

## **TO DEVELOP AND TESTING OF DIFFERENT COOKING ACCESSORIES FOR L.P.G SAVING**

**ShimpiSagar<sup>1</sup>, PatilBharat<sup>2</sup>, Suryawanshi Sachin<sup>3</sup>,  
Shewale Prashant<sup>4</sup>, Sneha Bire<sup>5</sup>**

*<sup>1,2,3,4</sup> B.EScholar, <sup>5</sup> Assistant Professor, BVCOE&RI ,Nashik,Pune University,(India)*

### **ABSTRACT**

*Food inflation that hit double digits mid-august and the hike in the prices of LPG are adding to citizens woes in 2013 in India. Restaurant had to bear the rising LPG cost without changing the menu prices. Ordinary consumers are worry after the oil ministry proposed to limit the number of the subsidized cylinder would cost Rs.1200. The price of the LPG commercially was Rs.1735 for 17.5 kg cylinders. A rise in LPG and fuel prices pushes up transport and food cost. Moreover, the fluctuating prices of LPG gas totally influence the prices of the needful commodities in market. So there arise a need to reduce the unbearable cost of LPG by taking measures to reduce LPG usage as well as efficient stoves and utensils to achieve maximum efficiency for cooking food in domestic use. For this reason we decided to reduce the heat loss during the cooking by using the various accessories and insulating pots. And also by developing various types of modification in the pots like by providing a different geometric shaped fins at the base of pot for increasing the heat transfer rate and reducing the flame losses. This modification in the pot gives a better result as compared with a simple pots used in kitchen. It gives best suggestion to the housewife that the helps in their life and also effectively utilization of LPG gas as the prices of the LPG is very high. By usage of different types of burners, the efficient design of LPG stove to give better efficiency, the different shapes of utensils and pots for cooking in domestic use. Moreover, the flexible skirting and insulation for the maximum usage of the waste heat to improve the overall performance of stove which can properly go with the size of different utensils are main concern to this project to testing purpose. Also the testing is to be conducted on the variable size of fixtures to maintain a good height for improved efficiency. It summaries measures and steps for a modern housewife for improved usage of domestic LPG gas stove and its accessories. By providing the fins at the base of pot the heat transfer rate increase and the different type of losses like flame losses are decreases. With all these cooking efficiency increase about 35% to 45% that means it saves about 10 to 12 days in month and about 120 to 130 days per year. It is conclude that cost of modified pot and other accessories recovered in 2 to 2.5 year.*

### **I. INTRODUCTION**

L.P.G is the most convenient and clean fuel for domestic use and is very popular in these days. The LPG hob industry is about 36 years old and is mainly concentrated in the small scale sector. LPG is a by-product during petroleum purification and is stored and marketed in gas cylinders of 14.2 KG capacity and used generally for cooking hobs and to some amount for industrial purpose also. The domestic LPG stove is primarily being used

