TRNSYS Software Model of Solar System with Long-Term Storage

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Abstract. The paper describes a Trmsys model of real solar heat pump system in Slatiñany, Czech Republic. The model was based on output data from the monitoring system for the year 2011 (solar irradiation, ambient temperature, heat consumption). The output data from the computed model were compared to the values recorded by a monitoring system.

Introduction

The article aims to describe a model of long-term heat storage created in the TRNSYS simulation tool [1]. The model simulates a real system installed in Slatinary (Czech Republic) in 1996. The output data from the computed model were compared to real values recorded by a monitoring system. The model was created to facilitate optimisation of the system.

System description

The system provides space heating and hot water for sheltered workshops of the Social Care Home in Slatiñany. During the summer, heat gain from the solar collector field installed at the roof of the building (absorber area 147.8 m^2) is stored in a long-term heat storage tank. The steel non-pressure water storage tank (usable volume 1083 m^3) is located outside the building and insulated by mineral wool (700 mm). During the winter, when the amount of solar radiation is limited, the energy from the long-term heat storage tank is used for space heating in the building (water floor heating, heat loss of the building is 57 kW at $\theta_c = -15 \text{ °C}$) [2], see Fig. 1.

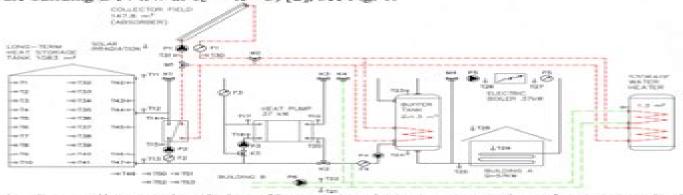


Fig. 1 — System diagram, description of key parts and measurement points of system monitoring.

If the temperature in the long-term heat storage tank is sufficient (over ca 36 °C based on heating curve), the building is heated directly using the water from the tank which enters the underfloor heating system over two buffer tanks. The water from the long-term heat storage tank is taken near the surface or from the middle of the tank and return water flows in at the bottom. At lower

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Report University of Wisconsin--Madison.** Engineering Experiment Station,1978

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development of a Virtual Building Dataset VBD of office buildings as an innovative benchmarking and classification tool The proposed methodology overcomes the difficulties and time required for collecting the necessary massive building constructional and energy bills data by creating them virtually using efficient stochastic simulation and by taking into account all parameters that may affect the energy performance and indoor thermal comfort of office buildings The knowledge and ideas conveyed by the book are supported with equations and algorithms and 137 colored figures and 55 tables and features a rich bibliography references and web sources The book contains the basic knowledge undergraduate and especially postgraduate courses on the emergent subject of energy management and saving in buildings The innovative aspects and guides of the book give serious opportunities to the postgraduate students in this scientific area to further develop their research skills and capabilities Active Solar Thermal Design Manual ,1985 **Envelope** Jorge de Brito, M. Glória Gomes, 2020-03-27 This book results from a Special Issue published in Energies entitled Building Thermal Envelope Its intent is to identify emerging research areas within the field of building thermal envelope solutions and contribute to the increased use of more energy efficient solutions in new and refurbished buildings Its contents are organized in the following sections Building envelope materials and systems envisaging indoor comfort and energy efficiency Building thermal and energy modelling and simulation Lab test procedures and methods of field measurement to assess the performance of materials and building solutions Smart materials and renewable energy in building envelope Adaptive and intelligent building envelope and Integrated building envelope technologies for high performance buildings and A Handbook on Low-Energy Buildings and District-Energy Systems L.D. Danny Harvey, 2012-08-21 Winner of cities Choice Magazine Outstanding Academic Titles for 2007 Buildings account for over one third of global energy use and associated greenhouse gas emissions worldwide Reducing energy use by buildings is therefore an essential part of any strategy to reduce greenhouse gas emissions and thereby lessen the likelihood of potentially catastrophic climate change Bringing together a wealth of hard to obtain information on energy use and energy efficiency in buildings at a level which can be easily digested and applied Danny Harvey offers a comprehensive objective and critical sourcebook on low energy buildings Topics covered include thermal envelopes heating cooling heat pumps HVAC systems hot water lighting solar energy appliances and office equipment embodied energy buildings as systems and community integrated energy systems cogeneration district heating and district cooling The book includes exemplary buildings and techniques from North America Europe and Asia and combines a broad holistic perspective with technical detail in an accessible and insightful manner

<u>Solar Energy Conversion II</u> A. F. Janzen, R. K. Swartman, 2013-10-22 Solar Energy Conversion II presents the proceedings of the 1980 International Symposium on Solar Energy Utilization held in Ontario Canada on August 10 24 1980 This book provides information on the utilization of solar energy and on the difficulties encountered in its implementation Organized into 42 chapters this compilation of papers begins with an overview of the important parameter in solar radiation

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Handbook of Heating, Ventilation, and Air Conditioning Jan F. Kreider, 2000-12-26 The building industry accounts for about 25 percent of the US gross national product through the design construction operation and maintenance of commercial institutional and residential buildings The Handbook of Heating Ventilation and Air Conditioning provides a current comprehensive review of the latest procedures and trends in the industry It combines practice and theory systems and control and modern methods and technologies to provide in one volume all of the design and operation information needed by HVAC engineers Through a link on the CRC Web site owners of the handbook can access new material periodically posted by the author Heating Load Charles Nehme, Heating Load Calculation Theory and Practice The calculation of heating load is a cornerstone of building design and thermal comfort management As we move toward more sustainable and energy efficient buildings understanding the dynamics of heat transfer and the intricacies of load calculation becomes even more critical This book aims to provide a comprehensive guide to both the theoretical underpinnings and practical applications of heating load calculations Objective The primary objective of this book is to equip engineers architects students and building professionals with the knowledge and tools necessary to accurately determine heating loads for various types of buildings Whether you are designing a residential home a commercial office or an industrial facility the principles and methodologies discussed herein will serve as a valuable resource Structure of the Book The book is divided into several key sections Fundamentals of Heat Transfer Basics of conduction convection and radiation Thermal properties of building

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and mass transfer at an urban scale while emphasizing the role played by different spatial arrangements manmade materials and green infrastructures on the outdoor microclimate The first chapters also address the implications of these factors on the outdoor comfort conditions experienced by pedestrians and on the buildings energy demand for space heating and cooling Then based upon cutting edge experimental activities and simulation work this book demonstrates current and forthcoming adaptation and mitigation strategies to improve the urban microclimate and its impact on the built environment such as cool materials thermochromic and retroreflective finishing materials and green infrastructures applied either at a building scale or at the urban scale The effect of these solutions is demonstrated for different cities worldwide under a range of climate conditions Finally the book opens a wider perspective by introducing the basic elements that allow fuel poverty raw materials consumption and the principles of circular economy in the definition of a resilient urban settlement **Insolation Data** Manual Connie L. Knapp, 1980 Monthly averaged data is presented which describes the availability of solar radiation at 248 National Weather Service stations Monthly and annual average daily insolation and temperature values have been computed from a base of 24 to 25 years of data Average daily maximum minimum and monthly temperatures are provided for most locations in both Celsius and Fahrenheit Heating and cooling degree days were computed relative to a base of 18 3 C 65 F For each station global anti K sub T cloudiness index were calculated on a monthly and annual basis Report to the United States Department of Energy, Conservation and Solar Applications, Solar Heating and Cooling Systems Development Branch, on Simulation and Design of Solar Thermal Processes University of Wisconsin--Madison. Solar Energy Laboratory, 1978

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