POLICY TECHNOLOGY MARKET
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POWER-TO-GAS

Session:3.4

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POWER-TO-HYDROGEN

Renewable Electricity

Water

ITM Electrolyser

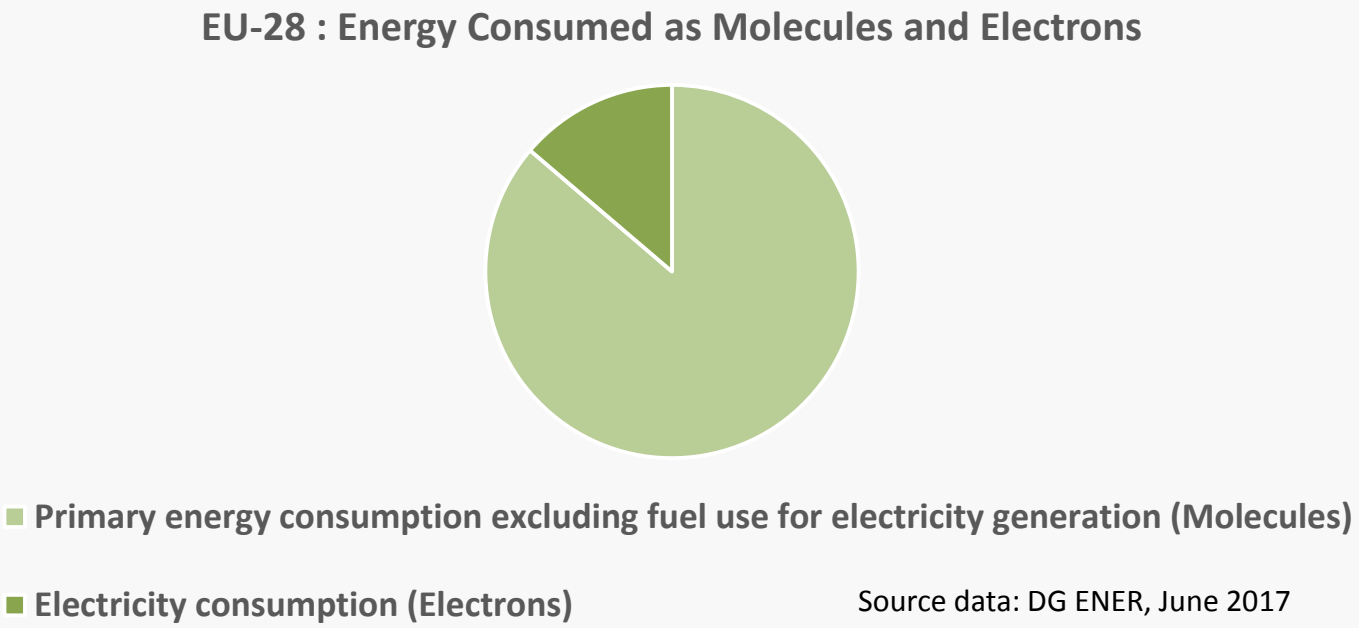
HYDROGEN

Power-To-Gas

Clean Fuel

Renewable Chemistry

WE NEED MOLECULES AS WELL AS ELECTRONS

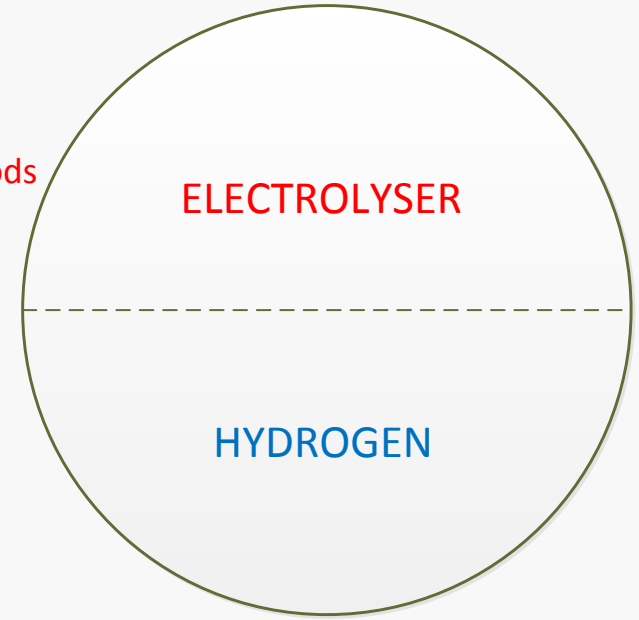


Source data: DG ENER, June 2017

- Electrolysers convert electrons to molecules

VALUE PROPOSITIONS OF POWER-TO-GAS

- Providing grid services to the electricity grid
