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# Scenario Study with Primes

[redacted] *GasTerra*

[redacted] *Eurogas*

DG ENER Meeting

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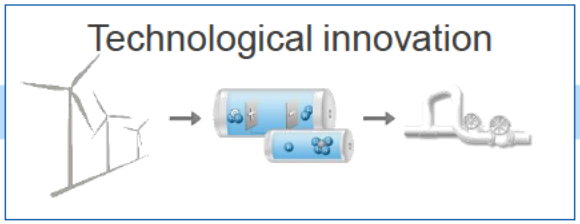
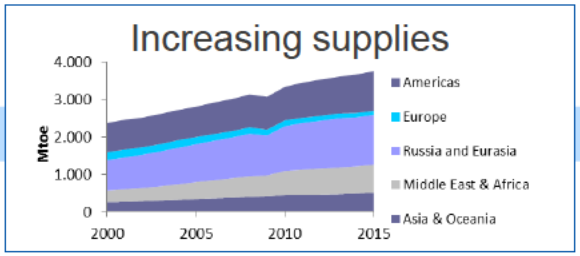
# 1. Why a forecasting study?

- We aim to show the contribution that gas can make to meeting Europe's climate targets.
- In order to have an insightful debate on the future, we use the same set of assumptions and macro-views as the European Commission.
- We have thus used the PRIMES model, including its recent updates as currently used for the upcoming Reference Scenario and impact assessments.

# 2. What does the last half decade mean for the future?




**All scenarios and sensitivities assume the achievement of the EU's 2030 + 2050 targets, as well as the global "2 degrees" objective.**

## 1. Scenario: Conventional Wisdom

- Economy to pick up, overall lower than previous outlooks.
- Renewable energy, especially wind power, to increase.
- Nuclear power is limited by upcoming closures, but stable in the long-term.
- CCS to be developed at a slower pace than previously expected
- Increasing use of gas for shipping and truck transport.

## 1.1 Sensitivity: Electrification

- The aim is to assess consequences of an increasing push towards electrification.
- Electrification is increased in all sectors.

## 2. Scenario: Innovative Gas

- Aim: to assess new technological developments of recent years.
- Same macro-economic outlook as 'Conventional Wisdom'
- Exploring the potential of power-to-gas, used in full gas system.
- Reflecting current societal concerns: Less new nuclear sites to be available, and less CCS site to be available.

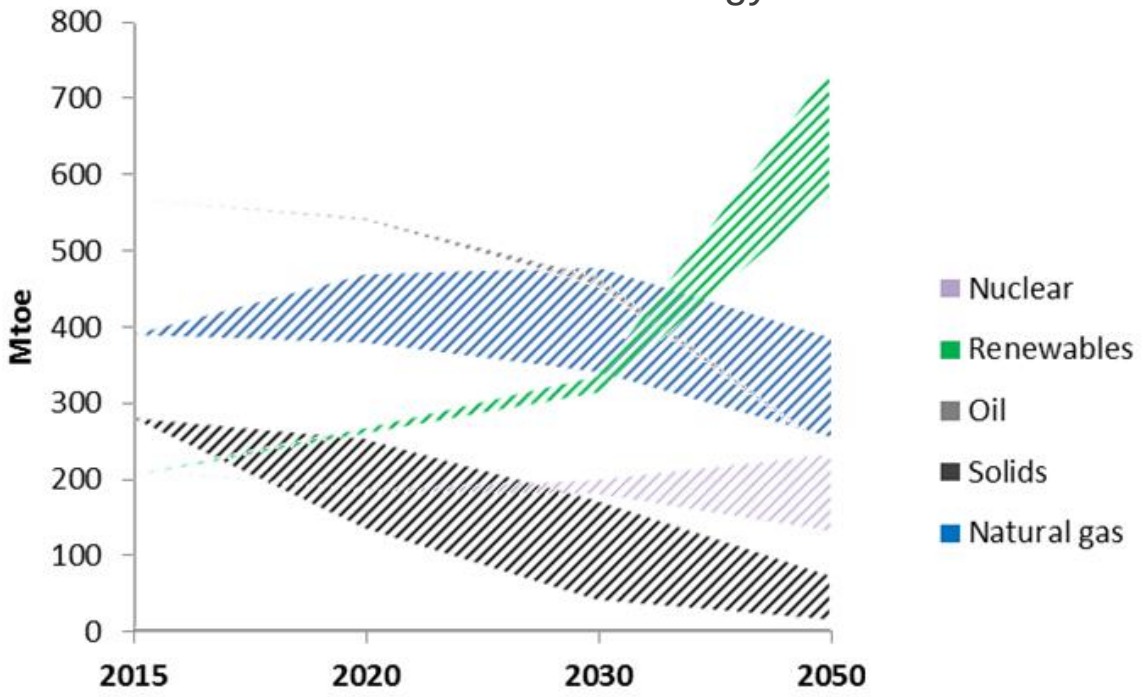
## 2.1 Sensitivity: Fuel Switch

- Aim: to assess consequences of a fuel switch in the power sector, based on the Innovative with gas scenario, as it is found that this does not occur with current model settings.

# Range of outcomes show largest uncertainty for gas

## Risking of not using gas its contribution to emissions reduction, particularly in the short and medium term

Range of scenario outcomes (minimum to maximum values) for all sources of energy



# 2. The PRIMES model – methodology

- The PRIMES model is a model that explores ‘what-if’ questions. It is a modelling system that simulates a market equilibrium solution for each form of energy supply and demand.

- The market equilibrium is achieved for each 5-year interval and is dynamic over time. Market equilibrium solution means a scenario where demand and supply are equalised, taking into account consumer choice. Prices produced from this cocktail are linked by feedback loops with behaviour.

- Variability is modelled by 120 typical days of high/low wind and/or sunlight, affecting the operation of the power plants in the model for which fast ramp rates for flexible operation are included. Curtailment of renewable energy production is captured in the updated model.

