



## South Asia Access to Energy Brief

460-425 Carrall St.  
Vancouver, BC  
V6B 6E3

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### Current Energy Landscape

No country in the world has moved faster than India to deliver electricity to more people, connecting an average of 24 million to the grid system every year since 1990.<sup>1</sup> This impressive progress, however, seems to be undercut by population growth. Today, there are still 306.2 million people in India without electricity, and 705 million people who rely on wood and biomass for cooking.<sup>2</sup> Like most developing countries, there are also marked differences between rural and urban communities in both cooking fuels and electricity consumption. In urban areas, only about one-third of households burn fuelwood for cooking; in rural areas, that fraction is nine out of 10 households.<sup>3</sup> India has had great success in expanding electrical grid coverage over the past decades, with 94 per cent of urban populations now connected. The rural electrification rate is about 60 per cent.<sup>4</sup> India has supported these newly connected households largely with new coal-generated power.

In 2012, coal made up 56 per cent of the country's installed capacity, but actually accounted for 70 per cent of total power generation that same year.<sup>5</sup> The general theme of coal as India's main power source is not expected to change in the near future. India's twelfth five-year plan, spanning 2012-17, calls for 88.4 gigawatts of capacity, 78 per cent of which will be met by new coal power plants.<sup>6</sup> This scenario has not been without controversy. This year, a former secretary to India's

1 Lavelle, Marianne. "Five Surprising Facts About Energy Poverty." National Geographic, May 30, 2013. <http://news.nationalgeographic.com/news/energy/2013/05/130529-surprising-facts-about-energy-poverty/>.

2 Lavelle, 2013.

3 Khandker, Shahidur R., Douglas F. Barnes, and Hussain A. Samad. "Are the Energy Poor Also Income Poor? Evidence from India." *Energy Policy* 47 (August 2012): 1-12. doi:10.1016/j.enpol.2012.02.028.

4 Khandker et al, 2012.

5 Razdan, Anil. "Energy Poverty in India and What's Needed to Address It." *Cornerstone*, July 28, 2014. <http://cornerstonemag.net/energy-poverty-in-india-and-whats-needed-to-address-it/>.

6 Razdan, 2014.



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Ministry of Power published an article in the Guardian claiming that while coal power increases India's generating capacity, it benefits affluent, already connected customers instead of the disconnected rural and urban energy-poor.<sup>7</sup> Advocates for coal insist that it is the only way India – with a rapidly growing economy and therefore rapidly growing thirst for energy – can affordably meet its obligations to its people.<sup>8</sup> Coals detractors insist that its climate change impacts globally and its health care impacts locally make the cost of coal far too high, and that locally generated, indigenous renewable energy is the only way to solve energy poverty.<sup>9</sup> Key to this energy landscape is the fact that India is a massive importer of energy resources. Despite its large landmass, the country is relatively energy-poor, with no major sources of fossil fuels or hydropower. Instead, the country imports energy from its neighbours in the region, such as Bhutan which has been investing heavily in hydropower. As the largest and fastest growing economy in the region, India demonstrates many of the energy challenges typical of the region. Some regional nuances will be discussed in the sections below. As all economies in the region expand, energy investments will have to cover a diverse set of strategies – from large-scale fossil fuel and hydropower investments to off-grid renewables – to achieve reliable electricity for 100 per cent of the population.

## Rural-Urban Divide

Like most developing regions, South Asia has a stark divide in energy access between rural and urban areas. However, in the South Asia region, researchers have been extensively investigating the subtleties of this divide and the various

<sup>7</sup> Sarma, EAS. "Coal Is Not the Answer to India's Energy Poverty, Whatever Tony Abbott Says." The Guardian, August 7, 2015, sec. Comment is free. <http://www.theguardian.com/commentisfree/2015/aug/07/coal-is-not-the-answer-to-india-as-energy-poverty-whatever-tony-abbott-says>.

<sup>8</sup> Razdan, 2014.

<sup>9</sup> Sarma, 2015.



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causes of its tenacity. When it comes to cooking fuel, in India, for example, rural households still rely almost exclusively on traditional biofuels. These include charcoal, animal dung, crop waste, and firewood – the most highly prized being firewood, because of the superior flavour it imparts to food. This traditional biomass accounts for 89 per cent of total energy use in India’s rural areas, but only 35 per cent in cities.<sup>10</sup> There are likely many reasons for this disparity, chief among them being opportunity cost. Biomass is typically collected by women and children, who in most rural cases are not employed outside the household. Therefore, little to no cash income is lost by reliance on biomass. Additionally, biomass is freely available in the environment surrounding rural villages. This means that even when improved modern fuels such as Liquefied Petroleum Gas (the fuel preferred by government and international development agencies because of its efficient and clean-burning nature) are available in rural areas, households may not adopt them because of the perceived cost differential, or because agrarian families with low levels of cash-flow simply cannot afford them, while they can afford to spend time collecting firewood.<sup>11</sup>

### Who is Most Affected?

Interestingly, it is also women and children who bear the brunt of biomass’s negative effects, as they are the ones most often inside during cooking activities. One study found that young children living in households reliant on solid biomass fuels have a two to three times greater risk of contracting acute lower respiratory tract infection (ALRI), which is also the chief cause of death for children in developing nations.<sup>12</sup> Indoor air pollution from biomass has further been

<sup>10</sup> Khandker et al, 2012.

