Technical University of Sofia, Plovdiv Branch

Laboratory of Renewable Energy Sources, Department of Mechanics

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General description of the activities

The laboratory "Renewable Energy Sources" of the Technical University of Sofia, Plovdiv Branch in Bulgaria has a test installation consisting of solar collectors, phase change material (PCM) storage, a borehole thermal energy storage and a heat pump. Several different regimes are implemented by means of the existing installation (charging of the borehole thermal energy storage, ground-source heat pump heating, ground-source heat pump cooling and etc.).

Overview of facilities

Laboratory testing facilities

- PCM thermal energy storage charge/discharge cycle testing

Field testing facilities

- TRT equipment (heating) mounted on a caravan;
- Three test boreholes equipped with underground temperature sensors.

Computational capacities

- TRNSYS 16.1 (557 VERTICAL GROUND HEAT EXCHANGER);
- Earth Energy Design;
- GEOSYST.

Key projects

- Design and construction of a mobile testing unit for performing in-situ determination of geothermal properties of the ground and implementation of some tests at different locations in Bulgaria involving monitoring and data analysis, Funded by the Ministry of education and science, Bulgaria, 2006 - 2011;
- System for measuring and control of a hybrid thermal installation, Funded by the Technical university of Sofia, 2013 - 2014;
- Simulation and validation system for models of hybrid thermal installations, Funded by the Technical university of Sofia, 2015 – 2016.

Key references

- A. Georgiev, R. Popov, S. Stavrev. Borehole for Implementing of Thermal Response Test in the Technical University Sofia, branch Plovdiv. Proc. of the 4th Int. Scientific Conference "Energy Efficiency and Agricultural Engineering", 1-3 October, 2009, Rousse, Bulgaria, p. 525 – 530.
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- E. Toshkov, A. Georgiev, R. Popov. Measuring system of a hybrid installation with ground source heat pump and solar collectors. J. of the Technical Univ. Sofia, branch Plovdiv, "Fundamental Sciences and Applications", Vol. 20, 2014, pp. 33-38.
- A. G. Georgiev. Long term experience and research on hybrid thermal systems. Bulgarian Chemical Communications, Vol. 48, Special Issue E, 2016, pp. 7-18.
- A. G. Georgiev, R. K. Popov, E. T. Toshkov, In-situ measurements of ground thermal properties around borehole heat exchangers in Plovdiv, Bulgaria. Bulgarian Chemical Communications, Vol. 48, Special Issue E, 2016, pp. 19-26.
- N. D. Vassileva, A. G. Georgiev, R. K. Popov, Simulation study of hybrid ground-source heat pump system with solar collectors. Bulgarian Chemical Communications, Vol. 48, Special Issue E, 2016, pp. 71-76.
- R. K. Popov, A. G. Georgiev, D. B. Dzhonova-Atanasova, Parameter estimation of borehole thermal properties using artificial intelligence methods. Bulgarian Chemical Communications, Vol. 48, Special Issue E, 2016, pp. 88-95.
- T. Amanzholov, B. Akhmetov, A. G. Georgiev, A. Kaltayev, R. K. Popov, D. B. Dzhonova-Atanasova, M. S. Tungatarova, Numerical modelling as a supplementary tool for Thermal Response Test. Bulgarian Chemical Communications, Vol. 48, Special Issue E, 2016, pp. 109-114.

Additional information, remarks

TRT rig detailed information (power, heating/cooling, number of tests conducted, …)

- Heating power up to 10 kW (max value);
- 6 tests conducted;
- Test duration 5 to 10 days.

Ongoing PhD theses, research

- Investigation of Geothermal Systems, 2006 - 2010, Svetlana Barzilova, Sonia Tabakova - Aleksandar Georgiev;
- Investigation of a Hybrid System with a Ground Source Heat Pump and Solar Collectors, 2012 - 2015, Emil Toshkov, Aleksandar Georgiev - Rumen Popov;
- Modeling and Investigation of Hybrid Thermal Systems, 2014 - 2019, Nadezhda Vassileva, Aleksandar Georgiev - Rumen Popov;
- Study of Charge and Discharge Regimes of Hybrid Thermal Energy Storage System, 2014 - 2017, Bakytzhan Akhmetov, A. A. Dzhomartov - Aleksandar Georgiev.

Potential supervisors for thesis, PhD thesis, …
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