Rethinking India's Energy Policy

Development Challenge around Multiple Objectives

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An energy supply approach is inadequate to India's energy requirements at a time when multiple objectives need to be addressed. The state of play in energy supply and demand is examined, and the recovery of an older tradition of attention to energy demand patterns in addition to energy supply is argued for. The gains from an explicit attention to the fact that India has to address multiple and simultaneous objectives in shaping energy policymaking are laid out, and emerging methodologies to serve this goal are discussed. Shifts in governance patterns are a necessary part of transitioning to a broader, and more development-focused approach to energy policy.

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The provision of energy has long been central to India's development. However, India's energy strategy and planning has largely been constructed in supply-oriented terms, which can and has been limiting, given the complex and interconnected set of energy issues facing India. This is especially relevant to the current context in which India is undergoing multiple large-scale transitions in its demography, job creation, urbanisation, provision of energy access and built environment, all of which have implications for energy needs and consumption patterns. While energy policy in response to these transitions is often reduced to simply ensuring sufficient fuel growth, in reality, the challenge is more complex and includes ensuring energy security, providing equitable energy access, and protecting both the local and global environment. In this article, we argue that India's long-standing supply focus needs to give way to a more explicit strategic approach based on addressing multiple objectives simultaneously. We then describe emerging methodologies in the literature which provide examples for ways to operationalise an integrated approach and discuss their corresponding institutional features, to help shape the still fluid future energy supply and demand patterns.

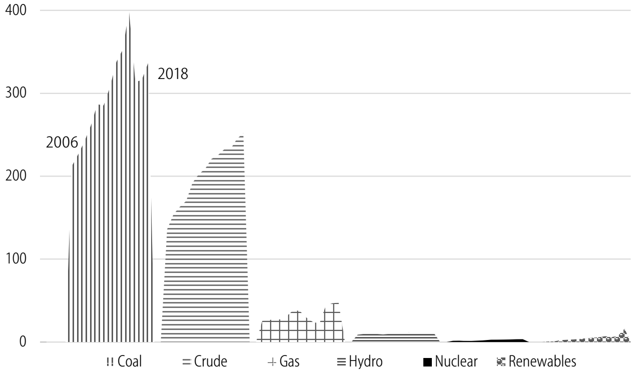
India's Energy Strategy

There is little doubt that India will need to substantially enhance its total energy use if it is to develop. India's per capita energy consumption is a third of the global average, at 0.55 tonne of oil equivalent (toe)/cap compared with the global average of 1.78 toe/cap (British Petroleum 2017). Analogously, in 2014 India consumed 806 kWh/cap of electricity compared to the global average of 3,125 kWh/cap, United States' (US) consumption level of 12,987 kWh/cap and Chinese consumption level of 3,927 kWh/cap (World Bank 2014). These low levels of energy serve as a constraint to development, as evidenced by the Human Development Index (HDI) which is a measure of social development and is strongly correlated with high energy access (Gaye 2007). For India to reach higher levels of human development, it will likely need to at least double, if not triple, its energy needs, making energy critical to its development aspirations (Sreenivas and Prayas Energy Group 2014). In fact, existing modelling studies suggest that India may double its energy use by 2030 (Dubash et al 2017).

Historically, a perennial sense of energy scarcity has dominated India's policymaking for the past two decades (Dubash 2011). The landmark Integrated Energy Policy of 2006 called for increasing primary energy use by a multiple of three or four, and to do so by pursuing "all available fuel options and forms of energy" (Planning Commission 2006: xiii). Successive Five Year Plans set ambitious targets, which until recently, were almost always dramatically underachieved, exacerbating the sense of scarcity. The need for enhanced energy availability has also been tempered by a growing attention to energy security, as energy imports climbed up 50% of India's total primary energy use in 2017–18 (CSO 2019: 42, 43, 60, 76).