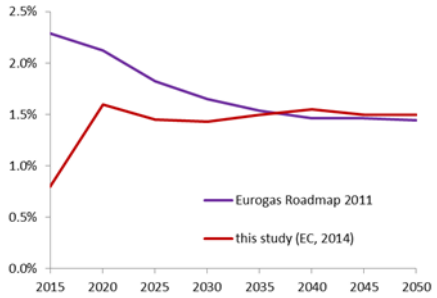
# 2. The PRIMES model – input and key assumptions

**Assumptions and input parameters arguable and key to understanding the results**

## Lower economic growth…

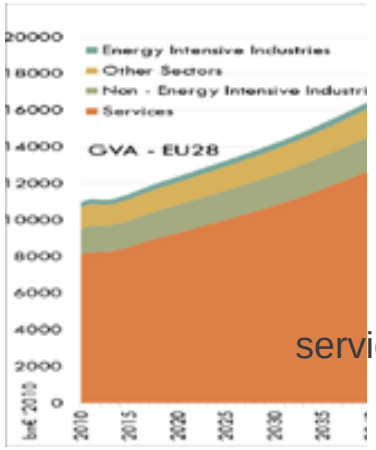
- Much lower economic growth than in previous outlooks
- Assumed quick recovery to 1.5% growth rate

Economic outlook




## … but dependent on services?

- EC Ageing Report: Europe becomes an increasingly services based economy
- Higher unemployment rates, and more elderly people.
- Despite economy shifting from agriculture to industry to services, a very strongly services based economy is not realistic.




services

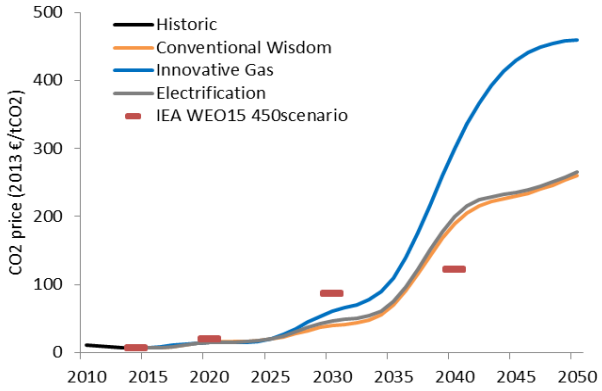
78%

# 2. The PRIMES model – input and key assumptions

**Assumptions and input parameters arguable but key to understanding the results**

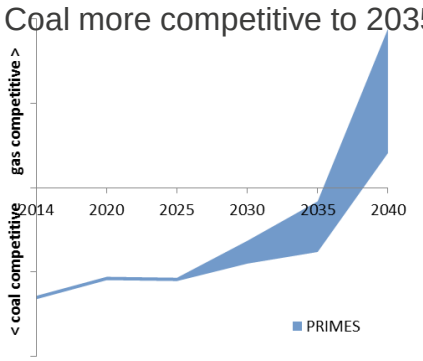
## Modelled prices…

- ETS is endogenously modelled and interacts with the emitting energy sectors
- There is a strong increase after 2035. Investment certainty and lead times seem to be missing from the interaction in technologies and prices




## … strongly influence potential of gas

- Primes uses prices of other global models of E3MLab.
- Global demand is based on GDP, while the global supply outlook does not take into account new discoveries.
- Consequently, despite high $CO_2$ prices, the model shows gas prices to be higher than coal for power generation up to 2035.

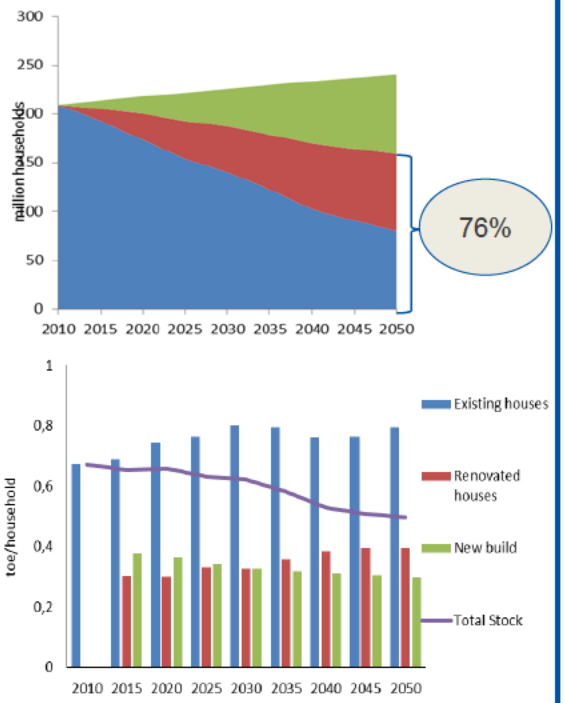


# 2. The PRIMES model – input and key assumptions

**Assumptions and input parameters arguable but key to understanding the results**

## High renovation rates…

Increasing renovation rates from historic 1% to 2-3%.




## … as ¾ of the current houses will still stand in 2050



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# 3. Key findings of the study

- **This study envisions a future in which the EU's agreed climate targets are met. It demonstrates that considerable progress can be made early by tapping the vast potential that gas (natural and renewable) offers in delivering a sustainable future.**

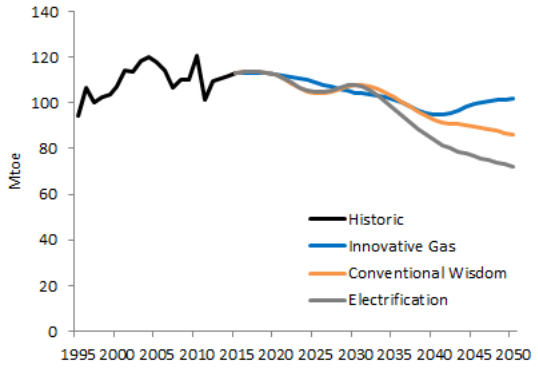
- **The versatile role of gas enables a socially acceptable pathway to 2050 with even more ambitious emissions reductions by 2030, supporting higher shares of renewable energy, while limiting the cost increase for consumers.**

# 3. Key findings – Conventional Wisdom scenario

**Sectors difficult to decarbonise, such as residential, transport and industry, illustrate the versatile role of gas to reduce emissions.**

