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SPECIFIC ASPECTS OF SOLAR-HEATING-COOLING SYSTEM

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ABSTRACT
SHC (Solar-Heating-Cooling) system was already published at TMT conferences. The problems with energy situation and environment protection call for solving and they are more and more actual at present time. The sun can well cool of own energy via air condition in summer of interiors. The field of application of SHC system is everywhere where is sun shine, but very good conditions for the processes are in Turkey and in all next states in Mediterranean. There is good synergy between sun radiation and air condition with cooling. The specific aspects of SHC are solved in mathematical model in Matlab-Simulink and or MS Excel. The user can define a dimension of sun collectors, volume of accumulation tank, power of absorption cooling equipment and power of cooling exchanger of air condition system. He can simulate all there. The mathematic model has static and dynamic states. In the model there are practicable a calculation according to geographic position and its impact. The results are definited for concrete place of the Earth. In the TMT08 conference there will showed and simulated situation in Turkey, Italy, Egypt, Tunisian etc.
Keywords: Sun energy, heating-cooling, modeling

1. INTRUDUCTION
Problems of solar energy is really very actual. New life style asks for more and more energy. A lot of energy is used for air condition systems. At the present time there is used most the electrical energy made from some fossil fuels. The situation is bad for environment. The SHC (Solar Heating Cooling) system can help to change the situation[1,2,3,4]. The system offers a new possibility. It is optimal because
It has good synergy for sun radiation and cooling air condition.

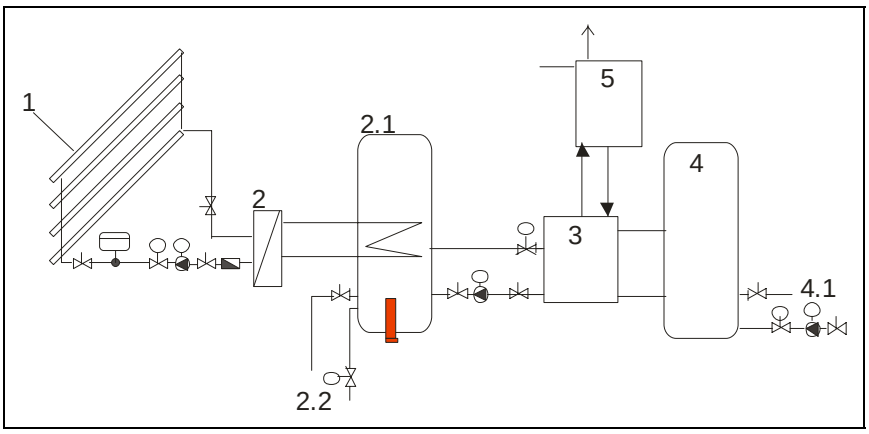

Figure 1. Basic scheme of the SHC system.

The system SHC uses a absorption principle. The scheme is in the figure 1. The hot water (75-95°C) makes a cool water (6-12°C) in the absorption machine with the sorption liquid of lithiumbromid. The source of thermal energy in the SHC is a solar collectors (1). The special liquid comes thru a exchanger (2) into accumulation tank (2.1). The hot water is used as a thermal energy in the heating system (2.2) in winter or in the cooling absorption system (3) in summer. The cooling system produces a cool water , the comes into accumulation tank (4) and then (4.1) in air condition exchanger for cooling of air. The energy balance does a air-cool-machine (5). The power of cooling part is from 10 kW.
In the paper is solved a special aspect, mathematical modeling. The main goal is to learn, study the SHC and to help by its projecting.

2. BASE OF MODELING

The model is built according the scheme in the figure 2. There is used five parts of model:

- Solar collectors with energy input (Q_s-Q_{s-}) and output (Q_{col})
- Heat accumulation with energy input (Q_{col}) and output ($Q_{h,acc}$)
- Absorption cooling with energy input ($Q_{h,acc}$) and output (Q_{ab})
- Cool accumulation with energy input (Q_{ab}) and output ($Q_{c,acc}$)
- Cool using with energy input ($Q_{c,acc}$) and output ($Q_{c,u}$).