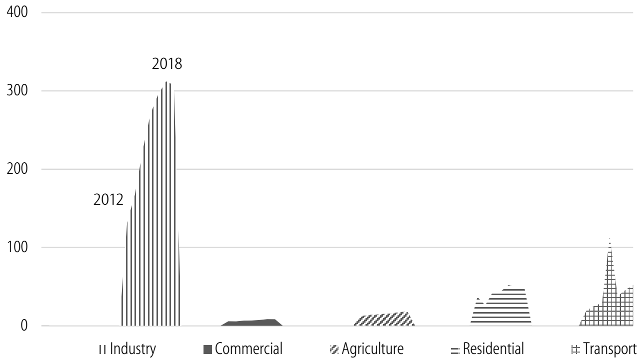
More recently, spurred by shortages and security considerations, energy supply has picked up. After a problematic effort at coal auctions, and a steep decline in coal supply, administrative measures appear to have stimulated coal production (Sarma 2013). At the same time, an ambitious renewable energy target of 175 GW, driven both by energy security and a focus on clean energy, has led to a spurt in renewables generation, with solar energy exhibiting falling costs and double digit growth rates (Bridge to India 2017: 8; Saran et al 2019: 8). In addition, the government has announced the construction of 10 large new nuclear plants (Das and Bera 2017). As of 2018, India was still heavily dependent on coal use,

Figure 1: India's Primary Energy Supply, 2006–18



Source: CSO (2018: 28, 44; 2019: 42, 43, 60, 76); NITI Aayog (nd); Central Electricity Authority (2017: 1B; 2018: 1B).

Figure 2: India's Energy Demand, 2012–18



Source: Compiled by authors from CSO (2013: 60; 2014: 68; 2015: 60; 2016: 58; 2017: 64; 2018: 28, 44, 57; 2019: 42, 43, 60, 76).

but had a rapidly growing renewable energy sector (Figure 1).

However, even from a supply point of view, recent uncertainties about India's energy future have by no means been banished. Looking to the future, the technological transition from fossil fuels to renewable energy depends on the complementary development of storage technology at low cost, around which there is uncertainty. Even more problematic is the fact that levels of access to commercial energy remain low and usage levels remain well below the thresholds associated with high scores on the HDI. By some metrics, usage remains at a quarter of the levels associated with high HDI (Ministry of Finance 2019: 163). Increasing energy supply has by no means guaranteed sufficient energy access.

This suggests that to understand the future of Indian energy requires looking beyond the supply side. In particular, for a rapidly transforming economy and society like India, paying attention to demand patterns and their determinants is equally important. Moreover, an examination of energy sector institutions and governance—the mechanisms through which supply and demand are mediated—is necessary particularly given past flawed governance arrangements in Indian electricity systems. Finally, there is growing concern about environmental externalities, whether local issues such as water, land use and air pollution, or global concerns like climate change.

Demand patterns and their determinants: Understanding the patterns of future energy use is both challenging and complex, in part because they will be shaped by a set of imminent transitions. First, as part of a demographic transition, the country is expected to add at least 10 million people to the job market each year for the next two decades, with consequences for energy use (Tandon 2018). Second, ongoing urbanisation will lead to about 300 million more Indians moving into urban spaces by 2050, who will demand more resources for improved lifestyles (UN Habitat 2016). Third, infrastructure is rapidly developing and estimates suggest that two-thirds of India's buildings that will exist in 2030 will be built after 2010 (Kumar et al 2010: 1). Fourth, India's transition to full commercial energy access is still a work in progress; while the government states that it has achieved more than 99% of household electrification, as per the Saubhagya dashboard of the Ministry of Power, usage rates remain low at about a third of the world average (Prayas Energy Group 2017), and while about 95% of houses have access to modern cooking fuels, the proportion of total needs met by gas versus biomass remains inadequate (Ministry of Petroleum and Natural Gas 2019). Indeed, studies predict that electricity generation in business-as-usual scenarios will grow approximately by two to three times by 2030 (Dubash et al 2017).

