

Electric cooking solutions: The pathway to achieving Nepal's NDC targets through clean-cooking energy transition

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Overview

Nepal has made remarkable strides in electricity access over the last 10 years. However, the increased access to electricity has not led to expected progress in modern energy cooking practices. A lack of access to clean and modern cooking solutions has implications for national efforts to achieve, among other things, Sustainable Development Goals: SDG 3 (Good Health and Well Being), SDG 7 (Energy Access) and SDG 13 Climate Action. Given the limited evidences on health and environmental benefits of traditional fuel-based technologies¹, and the country's interest to limit its reliance on imported fuels (mainly LPG, petrol, diesel and kerosene), electric cooking is increasingly being recognized as a sustainable alternative to conventional (i.e. solid fuel and LPG-based) cooking practices for Nepal. Since 2018, electric cooking has received considerable space in a number of national policies

and plans of Nepal, particularly around energy sector development and climate change. While the improving access to electricity has rendered the idea of electric cooking more pertinent to the country's clean cooking, energy access and climate change mitigation agenda, the uptake of electric cooking practices is faced with many challenges. This paper is an attempt to take a look at the current status of electric cooking, opportunities for its promotion and challenges. It also recommends the way forward to establish electric cooking as a viable clean cooking and climate change mitigation option for Nepal.

Current cooking fuel choices and their implications

Despite an upward trend in the uptake of clean fuels particularly liquefied petroleum gas (LPG) across both the rural and urban areas, national surveys

1 WHO, 2014. WHO Guidelines for Indoor Air Quality: Household Fuel Combustion. Washington DC: World Health organization.

point out that almost two thirds of the households in Nepal (i.e. 18 million people) continue to use traditional solid fuels (mainly firewood) as primary source of energy for day-to-day cooking². As of the Annual Household Survey 2016/17, percentage of households using electricity as primary energy source for cooking remains too low to be reported in a separate cooking fuel category. This section highlights the implications of solid fuels and LPG, two most common cooking fuels in Nepal.

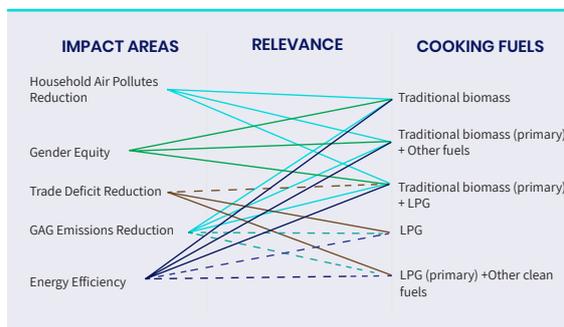


Figure 1: Relevance of different development issues/impact areas to the use of different cooking fuels (Level of relevance: Solid lines: high; Dashed lines: moderate)

Household air pollution

Traditional solid fuels remain a dominant cooking fuel in Nepal. Burning solid fuels using traditional inefficient cookstoves releases high levels of toxic gases and particulate matters that have been linked to a number of health issues such as acute respiratory infections, chronic respiratory disorders,

heart diseases and lung cancer³. A number of studies^{4,5,6} have also linked maternal exposure to household air pollution (HAP) to adverse birth outcomes and low life expectancy. The World Health Organization has estimated that in 2016 alone, Nepal lost more than 23,397 lives to diseases attributable to HAP resulting from combustion of solid fuels. These findings demonstrate a strong interplay between the **clean cooking (SDG 7.1.2)** and **good health and well being (SDG 3)** goals within the Sustainable Development Framework.

Socio-economic impacts

Reliance on solid fuels for cooking also has implications for **gender equality (i.e. SDG 5)** and household economy. It is well documented that women and small children (who spend most of their times with their mothers) are disproportionately affected by HAP-related illnesses. In addition to that, spending several person-hours to collect fuels and prepare meals leaves women with limited opportunities to participate in remunerative and community development activities, attend training, and engage in self-care and personal growth. As a result, socio-economic development of women is compromised, which in turn contributes further to gender disparity. This altogether underscores the need for solid fuel-dependent population to transition from traditional cooking to modern cooking practices. Evidences^{7,8,9} suggest that a household's access to modern energy cooking technologies (such as energy efficient electric

