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Conversations  
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Centre for New Economics Studies



Jindal School of  
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# CENTRE FOR NEW ECONOMICS STUDIES CONVERSATIONS IN DEVELOPMENT STUDIES

VOLUME 4 ISSUE IV

RENEWABLE ENERGY IN INDIA: EVOLVING  
POLICY, TECHNOLOGICAL & SOCIAL BASE

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# **CONVERSATIONS IN DEVELOPMENT STUDIES (CIDS)**

Volume 4: Issue IV

## **RENEWABLE ENERGY IN INDIA: EVOLVING POLICY, TECHNOLOGICAL & SOCIAL BASE**

### **ABOUT CIDS**

CIDS (Conversations in Development Studies) is a peer-reviewed, quarterly research journal publication produced by the research team of the Centre for New Economics Studies, Jindal School of Liberal Arts and Humanities, O.P. Jindal Global University. This student-led editorial journal features solicited research commentaries (between 2500-3000 words) from scholars currently working on the cross-sectional aspects of development studies. Each published CIDS Issue seeks to offer a comprehensive analysis of a specific theme identified within development scholarship.

The editorial team's vision is to let CIDS organically evolve as a space for cultivating creative ideas for research scholars (within and outside the University) to broaden the development discourse through conceptual engagement and methodological experimentation on contemporary issues. Any research commentary submission features: a) a brief review of the literature on a research problem, b) the argument made by the author with details on the method used, c) documenting the findings and relevance of them in the larger scope of the literature, and (in some instances) d) present a brief policy action plan for agencies of the state (to address the issue highlighted in the commentary). There are no pre-identified limitations or restrictions to methodological frameworks used by solicited scholars (*i.e.*, those writing the commentary). However, the research method incorporated in any accepted submission must be explained along with its relevance in context to the study undertaken.

# CONTENTS

About this Issue .....	3
Policy, Challenges, and Possible Solutions of the Energy Sector.....	9
Public Sector Undertakings and Public Financial Institutions as Catalysts .....	17
Renewable Energy Markets are Moving with Adequate Policy Support .....	23
Sustainable Development Goals: India is busy Mimicking the West.....	30
CIDS Editorial .....	39

## About this Issue

### **RENEWABLE ENERGY IN INDIA: EVOLVING POLICY, TECHNOLOGICAL & SOCIAL BASE**

The urgency for climate action has manifested itself through various ‘green’ initiatives, with a shift to renewable energy sources, and the socio-economic consequences arising from it, at the crux of the climate change debates. India finds itself an essential player in these conversations, mainly due to its 1.39 billion population and developing economy, making it one of the largest energy-consuming countries in the world.<sup>1</sup> The pace of development has indeed been matched by a push for increased energy access to the country’s households — over 900 million citizens gained access to an electrical connection in the past two decades. With continued urbanization and industrialization, this energy demand and supply are predicted to grow even more.<sup>2</sup>

There are still questions about the quality and affordability of this energy supply and the inequality across India’s rural-urban and wealth divide. However, the data does show us the trend of energy usage in the country. Ensuring that this trend takes the positive direction of sustainability necessitates an examination of policy and attitudes towards renewable energy and issues involved with the transition to it.

India faces the pressing challenge of working towards its ambitious climate goals and integrating renewable sources into its energy mix while simultaneously lifting millions of people out of poverty on its development path. The International Energy Agency predicts that the country will need to add a power system the size of the European Union to its current capacity in order to meet the increased energy demand over the next two decades.<sup>3</sup>

Currently, India’s installed renewable energy generation capacity is 40.4% of the total share, while that of fossil fuels is 57.9%.<sup>4</sup> However, over 80% of the nation’s energy demand is met by coal, oil, and solid biomass,<sup>5</sup> fuels that emit large amounts of carbon dioxide and cause global warming.<sup>6</sup> Thus, ensuring energy security for its low-income population means that the country’s transition from fossil fuels to renewable sources of energy will likely be a long and arduous process —

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<sup>1</sup> IEA, *India Energy Outlook 2021, World Energy Outlook Special Report* (2021) <<https://www.iea.org/reports/india-energy-outlook-2021>>

<sup>2</sup> IEA, *Energy in India Today, India Energy Outlook 2021* (2021) <<https://www.iea.org/reports/india-energy-outlook-2021/energy-in-india-today>>