These structural transitions make the implications for future energy needs immense but also uncertain, because future needs will depend on the form that each transition will take. For example, the implications of a services-led jobs trajectory will be quite different from one that is led by manufacturing. Or, urbanisation built on dense cities would require very different energy needs than sprawling cities. And urban form—with its networks of buildings, transport and streets, which are some of the longest lasting components of the economy—once built, will sustain its spatial patterns for decades. These spatial patterns, in turn, will lead to corresponding patterns of energy consumption, on the order of similarly long timescales (Creutzig et al 2016). In other words, the reality of how India's energy future unfolds will depend on the manner in which the transitions are undertaken, and explicitly on their energy services consumption resulting in demand-side patterns (Figure 2).

Without explicit consideration of these factors, energy challenges will be compounded by the risk of accidental "lock-in" to potentially suboptimal consumption technologies, and analogous institutional structures and behaviours, since the bulk of development in cities and infrastructure is yet to occur. If investments are made in technologies and subsequent behaviours with poor energy performance levels, it can lead to a series of path-dependent outcomes which are difficult to reverse (Seto et al 2016). That is, if energy saving practices are not followed during the current phase of new construction, then subsequent measures to go back and capture benefits from these infrastructures typically provide fewer savings, and include significant transaction costs (Urge-Vorsatz et al 2012). To give an example of the scale of the lock-in effect, studies estimate that the lost potential energy savings from the buildings sector alone in 2050 (compared to 2005) will be in the range of 53% in the US, 63% in China, and 414% in India (Urge-Vorsatz et al 2012). The numbers demonstrate the distinctive opportunity ahead of India to avoid energy and carbon lock-in, and instead, to shape long-term consumption patterns. To avoid doing so, risks missing out on a substantial opportunity to determine India's energy demand future.

Energy institutions and governance: India has a long history of confused and contradictory governance arrangements around energy exploration and supply, including flawed coal auctions (Mishra 2016), disputed gas contracts (Dabadge et al 2016) and disputes over "compensatory tariffs" for electricity (Rautray and Prasad 2017; Chitnis and Dixit 2017).

The traditional supply-side approach has contributed to these issues as it fails to account for the institutional complexities of shifting from ensuring adequate energy supply to actually meeting energy needs. The supply-side focus, driven by a historic scarcity mentality, has led to a strategic choice to pursue all supply (but not demand) options—coal, renewable energy, gas and nuclear—with equal vigour. But such an "all of the above" approach is deeply non-strategic. It fails to recognise that in the context of limited political focus, diplomatic attention, administrative capacity, and technological resources, it may make sense to be more discriminating across options, by developing a better understanding of demand.

A crisis-driven supply-oriented focus can also lead to bad decisions, with long-term consequences. In the mid-1990s, for example, generous financial incentives to independent power producers were put in place to ensure enhanced supply. Not only were few new plants realised, but they led to unsustainable financial burdens in some states (Dubash and Rajan 2001). In another more recent example, based on an argument that much-needed power could not be foregone, private producers were able to successfully argue for a rewritten set of contracts to reflect rises in imported coal prices, although there are certainly grounds to argue that private producers should have accounted for price risks when they bid for the contracts (Chitnis et al 2012).

As in the 1990s, a priority on ensuring supply without adequate attention to whether the conditions of supply are favourable can have negative implications for consumers. Since about 2015, India has swung from a crisis of fuel shortages, notably coal and gas, to having what is labelled "surplus" power in the electricity system, and idle capacity (Singh 2016). This surplus capacity coexists with continuing chronic shortages for actual consumers, and hundreds of millions unserved by electricity. This seeming paradox is driven by flawed institutional mechanisms, notably, financially weak distribution companies and a regulatory mechanism that fails to link electricity suppliers and users in viable ways (Ramdev 2015). A supply orientation, without paying attention to the ultimate objective—affordable quality energy services for end-users—thereby perpetuates perverse results.