- 2 CBS, 2017. Annual Household Survey 2016/17 (Major Findings). Central Bureau of Statistics, National planning Commission. Kathmandu, Nepal: Government of Nepal.
- 3 WHO, 2021. [Accessed from <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/2256>]
- 4 Islam, S. and Mohanty, S.K., 2021. Maternal exposure to cooking smoke and risk of low birth weight in India. *Science of the Total Environment*, 774, p.145717.
- 5 Yuan, L., Zhang, Y., Gao, Y., Tian, Y., 2019. Maternal fine particulate matter (PM2.5) exposure and adverse birth outcomes: An updated systematic review based on cohort studies. *Environ Sci Pollut Res* 26:13963–13983; doi.org/10.1007/s11356-01904644-x.
- 6 Khan, M.N., Islam, M.M., Islam, M.R. and Rahman, M.M., 2017. Household air pollution from cooking and risk of adverse health and birth outcomes in Bangladesh: a nationwide population-based study. *Environmental Health*, 16(1), pp.1-8.
- 7 ABF/NACEUN, 2020. Market-led promotion of electric cooking in Timal Community Rural Electrification Area. Kathmandu, Nepal: Ajummary Bikas Foundation/National Association of Community Electricity Users Nepal.
- 8 Batchelor S. 2020. The political economy of Modern Energy Cooking Services (Working Paper). UK: Modern Energy Cooking Services (MECS) Programme
- 9 ENERGIA, 2021. Gender-responsive electric cooking in Nepal. Netherlands: International Network on Gender & Sustainable Energy (ENERGIA)

cooking appliances) does not only contribute to women's better health and socio-economic outcomes, it can also encourage men's participation in cooking activities thereby facilitating a shift in gender roles.

Climate impacts

In 2019, the net **greenhouse gas (GHG) emissions** from Nepal was estimated at 60.07 mMtCO₂eq, of which 10% was attributable to the residential sector¹⁰. Combustion of solid fuels, followed by LPG, is the largest contributor to the overall GHG emissions from the residential sector in Nepal¹¹. Cooking and water heating remain dominant end uses contributing the most to the GHG emissions in the residential sector.

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report¹² suggests that in South Asia, residential sector contributes the most to the emissions of short-lived climate forcers (SLCFs) i.e. anthropogenic fine particulate matter/aerosols including black carbon¹². Incomplete combustion of solid fuels is one of the major sources of SLCFs, and has been linked to unprecedented changes being observed in the South Asian and Southeast Asian monsoon. Although SLCFs remain in the atmosphere for shorter duration as compared to GHGs, they have

a significant impact on regional climate¹³. On the bright side, SLCFs present opportunities for climate change mitigation through actions at household level¹⁴. In other words, a shift from biomass burning for household cooking and heating to electricity-based solutions, such as electric cooking, can potentially contribute to mitigating the regional climate change.

Economic implications

Given the poor energy efficiency of 5-10% and opportunity costs involved in collecting and preparing firewood, cooking meals with traditional cookstoves is also expensive and resource-intensive. Studies¹⁵ suggest that a household spends a total of around 20 hours (i.e. 2.5 person-days; considering 8 hours = 1 person day) per month to collect firewood enough for a family of five. At the current minimum wage of NRs. 577/day¹⁶, it implies a household performs NRs. 1442.5 worth of work per month to just fetch firewood. On the other hand, for about NRs. 1400, a household can use more than 150 kWh of electricity per month at the current tariff rates for a household with 15-ampere single-phase connection (true also at the newly implemented tariff rates, effective from 17 November 2021)¹⁷. 150 kWh of power is generally considered more than enough for cooking day-to-day meals and performing basic electric power-based household

10 GoN. 2021. Nepal's Long-term Strategy for Net Zero Emissions. Kathmandu, Nepal: Government of Nepal.

11 Bhandari, R., Pandit, S. 2018. Electricity as a Cooking Means in Nepal - A Modelling Tool Approach. Sustainability.2018, 10, 2841.

12 IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

13 Bailis, R., Drigo, R., Ghilardi, A. and Masera, O., 2015. The carbon footprint of traditional woodfuels. Nature Climate Change, 5(3), pp.266-272.

