World Hydrogen

Industry Study with Forecasts for **2016 & 2021**

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INDUSTRY STRUCTURE

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The Asia/Pacific region has supplanted North America as the leading hydrogen consumer, as demand is driven by the low-sulfur, cleaner burning fuels from the petroleum refining industry.

World demand to rise over 4% yearly through 2016

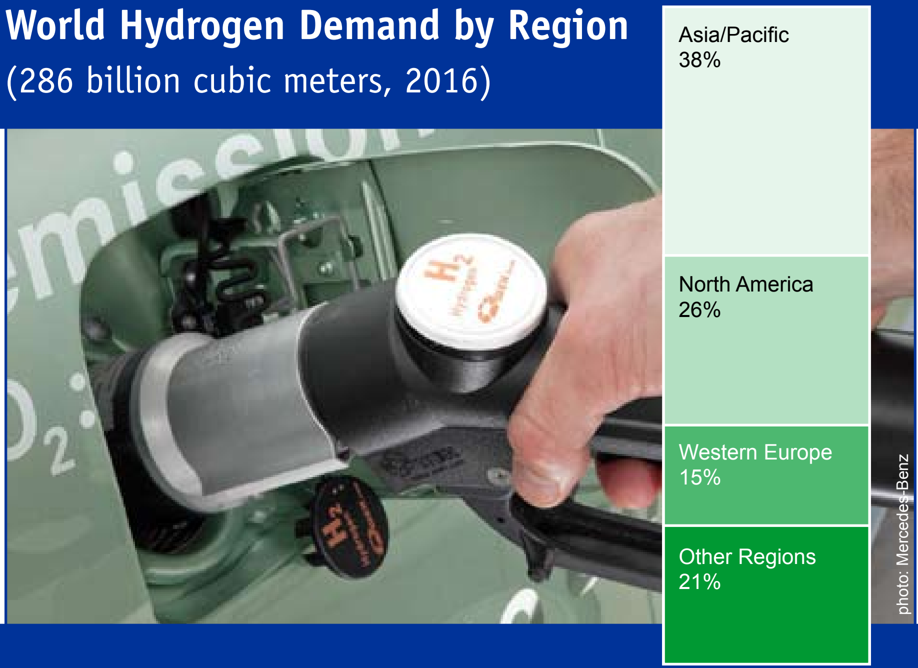
Global demand for hydrogen is projected to increase 4.1 percent annually through 2016 to 286 billion cubic meters, valued at $43.2 billion. The primary driver of this growth will be the petroleum refining industry, whose hydrogen consumption is driven mainly by the production of low-sulfur, cleaner burning fuels. Though approximately 90 percent of this consumed hydrogen is captive production liberated by oil refining processes, the balance is merchant hydrogen, usually generated by steam methane reformers.

Various countries and regions around the world have legislated carbon dioxide emission limits from the burning of hydrocarbon fuels. These are generally becoming more stringent, and as they are enacted and enforced, additional hydrogen is needed to hydrotreat petroleum to yield cleaner fuels that meet emission regulations. Also adding to hydrogen demand is the fact that the quality of crude oil feedstocks is gradually declining, leaving higher sulfur crudes that require more hydrogen to be refined.

Chemical manufacturing a large hydrogen market

Chemical manufacturing is the second largest consumer of hydrogen. Some hydrogen used by chemical and petrochemical producers is generated from process off-gas, though most is supplied by dedicated on-site hydrogen plants or purchased from merchant suppliers. In general, manufacturing and other applications, the production of semiconductors and float glass, the thermal treatment of metal components, and the hydrogenation of processed foods are the largest consumers of hydrogen.

World Hydrogen Demand by Region
(286 billion cubic meters, 2016)



Asia/Pacific region now world's largest consumer

Whereas North America led the world in hydrogen consumption in 2006, rapid growth of many national economies in the Asia/Pacific region -- especially those of China and India -- made the Asia/Pacific region the world's largest hydrogen consumer in 2011. Western Europe is third among the world's hydrogen consumers. Hydrogen consumption in Central and South America will be led by Brazil; in Eastern Europe by the economies of Russia, Ukraine, and Poland; and in the Africa/Mideast region by the oil-rich nations of Saudi Arabia and Iran.

