DESIGN AND OPTIMIZATION OF A MASSIVE SOLAR-THERMAL COLLECTOR

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Abstract. A Massive Solar-Thermal Collector is a device that absorbs the solar radiation and turns it
into thermal energy to cover (partially or not) the heating loads of a building. It uses concrete (or cemen-
titious materials) as absorbing material, and water (flowing inside tubes) as energy transfer medium. An
optimized design of this device, during the day, will allow the conduction of heat flow from the collector
to the water (forward mode). Then, at night, it will block the heat leaving the collector (backward mode),
reducing the energy losses to the environment. By using the computational design of metamaterials,
the microstructure of the absorbing material will be designed at will to obtain "à la carte" design of the
forward and backward modes. Cementitious materials (combined with phase change materials) will be
used as candidate materials, and the weather conditions of a whole year will be taken into account. It is
expected to improve the efficiency of the device for its use in different geographic site locations.