4. Energy storage device: We will try to store a part of the heat energy so that we can use it later in evening and night. What should be the size, material and configuration of this so that we can store the energy and reuse it effectively?

5. Stirling engine: Let's assume we will use a stirling engine to extract useful work from the high temperature working fluid. We've heard good things about the stirling engine from reading around. But how will we design it? What should be its dimensions? How can we optimise its size and configuration?

6. Low temperature reservoir: We've heard that there should be a low temperature reservoir to remove some of the waste heat. What should be its temperature and size? Why do we even need it?

7. Output torque: What is the output torque and angular velocity? We know that the product of the two will be the total power output, but will we obtain a large torque and a small angular velocity or the other way around? What determines this? And what would be optimal?

8. Overall piping: What should be the configuration and dimensions of the piping of the entire system so that we can minimize the cost and losses?

As we go forward, we will take up each of the subcomponents and try to examine what principles we need to apply in order to design and optimize each of them. We will learn the associated principles of thermodynamics, fluid flow and heat transfer and learn to apply them.

3 Overall energy and power analysis

We must first begin with an understanding about how much energy and power we will require. This will give us a baseline of the energy rating of the entire system. Since our system is meant to power a typical home in Chennai, we will try to first get an understanding of the power and energy requirements.

To obtain the total energy requirement of a typical home, we could begin by enumerating the various devices. Then we can estimate the power requirement and the time of use during the day. From this we can get the total energy requirement.

Alternatively, we can try to look at at the current electricity bill for a typical home and knowing the cost per unit of electricity (1 unit = 1 kWhr), we can decide the total energy requirement per day. Naturally, the daily variations cannot be obtained from this method and we might have had a situation in which there was more energy usage during some days but not the others.

The second aspect of importance is the peak power requirement. Some devices have a large power requirement but are used only for short periods of time. For example, a water heater might be switched on for about hour per day. But the power requirement when it is switched on will be 2000 W. Mixers and grinders also have peak power requirements which are very high but are used for short times. On the other hand, fans and lights use small amounts of power for long periods of time.