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E-Methane From Volts to Volumes

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Brussels

September 10, 2018

ARTFuels

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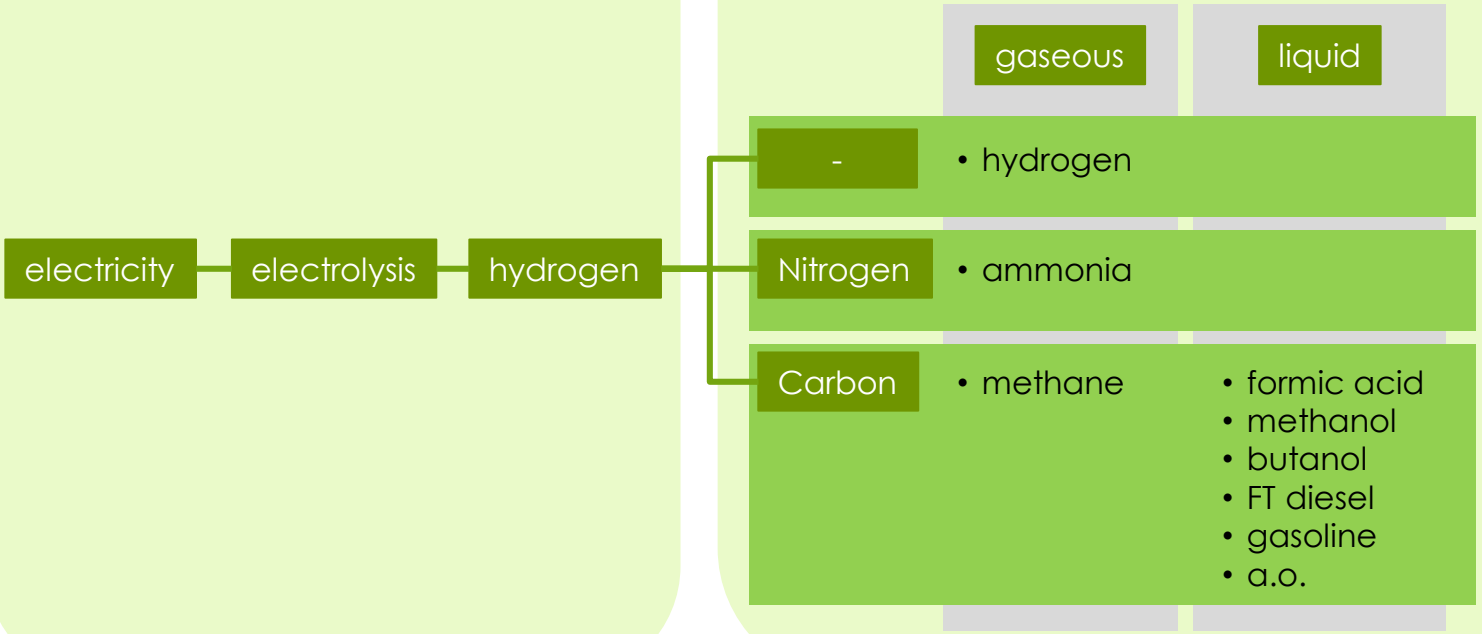
PtX and CCU are similar but not the same

