Greener grassroots connections

Combining data sets with community engagement helps facilitate access to cleaner, safer energy sources. **By Gemma Conroy**

In January 2020, Australia's Northern Territory was gripped by one of its hottest summers on record. Almost 1,000 kilometres south of Darwin in Tennant Creek, Warumungu traditional owner of the land, and a community leader, Norman Frank Jupurrurla, struggled to keep his house cool as temperatures edged past 40 °C.

Energy insecurity for heating, cooling and cooking is an issue for millions of people around the world who are reliant on expensive, short-term measures for subsistence.

Frank was among the 10,000 public housing tenants in the Northern Territory who rely on a prepayment electricity meter, which allows households to pay for their energy before consuming it. When a household uses up the power it has purchased, its electricity is disconnected until more credit is bought. "I had to keep unplugging the air-con because it used too much power," says Frank, a board member of the Julalikari Council Aboriginal Corporation in Tennant Creek. "I put up with it, but it was very hot."

Frank's experience is not unique. In 2021, he co-authored an analysis of prepayment meter data from more than 3,000 remote Indigenous households across the Northern Territory with researchers from the Tangentyere Council Aboriginal Corporation in Alice Springs and the Australian National University, Canberra. Between 2018 and 2019, more than 90% of households experienced at least one disconnection, with almost three-quarters experiencing more than 10 power cuts over the same period. High-energy-use households located in the central climate zone, a region known for its extremely hot days and cold nights, had a one-in-three chance of a same-day disconnection during extreme temperatures (T. Longden *et al. Nature Energy* **7**, 43–54; 2022).

These frequent disconnections have an enormous impact on Indigenous communities' ability to access essential services, such as temperature control, refrigeration and lighting, according to study co-author Vanessa Napaltjarri Davis, a senior researcher at the Tangentyere Council Aboriginal Corporation. "It takes a really big toll on our people," says Davis, a Warlpiri and Northern Arrente woman.

The deeper problem is that the prepaid system, including smart meters, which show households how much electricity they have used, was not developed in consultation with the communities that rely on it, says study co-author, Simon Quilty, a physician and PhD candidate at the Australian National University in Canberra. "Suddenly, everyone was given smart meters as if it was a solution," he says.

In a related *Nature Energy* policy brief, the researchers suggested that policies be developed in collaboration with residents, local councils and other relevant organizations to improve energy security for remote Indigenous communities (T. Longden *et al. Nature Energy* **7**, 11–12; 2022). In addition to reducing the number of sudden disconnections during temperature extremes, the authors proposed that policymakers create more opportunities for communities to access rooftop solar.

But there are hurdles to overcome. While writing their paper, Frank and Quilty led a demonstration project with Original Power, an organization focused on clean-energy projects, to determine the barriers preventing Indigenous households from accessing solar energy. "There's no point doing the research without demonstrating a solution and the barriers to that solution," says Quilty.

In August 2021, the team installed solar panels on Frank's house, but it took months of negotiations with government agencies to get them switched on, as it wasn't clear whether they were compatible with his prepayment meter. The efforts paid off. Four months later, Frank became the first Indigenous public-housing tenant in the Northern Territory to integrate rooftop solar with a prepayment meter. "I can leave the air-con on all day and the heater on all night, and I don't have to pay too much," he says.

Ruby Heard, a Djaru woman and PhD candidate exploring energy justice for remote Indigenous communities at the University of Melbourne in Victoria, hopes that Frank and Quilty's efforts will lead to policies that enable Indigenous communities to transition to solar energy. "Everybody should have access," says Heard, who is also director of Alinga Energy Consulting, which specializes in renewable energy solutions for remote communities.

Since publishing the paper, the team has been sharing its findings with policymakers, local councils and media outlets to raise awareness of the energy insecurity Indigenous communities face. Although they are yet to hear from the government, Frank is undeterred.

ORIGINAL POWER

Employees of Ben Hill Electrical and Original Power work on rooftop solar installation at Norman Frank Jupurrurla's home in Tennant Creek.

"You have to keep talking and shaking the bush," he says.

A push for better access

Just as central as access to affordable heating and cooling is the need for safe, clean and efficient fuel for cooking. Roughly 2.6 billion people worldwide rely on solid cooking fuels, such as wood, coal and crop waste, leading to more than 3.8 million deaths each year from illnesses linked to household air pollution.

In 2016, India's Ministry of Petroleum and Natural Gas launched the Pradhan Mantri Ujjwala Yojana (PMUY) scheme to help households below the poverty line switch to liquid petroleum gas (LPG), a cleaner and safer cooking fuel. Beneficiaries receive a subsidy and loan to cover the cost of a stove kit and one gas cylinder. Refills are paid for by users. In 2019, the scheme reached its initial target of providing LPG connections to 80 million Indian households seven months ahead of schedule.

"The programme had already shown that it had been quite successful in providing connections to people who had not been connected before," says Shonali Pachauri, an environmental and resource economist at the International Institute for Applied Systems Analysis in Laxenburg, Austria. It wasn't clear, however, whether households benefitting from the scheme continued to use LPG regularly over time.

In July 2019, Pachauri and colleagues in Canada and the United States published an analysis of LPG sales data for more than 25,000 PMUY beneficiaries and non-PMUY consumers from the Koppal district, in the southwestern state of Karnataka. They found that between 2016 and 2018, the number of refills bought by PMUY beneficiaries was less than half of that of general rural households, with just 7% purchasing five or more cylinder refills a year – the threshold indicating regular use (A. Kar *et al. Nature Energy* **4**, 806–814; 2019). "We found that the policy wasn't as effective as it could be

in terms of getting people to use LPG often," says Pachauri.

