

TRNSYS Software Model of Solar System with Long-Term Storage

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Abstract. The paper describes a Trnsys model of real solar heat pump system in Slatiňany, 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 Slatiňany (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 Slatiňany. During the summer, heat gain from the solar collector field installed at the roof of the building (absorber area 147.8 m²) is stored in a long-term heat storage tank. The steel non-pressure water storage tank (usable volume 1083 m³) 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 $\theta_c = -15$ °C) [2], see Fig. 1.

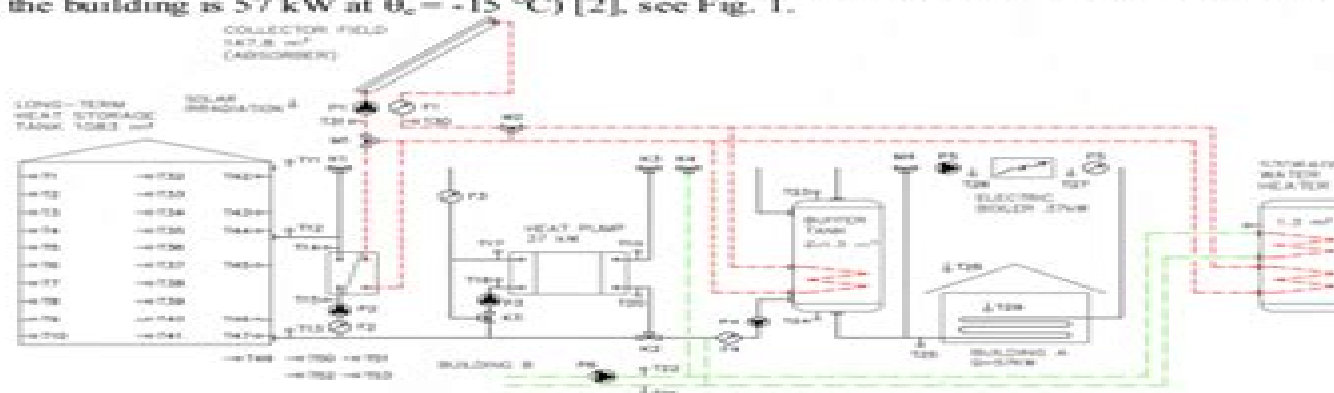


Fig. 1 – System diagram, description of key parts and measurement points of system monitoring.

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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Environmental Software Supplement Sam Stuart, 2013-09-24 Environmental Software Supplement is a supplement to the Directory of Environmental Software in Western Europe Section 13 of the report Environmental Software A Strategic Study of the European Environmental Software Market that is circulated in July 1992 This release presents additional 59 environmental software packages and revisions to three of the packages that are featured in the original report The first two chapters merely introduce and describe this book Chapter 3 is the meat of this supplement presenting the software package indices by application area one of the indices is just a supplement and the remaining ones are complete Application areas include agriculture and forestry air pollution buildings climate and meteorology energy and hazardous substances Laboratory land contamination noise pollution risk assessment survey and planning transport waste management and water pollution application areas are also listed This book is valuable to those who need a supplement to Directory of Environmental Software or those who need information on environmental software packages *Conference on Systems Simulation and Economic Analysis for Solar Heating and Cooling*, 1978 **Notice of Proposed Rulemaking**, 1979 Design and Installation Manual for Thermal Energy Storage, 1979 **Report** University of Wisconsin--Madison. Engineering Experiment Station, 1978 Solar Energy Conversion II 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 measurement This text then examines the use of solar radiation measurement the solar radiation scales the solar radiation units and the types of solar radiation Other chapters consider the general problems linked with building up data banks of observed solar radiation data This book discusses as well the fundamental modes of heat transfer The final chapter deals with the necessity to incorporate energy education into other disciplines like space geometry This book is a valuable resource for politicians government officials engineers scientists and research workers Technologists working on solar energy will also find this book useful **Geothermal Heat Pumps: Installation Guide** Stephen K. Ewings, 2008-10 Managing Indoor Environments and Energy in Buildings with Integrated Intelligent Systems Triantafyllia Nikolaou, Dionysia Kolokotsa, George Stavrakakis, Apostolos Apostolou, Corneliu Munteanu, 2015-08-22 Featuring a detailed analysis and presentation of innovative researches methods algorithms and technologies that deal with integrated intelligent systems for the efficient management of energy and indoor environment in buildings this book encompasses the regulations directives and standards regarding the energy and the indoor environment of buildings as well as a literature review and discussion on the current state of the art for buildings energy efficiency classification Maximizing reader insight into this topic with the aid of simulation models for buildings and energy audits at office buildings are presented including tables and

figures with the detailed information regarding the parameters inputs outputs and the outcomes of the surveys This book also outlines the 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

A Handbook on Low-Energy Buildings and District-Energy Systems L.D. Danny Harvey, 2012-08-21 Winner of 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

