Non-Party stakeholder input to the Talanoa Dialogue

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About TERI

The Energy and Resources Institute (TERI) develops solutions to global problems in the fields of energy, environment and current patterns of development not only by identifying and articulating intellectual challenges straddling a number of disciplines of knowledge but also by mounting research, training, and demonstration projects leading to development of specific problem-based advanced technologies that help carry benefits to society at large.

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Disclaimer

The contents of this paper are the organisational views of The Energy and Resources Institute only on the Indian electricity and air-conditioning sectors.

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List of abbreviations

AC	Air conditioning
BEE	Bureau of Energy Efficiency
CSR	Corporate Social Responsibility
DISCOMS	Distribution companies
EESL	Energy Efficiency Services Ltd
GHG	Greenhouse gas
GoI	Government of India
GWP	Global warming potential
HCFC	Hydrochlorofluorocarbons
HFC	Hydrofluorocarbons
MEPS	Minimum Energy Performance Standards
NDC	Nationally Determined Contribution
NEP	National Electricity Plan
PAT	Perform Achieve Trade
PPA	Power purchase agreement
RAC	Room air-conditioner
RE	Renewable energy
REC	Renewable Energy Certificate
RTS	Rooftop solar
UNFCCC	United Nations Framework Convention on Climate Change

Summary

This is a submission by The Energy and Resources Institute (TERI), New Delhi, India to the Talanoa Dialogue on the issue of ambition of parties for meeting the goals of the Paris Agreement. The Submission maps the barriers and obstacles to the current ambition embedded in India's energy related NDCs in the electricity (coal and renewable energy), and air conditioning sectors, with the aim of their removal through appropriate actions.

By identifying key barriers to increased ambition in these sectors and outlining requirements to overcome the challenges, we address the questions of where we are, where we want to be, and how do we get there (as envisaged under the Talanoa Dialogue).

The sectors chosen for analysis are not all-inclusive, but represent a significant segment in India's progress onto a long-term low carbon pathway. The submission identifies key questions at the national and international levels that need to be addressed in order to remove barriers in these sectors.

The submission is also an effort towards strengthening information flows between India and the international community on the matter of energy related NDC implementation and raising ambition. It aims to boost confidence nationally and internationally in India's ability to achieve its energy related NDCs and raise the possibility of over-achieving the goals if certain constraints and barriers in the chosen sectors are removed.

1. Overview

1.1 Post-Paris context :

The Paris Agreement was a transformative success of climate diplomacy which pooled together the efforts and actions at the national, sub national and corporate levels in a flexible, yet universal and ambitious framework.
It reoriented what was previously considered only an international issue into one requiring measures and actions at the national level in all countries.

By underscoring that climate action is anchored in Parties' national circumstances and capabilities, the Agreement recognised that a successful and ambitious global climate regime must consider countries' developmental aspirations and available technology and resource constraints.

With the world's second largest greenhouse gas (GHG) emitter retracting from the Paris Agreement and subsequent uncertainties in the political context, all major economies including India now bear an increased responsibility of meeting the challenge of climate change.

1.2 India's approach

It is increasingly evident that developmental and environmental needs cannot be achieved at the expense of each other. Indian policy makers have therefore emphasised a co-benefits approach in order to reconcile conflicting imperatives and priorities. There is a realisation that low-carbon growth will provide benefits in terms of energy security and access, as well as economic opportunities in various sectors. With this aim, India's NDCs include three specific mitigation goals of (i) economy wide emissions intensity reduction (through actions in a range of sectors), (ii) increased proportion of non-fossil fuel based electricity generation capacity, and (iii) increased carbon sequestration through afforestation and land-use change. The goals are challenging considering the fact that unlike most other nations India is faced with them relatively early in its development path. Implementing them successfully can therefore act as a test case for leap-frogging to a new paradigm of sustainable development.

