

# Future Role of Gas from a Regulatory Perspective

**Konstantin Petrov, Waisum Cheng, Cristiano Francese, Martin Paletar  
Brussels, Presentation at CEER Event**

24 April 2018

# Agenda

---

- Introduction
- Gas Demand
- Commodity Markets
  - Electricity generation
  - Transportation
  - Renewable gases
- Infrastructure
  - Conventional natural gas infrastructure
  - Natural gas infrastructure in the transportation business
  - Infrastructure for new gases
- Conclusions

# Introduction

# Introduction

## Background and project objectives

- In the last years, the natural gas industry has been undergoing a period of uncertainty regarding its future role in the energy mix.
- Despite its friendly environmental properties compared with other fossil fuels, its performance has been negatively influenced.
- These have been caused by the low prices of coal and oil, low carbon prices resulting from ETS, and large increase in RES generation mainly driven by various policy support schemes.
- Considering these developments, DNV GL has been commissioned by CEER to prepare a study aiming to assessing the potential future role of gas, and the consequent regulatory implications and measures that may be required.

# Introduction

The work has been divided into three parts: development of future gas demand, gas commodity markets and infrastructure.

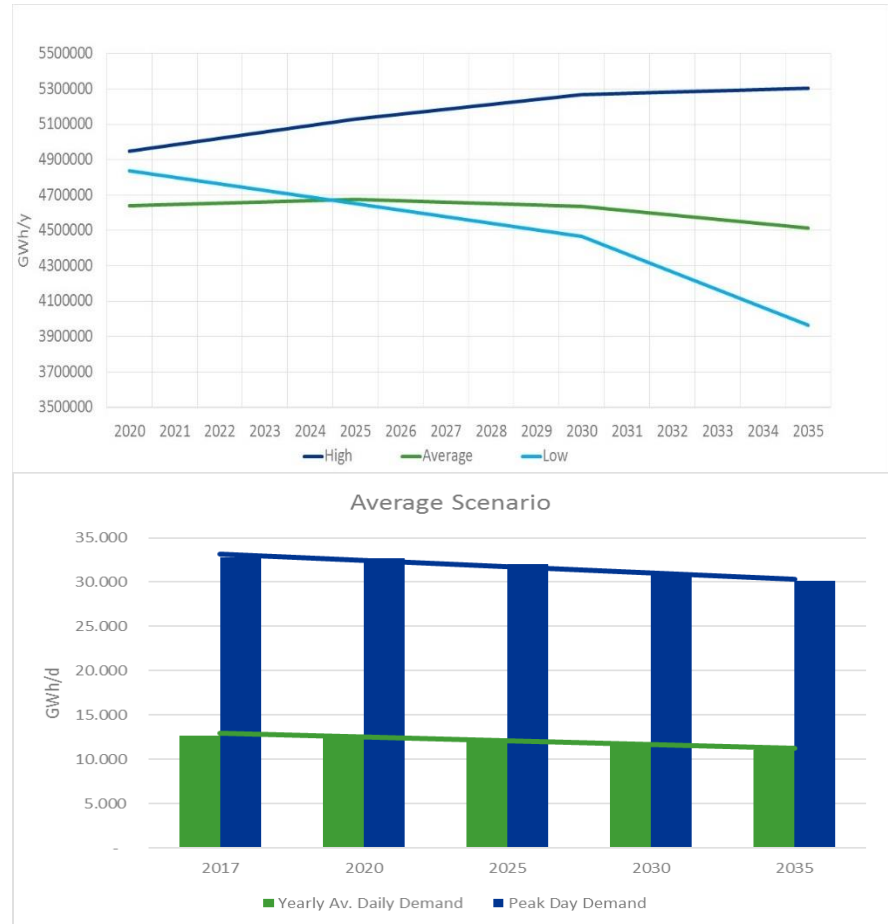
- Firstly, gas demand scenarios (high, average and low) were established. These scenarios define the range of possible evolutions of natural gas demand from a 2040 perspective for the EU-28.
- Subsequently, we looked at the competitive position of gas in several sectors and the need of regulatory measures including gas commodity markets, focusing on the traditional use of natural gas (for example for electricity generation and heat); use of other gas forms (LNG /CNG) in the transportation sector and renewable gases that can substitute natural gas such as biomethane and hydrogen.
- Lastly, we explored the regulatory measures needed in the infrastructure area. We started with the traditional natural gas infrastructure, particularly in the context of the low gas demand scenario. Consequently, we addressed the infrastructure for new uses of natural gas such as the use of CNG/LNG in the transportation. Finally, we turned to the regulatory measures needed for infrastructure for renewable gases and incentives for innovation and decarbonisation.