1 Convert electricity to hydrogen

2 Convert hydrogen to fuel



ARTFuels

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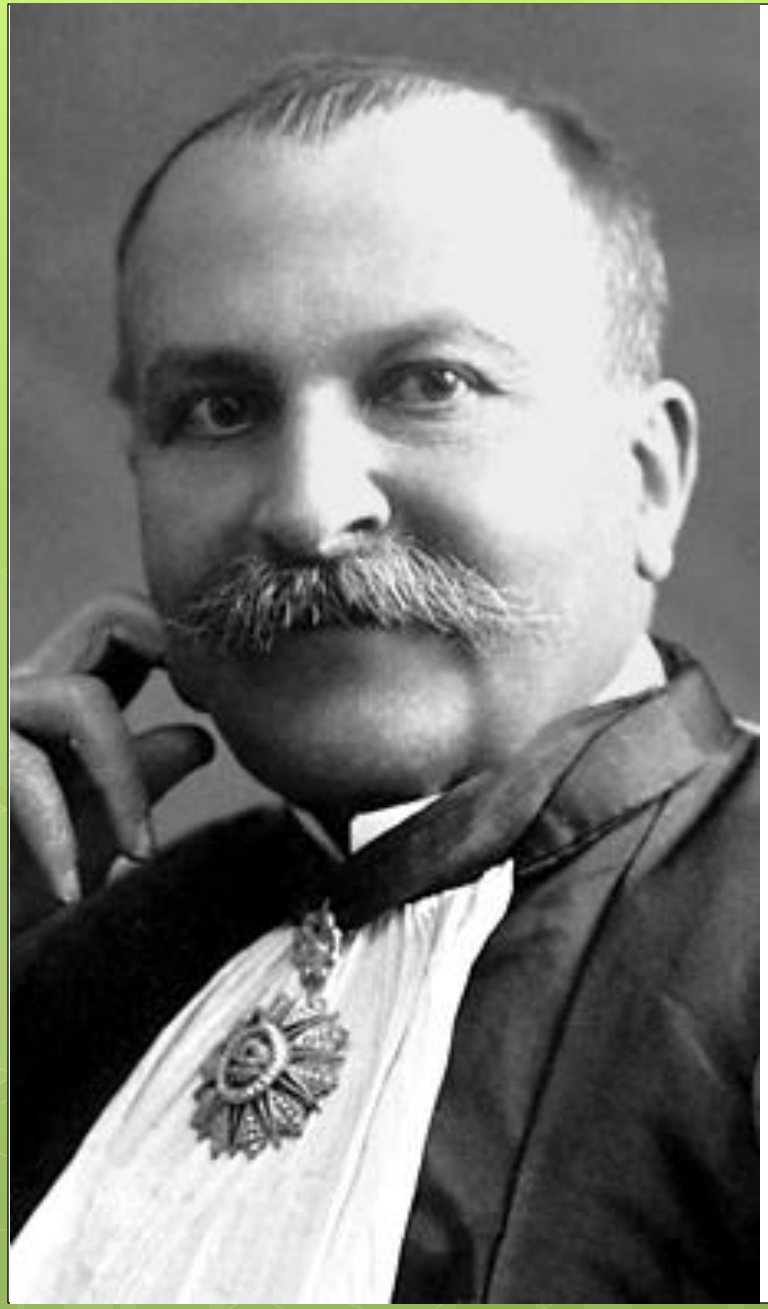
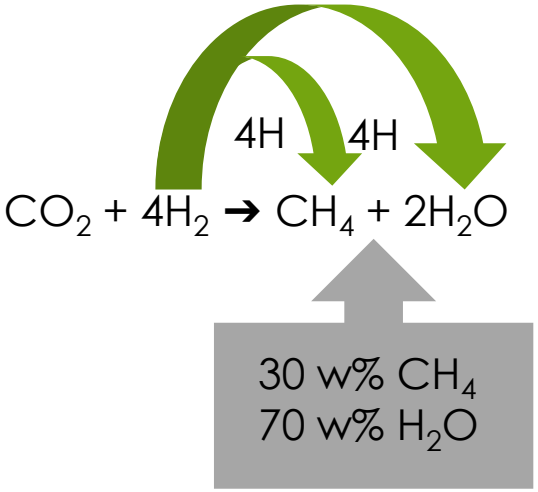
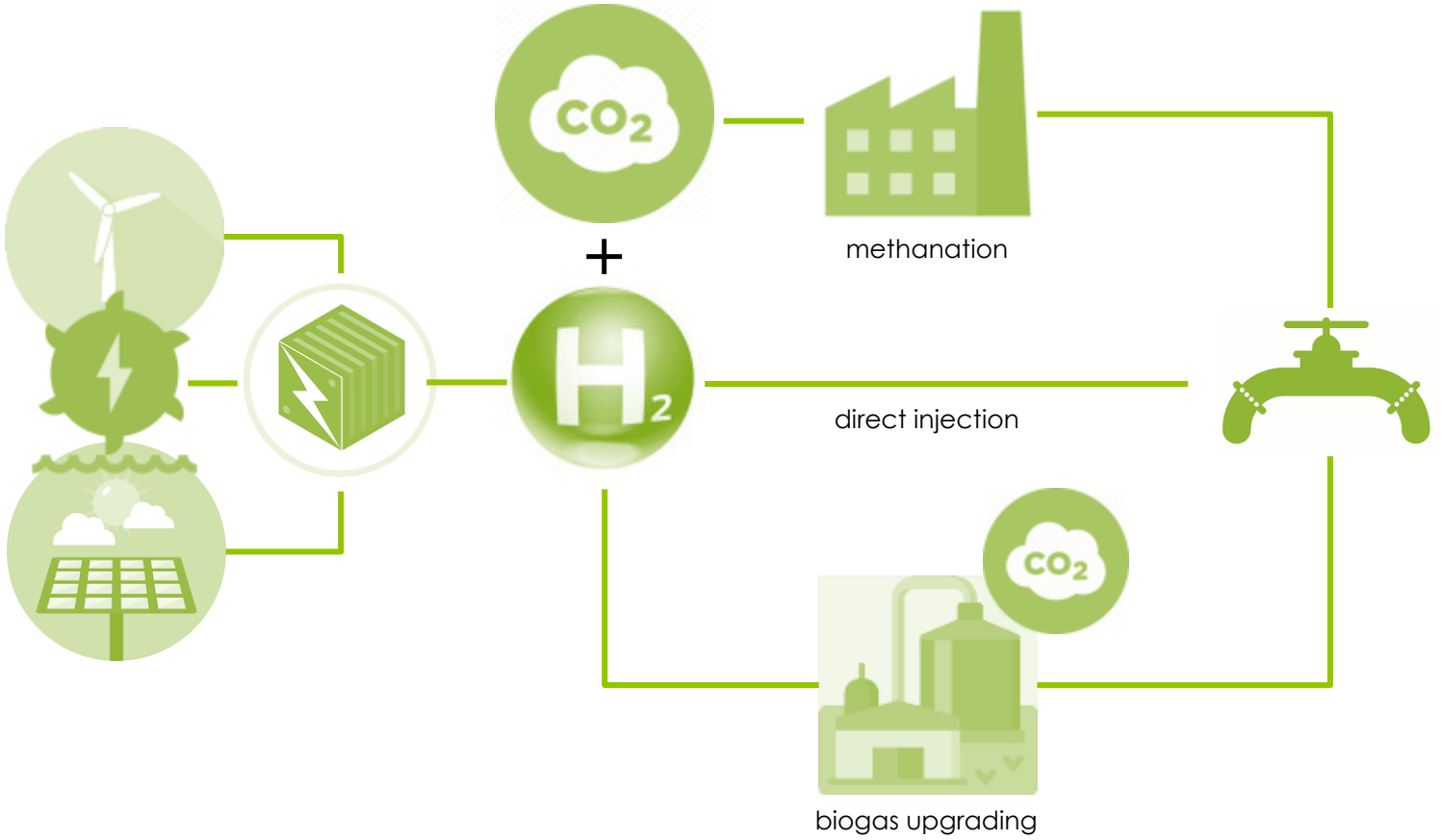


