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36

National Level Implications of the Implementation of SDG 7

Access to Modern Cooking Fuels in India

Pooja Vijay Ramamurthi
Shweta Srinivasan
Deepthi Swamy
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Preface

Southern Voice on Post-MDG International Development Goals is a network of 49 think tanks from Africa, Asia and Latin America. Since its inception in 2012, it has served as an open platform to provide structured inputs from the global South into the negotiations on the post-2015 development agenda, with a view to address the 'knowledge asymmetry' and 'participation deficit' that usually afflict such global discussions.

The *2030 Agenda for Sustainable Development* was finally adopted at the Seventieth Session of the UN General Assembly on 25 September 2015 by the member states. With the 17 new Sustainable Development Goals (SDGs) placed as oncoming global development priorities, *Southern Voice* is currently working to examine national experiences in meeting the early challenges of delivering the Agenda 2030.

The research programme titled *National Level Implications of Implementation of SDGs* is based on call for proposals among its network members, and through a peer process eleven country studies were commissioned for nine countries across Asia, Africa and Latin America. The broad areas of concern of the country papers are the following: (i) investigate the means of mainstreaming the SDGs into national planning process, within the context of its national priorities; (ii) explore the adequacy of coordination, management and leadership of the SDG implementation process, including the monitoring and evaluation mechanism; (iii) examine the adequacy of financing and other specific means of implementing the SDGs; (iv) investigate the extent of partnerships and stakeholder participation, including institutional arrangements for implementing the SDGs; and (v) evaluate the capacity of the national statistical agencies and other data-related issues.

This country paper titled **National Level Implications of the Implementation of SDG 7: Access to Modern Cooking Fuels in India** is the fifth of the eleven country studies to be published under the Southern Voice Occasional Paper Series. The study has been authored by *Ms Pooja Vijay Ramamurthi*, Research Engineer, *Ms Shweta Srinivasan*, Senior Research Analyst; *Ms Deepthi Swamy,* Research Scientist; and *Mr Rahul Kutticka,* a former Intern at the Center for Study of Science, Technology and Policy (CSTEP), India.

The paper particularly focuses on universal access to clean cooking fuels in India, given its significance to achieve the SDG 7 target regarding modern energy services. It observes that on the whole, clean cooking is not a state priority, while finance for improving access to clean cooking services and existing national data-monitoring mechanisms are inadequate in the country. The paper suggests for an integrated policy making approach, robust 'last-mile' deployment of clean cooking technologies, and region-specific data collection mechanisms in this regard.

I would like to take this opportunity to recognise the support of The William and Flora Hewlett Foundation towards *Southern Voice*, particularly of *Dr Ruth Levine*, Programme Director and *Ms Sarah Lucas*, Programme Officer of the Global Development and Population Programme, at the Hewlett Foundation.

In connection to the publication of this paper, contribution of *Ms Umme Shefa Rezbana*, Senior Research Associate, Centre for Policy Dialogue (CPD) and the focal point at the Southern Voice Secretariat for overseeing the programme is highly appreciated. *Ms Tarannum Jinan*, Administrative Associate, CPD is acknowledged for providing useful contribution in following-up of the country papers. *Ms Nahela Nowshin*, Programme Associate

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Hoping that the paper will be a useful addition to the ongoing discussion on challenges of implementing SDGs in developing countries.

Dhaka, Bangladesh
November 2016

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Abstract

Sustainable Development Goal 7 (SDG 7) aims to "ensure access to affordable, reliable, sustainable and modern energy for all" by 2030. India is home to the world's largest population without access to modern energy – 400 million people do not have access to electricity and 800 million people still cook with traditional biomass. In this context, this study analyses the potential to embed the SDG 7 target of universal access to clean fuels and technologies into India's national agenda.

The analysis of the present paper shows that at the current pace of deployment of clean cooking technology, it seems unlikely that India will meet the SDG 7 target by 2030. In order to progress towards achieving this target, India needs to adopt a two-pronged technological approach – access to modern cooking fuel needs to be increased alongside efforts to make traditional cooking fuels safer to use. Consumer affordability, access and awareness all remain large barriers to the successful uptake of clean cooking technologies. There exists a lack of intra-governmental coordination, and existing networks are not effectively utilised. Non-governmental stakeholders have a key role to play in facilitating market finance, robust 'last-mile' distribution, community engagement, awareness-raising and after-sales services. Current data monitoring mechanisms also need to be modified so as to effectively track progress towards the SDG 7 target.

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Acronyms

ASHA	Accredited Social Health Activist
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standards
BPL	Below-Poverty-Line
B2B	Business-to-Business
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CDM	Clean Development Mechanism
CEEW	Council on Energy, Environment and Water
CER	Certified Emission Reduction
CGA	Controller General of Accounts
COP 15	Conference of Parties 15
CO_2	Carbon Dioxide
CSO	Civil Society Organisation
CSR	Corporate Social Responsibility
CSTEP	Center for Study of Science, Technology and Policy
DALY	Disability-Adjusted Life Year
DBTL	Direct Benefit Transfer (of LPG)
DDUGJY	Deendayal Upadhyaya Gram Jyoti Yojana
DFID	Department for International Development
EESL	Energy Efficiency Services Limited
GACC	Global Alliance for Clean Cookstoves
GAIL	Gas Authority of India Limited
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GLPGP	Global LPG Partnership
GW	Gigawatts
IAP	Indoor Air Pollution
ICS	Improved Cooking Stove
IFC	International Finance Corporation
INR	Indian Rupee
IPDS	Integrated Power Development Scheme
KVIC	Khadi and Village Industries Commission
LED	Light-Emitting Diode
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goal
MFI	Microfinance Institute

MNES	Ministry of Non-Conventional Energy Sources
MNRE	Ministry of New and Renewable Energy
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forests
MoHFW	Ministry of Health and Family Welfare
MoP	Ministry of Power
MoPNG	Ministry of Petroleum and Natural Gas
MoRD	Ministry of Rural Development
NAPCC	National Action Plan on Climate Change
NBFC	Non-Bank Finance Company
NBMMP	National Biogas and Manure Management Programme
NCEF	National Clean Energy Fund
NGO	Non-Government Organisation
NPBD	National Project on Biogas Development
NPIC	National Programme on Improved Cookstoves
NSS	National Sample Survey
OMC	Oil Marketing Company
PAHAL	Pratyaksh Hastantarit Labh
PAT	Perform, Achieve and Trade
PAU	Policy As Usual
PFMS	Public Finance Management System
PMC	Project Management Contractor
PNG	Piped Natural Gas
PSB	Private Sector Bank
PSU	Public Sector Undertaking
RGGLVY	Rajiv Gandhi Gramin LPG Vitaran Yojana
SDG	Sustainable Development Goal
SHG	Self-Help Group
SNA	State Nodal Agency
SE4ALL	Sustainable Energy for All
TERI	The Energy Resources Institute
TIDE	Technology Informatics Design Endeavour
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States Dollar
VGF	Viability Gap Funding
VLE	Village-level Enterprise

National Level Implications of the Implementation of SDG 7

Access to Modern Cooking Fuels in India

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1. Introduction

The Millennium Development Goals (MDGs) have been credited with stimulating global development action for improved economic growth, social inclusion and environmental sustainability. Adopted in 2000, the MDGs came to their conclusion in 2015 (UN, 2015). To maintain the momentum of the MDGs, global leaders met at the United Nations (UN) in September 2015 to agree on a sustainable development agenda for the next 15 years. Following extensive dialogue, 17 Sustainable Development Goals (SDGs) and 169 associated targets were agreed upon.

While ambitious in their scope, the MDGs did not focus on the infrastructure required to facilitate the development that the goals aspired to achieve (UN, 2015). As such, although energy services are crucial for both social and economic development, there was no MDG exclusively assigned to energy access. Under Goal 7 – 'Ensure environmental sustainability' – target 9 monitored the proportion of the population relying on solid fuels. However, this indicator was intended to address deforestation concerns rather than energy poverty, as reliance on fuel wood can put significant pressure on forests in areas where biomass is scarce (WHO, 2015).

Compared with their predecessor, the SDGs have a broader scope, aiming to address poverty, inequality and unsustainable growth (Anyangwe, 2015). Recent discourse on sustainable development has recognised the important role that access to modern energy – clean cooking fuels and electricity – has in many aspects of development, including health, education, gender equity and income generation. This is manifested in SDG 7, which aspires to "ensure access to affordable, reliable, sustainable and modern energy for all" under the UN's Sustainable Energy for All (SE4All) Framework (SE4ALL, 2015).