in the urban areas as well as in rural areas. The industry of domestic LPG stove has grown considerably over the last 18 years and offers a wide range of products. In 1980, the Government of India had planned to push the exploration and assembly of LPG from Bombay High Project, thereby providing tremendous push to the LPG Stove Industry. More and more number of new connections is being released by the Govt. and therefore the demand of LPG stoves also increasing day by day. As per the last Survey, there were 186 units manufacturing LPG stoves in India. Out of them, 139 were from SSI sector. Most of the units are located in the state of Delhi and Haryana. Liquefied petroleum gas (LPG) is one of the conventional sources of fuel for cook hobs in India. The use of LPG as source of fuel is common both in the urban and in the rural areas, particularly in places where its supply is readily accessible. The main reasons why LPG is widely adopted for household use are: it is convenient to operate, easy to control, and clean to use because of the blue flame emitted during cooking. However, because of the continued increase in the price of oil in the world market, the price of LPG fuel had gone up tremendously and is continuously increasing at a fast rate. For a typical domestic, having four children, one LPG tank can be disbursed within 20 to 30 days only depending on the number and amount of food being cooked. The prices of domestic L.P.G were last revised in June last year and are priced at 399.2 Rs/cylinder in Delhi. Which as compared is cheaper than 483.06 Rs in Pakistan, and 670 Rs in Bangladesh, 666.31 Rs in Sri Lanka and 702.27 in Nepal, thus the prices are still predicted to rise. LPG is a predominant mixture of propane and Butane current with a small percentage of unsaturated (propylene and Butylene) and some lighter C<sub>2</sub> as well as heavier C<sub>5</sub> fractions. Commercial LPG invariably contains traces of lighter hydrocarbons like ethane C<sub>2</sub>H<sub>6</sub> and ethylene C<sub>2</sub>H<sub>4</sub> and heavier hydrocarbons like pentane C<sub>5</sub>H<sub>12</sub>. There are two main sources from which LPG gases are produced 1) Wet natural gas 2) Refinery operations. Different case studies have been observed from the usage of different types of burners, the efficient design of LPG stove to give better efficiency, the different shapes of utensils and pots for cooking in domestic use. Moreover the flexible skirting and insulations for the maximum usage of the waste heat to improve the overall performance of the stove which can properly go with the size of different utensils are main concern to this project for testing purpose. Also the testing is to be conducted on the variable size of fixtures to maintain a good height for improved efficiency. It summarizes the measures and steps for a modern housewife for improved usage of domestic LPG gas stoves and its accessories. By usage of different types of burners, the efficient design of LPG stove to give better efficiency, the different shapes of utensils and pots for cooking in domestic use. Moreover the flexible skirting and insulations for the maximum usage of the waste heat to improve the overall performance of the stove which can properly growth the size of different utensils are main concern to this project for testing purpose. Also the testing is to be conducted on the variable size of fixtures to maintain a good height for improved efficiency. It summarizes the measures and steps for a modern housewife for improved usage of domestic LPG gas stoves and its accessories. We have dealt with some energy efficient utensils available in market as well as some latest systems available in market for cooking. Our tests are mainly conducted on WBT and set up includes same equipment's as the modern housewife uses. We have added cooking accessories and insulating materials to save gas in domestic cooking system and done frequent modifications so as to see the optimum positive results keeping in mind the cost of such accessories and handling convenience. Thus thereby we present tabulated results, steps, measures for efficient cooking for a modern housewife which in our tests are positive.

## 1.1 NEED OF PROJECT

The prices of the LPG commercially were Rs.1200 for 17.5 kg cylinders. A rise in LPG and fuel prices pushes up transport and food cost. The fluctuating prices of LPG gas totally influence the prices of the needful commodities in market. The fluctuating prices of LPG gas totally influence the prices of the needful commodities in market. For a typical household, having four children, one LPG tank can be consumed within 20 to 30 days only contingent on the number and quantity of food being cooked. The prices of domestic LPG were last revised in June last year and are priced at 399.2 Rs/ cylinder in Delhi. Which as compared is cheaper than 483.06Rs in Pakistan, and 670 Rs in Bangladesh, 666.31Rs in Sri Lanka and 702.27 in Nepal, thus the prices are still predicted to rise.

## II. LITERATURE REVIEW

### **A. Carrabba's Italian Grill, by Joel barker, carraba's Vice President of R & D and Kitchen Operations.**

This paper accomplishes that total energy essential to cooking is reduced to increase the efficiency. It is concluded that energy consumption per burner is reduced to 50%. payback on pot purchase and burner conversion is 5 to 6 months.

### **B. National Account Case Study: turbo pot, by Lee Huang Eneron Inc.**

It is concluded that while it is used on electrical ranges then it is 70% efficient and while it is used on thermal ranges, it is 50% efficient. The total heating time required for cooking is decreased up to 30% to 48% of normal pot cooking time. By increasing the heat transfer rate the total efficiency is increased up to 60%. For the environment, once it is fully retrofit, the whole chain will reduce CO<sub>2</sub> emissions by over 10 million pounds annually.

### **C. What's Cooking'? A Suite of Gas Efficiency Technologies for Commercial Kitchens by Mary Horsey, E Source.**

The purpose of this paper is to raise awareness of some new and emerging energy efficient commercial kitchenette technologies that are likely to demand to food service owners and operators for their non-energy benefits as well as their efficiency. This paper will examine four gas fired commercial kitchen technologies—the Turbo Pot, the Advanced Under fired Charbroiled, the Rocket Fryer, and the hybrid optimized tankless water heater that offer either large efficiency improvements. Standard pots allow the flame to slide ineffectively around the smooth bottom of the pot and up the sides. After a period of test and fault, Huang developed a design with fins that capture and guide the burner flame into channels, creating turbulent flow as the hot gases contact the fins and increasing the surface area for heat transfer. The fins are easy to clean yet sturdy enough for the rigors of commercial food service.

### **D. Eneron, Inc. Prototype commercial Stock Pot Testing, by Greg Sorensen And David Zabrowski.**

It is concluded that Gas fired range top was raised to over 40%. When used on a top range with energy efficiency in the low 30's the no. approached 60%.