<sup>3</sup> IEA (n 1)

<sup>4</sup> Ministry of Power, Government of India, *Power Sector at a Glance - All India* <<https://powermin.gov.in/en/content/power-sector-glance-all-india>>

<sup>5</sup> IEA, *Energy* (n 2)

<sup>6</sup> IPCC, *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (2021)

<[https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC\\_AR6\\_WGI\\_Full\\_Report.pdf](https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf)>

reflected in India's hesitancy to commit to "phase out" coal from its energy mix at the COP 26 climate summit in Glasgow in 2021.<sup>7</sup>

Despite the concerns, a transition to clean energy presents a substantial economic opportunity. The country has the potential to become a global leader in low-carbon technologies and create a market worth \$80 billion in India by the end of this decade.<sup>8</sup> Moreover, this does not take into account the social benefits of this green transition.

The toxic emissions from the burning of coal kill more than 1,12,000 Indians each year, according to a report by Greenpeace India.<sup>9</sup> Thus, India adopting renewable energy is not only beneficial for the world in the fight against climate change but also for its own economy and citizens. In the context of this crucial juncture of India's potential next green revolution, this Issue of the CIDS explored governmental policies on green energy and whether they are in line with and conducive to India's climate goals.

At the COP 26 summit, Prime Minister Narendra Modi pledged that India would cut its emissions net zero. Despite the target being 20 years after most significant economies have promised to do the same, it is still a significant commitment from the third largest CO<sub>2</sub> emitting nation<sup>10</sup> and a step forward in the global fight against climate change. On the path to this more considerable promise of net zero emissions, India has also set itself the goal of building an electricity capacity of 500GW from non-fossil fuel sources by 2030.<sup>11</sup> To put this in context, India's current total energy generation capacity from fossil fuels and renewables is only 400GW.<sup>12</sup> That is the country plans to more than double its entire energy output in the next 8 years using only renewable sources.

Investor-friendly policies will be crucial in financing this transition; the \$500 billion of clean investment needed by 2030 to meet these targets will only be possible if the government can tap into India's potential as a global hub for green energy investment. Indeed, the government's climate ambition has been reflected in its policies. The Production Linked Incentive (PLIs) scheme introduced by the government has helped boost the competitiveness of Indian manufacturers in the renewable sector. Other moves like a push in manufacturing of solar photovoltaic modules and waiver of transmission charges for renewable energy have also been vital in the growth of the

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<sup>7</sup> Somini Sengupta, 'Narendra Modi says India will sharply increase renewable energy' (*The New York Times*, 1 November 2021) <<https://www.nytimes.com/2021/11/01/world/asia/modi-india-cop26-renewable-energy.html?searchResultPosition=1>>

<sup>8</sup> Dr Fatih Birol & Amitabh Kant, 'India's clean energy transition is rapidly underway, benefiting the entire world' (*IEA*, 10 January 2022) <<https://www.ica.org/commentaries/india-s-clean-energy-transition-is-rapidly-underway-benefiting-the-entire-world>>

<sup>9</sup> Conservation Action Trust, *Coal Kills: An Assessment of Death and Disease caused by India's Dirtiest Energy Source* (2012) <[https://wayback.archive-it.org/9650/20200401013953/http://p3-raw.greenpeace.org/india/Global/india/report/Coal\\_Kills.pdf](https://wayback.archive-it.org/9650/20200401013953/http://p3-raw.greenpeace.org/india/Global/india/report/Coal_Kills.pdf)>

<sup>10</sup> 'COP26: India PM Narendra Modi pledges net zero by 2070' (*BBC*, 2 November 2021) <<https://www.bbc.com/news/world-asia-india-59125143>>

<sup>11</sup> Saurav Anand, 'India committed to 500GW of clean electricity by 2030' (*Live Mint*, 24 September 2022) <<https://www.livemint.com/industry/energy/india-committed-to-500gw-of-clean-electricity-by-2030-11664011296561.html>>

<sup>12</sup> Ministry of Power (n 4)

renewable energy market in India, which saw a record \$14.5 billion investment in the financial year 2021-22 up by 125% compared with the financial year 2020-21.<sup>13</sup>

These figures are expected to grow even more. Private firms, including some of India's giant conglomerates in Reliance Industries, Adani Group, and Tata Group, have plans to invest more than \$200 billion in the coming years in the sector.<sup>14</sup>