Back to the future

In 1897 Paul Sabatier discovered a process involving hydrogen and CO_2 using a nickel catalyst to produce methane and water



More than one option to the gas grid



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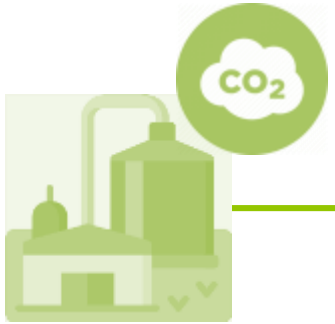
Some examples

methanation

direct injection



biogas upgrading

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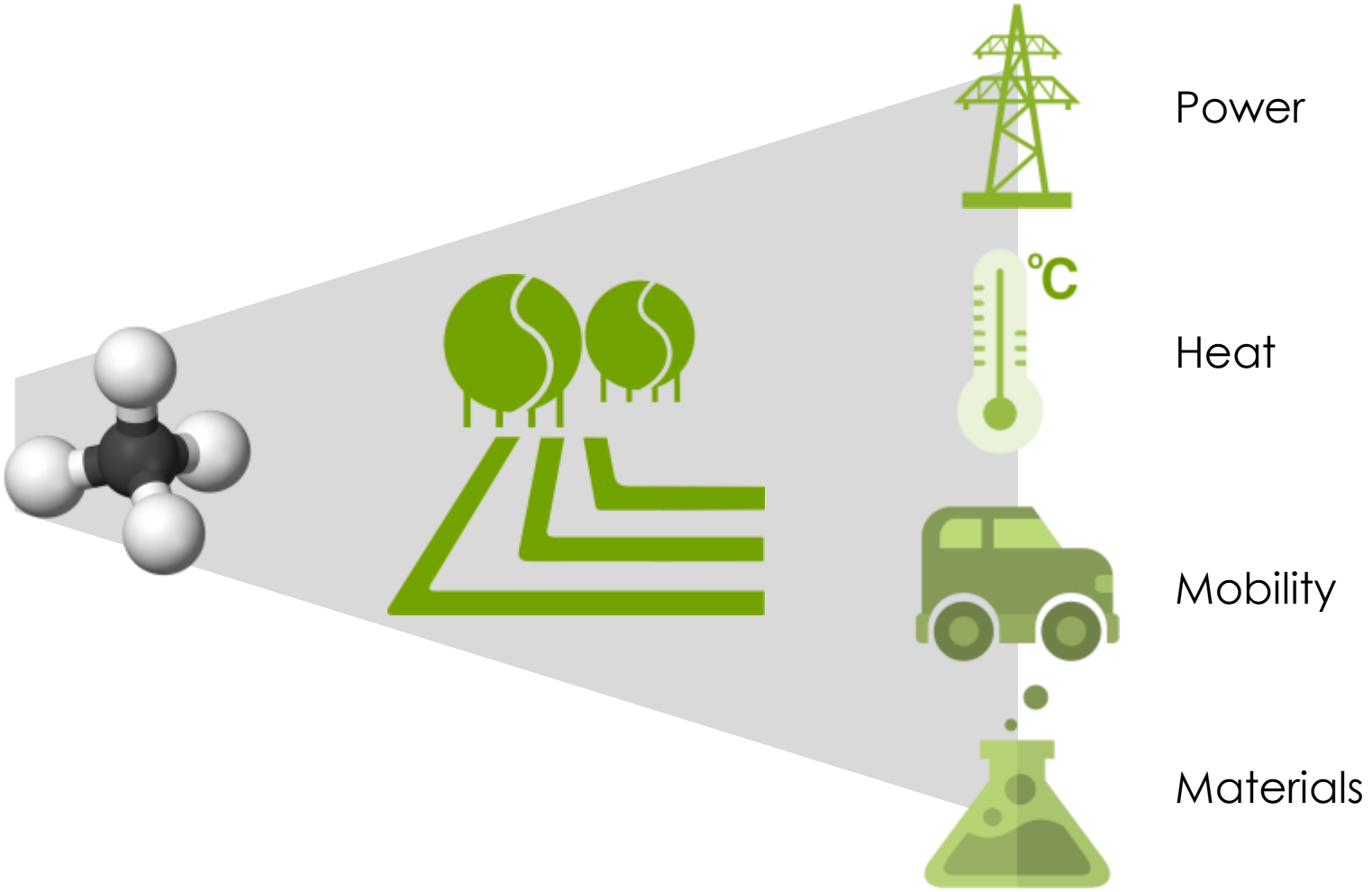
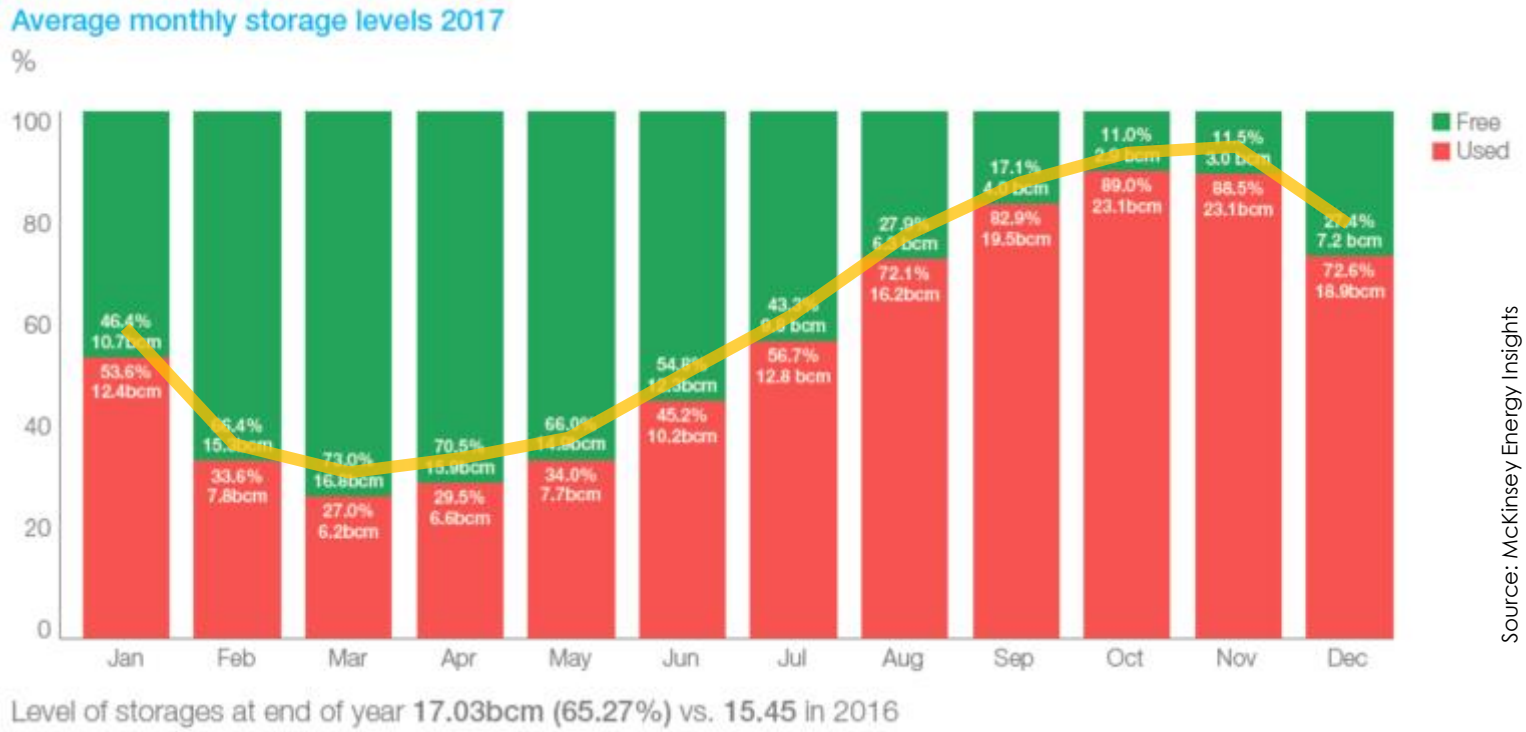
Versatile way to store energy and recycle carbon