Six months later, the researchers outlined a set of policy recommendations, which included creating additional financial incentives and establishing better strategies for educating low-income communities about the health benefits of clean cooking fuel (A. Kar *et al. Nature Energy* **5**, 125–126; 2020).

In late 2021, the Ministry of Petroleum and Natural Gas invited Pachauri and her team to evaluate the effectiveness of interventions they had been trialling to encourage households to use LPG consistently, such as enlisting community health workers to visit homes and explain the benefits of using gas over solid cooking fuels. They are now finalizing their analysis of the trials and hope to publish the results in the coming months.

Pachauri says that broad policy change takes time, particularly in the wake of the COVID-19 pandemic. In 2021, Pachauri co-authored another analysis, which found that the set-up costs of clean cooking could become unaffordable for around 470 million people around the world by 2030 if economic recovery from the pandemic is drawn out (S. Pachauri *et al. Nature Energy* **6**, 1067–1076; 2021). "This whole issue of affordability is getting more and more critical," says Pachauri. "That's something that clearly needs to be given much more attention."

It's also important to build a broader understanding of what drives households to consistently use clean cooking fuels, a story that existing data sets don't always reveal, says Sunil Mani, an analyst at the Council on Energy, Environment and Water, a not-for-profit policy research institution in New Delhi, India. "The numbers are sometimes not reliable. There's a lot of data-recording error," says Mani.

Over three years, Mani and his colleagues in India and the United States collected data from roughly 9,000 rural households across six Indian states. From 2014 to 2015, and in 2018, participants completed a survey about the cooking fuel they mainly used, the number of LPG cylinders they consumed each year, and the reasons for their choices.

As with Pachauri's analysis, the team found that PMUY beneficiaries were less likely to cook exclusively with LPG, compared with other consumers, but economic status was not the only factor. For instance, households that had free access to firewood or dung cakes were less likely to use LPG as their main cooking fuel. Those who had to travel long distances for a refill were also less likely to rely solely on LPG (S. Mani *et al. Nature Energy* **5**, 450–457; 2020).

Although surveying households can be costly and time-consuming compared with analysing existing data sets, it can reveal rich insights into the unique barriers that individual households face, says Mani. For instance, when Mani asked one household in the northern city of Sultanpur why they were still relying on firewood, he learnt that it was because they could purchase it on credit instead of paying upfront. "It's important to establish those conversations with the community," he says.

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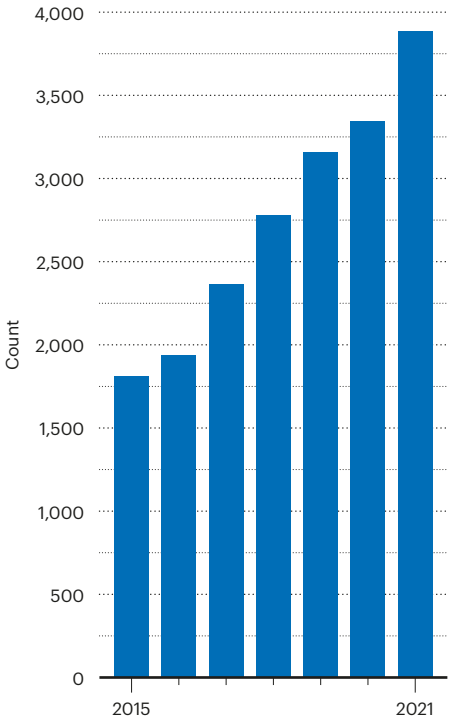
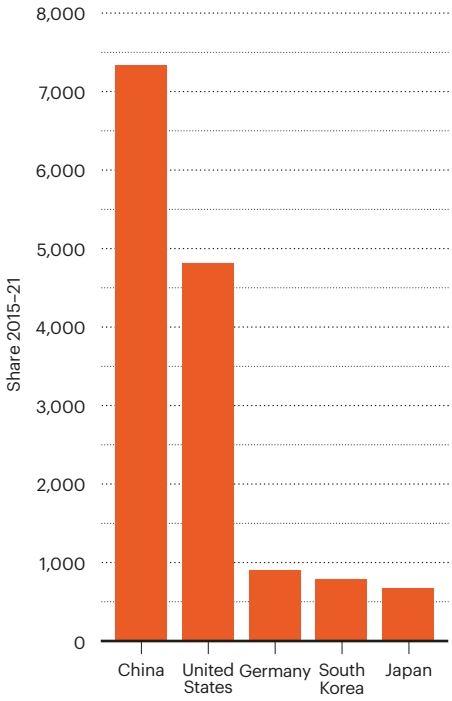
HIGH ENERGY

Last year, output in the Nature Index related to the United Nations' Sustainable Development Goal (SDG) 7 (clean and affordable energy) had its biggest jump since 2015, up from 3,345 articles in 2020 to 3,889 in 2021. China, which had a 324.1% change in Share in SDG 7-related output from 2015–21, is the fastest rising country in the field.

Global affordable and clean energy Count, 2015–21



Leading countries in affordable and clean energy, 2015–21



SOURCE: NATURE INDEX

T. NARAYAN/BLOOMBERG VIA GETTY IMAGES

A liquefied petroleum gas cylinder is connected to a stove at a home in Greater Noida, India.