

## Boiler Design for Power Generation using Coconut Shells

G. Thivagaran, S. Tharani<sup>†</sup>, S. Vinoth and M. Pathmavel

Department of Mechanical Engineering, University of Peradeniya  
tharanis30@yahoo.com

**Abstract:** The aim of this study is to design a boiler for a small scale steam power plant and to industrialise the design, considering coconut shells; a renewable energy source with lower cost, as the source of energy. The study was concentrated on steam cycle, classifications of boilers, requirements of a perfect steam boiler, design and operation of boilers, boiler accessories, boiler selection and heat balance in a boiler. In addition analysis was done on on-going small scale power plant projects in Sri Lanka. To get superheat steam and to work with high pressure, a vertical water tube boiler was selected. The calorific value of 20,000 coconut shells was calculated by the Bomb calorimeter experiment, and the value found to be 606.4kW. The steam cycle was designed according to the available data and the boiler calculations were done by using trial and error method using ASME boiler design manual, solid work and the software ANSYS. Over view of the project design is: Available power from boiler 485.12kW, isentropic efficiency 80%, Turbine output 122.5kW, Power output 115 kW, Flow rate 0.144 kg/s, Cycle efficiency 25.2%, Overall efficiency 19%, Water tube boiler Efficiency 80%, operating pressure 30 bar, Design pressure 32.4 bar, Capacity of the boiler 522 kg/h, Mass flow rate of the water 0.144kg/s, Mass flow rate of the gas 1.66 kg/s, Heat transfer area 29.31m<sup>2</sup>, Outer diameter of a tube 25mm, Wall thickness 2 mm, Inner diameter of a tube 21 mm, Length of a tube 2.44 m, Number of tubes 160, Overall heat transfer coefficient 40.24 W/m<sup>2</sup>°C.