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Power to Methanol in German and European context

***e-Methanol* as a Carbon Product**

Methanol Policy Forum
13-14th October 2015, Brussels

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Share our experience in a future market!

In a joint effort with our project supervisors, planners and engineers, we were able to assume a prominent position in the planning and realization process of Europe´s largest bio-ethanol complex. You can become part of a growing renewable energies market by taking advantage of our service.

- Planning , authorization and execution of projects
- Administrative management
- Budgeting
- Investment planning
- Cost management
- Project management

Production start: spring 2005
Product: 800 m³ ethanol/ day
Budget: over 185 Mill. Euro

industrial and constructional planning involving bio-ethanol and sugar industry • schematic design, realization and administrative management • project and cost management

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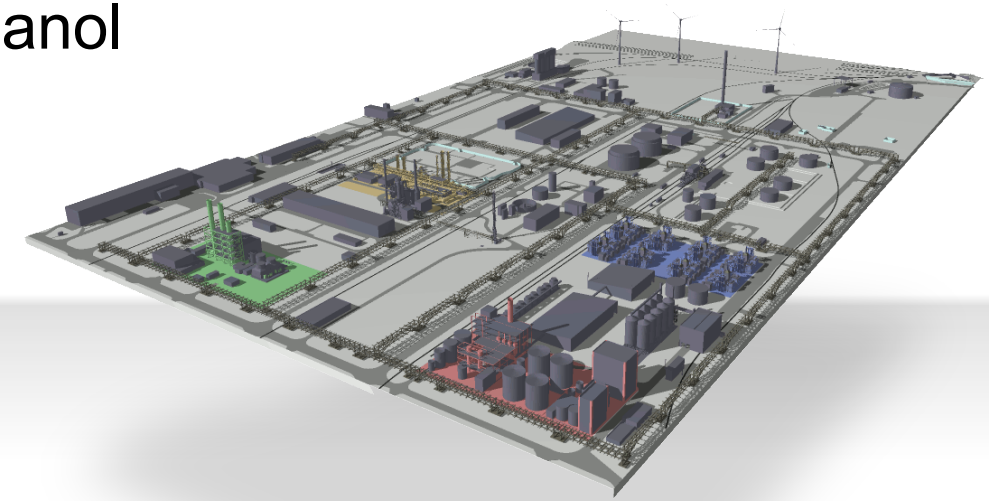