Gas grid offers capacity to store additional energy



Source: McKinsey Energy Insights

2015 total monthly renewable energy production (wind, solar) in Germany at hypothetical 100% conversion efficiency

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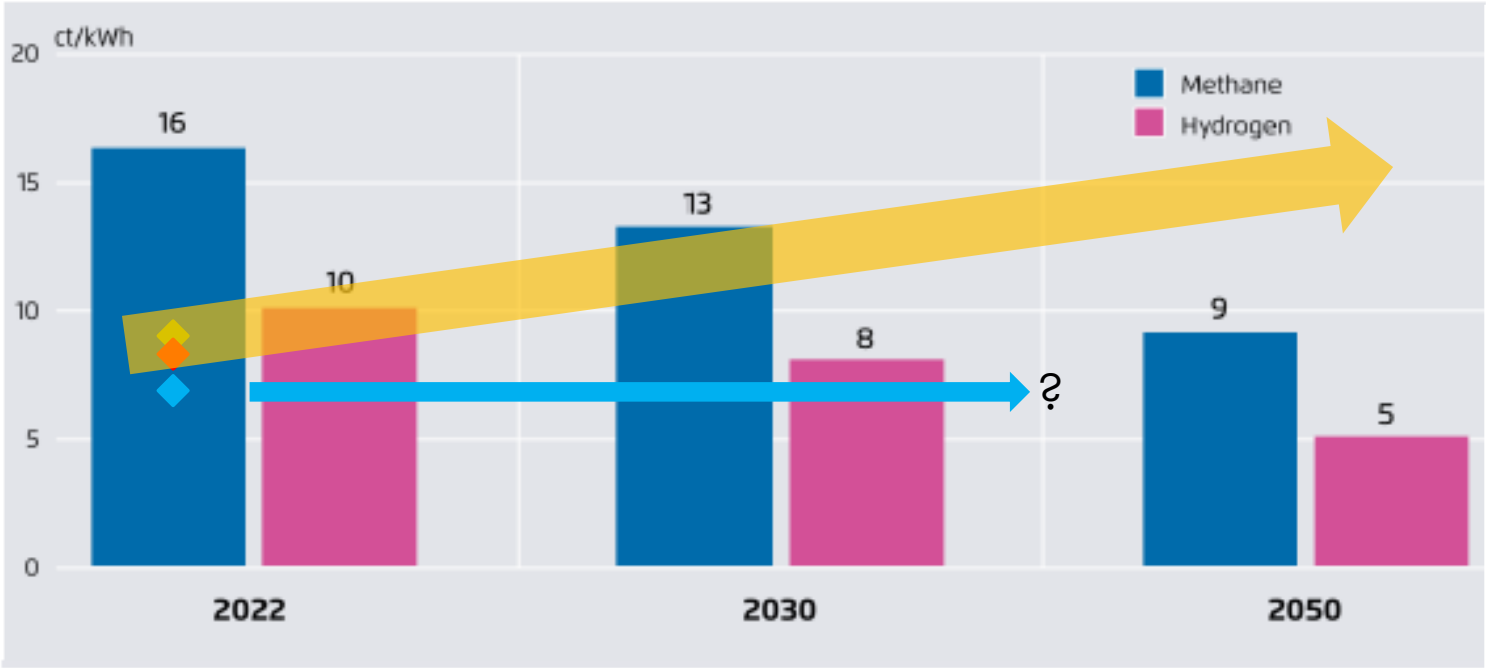
Comparing apples to apples

Cost of synthetic methane and hydrogen production in ct_{2017}/kWh



Production with PV in North America without cost of transport to Germany, calculation AGORA based on Frontiers Economcs (2018)
Biofuels estimates added by Conker

- Ethanol (average T2 FOB Rotterdam S2 2017)
- FAME -10 (average T2 FOB Rotterdam S2 2017)
- Bio-methane (assumed €0,60/Nm^3)

Estimated direction for advanced biofuels

We cannot change the laws of physics

Which means we have to be extra smart with the rules we set ourselves

Proof of renewable origin

Source of CO_2

Carbon footprint methodology

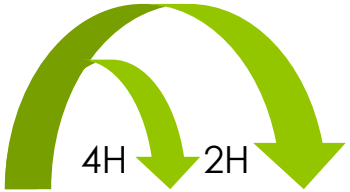
Additionality of renewable electricity

Recognition as advanced renewable fuel

Efficiency versus volumes

Efficiency improvement optionality

Power-to-Methanol



$CO_2 + 3H_2 \rightarrow CH_3OH + H_2O$

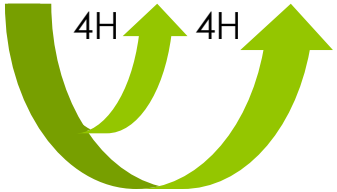
64 w% CH_3OH
36 w% H_2O

1/3 difference in hydrogen

Power-to-Methane

$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$

30 w% CH_4
70 w% H_2O



bse engineering

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Power-to-Methane pros and cons

+ Existing gas grid offers large storage potential
+ Potential to reduce gas imports and use local energy sources instead
+ CO_2 emission reduction by recycling carbon ànd displacing convential methane from fossil sources
+ When integrated with European industry offers possibility to avoid carbon leakage
+ Can be used in existing applications
+ Option to optimize and integrate with biogas processes

? Possibilities and time line to improve efficiency and reduce cost (CAPEX & OPEX)?
? Future demand for methane?

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"The best way to predict the future is to create it"

A. Lincoln

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