Technology Fact Sheet

Hydrogen technologies[i] /http://climatetechwiki.org/technology/hydrogen/

General description

Hydrogen is considered an important fuel for future use in transportation, central and distributed electric power, portable power and combined heat and power for industrial development. The plethora of sources for hydrogen production, along with the variety of methods to extract it, makes hydrogen a very promising fuel. The introduction of hydrogen can be feasible in both industrialized and developing countries.

Chemically bound hydrogen is found everywhere on Earth: in water, fossil fuels and all living things. Yet, it rarely exists free floating in nature. Instead, it has to be extracted from water or from hydrocarbons. Hydrogen can mainly be produced from water or fossil fuels.

Today, nearly half the hydrogen produced in the world is derived from natural gas via a steam reforming process. The natural gas reacts with steam in a catalytic converter. The process strips away the hydrogen atoms, leaving carbon dioxide as the byproduct (and, unfortunately, releasing it to the atmosphere as a global warming gas). Coal can also be reformed through gasification to produce hydrogen, but this is more expensive than using natural gas. Hydrogen can mainly be produced from water through electrolysis or from fossil fuels through the process of reforming, whereby water (H_2O) is dissolved into oxygen (O) and hydrogen (H). The hydrogen can be stored and transported and used as energy source elsewhere and/or at a later time. The energy required for these processes can be obtained from various sources, such as fossil fuels, nuclear energy and renewable energy sources, including bio-fuels.

Hydrogen can be used in transport –buses, trucks, passenger vehicles, aircrafts, and trains, with technologies being developed to use hydrogen in both fuel cells and internal combustion engines, including methanol systems. Almost all major carmakers have a hydrogen-fuelled vehicle demonstration program. Hydrogen-fuelled, internal-combustion engine vehicles are viewed by some as a near-term, lower-cost option that could assist in the development of hydrogen infrastructure and hydrogen storage technology (Sapru et al., 2002). A key advantage of this option is that hydrogen-fuelled internal-combustion engines vehicles can be made in larger numbers. Since the early 1990s, several car makers (BMW, Daimler-Benz, Mazda) have developed and tested prototype hydrogen-powered passenger cars with internal combustion engines. In addition, first fuel-cell hydrogen passenger cars are under development (e.g. Renault/Volvo - France/Sweden). To date, first city bus prototypes are under development.

Implementation –data not available.

Hydrogen is not yet commercially used in transports industry. (Technologies for Climate Change Mitigation: Transport Sector, March 2011)

Implementation barriers

- Public acceptance: creating confidence in hydrogen safe application;
- Technological and technical challenges: to develop durable, storage and use systems; to develop the infrastructure, to reduce the costs of hydrogen production (National Academy of Engineering 2004);
- Lack of the main infrastructural components are pipelines, compression, liquefaction, tube trailers, liquid and gaseous tanks, geologic storage, separation/purification, dispensers, carriers and carrier charging and discharging (Freedom Car Fuel Partnership 2005);
- Safety challenges and requirements: Safety will be a major issue for commercialization of hydrogen applications and this requires an early discussion of safety policy goals with stakeholder groups, continuing work with standards development organizations, the inclusion of safety in systems analysis, a physical testing program to resolve safety issues, and public education focusing on hydrogen safety.
- Regulatory issues: In the special case of hydrogen, existing codes and regulations usually do not include or reflect hydrogen as a product itself. For a successful and efficient planning and design process for a new technology or concept to be applied on a worldwide basis as well as for a successful marketing, an extension of such codes to the technology or concept in question is needed.

GHG emissions reduction (megatons CO_2 equivalent) – data not available.

Impact on development priorities:

a) Social

- Create jobs;
- Reduce health risks.

b) Economic

- Substantial increase of energy security;
- Improved balance of payments.

c) environmental

- Improve local air quality.

d) other

Investment – data not available.

The costs of hydrogen technologies refer mainly to the processes necessary to produce, distribute, and dispense the hydrogen. The major factors that will affect the cost of delivered hydrogen are the following:

- The feedstock and/or the major energy source with which the hydrogen is produced,
- The size of the facility at which the hydrogen is produced and the transportation requirements to deliver it to the customer,
- The state of the technology used and future improvements, and
- Whether or not the CO_2 by-product is sequestered when hydrogen is produced using fossil fuel.

However, it should be noted that there remains significant uncertainty about the actual costs of the technologies under current conditions. Considering all costs (production, storage, distribution), depending on the electric power source, indicative costs vary from 3.7 (large scale hydropower plant) to 17.5 (solar parabolic trough plants) Euro per kWh H_2.

Operation and maintenance costs– data not available.

GHG reduction costs– data not available.

Technology lifetime– data not available.

Other

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[i] This fact sheet has been extracted from TNA Report - Technology Needs Assessment for climate change mitigation - Republic of Moldova. You can access the complete report from the TNA project website **http://tech-action.org/**