

By continuing to use this site you consent to the use of cookies on your device as described in our [cookie policy](#) unless you have disabled them. You can change your [cookie settings](#) at any time but parts of our site will not function correctly without them.

[Sign In](#)[Subscribe](#)

## Pollution

### India: Cooking up a recipe for clean air

Millions still burn solid fuel indoors preparing food but also producing deadly fumes

## The Big Read



*Girls carry wood sticks back home to use as fuel for cooking in Amritsar, north-west India © AFP*

DECEMBER 21, 2016 by: **Kiran Stacey**

Puni Pradhan heaves a heavy metal pot on to her small stove, then hunches over it to feed wooden branches into a chamber below. It is a routine she follows twice a day before cooking the family meal, usually consisting of rice and a few vegetables.

Her house is one of 34 mud huts in the village of Notarpalli, a remote farming community three hours' drive from Bhubaneswar, the capital of the eastern Indian state of Odisha. The village is flanked on one side by the lush mountains of the Eastern Ghats and on the other by sprawling paddy fields.

Any sense of rural idyll is dispelled in Puni's kitchen, however, where dark soot marks streak up the walls and across the ceiling — a sign of the damage that cooking the family's meals is doing to

all of them.

Puni Pradhan does not enjoy talking to strangers about her life, but her neighbour Rambha Pradhan (most of the villagers here share the same surname) explains what it is like cooking in a kitchen like this. “Everything gets dirty,” she says. “Our hands, our clothes, all the interiors of our house have all gone black because of the smoke.”

Nearly half of the world’s population — about 3bn people — eat food cooked indoors on stoves fuelled by wood, coal or animal dung. In [rural India \(http://next.ft.com/content/f5bd1bbc-b243-11e6-a37c-f4a01f1b0fa1\)](http://next.ft.com/content/f5bd1bbc-b243-11e6-a37c-f4a01f1b0fa1) the proportion of people cooking indoors with solid fuel is 64 per cent, and an [estimated 60m tonnes \(http://wgbis.ces.iisc.ernet.in/energy/paper/Biogas/intro.htm\)](http://wgbis.ces.iisc.ernet.in/energy/paper/Biogas/intro.htm) of cow dung is burnt for cooking each year. In many countries of sub-Saharan Africa, including Rwanda, Uganda and Ethiopia, the proportion is 98 per cent.



*Transmitters powered by solar panels monitor a stove's energy usage*

The noxious fumes are deadly, especially in the small, enclosed spaces of village kitchens. A study in southern India found that levels of harmful airborne particulates in households cooking with solid fuels are well over [2,000 microgrammes per cubic metre \(http://www.who.int/globalchange/resources/country-profiles/climatechange\\_global\\_overview.pdf\)](http://www.who.int/globalchange/resources/country-profiles/climatechange_global_overview.pdf) — far exceeding the level of 100 considered safe by India’s pollution control board.

The World Health Organisation estimates that solid-fuel stoves contribute to about 4.3m deaths a year, with tuberculosis, chronic bronchitis and lung cancer common in areas where they are

used. They also contribute to climate change and air pollution, even in big cities such as New Delhi and Beijing, where solid-fuel cooking is also common. [According to estimates \(http://www.teriin.org/files/reducing-air-pollution-report/#p=15\)](http://www.teriin.org/files/reducing-air-pollution-report/#p=15) from New Delhi's Energy and Resources Institute, nearly 40 per cent of India's air pollution comes from domestic fuel burning.

For decades, researchers, charities and non-governmental organisations have looked for ways of persuading [people in India \(https://www.ft.com/topics/themes/Indian\\_Society\)](https://www.ft.com/topics/themes/Indian_Society) and around the world to switch to more efficient cooking methods, which use less fuel per unit of heat and often cost relatively little. But time and again, people in rural areas return to their traditional stoves — though until recently it has never been entirely clear why. “Three decades of efforts to promote both modern fuels and improved biomass stoves have seen only sporadic success,” [a World Bank report \(http://documents.worldbank.org/curated/en/164241468178757464/pdf/98664-REVISED-WP-P146621-PUBLIC-Box393185B.pdf\)](http://documents.worldbank.org/curated/en/164241468178757464/pdf/98664-REVISED-WP-P146621-PUBLIC-Box393185B.pdf) found in 2014.

Now a project working in Puni Pradhan's village may be uncovering both the root of the problem and the solution. Using state of the art technology, researchers at Nexleaf, a non-profit organisation, monitor real-time usage of different designs of new [cooking stoves \(http://nexleaf.org/cookstoves/\)](http://nexleaf.org/cookstoves/) to find out which one is more popular and why, before feeding the data back to the manufacturers.

