

## Low Carbon Technology and Innovation Policy in India

*Manish Anand\*, Shailly Kedia*  
*The Energy and Resources Institute*

### The Context

- India's development imperatives must integrate environmental issues with socio-economic and science, technology & innovation policy process. The brief highlights the recognition of the need for "innovation" and the role of "innovation policy" to help in realization of low carbon development for tackling the trade-offs between economy, society and environment.
- Existing production technology and consumer behaviour can produce positive outcomes only up to a point or a frontier; beyond which depleting natural capital has negative consequences for overall growth for the economy. Innovation – implying both the creation of new products, processes and technologies, as well as their diffusion and application – can push the frontier outward
- There is growing realization that aligning S&T with sustainable development needs requires breakthrough innovations in a wide range of areas including energy, farm production, water management, waste disposal, and the like. Challenges in these sectors require near-term solutions as well as investments in nascent technologies that show promise for the future.
- The nature and characteristics of innovation across various sectors in a national context might not be structured and addressed in the same way. In this regard, the different stages of development of low-carbon technologies, from R&D through to commercial diffusion, introduce new and unique barriers, opportunities and policy challenges need to be understood and addressed sectorally.
- The Science, Technology and Innovation Policy of India, 2013 prepared by the Department of Science & Technology (DST), recognizes the role of the science, technology and innovation (STI) system in the National Action Plan on Climate Change (NAPCC). The document states that the STI system will "serve as a source of strategic knowledge to cope with the challenges of climate variability and change as well as to meet equity-based differentiated and shared responsibilities of India."

### Stakeholder Needs & Expectations

- Adaption of imported technology to suit the local conditions emerged as an important aspect with regard to the transport, building and waste sector.
- Indigenous R&D and technology development was considered to be crucial for low carbon development in the agriculture sector
- Technology demonstration has been perceived as the most important in the renewable energy, industry and non-renewable energy sector.

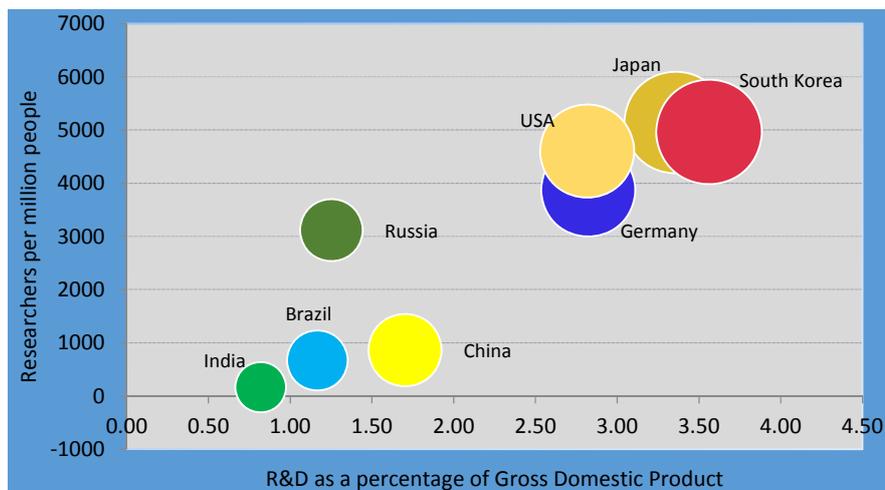
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\* Contact email: [manand@teri.res.in](mailto:manand@teri.res.in)

- Major source of technology is through in-house research and development activities in the renewable, transport, buildings, waste and non-renewable energy sectors. The agriculture and industry sector relied on technologies mostly from domestic sources.
- The following were listed as the most important strategy that could be adopted by the government for energy savings technology development, deployment and scaling up:
  - A deliberate, holistic plan and long-term commitment for indigenous development of low-carbon technologies – in the transport sector
  - Direct R&D funding programs to support the launch and scale-up of low-carbon technology innovation – in the buildings and waste sector
  - Initiatives and investment that improve technological absorptive capacity of businesses by facilitating technology learning – in the agriculture sector
  - Creation of domestic markets – in the industry and non renewable energy sector
- A high legal cost in the case of renewable, transport and non renewable sector, a high transaction cost in the buildings sector and a lack of clear understanding of IPR related issues in the agriculture, industry and waste sectors are the most important IPR related issues perceived by the stakeholders.

### Gaps/Barriers

- Research and Development (R&D) and innovation activities in many low carbon development related technologies especially related to environment are characterized by low investment and slow diffusion. Incentives for low carbon innovation are further weakened by real and perceived uncertainties about lack of clear direction and policy instruments
- R&D policy plays an important role in promoting innovations to achieve low carbon development. As depicted in Figure 1, R&D as a percentage of GDP as well as number of researchers is low in India.



Note: Size of circle reflects the relative amount of annual R&D spending by the country  
Figure 1: R&D expenditure (percentage of GDP) and S&T human resources (per million people) of select countries, 2009. Source: World Bank; UNESCO

- The current policy framework is largely linear with a R&D and techno-centric focus devoid of recognition to aspects such as sustainability and engagement with society.
- Linkages between different ministries such as human resource development, environment and finance among others, segments of the decision making fraternity of science, technology and innovation policy within India is lacking and needs to be established for low carbon development and innovation
- The scale of financing, infrastructure and human resource availability is an important concern, another critical challenge is to integrate existing capacities and developing a mechanism to give it an overall direction and continuity.

## Recommendations

- Dedicated government programmes on low carbon technology innovation across selected sectors could be initiated by Ministry of Science and Technology in coordination with concerned sectoral ministry and providing incentives and financial support for diffusion and adoption.
- Transition to a sustainable development pathway could be accelerated by incentives through a national directive for R&D in low carbon development, setting up of low-carbon technology incubation centres with strong industry–academia–government linkages, facilitation of technology transfer through existing and new technology transfer offices, a focus on low carbon innovations in the informal sector, among others.
- It is important to ensure that linkages and interaction across different ministerial mandates exist in the interest of a strong and holistic S&T system in India.
- The framework of prioritizing research areas should be targeted at the national level in consultation with the different states/regions. For science to address the various socio-economic and environmental challenges the research agenda needs to be driven by demands at a more local level
- A clear vision and prioritization for R&D for development of low carbon technology need to be determined through structured analysis. This could be facilitated by using the tools of technology foresight, technology roadmapping, technology assessment and evaluation.
- An integrated systems approach towards low carbon technology development and deployment needs to be adopted involving various agencies, both at the national and local levels as well as across thematic areas of energy and environment. Such a coherent approach would also help avoid a wasteful proliferation and duplication of initiatives across the various sub-sectors and enable greater industry involvement.
- Focusing on environment related innovations across sectors would have certain co-benefits in terms of growth, inclusion, local environment and carbon mitigation. A brief qualitative assessment of co-benefit potential would be an important dimension of technology development and innovation in the developing country context.

## Acknowledgement

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