CO_2 Removal and Gases: Hydrogen from SMR CCS

More than 95% of bulk hydrogen produced in the world today is from steam methane reforming (SMR) of methane source, such as natural gas.

In steam methane reformation, methane (CH_4) is reacted with steam in the presence of a catalyst to produce hydrogen, carbon monoxide and a relatively small amount of carbon dioxide. Subsequently, in what is described as "*water-gas shift reaction*," the carbon monoxide and steam are reacted using a catalyst to produce carbon dioxide and more hydrogen. In a final process step called "*pressure-swing adsorption*," carbon dioxide and other impurities are removed from the gas stream, leaving essentially pure hydrogen.

If the SMR production units are fitted with carbon capture and storage, the CO_2 emanating from these units can be captured and stored such that the production process becomes low carbon intensive.

The reserve of natural gas in Nigeria, currently estimated as 203 TCF, points to a huge potential for utilization of this resource for hydrogen production in the country.

Key Interaction

In the hydrogen supply priority list, hydrogen from SMR with CCS is considered as the second option. Total demand for hydrogen depends on the degree of conversion of the gas network into hydrogen and the level of demand for gaseous fuels in major sectors: buildings, industry and transport.

Level 1

No hydrogen is produced from SMR with CCS in Nigeria.

Level 2

Hydrogen production from SMR with CCS rises to 16.7 TWh/year.

Level 3

Hydrogen production from SMR with CCS rises to 30 TWh/year

Level 4

Hydrogen production from SMR with CCS rises to 59 TWh/year, equivalent to the maximum amount of energy required to satisfy the demand for heating and transport in the country, assuming full transition to hydrogen use.

Default Timing - Start Year: 2035 End Year: 2060

Hydrogen Production

Sub-lever	Units	2015	Level 1	Level 2	Level 3	Level 4
SMR with CCS	TWh/year	0	0	16.7	30	59