Global Pathways Analysis Tool (GPAT)  
(Sandia National Laboratories)

Objectives
Calculate least-cost pathways for hydrogen supply for eight participating countries: France, Germany, Norway, Spain, Sweden, Denmark, Japan, and the United States (U.S. further divided into eight regions to allow for additional regional analysis; additional countries could be added as data becomes available). The objective is to match country level demands for hydrogen with lowest cost supply options for each country.

Key Attributes & Strengths
Hydrogen pathways include consideration of feedstock, conversion, distribution (regional and long-distance), and carbon costs. Inter-regional transfers of hydrogen are taken into account, based on total cost of producing and delivering hydrogen. Users are able to vary key assumptions, including resource availability and cost, vehicle shares and efficiencies, carbon taxes, and renewable portfolio standards, and view real-time results, making the tool ideal for policy-level discussions. GPAT also quantifies the potential reduction in greenhouse gas emissions from the transport sector.

Platform, Requirements & Availability
GPAT was developed using the Powersim Dynamic Simulation Modeling platform. Model is not yet publicly available.

Inputs
- Feedstock costs and sensitivity.
- Regional distribution costs.
- Renewable/no-GHG policies.
- Fuel cell vehicle market shares.

Assumptions & Data
- H₂ production costs calculated based on country-supplied data on feedstock availability for H₂ production by type, cost, and quantity from 2010 to 2050, and assumptions about H₂ production technology.
- For each country, H₂ demand calculated based on assumptions about future FCEV market shares.
- Where country-level data are not available, U.S.-based analysis estimates are derived from the H2A model, HDSAM, and MSM.
- All costs calculated in 2010 U.S. Dollars and assume 0.71 €/$.

Outputs
- Delivered H₂ costs broken down by category (feedstock, production, and delivery).
- Country-level H₂ pathways.
- Composition of vehicle fleet.
- GHG emissions.