- Increasing demand during low demand periods
- Helping minimise wind curtailment
- Requires rapid-response electrolysers

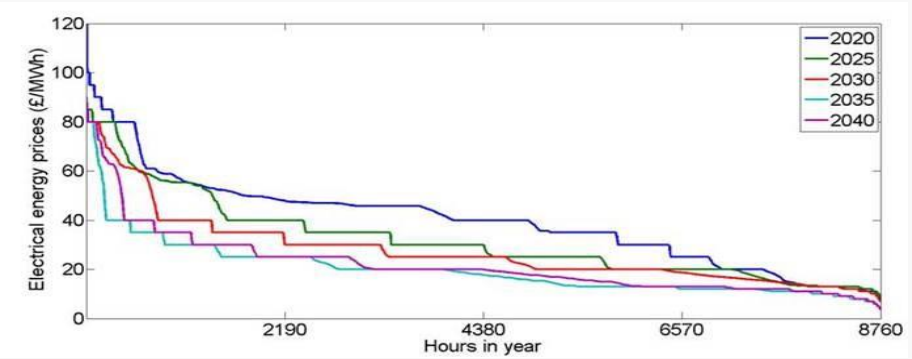


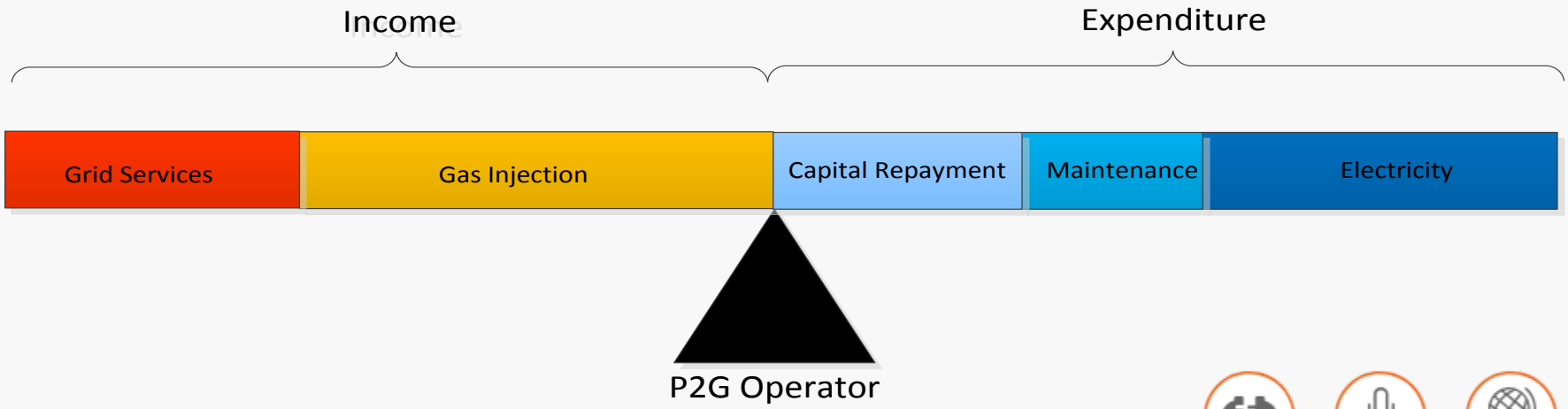
- Enables some early decarbonisation of gas networks
- Inject low concentration blends now, higher concentrations later
- H2NG combustion very similar to NG combustion characteristics
- SNG injection as a second step, using CO_2 from digesters, fermentation etc.
- No significant changes required on the demand side

