Appliances Guide
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Energy efficient rice cookers

Country

China

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1 Subtypes and markets

Typical size

As the name indicates, rice cookers are widely used to cook rice and related basic foods in Chinese households. It is a typical Chinese and Asian kitchen cooking ware.

The volume of the cooking pot is the main indicator of its cooking capacity. It has the range from smaller than 1L to bigger than 10L. Rice cookers with 3L-4L pot volume are the most popular types for typical Chinese families with 3 members. Rice cookers with pot volumes of more than 10L are commonly used for commercial applications, e.g. in canteens and restaurants. As the following figure shows, rice cookers with volumes smaller than 5L take the major market share of 74%.

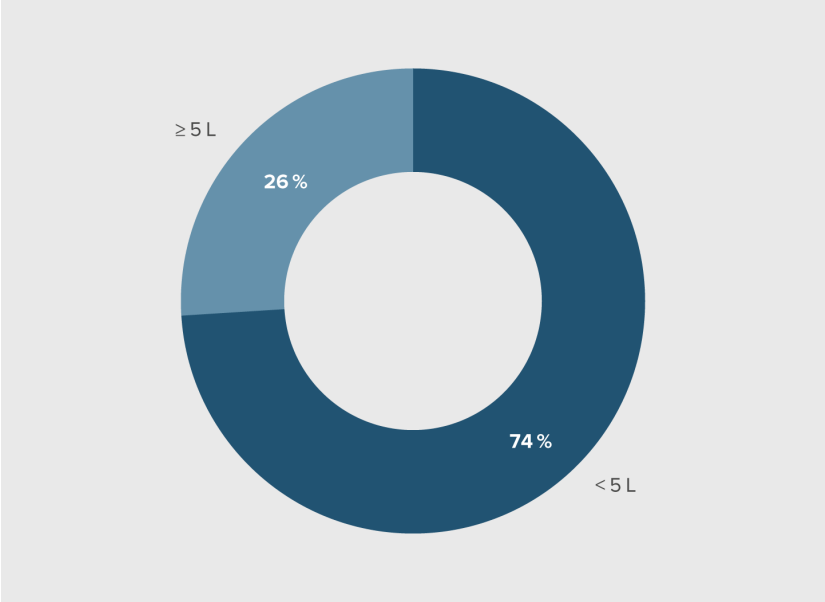

Figure 1: Size distribution of rice cookers

Main types of technologies

Originally, rice cookers were all mechanically controlled. Due to the general progress of controlling technology, also electronically operated rice cookers have been widely deployed. Except some low end products, electronic programmable rice cookers have taken the majority of the market. Traditional rice cookers were all based on electrical resistance heating devices, but new induction heated rice cookers have already been introduced to the market in recent years and take about 2% market share. Rice cookers have a wide power range depending on the respective cooking capacity. This analysis focuses on household rice cookers whose nominal power is below 2,000 W.

Typical usage pattern and relevant parameters

Rice cookers are characterized by three main energy-using operation modes:

Cooking: The period in which the food is heated and cooked at a relatively high temperature;

Keep-warm: Keep the food at designated temperature for food preservation after the cooking process is completed;

Standby: Rice cooker is connected to the power supply but not activated for cooking or warm-keeping mode. The heating component is deactivated.

According to a household appliance using habit research conducted by Collaborative Labeling and Appliance Standards Program (CLASP), the majority of Chinese households use rice cookers almost every day. Thereby, the average daily cooking time is 36 minutes and the average food warm- keeping time is about 13 minutes. 93% of the users cut off the power supply after cooking. Most of the pots are half loaded for cooking[1].

Current numbers for stock and market volumes

Rice cookers started to enter the Chinese market in the 1990's. With the rapid development of national economy and electrification, the household penetration rates kept increasing rapidly. In 2011, 186 million rice cookers were produced in China and the domestic sales reached 51 million in the same year[2]. By the end of 2011, it was estimated that 247 million rice cookers were in use in Chinese homes, rising to approximately 243 million in 2012[3].

Market share according to the main types of product group

The inner pot material also plays an important role in energy related and other performance aspects of rice cookers. Metallic inner pots represent the major part of the market taking about 96% market share. However, there are also some non-metallic (e.g. ceramic) inner pot cookers. Rice cookers with different inner pots have different requirements for MEPS[4].