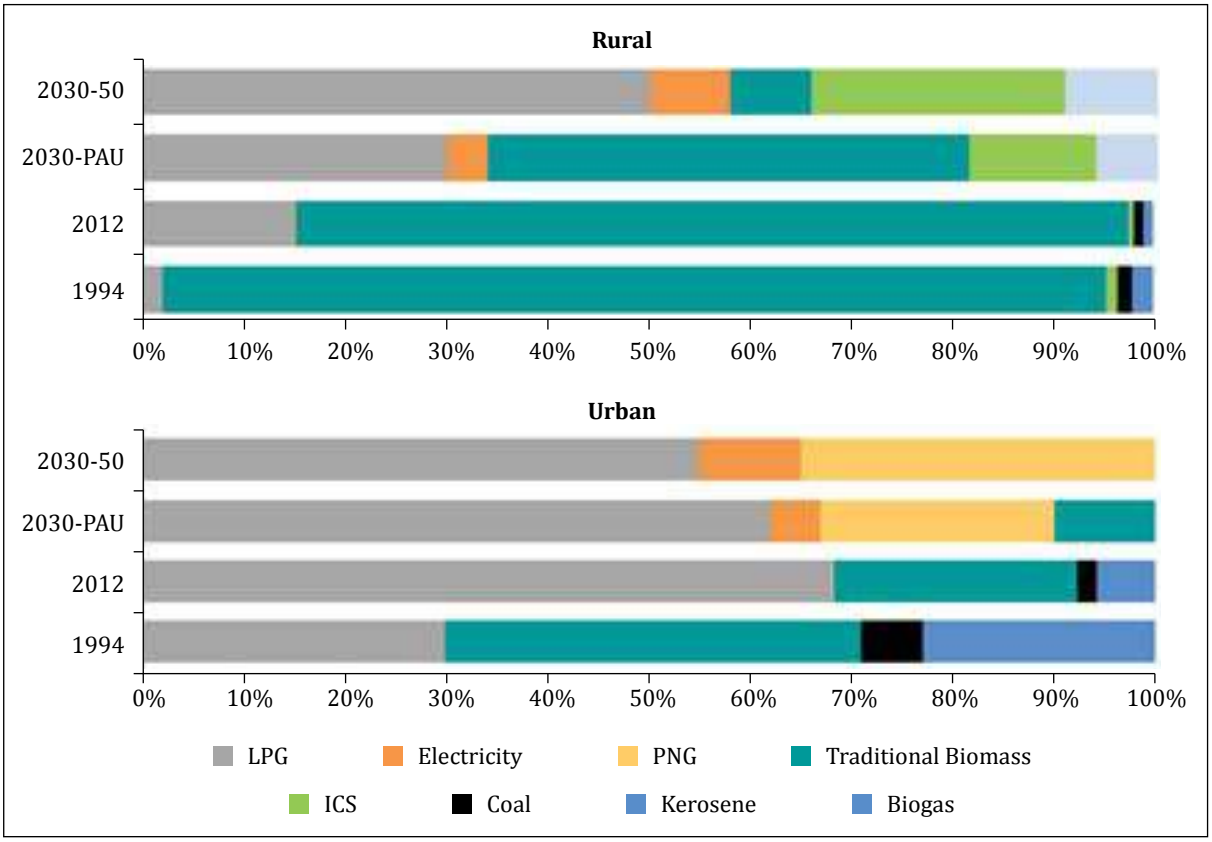
Today, India is home to the world's largest population without access to modern energy – 400 million people do not have electricity access and 800 million people still use traditional biomass for cooking (NSSO, 2015). With these staggering figures, it is crucial to examine whether India has the required capacity to meet SDG 7 in the next 15 years – this is the primary aim of this study. The progress of SDG 7 is to be measured through four indicators: proportion of population with access to electricity; proportion of population with primary reliance on clean fuels and technology; renewable energy share in the total final energy consumption; and energy intensity measured in terms of primary energy and gross domestic product (GDP) (UNStats, 2016).

The future of the electricity sector looks bright, with the present Indian government announcing schemes to provide '24x7' universal electricity access by 2019. These include plans for establishing new power plants, increased coal production, and the strengthening of transmission and distribution infrastructure under the Integrated Power Development Scheme (IPDS) (The Economic Times, 2015; Deccan Herald, 2015). As such, under a scenario that can be characterised as 'Policy As Usual' (PAU), India appears reasonably well-positioned to achieve the goal of quality electricity access to all by 2030.

Additionally, the government has decided to more than treble its installed renewable energy capacity, with a target of 175 GW (gigawatts) in 2022 from the existing 49 GW. This target includes 100 GW of solar, 60 GW of wind and 15 GW of other renewables such as bioenergy and small hydropower (MNRE, 2016a). Energy efficiency has been a priority for India over the past two decades with the Energy Conservation Act of 2001 enacted to reduce the energy intensity of the economy. The Ministry of Power (MoP), through its statutory body, the Bureau of Energy Efficiency (BEE) and Public Sector Undertaking (PSU), Energy Efficiency Services Limited (EESL) has aggressively implemented energy efficiency schemes, especially in the residential and industrial sectors. Recently, under a flagship scheme by MoP called UJALA over 160 million LED (light-emitting diode) bulbs were distributed, which could lead to an estimated 1 per cent reduction in India's overall annual carbon emissions (UJALA, 2016). Since 2008, the Perform, Achieve and Trade (PAT), a market-based mechanism to make energy efficiency cost-effective in large-scale industries, has been rolled out by the Indian government (BEE, 2016). Thus, it appears that India is on its way to meet the targets of increasing the share of renewable energy in its energy mix, and considerably reducing its energy intensity.

In developing countries, cooking and heating energy needs are often met by unclean fuels. The weather in most part of India remain rather warm throughout the year. So use of air or water heaters is not much common. Even in cold weather zones, usually the heaters are required for 3-4 months only (IEA, 2015). However, home cooking is highly pervasive in India; and as mentioned earlier, India remains the country with the largest population reliant on unclean fuels for cooking. Studies predict that at the current pace of deployment of clean cooking interventions (either improving the efficiency of biomass stoves or replacing biomass altogether), even in 2030, about 40-50 per cent of the rural population will continue to depend on traditional biomass cookstoves (see the PAU scenario for rural India in Figure 1) (CSTEP, 2015; IEA, 2015). This indicates that under the present scenario, it is unlikely that India will meet the SDG 7 target of ensuring universal access to modern fuels as a large population will continue to rely on unclean biomass cookstoves even in 2030. Despite this knowledge, there has been limited dialogue on clean cooking.

Figure 1: Access to Clean Cooking Fuel Scenarios of India in 2030



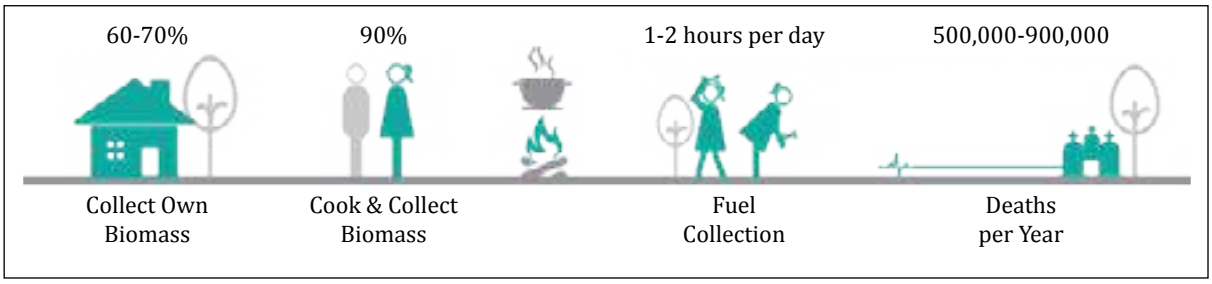
Source: Figure created by authors using data from CSTEP (2015) and NSSO (2015).
Note: LPG: Liquefied petroleum gas; PNG: Piped natural gas; ICS: Improved cooking stove.

India does not seem adequately prepared to meet the target of minimising reliance on unclean fuels, especially in the field of cooking. Hence, the institutional and policy framework required to realise universal access of clean fuels in India has been chosen as the focus of this study.

To ensure access to clean cooking fuels, there has been stress on promoting liquefied petroleum gas (LPG) as a cooking solution. Major LPG promotion schemes include the Pratyaksh Hastantarit Labh (PAHAL), a Direct Benefit Transfer of LPG (DBTL) scheme, which was launched in 2015 across the country[1] (MoPNG, 2015a). Consumers who join the scheme will get LPG cylinders at market price, along with an LPG subsidy directly transferred to their bank account. In parallel, a voluntary 'Give It Up' scheme was launched, which urged well-to-do LPG consumers to opt out of receiving subsidised LPG, thus freeing up their subsidy for below-poverty-line (BPL) families.[2] The Pradhan Mantri Ujjwala Yojana was also launched in 2016 to provide free LPG connections to women from BPL families, who can pay in monthly instalments, and buy LPG stoves and cylinder refills (PIB, 2016; Jindal, 2016). These schemes have been launched recently and the full extent of their success remains to be seen.

Cooking, as it stands today, is one of the biggest health hazards in India. The country annually accounts for one-third (500,000-900,000) of the global deaths from indoor air pollution (IAP) caused by the combustion of traditional biomass (GIZ, 2014; Dalberg Global Development Advisors, 2013) (see Figure 2). Premature deaths from IAP are higher than those from malaria and tuberculosis. IAP also increases morbidity among users and is responsible for 17 million disability-adjusted life years (DALYs) annually (Dalberg Global Development Advisors, 2013).

Figure 2: Current Scenario of the Residential Cooking Sector



Source: Figure created by authors using data from CSTEP (2015).

As women are primarily involved with cooking in Indian households, they are exposed to the greatest risks associated with IAP from traditional biomass combustion (Dalberg Global Development Advisors, 2013). In over 60 per cent of households using biomass, it is women and children who must perform the task of collecting fuel (Dalberg Global Development Advisors, 2013). In these households, each woman or child annually spends around 10 per cent of their time on fuel collection, time that could otherwise be used in education or income generation activities (CSTEP, 2015). The burning of traditional biomass releases black carbon into the atmosphere. Black carbon has also been associated with the Asian brown cloud phenomenon and the disruption of monsoon, which accelerates the melting of the Himalayan-Tibetan glaciers (US EPA, 2012).

Through achieving universal access to modern cooking fuel, it is estimated that India could avoid 130,000 deaths, 4 million DALYs, 25 kilotonnes of black carbon emissions, and 0.3 million hours of time spent on cooking activities (CSTEP, 2015). In summary, considering the health and climate implications of unclean cooking fuels, it is vital that India adopt this SDG 7 target into its national agenda and take action towards increasing the deployment of clean cooking interventions. This will require a significant reconsideration of how the access to modern cooking fuels is approached in India.

[1]It was first launched in 2013 to cover 291 districts. After a review, it was re-launched in 2014 for 54 districts, and extended to cover the remaining 622 districts by January, 2015.

[2]BPL is a poverty threshold to identify economically disadvantaged households, which are in need of government assistance.

Objectives

This paper presents the results of a three-month study commissioned by the Southern Voice on Post-MDG International Development Goals.[3] The paper is aimed at the major stakeholders involved in the SDG process at both the national and international levels. It is aimed at national policymakers who are involved in enabling the provision of clean cooking interventions. With respect to achieving the SDG 7 target to ensure universal access to affordable, reliable and modern energy services, with a focus on clean cooking services in India, the main objectives of the paper are to:

- Analyse the scope for embedding the SDG 7 target into India's national agenda;
- Understand the national level implications on intra-governmental coordination to meet the SDG 7 target;
- Examine the adequacy of existing finance and means of implementation within India to successfully achieve the SDG 7 target;
- Explore the role of non-governmental stakeholder participation in meeting the SDG 7 target; and
- Investigate the capacity of existing national statistical institutions to effectively monitor progress towards the SDG 7 target.

Methodology of the Study

In order to achieve the above-mentioned objectives, this paper presents a thorough analysis that is based on insights gleaned from both key primary and secondary sources. Primary research insights were gained from extensive consultation conducted with over 30 government officials, oil marketing companies (OMCs), industry experts, researchers, finance providers and non-government organisations (NGOs) (a detailed list of consulted stakeholders is provided in the Appendix to this paper). This primary research has been supplemented by a range of secondary sources, including reports, white papers and data portals from government sources, research findings and data from NGOs, private stakeholders and think tanks, as well as academic sources (including books and journal articles).

