# Research and development of promising hydrogen technologies

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In this talk, I will present our ongoing efforts in developing hydrogen technologies for electricity and heat production. Nowadays, thermal and nuclear power plants operate at working fluid temperatures not higher than 500-600 Celsius degrees. The net efficiency of such steam turbine power units usually does not exceed 42-43%. The obvious way to increase efficiency is to raise the steam temperature. However, the necessity of the usage of expensive heat-resistant alloys for the steam pipes and superheaters slows down the transition to higher working fluid parameters. The cheaper way to solve the problem is hydrogen overheating, which could be implemented by the installation of a hydrogen-oxygen combustion chamber. Cause the main combustion product is steam, it could easily mix with the main working fluid flow increasing its temperature. The issue of organizing stable and efficient combustion of the hydrogen-oxygen mixture in a high-pressure water vapor environment is one of the key issues in the creation of hybrid power units. According to the results of numerical studies, it is possible to achieve completeness of fuel combustion equal to 98% in the nominal operating mode. At the same time, reliable cooling of the flame tube will be organized. Installation of the hydrogen-oxygen combustion chambers determines the problem of increasing the capacity of turbomachines, in particular, the low-pressure turbines. The traditional way to solve this problem is to increase the blade height of the last stage, the maximum value of which today does not exceed 1460 mm. The other possible way, which was proposed by the researcher of the MPEI is the transition to a two-tier low-pressure turbine with a fork-blade of the penultimate stage. By joint efforts of the staff of the Department of Steam and Gas Turbines and the Department of Innovative Technologies for High-Tech Industries, the design of a two-tier low-pressure turbine of increased capacity was developed. The structure of the lower tier contains 5 stages and the upper one - 3 stages. In this case, the penultimate blade has a forked shape. The flow capacity of the low-pressure double-deck turbine is 40% higher compared to a traditional low-pressure turbine with a 1200 mm blade.

Bio: Senior lecturer Dr. Vladimir Kindra joined National Research University «Moscow Power Engineering Institute» in 2009 and currently is working in the Department of Innovative Technologies for High-Tech Industries. His research interests are in power generation technologies, hydrogen energy, oxy-fuel combustion power cycles, gas turbine cooling, heat transfer enhancement.