Local and global environment: In recent years, there is growing recognition that the energy sector generates substantial social and environmental externalities of both local and global nature. For example, public unease over worsening local air pollution, which is ranked amongst the worst in the world in Indian cities, and driven in part by energy use, is bringing lifestyle issues to the fore (WHO 2016). In some locations, such as Delhi (*Indian Express* 2015) and Goa (Shetye 2016), this has resulted in a push to reduce the activity of coal-fired power plants, a major source of harmful particulate matter. The land and water implications are equally severe, and studies indicate that there are 117 GW of inland coal-based power plants with environmental clearances granted, which would consume enough water to irrigate about 9,20,000 ha of land in a year, or provide drinking and domestic use water to about 7% of India's population every day for a year (Dharmadhikary and Dixit 2011: 14–15). Untangling domestic energy and environmental concerns is made more challenging by the overlay of global climate change. As energy accounts for 71% of India's greenhouse gas (GHG) emissions (MoEFCC 2015a), India's energy choices carry important implications for climate mitigation, a linkage that is laid out in India's contribution in the 2015 Paris Agreement and one that can no longer be ignored by mainstream planning (MoEFCC 2015b).

In sum, it is clear that assessing India's energy future is not straightforward. The country faces a complex and interconnected set of issues to which it must develop a longer-term response. In light of these complexities, past pathologies, and future uncertainties, how should India effectively plan its energy use for development? In the next section, we explore the need and potential for integrated energy decision-making.

An Integrated Approach

As we discuss above, to be effective, Indian energy policy must increasingly juggle economic considerations such as adequacy of energy supplies, macroeconomic costs of energy imports, incentives for efficient energy use, social considerations, namely access of energy services, and environmental factors such as local pollution, and global GHG emissions. The task is made more complex by considerable uncertainties about the scale of future energy needs, an ill-functioning electricity sector, rapidly changing technology, and the growing impact of environmental pollutants. In this section, we argue for an alternate demand-based approach to nuance the traditional assumption that higher energy supplies spontaneously lead to equitable and better living standards for all.

The principles of pursuing a development focused planning approach are, formally at least, already enshrined in India's Twelfth Five Year Plan and National Action Plan on Climate Change (Planning Commission 2013; MoEF 2008). Both plans call upon India to take actions which promote sustainable development objectives, which include inclusive growth, job creation, energy security, local environmental goals, and in recent years, addressing climate change. Energy policy is thus increasingly seen as needing to serve a range of economic, social and environmental development objectives simultaneously. The consideration of these multiple dimensions of development is articulated in the language of "co-benefits" in the context of the climate debate, and in the larger context of energy policy it is more usefully referred to as an assessment of "multiple objectives," which does not require declaring one objective as primary

(Khosla et al 2015). A multiple objective-based approach is useful because it allows the synergies and trade-offs across different objectives, arising from different potential policy options, to be made explicit during the process of policymaking.

Consider the example of coal to illustrate the nature of multiple objectives-based planning. Coal is a key component of India's energy mix and represented 70% of the economy's total generation capacity in 2012 (Dubash et al 2015: ii). Coal demand and the absolute volume of coal imports continue to increase, in response to which the government has set a target to increase domestic coal production from 600 MT to 1,500 MT by 2019 (PIB 2014). Continued coal use is most likely necessary in the next decade. However, a focus on ramping up coal production in the absence of complementary end-use analyses misses several important questions. What is the actual amount of additional energy supply that India will need? How much of additional supply will be met by coal, given the shifting economics of solar versus coal? What are coal's environmental consequences, as evidenced by an increasing number of court rulings over pollution? (*M P Patil v Union of India and Others* 2014; *Sudiep Shrivastava v State of Chhattisgarh and Others* 2014; *Ratandeep Rangari v State of Maharashtra and Others* 2015; *Jeet Singh Kanwar and Another v Union of India and Others* 2013). At what level is there a risk of overshoot resulting in high cost coal assets that are "stranded," that is, undercut by more efficient demand-side options and/or a future cheaper energy source? Given the domestic challenges of extracting coal—it tends to be located in areas of internal conflict with high transportation (rail freight) costs—what is the optimal mix of domestic versus imported higher quality and costlier coal? Finally, how will the expansion of coal affect the realisation of India's international climate pledge? Development-oriented decision-making around India's coal future, thus, must be based on an assessment of the linkages between coal and the use to which its energy is put, along with other socio-economic and environment aspects, and not merely on increasing domestic supply.