# Demand Scenarios

# Demand Scenarios

The uncertain future gas development in EU has been considered through multiple gas demand scenarios

- To account for future uncertainties, Existing publicly available natural gas demand scenarios have been selected (ENTSOG TYNDP 2017, World Energy Outlook 2016, EU Reference Scenario).
- Scenarios define the range of possible evolutions of natural gas demand in a 2040 perspective for the EU-28.
- The scenarios imply certain assumptions in terms of achieving EU environmental targets and key sectors driving change in gas demand.



# Demand Scenarios

## Major Characteristics

Sector	High	Average	Low
<b>Power Generation</b>	The use of gas for electricity generation increases, gas-fired plants used for based-load generation and as a main source of back-up for RES	The use of gas for electricity generation decreases, overall decrease of conventional generation (gas and coal), gas-fired plants used as a main source of back-up for RES	The use of gas for electricity generation decreases, electricity generation mainly from RES, gas-fired plants used as a main source of back-up for RES
<b>Heating</b>	Stable demand due to a lack of significant improvements in energy efficiency and keeping the status quo of the heat supply	Decrease of demand due to increase in energy efficiency, penetration of new technologies (e.g. heat pumps, biomass) and better access to district heating	Significant decrease of demand due to radical efficiency improvements, penetration of new technologies (e.g. heat pumps) and better access to district heating
<b>Transportation</b>	The use of natural gas (CNG and LNG) increases in the land transportation sector and natural gas becomes the primary fuel in the maritime transportation	The use of natural gas increases in the heavy-duty vehicles sector of land transportation and natural gas becomes the primary fuel in maritime transportation	The use of natural gas increases slightly in both land and maritime transportation
<b>Industrial</b>	Industrial gas demand remains stable mainly due to keeping demand for industrial goods and no substitutes of natural gas for industrial use	Industrial gas demand slightly declines due to substitution of natural gas for industrial use	Industrial gas demand declines due to partial substitution of natural gas for industrial use



# Commodity Markets

## Commodity Markets / Overview

Commodity markets are in most cases competitive markets and there is no scope for a direct regulation. Regulation should continue to focus on the further enhancement of competition and removal of market distortions.

- We studied selected segments of gas commodity markets:
  - the traditional use of natural gas (electricity generation and heat)
  - use of other gas forms (LNG /CNG) in the transportation sector, and
  - the role of renewable gases
- We looked at the competitive position of gas in these segments and highlighted the need to amend or further develop the existing regulation.
- As commodity markets are in most cases competitive markets the role of regulation is mainly related to the further enhancement of competition including inter alia improvement of market design and tariff setting/ access arrangements of relevant related infrastructures.