14 UNEP. Near-term climate protection and clean air benefits: actions for controlling short-lived climate forcers. Nairobi, Kenya: United Nations Environment Programme; 2011

15 Estimate based on a baseline study for the Temal Project conducted by Ajummary Bikas Foundation (ABF) and National Association of Community Electricity Users Nepal (NACEUN) in the summer of 2019, with support from giz EnDev. The finding on hours spent on fuel wood collection per month by a household is consistent with another study conducted in the Eastern part of Nepal by Das et. al 2019.

16 Ministry of Labor, Employment and Social Security, 2021

17 Electricity Regulatory Commission, 2021. Press Release. 27 October 2021. Kathmandu, Nepal: Electricity Regulatory Commission.

activities for a family of five. This implies, if the opportunity cost of collecting firewood is compared with the operational cost of electric cookstove, cooking with firewood is way more expensive than electric cooking.

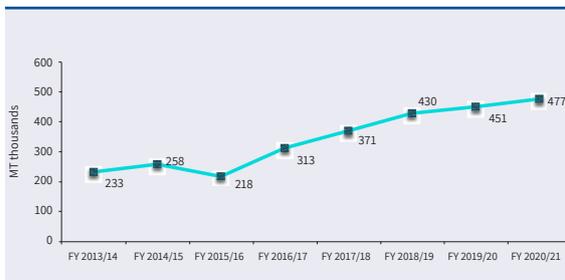


Figure 2: LPG import volume (in MT thousands) between FY 2013/14 to FY 2020/21

(Data source: Economic Survey 2020; Ministry of Finance 2021)

The World Health Organisation¹, the energy sector and development agencies put LPG, alongside electric cooking, in clean and modern energy category. However, its long-term benefit for Nepal has been debated in light of its contribution to the country's trade deficit, and recent developments in domestic production of hydropower. Since Nepal does not have any oil reserve of its own, the country is entirely dependent on India for petroleum products. In the fiscal year 2020/2021 alone, Nepal imported 477,422 MT of LPG (Figure 3) worth NRs. 36 billion, i.e. 2.35% of the total import value for that year. LPG import is growing at the rate of around 15% per year, and about 54% of the total LPG imports is consumed by the residential sector¹⁸. In addition to that, price volatility is another issue that characterizes petroleum products, and every now and then, sets off a ripple in the national economy. Therefore, limiting the use of petroleum products by transitioning to electricity-based infrastructures presents important opportunity for Nepal to reduce the trade deficit and also to build resilience of the national economy against petroleum products' price volatility in the global market.

Current status, opportunities and challenges for electric cooking in Nepal

Although electric cooking appliances (such as locally manufactured clay heaters, and rice cookers) have been in use in Nepal for at least 25 years, households using electric cooking as a primary mode of cooking were negligible until the 2015 energy crisis caused by the blockade of imports including LPG from India. LPG users had to either switch to traditional fuels or electric cooking alternatives. Import data for the following year (i.e. FY 2016/17; Figure 3) gives an impression that the status quo was restored soon after the LPG supply was resumed. However, in 2017, the interest in electric cooking was renewed as Nepal Electricity Authority (NEA) officially ended load shedding for the residential sector. A year later in 2018, the Ministry of Energy, Water Resources and Irrigation (MoEWRI) published the White Paper, which became the country's first ever policy document to explicitly recognize electric cooking, specifically '**Electric Stove in Every House**', as one of its visions.

Policy commitments

Under the SDG 7, Nepal has set a target to increase electricity access from 74% in the baseline year (2015) to 99% by 2030. It also targets to limit the proportion of people using LPG and solid fuels as primary cooking fuel to 39% and 30% respectively. Consistent with that, the 2018 MoEWRI White Paper underlines the country's plan to replace other fuels with electricity in the residential, public, private, transportation and industrial sectors. It envisions reaching the target of 100% electrification by 2023, well ahead of the SDG target deadline of 2030. The White Paper also envisions an increase in the per capita electricity consumption to 700-kilowatt hour (kWh) by the end of the FY 2023/2024, and to 1500 kWh by 2030. Given that residential sector is the

18 MoFE, 2021. Assessment of Electric Cooking Targets for Nepal's 2020 Nationally Determined Contributions (NDC), Kathmandu, Nepal: Ministry of Forests and Environment (MoFE).

largest consumer of energy in the country; cooking, heating and other household activities are expected to significantly contribute to the targeted increase in per capita electricity consumption. The 15th Plan reflects these visions, and sets out a plan to have its vision of 'Smokeless Kitchen' materialized by improving electrification rate, hydropower generation, power supply and distribution, and by developing energy efficiency standards, and initiating tariff reforms to encourage the adoption of energy efficient electric cooking at scale.

