NEERDHUR: Multi-Fuel Domestic Improved Cookstove

CSIR-NEERI has developed a domestic multi-fuel stove: NEERDHUR, an Improved Cook Stove (ICS) by adopting a comprehensive approach of technological innovations for improved stove efficiency, emission reduction and intensive stakeholder interactions to address issues of adoption such as stove cost, stove maintenance, fuel affordability, and availability. The NEERI stove "NEERDHUR" addresses adoption and sustainability related challenges of ICS. It is a multi-fuel (biomass, charcoal, agro residue etc.) stove with hybrid operation modes.

Overview

NEERDHUR delivers significant user benefits, including >40% reductions in PM emissions and >50% fuel savings compared to traditional cookstoves, reducing the burden of fuel collection particularly for women and children. The reduced emissions translate to improved health outcomes by decreasing exposure to harmful indoor air pollutants.

At CSIR-NEERI, NEERDHUR, a multi-fuel improved cookstove has been developed with high overall thermal efficiency, reduced fuel consumption and reduced emissions through design improvements and technological innovations. NEERDHUR has been extensively tested in the lab and field for user's perception and acceptability. At present, NEERDHUR cookstoves approved by MNRE on the basis of their performance testing conducted by Improved Cook-stove Test Centers and satisfying stipulated performance parameters. NEERDHUR is certified to meet the newly developed cook-stove emission standards by Bureau of Indian Standards (BIS 2013). NEERDHUR shows a thermal efficiency of 33.33% with emission levels as CO: 3.78 g/MJd, TPM: 340.10 mg/MJd at a power output of 1.70KW. NEERDHUR is rated among the best cookstoves in terms of thermal efficiency under the 2KW domestic natural draft biomass stoves.

The socio-economic impact of NEERDHUR extends beyond individual households to address broader challenges. It contributes to reduced deforestation, climate change mitigation, women's empowerment, and job creation through manufacturing and distribution networks. With an addressable market of over 50 crore

users relying on solid fuels in India, NEERDHUR presents a scalable solution aligning with national and global clean cooking initiatives.

IPR Status

The technology is protected by Patent No. 414595 and Design Registration No. 282681 and has received MNRE approval and certification. Patent and Design Registration details are given below:

1. Patent No. 414595, Dr. N.K. Labhasetwar, Er. Ankit Gupta, Er. S.S. Waghmare et al., "An Improved Multi-Fuel Cookstove with Adjustable Grate Mechanism" - App No: 201611024651; Date of filing: 19 July 2016 (Granted on 15 December 2022)
2. Design Number: 282681, Cooking Stove, Class:07-02-Cooking Appliances, Utensils and Containers, Journal Number: 29/2017 dt. 21/07/2017 (NEERDHUR)

Main Innovator from CSIR-NEERI

- Dr. Ankit Gupta
- Dr. Nitin Labhasetwar
- Er S S Waghmare

Salient Features

- Adjustable fuels grate for multi-fuel applications.
- Improved combustion chamber design.
- Material - SS, MS & Bakelite
- Power output Rating- 0.81-1.7 KW
- Thermal efficiency: 30% - 42%.
- Emission reduction > 60% ($PM_{2.5}$ & CO emissions)
- Fuel saving > 50 %.
- Time to boil: 5-8 min.
- Fuel/feed: 0.8 - 1 kg.
- Serving size: 4 - 5 person.
- Estimated Lifespan: 4-6 years
- Stove Weight - 4.5 kg.
- Strength Test – Stable at 70 kg load
- Front-feeding fuel tray
- Pot support for different vessel sizes.

Benefits

- Works on Wood, Agro-residue, charcoal, biomass pellets etc.
- Supports top and front fuel loading.
- Improved thermal efficiency.
- Reduced cooking time
- Reduced emissions.
- Lower fuel consumption.

- Zero maintenance & easy to use.
- Better safety and portability.

Beneficiaries

- Rural households.
- Slum dwellers.
- Street vendors.
- Small & Medium Enterprises.
- Forest and other Govt. Departments.