Share of the final energy consumption

The energy consumption of rice cookers in 2012 was 54.89 billion kWh, increasing from 47.65 billion kWh in 2011 and consuming about 1.1% of the total electricity consumption of the society.

2 Efficiency range and user savings

The following table gives a comparison between a typical inefficient appliance and the best available technology.

Level	**Typical Inefficient appliance. If MEPS is implemented: Appliance just complying to minimum requirement (MEPS)**	**Typical appliance purchased (BAU – Business As Usual)**	**Best Available Technology (BAT)**	**Typical appliance in the stock (over all appliances in use)**	**Expected future BAT (Best not yet Available Technology)**
Typical Capacity / Size	4L				
Category	*e.g. vertical or horizontal axis washing machine*				
Type	*No-metal inner pot*	Metal inner pot	Metal inner pot	Metal inner pot	Metal inner pot
Lifetime (years)	10	10	10	10	10
Qualitative classification of the provided service (e.g.: washing performance /etc.)	☐ Poor ☐ Low ☑ Average ☐ Good ☐ Excellent ☐ No infor-	☐ Poor ☐ Low ☐ Average ☑ Good ☐ Excellent ☐ No infor-	☐ Poor ☐ Low ☐ Average ☐ Good ☑ Excellent ☐ No in-	☐ Poor ☐ Low ☐ Average ☑ Good ☐ Excellent ☐ No in-	☐ Poor ☐ Low ☐ Average ☐ Good ☑ Excellent ☐ No in-

	mation	mation	formation	formation	formation
Yearly energy consumption ***Please precise the energy considered (electricity):*** ***kWh***	162 kWh	127kWh	122kWh	135kWh	100kWh
If applicable: yearly energy consumption for further energy carriers (which one?)					
If applicable: yearly water consumption					
Purchase cost in (currency) RMB	500	600	1100	740	1300
Operation & Maintenance cost	25	30	55	37	65
Labelling class (for the aforementioned labels)	5	2	1	3	1

3 Performance and information requirements

Mandatory requirements

The first energy efficiency standard for rice cookers was implemented in 1989, while the latest version was released in 2008 and implemented in June 2009. <GB 12021.6-2008> sets five energy efficiency tiers based on the thermal efficiency. The following table shows the requirements of each energy efficiency tier.

Table 1: Energy efficiency tiers requirements for rice cooker

Rated power (W)	**Thermal efficiency (%)**				
	Energy efficiency tiers				
	1	**2**	**3**	**4**	**5**
P≤400	85	81	76	72	60
400<P≤600	86	82	77	73	61
600<P≤800	87	83	78	74	62
800<P≤1000	88	84	79	75	63
1000<P≤2000	89	85	80	76	64

For rice cookers with metallic inner pot, the minimum energy performance standard (MEPS) is set on tier 4, while for non-metallic inner pot rice cookers, the MEPS is set on tier 5.

For automatic rice cookers with standby function, the standby power consumption should be below 2 W•h. The standby power of rice cookers with energy efficiency better than tier 3 should be below 1.6 W•h.

For rice cookers with a warm-keeping function, the energy consumption in this mode should not be higher than the value shown in table 2.

Table 2: Energy consumption requirements for rice cookers in warm-keeping mode

Rated power (W)	Energy consumption of warm-keeping (W•h)
P≤400	40
400<P≤600	50
600<P≤800	60
800<P≤1000	70
1000<P≤2000	80

According to the market research from Top10, 47% of all rice cookers on the market are tier 2, whereas tier 3 rice cookers take 40% market share. Tier 1 rice cookers only take 1% market share.