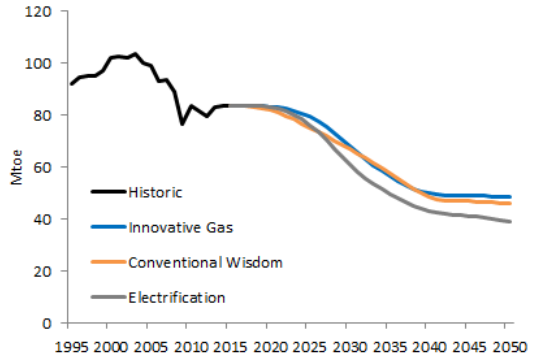
## Residential

- 76% of current houses in 2050; stable gas demand to 2030
- Increasing shares of renewable gas to maintain relevance
- Renovation rate of 2-3%



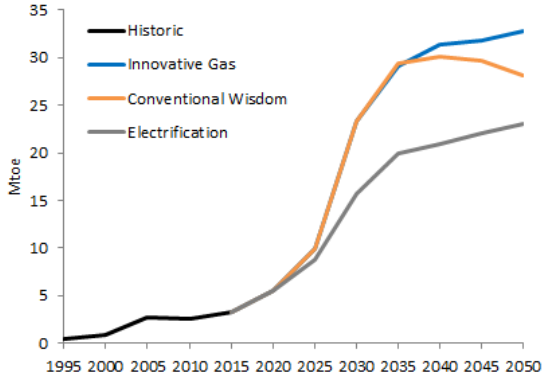

## Industry

- Short-term energy demand rise in industry could occur, despite weak economic outlook
- Efficiency is key, and so is natural gas




## Transport

Gas contributes to decarbonising the transport sector and to clean air while maintaining travel distance and load

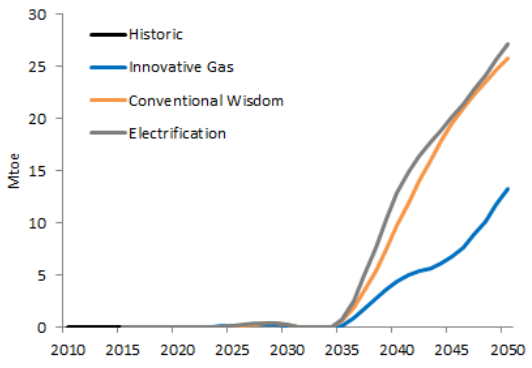


# 3. Key findings – Electrification sensitivity

**A strong push for electrification would result quickly in system limitations and in high overall costs.**

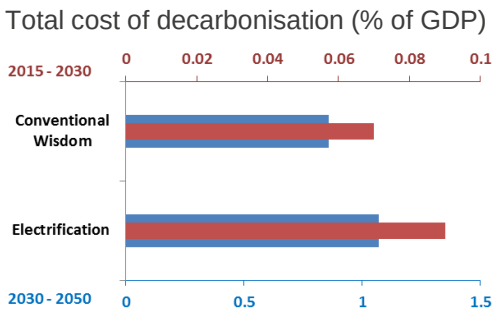
## More CCS…

Decarbonisation of electrified society would require 10% stronger dependency on CCS - and on nuclear energy



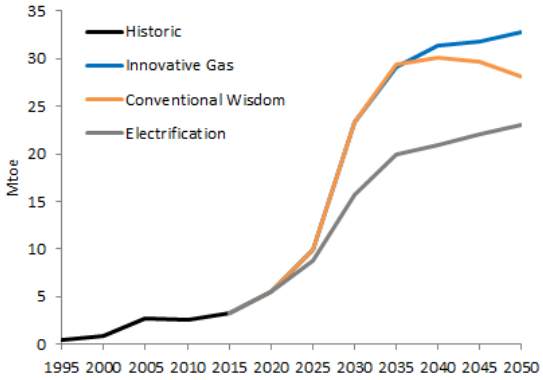

## …higher costs…

- Electrification of residential sector limited by high investment burden for consumers
- Natural gas not modelled as part of a smart energy system.




## …and not all transport

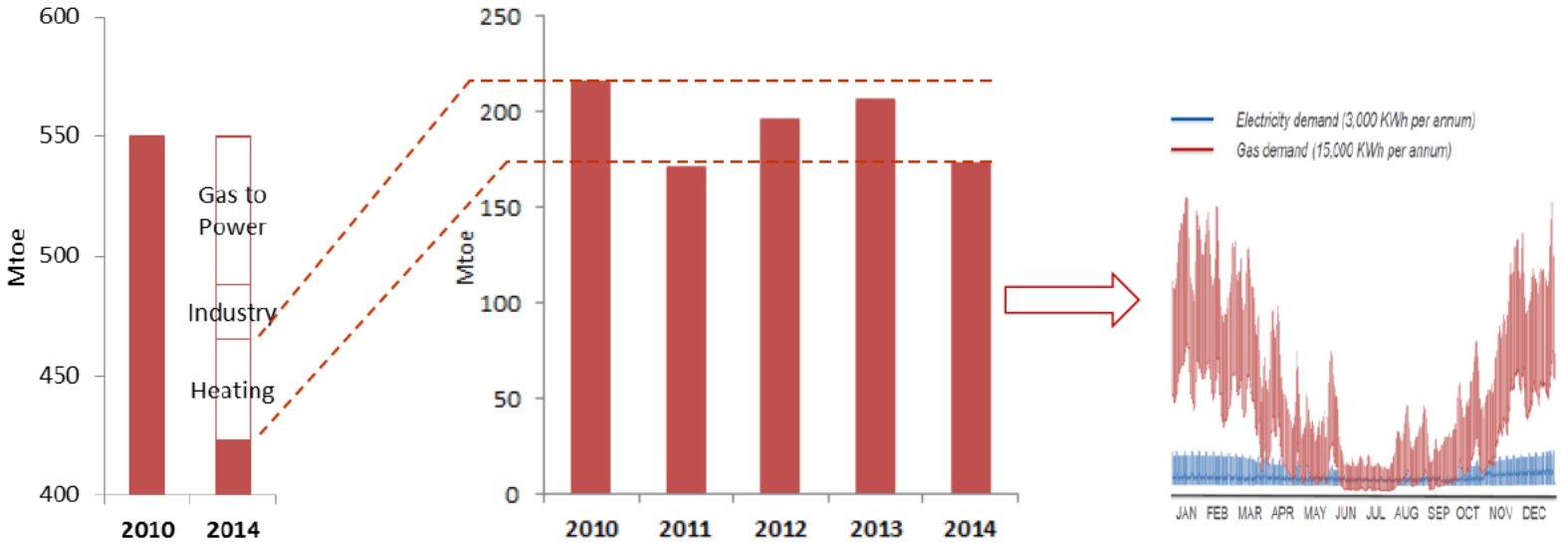
Despite electrification of the transport sector, gas demand is set to increase, confirming a need for gas fuel stations