<sup>11</sup> Ibid.

<sup>12</sup> Smith, K., J. Samet, I. Romieu, and N. Bruce. “Indoor Air Pollution in Developing Countries and Acute Lower Respiratory Infections in Children.” *Thorax* 55, no. 6 (June 2000): 518-32. doi:10.1136/thorax.55.6.518.



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linked to low birth weight and malnutrition in children, as well as an increased risk of lung cancer, tuberculosis, cardiovascular disease, and even cataracts in adults.<sup>13</sup> A World Health Organization (WHO) fact sheet from 2014 reports that women who are exposed to high levels of indoor smoke are 2.3 times as likely to suffer from chronic obstructive pulmonary disease (COPD) than women who cook with cleaner fuels.<sup>14</sup> The same fact sheet also points out that when women and children use their time to gather fuel for cooking, their ability to participate in other productive activities – like income generation or school – are severely limited.<sup>15</sup> Reliance on traditional biofuels, therefore, not only harms the health of women and children, but it can help trap families in cycles of poverty that stymie other development efforts.

## Technological Solutions

One potential solution that has circulated for many years now is the adoption of improved cookstoves. This is a solution that does not require extensive infrastructure or connectivity, and allows communities to continue local traditions associated with biomass. However, although improved cookstove programs have been around since the 1970s, they have not seen widespread success, and adoption rates remain low. First: what is an improved cookstove? They come in a variety of models – from home-constructed clay to industrially assembled steel – but in essence, an improved cookstove is a device that controls the flow of air into the combustion process, improves heat transfer from the fuel to the cookstove, and removes the byproducts of combustion from the kitchen.<sup>16</sup> The end result uses less fuel, and improves indoor air quality.

13 Fullerton, Duncan G., Nigel Bruce, and Stephen B. Gordon. "Indoor Air Pollution from Biomass Fuel Smoke Is a Major Health Concern in the Developing World." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 102, no. 9 (September 2008): 843-51. doi:10.1016/j.trstmh.2008.05.028.

14 WHO. "Household Air Pollution and Health." World Health Organization, March 2014. <http://www.who.int/media-centre/factsheets/fs292/en/>.

15 WHO, 2014.

16 Bhutto, Abdul Waheed, and Sadia Karim. "Energy-Poverty Alleviation in Pakistan through Use of Indigenous Energy Resources." *Energy for Sustainable Development* 6, no. 1 (March 2007): 58-67.



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These clear advantages have caused improved cookstoves to be touted as a development solution by governments and NGOs for decades. The United States donated \$105 million to a United Nations program aimed at putting improved cookstoves in 100 million households by 2020, and the leaders of the G8 countries have pledged to help reduce indoor air pollution by distributing improved cookstoves.<sup>17</sup>

Despite the clear advantages and international attention, however, improved cookstoves have not become widespread in South Asia. Research from Pakistan provides some answers to this conundrum. For one, the urban poor benefit from programs to disseminate improved cookstoves more than their rural counterparts, despite the fact that most biomass is burned in rural areas.<sup>18</sup> Higher adoption rates in cities are due to the higher likelihood that the urban poor are already using a stove of some sort, rather than an open fire. They are more likely to spend money rather than time on acquiring fuel, which may give them the capital necessary to invest in an improved cookstove. Finally, the urban poor have better access to credit than poor people living in rural areas.<sup>19</sup> Additionally, education plays an important role in who chooses to invest in improved cookstove technology. A study of 100 households in northwestern Pakistan observed that the most important barrier hindering adoption of improved cookstoves was simply that there was very little awareness among villagers of the potential negative effects of traditional cooking methods. Without an intensive program of information dissemination on the part of the government or NGOs, the study concludes, rural inhabitants will see little motivation to transition to improved cookstoves.

<sup>17</sup> Fraser, Barbara, and Environmental Health News. "Improved' Cookstoves May Do Little to Reduce Harmful Indoor Emissions." *Scientific American*, July 11, 2012. <http://www.scientificamerican.com/article/improved-cookstoves-little-reduce-harmful-indoor-emissions/>.

<sup>18</sup> Bhutto and Karim, 2007.

<sup>19</sup> Ibid.