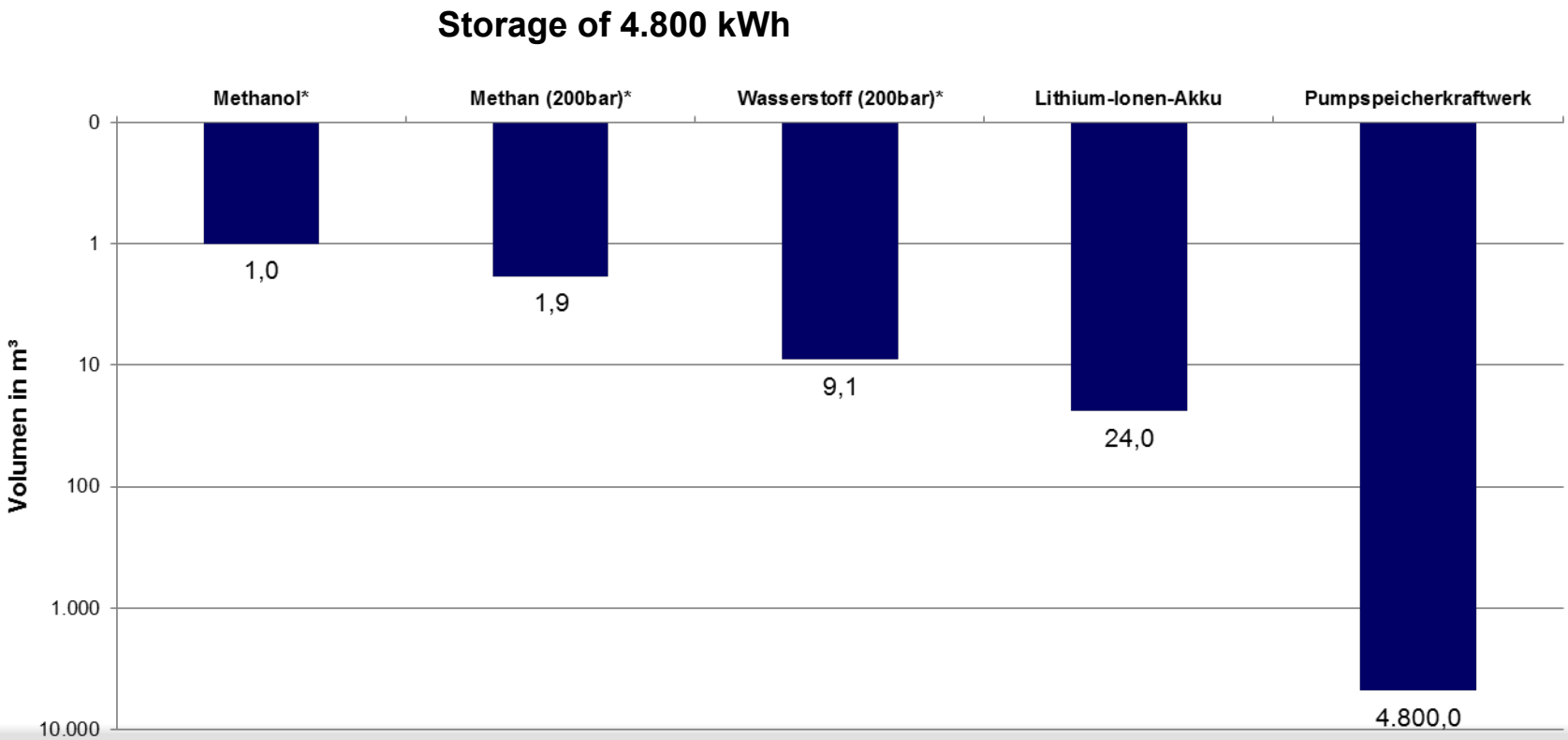
Power Production in Germany

- Power export Germany in 2013 was 34 TWh
- Emission load for Germany 30 Mio to CO_2/a
- Additional saving demand 22 Mio to by 2020
- Missing grid infrastructure reduce the renewable power production capacity
- Transport sector drags behind power sector with share of renewable energy consumption
- 656 TWh consumption in the transport sector

Solution must be the Chemical Power Storage

Power Storage

Volume of different Storage Systems



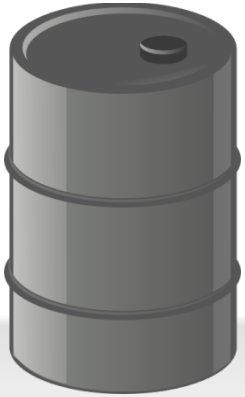
Solution must be the Chemical Power Storage

*Berechnung ohne Umwandlungsverluste auf Basis der Heizwerte.