The government has come up with policies that specifically address the deterrents to investor confidence in the renewable sector. For instance, given the financial troubles of power distribution companies (DISCOMs), many investors seeking to sell clean energy might fear payment delays. To counter this, the central government has introduced a mechanism that makes itself the financial backstop for new long-term contracts to provide renewable energy to the grid. The government has also allowed solar and wind power generators to bypass DISCOMs altogether and sell power directly to manufacturers of green hydrogen.<sup>15</sup>

To overcome red-tape problems, clean energy parks are being set up that have direct connections to the grid and are given necessary permits quickly. The government's use of reverse auctions has helped maximize investment in renewables at the lowest possible cost. All these innovative policies have helped push India into becoming one of the most attractive emerging markets for clean energy investment.<sup>16</sup> However, there are still many obstacles that could hinder this potential growth of the renewable sector. India needs to attract significant sources of capital at a time when interest rates are rising. In the face of this and the financial risk of colossal capital projects, there are questions over whether the big domestic conglomerates can keep up with their generous promises of investments.

The sector also faces resistance from an influential coal lobby that employs millions of people and controls vast budgets.<sup>17</sup> Apart from the exogenous variables that could impact India's renewable energy sector, there still exist problematic components in India's own energy policies that necessitate examination. Firstly, there exist no accountability policies in India's federal structure to ensure that states meet their climate/renewable energy targets on time. The issue falls under the purview of the Union Ministry of New & Renewable Energy (MNRE), and states give regular reports about their targets; however, they have the power to reject them at their discretion. Therefore, India's targets of building a renewable electricity generation capacity of 175GW by 2022

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<sup>13</sup> 'Record US\$14.5 billion investment in Indian renewable energy sector in last financial year' (*Institute for Energy Economics and Financial Analysis*, 9 June 2022) <<https://ieefa.org/articles/record-us145-billion-investment-indian-renewable-energy-sector-last-financial-year>>

<sup>14</sup> 'India's Next Green Revolution' (*The Economist*, 20 October 2022) <<https://www.economist.com/leaders/2022/10/20/indias-next-green-revolution>>

<sup>15</sup> 'Will India become a Green Superpower?' (*The Economist*, 20 October 2022) <<https://www.economist.com/briefing/2022/10/20/will-india-become-a-green-superpower>>

<sup>16</sup> Bloomberg NEF, *India's Clean Power Revolution: A success story with Global Implications* (2020) <[https://data.bloomberglp.com/professional/sites/24/2020-06-26-Indias-Clean-Power-Revolution\\_Final.pdf](https://data.bloomberglp.com/professional/sites/24/2020-06-26-Indias-Clean-Power-Revolution_Final.pdf)>

<sup>17</sup> The Economist (n 14)

and 450GW by 2030 are only voluntary commitments with no liability or repercussions on any particular agency if they are not met.<sup>18</sup>

Given these issues of transparency and accountability, it is not surprising that India is set to miss its 2022 goal, with 61% of the current target shortfall coming from the 4 big states of Maharashtra, Uttar Pradesh, Andhra Pradesh, and Madhya Pradesh.<sup>19</sup> There are also worrying trends in the comparison of India's subsidy policy between fossil fuels and renewables. Even though overall fossil fuel subsidies fell 72% between 2014 and 2021, they were still 9 times higher than clean energy subsidies in FY 2021<sup>20</sup>. To achieve its climate and renewable energy goals, it is crucial that India shifts its support away from fossil fuels and towards green technologies.

A potential green revolution is as significantly dependent on the supply of renewable sources as it is on its demand. This Issue of the CIDS not only unpack governmental policies and investment hurdles that are defining the supply-side landscape of renewables in India but also the demand-side factors that are reflected in societal attitudes towards sustainability and the evolving technology that influences it.

Consumerism is the idea that a person's well-being and happiness depend on the acquisition of goods and services. Hence, the market should produce increasing quantities of material products.<sup>21</sup> This is an outcome of the Keynesian economic theory which encourages consumer spending and considers demand the driving force behind ever-lasting economic growth. This trend of consumerism is what most governments and big corporations rely on in contemporary times. Companies promote and sustain this trend by showing advertisements that appeal to one's emotions,<sup>22</sup> bringing out new innovative products, and utilizing consumers' online data, among other means. While launching innovative products makes the existing products obsolete or *feel* obsolete, on the other hand, through targeted advertisement, companies can use consumers' online data to display their products that are close to consumers' predicted preferences at competitive prices<sup>23</sup>. These practices are often a product of capitalistic profit-making motivations and result in a detrimental impact on the environment.