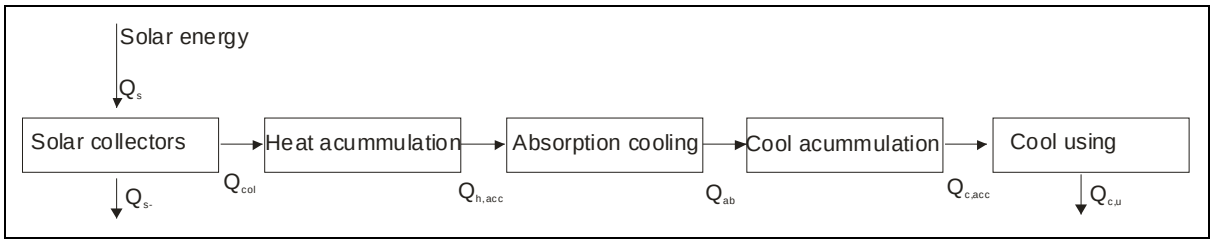

Figure 2. Block scheme of SHC modeling.

The modeling is made in the Excel and in the Matlab-Simulink system. The calculation model in Excel has a sheet for complete model and other sheets for partition of model. The advantage of Excel model is independent on a special modeling software.
The modeling in the Matlab-Simulink uses the installing of special software but there is realized really the modeling: graphical and mathematical together.

3. MODELING IN EXCEL

The modeling in Excel uses the system of calculation into sheets. It is built according the scheme in the figure 2. There is used five parts of model.
For the first partition, solar radiation, there is done set date for moment of calculation: day and month, place position, day time, elevation and azimuth of radiated area of sun, elevation above sea-level, atmosphere contamination, reflex ion coefficient. Output data from the calculation of inputs is in the main nominal solar energy radiation Q_s.
The secondary partition is about solar collector. For the concrete type of collector is set: size, thermal parameters of construct materials, ambient temperature. Input for calculation is nominal energy flow for set position of collector. Output of the calculation for number of collectors and for request flow of medium is total energy flow from the collectors.
The third part of model is heat accumulation in a exchanger. The input parameters and data are: max power of exchanger, its efficiency, sedimentation coefficient, input temperature of collector medium, temperature of output, value of flow of output medium. Output parameters are: power of accumulation, temperature of input medium, flow of input medium.
Model of absorber machine is a fourth sector. It is the main part and not simple. As input parameters are set: request cooling power, efficiency of machine, temperature parameters. Outputs are power of absorption process, flow of absorption medium and power of air refrigeration.
The last parts of model are cool accumulation and using.
In the Excel model there is possible power of temperature analysis. In the figure 3 is showed the power portions in the main parts of SHC.

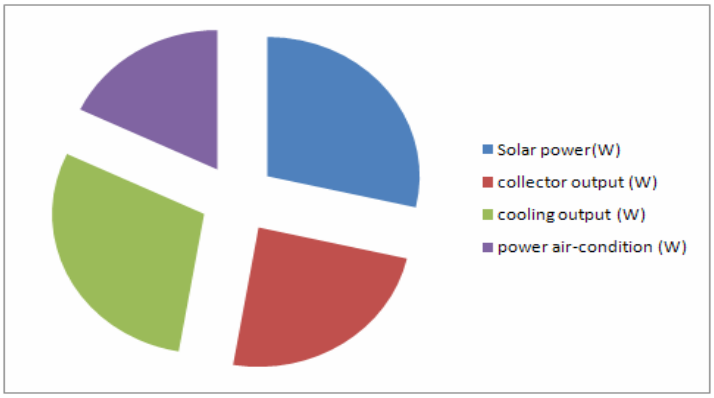

Figure 3. Graph of devided of SHC powers.