Energy Density

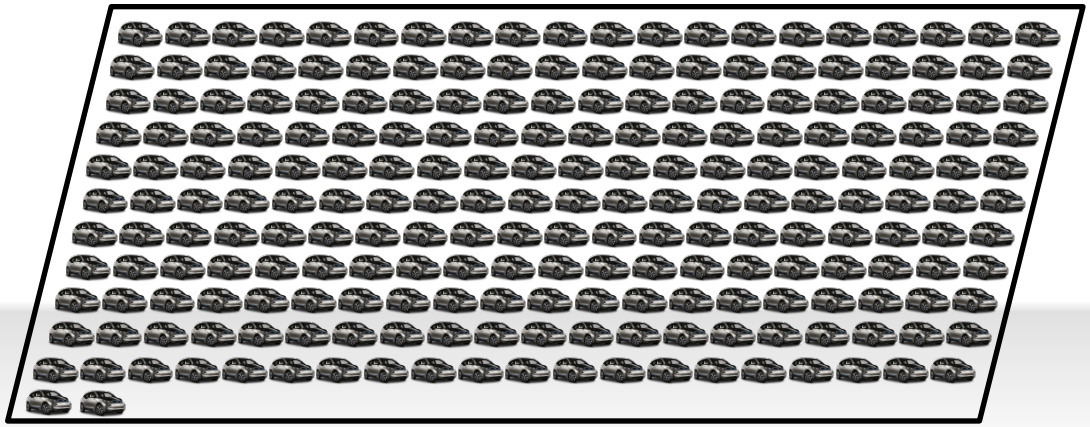
Chemical Power Storage vs e-mobility

1 cubicmeter of liquified power e-Methanol compares with **222** BMW i3!*



1 m³ CH_3OH

=



*Speicherkapazität BMW i3 beträgt 21,6 kWh

Market Opportunities

Description of the market opportunities of the e-Methanol

1. High energy content (15.67 MJ/l vs. 8.50 MJ/l H_2)
2. M3 "Drop-in" transportation fuel in addition to BioEtOH
3. Higher blend with adjustments in the vehicles
4. E-MTBE in competition to Bio ETBE and MTBE
5. Auxiliary material in the Biodiesel production
6. Power generation in small scale CHP´s (BHKW´S)
7. Basic building block for chemical production

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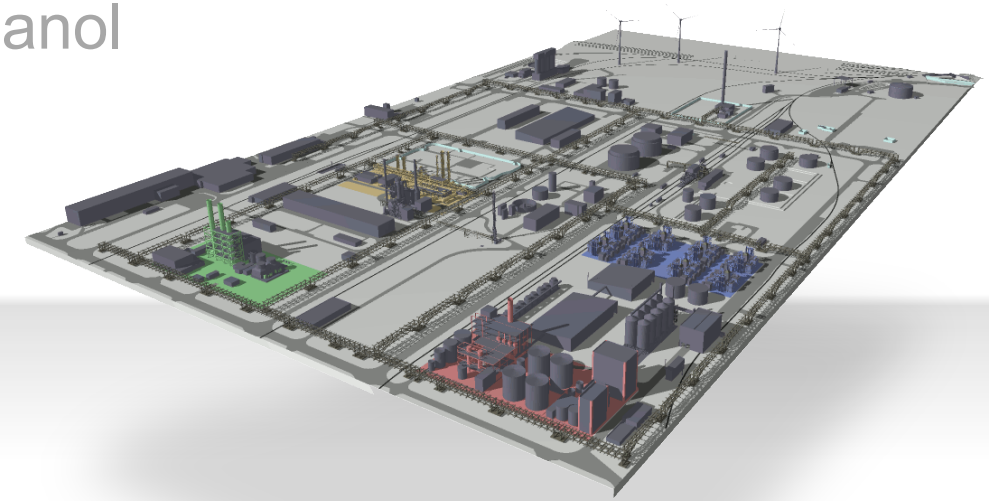

Renewable Energy Directive (2009/30) & Fuel Quality Directive (2009/28)

The amended FQD and RED introduce RED-Annex IX advanced fuels and feedstocks:

(a) renewable liquid and gaseous fuels of non-biological origin	**Power to X**
(b) carbon capture and utilization for transport purposes	**Carbon to fuel**

Power to X and Carbon to fuel is there

The emission intensity of needed power is emission intensity of the national grid -
Then PtX is not a sustainable product and is not a recognized product

Or

Power is supplied by a renewable energy production with no grid connection -
then PtX is not in sufficient production

In contradiction to Annex IX is Article 15 RED, where the energy supplier is allowed to supply renewable power with guarantees of origin.

