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Solar Collectors for Northern Countries

Authors : Ilze Pelece, Imants Ziemelis, Henriks Putans

Abstract : Traditionally the solar energy has been used in southern countries, but it has been used also in northern ones. Most popular kind of use of solar energy in Latvia is solar collector for water heating. Traditionally flat-plate solar collectors are used because of simplicity of manufacturing. However, some peculiarities in use of solar energy in northern countries must be taken into account. In northern countries, there is lower irradiance, but longer day and longer path of the sun during summer. Therefore traditional flat-plate solar collectors are not appropriate enough in northern countries, but new forms must be developed. There are two forms of solar collectors - cylindrical and semi-spherical – proposed in this work. Such collectors can be made both for water or air heating. Theoretical calculations and measurements of energy gain from those two collectors have been done. Results show that daily energy sum received by the semi-spherical collector from the sun at the middle of summer is 1.43 times more than that of the flat one, but for the cylindrical collector, it is 1.74 times more than that of the flat one or equal to that of the tracking to sun flat-plate collector. The resulting difference in energy gain from collector will be not so large because of the difference in heat loses. Heat can be decreased by switching off the water circulation pump when the sun is covered by clouds. For this purpose solar batteries, powered pump can be used instead of complicated and expensive automatics. Even more important than overall energy gain is the fact that semi-spherical and cylindrical collectors work all day (17 hours in the middle of summer at 57 northern latitudes), while flat-plate collector only about 11 hours. Yearly energy sum received by the collector from the sun is 1.5 and 1.9 times larger for the semi-spherical and cylindrical collector respectively as for the flat one. The cylindrical solar collector is easier to manufacture, but semi-spherical one is more aesthetical and durable against the impact of the wind. Although solar collectors for water and air heating are studied in this article, main ideas are applicable also for solar batteries.

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