In 2020, Nepal's Second Nationally Determined Contribution (NDC) also set a target that 25% households will have adopted electric cooking as a primary mode of cooking by 2030. It is estimated that, in the business-as-usual scenario, the GHG emissions from cooking sector alone will be approximately 2064 GgCO₂eq in the year 2030. If all the NDC targets related to clean cooking including electric cooking are met, it is estimated that the total emissions can be reduced by 23% to 1599 GgCO₂eq.¹⁹

In June 2020, as envisioned in the 15th Plan, the Electricity Regulatory Commission introduced a revised tariff structure as an attempt to adapt to the increasing power generation/supply capacity of the country and emerging technological opportunities at the demand-side. It is expected that the revised tariff rates for domestic consumers would encourage the increased use of electricity in the residential sector. However, the impact of the revised tariff structure on electricity consumption at household level is yet to be established.

The Nepal Bureau of Standards and Metrology (NBSM), in 2018, developed Nepal Standards for household and similar electrical appliances. In the same year, another set of standards was developed

specifically for induction hobs. Development of national standards for infrared stove and electric pressure cookers are underway²⁰. Currently, the country does not have any mechanism to provide labeling/certification to products that meet the standards and any facility to test if they meet the safety and performance standards. However, discussion is ongoing between concerned government agencies and relevant stakeholders to upgrade domestic testing facilities so that they are able to involve in electric cooking products' standardization and certification processes²¹. Well-equipped testing facilities will not only contribute to quality control, but also to promoting innovations and investments in high quality products.

In the Budget Speech for the fiscal year 2021-2022, the Government of Nepal explicitly stated its intention to reduce trade deficit by increasing the consumption of electricity and displacing petroleum products. In the same vein, the government reduced customs duty on electric home appliances including electric stoves and waived their excise duty. Similarly, it reduced customs duty on induction stove to 1% and waived service charge for upgrading domestic power meter capacity.

The above provisions suggest that the government is geared towards making electric cooking an attractive cooking alternative for the general mass. Targets set around electric cooking are also ambitious. In line with the national goals, all seven provincial governments have also shown commitments toward clean cooking, either by setting targets that directly relate to electric cooking or by supporting the national targets around it. However, all these commitments at federal and provincial levels are yet to reflect in majority of the local governments' plans and policies. Currently, 25 local level governments based in Terai have set

19 GoN, 2020. Second Nationally Determined Contribution. Kathmandu, Nepal: Government of Nepal.

20 Bajracharya, K, 2021. Working together to accelerate clean cooking access in Nepal. E-Cooking Solution - Transitioning towards a clean cooking practice and pathways to achieving NDC targets (Webinar). 26 August 2021. Kavrepalanchowk, Nepal.

21 As per author's conversation with Mr. Nawa Raj Dhakal, Deputy Executive Director, Alternative Energy Promotion Centre.

a target to disseminate a total of 15,000 induction cooktops, in partnership with Alternative Energy Promotion Centre (AEPC). The effort is a part of the National Dung Replacement Programme, supported by the central government¹⁹. The NEA and National Association of Community Electricity Users - Nepal (NACEUN) are providing technical support to ensure uninterrupted and reliable supply of electricity in the project areas.