## 3. CASE STUDY

**3.1. CONVENTIONAL METHOD OF COOKING FOR DOMESTIC LPG STOVE** Generally the domestic cooking in households of India are carried out by the housewives. Variable sizes of cylinders are available in market for both commercial and domestic purposes ranging from 14.2 kg to 17.5 kg and also in lower range of 2 kg to 5 kg. A cylinder of 14.2 kg has the price of Rs 400 for domestic purposes including the subsidy provided by the government. The LPG mix used in India is made up of 78% butane and 20% propane also 2% mercaptan, adding that during the month of August, the price of butane increased to over US\$1,000 per ton. However the calorific value of combined LPG gas is 46.1 MJ/Kg. It is found to be convenient and easy method for cooking. Also it has its limitations of emission of CO and CO<sub>2</sub> gases as they are hydrocarbons. A general housewife wastes a good amount of heat energy because of the unawareness of energy efficient quotient and not so scientific and traditional methods of cooking. Some people have the habit of switching on the fan while cooking which disturbs the flame of the fuel. Moreover less concern is taken to see that a good amount of draft of air is available for combustion. Cooking is done in suffocating areas of the house. The cooking method should be such that optimum time is taken for cooking thereby providing delicious and nutritious food. The nutritious value of the food should be conserved. Pollution free cooking is also favourable, waste heat should be minimized and used as much as possible. Mostly the cooking utensils used are of aluminium, stainless steel, brass and their alloys. The regulator used is also conventional having the flow rate of 0.5 Cu.m/hour as for the domestic use. Generally burners made up of cast iron is used which has a circumscribed hole surrounded by it according to the design. The stoves are made of aluminium and sheet metal.

## 3.2. CARELESSNESS AND WASTAGE OF HEAT ENERGY WHILE COOKING FOOD

Generally carelessness occurs because of the unawareness about the need of energy conservation and the importance of energy saving and its efficiency. The role of housewife has a good amount of participation in it. The usage of fans alters the food cooking capacity of stove and its efficiency. The flame from the burner is more or less is wasted outside the surface area which comes in direct contact of the flame i.e. the utensils used for cooking should have good bottom surface area at which the flame of the burner is directly impinged. The conductive heat transfer rate should be highest of the burner so as not to retain heat. Also heat retaining capacity of the utensil should be good. Sometimes a good amount of draft of air is not available for the combustion of fuel i.e. stove is placed in corners of the houses adjacent to the wall with no space. Sometimes the stove is burning at high flame at the intervals or the gaps between shifting of cooking utensils. Inadequate information about the regulation of flow rate of gas while different cooking methods are not available in general public and also are unawareness.

## IV. WORKING

### 4.1 TEST PROCEDURE

Make ready the gas assembly.

Step 1:- Take 5 lit. of water in the pot and put it on the stove. Allow it to evaporate about 1.3 lit. Water for each test then mark the level of water by inserting stick into the water using marker.

Step 2:- Note the room temperature and water initial temperature. Take initial

Weight of water with pot and initial weight of cylinder by using weighing machine.

Step 3:- Now put the pot on stove at the same time start the stopwatch and during this according to test keep the knob of stove in maximum or simmering state.

Step 4:- During boiling of water, throughout check out the level of water by using stick.

Step 5:- When water will evaporate at the desired marking of stick then stop heating simultaneously stop the stopwatch.

Step 6:- Now note down the final weight of water, cylinder weight and note down the final temperature and time required.

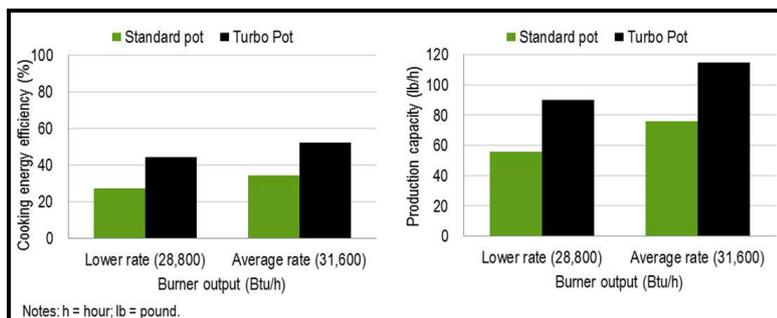
Step 7:- Calculate gas required by using formula

Gas required = Final weight of gas – Initial weight of gas



Fig 4.1 -STANDARD POTS Fig 4.2-TURBO POT

## 4.2 COMPARISON



## V. FUTURE SCOPE

## **Graph No-1 :Turbo Pots Cooking Energy Efficiency and Production Capacity Improvements over Standard Cooking Pots**

### **5.1 FUTURE SCOPE**

Gas for more 20 days than our estimate of 10 days. Different alternative methods of saving energy such as induction cooking, using wood stoves and LPG saving stoves are welcome in today's world. A whole new genre for house wife friendly cooking systems may come to effect in coming generations.

