HYDROMATRIXÒ-TECHNOLOGY IN NEW RUN-OF-RIVER PLANTS

REINHARD PRENNER[1] and ANDREAS RAMMLER[2]

[1] M.Sc. Ph.D., Project Manager, Institute for Hydraulic and Water Resources Engineering, Vienna University of Technology, Karlsplatz 13, A-1040 Vienna, Austria
(Tel: +43-1-58801-22244, e-mail: Reinhard.Prenner@kw.tuwien.ac.at)
[2] M.Sc., Project Manager,VA TECH HYDRO GmbH & Co,
Lunzerstraße 78, P.O.Box 28, A –4031 Linz, Austria
(Tel: +43-70-6987-6097, e-mail: Andreas.Rammler@vatech-hydro.at)

At times, hydropower is the best developed and the most important form of renewable energy. In contrast to other renewable sources of electricity, hydropower plants can instantaneously respond to changing electricity demands. According to international estimations the worldwide electric energy consumption will reduplicate approximately until the year 2040. At present this electricity demand is covered by hydraulic energy generation in the range of 17 %. To satisfy the necessary requirements of a reasonable future energy mix, hydropower should contribute at least a similar or higher portion in terms to this duplication and as sustainable energy form.

More than 70 % of worldwide existing dam projects have been utilized for primary purposes like irrigation, flood protection, navigation and more, and not for the generation of electric energy. Thus the HYDROMATRIX®-concept advanced by VA TECH HYDRO GmbH & Co enables dam operators to tap the unused hydropower potential of their existing dam facilities for energy generation at extreme low costs. By this technology so called HYDROMATRIX®-modules are installed in place of stop log or gate slots of weirs, ship lock sluices, intake towers for drinking water and intake structures of irrigation systems. A HYDROMATRIX®-module basically consists of a compact grid arrangement of small turbine-generator units installed on a steel structure that contains draft tubes and other essential electro-mechanical equipment for operation. The module can be raised out of water in case of repair or revision and even can be removed at flood discharges. A turbine-generator unit (output of 300 kW up to 800 kW) consists of a stay ring with fixed stay vanes, a fixed blade propeller type runner (diameter 1000 mm up to 1320 mm) and an induction type generator directly connected to the turbine runner with a total maximum efficiency of about 85%. However, specific utilization of the HYDROMATRIX ® - technology in existing hydro civil structures have already been the subject of several previous articles. But the HYDROMATRIX®-technology will not only applied to existing hydraulic structures, it will be probably used in the next future in new barrages for electric energy production, therefore reconsideration of the design schemes of conventionally constructed power plants are required.

The use of the HYDROMATRIX® - concept in new barrages makes an adaptation of the conventional concrete weir structure to the specific module construction and the general boundary conditions at the dam site such as floodwater and operation discharge, gross head, sediment transport, size of module units and gates, etc. necessary. At present, no finished project exists but some are under feasibility studies and it seems to be only a question of time before the first low head plants will be realized by this technology.

The HYDROMATRIX®-technology offers the opportunity, assuming innovative planning, reducing the construction costs of new low-head plants up to 25% in comparison to a conventional plant. This advantage is mainly gained by omitting the construction of the power house. Consequently the required plant area is smaller which also leads to reduced environmental impacts. Extra economic advantages would result by the use of standardized electromechanical equipment that facilitates a simple maintenance.

A further attempt to refine the HYDROMATRIX®-technology has been recently finished by VA TECH HYDRO GmbH & CO by the development of the StrafloMatrix™-turbine in the frame of the HYDROMATRIX®-concept. This advanced development of the StrafloMatrix™-turbine has been made possible actually by the permanent magnet technology which avoids former occurring seal troubles. The utilization of StrafloMatrix™-turbine-generator units allows an additional optimization of the module structure in form of reduced dimensions in the direction of flow (of about 40% in comparison to the classical HYDROMATRIX®-turbine) and with about 30% less weight.

The paper presents several conceptual design studies of new low head plants developed and evaluated under consideration of their particular dominating boundary conditions. In this stage the drafts are not worked out in detail; nevertheless all proposals should give essential impulses for the further development of this promising technology enabling highly economical plant solutions.