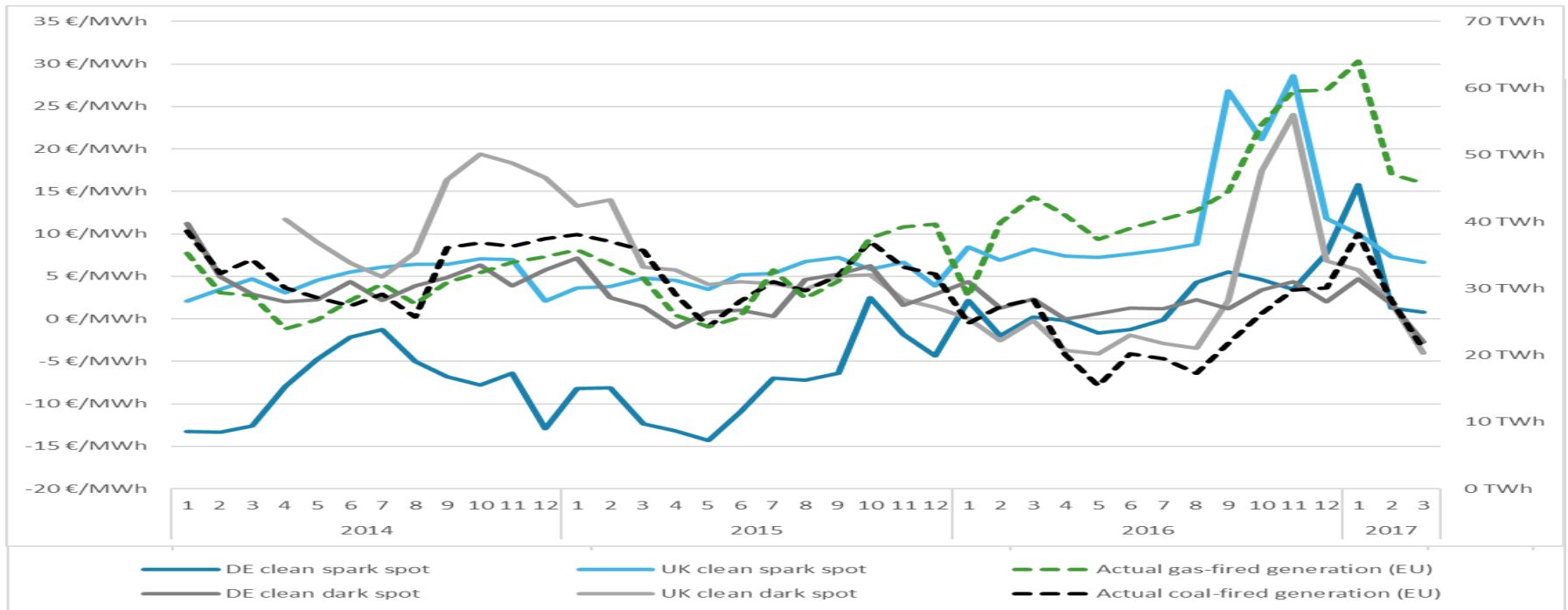
# Commodity Markets / Electricity Generation

In the last few years, natural gas has under-performed when compared to RES and coal.

- Natural gas is used for electricity production, mainly in open and combined cycle turbines. Due to their technical flexibility they can quickly be started and stopped, and can be used both as base-load and peak-load plants.
- Gas plants under-performance was largely driven by:
  - Large promotion of RES in the EU (feed-in tariffs, feed-in premiums, tax credits and grants, auction/tender systems)
  - Shrinking production costs of RES due to the scaling-up of global production volumes and technological advances have also played an important role
  - Price competitiveness of coal supply together with low carbon prices resulting from the European emission trading scheme (ETS)
    - The competitive coal supply was largely driven by coal imports from the USA due to coal displacement with shale gas.
    - The low carbon prices were mainly due to the surplus of trade allowances allocated to companies who were the largest emitters of CO<sub>2</sub> and therefore did not need to buy additional certificates.

# Commodity Markets / Electricity Generation

Recently the performance of gas power plants has started to improve which indicates a possible change. This can be largely attributed to falling gas prices and favourable electricity prices driven inter-alia by the closure of coal-fired power plants.



- The challenges in the performance of gas-fired power plants in the last years have been reflected in the development of clean versus dark spark spreads.

# Commodity Markets / Electricity Generation

The existence of effective wholesale gas markets is relevant not only for use of gas for electricity production but also for all markets for goods using gas input. The existing market design and tariff setting/ access arrangements can be further improved.

- ACER revisited the gas target model (GTM) and developed a “Bridge to 2025” aiming to improve wholesale market functioning; Quo Vadis project launched by EC and aiming to assess the current market design / suggest improvements.
- Wholesale market design
  - The GTM advocates larger markets and trading areas to pool liquidity and promote competition in upstream supply.
  - Regulators may think of a series of regulatory initiatives to further develop the necessary tools for market integration across Europe.
    - A mechanism can be defined to support efficient mergers of trading hubs or markets managed by different TSOs, options including re-examination of the governance of decisions on zonal mergers, regular reviews of the gas target model
- Improve coordination of power and gas sectors
  - An improvement of the coordination of gas and power network operators is required in terms of operational decisions, time alignment also coordinated planning of new infrastructure

