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A method for the design and costing of a metal hydride heat pump for residential use and a computer program, HYCSOS, which automates that method are described. The system analyzed is one in which a metal hydride heat pump can provide space heating and space cooling powered by energy from solar collectors and electric power generated from solar energy. The principles and basic design of the system are presented, and the computer program is described giving detailed design and performance equations used in the program. The operation of the program is explained, and a sample run is presented. This computer program is part of an effort to design, cost, and evaluate a hydride heat pump for residential use. The computer program is written in standard Fortran IV and was run on a CDC Cyber 74 and Cyber 174 computer. A listing of the program is included as an appendix. This report is Volume 1 of a two-volume document.

The GEODIM computer program has been developed as a joint project of the University of Lund, Lund, Sweden and the Washington State Energy Office (WSEO). The development of GEODIM was originally begun in response to the need to optimize the Lund, Sweden geothermal system. This system is the world's largest heat pump geothermal system having an output of 50MW thermal. The 50MW of output provides a significant percentage of the base load thermal demand of the Lund district heating system. When approached by WSEO, the University of Lund agreed to expand the capability of the program and make it equally usable for the optimization of direct use system's which do not employ heat pumps. In addition, the university prepared examples of how the program can be used. The program has been extensively tested against data from the Lund system which now has five years of operating data. The program has proved itself to be a valuable tool for optimizing piping systems and system operation. Although the program was originally designed for the optimization of geothermal systems employing both production and injection

wells, it can be just as successfully used for any system using a water source, be it surface water or waste water from industry or effluent from a sewage treatment plant.

Geothermal Heat Pumps is the most comprehensive guide to the selection, design and installation of geothermal heat pumps available. This leading manual presents the most recent information and market developments in order to put any installer, engineer or architect in the position to design, select and install a domestic geothermal heat pump system. Internationally respected expert Karl Ochsner presents the reasons to use heat pumps, introduces basic theory and reviews the wide variety of available heat pump models.

HPASS (Heat Pump district heating ASSessment) is a computer program for assessment of district heating and cooling with heat pumps. The software facilitates comparison of site- and source-energy use, discounted payback, and life-cycle costs of these systems with alternative systems providing similar services. The program also performs parametric studies of these analyses. This report explains the use of HPASS; the input requirements, available outputs, and program options are described.

Thermodynamic Design Data for Heat Pump Systems provides a comprehensive data base for the design of vapor compression heat pump systems, particularly in industrial applications where careful matching is essential. The book contains two chapters and 21 appendices. Chapter 1 describes how the data in the graphs and tables in the appendices have been derived, and chapter 2 gives examples of how the data can be used. The appendices present the required design data for 21 materials which are likely to be used as heat pump working fluids.

The design and performance of a waste heat recovery system which utilizes a high temperature heat pump and which is intended for use in those industries incorporating indirect drying processes are described. It is estimated that use of this heat recovery system in the paper, pulp, and textile industries in the US could save 3.9 x 1014 Btu/yr. Information is included on over all and component design for the heat pump system, comparison of prime movers for powering the compressor, control equipment, and system economics. (LCL).

Sponsored by the Residential Heat Pump Committee of the Edison Electric Institute and intended to serve as a comprehensive marketing and technical reference guide for electric utilities on the application of Geothermal Heat Pump systems in the U.S.

The Seasonal Performance Model (SPM) was developed to provide an accurate source of seasonal energy consumption and cost predictions for the evaluation of heat pump design options. The program uses steady state heat pump performance data obtained from manufacturers' or Computer Simulation Model runs. The SPM was originally developed in two forms - a cooling model for central air conditioners and heat pumps and a heating model for heat pumps. The original models have undergone many modifications, which are described, to improve the accuracy of predictions and to increase flexibility for use in parametric evaluations. Insights are provided into the theory and construction of the major options, and into the use of the available options and

output variables. Specific investigations provide examples of the possible applications of the model. (LEW).