2. Where we are

2.1 India's energy related NDCs

Amongst the three mitigation related goals of India's NDC, two are related to energy and are key to successfully transitioning to a low-carbon economy. This is reflected in targets for reduction of GHG emissions intensity of GDP by 33-35% compared to 2005 levels; and 40% of installed electricity generation capacity from non-fossil fuel based energy sources by 2030.

The non-fossil fuel-based electricity generation capacity target is to be achieved through a combination of ground mounted solar PV, rooftop solar, wind power, bio-fuels, nuclear and hydro power. One of the world's most ambitious renewable energy (RE) programs (175 GWs

by 2022) has been launched in the Indian power sector in pursuit of the above mentioned target. If achieved successfully, this would position India as a global leader with unprecedented levels of RE penetration in its electricity system, for a country of its economic size with low per capita income.

2.2 Progress towards achieving its energy NDCs

Analyses suggest that slow uptake in the rooftop solar (RTS) segment may adversely affect the 175 GW by 2022 target. However the direction of movement is clearly towards a high RE system, potentially going beyond government objectives in the mid-term (2027-30). Climate Action Tracker foresees that with current policies, India may overachieve its emissions intensity target and is likely to reach 50-51% below 2005 levels by 2030.

Notably, the draft National Electricity Plan (NEP) for 2018 projects 275 GW of RE by 2026-27. According to this projection, the total share of non-fossil fuel capacity would be 47% by 2026-27. After the current project pipeline is completed, NEP 2018 does also envision further modest coal additions of 47 GW, mainly as peaking power to balance variable renewables.

These projections indicate India's resolve to make ambitious transitions in energy and other economic sectors within a foreseeable future.

2.3 Electricity sector (coal and RE)

India's current electricity mix is dominated by fossil fuels, with thermal power representing about 65% of the total installed capacity and contributing about 85% to the total generation mix. However RE has of late become more attractive, and RE installed capacity has more than doubled in the last four years. This is thanks to policy pushes as well as decreasing costs of RE resulting in a sharp decrease in RE tariffs. It can be argued that existing subsidies on wind and solar energy as well as aggressive bidding practices may distort those costs. Nonetheless, there is strong evidence that solar PV based energy generation is now cheaper than coal-based power generation in India.

2.4 Challenges in the electricity sector

India's push towards decarbonising its electricity sector is likely to be achieved only if specific challenges (existing and new) in the power sector are addressed. The challenges are tremendous, even as the incremental cost challenge is no longer the dominant one.

Firstly, India's grid was built and operated on the paradigm of baseload generation, the vast majority of which is tied-up in long-term, fixed cost power purchase agreements (PPA). Electricity markets account for a very small share of generation, and markets for grid balancing and ancillary services, necessary for higher shares of RE penetration, need to be built. India needs strong reforms in the electricity distribution sector to be able to develop institutional capacity including improved inter-state cooperation, in order to make this happen.

Given the intermittent and variable nature of RE sources, and in the absence of battery storage technology which is not yet commercially viable at the scale required, electricity generation still needs the support of conventional sources of energy for meeting baseload demand. This leads to technical challenges in terms of integration of RE into the grid. While India's grid has some inbuilt flexibility, it will require new flexibility after 2022-25 to integrate increasing shares of RE.

Related to this will be the peak-management challenge. Renewables today may be cheaper than coal in India, but only when the sun is shining and the wind is blowing. Storage technologies are not yet available at affordable prices to make RE cheaper than coal 24/7. In addition, generation from solar plants is typically at its maximum at noon. However peak demand occurs at night to cater to the electricity-consumption related to air-conditioners. This peak will only increase with time as more Indian households meet their cooling needs. Meeting this peak will require meeting the challenges of stable grid operations. Distribution companies (DISCOMS) have already expressed concerns with managing such amounts of variable power.