More broadly, if energy is to truly support development, energy policy and planning should be rooted in a more explicit process of matching energy needs to development objectives. This requires widening the emphasis of energy planning from a focus on energy security, to the security of energy services (Khosla et al 2015). But working through these interconnections is complex, and in spite of the acceptance to broaden the dimensions of energy planning, there are few efforts to put it into practice to maximise the synergies between energy and development.

Integrated Energy Sector

In this section, we introduce and discuss an emerging domestic literature on efforts to integrate political, socio-environmental and economic aspects of energy decisions. Part of this analysis uses global models, which provide strong evidence of substantial complementarities between climate mitigation, reduced air pollution and energy security outcomes in the South Asian region (Rao et al 2015). Indian studies, on the other hand, have paid limited attention to such linkages, but a few track achievements *ex post* of the multiple objectives of energy policy (Sreenivas and Iyer 2014).

The limited consideration of the different dimensions of Indian energy is evident in a review of national energy–climate modeling studies (Dubash et al 2015: ii). The review shows that most studies emphasise supply trends, and fewer provide comprehensive data on the distribution, patterns and requirements of future end-use energy (Table 1). The current studies are also limited in their treatment of the other complementary objectives of Indian energy, such as job creation or implications for the local environment, or on the trade-offs across development objectives when pursuing a particular growth path.

The studies have an implicit assumption that an increase in gross domestic product (GDP) will mean the achievement of development goals. But this often may not be the case—energy use and GDP may grow, even as access to electricity and energy services remains stagnant, environmental quality worsens, and energy supplies become more insecure (Reddy 1991: 4). By contrast, an explicit focus on end uses of energy provides a better understanding of the link between energy and development (Dharmadhikary and Bhalerao 2017).

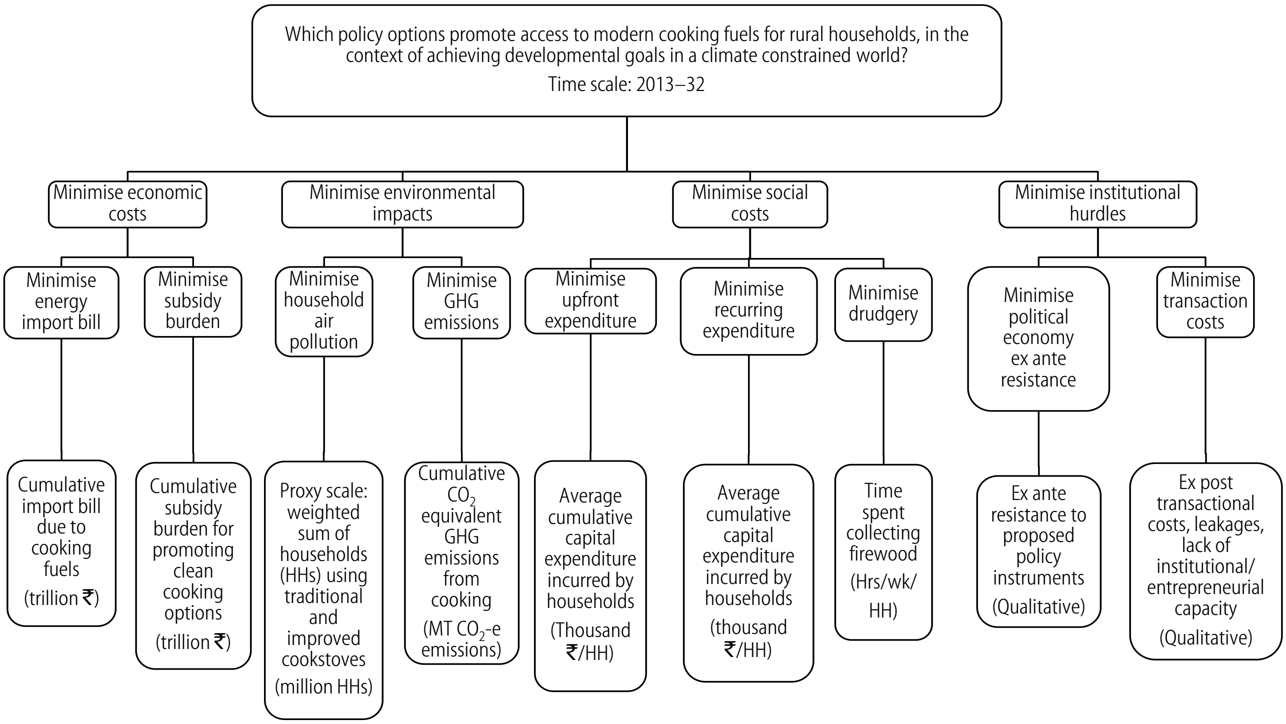
Fortunately, there is growing literature that is encouraging an alternative and integrated framework for Indian energy decisions. Originally, such a narrative change was promoted in the 1980s in the work of A K N Reddy, who underlined the need to extend the energy system beyond its conventional supply-side definition and move from the idea of "energy sources" to "energy services" (Goldemberg et al 1994). In Reddy's work, the objective of the energy system (and its supply and utilisation activities) is to provide energy services, for instance, lighting, comfortable indoor temperatures, refrigerated storage, transportation, and appropriate temperatures for cooking to achieve development outcomes for all sections of society (Reddy and Balachandra 2006).