Renewable Energy Focus e-Mega Handbook Bent Sorensen, Mukesh Doble, Michel Broussely, Preben Maegaard, Frano Barbir, Gianfranco Pistoia, Soteris Kalogirou, Truman Storvick, Paul Breeze, Galen J. Suppes, Nasir El Bassam, Dr. Semida Silveira, Shang-Tian Yang, Aldo Vieira da Rosa, Harsh K. Gupta, Sukanta Roy, 2008-12-29 A one stop Desk Reference for engineers involved in renewable energies this is a book that will not gather dust on the shelf It brings together the essential professional reference content from leading international contributors in the field Material ranges from basic to advanced topics A fully searchable Mega Reference Ebook providing all the essential material needed by Energy and Environmental Engineers on a day to day basis Fundamentals key techniques engineering best practice and rules of thumb together in one quick reference Over 2 500 pages of reference material including over 1 500 pages not included in the print edition

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 Energy Conservation in Buildings A. A. M.

Sayigh,2012-12-02 The NORTHSUN 90 conference provided a forum for scientists from high latitude countries to discuss their experience of solar energy The book is divided into two parts Part One deals with energy conservation and management in buildings and solar and low energy architecture Part Two covers all aspects of renewable energy materials science and photovoltaic conversion weather data heating and cooling of buildings hot water systems wave energy geothermal energy energy storage country programmes and other related topics In northern latitudes energy savings in buildings of up to 50% can be achieved NORTHSUN 90 encouraged the attainment of this goal promoting the use of solar energy in heating and collective work on solar projects of direct benefit to the region **Building Thermal 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 cities **Active Solar Thermal Design**

Manual ,1985 **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 SERI/TR- ,1980 *Proceedings CLIMA 2022* Laure Itard,Lada

Hensen-Centnerová,Atze Boerstra,Philomena Bluyssen,Jan Hensen,Tillmann Klein,Marcel Loomans,Pieter Pauwels,Christian Struck,Martin Tenpierik,Bob Geldermans,2022-10-12 The 14th REHVA HVAC World Congress CLIMA2022 challenges advances in technologies for smart energy transition digitization circularity health and well being in buildings How can we create circular buildings fully heated cooled and powered by renewable energy How can we design human centered indoor environments while mastering life cycle costs How can we also include their integration into infrastructure for energy health data and education **Urban Heat Stress and Mitigation Solutions** Vincenzo Costanzo,Gianpiero Evola,Luigi

Marletta,2021-09-08 This book provides the reader with an understanding of the impact that different morphologies construction materials and green coverage solutions have on the urban microclimate thus affecting the comfort conditions of urban inhabitants and the energy needs of buildings in urban areas The book covers the latest approaches to energy and

outdoor comfort measurement and modelling on an urban scale and describes possible measures and strategies to mitigate the effects of the mutual interaction between urban settlements and local microclimate Despite its relevance only limited literature is currently devoted to appraising from an engineering perspective the intertwining relationships between urban geometry and fabrics energy fluxes between buildings and their surroundings outdoor microclimate conditions and building energy demands in urban areas This book fills this gap by first discussing the physical processes that govern heat 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

Thermal Systems

Ivan CK Tam, Brian Agnew, 2021-04-07 We live in interesting times in which life as we know it is being threatened by manmade changes to the atmosphere in which we live On the global scale concern is focused on climate change due to greenhouse gas emissions and on a national scale atmospheric pollution produced by combustion processes is of concern A possible approach is through the development of new ideas and innovative processes to the current practices Among the available options multi generation processes such as the trigeneration cycle battery storage system solar power plants and heat pumps have been widely studied as they potentially allow for greater efficiency lower costs and reduced emissions On the other hand some researchers had been working to increase the potential of energy generation process through heat recovery under the steam generator organic Rankine cycle and absorption chillers In this Special Issue on Thermal Systems of fundamental or applied and numerical or experimental investigation many new concepts in thermal systems and energy utilization were explored and published as original research papers in this Special Issue

Designing Zero Carbon

Buildings Using Dynamic Simulation Methods Ljubomir Jankovic, 2013-07-03 As we increasingly become aware of the causes and consequences of the climate change there is a sense that we are dealing with an almost impossible problem to solve that our targets for zero carbon buildings are far in the future and that our targets are hard to achieve This book develops a structured method for zero carbon design and demonstrates that it is perfectly possible to design new or retrofit zero carbon buildings today using existing technologies Dynamic simulation is an essential ingredient of this method and a pre requisite for the level of analysis and optimization that is needed in order to achieve zero carbon design The second

essential ingredient is the economic analysis and the book demonstrates how zero carbon designs can be optimised to result in lucrative rates of return on investment The third essential ingredient is the achievement of thermal comfort The book argues that zero carbon living is not about a considerable change of behaviour but that it is about design that works with climate rather than against it that uses predominantly passive rather than active means for achieving thermal comfort and that is well tested integrated and optimised using dynamic simulation Using this method designers can start making a difference today This book therefore makes a case for change a change of our perceptions that we are dealing with an impossible problem to solve a change of our business and economic models and a change of our attitudes towards zero carbon design and zero carbon living

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