Smart solar tanks for small solar domestic hot water systems

Investigation of small SDHW systems based on smart solar tanks are presented. The domestic water in a smart solar tank can be heated both by solar collectors and by means of an auxiliary energy supply system. The auxiliary energy supply system – in this study electric heating elements – heats up the hot-water tank from the top and the water volume heated by the auxiliary energy supply system is fitted to the hot-water consumption and consumption pattern. In periods with a large hot-water demand, the volume is large; in periods with a small hot-water demand, the volume is small. Two small SDHW systems, based on differently designed smart solar tanks and a traditional SDHW system were investigated by means of laboratory experiments and theoretical calculations. The investigations showed that the yearly thermal performance of SDHW systems with smart solar tanks is 5-35% higher than the thermal performance of traditional SDHW systems.

Estimates indicate that the performance/cost ratio can be improved by up to 25% by using a smart solar tank instead of a traditional tank when the backup energy system is electric heating elements. Further, smart solar tanks are suitable for unknown, variable, large or small hot-water consumption and the risk of oversized solar heating systems and oversized tank volumes is reduced by using smart solar tanks. Based on the investigations it is recommended to start development of smart solar tank units with an oil-fired boiler or a natural gas burner as auxiliary energy supply system.