Table 1: Informing Multiple Objectives

Objectives		LCSIG	TERI–WWF	Shukla et al	CSTEP-QoL	IESS-v2	IEA	DDPP
Energy for growth	Supply	●	●	●	●	●	●	●
	Demand	○	●		●	●	●	●
Energy security			●		○	●	○	●
Inclusive growth		○			●		○	○
Local environmental objectives			○	●		●	●	
CO_2 mitigation	Emissions	●	●	●	●	●	●	●
	Intensity	●			●		○	●
Costs		●	○			●	●	●

○ Partial coverage: Addressed to an extent, but falls short in some respects, including accessibility.
● Full coverage: Reasonably comprehensive and transparent treatment.
Study name acronyms are as follows—Expert Group on "Low Carbon Strategies for Inclusive Growth" (Planning Commission 2014); Climate Change Impact on the Indian Economy—A CGE Modelling Approach (NCAER 2009); The Energy Report – India, 100% Renewable Energy by 2050 (WWF-India and TERI 2013); Energy-Emissions Trends and Policy Landscape for India (Shukla et al 2015); A Sustainable Development Framework for India's Climate Policy (CSTEP 2015); Energy Intensive Sectors of the Indian Economy: Path to Low Carbon Development (World Bank 2011); India Energy Security Scenarios 2047 (IESS) (NITI Aayog 2015).
Source: Dubash et al (2015: ii).

Figure 3: Multiple Objectives and Policy Alternatives for the Cooking Sector



Source: Khosla et al (2015).

While Reddy's interventions remained unimplemented, in part because they required an institutional re-envisioning of how energy policy is made, of late, other studies are reintroducing a broader conception of energy planning that draw, at least in part, on elements of Reddy's work. Sreenivas and Iyer (2014: 7) propose an "energy sector assessment index" to capture the relationships and impacts of energy policy across different dimensions of development. The index includes assessment of energy access and use, assessment of energy supply diversity, management and import exposure, assessment of social implications such as resettlement and rehabilitation in the vicinity of energy projects, assessments of GHG emissions and the local environment, and an economic assessment of trade deficits from imports and subsidies. In another approach, Narula and Reddy (2016) develop a "sustainable energy security index" using energy security and sustainability as the frame to analyse the energy system. The index's energy security indicators include availability (adequacy and access to energy), affordability or the economic dimension (prices and paying ability), efficiency (productivity in resource use), and acceptability (environmental protection), with sector-specific and detailed indicators under each dimension. In addition, others approaches that focus at the city scale are being introduced, such as the Smart Cities Index (Mohan et al 2017) and the government's City Livability Index (MOHUA 2017).

While these efforts to consider diverse objectives are important, their focus is largely on enabling policymakers to monitor success or failure across multiple policy priorities ex post, or after implementation. A complementary need, however, is for policy design tools that allow policies to be designed ex ante to meet multiple objectives. If equitable access, sustainability and energy security are not factored explicitly into policymaking at the start, it is unlikely they will adequately be reflected in policy outcomes.

