Corporate R&D Centre

Bharat Petroleum

energising through innovation

Bharat Hi-Star PNG Stove

World's Most Energy Efficient Dedicated PNG Stove

Present Status – Natural Gas

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India is predicted to become a Gas-based economy.

Natural gas contribution in India's energy basket is expected to increase from 6% to 15 % by 2030.

Number of PNG connections at present in the country is 1.4 Cr.

Expected PNG connections by 2030 : 12 Crore

Dedicated PNG stove – Not available in the market

For better tomorrow we are transitioning towards Natural Gas, but are we utilizing the energy effectively?

Need of Dedicated PNG Stove

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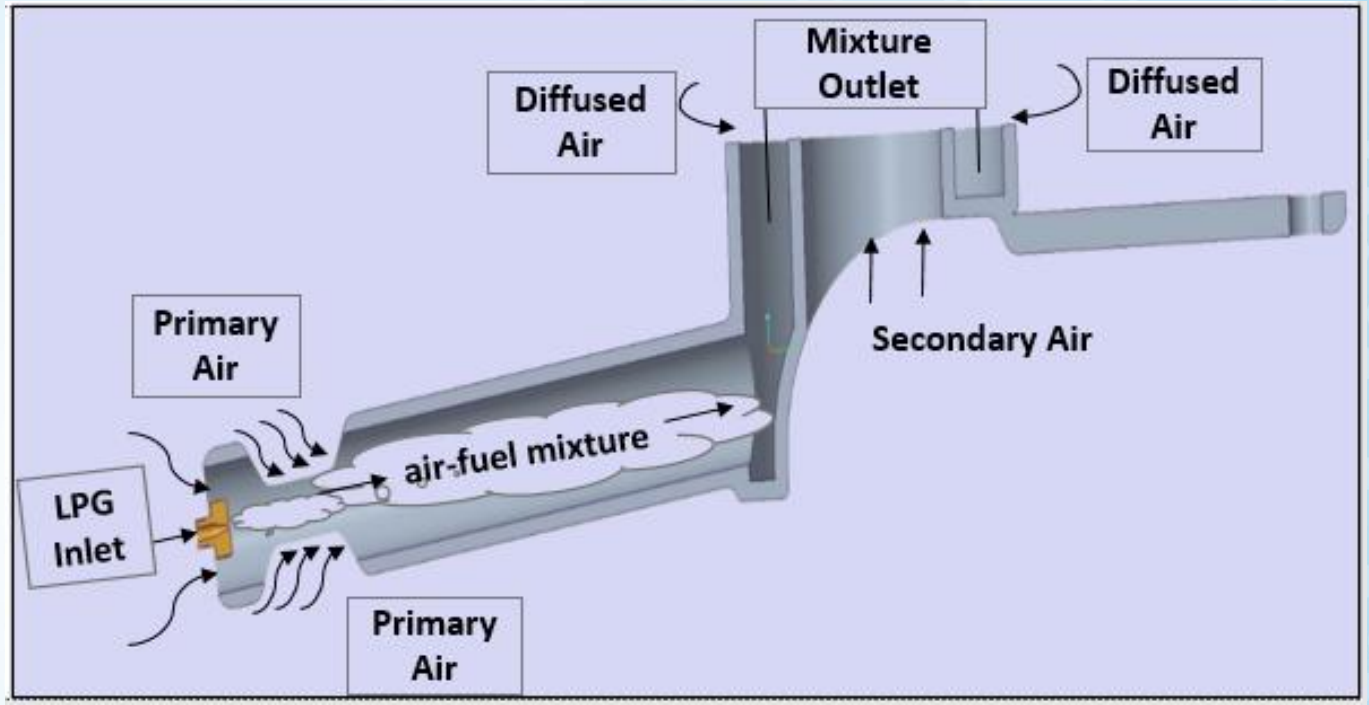
Conversion of LPG Stove for the PNG

- Case 1 – New LPG Stove
  - Thermal Efficiency for LPG – 70%
  - After conversion – 55%
- Case 2 – Old LPG Stove
  - Thermal Efficiency for LPG – 55%
  - After conversion – 40%



Parameter	LPG	PNG
Flow rate (LPH)	50-80	150-240
BIS	4246	17153
Working Pressure	2.9 kN/m2	2.1 kN/m2