### **5.2 ADVANTAGES**

1. Less heat consumption.
2. Cooking accounts for one quarter of energy consumption.
3. The release of heat energy from burning fuel saved.
4. To improvement the efficiency.
5. To reduced cooking times and the energy saving.
6. Fast heat up time can preserve freshness of food, especially while cooking in large quantities.
7. Cost of modified pot and other accessories recovered in 2 to 2.5 year.
8. The total heating time required for cooking is decreased up to 30% to 48% of normal pot cooking time.
9. Increases the heat transfer rate.
10. Thermal efficiency is high.

### **5.3 LIMITATIONS**

1. More expensive to build & operate
2. Airflow cannot easily regulated to change heatsetting.
3. Potentially less efficient.
4. The prices of LPG gases is high.
5. Fuel prices pushes up transport and food cost.

### **5.4 APPLICATIONS**

1. It is use for household purpose.
2. The System is also useful for residential complexes, hotels, college hostels etc.
3. It is used in multitude of industrial manufacturing processes.

## **VI. CONCLUSION**

- 1) There is increase of **10%** in efficiency in cooking without fan than with fan i.e.we can save up to around **7 day's**; Likely a week. So it is of utmost importance to cook fan without presence of fan which is opposite to what a house wife does inday to day cooking.
- 2) Today the house wife can buy a spare burner head for Rs.50/onlyand exchangethis with her current burner every month contingent on usage. Now she has thetime & effort later, to clean the removed burner leisurely not in a hurry, thoroughlyand effectively. She can later dip & rinse it for an hour in the solvent and withnylon brush, spotless the holes &measures with appropriate detergent etc. and keep it readyto reuse. This can give savings in

her LPG up to 10 % & more and her cooking time is less now! .There is saving for 3 days equivalent to 6 frequent meals. So please buy a spare burner head for your existing stove today and experience the LPG savings. And when you have accomplished less time in cooking & LPG savings, kindly pass on this message to others for their benefit & it is our National importance too. When you are buying a new stove, then and there itself please buy a spare burner head for extensive & proficient usage by using alternatively monthly over the gas hob life period.

3) We have used skirting made of sheet metal , one is low height skirting and other is high height skirting .It has specific design providing proper no of holes allowing air for proper combustion. We have been able to see difference in gas consumption with availability of proper air duct ie holes provided in skirting .Again there is saving of 3 to 4 days for skirting with high height than low height .

4) The release of heat energy from burning fuel is saved in skirting without holes than skirting with holes, which directs the passing air directly to the utensil thereby saving wastage heat .It accounts for 2 days saving; Gas will run for two days extra.

5) In our case we have used combination of glass wool with sheet metal which gave us positive results. The low height skirting with insulation gives better results than without insulation ; There is saving of around 3 days, again 6 frequent meals can be cooked extra. Glass wool is known to have good insulating properties.

## 6.1 TIPS AND MEASURES FOR ENERGY EFFICIENT COOKING

Follow the simple tips given below

- Clean the burner of your stove (gas/pressure/wick) regularly.
- Before cooking, allow frozen food to come to room temperature, as it will use less fuel to get cooked.
- Soak pulses, dals and rice for some time before cooking.
- Always use a pressure cooker instead of an open pan as it will use less fuel.
- Try to cook as many things (e.g. rice, dal, vegetables etc.) as possible at one time in the pressure cooker, using the separators.
- If you are using the pressure cooker, lower the flame after the pressure is built in the cooker i.e. after the first whistle.
- Cover the pan while cooking.
- Allow hot food to come to room temperature before storing in the refrigerator.

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# International Conference On Emerging Trends in Engineering and Management Research

NGSPM's Brahma Valley College of Engineering & Research Institute, Anjaneri, Nashik(MS)

(ICETEMR-16)

23rd March 2016, [www.conferenceworld.in](http://www.conferenceworld.in)

ISBN: 978-81-932074-7-5

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