The dangerous consequences of consumerism can be assessed from a study done in Earth Institute's Research Program on Sustainability Policy and Management, which states that an

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<sup>18</sup> Noble Varghese, 'India's renewable energy race: MP, UP will take more than 50 years to meet 2022 target at current pace' (*Down to Earth*, 29 September 2022) <<https://www.downtoearth.org.in/news/renewable-energy/india-s-renewable-energy-race-mp-up-will-take-more-than-50-years-to-meet-2022-target-at-current-pace-85195>>

<sup>19</sup> Aditya Lolla, 'The good news and bad news of India's race to 175 GW Renewables' (*Ember*, 22 September 2022) <<https://ember-climate.org/insights/research/india-race-to-175-gw-renewables-updates/>>

<sup>20</sup> IISD, *Mapping India's Energy Policy 2022: Aligning Support and Revenues with a Net-zero Future* (2022) <<https://www.iisd.org/publications/mapping-india-energy-policy-2022>>

<sup>21</sup> Adam Hayes, 'Consumerism Explained: Definition, Economic Impact, Pros & Cons' (*Investopedia*, 28 September 2022) ><https://www.investopedia.com/terms/c/consumerism.asp>>

<sup>22</sup> 'Psychology in Advertising' (*Glint Adv*, 10 January 2017) <<https://glintadv.com/2017/01/10/psychology-in-advertising/>>

<sup>23</sup> Tim Murphy & Karolina Kiwak, 'Customer Analytics' (*Tech Target*, April 2022) <<https://www.techtarget.com/searchbusinessanalytics/definition/customer-analytics>>

average product during its entire lifetime produces carbon emissions of 6.3 times its own weight.<sup>24</sup> More goods produced translates into more resources depleted, more waste, and a carbon footprint. In this backdrop, it is essential to ask whether recent technological innovations present a solution to this negative trade-off between consumerism and ‘green’ resources.

Electric Vehicles (EVs) are considered a modern technology to tackle pollution and unsustainable consumerism. After all, utilizing electricity instead of traditional fossil fuels will result in reduced carbon emissions, apart from indirect payoffs like reduced accidental oil spills during petroleum transportation. However, EV batteries are made of rare earth metals like cobalt, nickel, cobalt, or graphite which need extensive mining. For producing one ton of rare earth metals, 75 tons of acid waste and 1 ton of radioactive waste are generated.<sup>25</sup>

So, the question arises - how effective are these Electric Vehicles in promoting sustainability? Moreover, it also necessitates more extensive conversations on renewable energy storage — and whether the benefits of clean energy usage offset the harmful processes of battery manufacturing.

Further, the world seems to be divided on the issue of utilizing nuclear energy to guarantee a low-carbon future. Belgium plans on closing its nuclear reactors by 2025, Spain will start a nuclear phaseout in 2027 and Italy hasn’t had a nuclear power plant since 1990.<sup>26</sup> On the contrary, France sources almost 70 percent of its energy needs from nuclear technology, resulting in much lower carbon emissions.<sup>27</sup> Therefore, there is a need to investigate whether nuclear energy is used more extensively, under the ambit of green energy, given that countries have some concerns regarding its use such as mishandling radioactive wastes, mining uranium, and nuclear accidents.

An extensively debated measure to promote sustainability is the imposition of a carbon tax by governments. In other words, governments can implement legislation that mandates industries to pay for each ton of greenhouse gases they emit. As of 2021, 35 carbon tax programs are in place throughout the world.<sup>28</sup> The idea behind such a tax is to compel industries to voluntarily switch over to clean energy or increase the prices of their products which would discourage their consumption.