The primary findings of this study were presented at the Indian Clean Cooking Forum 2015 – this was invaluable in gaining feedback from relevant stakeholders.

Structure of the Paper

Section 2 of the paper focuses on how India can integrate the SDG 7 target into its national planning process. It considers past, existing and proposed national plans and programmes to provide universal access to modern cooking fuels. Section 3 analyses challenges in regard to intra-governmental coordination and the accountability mechanisms between implementing agencies, and explores the leadership role of various agencies. Section 4 examines whether the existing financing environment and capacity of implementing stakeholders can successfully execute the activities required to ensure universal access to clean cooking in India. Section 5 then reflects on the role that non-governmental stakeholders can play in achieving the SDG 7 target; and Section 6 examines the adequacy of India's statistical agencies and mechanisms in monitoring progress towards achieving universal access to modern cooking fuels in India. The final section then concludes with a series of policy recommendations.

2. Integration and Mainstreaming of SDG 7 in the National Planning Process

Access to clean cooking (the definition of clean cooking in the present study is mentioned in Box 1) has been part of India's national agenda for decades (see Figure 3). However, India has been largely unsuccessful in achieving its targets. National schemes have largely focused on three technologies –

[3]Southern Voice is a network of 49 thinks tanks from Africa, Asia and Latin America. It serves as an open platform to make contributions to the international discourse on the post-MDGs development framework.

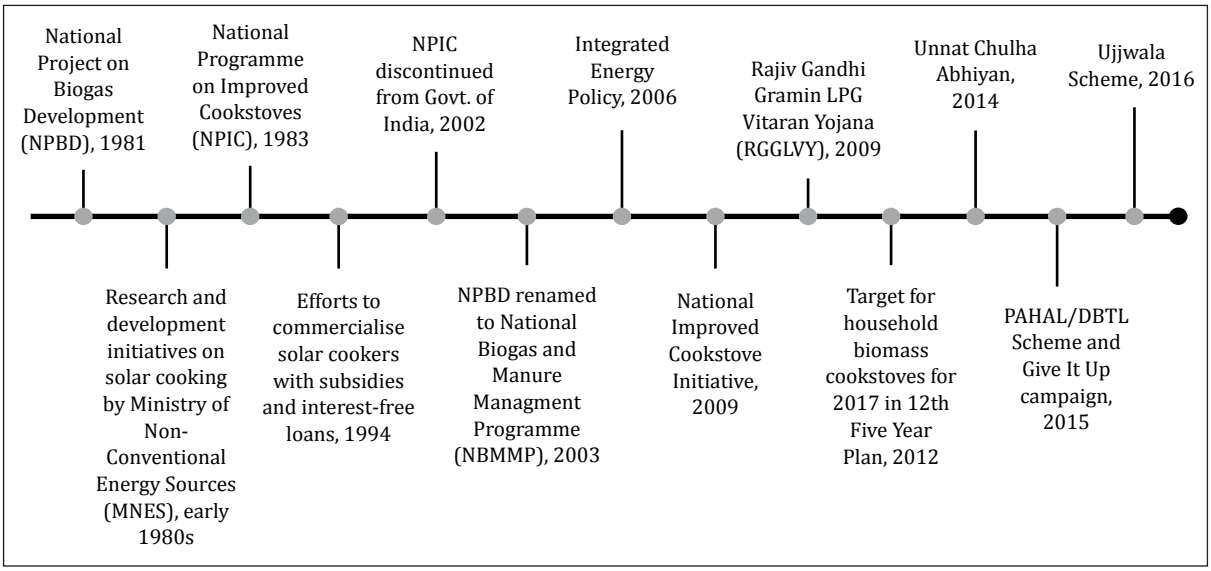
Box 1: SDG 7 and Clean Cooking

Under SDG 7, an exclusive target or indicator does not exist to measure the share of the population using clean cooking fuels.

At present, the indicator under SDG 7 most suitable to measure access to clean cooking is "Proportion of population with primary reliance on clean fuels and technology (%)." This indicator is calculated as the number of people using clean fuels and technologies for cooking, heating and lighting divided by total population reporting cooking, heating and lighting.

As the indicator mentions not only clean fuels but also technologies, efficient biomass cooking stoves, which meet certain national and international health guidelines, are also categorised as a clean cooking technology in the present study.

Figure 3: Policy Timeline in the Clean Cooking Sector



Source: Figure created by authors using data from Maithani and Gupta (2015); Venkataraman, Sagar, Habib, Lam, & Smith (2010); and MNRE (2016b).

biogas, LPG and improved cooking stoves (ICSs). There have also been smaller, subsidy-based initiatives targeted at delivering fuels, such as kerosene, to 'the last mile', and encouraging the uptake of solar-based cookers at the individual and community levels. However, despite these national-scale efforts, 65 per cent of the population continue to rely on traditional biomass to meet their cooking needs (NSSO, 2015). The failure of the government's top-down initiatives can be largely attributed to a lack of consideration of cooking habits and needs, which are largely based on cultural preferences and cooking methods that involve varying heat intensities (Dalberg Global Development Advisors, 2013). Progress has also been hindered by a lack of effective monitoring, evaluation and after-sales management; limited awareness of the advantages of modern cooking fuels; and ineffective subsidy models. As a consequence, large-scale efforts to promote clean cooking got disparaged between 1990 and 2010.

Although energy access in India is largely focused on electricity provision, greater emphasis on clean cooking is slowly returning. This renewed focus is a result of increases in government subsidies on LPG (reaching USD 8 billion in FY2013-14) ((Jain, Agrawal, & Ganesan, 2014) and a greater recognition that lack of clean cooking poses one of the biggest health hazards in the country. In forest fringe areas, the Ministry of Environment and Forests (MoEF) and state forest departments make special efforts to promote clean cooking due to the negative impacts that the use of fuel wood has on forests.

India has a series of parallel policies that are aimed at deploying different technologies (as listed in Table 1). However, there is no single policy or target through which the SDG target of ensuring access to modern energy, of which clean cooking fuels are a major component, can be mainstreamed.

Table 1: Alignment of Existing Schemes with SDG 7

Policy for Technology	Alignment	Misalignment
Biogas: NBMMP (2003)	• Successful development of individual and community biogas models • Scheme targeted at rural populations	• Unambitious targets: for the 12th Plan period, the target of 0.65 million family-sized plants was significantly below the estimated potential of 1.23 million • Top-down approach with lack of focus on sustainable use • Lack of monitoring mechanisms and incentives to ensure successful operation of plants • No mechanism to ensure effective implementation and use of funds
ICS: Unnat Chulha Abhiyan (2014)	• Successfully set up centres for ICS standardisation • Scheme targeted at rural populations	• Unambitious targets: the annual target of less than 1 million is below the deployment potential of 1.5-3 million • Top-down approach with lack of focus on sustainable use • No mechanism to ensure effective implementation and use of funds
LPG: RGGLVY (2009) PAHAL/DBTL (2015) Give It Up Scheme (2015) Ujjwala Scheme (2016)	• Aggressive expansion and subsidy schemes to increase LPG use • Schemes to reduce subsidy leaks	• Subsidies are not targeted at the most deserving • No focus on 'last-mile' distribution, leading to reduced use in rural areas • Increased focus on providing initial connections rather than sustained use of LPG
Electricity: DDUGJY (2014) IPDS (2014)	• Increased rural electrification can lead to more electric cooking	• The focus on providing electricity only for basic needs makes the electricity provided to consumers inadequate for cooking
PNG: Expansion schemes	• PNG intended to serve large urban populations	• Higher importance given to the industrial sector

Source: Stakeholder interviews; CSTEP (2015); Jain, Choudhury, & Ganesan (2015a); Maithani & Gupta (2015).

Further, the central government's strategy concentrates primarily on LPG expansion. As of March 2016, the government's Give It Up programme, which encourages high-income households to give up their LPG subsidy, reported savings to the tune of INR 41 billion (Singh, 2016). Meanwhile, the Ujjwala scheme was launched with a budget of INR 80 billion between FY2016-17 and FY2019-20, and targets 50 million BPL households (PIB, 2016).

On the other hand, there is a great disparity between funding for LPG expansion and other clean cooking schemes that might better meet local needs. It is predicted that biomass will continue to be the primary fuel source for a significant number of households even in 2030. It is, therefore, important to ensure that technologies that 'make the available clean' (see Box 2), such as biogas plants and ICS, are promoted alongside LPG use. Use of piped natural gas (PNG) and electricity in urban areas can free up LPG for use in rural areas. So to realise progress, a system of gradation that factors in household preferences, cooking habits and region-specific resources is required.

In order to integrate SDG 7 into India's national agenda, it is useful to examine recent international goals to combat climate change that have, since 2008, been embedded into the national policy.

Box 2: Clean Cooking Approaches

This study has identified two main approaches to providing clean cooking access:

1. 'Make the available clean' — the solid fuels available for use are made cleaner by using efficient and innovative conversion technologies.