# Commodity Markets / Electricity Generation

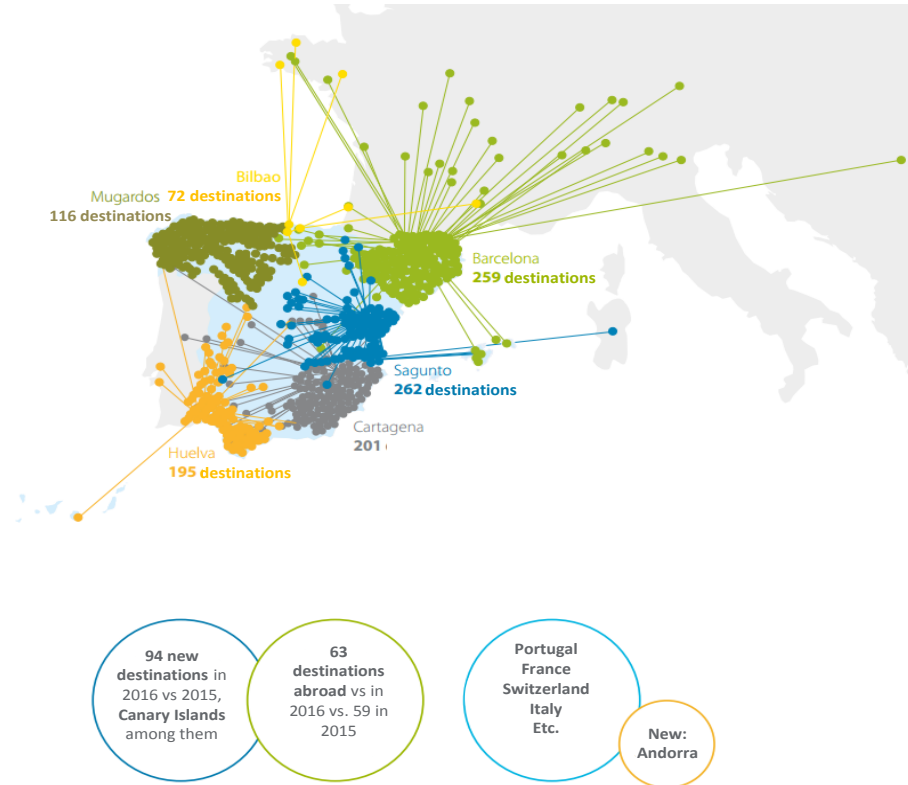
Regulators should consider revisiting elements of the tariff design of the gas transmission networks.

- Gas transportation tariffs
  - The transmission tariff design is set out in the Network Code Tariffs (TAR NC) which was adopted in March 2017 and now is being implemented. The code deals with tariff design at interconnection points, and not at domestic network points.
  - The current design of network tariffs can discourage the efficient use of gas-fired power plants in some cases by creating excessive costs for such plants in accessing the gas network and gas supplies.
  - Regulators should consider revisiting elements of the tariff design, e.g. adequate short-term capacity charges that will not discourage users to book this capacity.
  - In a broader context, the declining demand and excess transportation capacity may necessitate a basic rethinking of the network tariff design.
    - Role of auctions for capacity allocation
    - The role of reserve prices and their structure/ level
    - Cost allocation and cost recovery schemes

# Commodity Markets / Transportation

The extensive deployment of LNG and CNG technologies in the road and maritime transportation plays a substantial role in the future gas demand.

- In the last few years, gas has become increasingly important in the transportation sector, in both LNG and CNG forms.
- CNG is used in several applications including cars, buses, vans, trucks with an increasing number of vehicles being available on the market from multiple suppliers
- LNG is used in land (heavy duty vehicles ) and maritime transportation (fuel for ships)
- Several initiatives have been taken both at the European and national level to foster the use of gas in transportation.