However, Stanford research has found that a carbon tax often ends up hurting the poor consumers the most, with the poorest households paying, as a fraction of income, more than twice what households in the “highest 10 percent of the income distribution pay”. Thus, it becomes crucial

<sup>24</sup> Renee Cho, ‘How Buying Stuff Drives Climate Change’ (*Columbia Climate School*, 16 December 2020)

<<https://news.climate.columbia.edu/2020/12/16/buying-stuff-drives-climate-change/#:~:text=This%20is%20because%2045%20percent,use%20and%20buy%20every%20day.&text=While%20large%20oil%20companies%20like,emissions%2C%20we%20consumers%20are%20complicit>>

<sup>25</sup> André Gonçalves, ‘Are Electric Cars Really Greener?’ (*You Matter*, 25 September 2018)

<<https://youmatter.world/en/are-electric-cars-eco-friendly-and-zero-emission-vehicles-26440/>>

<sup>26</sup> Rahul Rao, ‘Is Europe’s Nuclear Phaseout Starting to Phase Out?’ (*Spectrum*, 11 February 2022)

<<https://spectrum.ieee.org/frances-nuclear-push-shows-that-germanys-phaseout-isnt-the-whole-story#toggle-gdpr>>

<sup>27</sup> Matt Reynolds, Europe Is in the Middle of a Messy Nuclear Slowdown (*Wired*, 21 January 2022)

<<https://www.wired.com/story/europe-nuclear-power-plants/>.

<sup>28</sup> Carbon Tax (*Centre for Climate and Energy Solutions*) <<https://www.c2es.org/content/carbon-tax-basics/>>



to place initiatives like the carbon tax in the larger context of socio-economic dilemmas arising from such a move.

We explored the country's clean energy policy through the lens of administrative, legislative, and investment barriers faced by the sector and the path ahead. We interviewed **Aditya Lolla, Senior Electricity Policy Analyst, Asia, Ember**. He explained the challenges that the Indian administration is facing regarding the scaling up of energy sources and the economic trade-offs that India is likely to face. We also interviewed **Chandra Bhushan, President & CEO iFOREST**, he placed these ideas in the larger context of the energy transition with his insights on the demand and supply side issues faced by the sector and Indian administrative policies regarding them. Further, **Dr. Vaibhav Chaturvedi, Economist, Council on Energy, Environment and Water** emphasized the notion of fair and just transition in order to prevent economic repercussions due to the closure of coal-based plants and/or a sudden change in demand and production patterns.

Alongside the government policies and barriers, the state of consumerism in India and its evolving technological base was just as central to our discourse, as these play a decisive role in India's sustainability. We interviewed **Professor (Dr.) Naresh Singh, Vice Dean & Professor, Centre for Complexity Economics and Applied Spirituality for Public Policy**. He gave us an insight into societal attitudes towards sustainability and the need for the inclusion of relevant frameworks to understand consumer behavior better and thereby achieve the SDGs.

This Issue of the CIDS thus explored governmental policies on renewable energy promotion, placing it in India's current energy context as a potential green energy superpower that is still dependent on coal. In spite of multiple benefits, these initiatives are severely debated worldwide and thus necessitate this Issue of the CIDS Journal to explore such perspectives.

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## Policy, Challenges, and Possible Solutions of the Energy Sector

*Due to the widespread and expanding nature of energy usage, the various adverse environmental effects associated with energy systems, and the significance of energy to living standards and economic development, sustainable energy is imperative. India, a developing economy, is trying to keep up with its economic growth target while simultaneously transitioning to clean energy.*

*The CIDS team interviewed **Aditya Lolla, Senior Electricity Policy Analyst, Asia, Ember** for this sub-theme. He explained the challenges that the Indian administration is facing regarding the scaling up of energy sources and the economic trade-offs that India is likely to face. He states that the GST and fluctuations in import duty result in a change in the consumption of energy sources. Still, given that technology is proliferating, one of the significant obstacles is that our policies and laws are lagging.*

**Do you think a shift to renewable energy also requires a shift in administrative strategies? What are the challenges that the Indian administration faces with regard to scaling up clean energy sources?**

**Mr. Lolla:** Well, that's a comprehensive question. I think there are four or five main challenges we are facing. A transition to a clean power system comes with a set of challenges, and it is no different in India as well.

First and foremost, in India, from a policy administration point of view, there are two main challenges. One is that most of the policymaking takes a top-down approach. In contrast, implementation is usually bottom-up, and there needs to be a reconciliation of these two approaches. So, from a policy point of view, I think that is the first thing that needs to be sorted out. Then we'll go on to the ground and look at some challenges. The most apparent issue is something which has got much press, it's got to do with the health of electricity distribution companies. So, many DISCOMs have gotten into power purchase agreements with coal generators which will require them to pay a certain amount of money over a period of time regardless of whether they kind of draw coal power from the generators or not, and that makes it difficult for them to invest more in renewables. Again, from an administrative point of view that becomes an issue because there are already between a rock and a hard place, so to speak. So that's another issue.

