

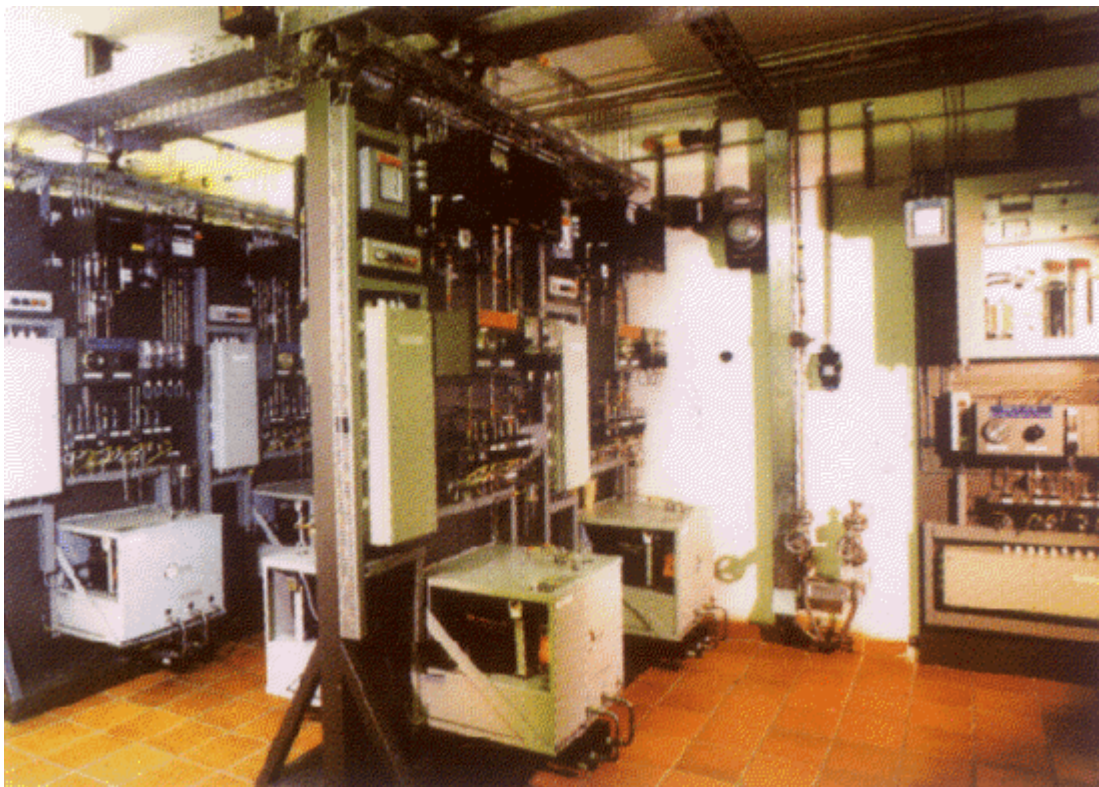
# Solar Hydrogen Project at Neunburg vorm Wald, Germany

**SWB**  
A member of the  
Bayernwerk Group



## Safety aspects

No safety restrictions on use of hydrogen as an energy medium



SWB's experience of operating safety at the facility installed at Neunburg vorm Wald, Germany, has confirmed that there is no fundamental obstacle to the introduction of solar hydrogen provided that all pertinent rules and regulations are observed.

At the same time, it has emerged that solar hydrogen systems constituting part of an energy

supply set-up are best constructed and operated as centralized facilities, not only for economic reasons but also out of operational and safety-related considerations. The production, storage and energy supply use of hydrogen - like natural gas or propane, for example - call for a proven standard of safety engineering.

### **Operation of SWB plant**

As a rule, the solar hydrogen plant at Neunburg vorm Wald is manned only on workdays. It can however be run around the clock to conduct special series of tests. With this in mind, most of the process engineering plant systems were housed inside an operating building for security reasons and to protect them from frost. Units sited outdoors are the liquid hydrogen filling station, the gas storage vessels and tank, and the absorption-type refrigeration unit, which was originally designed as an outdoor system anyway.

Under the original agreement with the licensing authorities, the systems were shut down during the time the facility was unmanned. As was to be expected, the repeated startups and shutdowns necessitated cost a lot of time, hampered the test program and moreover led to excessive wear on equipments.

In collaboration with the authorities a catalogue of measures was later worked out to allow temporary unsupervised operation of hydrogen-containing systems. From the autumn of 1997 on it was therefore possible to run the alkaline low-pressure electrolyzer, the hydrogen and oxygen gas systems, the gas-fired heating boiler, catalytic heater, absorption-type refrigeration unit and phosphoric acid fuel cell plant for maximum periods of 24 hours without manual attendance. This has since been extended to the pressure-type electrolyzer as well.

### **Safety first at all times**

Safety engineering implemented at the facility naturally included all due observance of the rules of standard practice, official safety codes for prevention of accidents and the explosion protection regulations applicable to the chemical industry. Past experience of the shareholder companies in operating power plants, designing and constructing process engineering plants and cryogenic tank systems was also put into the planning. All safety measures were defined in collaboration with the licensing authorities.

Like natural gas and many other gases, hydrogen readily ignites under certain conditions. Having no color or odor, it is not directly perceptible by humans. A number of safety provisions have been drawn up to prevent the formation of ignitable mixtures. These were generally applicable to the SWB project, but required adjustment of several details to the specific application.

All prescribed and necessary technical and structural measures to avoid ignition sources were adopted. The gas vessels are located outdoors, as is the liquid hydrogen filling station. Adequate ventilation is installed in the pertinent parts of the building. Sensors monitor every space where gas leakage might occur and trigger alarm in due time. Gas-conducting systems are purged with nitrogen prior to starting repair and maintenance work. Special rules of conduct are binding for everyone entering the facility. Adequate provisions are of course made for prevention and control of fire.

Supplementary precautions are a sophisticated safety control system, non-interruptible power supplies for the control system and all safety-related electrical equipment, specialized training of all staff, and regular inspection of all plant systems.

### **Safety to date**

The years of experience in operating the equipment have not shown any reason to tighten the safety concept as first drafted. All safety requirements are duly fulfilled. The concept developed for the overall facility and the measures implemented as a result have proved totally adequate. No fundamentally new safety risks needing attention have been identified.

Altogether, the existing codes and regulations for safe working with hydrogen, a material that has been used by industry for many years in both gaseous and liquid form, are entirely sufficient at least for industrial applications.