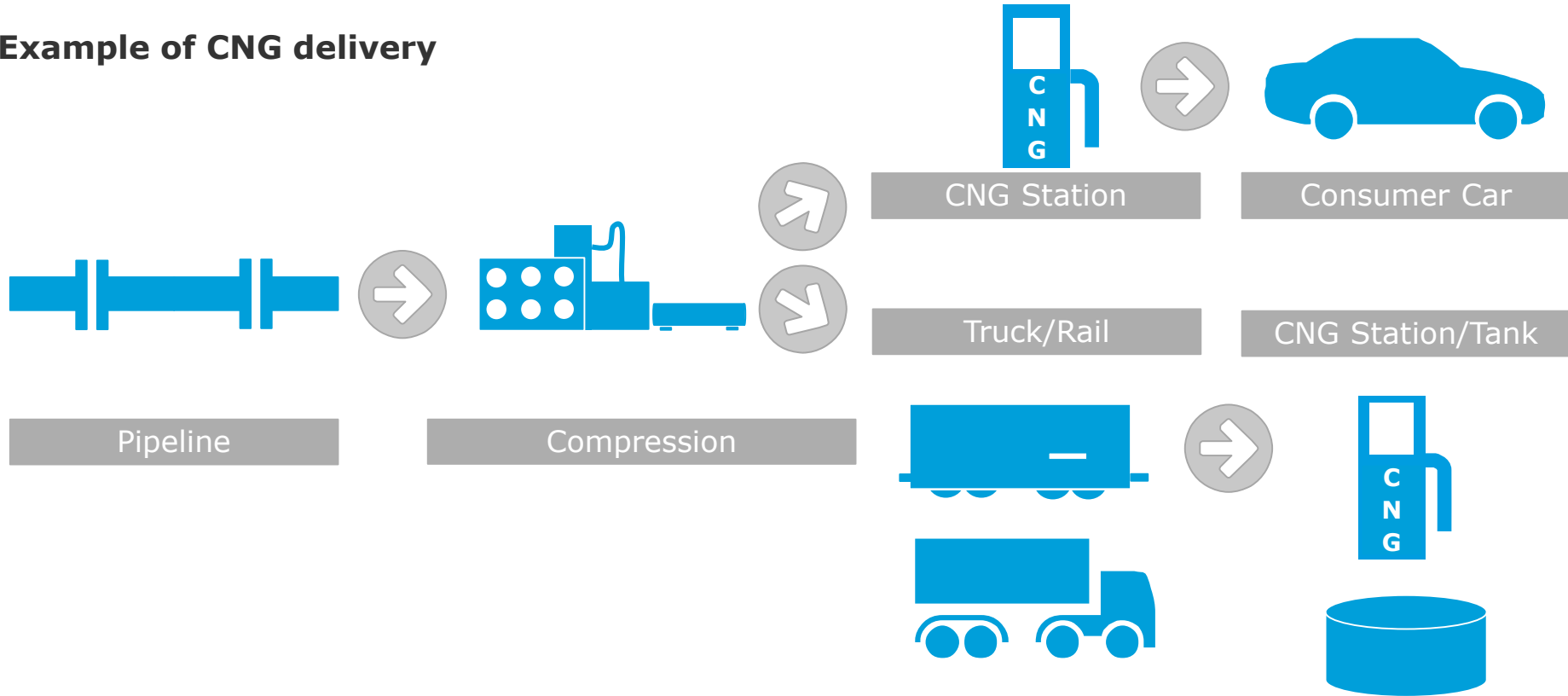


Example from Spain: The truck loading market of LNG in Spain represented 11,232 GWh/y in 2016, around 3,5% of the conventional annual demand in Spain.

# Commodity Markets / Transportation

There are multiple options to deliver CNG / LNG to users. Often the transport is based on virtual pipelines, i.e. transport by rail or track.

## Example of CNG delivery





## Use of CNG and LNG in Transportation

Natural gas can generally be considered as a competitive fuel both in land and maritime transportation.

### Cost competitiveness

Gas-fuelled vehicles exhibit competitive advantages in terms of operating cost. This counterbalances the higher capital investments (however decreasing over time) to purchase them compared to regular gasoline and diesel vehicles.

### Fuel availability

The availability of infrastructure for fuelling purposes (CNG/ LNG stations and bunkering facilities) is still fragmented / limited. Additional investments required to increase the use of natural gas in transportation.

### Emission reduction potential

In terms of environmental impact, natural gas vehicles generally have lower emissions compared to other types of vehicles, and are typically well positioned to support the achievement of environmental targets in the transportation sector.

