Underground Sun Conversion
Natural gas in a sustainable carbon cycle

Highlights of Energy Research 2018

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Challenges to meet for the future

• Ambitious goals set on COP21, Paris and within the EU to reduce green house gas emissions call for **research and innovation**

• Urgent development of renewable energy goes along with the need for **large scale, reliable storage solutions**

• **RAG among the leading storage operators** in Europe
  - 66 TWh volume; 30 GW withdrawal-rate

• RAG started several years ago with research activities in Power-to-Gas = Conversion of volatile energy from PV and wind into the energy-carrier gas

• RAG feels confident, that the integration of **power- and natural gas system** is part of the solution
Electricity Storage ≠ Energy Storage

Power Generation from renewable sources

Electricity Storage

Grid Balancing Day-Night Shift

H2, Methane → Gasgrid

Gas Storage = Energy Storage

20% Electricity
30% Mobility
50% Heating/Cooling Industry

Energy Demand
In our first flagship project „Underground Sun Storage“ we assessed hydrogen admixture and its behavior in natural gas reservoirs (underground gas storage facilities).

- No curtailment of storage integrity detected
- No H2S detected
- No decrease of permeability, no pore glogging
- Good analogy between lab-tests and field test
- Handling within the existing legal framework
- Discovery of future potential
Conclusion – Field Experiment

• Laboratory tests and „in situ“ experiments suggest a natural conversion of Hydrogen and CO2 to Methane (= natural gas) in suitable underground gas reservoirs

• Due to these results the follow up project Underground Sun Conversion was initiated:

  • → renewable natural gas made in the reservoir by an natural microbial process

  • = Geological history in fast motion
    – recreation of natural genesis of gas
Changes in gas composition
Microbiological Consortia (Orders)
Natural gas in a sustainable Carbon cycle

Electricity generated by solar and wind power will be converted to hydrogen by electrolysis.

Micro-organisms convert injected hydrogen (H₂) and carbon dioxide (CO₂) into renewable natural gas (CH₄) and water (H₂O).

Using existing natural gas reservoirs for conversion and storage of renewable energy.
High potential for the future

- Establishing a sustainable carbon cycle
- Seasonal storage of renewable energy
- Future use for existing infrastructure (grids, storages, appliances)
- Renewable gas for heat market and heavy duty mobility
- Import of renewable energy to Europe as gas
  - Decarbonizing despite missing production potentials of renewables
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Thank you for your kind Attention!