2.5 Air Conditioning (AC) sector

The AC sector is one of the fastest growing and technologically evolving sectors in India. Except those from HFCs (HFC-134a & HFC 23), emissions from other refrigerant gases covered by the Montreal Protocol are not included in the inventory of GHG emissions reported to the UNFCCC and India does not have a legal obligation for the phasedown of HFCs until 2028. However, it is prudent to consider options in this sector in the interest of an early and cost-effective transition to more efficient cooling systems. Notably, India is working on a National Cooling Action Plan.

India has the highest unmet cooling demand in the world.[1] In 2016 the room air-conditioner (RAC) penetration amongst urban households in India was around 6-7%.[2] The rest of those connected to the grid meet their space cooling requirements either by fan or desert cooler. With advancements in technology, urbanisation, rising temperatures, and rapidly increasing aspirations, RAC penetration in the Indian market is projected to increase substantially, in turn leading to a spurt in the peak energy demand to run these ACs. The total electricity consumption by ACs in India may increase to 50,000 GWh per year in 2031.[3] This would lead to tremendous pressure on electricity systems, and impact air quality and the climate if not managed properly.

Intensification of AC penetration in Indian households also needs to be managed for limiting the use of potent heat trapping refrigerant gases used in ACs namely hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). RACs account for 43% of HCFC consumption in India. Considering the massive projected growth in AC purchases, as well as India's obligations to phase out HCFCs by 2030 and limit HFCs to 15% of 2024-26

[1] Davis, Lucas W., Gertler, Paul J. *Contribution of air conditioning adoption to future energy use under global warming*. Proceedings of the National Academy of Sciences. 2015. Table 2. http://www.pnas.org/content/112/19/5962.full.pdf. Calculated by total population multiplied by number of cooling degree days.
[2] Bureau of Energy Efficiency, 2016
[3] *Residential Electricity Consumption in India*, The World Bank, 2008

consumption levels by 2047, it is critical for India to adopt low-Global Warming Potential (GWP) refrigerants along with super-efficient equipment.

2.6 Challenges in the air conditioning sector:

Considering the projected rise in energy consumption in the RAC segment, it is imperative to increase the efficiency of ACs to reduce power consumption. India, a developing country with a large middle class population, accords paramount importance to affordability while choosing equipment to meet its cooling demand. Expensive energy efficient cooling products dissuade consumers and encourage proliferation of low-efficiency ACs with high-GWP refrigerants, thereby increasing stress on power grids and generating substantial emissions.

The major challenge for the industry is to produce ACs of higher efficiencies at the most reasonable and affordable price, with the ultimate goal of tackling the issue of reducing peak-load demand especially in urban areas. In the large scale construction sector where 60% of the infrastructure required by 2030 is yet to be built, availability of affordable cooling equipment for upcoming and existing spaces is a major challenge due to high cost of energy efficient products.

On the refrigerant side, the challenges to phasing down are finding safe and cost-effective low-GWP alternative refrigerants for all ACs. India is making good progress here (see section 3.2.2).

3. How do we get there?

3.1 Pre-2020 action

Further progress by developing economies may be influenced by global progress on the pre-2020 commitments in terms of mitigation (pre-2020 emission reduction targets and achievements) and finance (meeting the target of USD 100 billion climate finance). Most developing countries treat the achievement of pre-2020 commitments by developed countries as a necessary condition for higher global commitments and further ambition.

3.2 National Actions: Overcoming barriers

3.2.1 Electricity sector (coal and RE)

As argued above, the challenge of transitioning to renewables in the power sector is no longer one of incremental cost of the generation technologies themselves, but rather:

(i) The institutional challenge of shifting the regulatory, market, and contracting approaches to ones that are suitable to integrating a high share of renewables.
(ii) The incremental costs of some crucial grid stabilization technologies, in particular electricity storage, pumped hydro, and peaking plants; and transmissions system expansion to bring RE to consumption centres.
(iii) Speedy and well-coordinated deployment of enabling infrastructures, such as transmission capacity.