Awards/Recognition

- NEERDHUR featured in the India Science and Technology Portal at: https://www.indiascienceandtechnology.gov.in/technologies/neerdhur-multi-fuel-domestic-improved-cookstove

  Over 50,000 NEERDHUR units have been disseminated, including through CSR programs and carbon finance initiatives, benefiting over 2 lakh people

- Publications:
  - Gupta, A., Naved, M. M., Kumbhare, H., Bherwani, H., Das, D., & Labhsetwar, N. (2021). Impact assessment of clean cookstove intervention in Gujarat, India: a potential case for corporate social responsibility (CSR) funding. Environmental Science and Pollution Research, 28(10), 12740-12752. https://doi.org/10.1007/s11356-020-11011-8
  - Gupta, A., Mulukutla, A. N., Gautam, S., Tane Khan, W., Waghmare, S. S., & Labhasetwar, N. K. (2020). Development of a practical evaluation approach of a typical biomass cookstove. Environmental Technology & Innovation, 17, 100613. https://link.springer.com/article/10.1007/s11356-020-11011-8
- Social Media Coverage:
  - https://www.youtube.com/watch?v=m7yFSQvwSkI
  - https://www.youtube.com/watch?v=VOlqKCXJYN8
  - Facebook Post by Corbett Foundation: https://www.facebook.com/thecorbettfoundation/posts/10157438475626906

Technology Licensee (2020-2025)

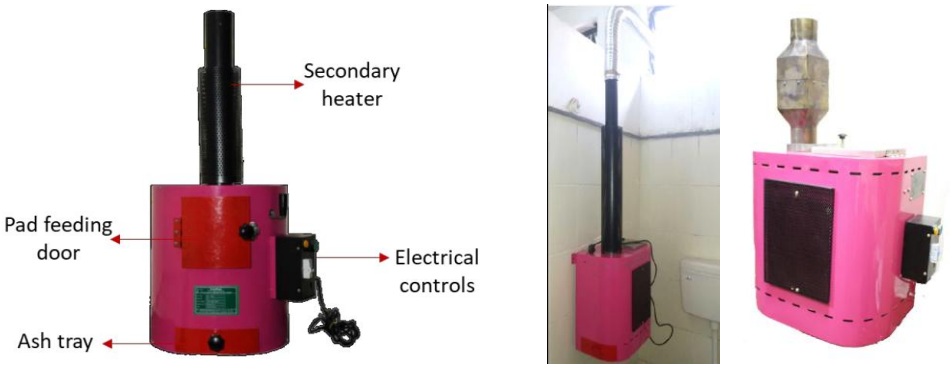
1. Eco Sense Appliances Pvt. Ltd
   K-151 Waluj MIDC Aurangabad – 431136
   Email: ketaki.kokil@ecosenseappliances.com

2. Ecologiqe Science Technik Pvt. Ltd.
   39, Agnelayout, Swawalambi Nagar, Khamla Road, Nagpur, Maharashtra – 440025
   Email: director@estpl.co.in

3. Punjab Renewable Energy Systems Pvt. Ltd.
   J-105, first floor, Tower - 7, Belapur Railway Station, CBD Beapur, Navi Mumbai - 400614,
   Email: info@prespl.com

GreenDispo: Electric Sanitary Pad Incinerator

With disposal of over 1 billion used sanitary pads burdening the waste management system, GreenDispo by CSIR-NEERI, an improved decentralised waste incinerator, has helped effective management of menstrual waste at source, reducing the health-sanitation risks and environmental-ecological footprints.



Overview

CSIR-NEERI has designed and developed an improved decentralized sanitary pad incinerator, "GreenDispo" with innovation in combustion chamber, offering improved combustion of menstrual wastes. It ensures instant & hygienic disposal in an automatic way, with auto power & thermal cut-off and is suitably insulated for energy conservation and user safety. Unlike many other decentralized incinerators operating at around 300-400°C resulting in harmful air emissions, GreenDispo has a primary and a secondary combustion chamber (optionally), which operates at 800 ± 50 °C and 950 ± 50 °C, respectively with 2 seconds of gases residence time to help reduce carcinogenic air emissions, produced during the burning of plastics/chlorinated products. The unit can efficiently burn pads with high moisture content and super absorbent polymers (SAP). The exhaust concentration of Total Particulate Matter (TPM), CO, SO_2, NO_x was observed to be 48.37 ± 8.7 mg/m^3, 62.46 ± 8.10 mg/m^3, 38.18 ± 1.08 mg/m^3, 1.08 ± 0.44 mg/m^3, respectively with less than 5% ash per napkin, meeting standards under Waste Management Rule 2016 (CPCB). GreenDispo offers practical operational benefits with its automated functioning that includes thermal cut-off and safety features. The energy-efficient design incorporates insulation for heat conservation, keeping operational costs minimal despite its 1-2 kW power consumption. With a processing capacity of 30-35 pads per hour in the standard model, it provides an efficient disposal solution for various institutional settings.