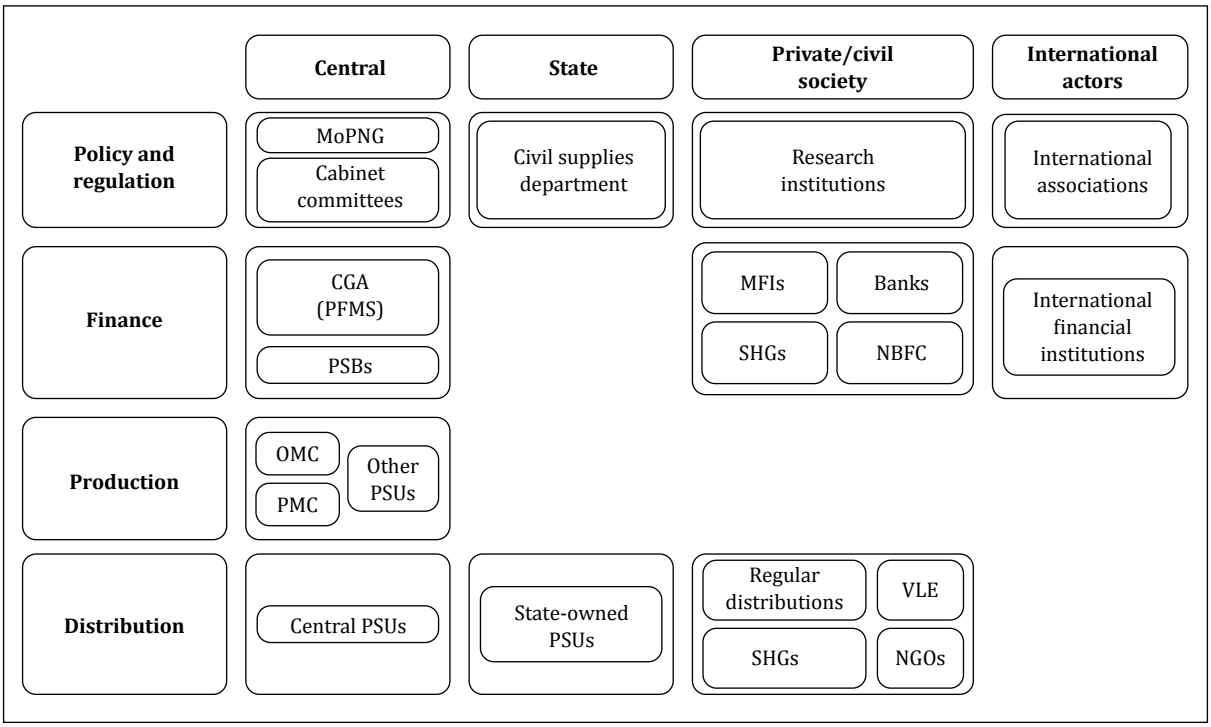
2. 'Make the clean available' — modern fuels such as LPG, PNG, biogas and electricity are made available to all (Smith & Sagar, 2014).

India's National Action Plan on Climate Change (NAPCC) mainstreamed climate change mitigation and adaptation schemes into India's agenda, following the announcement of voluntary emissions reductions at the Conference of Parties 15 (COP 15).[4] NAPCC includes various policies under different ministries, but all of them are aimed towards the single goal of addressing climate change. A similar approach could be taken to mainstream the goal of access to clean cooking. Such an approach would have implications on current plans and strategies aimed towards deploying clean cooking technologies – these implications are now to be discussed in the next sections of this paper.

3. Coordination, Management and Leadership of the SDG 7 Implementation Process

Traditionally, the government has played a primary role in the clean cooking sector. Its role has included designing schemes, financial incentives, and management and distribution of technology and fuel. The primary central ministry responsible for increasing access to modern fuels is the Ministry of Petroleum and Natural Gas (MoPNG). The MoPNG's work in cooking fuels is limited to LPG and PNG (see Figure 4). Through its PSUs, the MoPNG controls the distribution of LPG and PNG. PNG is distributed to consumers either directly by MoPNG's PSUs and the Gas Authority of India Limited (GAIL), or GAIL first supplies PNG to state-run gas PSUs who have local distribution networks. OMCs supply LPG to authorised private state distributors, NGOs, self-help groups (SHGs) and village-level enterprises (VLEs) who then serve the consumer.

Figure 4: Key Actors in the LPG and PNG Sector

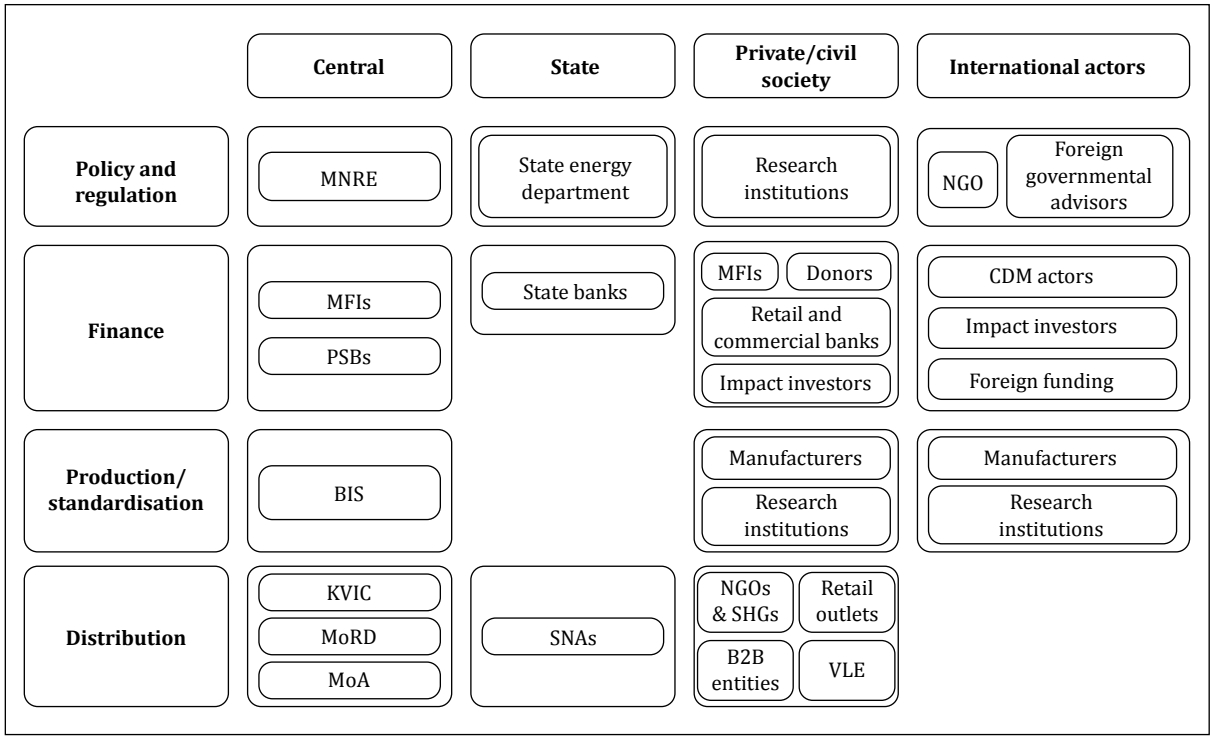


Source: Figure created by authors using data from stakeholder interviews and MoPNG (2016).
Note: CGA: Controller General of Accounts; PFMS: Public Finance Management System; PSB: Private sector bank; PMC: Project management contractor; MFI: Microfinance institute; NBFC: Non-bank finance company.

Other clean cooking technologies that are promoted by the government include ICS and biogas plants (see Figure 5). The Ministry of New and Renewable Energy (MNRE) is the central authority in this respect. It sets targets for different state nodal agencies (SNAs) to deploy ICS and biogas plants in their respective states. The MNRE is also tasked with implementing renewable energy technologies, upon

[4]The Conference of Parties 15, or COP 15, was a climate change summit held in Copenhagen in 2009 under the United Nations Framework Convention on Climate Change (UNFCCC). COP 15 was attended by more than 40,000 people and 115 world leaders. Countries agreed on an aspirational goal of limiting the global temperature increase to 2 degrees Celsius, and announced their individual voluntary emission reduction targets to reach this goal.

Figure 5: Key Actors in the ICS and Biogas Sector



Source: Figure created by authors using data from stakeholder interviews and MNRE (2016b).
Note: CDM: Clean Development Mechanism; BIS: Bureau of Indian Standards; KVIC: Khadi and Village Industries Commission; MoRD: Ministry of Rural Development; MoA: Ministry of Agriculture; B2B: Business-to-business.

which it places higher priority compared with clean cooking. This dual responsibility is also reflected at the sub-national level, where SNAs responsible for deploying clean cooking technologies under central mandates are also responsible for renewable energy power schemes. As a result, although a few states have set up clean cooking initiatives, on the whole clean cooking is not a state priority.

As SNAs lack the required resources and personnel to deploy clean cooking technologies, they hire the so-called 'turnkey operators' to carry out their projects. It then becomes the sole responsibility of the turnkey operator to manufacture, create a market and sell stoves to meet the targets. However, turnkey operators lack the incentive to effectively implement these technologies, with government initiatives being based on top-down subsidies that are often not disbursed in time, and a lack of focus on market creation. In addition, the MNRE lacks the capacity to monitor schemes directly and tracks progress using aggregated information on funds dispersed by the SNAs. Further, important indicators on usage and social impacts (e.g. health benefits, time savings and cooking convenience) are not measured. This limits the possibility of making informed programme amendments and hinders the strategic planning of the MNRE. Often, funds have been disbursed for a particular number of biogas or ICS programmes, but they have not been deployed. As such, these funds have both failed to be used effectively and reach rural communities.

Ensuring that stoves are of a minimum standard is crucial as cooking impacts climate change, health and gender equity. Hence, it is important for government agencies to develop and promote acceptable standards for different types of cookstoves to ensure that standardised technologies of high quality are available to all. The MNRE has set up a few testing labs in northern and western India. Currently, the process is expensive and time-consuming (Dalberg Global Development Advisors, 2013; Dhamija, 2014). Hence, there is a need to increase the number of centres in different regions of India to enable access to different types of stove manufacturers around the country. Such efforts at standard-setting, testing and certification need greater coordination, and will help incentivise suppliers to make products that meet certain performance criteria when in use.

Given that there are broader social objectives associated with clean cooking, the funding and implementation of such schemes have proven less effective when channelled through the MNRE than would be the case for more mainstream ministries, such as the Ministry of Health and Family Welfare (MoHFW) or the Ministry of Rural Development (MoRD). Although the MoHFW has established a committee tasked with reducing IAP by 50 per cent by 2025, they do not directly participate in the implementation of SDG 7. The MoHFW and the MoRD have very well-established networks in rural communities; for instance, the MoHFW has approximately 850,000 women working as accredited social health activists (ASHAs) in local communities around the country, all of whom are responsible for health-related awareness-raising.

The MoHFW has also created strong local ties through which it successfully eradicated polio and tetanus in children. Similarly, the MoRD has a large network of SHGs spread throughout the country, which actively work on a number of issues, including livelihoods. Collectively, these SHGs have easier access to finance. As clean cooking technologies can have a positive impact on job creation, as well as reducing morbidity and mortality, the MoHFW and the MoRD can assist by spreading awareness as well as by disseminating clean cooking technologies through their existing channels.

Recently, the MNRE attempted to promote clean cooking through intra-ministerial coordination by using the Compensatory Afforestation Fund Management and Planning Authority (CAMPA) funds given out by the MoEF to reduce the negative impacts of cooking with traditional biomass on forest areas.