Interest of non-governmental and private sectors in electric cooking

Electric cooking is increasingly becoming a popular development agenda among diverse stakeholder groups. Efforts are being made from different sectors to facilitate electric cooking promotion and adoption in Nepal. In 2019, Ajummary Bikas Foundation (a private company), the NACEUN (a civil society organization) and Radio Sagarmatha (a media partner), with policy support from the AEPC and NEA, initiated the National Electric Cooking Campaign to promote electric cooking through a market-based approach in community rural electrification areas of Nepal. Likewise, international actors such as Clean Cooking Alliance, GIZ EnDev and Modern Energy Cooking Services (MECS) Programme have been supporting electric cooking pilot/implementation and research projects in various ways. These efforts and the resulting knowledge/learning present an important opportunity for government agencies and other relevant stakeholders to formulate evidence-based policies, plans and scale-up projects to support wider adoption of electric cooking across the country.

Power supply and distribution situations

Recent years have seen a strong policy push in favor of electric cooking and increased use of electricity, which aligns with the roadmap presented in the 2018 MoEWRI White Paper. This transformation in the energy sector development paradigm of Nepal

may be attributed to the projected increase in the hydropower generation and supply capacity of the country. As projected, electricity generation mainly by independent power producers increased significantly over the past decade (Figure 4). Almost all of the 138 hydropower projects with a total installed capacity of about 3507 MW that are currently under construction across the country, are set to begin their commercial operations before the year 2025.²² This implies that Nepal will have abundant electric power supply to support increased consumption of electricity across all sectors and levels of the society in the near future.

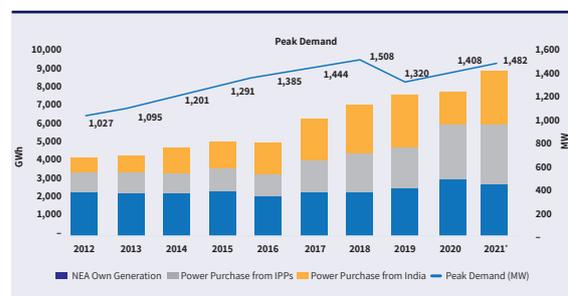


Figure 3: Total Energy Available and Peak Demand in the year 2020-2021

* Provisional Figures (Subject to audit); Source: NEA Annual Report 2020-2021

On the distribution side, plans are underway to expand and upgrade transmission and distribution lines to facilitate increased consumption of electricity in major cities. Technical improvements including expansion of smart grid and smart metering systems (which are currently in the pilot phase targeting the Kathmandu valley consumers) is expected to further improve efficiency, reliability and quality of power supply services in the country.²²

Current status of electricity access at household level

Encouragingly, electrification rate and power supply reliability in Nepal have improved significantly over the past few years with increasing production of electricity. However, due to differential techno-

22 NEA, 2021. Nepal Electricity Authority: A year in review fiscal year 2020/2021. Kathmandu, Nepal: Nepal Electricity Authority.

economic feasibility attributable to diverse topography of the country, some regions are doing much better in electricity reliability than others. According to the World Bank's Multi-Tier Framework for electricity access, more than 50% households in all seven provinces are in or below Tier 3²³. The 2019 ESMAP Report^{23,24} suggests that availability, reliability and quality attributes are the major constraints that define electricity access situation of households connected to the national grids in Nepal. However, in terms of capacity of the electricity grid connected households are generally considered more appropriate for the promotion of electric cooking.

As of 2021, about 10% of the total households across the country are electrified through off-grid systems²⁵. However, at present, studies suggest that transition to electric cooking in areas electrified through decentralized systems remain challenging mainly due to capacity and affordability concerns.^{24,26}

Market situation of electric cooking

The electric cooking practice is slowly picking up. However, the supply chain system of electric cooking appliances remains largely concentrated in urban centres and in some semi-urban areas located on the periphery of large markets. Unsurprisingly, majority of the current users of electric cooking are urban dwellers from middle to high consumption quintiles. There is generally

little incentive for e-cooking suppliers to take their businesses to rural areas because of challenges associated with low market volume (mainly due to sparsely distributed households), and high marketing and transportation costs. A lack of access to market/supply chain systems and reliable electricity, therefore, continue to preclude electric cooking in the rural areas.