# 3. Key findings – Electrification sensitivity

**A strong push for electrification would result quickly in system limitations and in high overall costs.**

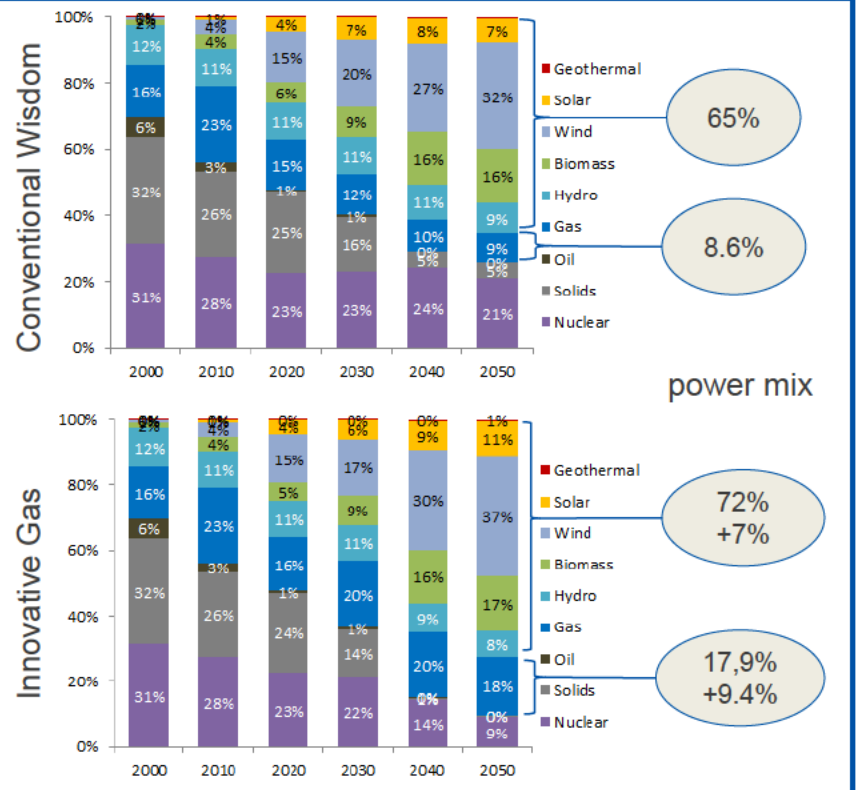
## Heating demand requires a grid capable of delivering peak demand



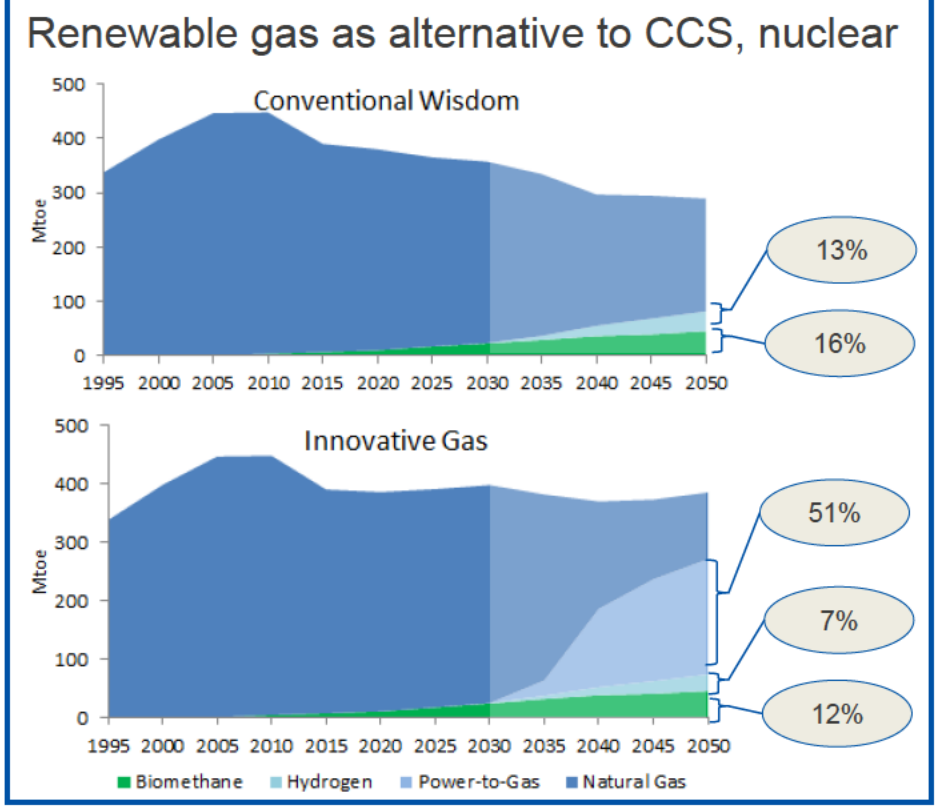
# 3. Key findings – Innovative Gas scenario

**Innovative gas solutions enable much higher shares of renewable energy, providing optionality to meet 2050 targets.**

## Higher shares of renewables + gas…




## … and more renewable gas



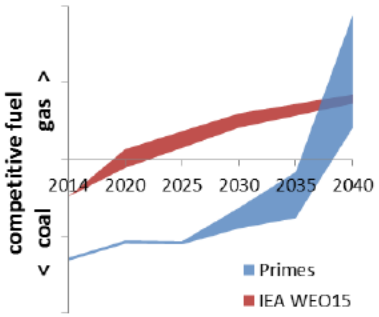
# 3. Key findings – Fuel Switch sensitivity

