End-use Energy Efficiency: A Path for Decarbonisation

Highlights

- **India's energy intensity of GDP needs to reduce by around 40% to fulfil the NDC pledge on emissions intensity of GDP.**
- **Rigorous implementation of current national policies would enable India to sufficiently reduce its energy intensity of GDP and thereby achieve its NDC target.**
- **Efficiency measures in transport followed by buildings (including cooking) sectors are projected to provide the highest energy savings potential.**
- **State level policy push is urgently needed to address gaps**

India, through the Paris Climate Agreement in 2015, made a commitment to reduce its emissions intensity of GDP (kg CO_2/INR) by 33–35% in 2030, over the 2005 levels (GoI, 2015). Although this commitment does not mandate any sector specific mitigation obligation, at least two missions (National Solar Mission and the National Mission for Enhanced Energy Efficiency) under India's National Action Plan on Climate Change (NAPCC) are expected to contribute significantly to this goal (GoI, 2010). However, these contributions are often provided indirectly in terms of sector-specific technology capacity to be deployed for emissions mitigation. For example; the goal to install 100 GW grid-connected solar power by 2022 and achieve 19.6 GW avoided capacity through Energy Efficiency (EE) measures (GoI, 2015).

In this context, Center for Study of Science Technology and Policy (CSTEP) conducted analysis by disaggregating the emissions intensity of GDP ($kgCO_2e$/INR) by its two constituents vis-à-vis, emissions intensity of energy ($kgCO_2e$/kWh $_{\text{primary energy}}$) (representing the level of fossil fuel use) and energy intensity of GDP (kWh/INR) (representing the EE in the economy). This is to understand the contribution of EE to India's emissions intensity of GDP reduction target.

The analysis indicated that, emissions intensity of energy of the electricity generation sector is expected to decline by about 13% from 2015 to 2030, on existing policy instance. However, on accounting for the primary energy requirement for the entire economy, the emissions intensity of energy is projected to increase by about 26% in 2030 (CSTEP, 2018). This increase in emissions intensity of energy is influenced by growing demand in the industry and transport sectors. This offsets the impact of a marginal decline in emissions intensity of energy in industry and transport sectors, and meteoric increase in emissions intensity of energy in cooking. The decline in emissions intensity of energy is on account of adoption of efficient manufacturing processes in industries, and use of alternate fuels as well as efficient technologies in transport. Whereas, the increase in emissions intensity of energy in cooking is driven by a switch from CO_2-neutral biomass to Liquefied Petroleum Gas (LPG) and/or electricity. However, the shift to an efficient cooking technology (biomass based cook stoves to LPG and electric cook stoves) triggered by the fuel shift, reduces the overall cooking energy requirement. This further increases the share of industry and transport sectors in total primary energy and thereby the emissions intensity of energy.

Generating lower emissions and meeting the growing demand for energy services, while maintaining economic prosperity, requires an unprecedented acceleration in decarbonisation of the economy (Luis, Urge-Vorsatz, & Wilson, 2018). This means that, India needs to reduce the

energy intensity of its economy; that is, improve its energy efficiency while maintaining the economic growth momentum. India's energy intensity of GDP declined at the rate of 2.4%, between 2005 and 2010. The analysis indicates that, in order to achieve India's NDC commitment of reducing its emissions intensity of GDP by 33–35% by 2030, the EE of the economy (the rate of reduction of energy intensity of GDP) should improve by at least 2% annually (CSTEP, 2018). This implies an approximate improvement of 40% in EE of the economy by 2030. Hence, there is a need for much stronger focus on EE measures for it to reduce emissions by reducing end-use energy (IEA, 2016). EE measures also entail fewer environmental risks and are closely associated with synergistic co-benefits for security, health and quality of life (Jenkins & Cohen, 2015; Luis et al., 2018).

Role of Energy Efficiency

Energy Efficiency is a critical enabler in transitioning to a cleaner and more sustainable energy economy (Clarke et al., 2014). It can be a key contributor to economic growth and social development. The avoided energy demand due to efficiency improvements can lead to increased energy security and fewer investments in new energy supply assets (IEA, 2018). EE measures can also lead to improved air quality and living standards, and reduce risks by introducing greater flexibility into the choice of energy system transitions (Luis et al., 2018).

As part of the analysis, CSTEP examined three scenarios, representing the progressive implementation of EE measures, based on current policy implementation and global best practices across key end-use sectors (Agriculture, Buildings, Cooking, Industries, and Transport). Three scenarios, namely Business-as-Usual (BAU), Energy Efficiency Scenario 1 (EE1) and Energy Efficiency Scenario 2 (EE2), were designed to envisage overall energy reductions in these key demand sectors.