Currently, induction stove, infrared stove, rice cooker, hot plates and electric pressure cookers are the most common electric cooking appliances available in the Nepali market. Of all of the above, induction cooktop and electric pressure cookers are found to be the most energy efficient because of their design principles. Costs of electric cooking appliances may vary depending on their types, functionalities, designs, brands, volume capacity and materials used in them. A few studies have been completed and many are underway that attempt to assess the social and market acceptance of different electric cooking technologies. A study jointly conducted by Ajummary Bikas Foundation and National Association of Community Electricity Users Nepal (ABF/NACEUN) with support from the GIZ EnDev, in Temal Rural Municipality of Kavre district revealed that people who have used induction cooktop generally like it. However, the need for specific induction-based utensils is often cited as one of the key hurdles for new adopters to reap optimum benefits from such cooking appliances.

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- 23 In 2015, the World Bank proposed a new Multi-Tier Framework to define electricity access based on "a set of attributes that capture key characteristics of the energy supply that affect the user experience". It uses Availability attribute measured in terms of total number of hours electricity is available for during day/night and evening; reliability measured in terms of total number of interruptions and duration or interruptions; and, quality measured in terms of voltage fluctuations; and capacity in terms of ability of the distribution system to allow beneficiary household to use appliances they desire. The MTF categorizes households into six tiers (tier 0 = lowest level of electricity access; tier 5 = highest level of electricity access) based on their level of access to electricity.
- 24 Pinto et al, 2019. Nepal: Beyond Connections, Energy Access Diagnostic Report based on Multi-Tier Framework. Washington, DC: IMRD/The World Bank.
- 25 Dhakal, N. 2021. Renewable Energy Status and Scenario in Nepal (presentation). Building linkages and synergies on Renewable Energy and Climate Change (Workshop organized by PRC and WWF Nepal). 25 March 2021. Kavrepalanchowk, Nepal.
- 26 Clements, W., Silwal, K., Pandit, S., Leary, J., Gautam, B., Williamson, S., Tran, A. and Harper, P., 2020. Unlocking electric cooking on Nepali micro-hydropower mini-grids. Energy for Sustainable Development, 57, pp.119-131.

Demand-side drivers and barriers

Households generally have multiple energy needs. While promoting clean cooking technologies, it is important to consider other energy services that the household derives from cooking devices. It is important to ensure that the technology matches the needs and aspirations of the target consumers. If the new technology does not fulfill their energy service requirements, they might revert to the use of traditional cooking devices. In mountain regions where households use cookstoves for cooking, heating and lighting, promotion of efficient electric cooking appliances may need to be bundled with efforts to compensate for their other energy needs.

In addition to consumers' needs, preferences and aspirations, the capacity of electric power delivery system is also a crucial determinant of what technology may be more appropriate for promotion at scale in a given setting. Households with 5-ampere single-phase low-voltage connections may not be able to use high power appliances; however, they can use electric cooking appliances with low to medium power ratings (i.e. maximum 1000 Watts; such as rice cookers and electric pressure cookers). In places where capacity and quality of electricity is satisfactory (i.e. comparable to Tier 4-5²⁴), low to high power appliances can be promoted. Power capacity ratings of 200-799W, 800-2000W and above 2000W are considered safer for moderate (such as rice cooker), heavy (such as toaster, microwave, single hob induction stove) and very high load (such as multiple hobs electric cookstove, water heater) appliances respectively²⁷. Importantly, consumers' awareness about power meter capacities and household wiring requirements to operate various household electric appliances is important to enable them to make informed decision, and to promote safe and sustained adoption of such products.

According to the 2021 WECS report, over 90% of households in Province 1 and 2 have 5-ampere power meter capacity²⁸. Low power meter capacity limits a household's ability to use high power electric appliances (such as induction cooktop, toaster, microwave oven, etc.). If per capita electricity consumption is to be increased, as envisioned in the MoEWRI White Paper and the 15th Plan, local power distribution systems including the household wiring and power meter capacity should be upgraded/improved.

Transition to clean cooking fuel is a complex process. In other words, it entails a combination of interventions. They include, among other things, adoption of effective technologies and cleaner fuels, sustained supply of relevant products and services, and actions by multiple stakeholders to ensure equitable adoption and sustained use of clean fuels and technologies. However, majority of clean cooking programmes in the past mainly focused on ensuring availability of effective technologies, but with limited participation of private sectors. As a result, the impact of such programmes mostly remained short-term, and effective and sustained use of clean technologies could not be realized to the desired extent. More recently, kitchen improvements, behavior change interventions, and the clean cooking supply chain management and strengthening are increasingly being recognized as crucial interventions to spur sustainable transition to clean cooking, and to ensure health and environmental benefits of clean cooking solutions. There is a growing realization that consumers' access to product and service-related information, awareness of electrical safety, and training on correct use and operation/maintenance, and post-adoption support (including after-sales services) should be integral aspects of any promotional and marketing efforts.