**Delivering more ambitious emissions reduction in 2030 provides time for new options to 2050.**

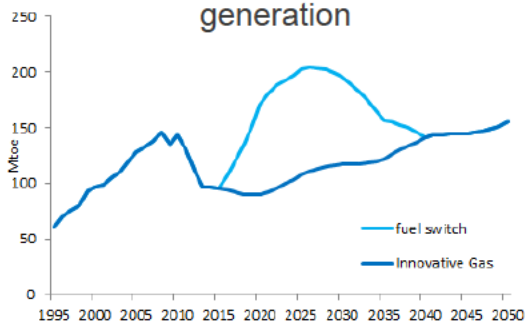
## Higher gas demand…

- Sensitivity justified by IEA WEO forecast
- Consequential increase in loadfactor remains within limits, in order to include capacities assumed in the model.

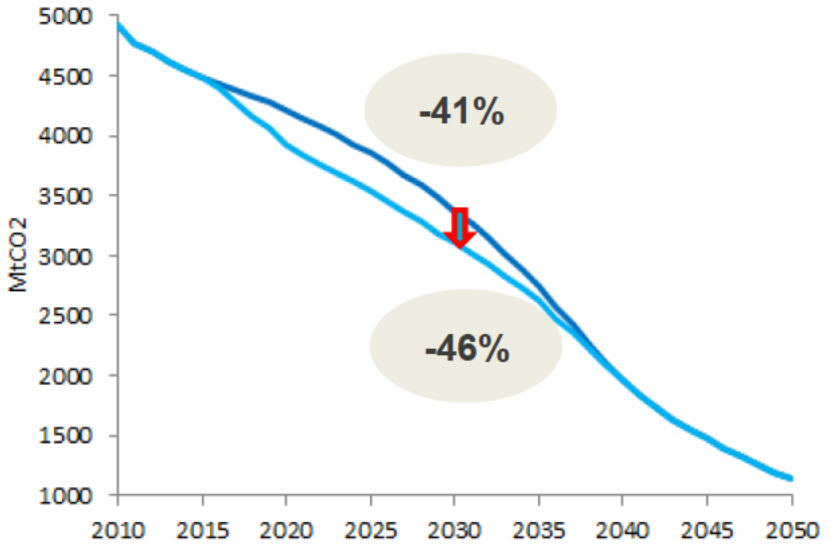
Competitiveness of fuels




Gas demand for power generation



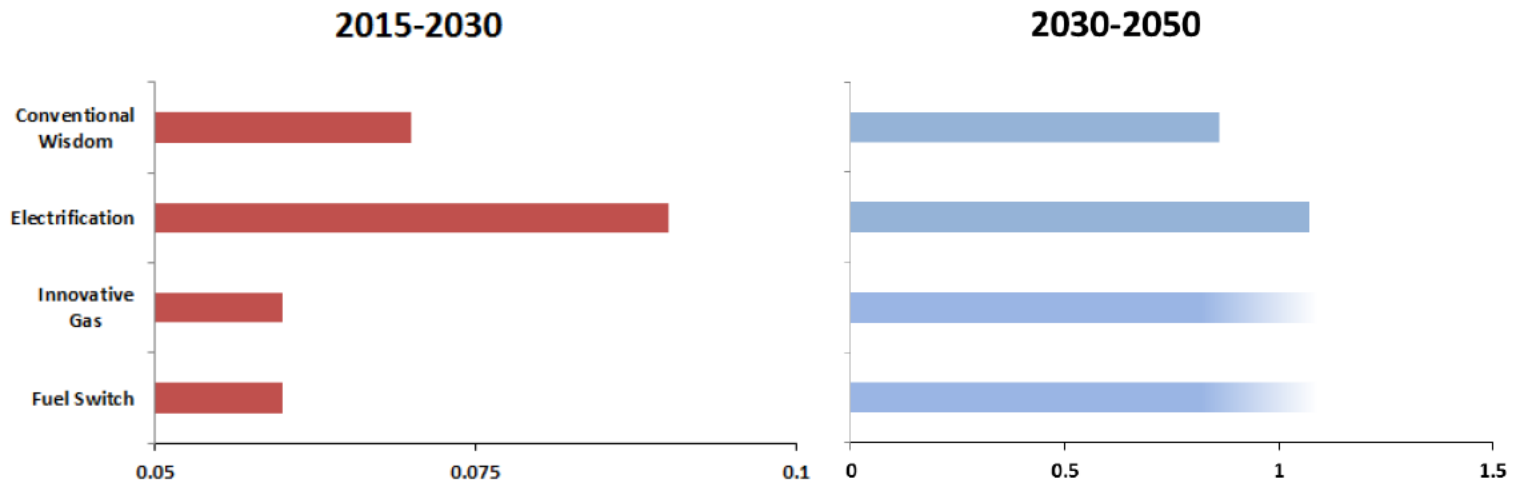

## …more ambitious emissions reduction



# 3. Costs

**A strong push for electrification would result quickly in system limitations and in high overall costs.**

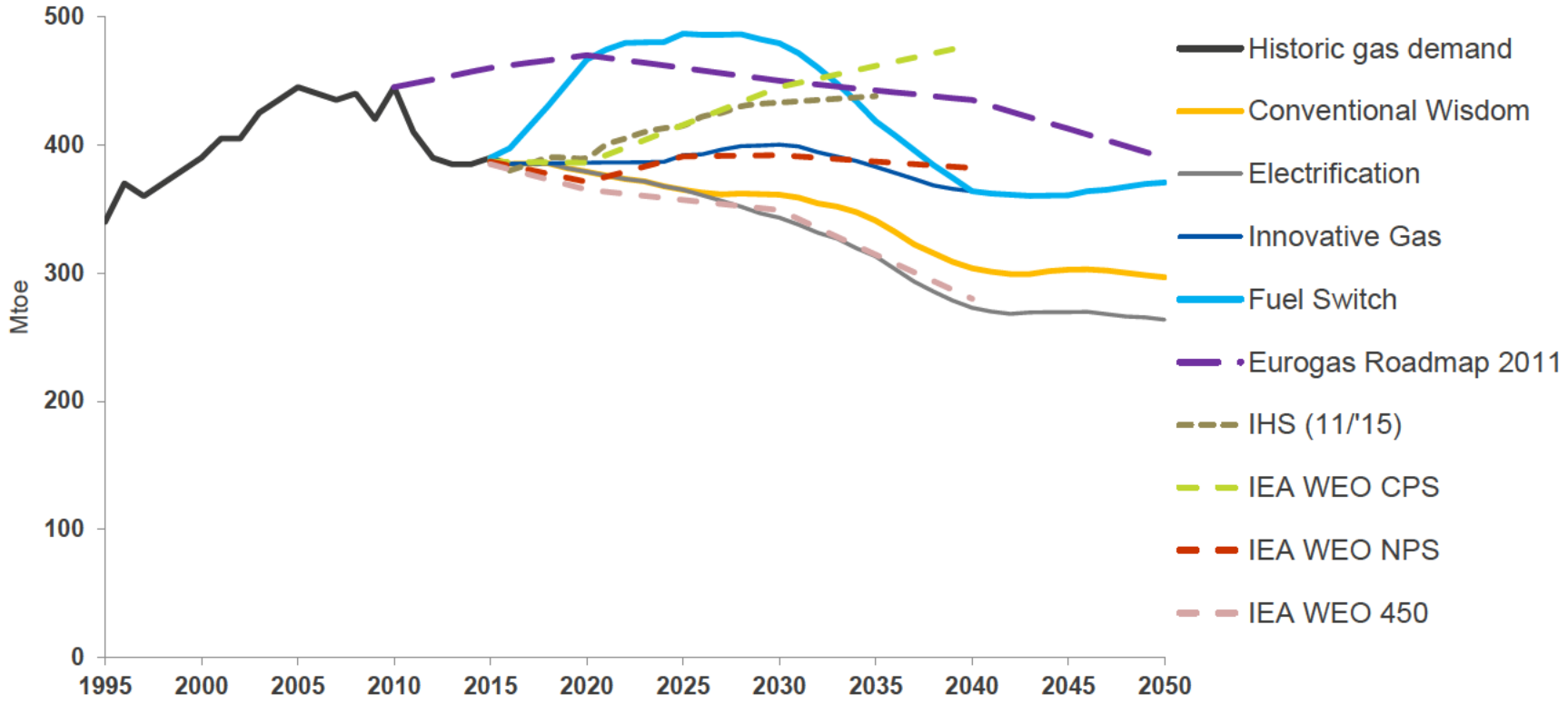
## Total cost for decarbonisation (% of GDP)




**Grids**

Investments in gas infrastructure are equal in all scenarios;
for power grids, the electrification sensitivity is **€ 335 billion** more expensive than the Innovative Gas scenario.

# 4. What others think of European gas demand



# 4. Arguable assumptions by PRIMES

- In the view of Eurogas, the model **underestimates the potential of natural gas** to achieve 2030 climate targets.
- The PRIMES model is based on cost optimisation, in which behaviour is included by a quantification of perception of risk and up-front investments. Gas is well positioned by cheap boilers, but the **role in smart grids is not included**.
- The effects of already observed **removal of gas distribution grids are not assessed**. While electrification is seen as not cost-effective, **consumer choice made regardless of impact on total system** might still point to more electric use.