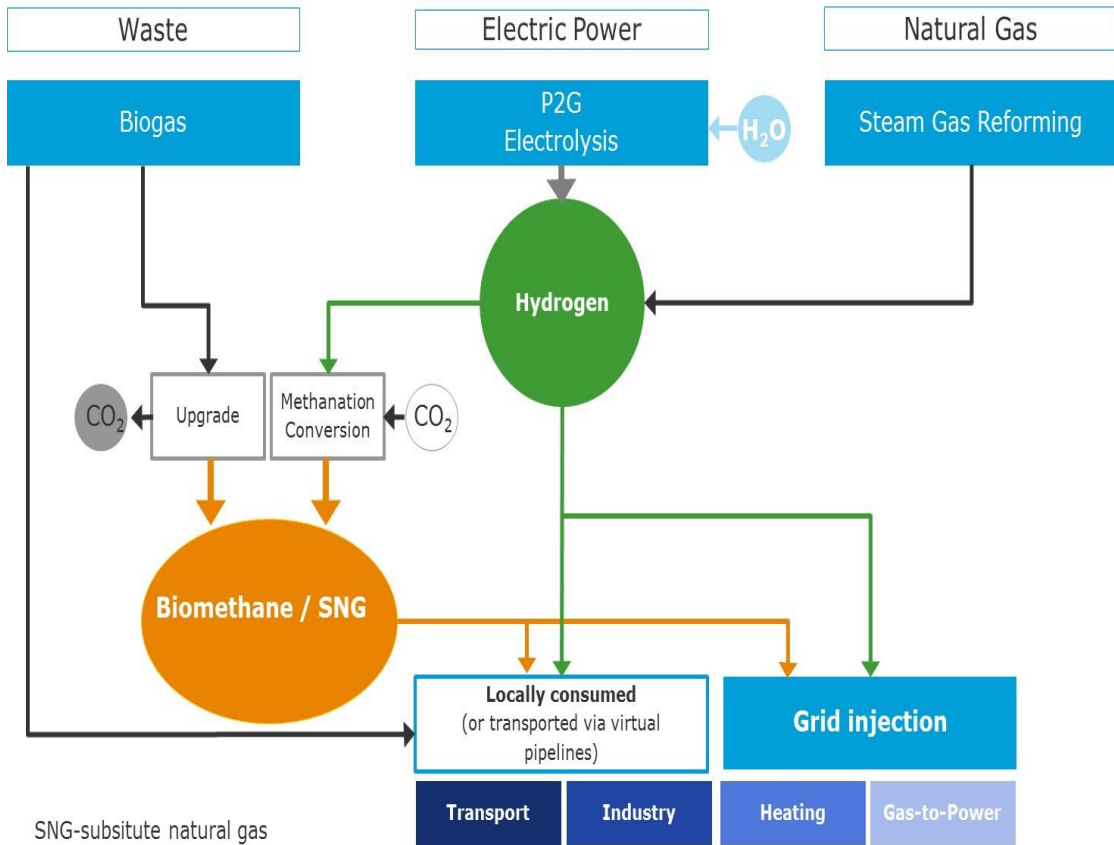
# Use of CNG and LNG in Transportation

The transportation business can be considered as contestable, however explicit incentives can be considered on policy level to support the use of natural gas.

- The transportation business can be considered as contestable due to the presence of multiple means of transportation, fuels and different suppliers and buyers both of fuels and vehicles.
- The competition of natural gas against other fuels is strongly affected by environmental regulation. Moreover, it is an important factor that steers vehicle manufacturers in determining the type of vehicles that they will offer to the market.
- On the policy level, there are multiple measures that can be considered to support the use of natural gas. Examples for incentives on policy level may include:
  - Tax breaks for the purchasing of vehicles
  - Incentives (direct subsidies or indirect ones) for the purchase of vehicles
  - Grants for the development of fuelling infrastructure (CNG and LNG)
- Licensing requirements for the supply of natural gas (and in broader context also LNG and CNG) differ across member states. A harmonization of licensing requirements across Europe for natural gas supply may be beneficial to remove uncertainties, establish a level playing field for competing fuels and facilitate cross-border activities.

# Commodity Markets / Renewable Gases

Because of their low CO<sub>2</sub> content, the role of renewable gases as well as their processes have been increasingly emerging as technologies with a high potential for decarbonisation.



Renewable gases are gases produced from renewable sources.

They are able to substitute natural gas and include biogas upgraded to biomethane and synthetic natural gas (SNG) produced in methanation process.

Currently blending of small hydrogen proportions exists, blending of larger quantities still under development.

Production costs are still high and development of renewable gases depends on policy and regulatory support.

## Commodity Markets / Renewable Gases

Production of new gases is potentially contestable, however regulatory and policy interventions to address positive externalities are often used in practice.

- Production of hydrogen and biogas production are potentially contestable activities and there is no normative need for regulation if functional markets exist.
- However, policy interventions to address positive externalities related to renewables gases are common and often used in practice. They aim to support commercial viability and to encourage supply of such gases as environmental benefits resulting from their use are not adequately reflected in the respective output prices.
- The policy interventions can be implemented through methods ranging from feed-in tariffs, to tax breaks and investment support etc.
- Green certificates can be used to support the establishment of regional markets for biomethane.
- Regulators in some jurisdictions (for example UK, Ireland, France) have provided funds to support the research and development of these new technologies.
- This has included pilot projects for possible injection of biogas and hydrogen into the gas network and exploring gas quality specification of biogas, hydrogen blend for example.

