

Solar Hydrogen Project at Neunburg vorm Wald, Germany

SWB
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Review of Neunburg vorm Wald Solar Hydrogen Demonstration Project

Gradual transition from natural gas to hydrogen as energy medium is realistic



Even when considered apart from the photovoltaic systems employed to generate electricity free from carbon dioxide emissions, the work undertaken in the hydrogen sector at Neunburg

vorm Wald, Germany, furnishes valuable knowledge for relevant hydrogen scenarios. Above all it has been shown that the process engineering and electrochemical focus of these hydrogen systems makes them more closely related to conventional process plant engineering and construction than might be supposed if they are ranked with renewable forms of energy.

Breaking new ground in system construction

In the course of implementing the SWB project at Neunburg vorm Wald it was made readily apparent that most hydrogen systems for energy conversion are available only in the form of prototypes or new developments at the present time. Integrating them into a feasible overall concept is often more extensive than commonly expected. Among other things, the extent and complexity of the associate peripheral systems is widely underestimated. Large-capacity hydrogen plants therefore require individual planning.

Many of the systems supplied for the project failed to work satisfactorily at the start. SWB was nevertheless successful in satisfactorily resolving, largely in collaboration with the suppliers, as good as all the problems occurring with individual subsystems and their interaction. Many improvements evolved in the process, leading to the inception of several new developments.

Such was the case with a number of crystalline solar cell technologies, the alkaline low-pressure electrolyzer, both gas-fired heating boilers, the catalytic heater and absorption-type refrigeration unit with catalytically heated desorber, operation of an alkaline pressure-type electrolyzer, the air-oxidized membrane fuel cell plant, and two advanced coupling systems together with a vehicle fuel tank system not employing cryovalves for fuelling liquid hydrogen test cars. Promoting advances in these areas is an important outcome of SWB's work and an integral part of its overall objectives.

Adequate safety ensured

In the interests of economy and an optimal level of safety engineering, facilities for production, storage and subsequent utilization of hydrogen are best centralized at one location. Plant systems for production and utilization of the gases should also be installed outdoors, not housed in a building as they were at Neunburg vorm Wald for reasons of practical test operation and security.

The experience acquired during the twelve years the facility has now been in place confirms that the overall plant - although constructed largely of prototypes - is capable of operating smoothly and in full safety. This is attributable in large part to the adequate safety engineering provided and the skills of the operating personnel.

Energy policy aspects

Owing to its favorable environmental properties, hydrogen is exceedingly desirable as an energy medium. Ecological considerations make conversion to this energy medium meaningful however only when it can be generated with primary energy that is not associated with the emission of carbon dioxide, for instance solar energy. In addition to its application as an energy storage medium to balance the supply of energy at different times and places, hydrogen can contribute to reducing local emissions in use as a heating fuel in inner city areas or as a motor fuel. As of now, road transport comprises a sizable field for adopting hydrogen as motor fuel and one that may well become reliant before long, above all in densely populated areas, on a clean fuel that lends itself well to storage.

Present-day conditions make hydrogen produced with solar energy very expensive compared to conventional energy systems, therefore it is a long way from qualifying as an economical alternative. This situation will hardly improve in the immediate future.

Accordingly it is to be expected that energy supply will remain based on a balanced mixed of energy forms for the medium term. Expediting the commercial introduction of hydrogen energy medium technology is tied to moving away from today's fossil fuels natural gas and oil to hydrogen step by step. On the technical side it is possible to do so in heating appliances and in stationary fuel cell plants as well as in mobile vehicle application. In this way the know-how already available could be profitably invested in gradually developing a world of solar hydrogen energy.

The know-how gained at Neunburg vorm Wald extends over a broad scope and is already being utilized in planning and implementing new solar hydrogen undertakings. The project has paved the way for the advent of hydrogen as an energy medium.