- The economic forecast of the European Commission foresees a **services-based economy**, more unemployment and more elderly people. These are challenging circumstances in themselves, and do not consider the **potential benefit of industry to the wider economy**.

# 4. Arguable assumptions by PRIMES

- **Very high $CO_2$-prices seem unrealistic** and are the result of the technology choices that are required to meet the climate targets, resulting also in very high shares of renewables.
- Despite very high shares of renewable gas, **conventional learning curves of power-to-gas are used**.
- **Gas in transport is only considered for trucks and shipping**, while there is a potential for CNG, too. It should be noted that in Gross Inland Consumption, data on fuels for bunkering is not included, leading to **European gas demand** to be **underestimated in the long term**.

# 5. Main outcome of the modelling

- A substantial fuel switch from coal and oil to gas would **exceed the EU's greenhouse gas reduction target for 2030**.
- This would allow the EU to **postpone costly investment** until the economy has reached a more stable, positive growth rate.
- Renewable gas, mainly from power-to-gas, is an opportunity to **increase the share of renewable energy overall**.
- Renewable gas can **reduce carbon dioxide emissions in sectors that are otherwise difficult to decarbonise** (industry, residential and transport) and can largely use the existing gas grid.
- A less conservative learning curve for power-to-gas could **reduce the costs of decarbonisation overall**.
- Whilst largely renewable, gas demand levels would still be important in 2050, **justifying continued investment in gas infrastructure**.