Thermal Efficiency Test Setup

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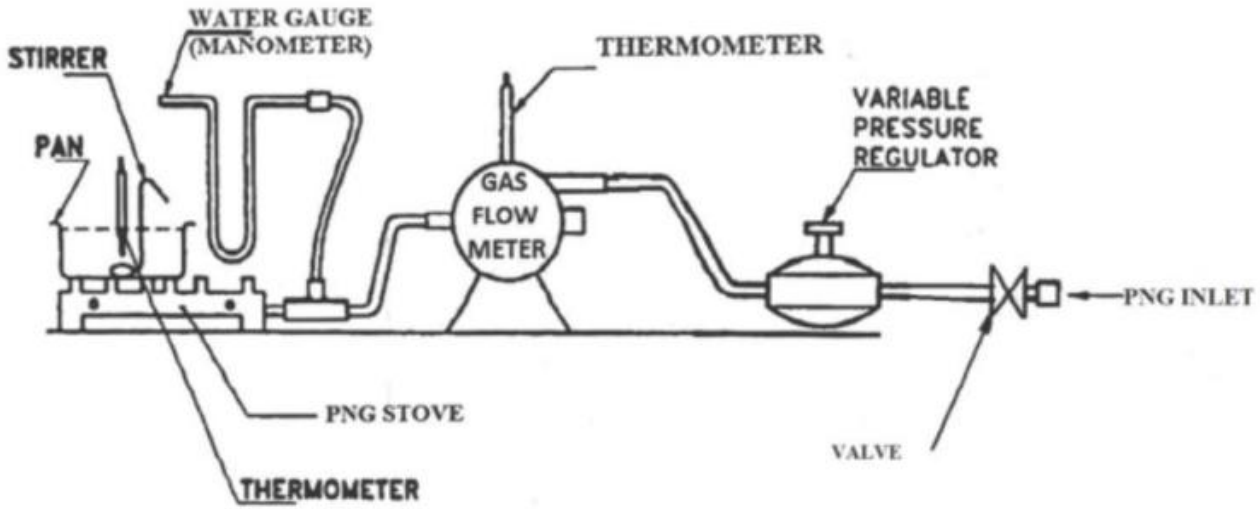
Thermal efficiency determined by the specification provided by Indian Standard IS: 17153



Test Setup

Thermal efficiency $$E = \frac{100(G+W)(T_2 - T_1)}{VH}$$

G = Quantity of water in the vessel, in kg

W = Water equivalent of the vessel complete with stirrer and lid, in kg

T_2 & T_1 = Final and Initial temperatures of water, in ^{0}C ,

V = Gas consumption in liters, H = Calorific value of the gas in kcal/l

CONSISTENCY

Experimental results:

- Less accuracy
- Low Repeatability

State-of-the-art Experimental Test Setup

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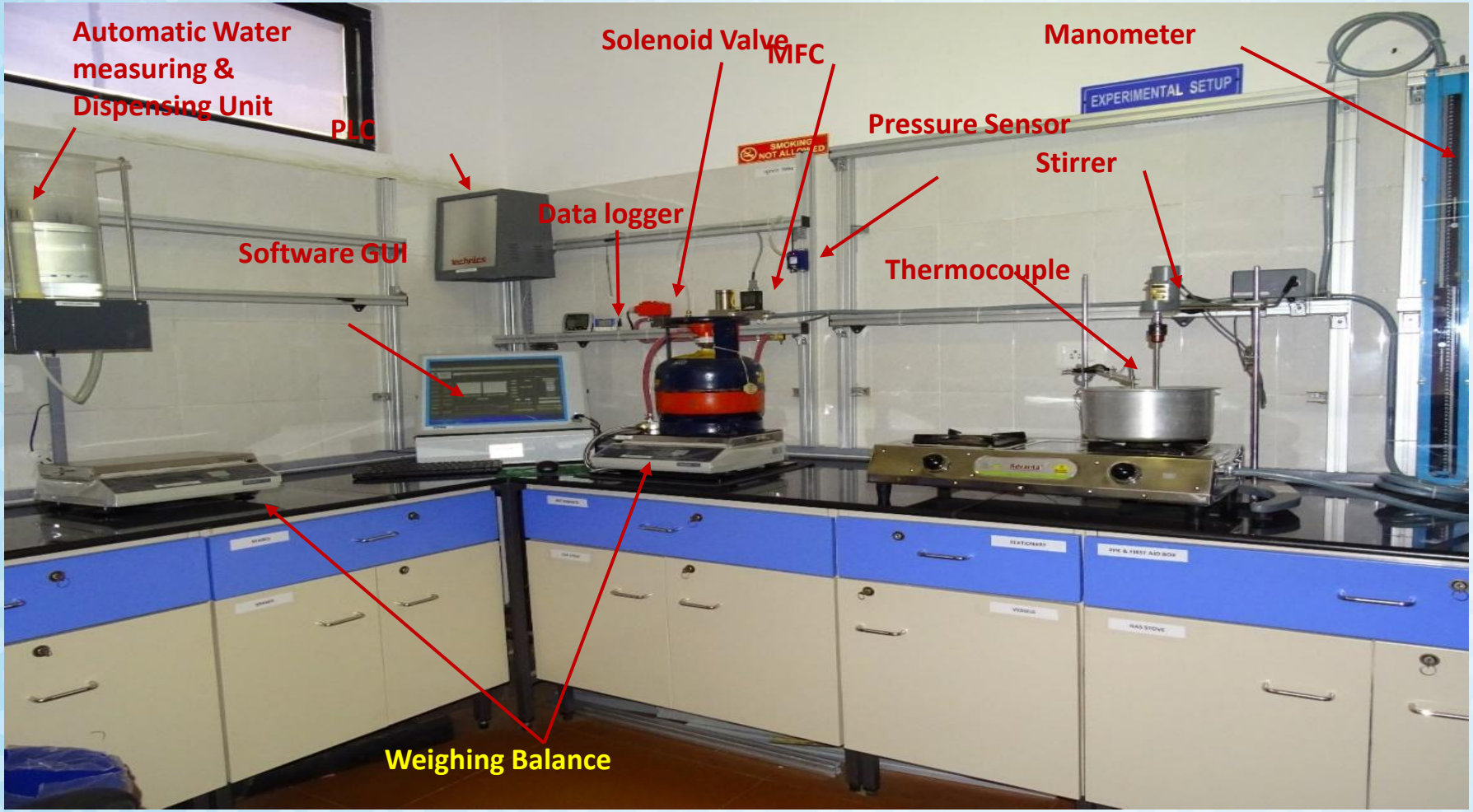
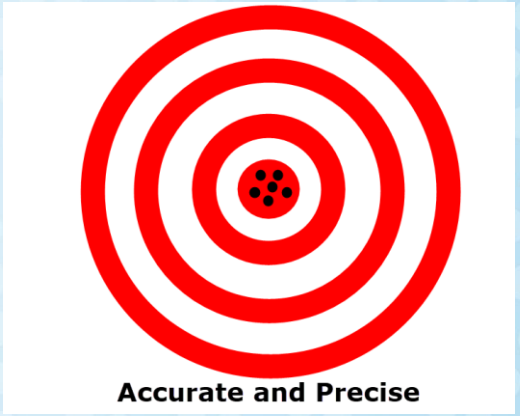


Experimental results:

- High accuracy
- High repeatability
- High consistency



Indigenously Designed, Fabricated and Commissioned at BPCL Combustion Lab

PRODUCT DEVELOPEMT PROCESS

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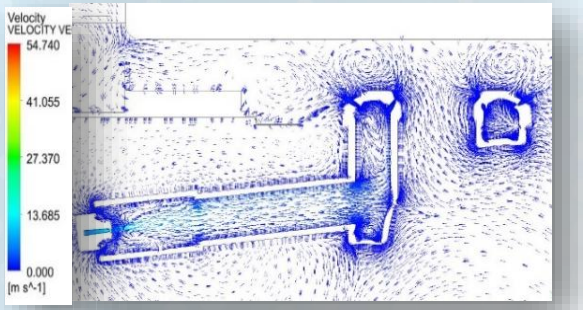
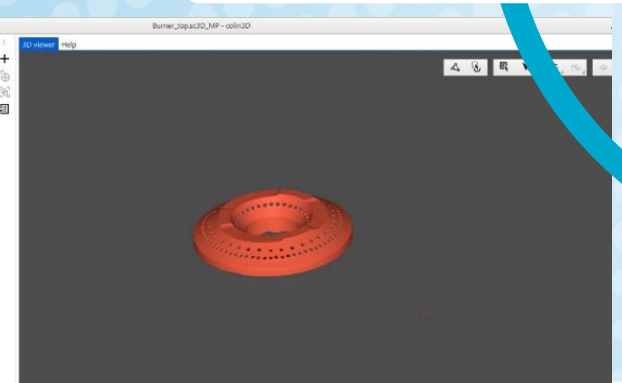


