Tatara binary plant as shown in Fig.1 is a small scale plant located in Beppu, with installed capacity of 70 kW. It started operation in August 2014 using geothermal fluid at about 102°C from geothermal well of 550m depth, and R245fa is used as a working fluid. This geothermal fluid is first heat exchanged with the ground water which is further heat exchanged with the working fluid and finally heat depleted geothermal fluid, as well as cooling water are both mixed with ground water to make hot water for local distribution. A simulated code was developed for performance evaluation and, energy and exergy analyses on the basis of energy and mass balance equations using the Engineering Equation Solver software. Field data for simulation such as mass flow rate of geothermal fluid was collected during the early stage of plant operation while others such as temperature and pressure were collected from the power plant operation logs. The required mass flow rate for the geothermal fluid, ground water, working fluid, and cooling water are 2.9, 17, 3 and 10.3 kg/s, respectively, pressure values for these fluids are 0.5, 0.47, 6.96 and 1.15 bar respectively. Simulated results for performance evaluation revealed that the plant is operating close to its optimal conditions, with the gross output of 58.8kW. The cycle efficiency and system efficiency were calculated to be 10.5% and 6.7% respectively.

Exergy analysis was conducted for two cases: 1) power generation only 2) power generation and hot water supply. The exergy of the geothermal fluid is calculated to be 133.5kW. Fig.2 shows the exergy flow in the system for the case 2. The exergy efficiency for case 1 is calculated to be 33% whereas for case 2, the exergy efficiency is calculated to be 78%. Case 2 has high exergy efficiency compared with case 1 because a part of the wasted exergy was used for hot water supply. Tatara binary plant has proven to be a good example for cascade utilisation of low temperature geothermal resources. Rwanda could adopt the technology used at Tatara plant to utilise its low temperature resources.