27 Bhatia, M., Angelou, N. 2015. Beyond Connections: Energy Access Redefined. Technical Report 008/15. The International Bank for Reconstruction and Development, The World Bank: Washington DC, USA.

28 WECS. 2021. Energy Consumption and Supply Situation in Federal System of Nepal (Province No. 1 and Province No. 2). Water and Energy Commission Secretariat, Government of Nepal. Kathmandu, Nepal: Government of Nepal.

Relevant market segments for electric cooking promotion

National household surveys suggest that the use of solid fuels is more common in rural areas and among the populations in 1st, 2nd and 3rd consumption quintiles, and the opposite seems true for LPG. So clearly, efforts to replace petroleum products may be more efficient and relevant in residential, transport and industrial sectors of urban and semi-urban areas, and to the populations in the 4th and 5th consumption quintiles. Given the power supply reliability, easy access to the market, better opportunities for product financing, and relatively high income-level that characterize urban populations, they may be the 'low hanging fruits' in our drive to achieve the Second NDC's electric cooking targets by 2030. Innovative promotional and marketing strategies, and increased access to information about costs and benefits of electric cooking as opposed to other alternatives may be important interventions to encourage electric cooking adoption in urban settings.

On the other hand, efforts to replace solid fuels with e-cooking solutions to achieve health and climate benefits may be more relevant in rural areas. However, in rural areas, limited access to supply chain system, low power supply reliability, and a lack of access to product and market information are key challenges for wider adoption of electric cooking options. Furthermore, unlike traditional fuels and cooking technologies which usually come at low or no cost in the rural areas, electric cooking comes with associated need to pay for the technology, electric system upgradation (in households with minimum amperage capacity) and monthly electricity bills. Therefore, affordability may be a challenge for low-income populations in both urban and rural areas to transition to electric cooking. Innovative financing mechanism

to procure e-cooking solutions and provisions to incentivize the e-cooking practices may be crucial to make electric cooking a viable option particularly for low-income population in rural areas. International funding mechanisms such as the World Bank's Clean Cooking Fund, Green Climate Fund, and result-based incentives (including carbon credits) may be important opportunities to support the transition of low-income communities to e-cooking options.

Learning from past and ongoing e-cooking projects

Historically, clean cooking projects have largely relied on direct subsidies on products to stimulate demand for clean cooking products. Availability and affordability are assumed to be the key determining factors and that if an efficient cooking technology is made available, it will automatically gain traction among potential users and increase the clean cooking practices. Conversely, past experience suggests that projects that have required households to pay a little or no price for cooking technologies offered to them, often do not own the technologies. In such cases, households are less likely to put an effort to change behavior, adapt and seek benefits, which can lead to neglect or misuse of the technology²⁹. There is a growing realization that availability and affordability are not necessarily the only issues that impede one's transition to clean cooking. Households' needs, aspirations, reliability of and access to supply networks of clean cooking fuels and technologies, users' knowledge on installation, use and maintenance, and importantly, users' ownership of the technology, play a key role in sustained adoption of the clean cooking solutions.

In recent times, market-based approach has demonstrated greater success in accelerating transition to clean cooking practices. Majority of

29 Energy Sector Management Assistance Program (ESMAP). 2021. What Drives the Transition to Modern Energy Cooking Services? A Systematic Review of the Evidence. Technical Report 015/21. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO

clean cooking projects in the past have treated potential users of clean cooking solutions as beneficiaries with the need for financial assistance. The choice of cooking technologies and purchase decisions were made using top-down approaches. On the contrary, market-based approach rests the purchase decision on the potential buyers of the technology. The approach acknowledges that product should match the consumer's needs, preferences and aspirations and that a household's willingness to pay for any new product can be raised by improving their access to information about products, their benefits vis-a-vis other alternatives, and supply reliability of the products (in the context of electric cooking, 'products' implies both electric cooking appliances, relevant wiring and cookware requirements, and electricity) and after-sales services. A market-based approach

also acknowledges that not all consumers have the same needs, preferences, priorities, and capacities to pay. In that sense, market-based approach is more adaptive, and better-positioned to cater to varied interests of diverse user groups and, facilitate electric cooking adoption at scale.