The movement aimed at promoting hydrogen as an energy carrier and reducing emissions produced by the consumption of hydrocarbon fuels is often referred to as the "hydrogen economy." Most of the world's leading economies have financed, through public and private sectors, the ongoing development of technologies (such as fuel cells developed for motor vehicles and power generation), infrastructures, and safety codes relating to hydrogen energy. Germany, Japan and the US lead the world in commercial fuel cell demand and R&D investment. Though the hydrogen economy is slowly becoming a reality, its true promise is still decades away.

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Sample Text, Table & Chart

TABLE VI-3

**CHINA:
MARKET ENVIRONMENT FOR HYDROGEN**

Item	2001	2006	2011	2016	2021
Population (mil persons)					
GDP/capita					
Gross Domestic Product (bil 2010$)					
cubic meters gas/capita					
cubic meters gas/000$ GDP					
Refined Petro Prdts (mil metric tons)					
Chemical MVA (bil 2010$)					
Manufacturing Value-Added (bil 2010$)					
Commercial Fuel Cell Demand (mil $)					
Hydrogen Demand (bil cubic meters)					
% China					
Asia/Pacific Hydrogen Dmnd (bil cu m)					

SAMPLE TABLE

ASIA/PACIFIC

China: Hydrogen Demand

Between 2001 and 2011, China's consumption of hydro… than tripled, to 31.4 billion cubic meters valued at $4.3 billio… result of spectacular growth in all the country's key hydrogen… ing sectors. Growth in these sectors will remain healthy, furt… hydrogen … bic meters in 2016, value… billion. … r 39 percent of regional… consump… China will account for 60… the Asia/… l hydrogen demand, and… of the w…

In 2… umed 18 billion cubic m… hydroge… ery consumption in the… mand fo… is projected to advance… annually … n 2016. The rapid growth in China's refinery capacity will drive these world-leading gains, as will investment in refinery upgrades designed to broaden the range of crude oils the country can import. Chinese refiners are investing in hydrocracking, catalytic cracking, and alkylation units to maximize their output of high-value motor fuels. Also, increased used of hydroprocessing will help drive hydrogen demand as Chinese authorities step up their campaign to improve air quality by reducing sulfur levels in motor vehicle fuels. China's aggressive investment in oil infrastructure and refining capacity supports a long term strategy of making it a world-player in energy markets. The nation is also investing in petroleum infrastructure abroad in partnership with OPEC suppliers of petroleum.

Chemical manufacturing in China accounted for 28 per… nation's hydrogen consumption in 2011 -- a very large share… to that in other countries. Relative to world hydrogen consu… which chemical production accounts for an average of 12 pe… total, China's 28 percent is indicative of its status as the wor…

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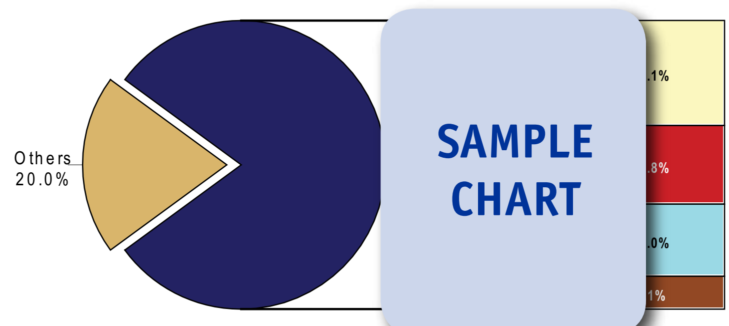
SAMPLE TEXT

CHART VII-2

**EASTERN EUROPE: MERCHANT HYDROGEN MARKET SHARE
(3.6 billion cubic meters, 2011)**



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Sample Profile, Table & Forecast

TABLE VI-4

CHINA: HYDROGEN DEMAND BY MARKET
(billion cubic meters)

Item	2001	2006	2011	2016	2021
Gross Domestic Product (bil 2010$)					
cubic meters gas/000$ GDP					
Hydrogen Demand					
Petroleum Refining					
Chemical Manufacturing					
Other					
$/000 cubic meters					
Hydrogen Demand (mil $)					

