In this study, mathematical models are formulated for predicting thermal behaviour of an indoor institutional focusing solar cooker. The explicit finite difference method is used in these models to determine variations of temperature with time. These models are then used to perform sensitivity analyses of the effects of several thermal, optical, geometrical and operational aspects on the performance of the cooker.

Two main types of this cooker are considered. In the first type, solar radiation is focused to a central zone at the bottom of a pot mounted inside a kitchen. Three variations of the pot in this type of cooker are studied, namely a bare pot, an insulated pot with an open cavity at the input zone and an insulated pot with a glazed cavity. In this type of cooker, the pot is filled with water and heating this water from 20ºC to 100ºC is used to simulate a cooking process. In the second type of cooker, concentrated solar radiation is focused, through a cavity, to a central zone at the bottom of a cylindrical insulted heat storage solid mounted inside a kitchen. Solar radiation is supplied to this solid at a constant rate for a pre-determined length of time at the end of which a pot filled with water is placed on the solid. The pt is kept in this position until the water either boils or starts cooling. Two variations of this type of cooker are considered, namely one in which the input cavity is open during charging phase and sealed with an insulating block during discharge, and another in which this cavity is glazed during both charging and discharging phases.

For heat transfer within the pot, a model, which provides for the possibility of nucleate boiling occuring within the pot is shown to be a better predictor than a model which assumes that heat transfer within the pot occurs through natural convection only.

It is shown that the performance of a bare pot will improve if the rate of incident solar radiation is increased. It is predicted that an insulated pot with an open cavity will deliver to the liquid a larger fraction of its solar input than a pot with a glazed cavity. Further, it is shown that unless the rate of solar input is below a certain value, an insulated pot with a glazed cavity will deliver to the liquid a smaller fraction of its input than a bare pot.

For a storage-type cooker, it is shown that reducing the concentration of solar input will increase the fraction of the input that is stored in the solid. The rate of heat transfers to the liquid the solid. The rate of heat transfer to the liquid will have a maximum value at a certain concentration of the input.

Increasing height to diameter ratio of the heat storage solid in a storage-type cooker will increase the fraction of the solar input that is stored in the solid. The fraction of the stored heat that is delivered to the liquid displays a minimum value at a certain aspect ratio. It increases with both increasing and decreasing aspect ratios on either side of this critical value.

Relative to an equivalent configuration where the input cavity is opened for charging and sealed during discharged, a storage-type cooker with a glazed input cavity will have a higher maximum liquid temperature, will heat the liquid faster and its solid will discharge faster. However, this configuration will deliver to the liquid a smaller fraction of its stored heat.

If the solid in a storage-type cooker is inverted after charging, the time required to heat the liquid to maximum temperature will be shorter than the case when the solid is not inverted. However, the fraction of stored heat that is delivered to the liquid will be lower.