In conclusion, each ministry is tasked with a set of discrete issues that they tackle 'in silos'. This implies that ministries are perceived to only follow individual mandates, with little scope to exchange implementation expertise amongst themselves. Indeed, clean cooking is often erroneously considered to be separate from wider issues on women and rural development, health, environment, amongst others. Bringing together organisational capacities and resources for these complementary mandates, all of which are aimed towards improving the quality of life, can promote effective coordination and greater success as shown in the case of Brazil's Bolsa Familia policy (see Box 3).

Box 3: Bolsa Familia in Brazil

Brazil has integrated access to cooking gas into its *Bolsa Familia* poverty alleviation programme. The programme includes a conditional cash transfer system that is focused on improving food, health and education. The programme reaches the poorest 40 per cent of the country. Recipients are given R$15 (USD 4) every two months to cover their cooking gas needs. This holistic poverty alleviation scheme has reduced administrative costs and eased the bureaucratic complexity for both families and those administering the programme. Studies indicate that the introduction of this programme has resulted in a sharp decrease in the levels of poverty in Brazil (Anthony, 2006).

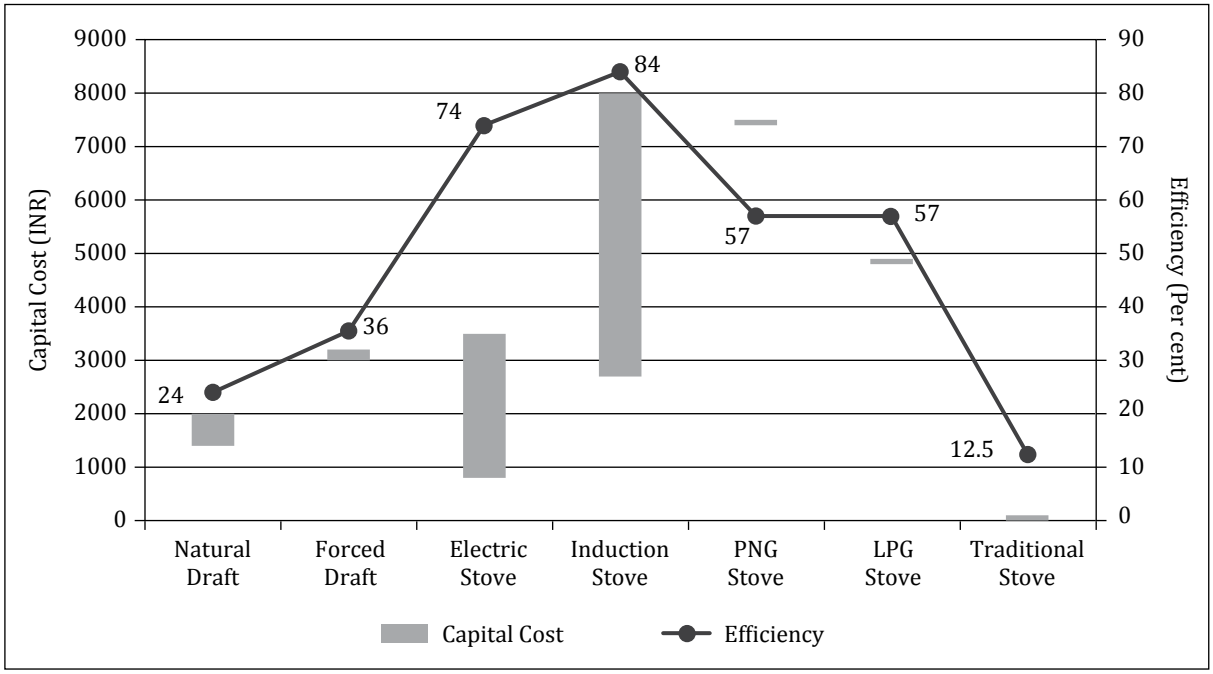
4. Adequacy of Financing and other Means of Implementation of SDG 7

Inadequate finance has been identified as a key barrier to improving access to clean cooking services, both in terms of consumer affordability, and access to finance for enterprises and businesses. With regard to consumer affordability, the capital costs associated with clean cooking technologies can be significantly higher than those of traditional fuels, as shown in Figure 6. For example, family biogas plants (not shown in Figure 6) have capital costs as high as INR 20,000.

A recent analysis conducted by the Center for Study of Science, Technology and Policy (CSTEP) that compared two scenarios, PAU and sustainable development, in the cooking sector identified an investment gap of approximately 40 per cent (see Figure 7). This investment gap indicates only capital costs of stove technologies for households.

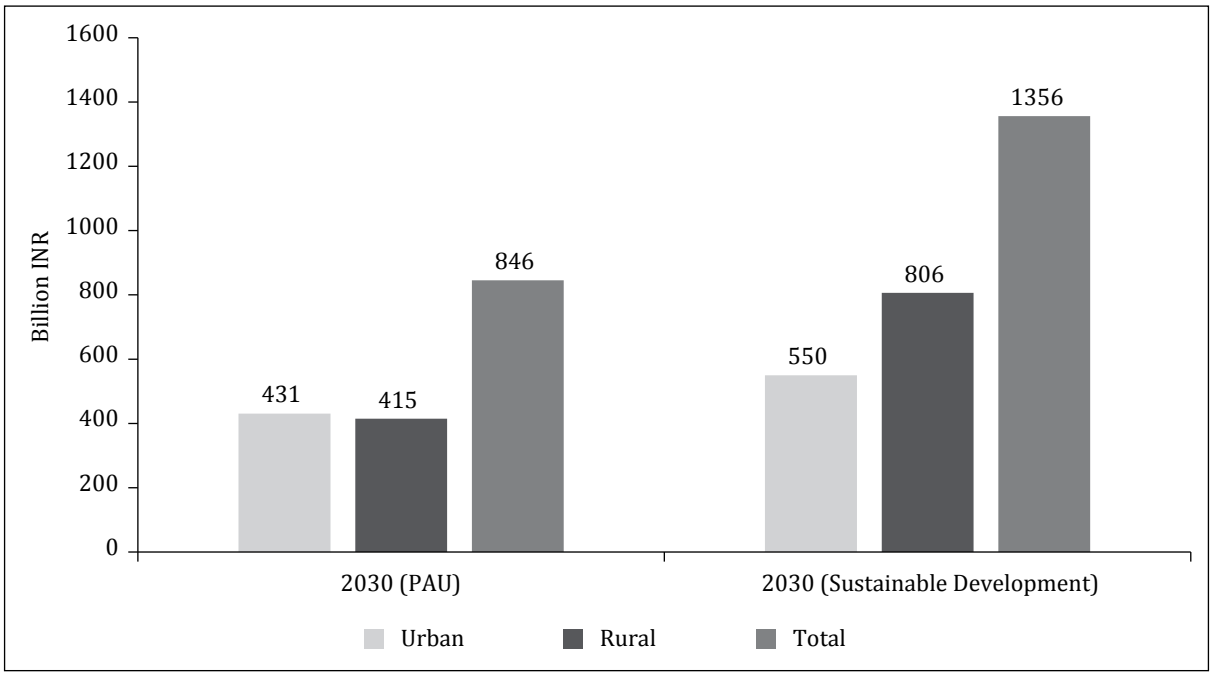
A study conducted by Jain *et al.* (2015b) across six states in India indicated that after factoring in efficiency and fuel costs without subsidies, ICSs using biomass, which are collected for free by the consumer (when biomass is not paid for), are the most economical cookstove technology, followed by biogas.

Figure 6: Capital Costs and Average Efficiencies of Cooking Stoves, by Type



Source: Jain *et al.* (2015a).

Figure 7: Investment Needs for Universal Clean Cooking Access in India by 2030



Source: CSTEP (2015).

However, to date, government investment has typically targeted LPG access via subsidies, and access to ICSs and biogas plants via direct consumer and indirect manufacturer subsidies. The absence of a consolidated policy roadmap for clean cooking has meant that there is no clear understanding of the government funding that is required (especially in sub-sectors) to secure the goal of access to clean cooking. Some stakeholders identified the need for such a financial roadmap for government spending across programmes in the sector. In Ghana, USD 3 million has been allocated to promote clean cooking technologies. The ratio of funds allocated to biomass and LPG clean cooking solutions

across the value chains is 1:6.[5] Meanwhile, in India, the annual government funding for biogas and ICS programmes is less than 1 per cent of the total spent on LPG subsidies per year. Illustratively, in 2014-15, the government spending on biogas and ICS programmes was about INR 5.5 per household, versus INR 1,574 per household of LPG fuel subsidy from government and OMCs.[6]

Aside the costs to the consumer, in order to ensure mainstreaming of this target, it is important to consider components such as awareness-raising, monitoring and evaluation. At present, these aspects are very poorly executed, especially in government-run programmes.

Potential finance streams include international public financing and donor grants, climate financing, private capital (domestic and international), as well as government spending. Table 2 considers the opportunities and challenges for these various financing avenues in India.

Table 2: Types of Financing Available for the Indian Clean Cooking Sector

Type of Finance	Opportunities	Challenges
International public finance and private impact investments	• Provide finance for enterprises along the whole value supply chain and enable asset financing • Some social impact investors and seed funds are willing to absorb initial manufacturer risk • Some donor investments are designed as 'subsidised' loans and include capacity-building and training • Performance grants can also subsidise consumer capital costs	• Absence of a standardised evaluation framework • Social impact investors still view clean cooking as a 'frontier market' • Businesses are vulnerable to changing donor priorities and funding cuts • Typically used in multiple finance streams, wherein different stakeholders need to be managed • Performance grants for meeting consumer costs for clean cooking stoves can cause market distortions
Clean development mechanism (CDM)[7]	• Earnings from selling carbon credits from avoided carbon dioxide (CO_2) emissions of clean cooking projects can be used to finance stove-manufacturing companies and provide communities that adopt clean cookstoves revenue for stove upkeep • Not widely used in India	• Volatile certified emission reduction (CER) prices • No guarantee of revenue flow for manufacturers • High transaction costs for compliance and validation • Low awareness of how to access carbon financing • Not applicable to small-scale manufacturers
Commercial loans	• Loans for businesses available to those who can borrow through other business lines or put forward collateral; viable as a finance stream for evolved markets	• Businesses, especially in rural markets, are unable to establish commercial viability and face greater risks • High interest rates
Microfinance institute (MFIs)	• Ease of access to small loans for stove purchase through SHGs, as well as to support community distribution arrangements	• The cost of clean cookstoves is too low for MFIs to provide exclusive loans for them to consumers. Loans for clean cookstoves are provided with product bundling arrangements. Going forward, a top-up loan approach could be required • MFIs are reluctant to lend to distribution businesses and individuals buying cookstoves due to challenges in

(Table 2 contd.)