GHG Saving Methanol

Stand Alone - Outlook

Definition of Methanol as e-Methanol in the RED/FQD?

Article 2 Number 10 FQD (NEW):

"renewable liquid and gaseous transport fuels of non-biological origin" means liquid or gaseous fuels other than biofuels whose energy content comes from renewable energy sources other than biomass, and which are used in transport;

ANNEX IX Part A. RED (NEW):

"Feedstocks and fuels, the contribution of which towards the target referred to in the first subparagraph of Article 3(4) shall be considered to be **twice their energy content**:

(r) Renewable liquid and gaseous transport fuels of non-biological origin.

(s) Carbon capture and utilisation for transport purposes, if the energy source is renewable in accordance with point (a) of the second paragraph of Article 2."

GHG Saving Methanol

Stand Alone - Outlook

The value of fuel is determined by Art. 7a FQD.

Counting the energy content of e-methanol twince onto the share of energy from renewable sources in all forms of transport in 2020 increase the value.

1 MJ e-methanol = 2 MJ e-methanol as renewable transport fuel

e-mobility: 5 times counting for renewable energy in electric vehicle and 2.5 times counting for renewable energy in electric train

Power to transport sector must be considered

GHG Saving Methanol

Stand Alone - Outlook

Definition of Methanol as BioMethanol in the RED/FQD?

Article 7 paragraph 2 FQD:

- obligation to 6 % GHG-saving
- indicative target 2 % GHG-saving with technology capable of reducing life cycle greenhouse gas emissions per unit of energy from fuel

No changes on GHG-saving target but on renewable target

Article 4 paragraph 3 (e) (new):

- indicative target of 0.5% RED-Annex IX

GHG Saving Methanol

Power Input

According Annex V Part C No 11, the GHG intensity of the production power process has to be considered in the calculation of actual value.

To reach the 60% target for Biofuel the power has to be less than 60 gCO_2/kWh (standard value in Germany is 527 gCO_2/kWh).

The default value has to be defined for chemical energy storage in 2017 .

NON GO aspect for e-fuel!!!!!!

Contradiction to Article 15 RED, which ensures the use of RES by final consumer.

Power from the grid must consider guarantees of origin!

Power Price Components

Power for Chemical Power Storage

In order that power can be stored in chemicals, then the final product has to be taxed.

If this becomes the case than, there will be a sustainable business case for investments.

Clarification of the power price components!

Regulation to reduce CO_2 emissions from new passenger cars (333/2014)

In 2021 manufacturer of cars must comply with the threshold of 95 gCO_2/km for their sold car fleet. Basis for calculation is the actual GHG-emission of the used fuel. Fuels with GHG-savings from life-cycle assessment don‘t have a legal impact on the fleet mix. Three major exceptions are:

- Emission innovative technology packages, which shall be used to reduce the specific emission target of a manufacturer up to 7 gCO_2/km.

- Alternative fuel vehicle (a vehicle designed to be capable of running on at least one type of fuel that is either gaseous at atmospheric temperature and pressure, or **substantially non-mineral oil derived**) ← **Not implemented for M 85, Biomethane**

- The definition for electrical vehicle is zero CO_2 Emissions

Power-to-X is not recognized

Directive on internal market in electricity (2009/72)

The liberalization of the electricity market aims a Europe-wide competition in the electricity production or their resale and import. Therefore the separation between Producer, Transmitter and Supplier is implemented.

With the foundation of European Network of Transmission System Operators for Electricity (Entso-e) and the International Grid control Cooperation (IGCC) the market is liberalized, but not implemented in the infrastructure.

With the missing grid infrastructure
large scale energy storage is needed

According to the Emission trade system the export from Power between the Member states is CO_2-free power supply for the national balance.

With the production of *e-fuel* power can be stored and power exports, which are disadvantageous in the national CO_2 balance, can be prevented and fossil fuel imports can be replaced.

