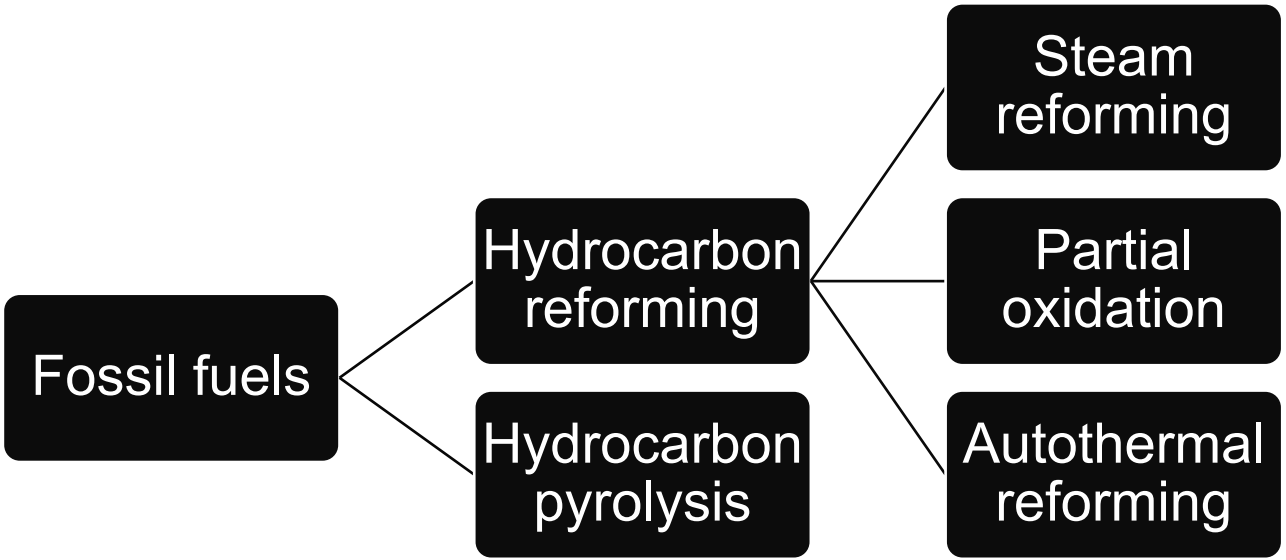
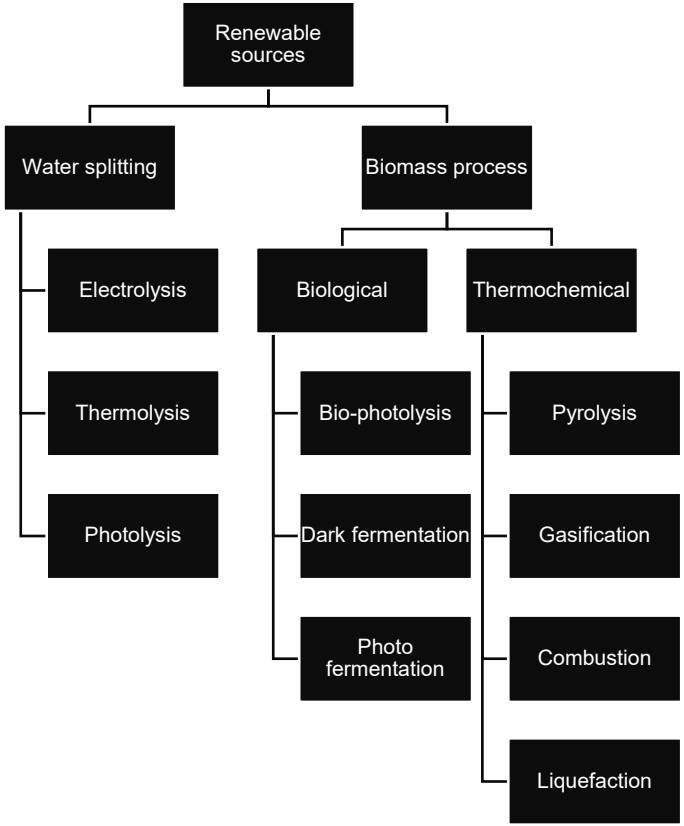
Introduction to Hydrogen Economy

Aalto University
School of Electrical
Engineering

Hydrogen production from fossil fuels



Hydrogen production from renewable sources



Hydrogen production in 2022 and until 2030 globally

Source: Global Hydrogen Review 2023 (windows.net)

Aalto University
School of Electrical
Engineering

Matti Lehtonen

14.12.2023

Hydrogen production 2022

- Hydrogen demand reached a historical high in 2022, but it remains concentrated in traditional applications (based on fossil fuels)
  - Global hydrogen production reached almost 95 Mt
- The production was dominated by the unabated use of fossil fuels:
  - Natural gas without carbon capture, utilisation and storage (CCUS) 62%
  - Unabated coal (mainly located in China) 21%
  - By-product hydrogen, which is produced at refineries and in the petrochemical industry 16%

Low-emission hydrogen production

- Low-emission hydrogen production in 2022 was 1 Mt (0.7% of global H2 production)
  - Low-emission production was produced almost entirely from fossil fuels with CCUS.
- Production from water electrolysis continued to be relatively small, still below 100 kt
  - However, there was a 35% growth compared to the previous year
- A large number of low-emission hydrogen production projects are under development
  - Half of the produced hydrogen from the announced projects by 2030 comes from projects that are today undergoing feasibility studies, followed by projects that are at very early stages (more than 45% in terms of production level).
  - Projects that are currently under construction or have taken a final investment decision (FID) account for only 4% of the announced projects in terms of production.

Low-emission hydrogen production

- Water electrolysis accounts for just 0.1% of today's global hydrogen production, but installed capacity and the number of announced projects have been growing rapidly in recent years.
    - More than 70% of low-emission hydrogen production in 2030 could come from electrolysis.
    - However, 55% of the announced electrolyser projects are at early stages of development.
- Annual production of low-emission hydrogen could reach 38 Mt in 2030
- 17 Mt come from projects at early stages of development
- The potential production by 2030 from announced projects to date is 50% larger than it was at the time of the release of the IEA's Global Hydrogen Review 2022.

Natural hydrogen -

Does it exist?

Aalto University
School of Electrical
Engineering

Natural hydrogen

- The common understanding has been that hydrogen rarely exists in pure form and is generally combined with other atoms, and therefore has to be produced by splitting atoms.
- Natural – or sometimes called “white hydrogen” has been considered to be rare
- However, some researchers believe that cheap, vast, and potentially renewable sources of natural hydrogen sit underground
- Hundreds of so-called hydrogen seeps have been documented around the world
- If you are interested in learning more, see **Hidden hydrogen: Earth may hold vast stores of a renewable, carbon-free fuel | Science | AAAS**