[5]This example was shared by an expert who was interviewed, but the numbers could not be independently verified by the authors.

[6]CSTEP estimates based on actual expenditure on MNRE's clean cooking programmes in 2014-15 (MNRE, 2015), LPG subsidies (MoPNG, 2015a), 2011 population (1.2 billion) and household size (4.8) (Census of India, 2011).

[7]The CDM is an arrangement under the Kyoto Protocol that allows industrialised countries or companies committed to lowering greenhouse gases (GHGs) to invest in ventures that reduce emissions in developing countries as an alternative to more expensive emission cuts in their own countries.

(Table 2 contd.)

Type of Finance	Opportunities	Challenges
		establishing the financial viability of the loan. This occurs due to a lack of performance benchmarks in stoves and a lack of experience of MFIs in the sector • Further, product endorsements are not permitted, which could reduce risk[8] • Low uptake due to high interest rates (as high as 25 per cent) • Sustainability linked to availability of subsidies and seed funding
Corporate social responsibility (CSR)[9]	• Potential to tap into corporate funds to promote clean cooking • CSR programmes focused on advanced technologies can avoid cost-efficiency challenges	• CSR is in its infancy • Funding is dictated by corporate priorities
Government subsidies and loans	• Direct and indirect capital subsidies (via consumer, manufacturer or distribution incentives) can be more useful if better strategised • Emerging priority lending sector status, and planning on custom and tax waivers, can help manufacturers and small entrepreneurs overcome project uncertainties • Growing recognition of the importance of awareness-raising and capacity-building in the Unnat Chulha Abhiyan ICS scheme	• Top-down incentives have previously led to market distortion • Non-service delivery approach may lead to discontinuation • Prevailing high interest rates and lack of clarity on disbursal priorities have resulted in poor use of government allocations • Lack of finance for monitoring programme effectiveness

Source: Stakeholder interviews; Dalberg Global Development Advisors (2013); Smith & Sagar (2014); Dhamija (2014); Planning Commission (2002); mftransparency (2015); Krishnaswamy & Chatpalliwar (2011); Shrimali, Slaski, Thurber, & Zerriffi (2011); IGEN-RE (2013).

Several stakeholders identified that consumer financing will continue to require government financing support. Meanwhile, several capacity-building measures and business development activities are increasingly relying on external donor financing.

Trends and Opportunities in International Finance

Current global development aid favours and prioritises the financing of electricity and renewable energy infrastructure. In 2013, only 0.01 per cent of the total USD 2.4 billion global aid disbursements for projects and grants in India was allocated to clean energy, and even less was concerned specifically with clean cooking.[10] Recent donor seed funding and enterprise financing commitments recognise the need to develop markets rather than the conventional approach of simply distributing subsidised stoves or fuel through programmes. Several organisations have pledged funds to support market creation up until 2020, while donors such as the United States Agency for International Development (USAID), the Department for International Development (DFID), the Shell Foundation, the United

[8]MFIs usually operate by borrowing money from larger banks. Thus, they prefer to lend money for products that have high repayment rates. Loans for ICSs are ideally based on the assumption that there will be advantages such as reduced wood collection, cooking time and IAP. The current standards that are set for ICSs are insufficient to guarantee that a stove will provide all these benefits to the consumer. If a consumer buys an ICS that does not meet the needs, then there is a high chance of low repayment rates to the MFI. Further, MFIs cannot promote one ICS over the other, even if the former has better features. Hence, MFIs are reluctant to lend to this sector.

[9]Under the Companies Act, 2013, all companies in India with a turnover of INR 10 billion, or a net worth of over INR 5 billion, or a net profit of over INR 50 million, must spend 2 per cent of their average net profit (of the last three years) as CSR funds. These funds should be spent in activities that lead to socio-economic and sustainable development.

[10]CSTEP estimates based on database available at http://www.oecd.org/dac/stats/data.htm

Nations Development Programme (UNDP), the International Finance Corporation (IFC) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) have provided grants to support pilot projects (Dalberg Global Development Advisors, 2013).

International aid as a means of implementation needs to be used alongside newer models of financing, such as result-based finance or output-based aid. These models can put greater emphasis on standards and user preferences as part of their conditionality, similar to carbon finance models; however, in the Indian context, this will require considerable institutional strengthening and capacity-building. Further, the SE4All initiative has attracted worldwide attention to issues related to clean cooking fuels. The Global Alliance for Clean Cookstoves (GACC) has also been initiated to promote the adoption of clean cooking stoves in 100 million households by 2020. In parallel, the Global LPG Partnership (GLPGP) has come up in support of governments, NGOs and social impact investors in the LPG sector. In India, the GLPGP has worked with public enterprises and companies on small-scale distribution models or cooperatives led by women to improve the 'last-mile' access of LPG to rural populations.

Alternative Implementation Models: B2B and VLEs

Several manufacturers of clean cooking stoves prefer to serve business-to-business (B2B) clients. B2B clients resell stoves to consumers at a lower, or no, cost under social responsibility programmes. These models enable manufacturers to overcome the cash flow challenges faced in availing government subsidies/carbon credits. Meanwhile, VLEs are emerging as useful entry points to overcome the 'last-mile' distribution challenges (see Box 4). These manufacturers and VLEs are often successful in leveraging international finance. These developments suggest that there is a need to strategically rethink how market actors, government incentives and international funding are aligned to meet clean cooking aims.

Box 4: Village-Level Enterprises

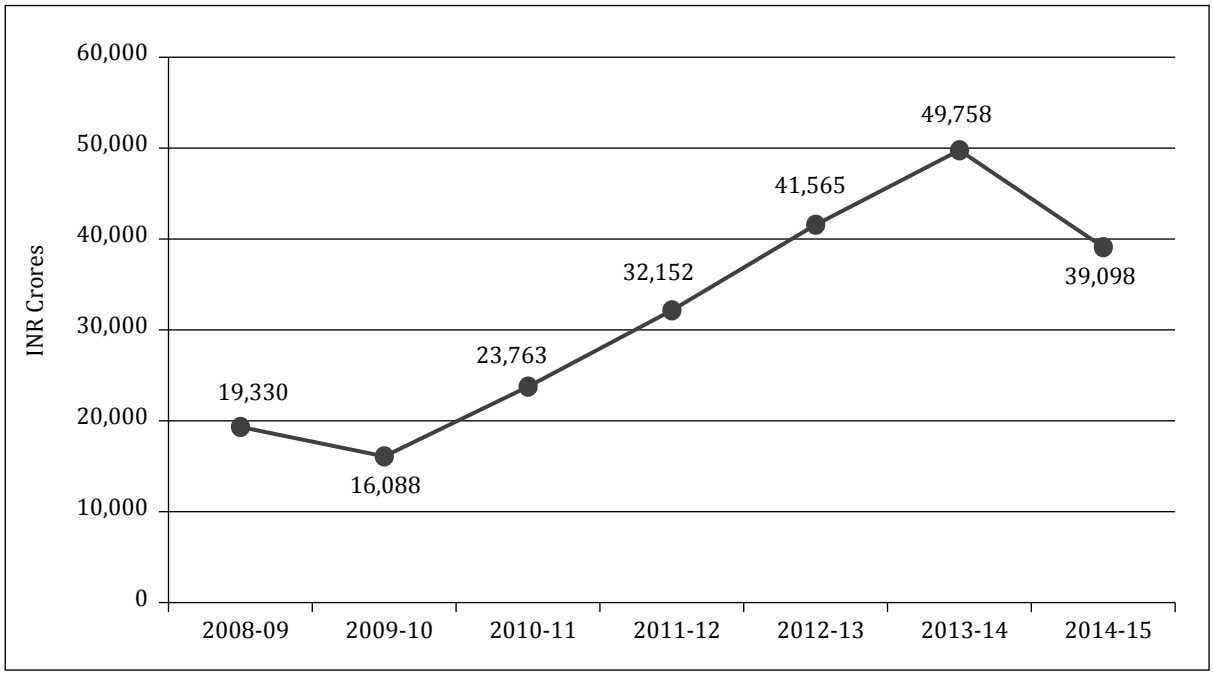
Project Dharma Life is a VLE project that has cooking access as a programme area. It has been able to overcome several financial barriers. Its model is to serve rural household needs by creating rural retail networks that provide customised products and services. These goods are sold to the 'Bottom of the Pyramid' consumers at affordable prices. The project also provides microfinance, credit and loan facility solutions to rural entrepreneurs and consumers. The company has approximately 400 VLEs in 15 districts. Independent, multi-product intermediaries, such as VLE networks, have been identified by the Shell Foundation as the most cost-effective new channels for social impact products. However, several interviewees identified ongoing challenges, in particular with regard to securing solid investments and sales of cooking solutions. The bulkiness of cooking products and the difficulties associated with 'last-mile' transportation logistics need to be overcome to facilitate easier sales (Shell Foundation, 2014).

Government Subsidies Pivotal for Increased LPG Access

Government energy subsidies are meant to be aligned with 'pro-poor' governmental objectives. Such subsidies are allocated to prioritise lighting needs (kerosene) and electricity, followed by cooking needs (LPG and PNG) (Krishnaswamy & Chatpalliwar, 2011). The Indian government has heavily subsidised LPG fuel prices[11] over recent decades (see Figure 8), which has led to a significant increase in consumption. However, the benefits of the fuel subsidy are not necessarily reaching the poorest households, for whom both the upfront and ongoing costs remain very high (Bairiganjan *et al.*, 2010). Further, it is estimated that approximately 50 per cent of the households still do not utilise LPG, although dependence on imports has risen to 89 per cent (Jain *et al.*, 2015a). Although the government has permitted the sale of LPG in the household sector by private companies, their share in total LPG sales is tiny in comparison with the share of government OMCs.

[11] Government subsidy per 14.5 kg cylinder is INR 568 (~USD 10), if the household is registered with OMCs.

Figure 8: Total Domestic LPG Subsidies by Government and OMCs



Source: MoPNG (2015b).

The main objective of the DBTL PAHAL scheme is to reduce unauthorised subsidy use. It is the largest cash subsidy programme worldwide and is a big step forward towards better targeting and rationalisation of LPG subsidies (Tripathi, Sagar, & Smith, 2015).