# Thank you for your attention!

# Contact details

**Av. de Cortenbergh 172**
**1000 Brussels**
**BELGIUM**

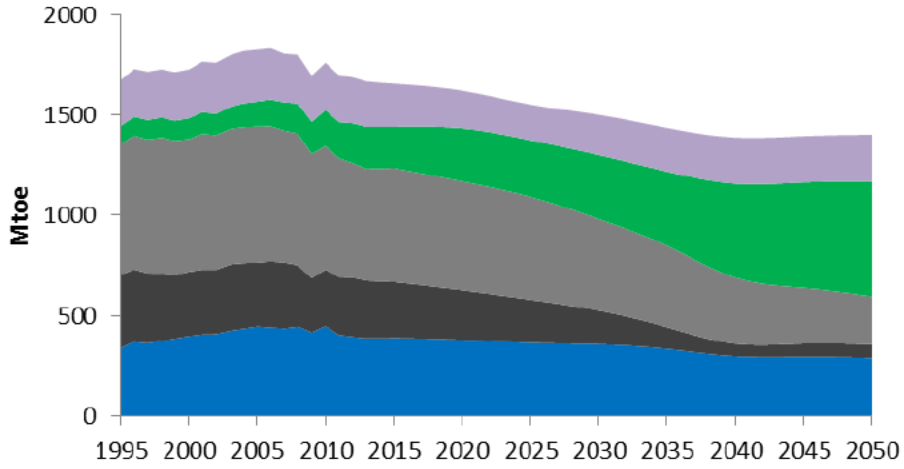
**Phone:**
**+32 2 894 48 48**

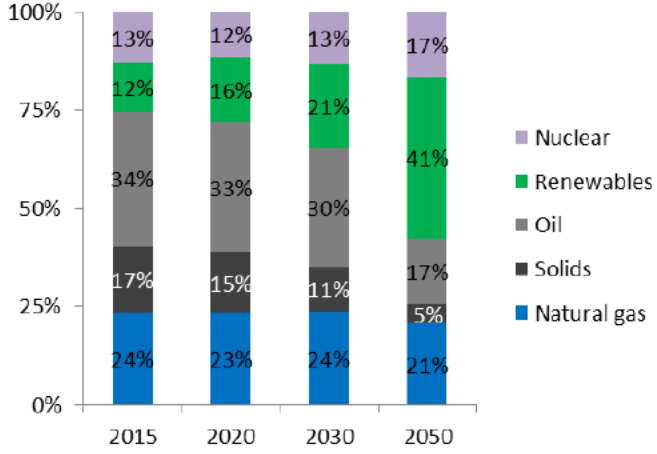
**eurogas@eurogas.org**
**www.eurogas.org**

# Annex

# 3. Key findings – Conventional Wisdom scenario

## Gross Inland Consumption – gas shares to remain stable while renewables grow

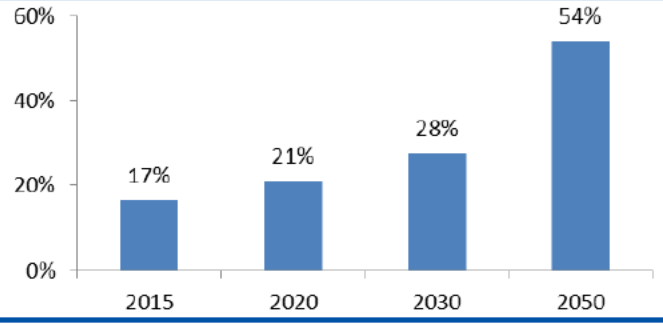



## Share of renewable energy – growth will take place particularly after 2030

The share of renewable energy is expressed in **gross final energy consumption**.

Compared to Gross Inland Consumption, it excludes transformation losses.



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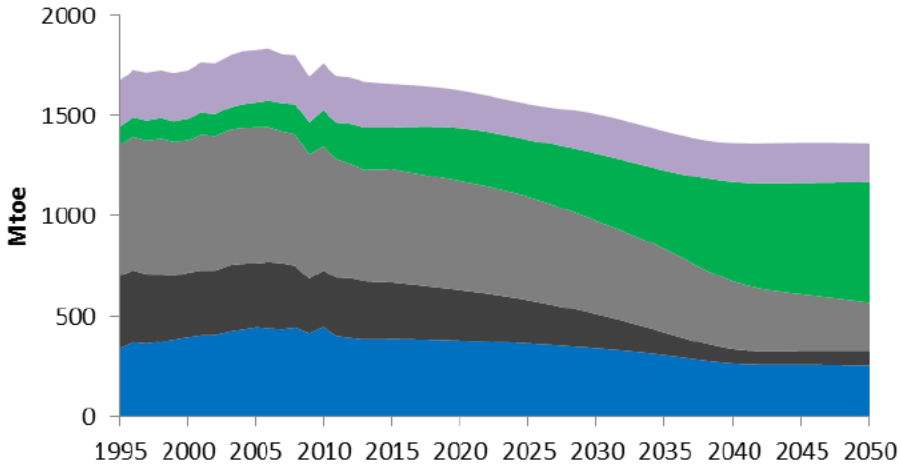
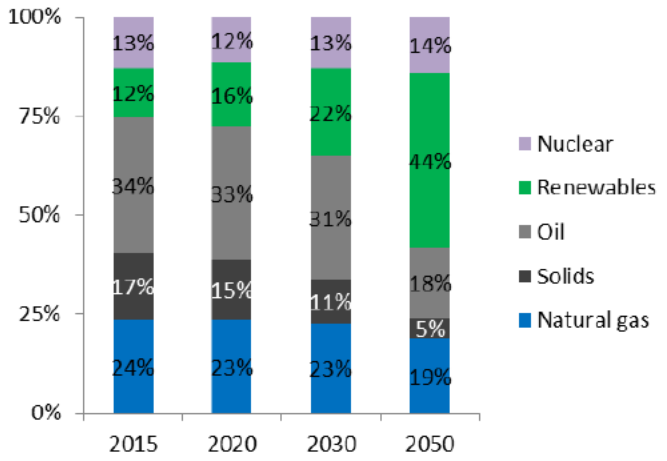
# 3. Key findings – Electrification sensitivity