ECONOMIC FACTORS

A P2G operator needs to achieve an economic balance to justify the investment:

- Cost of electricity during operating periods
- Grid fees
- CAPEX
- Maintenance Costs
- Income from providing grid services
- Income from injecting H2NG blends





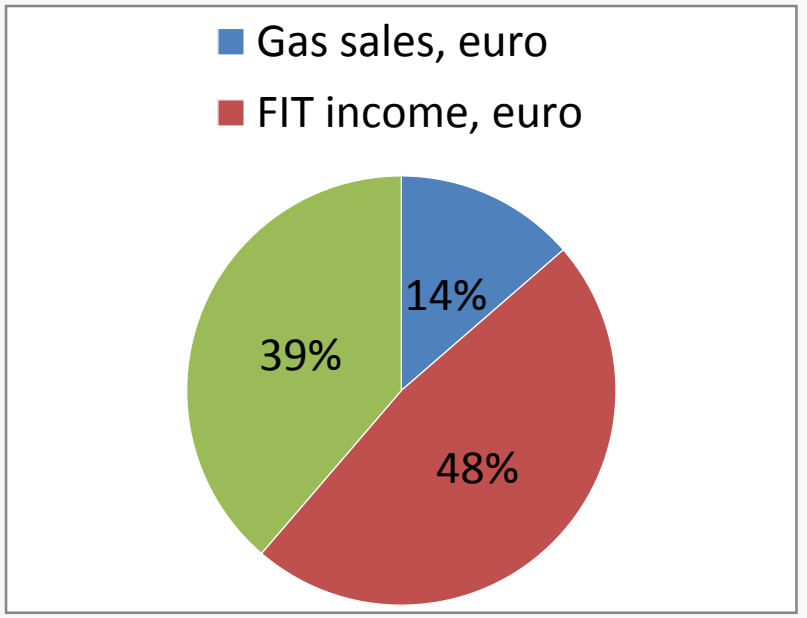
REMUNERATION EXAMPLE

- 10 MW P2G plant in the UK (8m euro Capex)
- Providing a "Demand Turn Up" service to National Grid and buying electricity @ 30 € /MWh
- Providing another 1000h of other operation annually and buying electricity @ 40 €/MWh
- Injecting a hydrogen admixture into the gas distribution network
- Electricity grid fees of 15 €/MWh
- WACC of 6%

→ Discounted Payback Period of 7.9 years if the injected hydrogen is valued at 70 €/MWh.

