Research on renewable energy sources (RES) and their integration with power grid is currently one of the priority research areas. Also undergoing significant development are energy storage systems, which can both integrate RES into the power grid and be grid balancing systems. Heat storage makes it possible to increase the flexibility of power systems by storing surplus energy in the form of heat in Thermal Energy Storage (TES) tanks, which can then be stored and used in power generation in the event of increased demand from consumers. The heat can also be used in a district heating network or other technological process.

Heat storage units and their characteristics are determined primarily by the storage material used. Among the most popular units are those that accumulate heat in liquids, such as water in district heating systems or thermal oil in solar systems. In recent years, heat storage in molten salts, which can store high-temperature heat due to their parameters, has gained popularity. The disadvantage of liquid heat storage is the self-mixing of liquids, which leads to dissipation of the stored heat. One technique for heat storage is the accumulation of energy in solid materials under the form of a rigid bed. A rock bed accumulated in a storage volume consists of relatively small elements (such as stones). The higher-temperature fluid flowing between them releases heat during the charging stage of the heat accumulator, and during the discharging stage the flowing fluid is heated. Among the most commonly proposed accumulation materials are volcanic rocks (such as basalt) or ceramic materials. These materials have a high resistance to high temperatures, which is crucial from the perspective of cyclic operation at varying temperatures.

The project focuses on the experimental and numerical study of heat transfer and accumulation processes within a rock deposit. The main objective of the project is to determine universal characteristics of energy and exergy efficiency on the basis of characteristic parameters of heat tanks. The experimental part will include the study of three geometries of the heat accumulator on the in-house laboratory stand, which is located in the resources of the Department of Power Engineering and Turbomachinery of the Silesian University of Technology. In addition, the processes of heat exchange and accumulation at different granulation of the rock deposit will be studied. Experimental results will help to perform the process of statistical evaluation of the author's numerical model, which will include the processes of heat transfer and dissipation not only within the rock deposit, but also in the wall and insulation of the heat storage tank. The comprehensive numerical model will enable multivariate numerical analysis to determine novel broad characteristics of heat storage tanks. The project's research plan consists of four interdependent stages:

- Experimental studies of the TES tank.
- Numerical modeling of the TES tank.
- Experimental-numerical data analysis.
- Preparation of scientific reports and publications.

The project, which is scheduled to be completed over 24 months, will result in the development of a proprietary methodology for selecting a TES tank depending on design parameters. A number of conference presentations and scientific publications of international scope are planned as part of the project.