Small changes have been incorporated into the designs, and they seem to have worked: every villager in Notarpalli is now using a more modern stove eight months into the trial. The new designs still burn wood, but they are around 25 per cent more efficient, and researchers say they could play a vital role in changing some of the villagers' most entrenched domestic behaviour.

“Apart from this, it is not clear that any more than a couple of programmes are achieving results in the long term,” says Nithya Ramanathan, Nexleaf's director.



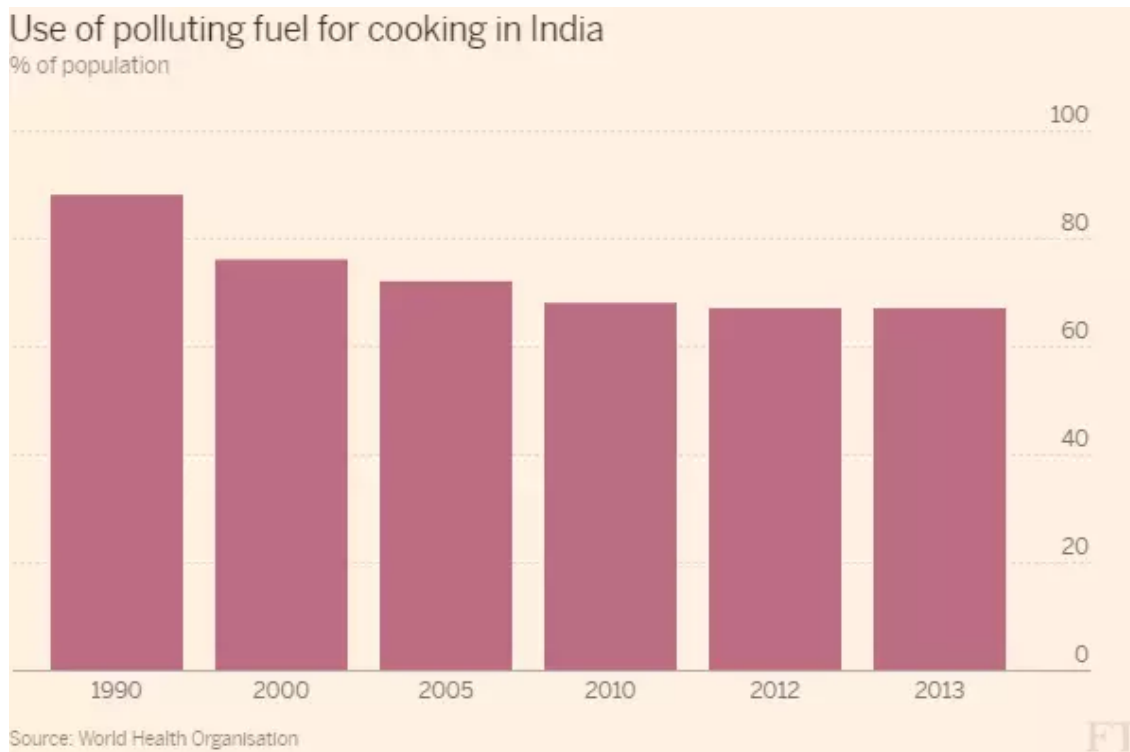


*A woman in Hyderabad closes her eyes as smokes rises from her cookstove © Tanvi Mishra*

Villagers in Notarpalli have long been suffering the effects of smoky stoves in their houses. But only since they began the shift to using cookers with more modern designs have they realised the toll it was taking, they say.

Rajani Pradhan has seen her husband's tuberculosis worsen over the past 15 years. "Recently we have had to take him to hospital for major treatment," she says. "He can't work and we have to survive off my daily wage." Every day she walks down the potholed track that leads out of the village to her job at a nearby farm, for which she earns around 150 rupees a day — about \$1.80.

Rajani, Rambha and their fellow villagers have all been part of Nexleaf's scheme. For the past few months they have been using a variety of stoves, but with a common feature: a small sensor attached to each one. The sensors are hooked to a blinking transmitter box attached to one of the hut's mud walls and powered by a solar panel.



This set-up allows researchers to tell exactly when each stove is being used. As soon as a family stops using one, caseworkers can visit and start asking detailed questions about why.

“We knew there were millions of cookstoves that were allegedly being used [around the world] but actually standing under a table or being used as a pot,” she says. “Why has so much [money \(http://next.ft.com/content/3725d2cc-baa2-11e6-8b45-b8b81dd5d080\)](http://next.ft.com/content/3725d2cc-baa2-11e6-8b45-b8b81dd5d080) gone into developing and distributing cookstoves and we weren’t getting the health benefits?”

