

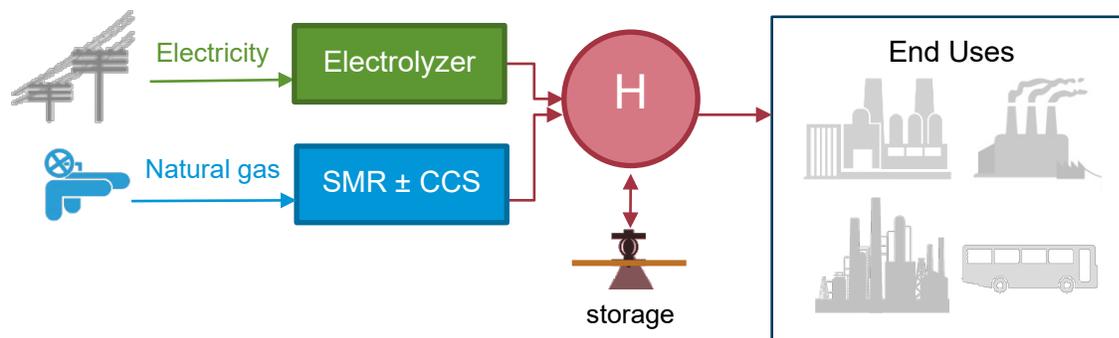
Annual Energy Outlook 2025 Fact Sheet: Hydrogen Market Module

We have introduced a new Hydrogen Market Module (HMM) to represent the domestic hydrogen market in the *Annual Energy Outlook 2025* (AEO2025). Representing an integrated hydrogen market in the National Energy Modeling System (NEMS) allows us to analyze the potential growth in hydrogen use as a clean energy source and to reflect current laws and regulations in our projections. The HMM allows us to evaluate the mid- to long-term impacts of policies, laws, and regulations governing hydrogen markets, such as the Section 45V hydrogen production tax credits in the [Inflation Reduction Act](#) (IRA). Given the uncertain future of the hydrogen market, this new module also allows us to evaluate the possible roles of hydrogen in alternative scenarios that make different assumptions regarding competing fuel prices, technological learning, and hydrogen demand compared with our Reference case.

The HMM projects hydrogen production by technology and connects the sources of hydrogen supply to existing and future hydrogen consumers. HMM demands electricity and natural gas from other NEMS modules, transforms those fuels into hydrogen, and delivers that hydrogen to consumers.

For AEO2025, HMM focuses on representing a simplified U.S. hydrogen market that integrates with other NEMS modules and reflects key market dynamics. Within NEMS, HMM represents the following elements of a domestic hydrogen market:

Schematic of hydrogen (H₂) market representation in HMM, AEO2025



- Economic competition between three hydrogen production technologies
 - Steam methane reforming without carbon capture and sequestration (CCS)
 - Methane reforming with CCS
 - Electrolysis using electricity from the grid
- A balanced market where hydrogen demand equals hydrogen supply
- Delivered end-use prices to sectors that could consume hydrogen in AEO2025: the industrial, transportation, and electric power sectors

- Energy use and emissions associated with hydrogen production
- Policies such as the IRA that affect hydrogen production and prices:
 - Section 45Q CO₂ sequestration incentives
 - Section 45V hydrogen production tax credits and related IRS guidance, including adherence to incrementality, regionality, and hourly time matching requirements
- Expansion and builds of hydrogen-related infrastructure
 - Limited expansion of interregional pipelines
 - Seasonal storage

In addition to developing the HMM, we are changing NEMS by modifying the existing consumption representation for ammonia plants and refineries and adding new potential sources of hydrogen demand for the industrial, transportation, and electric power sectors.

Hydrogen in AEO2025 Publication Tables

Hydrogen projections can be found as part of several of the published AEO2025 data tables, including both as modifications to existing tables and newly created tables for AEO2025:

- New publication tables
 - Table 19, *Hydrogen Supply, Disposition, and Prices*, added national hydrogen production, consumption, and price projections in physical units (million metric tonnes).
 - Table 73 and Tables 73.1–73.9, *Hydrogen Market Projections*, added national- and census division-level projections of hydrogen supply, consumption, and prices in energy units (trillion British thermal units).
- Changes to existing tables
 - Table 2, *Energy Consumption by Sector and Source*
 - Hydrogen is now explicitly accounted for as a delivered fuel for energy or feedstock use by sector.
 - Energy converted to hydrogen (for example, natural gas and purchased electricity) are separately accounted for outside of delivered energy.
 - Detail for hydrogen-related losses was added to ensure balancing with regards to total delivered energy.
 - Table 3, *Energy Prices by Sector and Source*, now reports hydrogen delivered prices to end-users.
 - Table 6, *Industrial Sector Key Indicators and Consumption*, expanded industrial consumption accounting to include totals with and without the energy used to produce hydrogen.
 - Table 11, *Petroleum and Other Liquids Supply and Disposition*, includes hydrogen as a feedstock supplied to refineries in the total accounting.
 - Table 13, *Natural Gas Supply, Disposition, and Prices*, separately accounts for consumption of natural gas for production of hydrogen.
 - Table 24, *Refining Industry Energy Consumption*, now includes hydrogen feedstocks consumed by refiners.