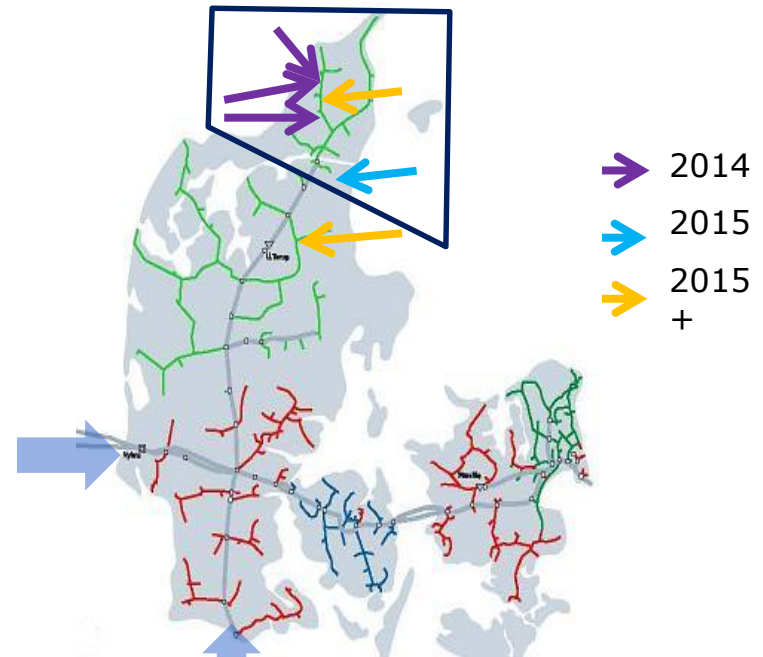
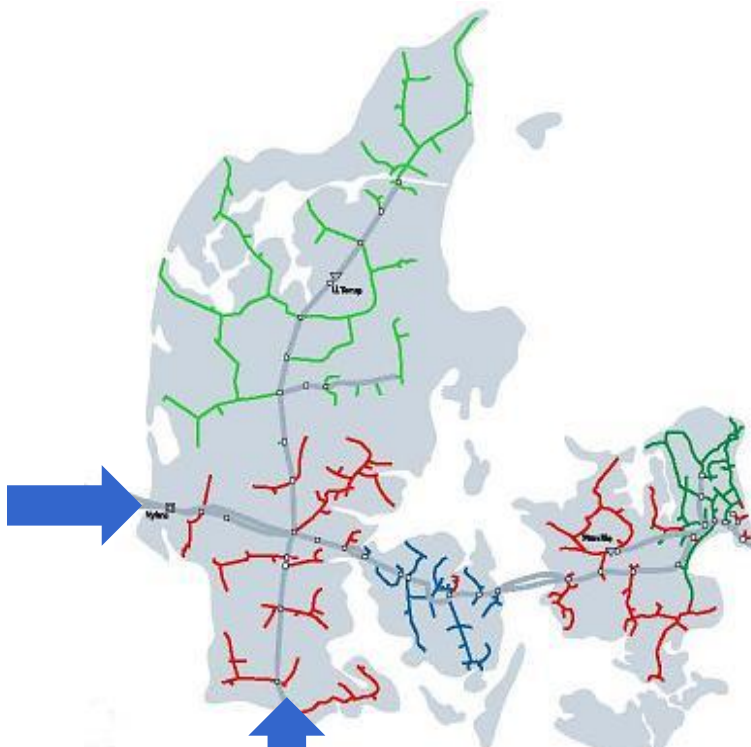


- Biomethane potential equivalent to about **40%** of the gas offtake in central and norther Jutland
- **75%** of this potential is expected to be distributed through the natural gas grid

Causes

➤ 2013: Only down-stream flow

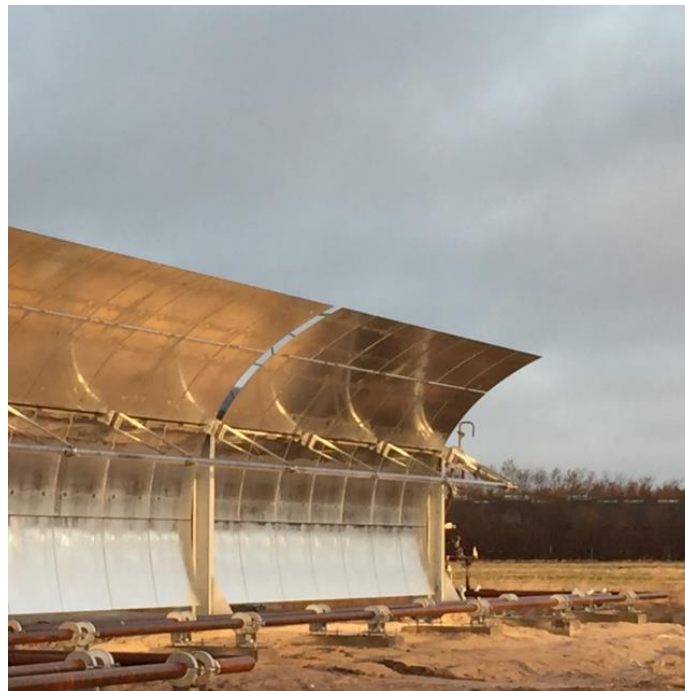
➤ Further development



In the long term there will be more transition points (100+) where the biomethane enters and must be run up-stream

Causes

- Decreasing local demand, due to the replacement of gas for district heating by other resources



Solution

➤ **Pressure adjustment in the transmission grid: short-term solution**

The pressure in the transmission grid is reduced, so that excess gas in the distribution grid can flow into the transmission grid

➤ **Auction and compensation payment: short-term**

Auctions for increasing demand and reducing biomethane production during periods of oversupply

Solution

➤ **Building a compressor: long-term**

The excess gas in the distribution grid will be compressed in order to be able to enter the transmission grid

➤ **New flexible demand sources- CNG and LNG: long-term**

LNG and CNG are storable to a certain extend and can add an opportunity to connect the gas grid to the transport sector. Two LNG ports are already planned in Hirthals and Frederikshavn

Thank you for your attention!



<http://www.matrixsales.dk/index.php?pageID=1484&subjectID=33598>