In addition, in 2009, the MoPNG also launched the Rajiv Gandhi Gramin LPG Vitaran Yojana (RGGLVY) scheme, with the goal of expanding LPG use in rural areas (Ushabala, 2009). Under this scheme, distributors are provided partial financial support to set up distribution centres in rural areas. Select distributors from scheduled castes/scheduled tribes[12] are given adequate working capital loans for the full operation of the RGGLVY, at an interest rate of 11 per cent per annum, which is paid back in monthly instalments. The scheme aims to shift kerosene users in rural areas to instead use LPG, with a target of 55 million new connections through low-cost LPG distributorships. Further, the Give It Up and Ujjwala schemes have been developed to reduce subsidy leakage and enable better subsidy targeting.

In earlier years, consumers were eligible to receive subsidies for a maximum of 6, 9 or 12 cylinders (of 14.5 kg each) per household per year in different years. The PAHAL scheme has included a provision of 34 cylinders of 5 kg each to make the upfront cost more affordable and for easier portability of the cylinder for rural populations. Unfortunately, unreliable supplies have hindered these efforts, particularly in remote locations where transportation costs are very high (Ashden India Renewable Energy Collective, 2015). Further, in order to reduce the number of well-off consumers who benefit from the subsidy regime, the government is allowing consumers to voluntarily give up their subsidy through an 'opt-out of subsidy' option. Estimates suggest that, to date, approximately 5 million households have given up their subsidy. The government has further proposed that households with an annual income of over INR 1 million cannot benefit from the LPG subsidy (The Indian Express, 2015). Indeed, future LPG connections could therefore be through 'opt-in' schemes where low-income households will need to self-certify in order to access the subsidy (Smith & Sagar, 2014).

Finally, both LPG and PNG require large centralised infrastructure, for which asset financing is crucial for state-run enterprises and OMCs. Typically, domestic and international private sector capital, as well as government concessional capital, has been used to enable such assets required for transport logistics, refining, storage depots and distribution infrastructure.

[12]Scheduled castes/scheduled tribes are the official designations given to historically disadvantaged indigenous communities in India.

5. Partnership and Stakeholder Participation (including Institutional Arrangements)

Throughout India, numerous civil society organisations (CSOs) have worked towards improving clean cooking access. CSOs have most notably spearheaded awareness-raising campaigns, providing training on the maintenance of existing cooking technology, supported entrepreneurs and arranged financing for individuals. In addition to conducting invaluable work on the ground, research organisations have created better stove designs that are suitable for the wide range of culinary needs in the Indian subcontinent, worked with government to formulate policies, and compiled primary data to fill information gaps. However, despite their success, these efforts do tend to be limited to the region within which each organisation operates.

Role in Awareness Creation

Households are often unaware of alternative options to the *chulha*[13] and the negative impacts that these chulhas have on their quality of life. A recent study conducted by the Council on Energy, Environment and Water (CEEW) in six major states of India showed that 42 per cent of the households did not opt to get an LPG connection due to lack of awareness (Jain *et al.*, 2015b). The majority of stakeholders interviewed agreed that when end users are aware of the health and corresponding economic impacts of cooking with traditional fuels, they are more willing to adopt clean cooking solutions. Further, even though women are actively involved in cooking activities in most Indian households, it is the men who tend to make the financial decisions. As such, men are more reluctant to switch to clean cooking as they themselves are not directly affected by the negative consequences. Civil society can therefore engage directly with local communities to provide them with timely information, educate them about available clean cooking choices that they can adopt and conduct campaigns that directly aim men.

International agencies, such as the GACC and GIZ, have actively engaged with Indian stakeholders in policy making, conducting market studies, implementing robust distribution channels and spreading awareness-raising campaigns. In early October 2015, GIZ, in association with the MNRE, hosted the Indian Clean Cooking Forum 2015. The Forum included a multi-stakeholder meeting that discussed the issue of achieving universal access to clean cooking by 2030. This meeting proved that there are a number of stakeholders involved in clean cooking access, and with an integrated approach, perhaps they can work together towards increasing access to clean cooking in India.

Role in Community Training/Human Resource Creation

Due to the lack of a developed market environment (caused by a focus on capital subsidies), the after-sales service for ICSs and biogas is inadequate. Although the MNRE schemes include funding for local community members to receive training in the operation and maintenance of ICSs and biogas systems, this training rarely occurs. Even in instances where the government has provided local community members good capacity-building and entrepreneurship skills, they are provided no further support to set up their own enterprise.

When rural customers need to repair their cooking systems, they have to approach their local community centres for advice. However, these centres are often themselves unaware of the needed solutions. Even larger manufacturers, such as Envirofit, who have sold more than 700,000 cooking stoves worldwide, do not deliver capacity-building. Instead, they provide only warrantees on their products. As a result of this, and a lack of an after-sales service network, systems typically fall into disuse after 1-3 years. In order to ensure sustained use of clean cooking solutions, it is necessary to devise innovative ways to ensure that systems remain operational.

NGOs have a crucial role to play in this effort. A number of organisations, including The Energy Resources Institute (TERI) and the Technology Informatics Design Endeavour (TIDE), have been

[13] A chulha is a traditional biomass indoor cookstove used mostly in villages.

successfully involved in capacity-building exercises for entrepreneurs, sales service personnel and 'last-mile' distributors. They have also provided specific design interventions for commercial cooking equipment in messes, wedding halls and mid-day meal[14] preparation in school kitchens. However, such initiatives have only been conducted on a small scale, limited to the region within which each of these organisations functions. NGOs should therefore work with governments and private actors to implement robust after-sales centres. The best way for this to be achieved will be by engaging and training local community members who can then themselves play a key role in spreading awareness, encouraging the use of modern technologies, and maintaining systems. Incentives should also be given to promote a whole-community shift to cleaner fuels; for instance, a scheme similar to the 'clean village' title could be awarded to recognise 'smokeless villages'.

Role in Generating an Evidence Base

The government, independent research organisations and industry associations (such as the GACC and GLPGP) have played key roles in conducting independent analyses and galvanising evidence in stakeholder discussions and policy formulation. Some research organisations have also been engaged in gathering relevant data on consumer preferences, behaviours and regional markets.

6. Capacity of National Statistical Agencies and other Data-related Issues

Data are key to making sound policy decisions and tracking progress towards achieving SDG targets. However, most experts believe the current available data are inadequate for these purposes. The Census of India and the National Sample Survey (NSS) are the two surveys currently conducted by the Indian government at the household level that provide data for monitoring access to clean cooking (see Table 3). Although stakeholders believe that, compared with other developing nations, India has efficient data monitoring agencies, there are concerns that the questions asked in the above-mentioned surveys are insufficient to monitor progress towards achieving universal use of clean cooking fuels in households.

Table 3: Comparison of National Surveys

Component	Census of India	National Sample Survey
Responsible ministry	Home Affairs	Statistics and Programme Implementation
Sample size	The entire population of India	8,000-10,000 villages and urban blocks
Frequency of data collection on household energy use	Once every 10 years	Once every 3-5 years

Source: Stakeholder interviews; MoSPI (2016); and Census of India (2016).

The relevant questions asked in the NSS and census surveys concern the primary energy source used for cooking by households. However, this is insufficient to monitor the actual adoption of technologies in households as it does not take into account the fact that a significant amount of fuel stacking may occur. Further, the NSS specifies a period spanning over the last 30 days, which may not accurately reflect annual cooking patterns. These two surveys do not reflect the technologies that are being used in households, and their impact on convenience, economics, environment, health, safety and fuel supply. While biomass might continue to be the primary fuel for cooking, the data do not indicate whether the use of more efficient and cleaner technologies is leading to enhanced quality of life for consumers.

The low frequency with which the surveys are conducted (only once in 5 or 10 years) results in large time gaps. Since the SDGs are set to be achieved by 2030, such gaps limit the use of NSS and census data to track progress and make corrections over the 15-year SDG implementation period.

[14]The Mid Day Meal Scheme is a national scheme in India that seeks to improve the nutrition of school-age children. Under this programme, free lunch is supplied to primary and upper primary students in government schools on weekdays.

Further, although NSS data are collected more often than census data, it still takes a large amount of time for the NSS data to be released due to the large sample sizes involved. For example, the 2011-12 68th NSS results were only released three years later, in 2015. Data are also not often released on time due to political reasons, for instance, when incumbent governments are unhappy with the survey findings and so postpone their release.

While the NSS and the census are holistic national surveys, there is a need for additional, shorter, more flexible surveys that provide a greater focus on access to energy and allow data to be released more frequently. Such initiatives have recently been undertaken by organisations such as the CEEW, which recently published a report titled 'Access to Clean Cooking Energy and Electricity', and TERI, which came out with a report titled 'Analysing Rural Energy Transitions and Inequities' (Jain *et al.*, 2015b; TERI, 2014). Both studies conducted a detailed energy survey of six states in India.

It is very difficult to obtain district-level data on the use of modern cooking fuels. However, such data are required in order to carry out adequate interventions in these areas. While states are mandated to provide a detailed monthly account of their rural electrification status, no such mandate exists for clean cooking access.

Different agencies keep track of the technologies they deploy. Whereas oil companies have data on the PNG and LPG connections that they have issued, the MNRE has data on the funds deployed for biogas and ICSs. However, as mentioned earlier, these data do not accurately measure the actual level of usage of these technologies. In order to better address data collection needs, some stakeholders have suggested that the support of international agencies, such as the World Bank, is needed to conduct large surveys on energy access.

Alternatively, instead of collecting certain types of evaluation data using surveys, low-cost technology solutions, such as household sensors, could be used. These sensors would monitor the emissions of devices and the hours of usage. Local bodies, such as health clinics or product distributors, could then send these data from the villages to a central data collection centre.

Further, social entrepreneurs have conducted pilot surveys that have evaluated the market potential for clean cooking devices and assessed the willingness of consumers to pay for these. A state-owned database that compiles such information could put all market players on a level playing field and create an environment conducive to new businesses.

7. Conclusions and Recommendations

In India, the SDG 7 target of universal access to clean energy services is of particular significance given that 65 per cent of the population (800 million households) continue to rely on traditional biomass for cooking. Despite being aware of the negative health and environmental impacts of traditional biomass, the government has not adequately mainstreamed clean cooking into its national agenda. There is, therefore, an urgent need for the government to accelerate efforts targeted towards the deployment of clean cooking technologies. An integrated policy making approach should be taken, in which a portfolio of clean cooking technologies is considered based on consumer preferences, as well as fuel availability and affordability. To create an environment conducive to reaching this goal, and to ensure successful planning and implementation, will require intra-ministerial coordination between key government ministries, as well as greater partnership among other stakeholders.

