Timing of CCS in the Netherlands

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Timing of CCS

Timing plays an important role during the development of a Carbon Capture and Storage (CCS) based energy system. The following events need to coincide or tuned to each other:

- **Climate policy** should be in place at the time investment decisions are to be made.
- Capture and storage should be **affordable in time** (compared to other CO_2 abatement options).
- The **vintage structure** and development of **electricity demand** determine when new power plants with CCS could be built.
- **Sinks**, where the CO_2 can be stored, must be **available** in time.

The Netherlands

The Netherlands has a number of characteristics that make it an interesting country for CCS deployment:

- It has a high fossil energy use
- Relatively limited potential for renewable energy
- A well developed natural gas infrastructure
- Good storage possibilities and many large point sources of CO_2.

Objective

This research project aims to investigate how events interact in a CCS deployment trajectory and to what extent planning is necessary.

Methodology

- A quantitative analysis of the Strong Europe (SE) scenario for the electricity sector in the Netherlands. In the SE scenario international cooperation and social motivations prevail.
- The scenario study is based on a cost minimisation approach within the time horizon 2000 to 2050.
- Different variants of SE are defined in which the dynamic factors are varied as follows:
  - A moderately strict versus a very strict climate policy.
  - Slow versus fast learning of CCS technologies in comparison with competing options.
  - A low versus a high electricity demand growth
  - A slow versus a high replacement rate of power plants
  - An optimistic and pessimistic view with regard to suitability of sinks
- The optimisation model MARKAL is used to find optimal timing of CCS trajectories for each variant.

Climate policy variants

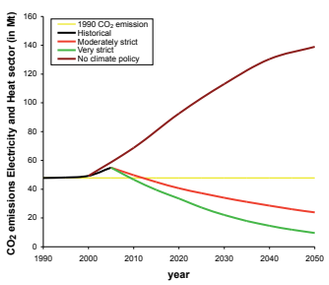


Figure CO_2 emissions of Dutch public electricity and heat sector

- The EU aims to agree on reducing European GHG emissions with 15% – 30% in 2020 and around 60% – 80% in 2050.
- CO_2 emissions have to be reduced with more than 100 Mt in the electricity sector (compared to a base case without climate policy) to reach these targets, if
  - reductions efforts are evenly distributed over the sectors, and
  - reductions are not met by Joint Implementation or Clean Development Mechanism projects.

Vintage structure variants

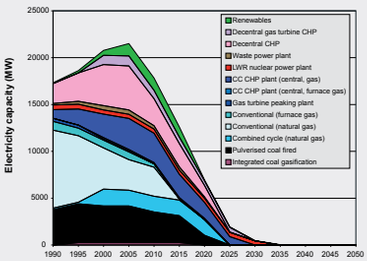


Figure Vintage structure 'Normal'

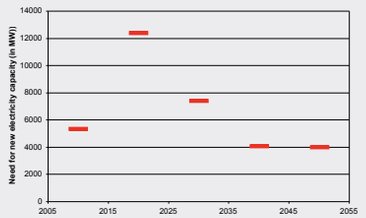


Figure Need for new electricity capacity over time

This vintage structure is based on 25 year life time of power plants. However, it also includes all known plans of power companies to extend the life time of power plants to around 35 years. In this situation there is a relatively short period for large scale introduction of CCS, because the majority of new capacity needs to be built around the year 2020.

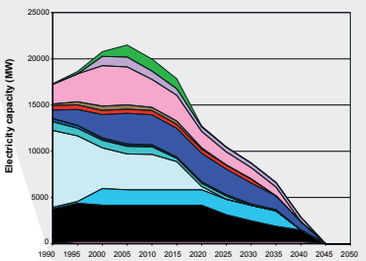


Figure Vintage structure 'Prolonged'

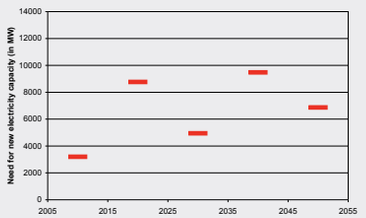
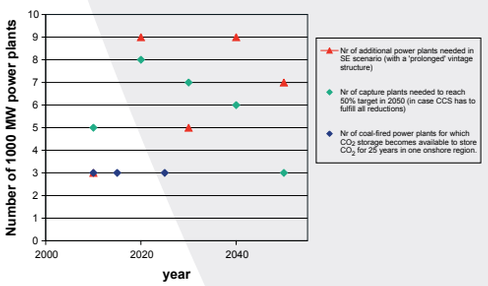


Figure Need for new electricity capacity over time

Due to the liberalisation of markets the life time of power plants might be longer than currently anticipated (40 – 50 years). This results in the above vintage structure. Prolonging the life time of power plants delays the construction of power plants. Opportunities for CCS are more evenly distributed over the first half of the 21st century.

Timing of events (preliminary results)



- A slower replacement of the electricity park is not a barrier for achieving a 50% reduction in 2050.
- Preferably already around 2010 a great effort should be made to build electricity capacity with very low CO_2 emissions in order to reach 15% reduction in 2020 and 50% reduction in 2050. Although there is a need for new power plants around that time, it is not expected that CCS will be affordable yet to be deployed at large scale.
- CO_2 onshore storage becomes available for 6 coal-fired power plants before 2015 (in the east and the north of the Netherlands). This is also too early for CCS. Therefore, it is important that these fields are not abandoned so that it is prevented that the land will be used for other functions like housing.

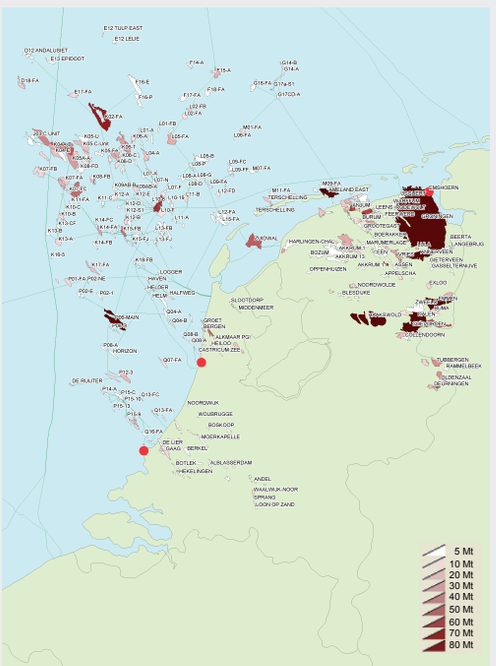


Figure CO_2 storage in gas and oil fields + probable locations for new power plants

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