SAMPLE TABLE

COMPANY PROFILES

Messer Group GmbH
Messer-Platz 1
65812 Bad Soden
Germany
49-6196
http://wv

Sales: $)
Geograp ern Europe 30%,
South Ea China 30%, and
Other 4%
Employ y)

SAMPLE PROFILE

Key Products: hydrogen for thermal spraying, plasma arc cutting, glass polishing, carburization, food and other applications

Messer Group produces, supplies, and distributes industrial gases and related equipment for the wastewater, electrical, electronics, health services, food and beverage, glass, ceramics, metal goods, automotive, petrochemical, rubber and plastics industries. The privately held company is owned by the Messer family. In September 2011, the Company moved its headquarters from Sulzbach to Bad Soden, Germany.

The Company competes in the world hydrogen industry through the manufacture of hydrogen and a wide range of other gases for thermal spraying, plasma arc cutting, glass polishing, carburization, food, and other applications. Thermal spraying hydrogen is used primarily in the automotive, aviation, mechanical engineering, mining, and trade industries. The thermal spraying process is used to protect base metals, including steel, from corrosion, wear, and heat damage. Messer Group's plasma arc cutting hydrogen gas is used to raise cutting speed, reduce metal waste and distortion, and provide clean cut surfaces.

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"Although China's chemical industry is evolving toward greater production of specialty chemicals, the nation will remain a leading global source of both organic and inorganic chemicals. This will drive gains in hydrogen demand to 13.1 billion cubic meters in 2016 on annual growth of 8.0 percent. Linde, for example, announced in late 2011 that it will build and operate a new hydrogen plant in the Jilin Chemical Industrial Park in China's northeast region."
--Section VI, pg. 195

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Other Studies

World Catalysts

World demand for catalysts will rise 5.8 percent per year to $19.5 billion in 2016. Rapid growth will occur in both Asia and the Middle East. Brazil will lead strong growth in Central and South America. Polymerization catalysts will experience the fastest growth, driven by healthy expansion of polymer resin production. This study analyzes the $14.7 billion world catalyst industry, with forecasts for 2016 and 2021 by material, type, market, world region and for 24 countries. The study also evaluates company market share and profiles industry players.

#2989 .... February 2013 .... $6400

Flame Retardants

US flame retardant demand will rise 6.0 percent yearly to 1.1 billion pounds in 2016. The shift toward lower cost non-halogenated types will be offset by their higher loading levels. Boron compounds will grow the fastest based on rapid gains in cellulosic insulation for new home building. Construction products will be the fastest growing market. This study analyzes the 816 million pound US flame retardant industry, with forecasts for 2016 and 2021 by material, market and product. The study also evaluates company market share and profiles industry players.

#2926 .... September 2012................ $4900

Industrial & Institutional Cleaning Chemicals

Demand in the US for industrial and institutional (I&I) cleaning chemicals will increase 3.7 percent per year to $11 billion in 2016. Disinfectants and sanitizers and hand cleansers will be the fastest growing products. The manufacturing market will lead gains, driven by the food and beverage processing and fabricated metals processing segments. This study analyzes the $9.3 billion US I&I cleaning chemical industry, with forecasts for 2016 and 2021 by market, product and raw material. The study also evaluates company market share and profiles industry players.

#2916 .... July 2012.................... $5100

Specialty Fuel Additives

US demand for specialty fuel additives will grow 4.8 percent yearly to $1.6 billion in 2016. Cold flow improvers will lead gains due to the mandated use of more biodiesel, while deposit control agents will remain the most common type. Gasoline will remain the largest application. Blenders and terminals will continue as the largest market. This study analyzes the $1.3 billion US specialty fuel additives industry, with forecasts for 2016 and 2021 by additive type, application and market. The study also evaluates company market shares and profiles industry players.

#2874 ....April 2012 .... $4800

Refinery Chemicals

US refinery chemical demand will rise five percent annually through 2014, driven by the use of new, higher-value products that offer enhanced performance. Merchant hydrogen will remain the largest product type and grow the fastest. Petroleum treatment and conversion will remain the largest and fastest growing applications. This study analyzes the $5.5 billion US refinery chemical industry, with forecasts for 2014 and 2019 by application and product. It also evaluates company market share and profiles industry players.

#2629 ....April 2010 .... $4700

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