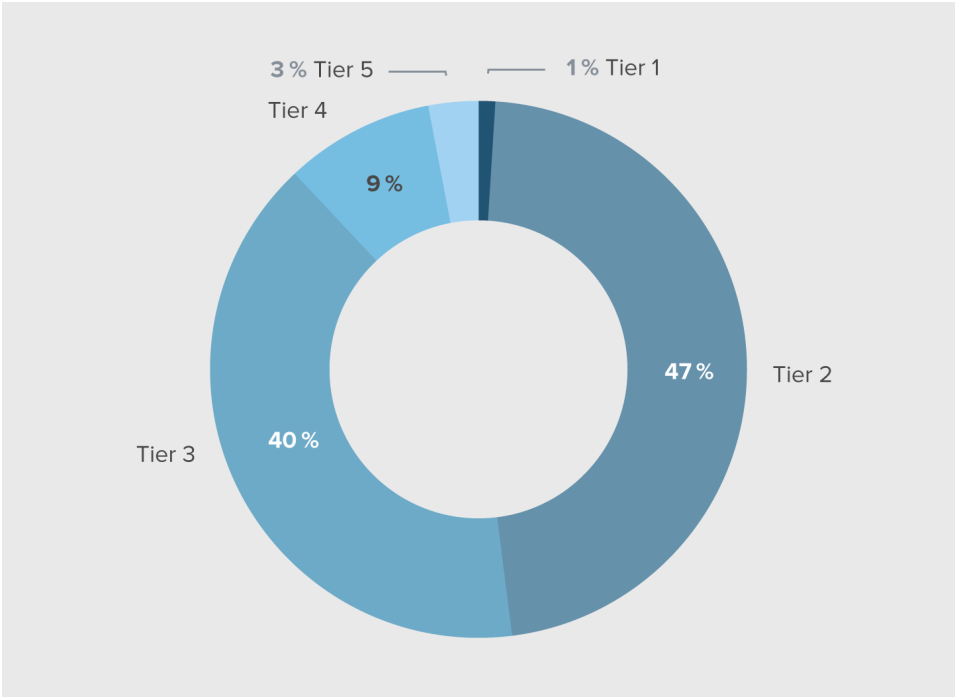

Figure 2: Energy efficiency tiers market distribution of rice cookers

Mandatory labelling

China energy label included rice cookers in 2009. The energy label of rice cookers includes information on energy efficiency tier, thermal efficiency, stand-by power, warm-keeping energy consumption and the inner pot material[6]. The following figure presents a sample energy label for rice cookers.

Figure 3: Energy efficiency label sample

Although the rice cooker energy label provides the information to help consumers to buy efficient products, the absolute cooking energy consumption is still absent.

Voluntary requirements

The voluntary energy conservation certification for rice cookers started in September 2009. Household rice cookers are included in this certification scheme, as well. For rice cookers with metal inner pot, tier 2 is the minimum requirement for the energy conservation certification, while for rice cookers with non-metal inner pot tier 3 is the minimum requirement. The stand-by power consumption should not be higher than 1.6 W•h (no differentiation between inner pot materials). The energy conservation certification scheme is managed by China Qualification Centre (CQC). The certificated rice cookers are allowed to use the following energy conservation label. However, this label does not provide any energy consumption information[7].

Figure 4: Energy conservation label

4 Test procedures and standards

The testing procedures and MEPS are included in <GB 12021.6-2008>, which is called “minimum allowable values of energy efficiency and energy efficiency grades for automatic electric rice cookers”. <GB 12021.6-2008> adopts thermal efficiency (η) as the main energy efficiency parameter. It is used to set the MEPS and requirements of energy efficiency tiers of rice cookers. The thermal efficiency is the ratio between thermal energy taken by the food and the input energy. Water has been adopted as the medium to test and calculate the thermal energy taken by the food[5]. Actually, no rice is used for the energy efficiency testing of the rice cookers.

The efficiency test is performed under the configuration of “standard rice cooking function”. If the rice cooker is multi-functional, the test is performed by the most efficient cooking function indicated in the instruction manual provided by the manufacturer. Tap water is filled up to 80% of the inner pot volume. The temperature of the water should be equal to ambient temperature before starting the test procedure.

The cooking cycle is then initiated until the water temperature reaches exactly the threshold of 90°C, at which the power is cut off. The temperature of the water continues to rise for a short period due to the delay in heat transfer to the water. The achieved maximum water temperature is then recorded. The thermal energy taken by the water is calculated according to the temperature rise. As the input power of the cooker is also measured during the heating process, the thermal efficiency can be calculated correspondently.

To measure warm-keeping energy consumption, the water is heated to 90°C in the same way as for the cooking test. The rice cooker is then switched to the keep-warm mode. The energy consumption is measured after 4 hours, 4.5 hours and 5 hours. Based on the three measured values, the average energy consumption is calculated and adopted as the final warm-keeping energy consumption. During the test, the temperature of the test medium should be between 60°C and 80°C.

The standby energy consumption is the average energy consumption of the first 4 hours after the rice cooker is set in standby mode.

5 References

[1] CLASP(2014): Collaborative Labelling and Appliance Standards Program: The re search on household appliance using habit and consumers cognition of energy labelling.

[2] CNIS (2012): China National Institute of standardization: White paper for the energy efficiency status of China energy-use products.

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