Some of the challenges lying in the domain of domestic policy are already being addressed. For example, the Indian regulators are progressively transitioning the electricity market structure to one that is more conducive to the integration of renewables.[4] Several tenders have been issued or will be issued to test the India-specific cost of combining renewables projects with electricity storage. Initiatives like the Green Energy Corridor and regulations on transmission system planning have been launched to promote the expansion of the required transmission system. In addition, the regulators are launching a process to shift from 15-minute to 5-minute scheduling and dispatch, which would greatly aid the integration of variable renewables.

While India is making ambitious efforts to transition to a high share of renewables, continued support and help of international community is necessary to address the sectoral barriers and fulfil the fullest potential of transition in the electricity sector (see section 4). An area of importance for India will be the development of the global market and technology for stationary electricity storage. This is expected to be a key technology for India's electricity sector transition. Current assessments indicate that renewables plus storage applications may be cost-competitive with some sources of peaking and load-following power by mid to late-2020s. Rapid technological innovation and diffusion in this area would make a tremendous difference to the feasibility of India's transition to a high share of renewables.

3.2.2 Air conditioning sector

Energy efficiency has great potential in the transformation of the Indian AC sector. India is making efforts under its Energy Conservation Act 2001 to mainstream energy efficiency into its energy policy, but more can be achieved by targeting growing sectors like ACs through innovative policy measures.

Regulatory agencies such as the Bureau of Energy Efficiency (BEE) can encourage energy efficiency, for instance through the continuous tightening of Star Labelling Programs. Under the ratcheting-up modalities of the labelling programme, the Minimum Energy Performance Standards (MEPS) are strengthened every 3 years i.e. the 2015 3-star ACs became 1-star (least efficient) ACs in 2018. Such developments and trends regarding adoption of rating systems for fixed speed units as well as inverter units, along with changes in the policy regime would enable increased climate friendliness in the AC sector. The Government of India's (GoI) 'Make in India' programme will also help to reduce the price of energy efficient products.

Innovative business models like the bulk procurement and mass deployment of efficient appliances will play a pivotal role in the availability of efficient ACs at affordable prices and tackling of the peak load issue. The publicly-owned Energy Efficiency Services Ltd (EESL) has recently implemented the first tranche of its bulk procurement scheme to sell 'super-efficient' ACs in the Indian market that will consume less power than a currently 5-star rated AC.

[4] Relevant regulations include the Deviation Settlement Mechanism, the Ancillary Services Mechanism, and the Model Regulations on Forecasting, Scheduling and Deviation Settlement of Wind and Solar Generating Stations at State Level.

However, as industry moves towards low-GWP refrigerants and super-efficient equipment, it is likely to face a price hump. There is a need to develop a holistic ecosystem for manufacturing, buyers, financiers and most importantly, business models, to curb this. There is also a pressing need to club these innovative models with grants and low-cost loans which are essential to raise ambition.

On the refrigerants' side the Indian industry is phasing out HCFC-22 by leapfrogging to the lower GWP refrigerant gas R-32. The number of R-32 based ACs have increased more than 11 times between 2009-10 and 2014-15 to about 3.75 lakh units. India has levied custom duties on the import of the high GWP refrigerant gases. GoI is providing the necessary thrust to research organizations, industries and academia to come together to formulate an R&D strategy within the country. India could further adopt innovative policies to oblige manufacturers to use low GWP refrigerants.

Increased flows of information, expertise and capacity from the international community to Indian distributors, technicians, engineers, building owners, and consumers on new cooling technologies and refrigerants would undoubtedly accelerate the penetration of efficient appliances in the Indian market.

3.3 Leveraging domestic financial resources

In India, the roles of domestic, public and private climate finance are well articulated. These work in tandem to support climate actions and provide a push to low carbon technologies and business models. The bulk aggregation model for LEDs, and the energy efficiency market for Perform Achieve Trade (PAT) are some notable efforts in this direction.