MODELING

- 3D Scanning
- Parameter identification
- CAD Model Preparation



SIMULATION

- Domain Definition
- CFD Studies – Cold flow and Combustion analysis
- Post processing

VALIDATION

- Prototype fabrication
- Experimental testing
- Final product preparation

CFD Simulation Studies and results

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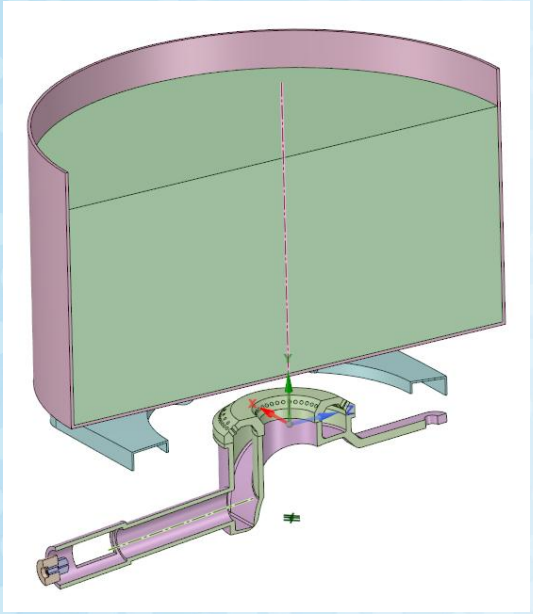
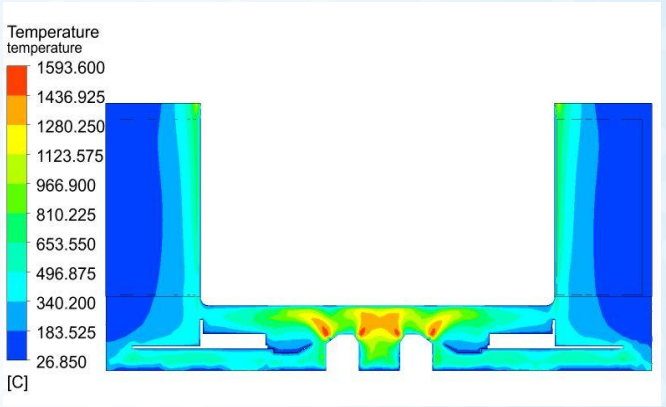
Design of experiments (DOE) based Computational Fluid Dynamics (CFD) Analysis of PNG stove