4. MODELING IN MATLAB-SIMULINK

The modeling in Matlab-Simulink system uses a graphical process and mathematical apparatus. The all scheme of system is in the figure 4.

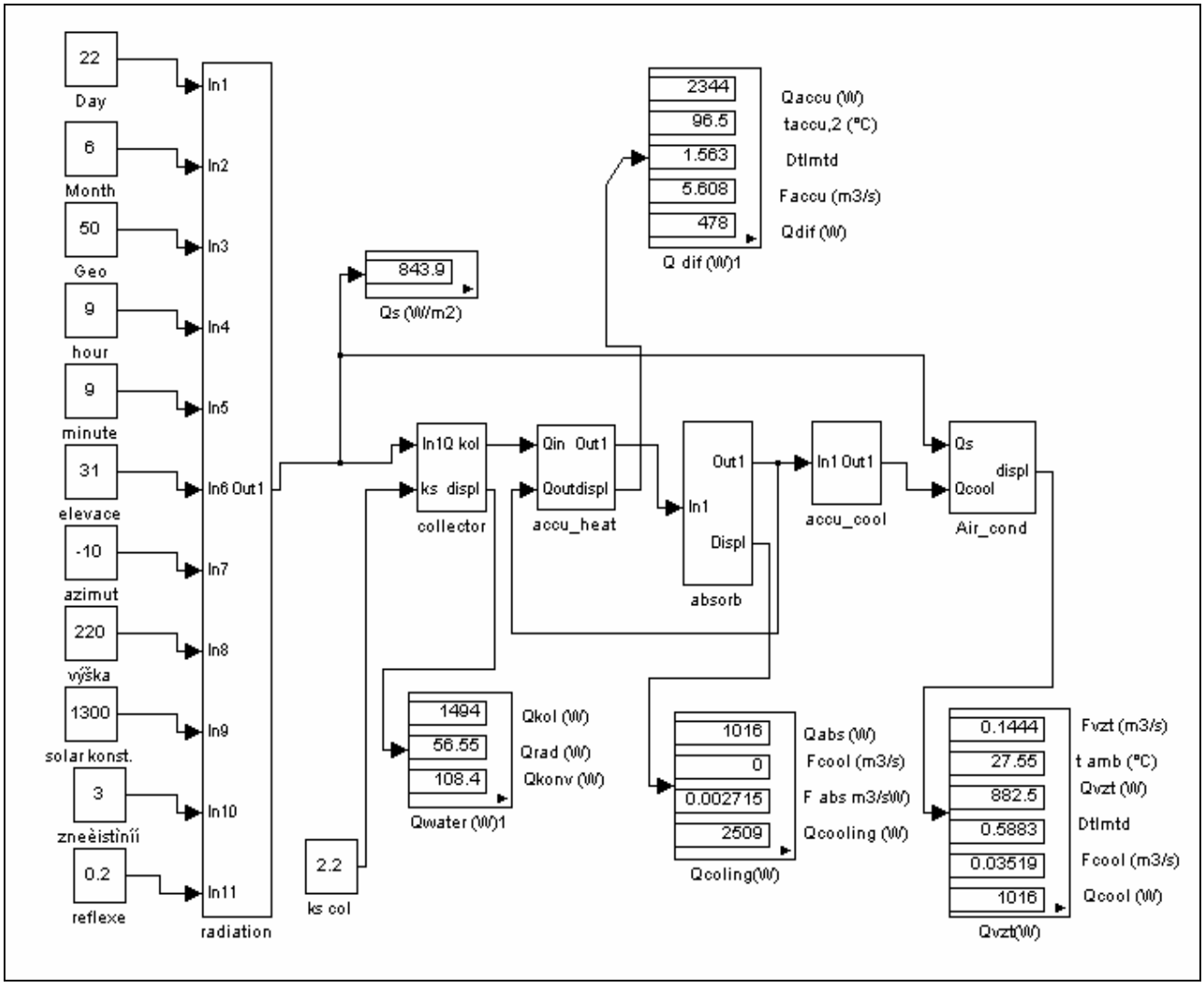

Figure 4. Block scheme of SHC modeling in Matlab-Simulink.