Electric cooking projects implemented in Panchkhal and Temal areas of Kavre district present an example of successful implementation of market-based approach to the promotion of electric cooking solutions (i.e. a package containing an Induction cooktop, and a compatible pressure cooker and a saucepan) in the rural settings. In both the projects, households paid 80%-100% of the product price. A few households used installment payment services, which allowed them to spread the cost of the product over several months. In both cases,



Photo: Biraj Gautam, PEEDA

the project supported the consumers by ensuring power supply reliability (through partnership with local power distributors, i.e. Community Rural Electrification Entities), facilitating the supply of quality products, and by ensuring access to information about electrical safety, cost-benefit of electric cooking, household wiring requirements and correct use and maintenance of electric cooking products. According to the end line study of the Temal project, out of 80 adopter households surveyed, 80% were found to be using the system on a regular basis, 14 percent used it occasionally while the rest (i.e. 6%) were not using the stove at all. Some of the frequently cited reasons for no or limited use of the technology were fear of electric shock, or the need for specific type of (i.e. induction base) utensils. At the time of end line study, on an average, the users had owned and used the induction cooktop for about 3.5 months. The above projects also highlight the need to strengthen supply chain systems to ensure local access to relevant products and services for the sustained use of electric cooking in rural settings. Electric cooking supply chain systems in the rural areas, at present, remain weak and unreliable.

Way forward

- Policy
 - ▶ Sensitization and capacity building of local leaders on interplay between clean cooking and other development agenda, target setting around national e-cooking related goals, and planning for safe and effective promotion of electric cooking.
 - ▶ Target setting should be driven by the interest in increasing the use of electric cooking technologies rather than increasing sales.
 - ▶ Quality control and effective monitoring of electric power distribution system and electric cooking products and services should be ensured.
- Power supply and distribution
 - ▶ Projects and programmes to promote electric cooking should be designed to align with power supply and distribution system reinforcement plans. As may be inferred from the picture below (Figure 5), not every local level government may be ready yet for the promotion of electric cooking as a primary mode of cooking. In such places, alternative clean cooking options such as LPG and biogas may be more relevant.
 - ▶ Innovative promotional and marketing strategies, and increased access to information about costs and benefits of electric cooking as opposed to other alternatives may be important interventions to encourage electric cooking adoption in urban settings.
 - ▶ Upgradation/improvements of power meter and household wiring are crucial to encourage increased consumption of electricity.
- Access to information about costs-benefits, quality standards, electrical safety, and household wiring requirements, correct use and proper maintenance of the systems must be ensured.
- Local access and availability of electric cooking products and services must be ensured. It is a key challenge in rural areas. Local community-based organizations (such as women groups, community rural electrification entities, micro finance institutions, cooperatives, etc.) and local vendors of household cooking appliances, utensils may be potential vehicles for ensuring local access to both information, electric cooking related products and services (including, post-acquisition support, repair and after-sales services), and financing supports.
- Although women are still the primary cooks in majority of households, women's participation in clean cooking supply chain system and purchase decision remains negligible. Electric cooking projects may be able to benefit more

if women are involved and encouraged to leverage their experiential knowledge in the promotion, marketing, and the supply of electric cooking products and services.

- Market-based approach is important to ensure sustained transition to electric cooking practices, and to ensure ownership of the technology by its users.
- Appropriate financing and dissemination modalities must be identified to address

affordability challenges of the low-income populations.

- Different communities have different needs, and may require different kinds of support in their transition to electric cooking. Further research around consumer preferences and needs, policy interventions, dissemination modalities, and technologies would be crucial to support evidence-based policy-making and planning.

Note : *This policy brief was prepared by Dr. Ashma Vaidya for Prakriti Resources Centre.*

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