IPR Status

- GreenDispo has been jointly developed by CSIR-NEERI, ARCI and Sowbal Aerothermics and protected by a patent Patent Number :459775 , “An ecofriendly incinerator to dispose of the used sanitary napkins and bio-medical waste” - App No: 201821021430; Date of filing: June 9, 2018 (Granted on 17/10/2023)

Innovators from CSIR-NEERI

- Dr. Ankit Gupta
- Dr. Nitin Labhasetwar
- Dr Rakesh Kumar

Salient Features

- Ensures used sanitary pads disposal in a scientific & hygienic way
- Energy efficient heaters and innovative design of combustion chamber
- Incinerates used sanitary pads at a temperature more than 800 °C
- Optimized A/F ratio and heating cycles
- Efficiently burn unbleached pads with high cellulose & super absorbent polymers (SAP)
- Exhaust emissions comply to BMW Management Rules, 2016
- Eliminates Dioxin & Furan during combustion
- Ash collected in separate tray with < 5% ash generated per napkin.
- Auto power & thermal cut-off and automatic temperature control
- Suitably insulated with safe device surface temperatures
- Easy to operate and with low maintenance

Benefits

- Hygienic & Efficient – Instantly disposes of sanitary pads at the source.
- Eco-Friendly – High-temp combustion (800-950°C) minimizes harmful emissions.
- Regulatory Compliance – Meets BMW Management Rules, 2016 (CPCB) standards.
- Energy-Efficient & Safe – Auto power cut-off, insulation, and optimized heating.
- Low Maintenance – Automatic operation with easy ash disposal (<5% per napkin).
- High Capacity – Processes 30-35 pads per hour, ideal for institutions.
- Sustainable – Reduces landfill waste and air pollution.

Beneficiaries

- Schools and institutions
- Community toilets
- Girls’ hostel
- Industries and Offices
- Metro/Railway Stations
- Convention centres
- Public Health Centeres

Awards/Recognition

- Over 1000 units covering different states/cities. Users and stakeholders include MP Government, MHRD, AICTE Institutions, UNDP, WaterAID, and many other reputed agencies.

Technology Licensee (Period - 2018-2022):

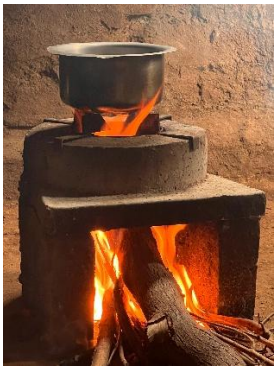
1. M/S Sowbal Aerothermics
   Kushaiguda, Secunderabad, Telangana 500062


2019.07.12 14:38

PAVAK: Mud and Concrete-Based Improved Cookstove

CSIR-NEERI's, in association with Glenmark Foundation has developed PAVAK improved cookstove specifically designed to address the cooking needs of India's most vulnerable populations. Unlike metal-based alternatives, this improved cookstove is constructed using locally available materials such as clay and concrete, making it 3-5 times more affordable while maintaining high performance standards.





Overview:

PAVAK addresses both health and deforestation concerns while easing the burden of fuel collection for rural households. The cookstove complies with BIS 13152:2013 emission standards, ensuring substantially reduced harmful emissions compared to traditional cooking methods.

PAVAK resembles traditional cooking practices, ensuring food taste is preserved—a crucial factor for adoption in rural communities where cooking traditions are deeply ingrained. This cultural sensitivity has resulted in higher acceptability rates compared to metal-based cookstoves that often fail to gain traction in remote areas. PAVAK can be fabricated and repaired on-site with minimal training, creating opportunities for local employment while ensuring sustainability of the technology. With an operational lifespan exceeding 4 years, it provides a durable solution despite its low-cost materials.