India has switched from carbon subsidization to taxation, by imposing a de-facto carbon tax on petroleum products through removal of subsidies and enhancement of excise duties. Similarly, a cess on coal is levied, the rate of which has been steadily increasing and is currently at approximately USD 5.70 per tonne of coal at today's exchange rate (400 INR). Together with the 175 GW RE target, these are clear signals to the private sector to ramp up their investments in this area.

GoI is also assisting private investors through generation based incentives, feed-in-tariffs, tax holidays, concessional allotment of public land, hedging costs of borrowings etc. The Reserve Bank of India has notified RE as a priority lending sector as well. Market-based mechanisms in favour of climate action, namely the Renewable Energy Certificates (RECs) and the PAT scheme, also exist.

Companies with a certain level of profit have to spend 2% of their annual profit on Corporate Social Responsibility (CSR) activities. Indian corporates are taking ambitious initiatives to integrate sustainability into their core operations through measures including internal carbon prices, GHG emission reduction commitments, transitioning to clean manufacturing methods etc. In 2016, 44 Indian companies in India were using or planning to use an internal price on carbon within two years, a 63% increase from 2015.[5]

[5] CDP (2016). Press Release - '*Major multinationals at forefront of drive to price carbon and meet climate targets but many companies still unprepared*', September 19, 2016 https://www.cdp.net/en/articles/media/press-release-

However, the financial sector still lacks the understanding and capabilities to evaluate clean energy projects, resulting in a lack of accessibility to finance for this sector. Further, there is a strong need to design business models across energy-consuming sectors which would put markets into auto-mode for the private sector to invest with little support from public finance.

4. Key trends at the international level to overcome these barriers

India must effectively transition to a low carbon economy not only to achieve its NDCs but also to create confidence in future actions and enhance its ambition in successive NDC cycles.

While a large number of challenges in the coal and RE sectors are India-specific and India is making efforts to find unique solutions to them, India is nonetheless eager to learn from other countries which have seen a high penetration of RE in their electricity systems through DISCOM reforms, energy market interventions, and integrating high shares of RE into the grid. India may study for instance Germany's foresight and deep dive into regulatory frameworks which made the transition to RE attractive for all stakeholders, as well as the learnings from actions that may have been unsuccessful. Similarly, India may learn from California's ability to integrate a high share of RTS.

To fulfil the potential of ongoing transitions in India, there is a need for technology innovation and diffusion, and R&D to generate conditions required for the deployment and dissemination of low-emission technology at affordable costs. The rate at which storage batteries will become cost-effective and the speed at which they enter the market will be crucial for India to meet the demand profile with dispatchable resources. This will likely determine the rest of the Indian energy transitions story. It is important that in this process, the global environment is conducive to the development of India's domestic industry.

It remains to be seen how India will obtain a significant and fair share of the promised external financing (public finance), including through private capital flows. India's NDC may in itself be a huge market signal to technology developers to seriously invest in clean technology, but there are large uncertainties in availability of finance for R&D and the potential cushion against investment failures. Besides due to lack of funding flows under global financial mechanisms, there is a lack of predictability in available finance to leverage the private sector within the country beyond mitigation actions. More show of developed countries' resolve to meet their financial commitments and the creation of an enabling environment for a liberal financial regime – free of conditionality – would incredibly boost confidence to implement domestic transitions.

Similarly, an enabling international trade environment which avoids dumping and safeguards tariffs on solar equipment will be crucial to strike a balance between free international markets and the promotion of domestic manufacturing. This will also be important to deepen the transitions on the ground.

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Finally, global political commitment and ambitious movement on the pre-2020 agenda are key to encourage India to do more. This would for instance enable India to trust that the price of battery storage technologies will come down, and take necessary anticipatory measures. However this global resolve must go beyond emissions and emission intensity reductions. There is a need to introduce more specific underlying sectoral policies/measures in national strategies to implement the NDCs, which calls for support in terms of technological innovation and climate finance. These parallel developments at the international level are crucial for developing countries like India to be able to effectively implement domestic policies for low carbon transitions.