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Study of Design Methods for Solar Heating System with Boilers/Stoves

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ABSTRACT:-
This study investigates the performance of combined solar and pellet heating systems by the optimization method .This paper is concerned with the design of solar space and water heating systems for residences. A simulation model capable of estimating the long-term thermal performance of solar heating systems is described. The amount of meteorological data required by the simulation in order to estimate long-term performance is investigated. The information gained from many simulations is used to develop a general design procedure for solar heating systems. The result is a simple graphical method requiring monthly average meteorological data which architects and heating engineers can use to design economical solar heating systems. The main purpose of the optimization is to find the design parameters that give the lowest energy and carbon monoxide (CO) emission.

Keywords:- grate-firing boiler, Optimization method, boiler and solar heating systems, metrological data, pellet, heat emission

I. INTRODUCTION

Wood pellets-Wood pellets are the most common type. A form of wood fuel, wood pellets are generally made from compacted sawdust or other wastes from sawmilling and other wood products manufacture. Wood pellet boilers are now used to heat homes. One million units are now in service throughout Europe, showing this to be a well-proven way to heat a home.Wood pellet boilers and Wood pellet furnaces are used for heating with base board radiators, radiant floors and forced hot air. Heating with a carbon-neutral fuel such as wood pellets is a sustainable solution that’s better for our ecosystem than are non-renewable fuels such as propane, natural gas, oil, and most electric power.

The main aim of this study is to present and evaluate the metrological data with combination of solar and pellet heating system.

II. METHOD

This method has following steps, which are given below:-

1. Collection of all metrological data.
2. Choice the optimization machine tool.
3. Define the boundary for the heating system,
4. Uses of optimization method with system tool.
5. Sensitivity analysis through impact testing.

6. Choice of the solar heating system according to the present environment.

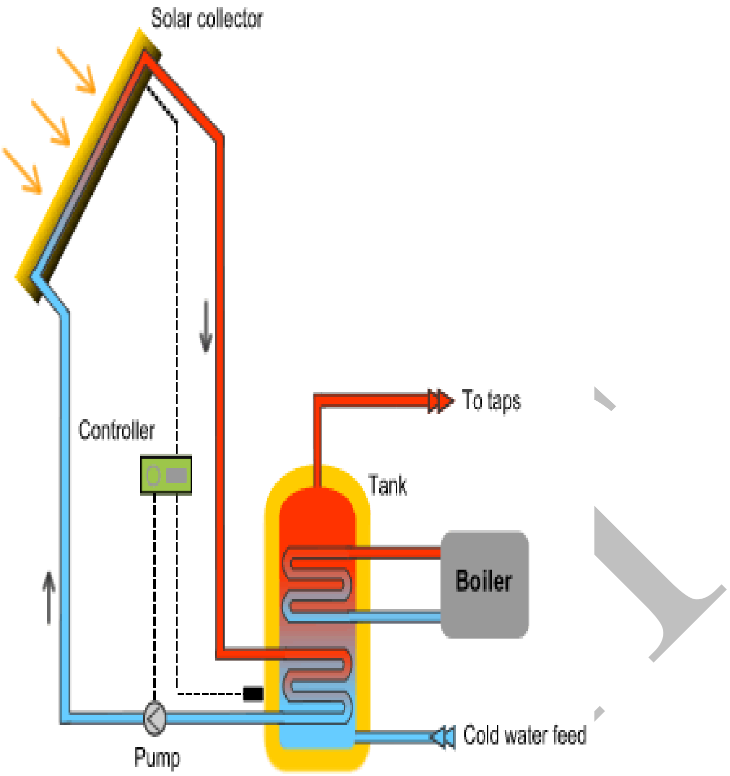

Fig.1. Solar Collector

III. Objective function and system tool for optimizing the boundary conditions.

Genopt is a generic optimization program being developed for such system optimizations. It is designed for finding the values of user-selected design parameters that minimize a so-called objective function, such as annual energy use, peak electrical demand, or predicted percentage of dissatisfied people (PPDvalue), leading to best operation of a given system. This program is used as a optimization tool.

The objective function has used as a output function for the solar heating system process. In this case the auxiliary energy is the main energy which comes from pellet fuels and the electrical backup heaters.

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IV. Boundary conditions for optimization method

Boundary conditions for any system are decided according to weather data space heating (SH) and domestic hot water heating (DHWH).

Table I.

1	individuals		
A	all applications	1kWp	Capital subsidy and interest subsidy
B	Pumps for irrigation and community drinking water	5kWp	
2.	Non-commercial entities		
A	All applications except 2B	100kWp	Capital subsidy and interest subsidy
B	Mini-grids for rural electrification	250kWp	
3.	Industrial/Commercial entities		
A	All applications except 3b	100kWp	Capital subsidy and interest subsidy
B	Mini grid for rural electrification	250kWp	

Boundary Conditions in India

V. SENSITIVITY ANALYSIS

In this analysis we study the impact of these parameters on the objective function, the annual auxiliary energy and the CO emissions, auxiliary heated standby volume; the hysteresis for the boiler control of this standby volume, dT .The minimum boiler power, P_{bmin} , with the maximum always fixed to 12 kW; and the set temperature for the standby volume, T_{boil} .The lower limit for the size of the standby volume and the boiler temperature is determined by the DHW load that has to be covered. Thus the analysis has been performed only for the parameter range where the complete load can be covered. The default values were: standby volume 140 litres; dT of 15 K; Pbmin of 3.4 kW;and Tboil of 70°C. All studied parameters influence the number of starts and stops of the boiler which in turn influence the boiler efficiency and the CO emissions. The CO emissions are not a linear function of the number start/stop of the boiler. This can be seen in figure 3c. In fact, the total CO emissions are a function of the start/stop emission and the emissions during operation that vary with the combustion power. Operating the boiler with low modulation power reduces the number of start/stop emissions but not necessarily the total emissions if the CO emissions for low combustion power are significantly higher than for the nominal combustion power [5].

3it can be seen that for the fuel consumption the set temperature of the standby volume and for the CO emission modulation band width have the highest impacts. The modulation band width influences the number of starts and stops of the boiler and the average combustion power which in turn both influence the CO emissions.

VI. Simulation Program Interface.

Genopt has an open interface on both the simulation program side and the minimization algorithm. It allows the easy coupling of any external pro-gram (like Energy Plus, SPARK, DOE-2, TRNSYS) by simply modifying a configuration file.

The data exchange between GenOpt and the external program is done with text files only for performing the optimization, Genopt, based on input template files, automatically generates new input files for the simulation program. To generate such templates, the user accesses the already-defined simulation input files and replaces the numerical values of the param eters to be modified with keywords

VII. System description and optimization result with metrological data.

In this study a grate- firing stoker is adopted for the proper development of boiler. The interior of the combustion chamber is set as a computational domain with a four layer domain. In this study the pellet burner supplies the pellet fuel from the top and it has also a top-fed type burner. The optimization method can be applied easily for other boilers and system configurations if the characteristics of the pellet boiler are available.

VIII. Discussion and Conclusion

This Paper has presented an optimization model for the design of water networks that includes effects of temperature and composition on property operators. In order to carry out property balances for the design of the network, property operators have been used as a convenient & vital tool. Mass and property balances have been included in typical formulations based on various optimization techniques.

This work shows that the properties of MINLP formulation includes mass, property and energy balances, along with a methodology to include the effect of variables such as temperature and composition. An improvement in the solution for the optimal network is obtained with the proposed approach is clearly shown from the results of the case study.

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