# Infrastructure

## Infrastructure / Overview

---

Depending of its characteristics infrastructure can exhibit natural monopoly or contestability features.

- We look at three major infrastructure types:
  - the traditional natural gas infrastructure
  - the infrastructure for new uses of natural gas such as the use of CNG/LNG in the transportation
  - infrastructure for renewable gases

## Natural Gas Infrastructure / Stranding

A continuous decline of gas demand could potentially lead to under-utilisation (and stranding) of network assets and require specific regulatory reaction.

- As other energy infrastructure industries natural gas networks are also characterised by high initial and irreversible investments, and has a relatively long asset life.
- In the EU natural gas infrastructure is regulated, however member states may opt for negotiated or regulated access regime for storage facilities.
- The development of future demand affects the traditional natural gas infrastructure.
- While a stable and high gas demand requires to maintain and extend the networks, a continuous decline of gas demand could potentially lead to under-utilisation and stranding of network assets.
- Regulators could apply different approaches to address stranded assets such as depreciation policy (accelerated depreciation), asset valuation, adjustment of cost of capital and explicit compensation outside of network tariffs.
- Decommissioning of gas infrastructure requires planning and coordination considering any legal, regulatory and especially technical and safety requirements.

# CNG/LNG Infrastructure in Transportation

The increased use of CNG/LNG in transportation determines the important role of the infrastructure for these emerging markets.

- CNG and LNG infrastructure makes CNG and LNG available for use as a fuel in transportation
- Infrastructure comprises:
  - Physical pipeline and non-pipeline transport (virtual pipelines) / connection to the gas networks
  - CNG and LNG refuelling stations including compression equipment to convert natural gas in CNG or LNG
- Contestability
  - Specific parts of the value chain like physical networks to transport gas to the CNG refuelling stations constitute a natural monopoly and should be regulated
  - Other activities like gas storage, which may not be natural monopolies, can become de-facto monopolies due to physical or operational limitations
  - Transportation via virtual pipelines (LNG/CNG) or provision of refuelling station services are contestable activities and can be provided in a competitive environment
  - Monitoring specific segments to prevent from distortion of competition /abusive use of market power (for example LNG and CNG refuelling stations)



# CNG/LNG Infrastructure in Transportation

The changing business environment and new business models require adequate regulatory reactions.

- Network operators may opt to diversify their business models towards contestable activities (P2G, CNG/LNG)
  - Complementary to the traditional transmission / distribution (diversification and scope effects)
  - Contribute to the commodity demand which in turn may encourage network demand (scale effects)
- Such involvements can provide various benefits in terms of infrastructure development, network security and increase competition
- Role of regulators
  - Should ensure that customers and market participants benefit to the largest extent possible from the range of services
  - Should prevent (unintended) interactions between the regulated and contestable sectors
  - Can use different approaches
    - Allow involvement of network operators only if there is no market interest from other parties to engage in these activities, or
    - Attribute a proactive role to gas network operators and recognise explicitly the specific circumstances and benefits of their involvement in contestable activities