In regard to funding, access to finance remains a key challenge for both consumers and manufacturers. Innovative financing mechanisms and business models, which go beyond a dependence on government subsidies, are therefore needed to ensure robust 'last-mile' deployment of clean cooking technologies.

Finally, this report has demonstrated how existing national data monitoring mechanisms are inadequate for tracking progress and the impact of household access to clean cooking fuels. Improved

monitoring techniques and targeted surveys are therefore required to provide accurate data relevant to the SDG 7 target.

The analysis in this paper has resulted in a series of key recommendations that will promote the achievement of the SDG 7 target by 2030.

Adopt a Multi-Technology Approach

LPG cannot be a 'silver bullet' to achieve universal clean cooking. In addition to LPG, a full-deployment portfolio must also include electricity, PNG, biogas and ICSs. Biogas and ICS schemes need to be considerably more ambitious, and allocated more resources and financial support.

The government should take an integrated approach where the most suitable clean cooking fuel/ technology is deployed based on an understanding of the region-specific needs and resources. This 'clean cooking roadmap' should include details of considered interventions, as well as the required timeframe, financing needed, implementation strategy and suitable monitoring mechanism. It should also address clean cooking targets for commercial establishments (restaurants, schools, canteens, etc.) as these are markets with negligible existing interventions. This identification of consumer-oriented solutions could lead to the creation of sub-markets consisting of specific types of technologies, where the government can provide required support for businesses to operate and thrive.

State level implementation of clean cooking would benefit from following an approach similar to that of electricity planning, i.e. each state could develop a clean cooking plan similar to the roadmaps that are aimed towards achieving 100 per cent electrification, and provide updates to a designated agency. Such a planning and monitoring mechanism at the state level should be integrated with national level schemes.

Understand and Cater to Customer Preferences

There is a need to better understand the situation on the ground, specifically, what consumers actually want and why previous products have failed. Innovative technologies that both meet the government's evolving standards and satisfy customer needs are required. Stakeholder deliberations coupled with market surveys and research studies in different regions will be needed to facilitate this.

Facilitate Inter-Ministerial Coordination

A holistic approach is required to consider household energy access issues within larger developmental goals of social transformation and poverty reduction. A successful example of such an approach is that of Brazil's Familia Bolsa (see Box 3). This can be achieved by the creation of a separate department (similar to water and sanitation). Alternatively, in the absence of a single department, there needs to be an integrated approach within the institutional framework (similar to the NAPCC). This integrated approach should involve the MoHFW and the MoRD, which have complementary goals such as rural development and public health, are important to the government, and have greater budgets and resources for tracking progress.

Utilise Better Deployment Channels

The government can utilise existing networks and schemes developed by government agencies, such as those of the MoHFW and the MoRD, which have a strong presence in rural areas, to spread awareness as well as to deploy clean cooking technologies. In the case of technologies that have high capital costs such as biogas plants, the government can consider absorbing the high capital subsidy by directly transferring cash to the consumer, which will reduce transaction costs and leakages. The

current government's aggressive promotion of the Jan Dhan Yojana[15], which aims to provide universal access to banking services, makes direct cash transfer of subsidies an attractive option.

Increase Awareness and Create Demand

Local governments, NGOs and civil society all have key roles to play in spreading awareness about both the impact of traditional biomass use on the quality of life and the available alternatives. With greater awareness, stakeholders anticipate an increased demand for clean cooking solutions, which can lead to greater success for distributors and retailers. Gender is also a factor that is little discussed in regard to demand creation and sensitisation programmes. Efforts to improve awareness should be undertaken in a more targeted manner and at a larger scale, similar to the successfully implemented national health campaigns. The MNRE, with GIZ support, has already started ICS awareness campaigns through video, radio and poster adverts focusing on targeted messaging for rural households.

Improve 'Last-Mile' Distribution and Product Availability

To improve the 'last-mile' distribution of LPG, existing SHGs and similar institutions can be used, and uniform delivery charges adopted. The government could consider channelling the subsidy or distribution-end support for absorbing travel costs. As smaller sized cylinders are easier to carry and involve lower upfront costs, they are ideal for poorer households in rural areas. Market-based approaches should be used to develop the ICS product value chain and facilitate the uptake of biogas plants. The involvement of local communities and the training of local entrepreneurs will be necessary to enable these approaches.

VLE business models could benefit from innovative mechanisms serving higher-income households and cross-subsidising select products to the most deserving consumers. Government and donor agencies should provide funding for VLEs with Viability Gap Funding (VGF) beyond just subsidies. The National Clean Energy Funds (NCEFs) and corporate social responsibility (CSR) funds can also be used to facilitate VLE businesses.

Build After-Sales Support Capacity

Private and public stakeholder support for capacity-building activities within local communities is crucial to ensuring that, at least at the *taluk*[16] level, product after-sales support is available. Clean cooking practitioners could be involved in developing a viable capacity-building curriculum, with these courses being implemented in state training and rural institutes. Opportunities to implement this under the recently announced Skill India Development Mission[17] should be explored.

Improve Targeting and Rationalisation of Fuel Subsidies

Capital subsidies should be better channelled and better targeted. It is important to progressively rationalise fuel subsidies, exclude high-income groups, and introduce targeted and differentiated subsidies for households of different income levels.

[15]The Pradhan Mantri Jan Dhan Yojana is a National Mission for Financial Inclusion that was launched in August 2014, to ensure access to affordable financial services.

[16]A taluk or tehsil is an administrative division for taxation purposes that usually consists of a group of villages. There is a three-tier local body system in every state; the tehsil is above the village and below the district. Each taluk has an administrative officer to govern it.

[17]The National Skill Development Mission was launched in July 2015, in order to rapidly implement and scale up skill development efforts across India. Its primary goal is to provide institutional capacity to train at least 300 million skilled people by 2022 to ensure sustainable livelihoods.

Improve Financial Support

In order to absorb financial risk and facilitate easier access to credit, manufacturers of ICSs and biogas plants should be included in the priority lending sector, and be permitted access to partial risk guarantee schemes from rural regional banks. Clarity on proposed tax mechanisms, well-designed tax holiday schemes, and indirect subsidies for ICS and biogas distribution and manufacturing, can also help to alleviate financial stress on businesses.

Strengthen Data Monitoring Activities

There is a need to modify the questions and fields of information in national surveys, such as the NSS and the Census of India, to better understand the use and impact of clean cooking solutions on the quality of life. Such national surveys need to be supplemented by region-specific data collection mechanisms that are supported by international donor agencies, especially in poor-performing states. Local entrepreneurs and distributors could also be incentivised to collect and track data on the use of products and repair requirements. Low-cost technology-monitoring options, such as data sensors, should also be considered.

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Appendix: List of Interviewees

This appendix contains details of stakeholders consulted during the research project. They included clean cooking practitioners, policymakers, manufacturers and product developers, as well as representatives from research organisations, social enterprises, government and donor agencies, foundations, and NGOs.

Srl.	Name	Position	Institution
1	Harish Anchan	Managing Director	Envirofit
2	Debasis Barik	Associate Fellow	NCAER
3	Svati Bhogle	MD & Founder	TIDE/Sustaintech
4	Alex Evans	Chairman of Operating Committee	Global LPG Partnership
5	Dr Sarath Guttikunda	Associate Research Professor	Desert Research Institute
6	Abhishek Jain	Junior Research Associate	CEEW
7	Anil Jain	Adviser (Energy)	NITI-Aayog
8	Abhishek Kar	PhD student	University of British Columbia
9	Vanitha Kommu	Former Programme Coordinator for CEE and Consultant on SRLM for MoRD	CEE & MoRD
10	Rekha Krishnan	Energy Policy Researcher	Independent Consultant
11	Srinivas Krishnaswamy	CEO	Vasudha Foundation
12	Christian Liedtke	Technical Expert	GIZ India
13	Katharina Michaelowa	Professor and Chair of Research Committee on Development Economics	University of Zurich
14	Shonali Pachauri	Senior Research Scholar	IIASA
15	Sudha Padmanabha	Senior CDM Specialist	FCN
16	DC Patra	Deputy GM – LPG Strategy	BPCL
17	Abhishek Pratap	Senior Energy Campaigner	Greenpeace
18	Pradeep Pursnani	Deputy Director	Shell Foundation
19	Sudhir Chella Rajan	Professor	IIT, Madras
20	Dr TV Ramachandra	Senior Scientific Officer	IISc
21	SV Ranganath	Former Chief Secretary	Karnataka
22	Ibrahim Rehman	Senior Director	TERI
23	Surya Sethi	Adjunct Professor at NUS	Former Planning Commission
24	Sudha Setty	Country Representative, India	GACC
25	Kirk Smith	Professor of Global Environmental Health	University of California, Berkeley
26	HI Somashekhar	Technical Officer	IISc
27	Ashok Sreenivas	Senior Research Fellow	Prayas Energy Group
28	Arjuna Srinidhi	Programme Manager	CSE/formerly WOTR
29	Hisham Zeriffi	Assistant Professor	University of British Columbia

The following individuals provided their inputs via written reports/publications (as opposed to oral interviews):

Name	Position	Institution
Deepak Gupta	Secretary	Ex MNRE
Aruna Kumarankandath	Programme Officer of Renewable Energy Programme	CSE
Rachita Misra	Programme Manager of Urban Community Lab	SELCO

In addition, some officials from relevant government ministries agreed to participate on the condition that they remain anonymous.

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Launched in 2012, **Southern Voice on Post-MDG International Development Goals** (Southern Voice) is a network of 49 think tanks from Africa, Asia and Latin America, which was set up to serve as an open platform to contribute to the global discourse pertaining to the formation of the Sustainable Development Goals (SDGs), the challenges of implementation, monitoring and mid-course review of the SDGs. *Southern Voice* addresses the existing 'knowledge asymmetry' in the global debates and 'participation deficit' of the developing countries by generating evidence-based knowledge, sharing policy experiences originating in the Global South, and disseminating this knowledge and experience among key stakeholders. *Southern Voice Occasional Papers* are based on research undertaken by members of the network as well as inputs received at various platforms of the initiative. The *Centre for Policy Dialogue (CPD)*, Bangladesh hosts the Secretariat of *Southern Voice.*

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