

# Huge subsurface storage potential for excess energy already available in Germany

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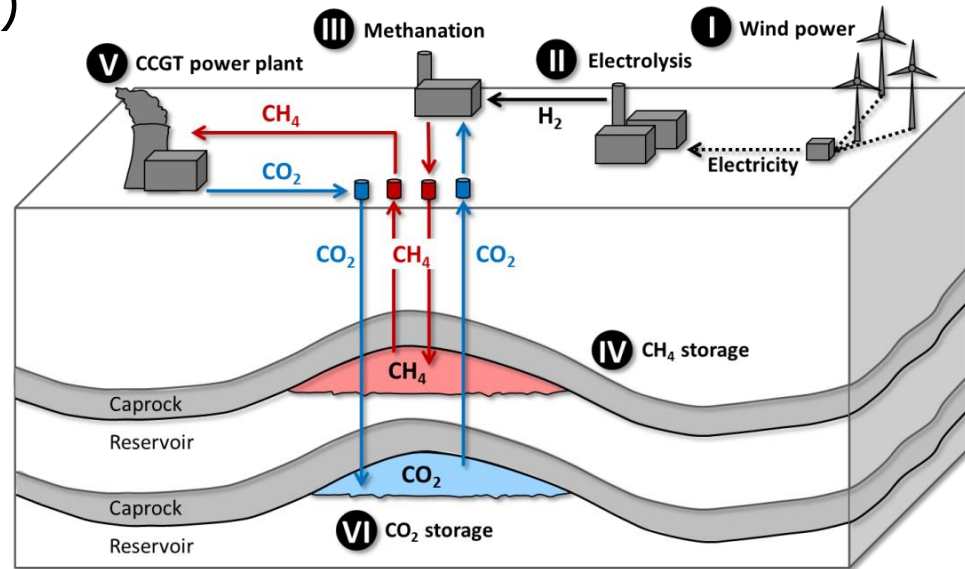
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European Geosciences Union, May 7<sup>th</sup>, Online  
Process quantification and modelling in subsurface utilisation

# Integrated and flexible underground storage of renewable excess energy

- Power-to-Gas-to-Power (PGP) as **extension** of conventional Power-to-Gas (P2G)
- Closed **carbon cycle**
  - I. Excess **renewable energy**
  - II.  $H_2$  produced by **electrolysis**
  - III.  $CO_2$  from storage with  $H_2$  gives  $CH_4$
  - IV.  $CH_4$  stored underground
  - V. **Power production** from  $CH_4$  with  $CO_2$  separation
  - VI.  $CO_2$  storage underground



# Regional showcase to demonstrate applicability of the extended concept

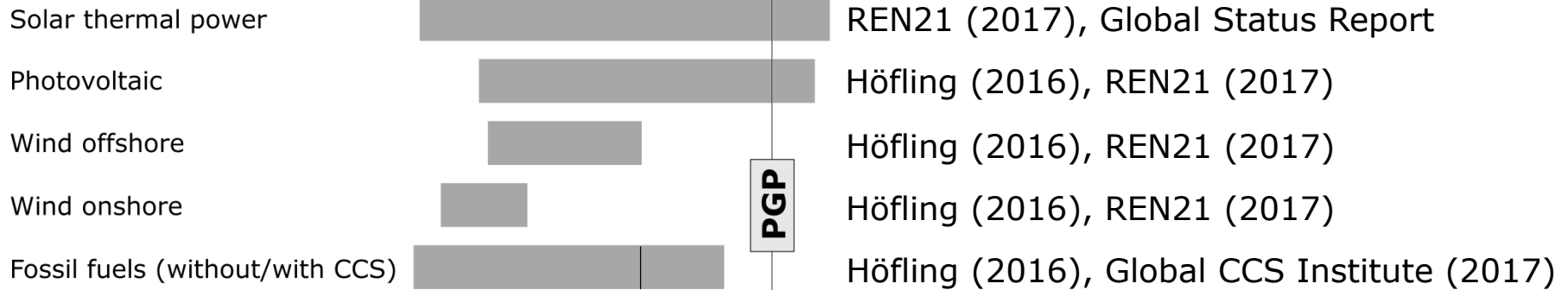
- Using 17% of the renewable electricity generated in the State of Brandenburg are required to provide 30% of electricity for the city of Potsdam by synthetic methane
- What are the overall efficiency and total capacity of such a PGP closed carbon cycle?
- What are the energetic costs for coupling the P2G concept to geological storage reservoirs for CH<sub>4</sub> and CO<sub>2</sub>?



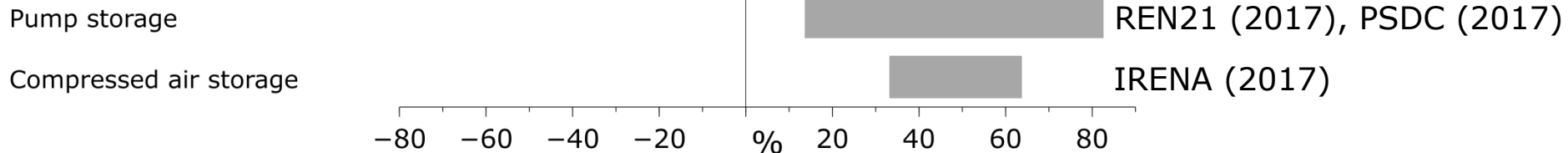
Streibel et al. (2013)

# PGP is economically viable compared to other energy storage technologies

## Energy production technologies



## Storage technologies



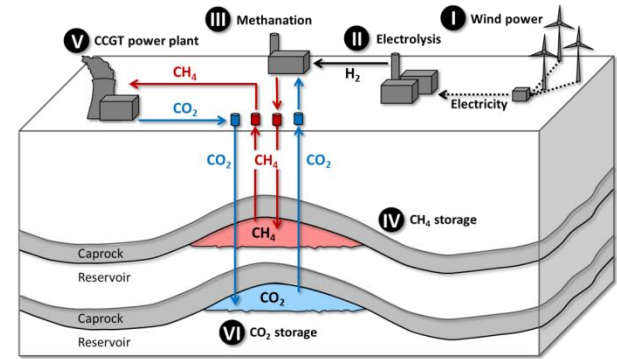
# Potential within the German subsurface to store excess energy is enormous

**Motivation:** intermediate option to reduce greenhouse gas emissions while hydrogen storage is still under research and development

**Methods:** taking into account the actual German storage capacity for natural gas

**Results:** optimal depth range for combined storage allows for 10 sites with a capacity of >85 TWh for renewable excess energy

**Conclusion:** >15 times actual requirement



## Energy production technologies

