DIRECT SOLAR STEAM GENERATION IN PARABOLIC TROUGHS (DISS)
The first year of operation of the DISS Testfacility on the Plataforma Sola de Almería

Eduardo Zarza
Plataforma Solar de Almería, CIEMAT, Apartado 22, E-04200 Tabernas, Almería
Tel.: (34) 950 387931, Fax: (34) 950 365015, e-mail: eduardo.zarza@psa.es

Klaus Hennecke
Deutsches Zentrum für Luft- und Raumfahrt e.V., Solare Energietechnik, D-51170 Köln,
Tel.: (49) 2203 601 3213, Fax: (49) 2203 66900, e-mail: klaus.hennecke@dlr.de

Direct steam generation in the absorber is seen as a promising option to further the competitiveness of parabolic trough technology for solar thermal electricity generation. Expected performance improvements and cost reductions are the driving force behind a series of R&D projects investigating the thermohydraulic peculiarities and developing solutions for design and control of the solar steam generator.

A major milestone in this development was the implementation of the DISS Testfacility at the Plataforma Solar de Almería (PSA), a full scale solar steam generator to study the system behaviour under real operating conditions, and to develop and demonstrate appropriate components, control algorithms and operating strategies. The test loop was designed, procured and constructed during the first phase of the DISS project, with financial support from the European JOULE Programme, the Spanish and German Governments, and the participating research institutions, industries and utilities. Inaugurated on April 20th 1999, the facility is currently undergoing a comprehensive test programme.

The solar steam generator consists of a single row of 11 collectors, with a total aperture area of 2725 m_. Their design is based on the proven LS-3, with some modifications accommodating the needs of direct steam generation and special requirements of the test facility. The system is designed to be operated at outlet pressures up to 100 bar. Three different modes of operation can be investigated. Special instrumentation is provided at several positions along the loop to monitor void fraction of the flow and temperature distribution in the tube walls. The BOP equipment is dimensioned to allow the addition of a second collector row, which is planned for a later phase of the project.

During the start-up testing performed in the first half of 1999, the system was operated mainly in recirculation mode and with stable insolation conditions. The main aim of this phase was the calibration of the instrumentation and tests and adjustments of the control circuits. As expected, the steam generator worked smoothly, except for some initial leaks at 100 bar. Improving the operating procedures with growing experience significantly reduced initial long start-up times. A major drawback was the failure of the instrumentation monitoring the temperature field in the absorber tube walls. Although not essential for the initial test programme or future commercial applications, remedial action is required to allow testing to the operational limits without endangering the plant integrity.

The experience of the first year of operation of the DISS testfacility will be summarised. Problems and achievements will be presented and discussed together with lessons learned and an outlook on the next steps forward.