The organisation discovered two things from the data. First, the time women actually spent using the stoves was far less than they had told the researchers. Second, many of the problems they reported were surprisingly easy to solve.

## Towards a new design

Sitting on a small plastic chair as the sun sets over the village, Rambha explains why she stopped using an earlier version of a more efficient stove. “The feeder hole was very small,” she explains. “If we wanted to cook rice, which takes a longer time, it was difficult to feed the chamber. Also, the pot was too small so I couldn’t cook for 10-12 people.”



*Traditional cooking methods in India*

Nor did Puni Pradhan like the fan on the side — a design feature that was meant to make cooking more efficient. “The fan was just opposite the feeder, and the soot would fly out from that when used,” she says.

Minati Jani had a different problem. “The cooking happened too fast,” she says. “Earlier we could place more firewood in the mud stove and then go and do other work, but with this stove we needed to sit near it all the time.

“When I went out for work, my mother-in-law refused to use it, complaining that she could not cook in the new stove . . . That meant I had to do all the cooking, which made it even harder.”

Tiny design faults such as these — problems that were not picked up in traditional aid programmes — may lie at the heart of previous failures.

[A study in 2012 \(https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2039004\)](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2039004) looked at another programme, also in Odisha state, which subsidised stove construction for 15,000 households over four years.

“Initial household take-up and usage of the almost free new stoves was far from universal and then declined markedly,” it found.

Ajay Mathur, director-general of the Energy and Resources Institute based in New Delhi, says: “The improved cookstoves were made, but they didn’t take into account how people cooked. They

wouldn't realise, for example, that the stove for making rice should be different from the one for making rotis."

The feedback from villagers in Notarpalli has been incorporated into a new design, which is loaded from the side, has a larger hole and a larger burner. The new design worked — all but one of the three dozen houses in Notarpalli are now using it. The other is using a different design. Some of the villagers have buried their old mud stove under piles of firewood, unlikely ever to use them again.

Chandra Shekhar Sinha, lead climate change specialist at the World Bank, says: "The main thing holding clean cooking stoves back was the absence of an attractive product which meets people's requirements. We are only now moving towards a user-centric design of stove and recognising what causes failure or success."

The approach of using more feedback — supported by the data — to refine programmes might help improve the efficiency of other aid spending, too. This is a high priority for politicians in western countries where the idea of international development is under attack.

Outside Jhunu Pradhan's house, partly obscured by the undergrowth, is a ceramic squatter toilet, filled with sand. "An NGO built this here 10 years ago, but nobody ever wanted to use it," her husband explains. Asked whether the organisation that built it knows it is not being used, he replies: "I don't know, they never came back to check."

## Nascent carbon market

Nexleaf's sensors have another benefit, one that has proved crucial in increasing take-up: they have enabled the aid organisations to start a market in payments for carbon savings. For every hour the newer stove is used, households receive a payment, which can add up to a total of anywhere between Rs100 and Rs500 a month — equivalent to several days' wages.

"I've earned Rs540 of carbon credits over the past one-and-a-half months," says Jhunu Pradhan. "Last month it was Rs322. It is a major benefit." Minati Pradhan says it was the carbon financing scheme that persuaded her not to go back to her old mud stove.

## Related article

Trash to treasure (<http://next.ft.com/content/04f2>)

For now, the carbon financing is being provided by a group of donors that includes Beneventures, a Californian foundation, and [Qualcomm \(http://markets\)](http://markets).

fc8c-39e9-11e2-a00d-00  
144feabdc0)

A rubbish-burning stove is helping  
fuel communal harmony in Kenya

[ft.com/data/equities/tearsheet/summary?s=us:QCOM](https://www.ft.com/data/equities/tearsheet/summary?s=us:QCOM)),  
the US telecoms company. But eventually Ms  
Ramanathan hopes projects like this can tap into  
national or multinational carbon trading schemes.

The change in Notarpalli is already improving villagers' health. Bidyadhara Dash, a local doctor, says: "Because of the smoke produced by the mud stove, 80 per cent of children had nausea, allergies and difficulty sleeping. That figure has been reduced to 10 per cent," he says. "Rates of dysentery, bronchitis and tuberculosis have all fallen."

The improvements made by using the newer type of stove are not enough, however. Although it only uses half the fuel of the old ones, it is still fired with wood, and still puffs smoke into the heart of villagers' homes. And some believe that rather than trying to encourage people to use more efficient solid-fuel stoves, governments should focus instead on getting them on to piped gas or electricity.

"I don't think improved biomass cookstoves are what people want," says Mr Mathur. "They want LPG [liquefied petroleum gas] or electricity — the same thing people have in the towns."

