

High-Tech for Reliable Cooking Energy in Developing Countries

A stove working on oil from plants – with automobiles already running on rapeseed oil, that doesn't seem to be very spectacular. But if the stove is to function with oil from diverse sources including coconuts, rapeseed, and sunflowers while remaining cheap enough for poor families in developing countries, things are starting to become more difficult. The solution is called Protos, the plant oil stove developed by Bosch and Siemens Home Appliances Group (BSH) in cooperation with its partners.

The basic principle of the Protos stove resembles to the familiar camping stoves, except that it runs on plant oils instead of kerosene. The stove consists of a tank, a pump, a frame, a valve, a fuel line, and an innovative burner.

The functioning principle of Protos: The plant oil is filled in the tank. Through application of the pump, a pressure is created in the tank. The oil rises into the stainless steel vaporizer, where the heat of the flame converts the liquid into a gaseous mixture. The gas flux emits from a nozzle into a burning area, where it mixes with surrounding air and burns in a blue flame. The power output of the flame can be adjusted with a valve in the fuel line.

Seems to be simple but Protos presented a number of tricky technical challenges to the engineers. Before starting the research on Protos, the vaporization and combustion of plant oils in a simple stove had to be investigated. This vaporization alone involves more than 10,000 different chemical reactions which are different for every plant oil, depending on its origin, quality, and means of extraction. In the new burner a combustion temperature of up to 1,400 °C is reached which ensures continuous vaporization and combustion with very low emissions. However, this high temperature requires special materials in the stove construction. A further challenge was presented by the carbon residues which values are more than 100 times higher than the values for kerosene. For protecting the vaporization tube from clogging special burner geometry was required to maintain a specified temperature profile which minimizes soot formation.

Because plant oils are natural products, their chemical and physical properties vary widely – not only for different oils but also for oils from the same plant variety when produced in different places and with different production methods. Regarding the set-up of a locally

sustainable systems is it crucial that fuel for the stove can be produced locally by simple means even in remote areas. In those areas only limited quality control is possible. The stove also works with used oils which were used for frying before. However, it also works with refined oils and plant oil esters as well as kerosene if applicable.

Since end of 2004, Protos has been tested in the Philippines in 100 households and small restaurants. Moreover, a village level production center for the extraction of coconut oil has been developed. BSH project leader Dr.-Ing. Elmar Stumpf summarizes the very encouraging results: "The plant oil stove is easy to operate and offers a very safe cooking environment since plant oils can neither burn nor explode. Moreover, the Protos design is very stable. Users of the new stove are excited about this new cooking technology."

Preliminary marketing of the plant oil stove Protos is about to start. The production will take place mostly in the Philippines. Only the technically delicate burner unit, which demands a sophisticated production process with very exact tolerances, will be delivered from Germany.