Trend beyond 2020

EU Energy Roadmap 2050 (dated 2011)
defines the post 2020 targets in a decarbonization strategy of the European Union

Carbon Capture and Storage (CCS) is considered as system solution from 2030 on, but acceptance of the population can not be assumed anymore.

Instead of that Carbon Dioxide Utilisation (CDU) CCRecycling, CCUtilization becomes the answer for a Low Carbon society.

„Of special importance is the shift towards alternative fuels, including electric vehicles."

„In transport, a mix of several alternative fuels will be needed to replace oil."

Commission July 2015
Electricity and other fuel use in transport

„The share of renewable electricity is expected to increase significantly until 2020 and beyond. Given the move towards a low carbon electricity mix, both electrification of transport and the use of renewable hydrogen could contribute to the decarbonisation options of the transport sector."

Uncertainty in the currently developing legal framework doesn't provide needed planning reliability. For this reason we suggest to initiate an interest group.

The foundation of an *e-fuel* Association is needed

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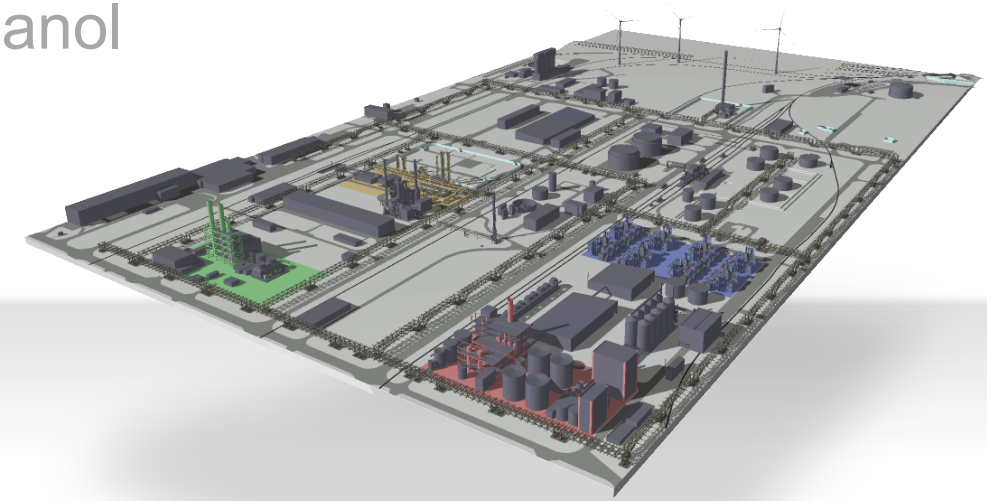


GAP

German Model supports PtX

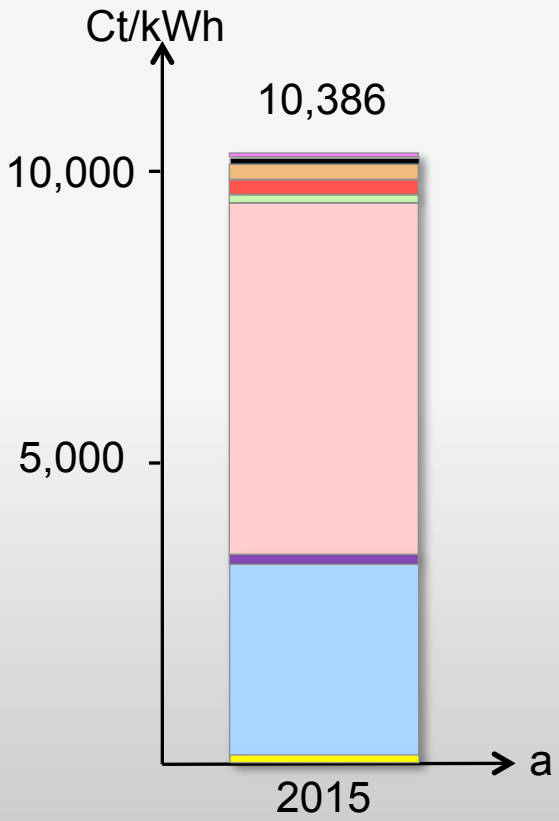
- If renewable methanol market then power must be green without CO_2 footprint
- Alternative is fossile methanol market
- Green power = power under the Renewable Power Act
  - Renewable power can be feed-in with guaranteed feed-in tarifs, but can alternatively be market directly (Direktvermarktung). A certain amount of feed-in power must be market directly.
  - If no feed-in or direct marketing Guarantees of Origin can be issued