One line of thinking aimed at an ex ante focus on achieving multiple objectives propose a "multi-criteria decision analysis" (MCDA)-based approach for addressing India's simultaneous economic, social and environmental objectives (Dubash et al 2013; Khosla et al 2015). Such an approach is finding prominence in international energy decision-making contexts as well (Cohen et al 2019; Kumar et al 2017; Pohekar et al 2004). The approach provides a methodology by which development goals can be made explicit and discussed within an open process. It also enables a transparent assessment of complementarities and trade-offs across objectives; that is, it helps decision-makers understand where co-benefits exist, and can be realised, and where trade-offs exist, and can be avoided. Significantly, the approach also recognises the political nature of energy decisions—that different actors will place different values on competing objectives. It is thereby underpinned by a continuous involvement of stakeholders to deliberate on the trade-offs and complementarities between objectives. The MCDA approach is illustrated in Figure 3 which shows the policy objectives map that is laid out at the start of decision-making, in this case using the example of India's modern cooking fuel transition.

The fundamental shift implied by an integrated and multiple objective-based policy approach is that objectives which historically receive only lip service, such as access and environment, are instead explicitly considered when assessing policy choices. For example, if access of energy services is important, then any policy to enhance energy supply would need to ensure that the generated energy reaches the currently unserved. It would no longer be acceptable, as happened in the last decade, to have a doubling of electricity generation capacity and yet have more than 300 million people remain without access to electricity (Adve and Kothari 2015).

Another reason to consider the spectrum of policy objectives *ex ante* is that it allows policymaking to reflect on factors that are often not incorporated in decision-making, such as assessing obstacles to policy implementation. Ignoring implementation and its underlying structural incentives (for example, vested interests or limited bureaucratic capacity) risks obscuring the larger, more explicitly political, analysis of the reasons for the inequalities and inefficiencies in India's energy sector.

Conclusions

To address the challenges of Indian energy, we first need to change how we think about the problem. A limited supply-centric perspective has not served India well. Instead, we suggest a reorientation to explicitly organise Indian policymaking in the service of multiple objectives of energy policy, which include energy services provision and linked socio-environmental and economic goals. This reorientation, and the resultant intended transparency and clarity in decision-making, increases the likelihood that long-ignored goals, such as energy access and environmental quality are given their due importance.

Developing a conceptual and methodological framework for energy planning that internalises development objectives is only part of the challenge. Bringing about this shift is more than a technical process—requiring new methodologies and approaches—and in part institutional, requiring shifts in data collection (Dukkipati et al 2014), analysis of synergies and trade-offs, and decision processes. Data on energy demand is particularly scattered and incoherent, and difficult to collect or estimate. A serious gap is the lack of data on the use of non-commercial energy, primarily in the form of biomass and non-motorised transport (World Bank 2010). It is necessary for the institutional framework within which energy choices are made and implemented to be sufficiently elastic to adopt this approach. At the moment, Indian energy institutions tend to operate in sub-sectoral supply-based silos—ministries for coal, oil and gas, power, renewable energy and so on, with little integration with and across demand sectors. Energy demand is even more complex as it is indirectly governed by ministries that typically have non-energy objectives, such as urban development, and are often governed at the state and local scale, introducing a further complication to coordination (Khosla et al 2017). Forms of tight coordination and, ideally, integration across ministries and governance levels, and across demand and supply side ministries is necessary to enable the required integrated thinking.

Ultimately, both technical and institutional changes cannot be drivers in themselves. However, they can open spaces for more productive engagement with energy policymaking. This will require a process of transparent discussion often involving conflicting points of view. The framing of multiple objective-based energy policy provides a construct that allows more democratic engagement in energy policymaking, which has historically been a technologically opaque arena. But it does not guarantee that those spaces will be occupied. To bring about real changes on the ground in Indian energy, requires the productive interaction and reinforcement of technical, institutional and political spheres.

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