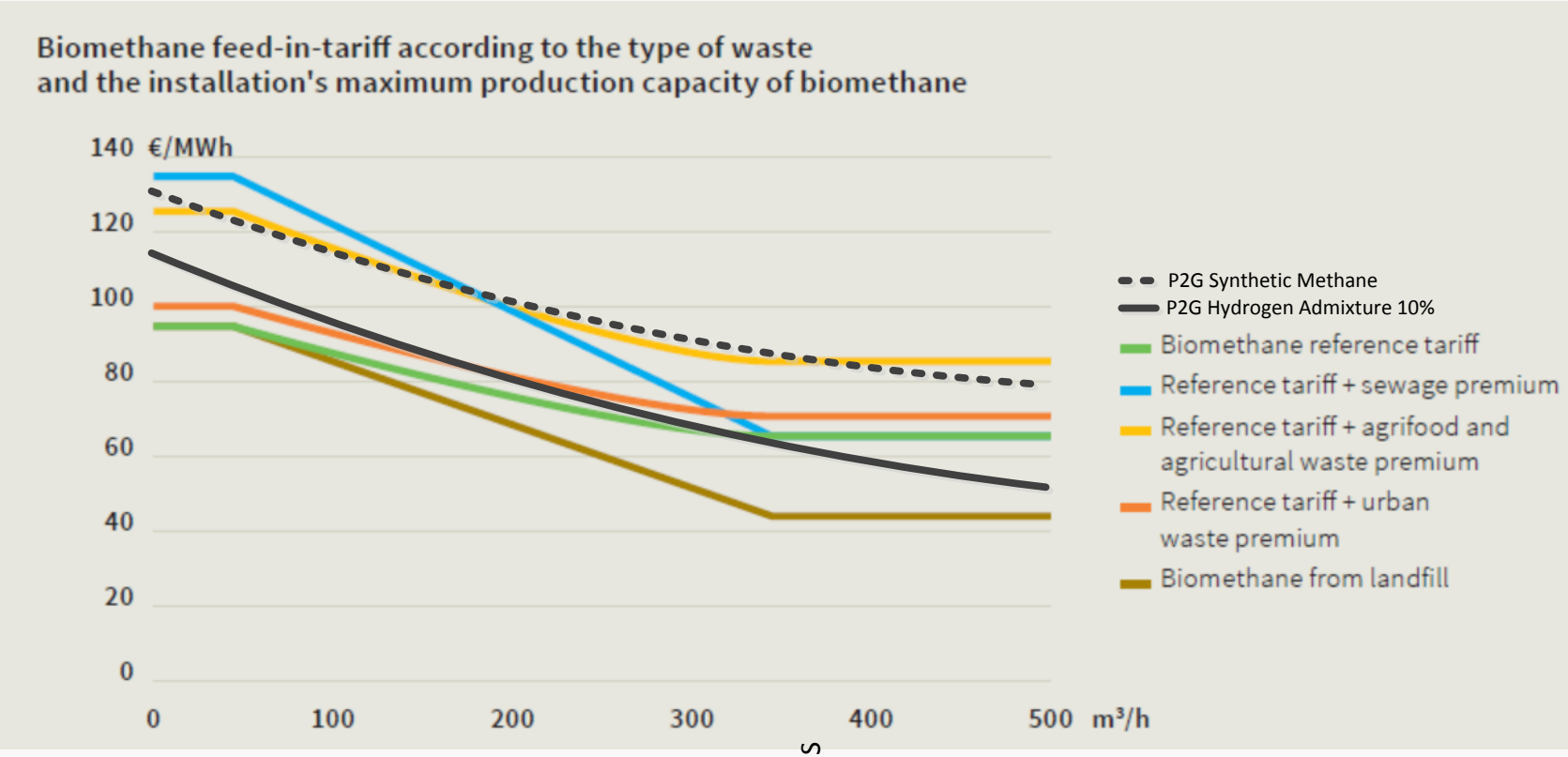
If the natural gas price is say 20 €/MWh, the H2NG blend will cost:

H2NG Blend Concentration (% vol.)	Blend Cost (€/MWh)
2	20.3
10	21.7
20	23.3
30	25.0



REMUNERATION FRAMEWORK

Illustratory P2G FITs superimposed on the existing remuneration framework in France for bio-methane injection



SUMMARY

1. The gas grid has inherent storage capacity, the electricity grid doesn't.

2. P2G storage technology is ready for deployment (TRL 8/9).

3. Today hydrogen isn't valued by the gas grid – policy frameworks for enabling the adoption of low concentration H2NG blends in the short term are required urgently.

4. P2G has a set of value propositions that should be attractive to both the electricity and gas sectors in their efforts to decarbonise.

5. The adoption of H2NG blends in gas distribution networks is relatively straightforward and a time progression from low to medium concentrations could be achieved without making any significant changes on the demand side.