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While improved cookstoves may allow households to limit their exposure to harmful toxins in the short run, the investment does also lock them into use of biofuels for the foreseeable future, and curtails any incentive to expand modern energy services to that area. Additionally, recent research from other parts of the world that quantitatively tests indoor air quality in households using different cooking methods shows that improved cookstoves can still produce elevated levels of indoor pollution.<sup>20</sup> Some families may use their stoves to burn plastic and other trash, and even when using other fuels, incomplete combustion of solid fuels produces many toxic substances.<sup>21</sup> Ultimately, the cleanest and most versatile cooking solution is that currently used by 60 per cent of the world: natural gas or electricity.<sup>22</sup> The challenge is to make gas or electricity widely available, with extremely clean cookstoves filling the gaps in only the hardest to reach communities.<sup>23</sup>

### Renewable Electricity

The ultimate goal is to eventually provide all rural villages with access to electricity. There is one question that remains: what is the best way to accomplish this? As mentioned above, India has seen tremendous success in its efforts to electrify populations in the proceeding decades. Until now, grid-based electrification has been the predominant model in India, successfully covering 94.5 per cent of the county's inhabited area. Even when it comes to renewable energy, India has focused on large-scale investments, such as hydropower plants in the highlands of Bhutan. In fact, Bhutan has been praised by the World Bank for successfully redistributing the wealth created by its hydropower projects. With pro-poor policies in

<sup>20</sup> Fraser and Environmental Health News, 2012.

<sup>21</sup> Ibid.

<sup>22</sup> Ibid.

<sup>23</sup> Ibid.



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place, the revenue gleaned from sales to energy-hungry India has allowed Bhutan to reduce its percentage of poor citizens to only four per cent, while the whole of South Asia's poverty rate is still 30 per cent. With its abundant steep slopes, fast flowing rivers, and large glacial flows, Bhutan has a large estimated hydropower potential – about 30,000 megawatts, with only six per cent of that currently exploited.<sup>24</sup> The importance of Bhutan to India's energy future was demonstrated after the 2014 landslide election of Prime Minister Modi, who made his first official state visit to India's tiny landlocked neighbour to the northeast. The two countries expect to jointly install an additional 10,000 MW of capacity by 2020, in the form of 10 mega hydropower projects.<sup>25</sup> Despite the enthusiasm of both countries for these projects, as with most undertakings of this scale, the plan has generated major controversy. The required excavation and flooding for reservoirs will disrupt important and unique ecosystems in both countries, and a number of farming communities must be relocated – although they are compensated by the Bhutanese government, many argue that new land is simply not enough.<sup>2627</sup>

However, South Asia's unconnected villages today are often quite remote, or small enough that national censuses do not even recognize them as villages.<sup>28</sup> Although Bhutan's hydropower development will help to green the region's energy mix, it will do little to solve the energy poverty of these remote and tiny hamlets. Therefore, off-grid solutions based on renewable energy may be most appropriate for these areas. The majority of off-grid renewable projects in India have been

24 Dharmadhikary, Shripad. "Hydropower in Bhutan - Time for a Rethink?" *International Rivers*, January 8, 2015. <http://www.internationalrivers.org/blogs/328-5>.

25 Dharmadhikary, 2015.

26 Ibid.

27 Liu, Coco. "Bhutan Prospers by Exporting 'Sustainable' Energy, but Some Doubt That It Is." *Climate Wire*, December 4, 2013. <http://www.eenews.net/stories/1059991245>.

28 GNES. "Renewable Energy-Based Rural Electrification: The Mini-Grid Experience from India." New Delhi: Global Network on Energy for Sustainable Development, 2014.



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undertaken by state energy agencies, under the direction of the national Ministry of New and Renewable Energy (MNRE). A number of NGOs have also financed and constructed pilot projects across the region.<sup>29</sup> India's experience with deploying renewable-based mini grids to electrify rural areas has led to a number of important lessons. First, community buy-in and acceptance of the project is essential; projects that focus on productive uses of electricity, and thus allow community members to see direct and concrete benefits in the form of income generation, are most successful at creating buy-in and acceptance.<sup>30</sup> Second, research has demonstrated the importance of modular projects – this allows communities to adapt technologies to their specific needs, without necessarily requiring an expensive custom-designed system.<sup>31</sup> Finally, communities cannot make these microgrid projects happen alone – governments must play a strong and active role, with clear-cut policy frameworks, milestones, financial support, and capacity-building initiatives.<sup>32</sup>

India is also home to some interesting and innovative business models from the private sector that are allowing companies to participate – and turn a profit – in rural electrification. One example, known as the A-B-C model, is a particular favourite of the World Bank. Using this model, OMC Power identifies three groups of customers in a rural village: “Anchors,” “Businesses,” and “Community” members. The anchor customer provides a predictable load that offers a guaranteed source of revenue for the company, for example a school or health clinic. In the case of OMC Power, the main anchor customers in rural India have most often been telecom towers.

<sup>29</sup> GNES, 2014.

<sup>30</sup> Ibid.

<sup>31</sup> Ibid.

<sup>32</sup> Ibid.





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With a guaranteed revenue stream to predictably pay off their investment, the project developer can then expand the mini grid to service usual customers such as businesses and the surrounding community. OMC Power has further developed something called a “business-in-a-box” concept through which community entrepreneurs are brought into the village electrification process.<sup>33</sup>

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