PAVAK addresses multiple developmental challenges simultaneously—improving health outcomes through reduced household air pollution, mitigating environmental impact, reducing cooking costs and time, creating local employment, and empowering women by reducing the drudgery associated with traditional cooking methods.

IPR Status

The technology has reached TRL 9 status, with successful field validation and commercialization. It is protected by granted design registrations (Design No. 356681-001, 355605-001) and has been documented in peer-reviewed research demonstrating its benefits.

Innovator

- Dr. Ankit Gupta
- Er Roshan Wathore
- Dr. Nitin Labhasetwar

Salient Features

- Constructed using low-cost materials such as mud/clay and concrete, which is readily and cheaply available throughout the country, even in rural areas.
- Satisfies BIS 13152 standards for emissions and thermal efficiency
- Flanged inlet for creating a natural draft air flow.
- Secondary air supply via holes for optimized air-fuel ratio and efficient combustion of biomass by providing air vents
- PAVAK can easily be maintained and repaired with locally available resources such as mud/clay and cement
- Field performance is comparable to metal-based cookstoves.

Benefits

- 35-50% reduced $PM_{2.5}$ emissions and upto 600 kgs of annual firewood savings, resulting to health and environmental benefits
- 3-5 times more affordable than metal-based improved cookstoves
- No compromise in taste of the cooked food

Beneficiaries

- Rural populations living in remote/tribal/forest areas and are dependent on firewood for daily cooking.
- Urban slums who are unable to afford clean cooking fuels

Awards/Recognition

- PAVAK field performance has been validated in the field. The findings have been published in an international peer-reviewed journal.
  Wathore, R., Hedaoo, R., Ahmad, A., Gupta, A., Dhoble, A.S., Labhasetwar, N., 2023. Field based performance evaluation of optimized improved biomass mud cookstoves in rural India. Renewable Energy 119567. https://doi.org/10.1016/j.renene.2023.119567

Technology Licensee

- Developed under a project funded by Glenmark Foundation, Mumbai, to help rural community, especially those at the bottom of the economic pyramid.

रखरखाव

बेहतर रखरखाव के लिए निम्लिखित बिंदुओं पर ध्यान दें :

- ✓ हर 8-10 दिनों में किया जाने वाला नियमित रखरखाव स्टोव के जीवनकाल में सुधार कर सकता है
- ✓ बेहतर रखरखाव के लिए मिट्टी का लेप लगाया जा सकता है

पावक चूल्हा

•उत्सर्जन परीक्षण सुविधा, सीएसआईआर-नीरी, नागपुर में परीक्षण किया गया

क्षमता / ईंधन उपयोग | कम प्रदूषण | समय की बचत | सुरक्षा

SDG में योगदान

अधिक जानकारी के लिए

CSIR - National Environmental Engineering Research Institute (CSIR-NEERI)
Nehru Marg, Nagpur – 440 020
Email: nk_labhsetwar@neeri.res.in / a1_gupta@neeri.res.in / r.wathore@neeri.res.in

पावक चूल्हा

घरेलू उन्नत एवं किफायती चूल्हा

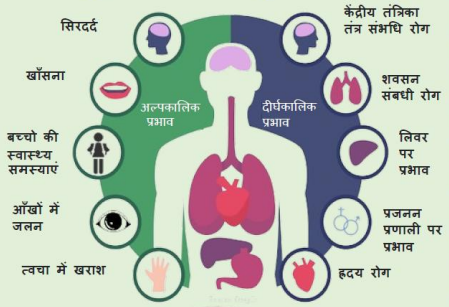
CSIR - National Environmental Engineering Research Institute (CSIR-NEERI)

Glenmark Foundation

Spandan Samaj Seva Samiti

कार्यान्वयन भागीदार

पारंपरिक चूल्हे से निकलने वाले धुएं से स्वास्थ्य समस्याएं



पावक चूल्हा

- ✓ धुएं में लगभग 50% की कमी
- ✓ 600 किलो वार्षिक लकड़ी की बचत

पावक चूल्हा
घरेलू उन्नत चूल्हा

- ✓ कम प्रदूषण और धुआं
- ✓ लकड़ी की बचत और वन संरक्षण
- ✓ समान स्वाद और भोजन पकाने में कम समय
- ✓ स्वच्छ एवं कुशल दहन
- ✓ आसान संचालन और रखरखाव