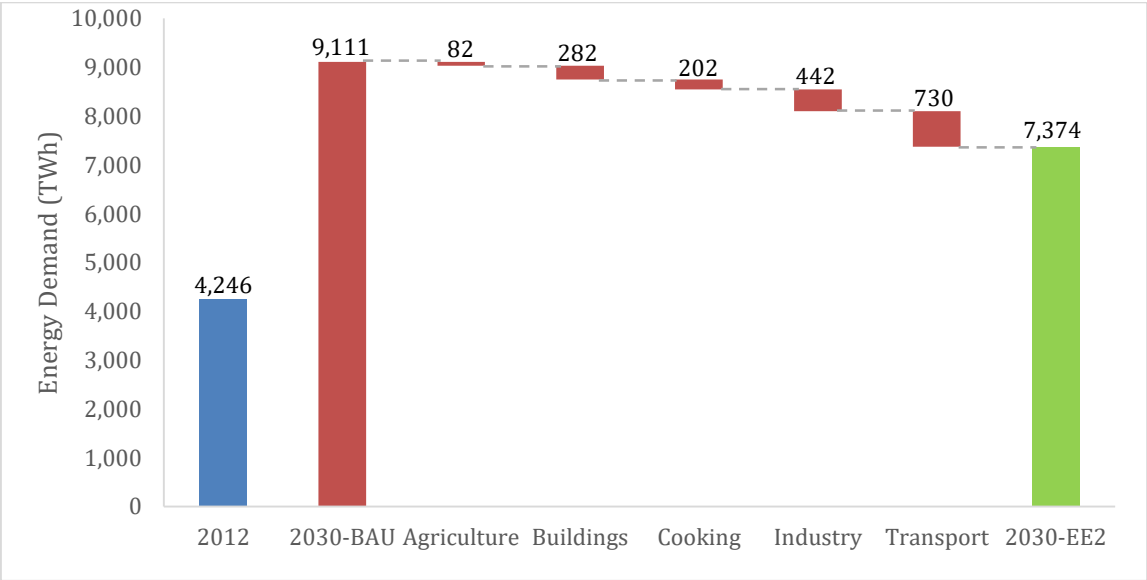

Figure 1 Energy savings from various end-use sectors

The BAU scenario showcased projections driven by focused implementation of existing EE norms until 2030. The policy scenarios were modelled to examine the role of EE towards the NDC pledge. EE1 scenario depicts a pathway using proposed government policies and designated roadmaps, in addition to policies that have already been implemented or are under implementation. EE2

scenario illustrates a trajectory where, along with proposed policies being completely implemented, there is an additional push to achieve current global best practices. The potential energy savings across these sectors are represented in Figure 1.

With a greater thrust towards efficient public transport, including mass-transit systems, ambitious adoption of Electric Vehicles (EVs) and alternate fuels, the transport sector is projected to bring in the highest savings of about 40%. This is despite the increase in energy demand (in passenger and freight segments) and continued dependence on fossil fuels.

Driven by rapid urbanisation, energy demand in residential and commercial buildings (including cooking) is poised for tremendous growth in the near future. This presents a huge opportunity for EE in this sector. The analysis indicated that with implementation of Energy Conservation Building Code (ECBC) and adoption of energy efficient appliances, up to 30% energy demand can be reduced. However, a major part of the savings come from the ongoing shift to cleaner cooking fuels and use of efficient appliances for cooking.

Efficiency gains complemented by shift to alternate fuels would play a key role in realising energy savings of about 25% in the industries. The energy intensive industries, driven by increasing costs, market competition and proactive policy regulation, are at the forefront in adopting EE measures. However, with key processes reliant on fossil fuels, the industry sector faces formidable challenges to decarbonise unless low carbon technologies and processes are adopted in larger scale.

These energy savings through various EE measures across sectors could help avoid a total capacity addition of about 38 GW to India's electricity generation grid. The analysis further indicated that, with rigorous implementation of current policies at the national and state level, the energy intensity of GDP can reduce at the rate of about 3%, i.e., by over 40% by 2030 implying that India could meet its NDC commitment by 2030 (CSTEP, 2018). This is however contingent to the continuation or enhancement of existing policy targets until 2030 if not beyond.

Identifying Gaps in Policy

The central government has taken giant strides in making EE one of the mainstream interventions in its decarbonisation pathway. It has introduced flagship mechanisms such as Perform Achieve and Trade (PAT), ECBC, and Standards and Labelling programme specifically targeting end-use EE. However, states should be further encouraged to strengthen the policy and regulatory mechanisms to help steer EE policy and program implementation at the state and local level, thus complementing the national policies.

This is especially true for the demand-side, which, unlike power generation, is largely imperative to state governments. CSTEP's analysis of eight key states to understand the policy maturity towards EE in end-use sectors indicated that, while many states are in the process of incorporating ECBC into the state and Urban Local Body (ULB) by-laws, there is incongruence in mandating and formalising these regulations. Given the potential for EE driven savings in the transport sector, states need to significantly enhance their efforts in this sector. Very few states have polices or targets for EVs and on fuel efficiency standards in public transportation systems (CSTEP, 2018). While most states focus on central government driven programmes such as PAT, hardly any states define targets for EE in industries, though some provide financial assistance for energy audits.

Way forward

The EE policy lacunae at the state level will be a bottleneck in meeting India's NDC commitment of 33–35% reduction in emissions intensity of GDP. Policies with a clear implementation framework at the state and ULB are urgently needed. In order for the states to fully realise the potential for EE in the key demand sectors the following measures are suggested.

Buildings

- Mandate National Lighting Code for residential and commercial buildings
- Mandate ECBC for the residential sector
- Mandate supply of higher thermal efficiency cook stoves with new LPG connections
- Use online approval processes and third party assessors (on the lines of BEE energy auditors) to check for compliance and reduced cost for states and ULBs

Transport

- Adopt mandatory performance labelling for vehicles and crucial spare parts (similar to star labelling of appliances)
- Mandate/suggest fuel efficiency targets for state transport corporations
- Mandate institutional mechanisms (tax levies) to encourage the purchase of fuel-efficient vehicles

Industries

- Introduce targeted financial incentives to encourage investment in energy-efficient industrial equipment and processes
- Mandate energy data reporting in industries and Micro, Small and Medium Enterprises
- Adopt time-stipulated and achievable energy savings targets
- Stipulate demand-side management measures through a resource purchase obligation

While these are broad suggestions to hasten the implementation of key EE measures, state governments should proactively define sectoral voluntary EE targets enabling effective emissions mitigation. Without concerted action to ease the bottlenecks in the implementation of EE measures in various key sectors, meeting the climate goals laid under the Paris Climate Agreement could be a challenge. From the policy point of view it underlines the need for crucial synergy between the central and state governments in driving the pace of decarbonisation.

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