The scheme is contented the models of the main partition of the SHC system: solar radiation (radiation), solar collector (collector), accumulator of thermal energy (accu_heat), absorption cool

unit (absorb), accumulation cool energy, air condition unit (air_cond). The ever main unit is a sub model of the Simulink. A example is introduced the partition of unit radiation in the figure 5.

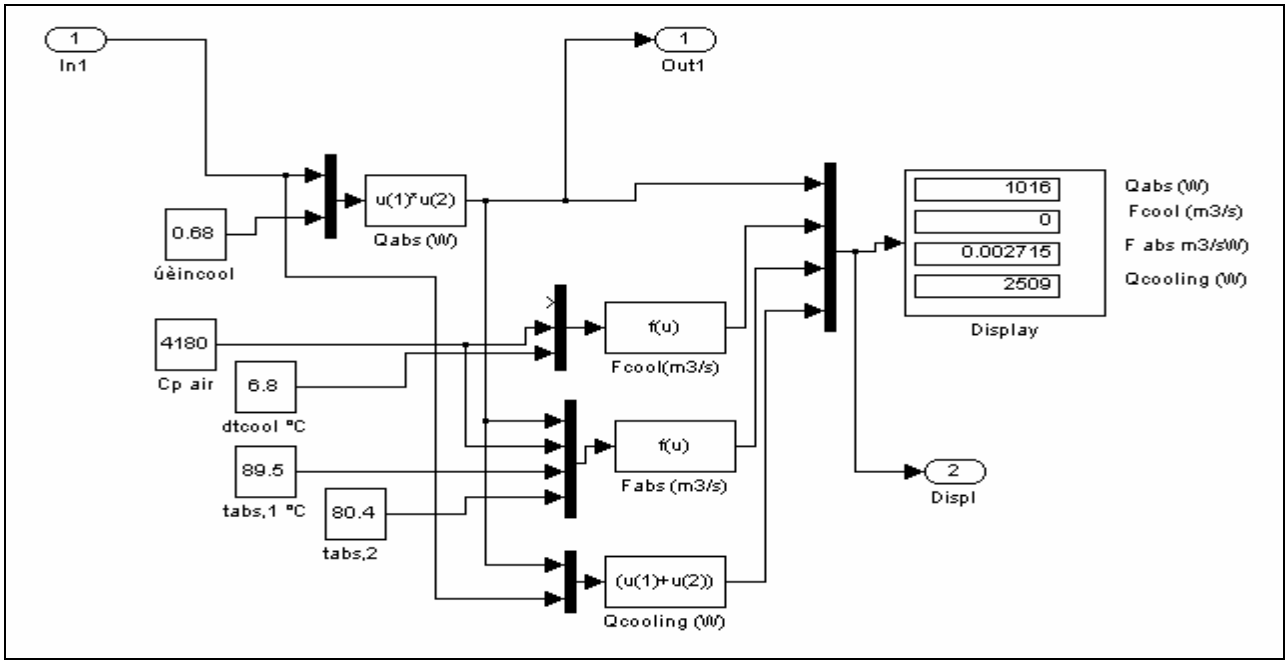

Figure 5. Block scheme of sub model of the patition radiation in Matlab-Simulink.

5. CONCLUSION

The specific aspects can be show, test, introduce of the SHC system in the model written in the Excel and Matlab-Simulink. The both are a tool for professional support. The models are open and it is possibly to extend of other parameters or other partition. There is going to add a partition of economic efficiency and evaluation for other comparing source of energy.

There is generally used the solar radiation. The problem to use rotation according to the sun during day is solved very fast and the result shows real differences to a fix point position.

The modeling presented in the paper is a static modeling. The extension of dynamic modeling is going to prepare in the future. In the stand there is going to finish the complete model.

6. REFERENCES

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