No Contradiction to Article 15 RED

- Goal in Germany is flexible operation of power consumption (+/- market of power range)

Power Price Components

including fees ex tax



		costs Ct/kWh
Detachable load levy	§18 AbLaV	0.006
Concession levy	§2 (3) KAV	0.110
System Usage Charge levy	§19 (2) StNEV	0.237
Offshore levy	§17f EnWG	-0.051
Margin Trader		0.050
EEG levy	§ 41 EEG	6.170
CHP levy	§ 9 (2) KWKG	0.254
Power Price		3.500
Power Grid Costs (Delivery Costs)		0.110

GHG Saving Methanol

Stand Alone - Outlook

Definition of Methanol as BioMethanol in the RED/FQD?

Article 7 paragraph 6 FQD (NEW):

"6. The Commission shall be empowered to adopt no later than 31 December 2017 delegated acts in order to establish **greenhouse gas emission default values**, where such values have not already been established prior to 5 October 2015, as regards:

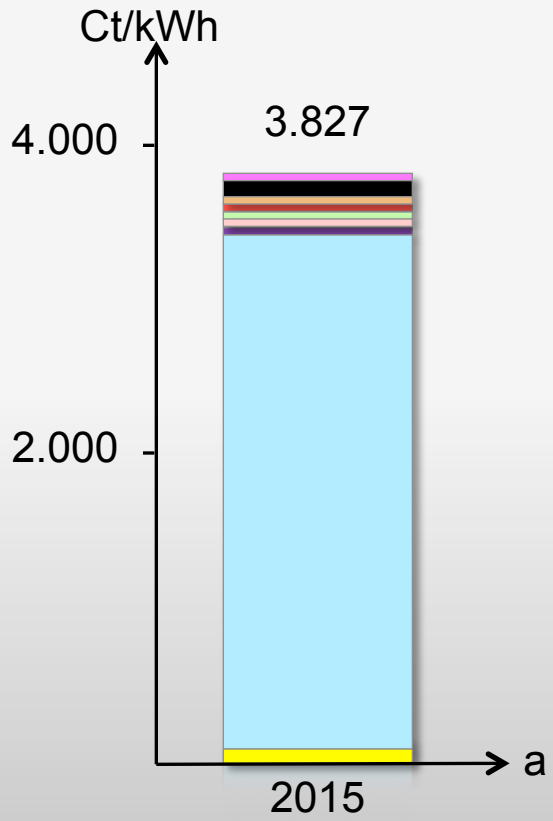
(a) renewable liquid and gaseous transport fuels of non-biological origin;

(b) carbon capture and utilisation for transport purposes."

Clarification now needed

Power Price Components

Composition energy intensive industry



		Costs Ct/kWh
Detachable load levy	§18 AbLaV	0.006
Concession levy	§2 (3) KAV	0.110
System Usage Charge levy	§19 (2) StNEV	0.025
Offshore levy	§17f EnWG	-0.051
Margin Trader		0.050
EEG levy	§ 41 EEG	0.052
CHP levy	§ 9 (2) KWKG	0.025
Power Price		3.500
Power Grid Costs (Delivery Costs)		0.110

Conclusion

- Chemical Energy storage is technical possible
- CO_2 as reasonable feedstock is available
- Industrial implementation is competitive
- Sustainable Framework is not in place

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