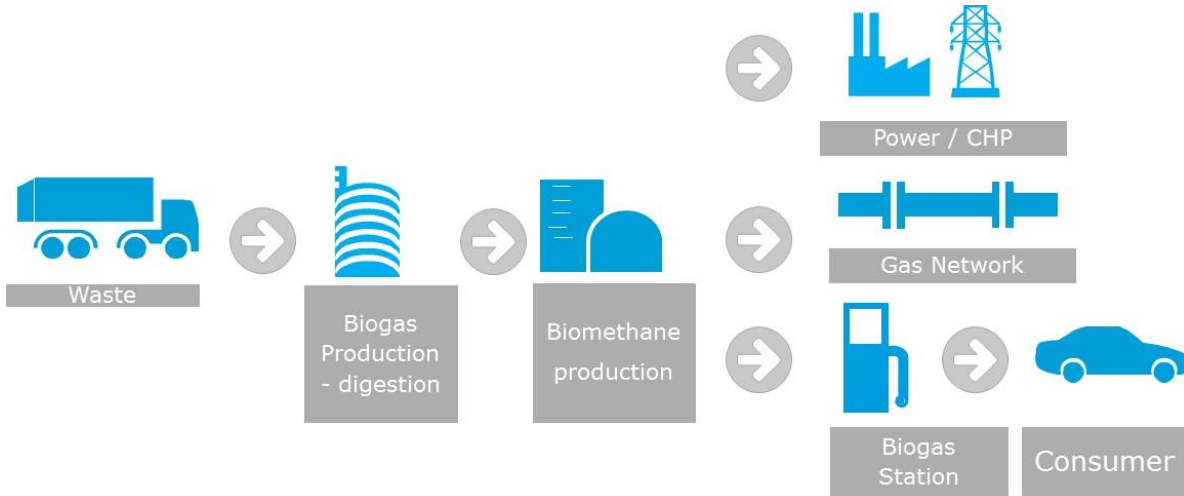
# Infrastructure for Renewable Gases

## Hydrogen

- Hydrogen can be transported via trucks/rail cars or pipelines. The transport by trucks or rail cars is relatively new across European markets, mostly involving a large industry partner participating in pilot projects.
- While small hydrogen pipeline networks already existing (e.g. Germany, the Netherlands), the technical feasibility of hydrogen transport through natural gas networks is still under research.
- The transport of hydrogen via pipelines of natural gas network should be a regulated activity. It is likely that new hydrogen pipelines will have similar economic characteristics to the existing natural gas networks and therefore should be regulated.
- Regulators should:
  - Accompany and steer the transition towards higher hydrogen quantities blended in the gas networks (adjust the technical specifications for the blended natural gas and regularly amend the relevant regulation)
  - Steer the technology roll-out in terms of time and targeted penetration zones where the hydrogen quantities will gradually grow
  - Develop the design of the commercial and access arrangements of such a system

# Infrastructure for Renewable Gases

## Biogas / Biomethane



- Biogas can effectively be a substitute for natural gas once it is further refined and converted to biomethane.
- The transport of biomethane via pipelines of natural gas network should be a regulated activity.
- In the transportation process, the network operator must follow gas quality standards and only allow biomethane that satisfies these standards into their network.

- Energy regulators should set clear connection rules including connection charges, technical connection requirements, responsibilities for setting and maintaining the relevant product quality norms, metering and compression.
- They may consider providing explicit incentives in national regulation to the parties injecting biomethane into the natural gas networks via favourable network tariffs and connection charges.

# Regulatory Incentives for Innovation and Decarbonisation

Regulation can apply specific arrangements to promote and encourage decarbonisation investments.

- Investment in innovation and decarbonisation is happening in Europe, irrespective whether the funding is part of the regulatory framework and/or on a national policy level.
- However, regulators can provide explicit incentives for innovation and decarbonisation as part of the regulatory framework. This would facilitate development and drive improvement in processes and technology application in the gas sector.
- In practical terms national regulators should set clear objectives and qualification criteria for what projects would be subject to innovation incentives.
- For example the innovation project should relate to the development, and research in a field, or technology that could help achieve certain targets such as decarbonisation by the possibility of using biogas, CNG/LNG or hydrogen.
- Innovation and decarbonisation incentives can be incorporated into the regulatory framework by explicit adjustment of the allowed revenues
- There are multiple practical experiences from European regulators (UK, France, Ireland) in this direction

# Conclusions

The overall objective should be to manage the transition to a widely decarbonized energy sector in the most effective and cost-efficient way.

- Natural gas is witnessing some significant challenges regardless of its environmental advantages over other fossil fuels. Despite the existing challenges, the natural gas sector can still play a substantial role in meeting EU future energy demand.
- In the commodity markets this can be achieved by using natural gas in its current form, other forms like LNG and CNG and penetration of substitutes such as renewable gases.
- The development on the commodity markets will require adequate consideration of the associated infrastructure.
  - The existing gas infrastructure may not only be dedicated to the commodity gas in its current form but may also be facilitating the penetration of other technologies, and particularly of renewable gases.
  - The increasing use of CNG/ LNG in transportation determines the important role of the infrastructure for these emerging markets.
- The complex transition process involves substantial changes along the entire value chain and requires adequate policy and regulatory attention, and effective coordination between policy makers, regulators and industry as well.

# Thank you!

**Dr. Konstantin Petrov**

Managing Consultant

[Konstantin.Petrov@dnvgl.com](mailto:Konstantin.Petrov@dnvgl.com)

Telefon: 0049 228 44 690 58

Mobil: 0049 173 5151946

**[www.dnvgl.com](http://www.dnvgl.com)**

**SAFER, SMARTER, GREENER**

**KEMA Consulting GmbH**

Zanderstr. 7

53177 Bonn

Germany