Nexleaf's Ms Ramanathan disagrees. For remote communities such as Notarpalli, changing people's behaviour in the long term is such a difficult task that it is better to start small.

"It is not enough yet," she says. "But it is a step, and crucially it helps entrench behavioural change. If everyone works together on this problem in a co-ordinated way, maybe in the next 10 years we might be able to solve this."

*Additional reporting by Jyotsna Singh*

### **Development: Clean cooking efforts are prey to familiar aid problems**

In the months following the 2010 Haiti earthquake, the Red Cross launched a housebuilding project to try to regenerate some of the island's poorest neighbourhoods. Four years later, half a billion dollars had been raised, but only six permanent homes [had been built \(https://www.propublica.org/article/how-the-red-cross-raised-half-a-billion-dollars-for-haiti-and-built-6-homes\)](https://www.propublica.org/article/how-the-red-cross-raised-half-a-billion-dollars-for-haiti-and-built-6-homes).

The programme was criticised for the same failures that have beset many large aid projects around the world — a lack of local understanding from those carrying it out and



inadequate monitoring of the money being spent. Critics say problems like this have contributed to declining public confidence in international development spending.

“Even among the most dedicated organisations, there is very little transparency regarding the impact on the ground,” says Nithya Ramanathan, a director of Nexleaf, an NGO. “The technology just didn’t exist, or increased transparency wasn’t possible without dramatically increasing the cost.”

The same kinds of problems have blighted attempts to get people to use more modern cooking stoves.

In 2010, Hillary Clinton, then the US secretary of state, launched a headline-grabbing initiative known as the [Global Alliance for Clean Cookstoves \(https://www.washingtonpost.com/opinions/these-cheap-clean-stoves-were-supposed-to-save-millions-of-lives-what-happened/2015/10/29/cob98f38-77fa-11e5-a958-d889faf561dc\\_story.html?utm\\_term=.63d42b6c30de\)](https://www.washingtonpost.com/opinions/these-cheap-clean-stoves-were-supposed-to-save-millions-of-lives-what-happened/2015/10/29/cob98f38-77fa-11e5-a958-d889faf561dc_story.html?utm_term=.63d42b6c30de).

“Today, we can finally envisage a future in which open fires and dirty stoves are replaced by clean, efficient and affordable stoves and fuels all over the world,” Mrs Clinton said when she launched the programme.

Despite the fact the foundation attracted \$400m (<http://cleancookstoves.org/about/how-we-work/our-accomplishments.html>) in funding, the proportion of people around the world using solid fuels to cook has barely changed at about 40 per cent.

“It is critical to allow for household behaviour when evaluating health and environmental technologies,” said a Harvard paper two years later. “All technologies must ultimately be used by humans who reveal their valuations through their usage and maintenance decisions.”

*This article has been [amended \(http://next.ft.com/content/f8e092da-c899-11e6-8f29-9445cac8966f\)](http://next.ft.com/content/f8e092da-c899-11e6-8f29-9445cac8966f) to reflect the fact that an estimated 60m tonnes of cow dung is burnt for cooking in India each year, not 60 tonnes.*

---

Print a single copy of this article for personal use. Contact us if you wish to print more to distribute to others. © The Financial Times Ltd.

### **Read latest**

US fracking shown to benefit local households

---

## Latest on Pollution

### Shale Oil and Gas

## US fracking shown to benefit local households

Study on shale boom impact finds average annual gain of \$1,900 in high-activity areas

### Sustainability

## China announces comprehensive ban on ivory trade

Prohibition by world's largest consumer hailed by conservationists

### Europe

## Polish city more polluted than Beijing

Coal burning makes Poland Europe's capital of smog

---

### Special Report **The Connected Business**

## Parents turn entrepreneurial to make Christmas gifts

Technology that encourages children to get up and do rather than sit back and watch

### Special Report **Poland**

## Poland backs off media curbs but fails to end stand-off

Demonstrations inside and outside parliament continue

---

## Latest in Opinion

### Lombard **Kate Burgess**

## Wolfson's escalating problems at Next

Retailer cuts full-year profit guidance for a third time

2 HOURS AGO

FT View

New politics of the UK’s trade union movement

The latest leadership contest at Unite offers a chance for change  
4 HOURS AGO

Chris Giles

Brexit experts, confess to your errors and carry on

Economists are absolutely justified in sticking to pre-referendum views on leaving EU

Follow the topics mentioned in this article

Opinion

The Big Read

Energy & Resources Institute

World Bank

Bhubaneswar

Follow the authors of this article

Kiran Stacey

Take a tour of myF<sup>+</sup>