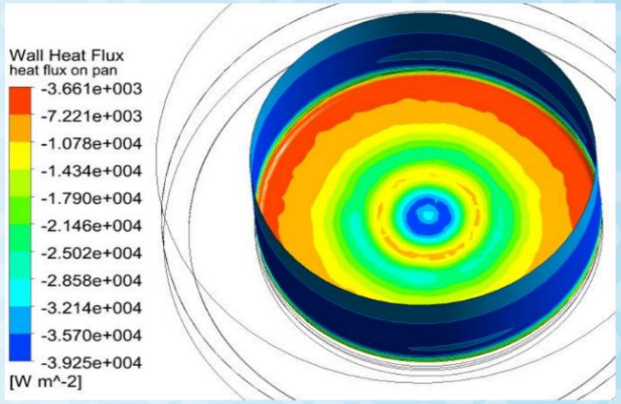


Components

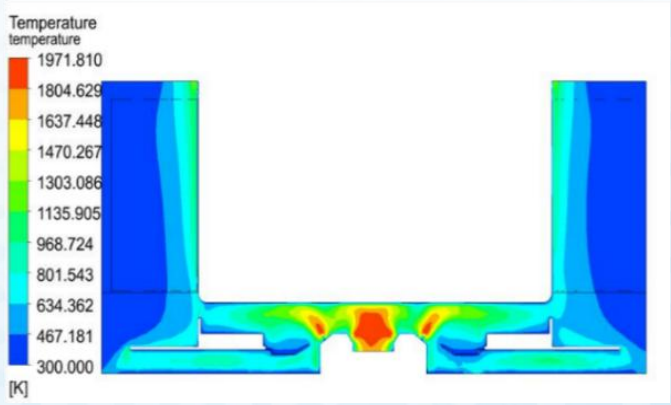
1. Burner Top
2. Mixing Tube
3. Pan support
4. Pan
5. Water in the pan
6. Nozzle

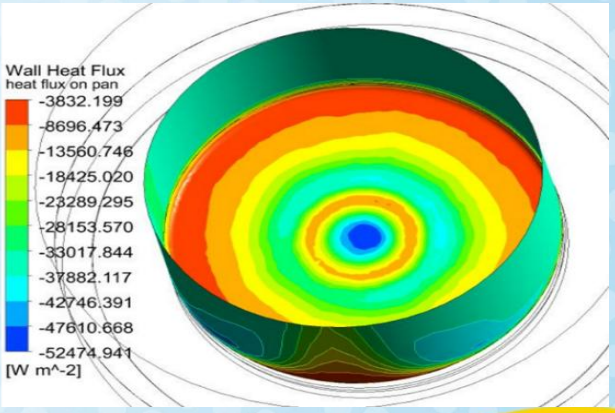
Base Design





Optimized Design





Prototype Fabrication

- Multiple prototypes were fabricated
- Experimental validation of CFD simulation results
- Firming up the final design

Burner Top

Mixing Tube

Pan Support

Product Development

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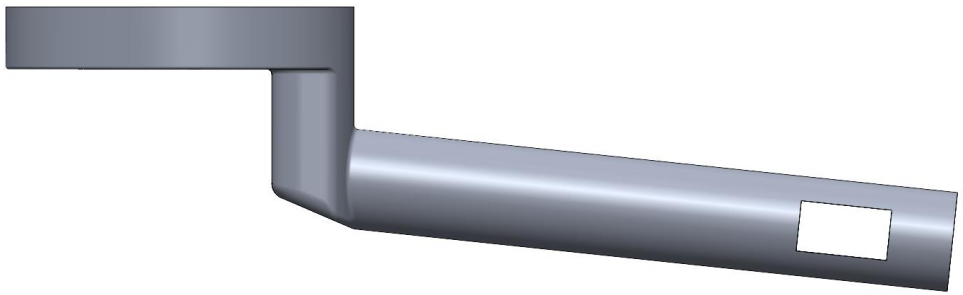
Burner Top

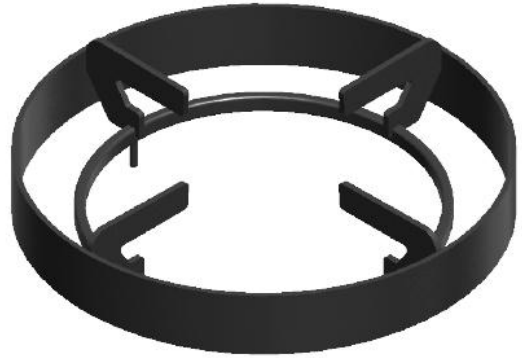
- Diameter of port
- Number of ports based on flame speed
- Better flame structure

Mixing Tube



- Mixing tube design for better air-fuel mixing
- Based on the mixture velocity – cup section designed for less residence time

Pan Support



- Heat shield integrated pan support
- Optimized loading height

World's Most Energy Efficient PNG Stove

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74%plus

Thermal Efficiency

- Designed by BPCL Corporate R&D Centre
- 10 to 15% more efficient than burners available in the market
- Patent applied at Indian patent office
- 25 - 30% savings in PNG consumption

Customer Benefits

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Case 1 – New LPG Stove

- Thermal efficiency – 70%
- After modification for PNG
- Thermal efficiency – 55%
- Savings with Bharat Hi-Star-NG: ***25 – 30% in PNG consumption***