The RETScreen International Ground-Source Heat Pump Project Model is a standardized & integrated project analysis software that can be used to evaluate the energy production or savings, life cycle costs, and greenhouse gas emission reductions for the heating and/or cooling of residential, commercial, institutional, & industrial buildings. The Model can be used to evaluate both retrofit & new construction project using either ground-coupled (horizontal or vertical closed-loop) or groundwater heat pumps. This manual describes how to use the Model software, and includes instructions related to energy & site calculation, heating & cooling load calculation, cost analyses & financial summaries, greenhouse gas emission reduction analysis, data entry, and saving & printing files.

Explains energy-saving features of new homes in California. Shows you how to develop smart energy habits that will quickly lead to energy and dollar savings. Drawings and tables.

Experimental data is being obtained from operating a high temperature heat pump system. The use of methanol as a working fluid will necessitate careful monitoring of refrigerant temperatures and pressures with chemical analysis performed on the working fluid during scheduled down time. Materials sent to vendors by Auburn University and quotes received by Auburn concerning equipment (compressor, evaporator, condensor, air heater, dryer, two accumulator tanks, and three expansion valves) are discussed. The simulated dryer and two accumulator tanks were designed by Auburn. The detailed design and pricing estimates are included. Additional information is presented on layout and construction; start-up; testing; shut down; scheduled maintenance and inspection; safety precautions; control system; and trouble shooting.

This leading manual presents the most recent information and market developments in order to put any installer, engineer or architect in the position to design, select and install a domestic geothermal heat pump system.

This manual is intended to serve as an authoritative and comprehensive guide on heat pump equipment and applications for utility energy management and consumer service personnel, marketing specialists, and corporate planners. The information provided here is general in scope and is not intended to replace manufacturer' technical performance data or installation, operation, and maintenance guidelines for specific products. If the information provided conflicts with a manufacturer's instructions, the manufacturer's instructions should be followed.

Passivhaus is the fastest growing energy performance standard in the world, with almost 50,000 buildings realised to date. Applicable to both domestic and non-domestic building types, the strength of Passivhaus lies in the simplicity of the concept. As European and global energy directives move ever closer towards Zero (fossil) Energy standards, Passivhaus provides a robust ‘fabric first’ approach from which to make the next step. The Passivhaus Designers Manual is the most comprehensive technical guide available to those wishing to design and build Passivhaus and Zero Energy Buildings. As a technical reference for

architects, engineers and construction professionals The Passivhaus Designers Manual provides: State of the art guidance for anyone designing or working on a Passivhaus project; In depth information on building services, including high performance ventilation systems and ultra--low energy heating and cooling systems; Holistic design guidance encompassing: daylight design, ecological materials, thermal comfort, indoor air quality and economics; Practical advice on procurement methods, project management and quality assurance; Renewable energy systems suitable for Passivhaus and Zero Energy Buildings; Practical case studies from the UK, USA, and Germany amongst others; Detailed worked examples to show you how it’s done and what to look out for; Expert advice from 20 world renowned Passivhaus designers, architects, building physicists and engineers. Lavishly illustrated with nearly 200 full colour illustrations, and presented by two highly experienced specialists, this is your one-stop shop for comprehensive practical information on Passivhaus and Zero Energy buildings.

Increases the design community's awareness and knowledge of the benefits, design, and installation requirements of commercial/institutional ground--source heat pumps (GSHP).

If you want an inexpensive, environmentally sound source of energy for your home, you need look no further than the sun. Solar heat is not subject to rate increases, is totally renewable, pollution free and requires little or no technology. It is here for you today, and can easily provide up to 50% of your space and water heating requirements. This is a book that simply and clearly explains the principles of using solar energy to heat your home. Anyone building a new home, or renovating an old one can incorporate one or several aspects of solar energy into their design. Taking you through the process of designing a solar home from the ground up this manual is also a basic course in conservation and sustainable house design. If you live in a 'heating' climate, meaning if you have space heating requirements for most of the year then this is an invaluable resource. A house is the biggest single investment most of us will make in our lives - the way it is built and how it operates can reflect a long term investment in both the building and the planet.