## Gross Inland Consumption – increasing shares of nuclear energy

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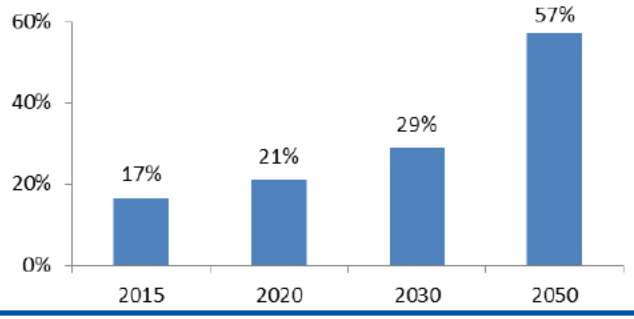
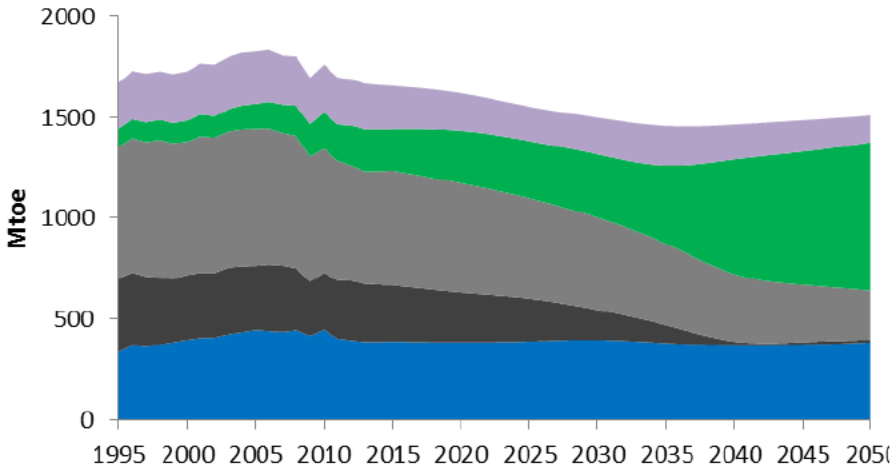
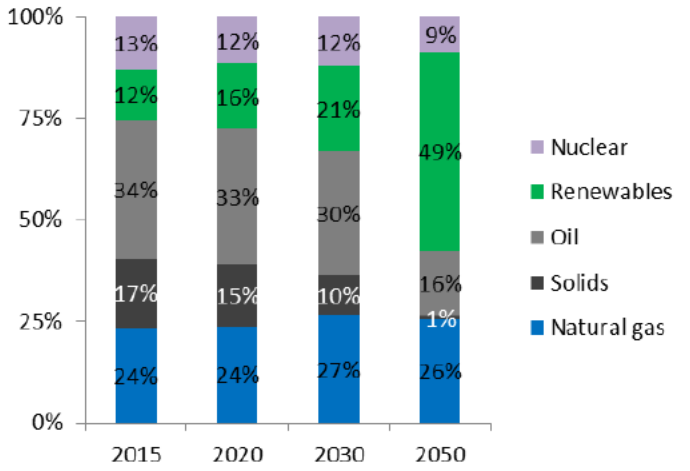


# 3. Key findings – Innovative Gas scenario

## Gross Inland Consumption – increasing shares of nuclear energy

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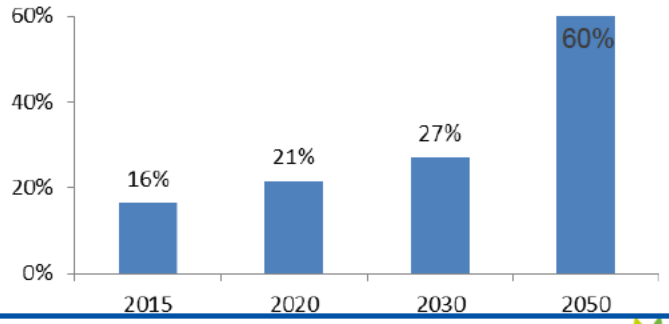




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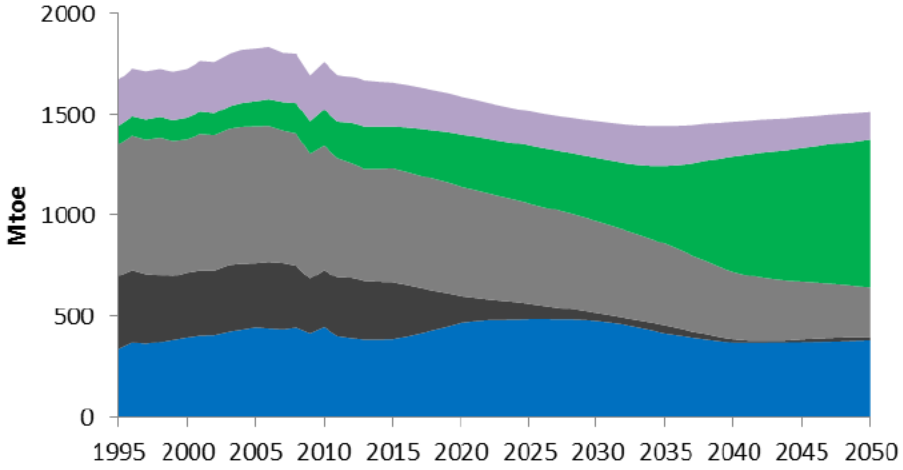
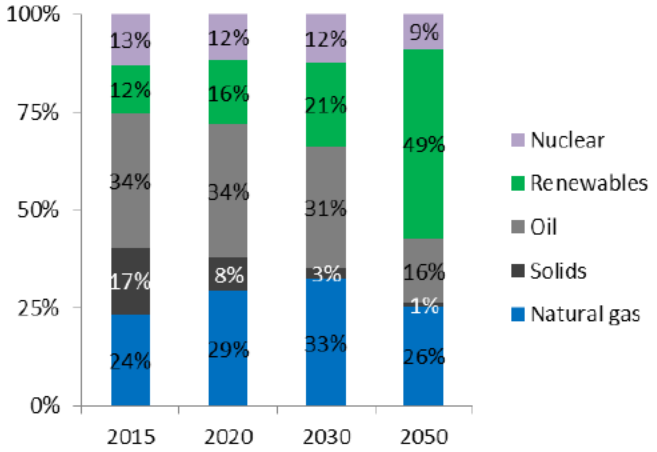
# 3. Key findings – Fuel Switch sensitivity

## Gross Inland Consumption – significant shares of gas and meeting climate targets

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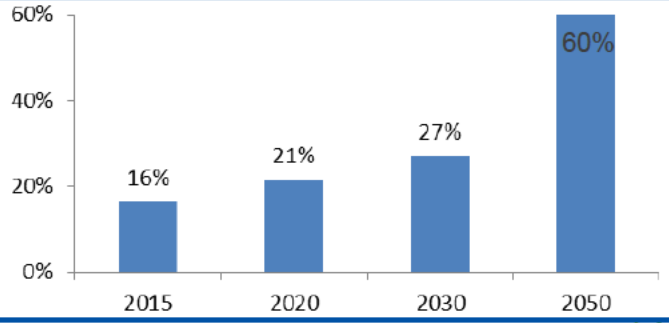




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