Case 2 – Old LPG Stove

- Thermal efficiency – 55%
- After modification for PNG
- Thermal efficiency – 40%
- Savings with Bharat Hi-Star-NG: ***45 – 50% in PNG consumption***

Sl. No.	Burner	Consumption (SCM)	Thermal Efficiency (%)	PNG Savings (%)
1	Big Burner	152	40%	45-50%
2	Big Burner	110	55%	25-30%
3	Big Burner	82	74% plus	NA
4	Small Burner	120	40%	45-50%
5	Small Burner	87	55%	25-30%
6	Small Burner	64	74% plus	NA

Benefits

Benefit to customer: 25 – 30% savings in gas bills

Benefit to Nation: Savings in Natural Gas Import and savings on FOREX

Benefit to Environment: Reduction in carbon emissions

BPCL – Beyond fuel, energizing lives!.

Leading the charge towards a greener and more sustainable tomorrow.

Patent Application Filed

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Controller General of Patents, Designs & Trade Marks

सत्यमेव जयते

INTELLECTUAL PROPERTY INDIA
PATENTS | DESIGNS | TRADE MARKS
GEOGRAPHICAL INDICATIONS

G.A.R.6
[See Rule 22(1)]
RECEIPT

Docket No 105891

Date/Time 2023/12/21 17:54:58

TARUN KHURANA S/19-22, IFAIA Center, Greater Noida Shopping Plaza, Site IV, Kasna Road, Plot 7/2 Email: info@khuranaandkhurana.com

Sr. No.	App. Number	Ref. No./Application No.	Amount Paid	C.B.R. No.	Form Name	Fee Payment	Remarks
1	202321087717	TEMP/E-1/103934/2023-MUM	8000	50786	FORM 1	Full	ENERGY EFFICIENT DOMESTIC PIPED NATURAL GAS (PNG) COOKING STOVE

BIS Certificate

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ATMY ANALYTICAL LABS PVT.LTD.

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Phone: 0120 - 4004943
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- Testing
- Research
- Innovation

TEST REPORT

Report No.: **N12402160001**

Date: 19-02-2024

I. Mechanical

THERMAL EFFICIENCY TEST — **Test performed on: 19-02-2024 to 19-02-2024**

Test Method : IS 17153:2019

Test Parameter	Result	Requirement (as per IS 17153:2019)	Conformity
Thermal Efficiency test (Clause 26, Annex.D)			
Burner 1 (small)	74.6%	50.0% min.	Yes
Burner 2 (big)	75.5%	50.0% min.	Yes

India is predicted to become a gas-based economy.

Natural Gas Contribution

in energy basket is projected to increase from **6%** to **15%**

Bharat Hi-Star Stove
Save more. Serve more.

BIS approved

Current PNG Connections 1.4 Crore

Expected PNG Connections by 2030 12 Crore

No Dedicated PNG Stove in the Market

Introducing World's Most **Energy-Efficient** Dedicated **PNG Stove**

Bharat Hi-Star PNG Stove
with 74% + thermal efficiency

Steel Body
2 Burner

Glass Top
2 Burner

Glass Top
3 Burner

Glass Top
4 Burner

- Designed by BPCL Corporate R&D Center
- 10-15% more efficient than burners available in the market
- 25-30% savings in PNG Consumption
- Applied for Patent

Customer Benefits Comparison:

New PNG Stove	Vs	Old LPG/Modified Stove
Thermal efficiency for LPG - 70%		Thermal efficiency for LPG - 50 - 55%
After modification for PNG - 50%-55%		After modification for PNG - 35 - 40%
Bharat Hi-Star PNG Stove with 74% + thermal efficiency		
Gas Consumption Savings – 25 – 30%		Gas Consumption Savings – 40 – 45%

Allied Products:

Burner Top
Optimized flame orientation

Mixing Tube
Better air-fuel mixing

Pan Support
Design to prevent heat loss

Bharat Petroleum
energising lives

Bharat Petroleum Corporation Limited
For more details, contact: Corporate R&D Centre, Plot No. 2A, Udyog Kendra, Surajpur – Greater Noida, UP-201 306.
Email: **dlbharathistar@bharatpetroleum.in**
Phone: 0120 2354151

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LAUNCH OF PNG STOVE

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THANK YOU