The next issue related to the previous issue is of curtailment of power. Most DISCOMs, because they have to pay a fixed charge to some of the generators, end up curtailing renewable power even though renewables have mustered status in the country. So, this results in a new risk to investment into new renewables. Furthermore, state governments sometimes want to renegotiate the power purchase agreements.

From the administrative point of view, GST and fluctuations in import duty do have some effect. But overall, the power system needs to adapt, especially given that the technology is proliferating. One of the significant obstacles in this regard is that the cost of technology is coming down quickly, but our laws and policies are still lagging behind. This is a big challenge to be addressed.

### **How should India place itself between the trade-off of revenue generated from fossil fuels and its commitment to clean energy?**

**Mr. Lolla:** In my opinion, India can get the best of both worlds, especially now. The benefit from fossil fuels was a thing five years ago, but now the world has drastically changed, more so in the last two-three years. The cost of solar has fallen significantly and especially in India. Solar power is one of the cheapest power sources in India compared to any other country. Bloomberg recently published an article that said solar energy is the cheapest in India.<sup>29</sup> On the other hand, the perception of fossil fuels, especially in the private sector, has taken a big hit.

It is no longer being looked at as a field that gives security in terms of revenue because it is more expensive. Hence, private interest in building fossil fuel power plants has completely dried out. So, all the new coal power plants which are being built in India are built by the government on taxpayers' money, and they do have a good reason to continue building them. To understand that we have to go into the technical side of the power system modeling.

We are in a place right now where the trade-off is not a tough decision anymore. I think it is clear and the government also recognizes that. Recently, the government released a draft national security plan in September, and in that they increased solar targets for 2032. They have reduced coal targets which clearly shows that it's no longer a trade-off.

### **What is the role of public sector undertakings and public finance institutions in India's path to renewable energy?**

**Mr. Aditya:** Public sector undertakings and public finance institutions have a role to play in terms of creating an ecosystem and creating a market that attracts more private enterprises to take part. So, the role is more perceived as a capacity-building side. Previously, what was happening was because it is the duty of the government to make sure power reaches everybody, they were building more coal plants in the absence of investments. But now, much of the growth especially if we have to meet our long-term ambitious targets of renewables like 500 GW of non-fossil capacity by 2030 then it would require much private investment.

So here the role of public finance institutes would be to plug in the gaps in this process. In India, they also play the role of a manager. So, if there is PPA with a private generator, the financing of subsidies that the government gives are channelized by the public finance institutions, So, in that

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<sup>29</sup> Rajesh Kumar Singh, 'India Wants Solar Manufacturers to Bid for \$2.4 Billion in Aid' (*Bloomberg*, 22 November 2022) <<https://www.bloomberg.com/news/articles/2022-11-22/india-wants-solar-manufacturers-to-bid-for-2-4-billion-in-aid>>

sense, their role is to create an ecosystem to smoothen all the process which will allow the public sector to actually thrive.

**RBI has set up a Sustainable Finance Group with the department of regulation. What challenges will this body face in terms of regulating sustainable finance with regard to the current political and economic landscape of India?**

**Mr. Lolla:** There are severe macroeconomic headwinds that the renewable sector is facing. This is due to multiple factors some of which are the pandemic and the Russia-Ukraine war that has led to sharp economic changes. This makes the whole macroeconomic ecosystem uncertain from the financing point of view and regulating financing. This is the first challenge that the regulatory body has to deal with.

The depreciating Indian currency against the dollar hurts the generators with foreign currency obligations. Furthermore, there is inflation which leads to returns for investors. The sovereign credit rating as well, which is low for India. Companies like Fitch and Moody indicate the level of perceived risk for investors in Indian companies. So, all these macroeconomic headwinds make it difficult for the RBI to introduce banking regulations.

On the other side of the spectrum, debt availability from Banks and NFBCs in India is oftentimes constrained by bad loan situations, and lending to IPPs may be restrictive through regulations. It may be restricted by RBI limits on sectoral exposure. Nowadays, most power generators use bonds to access a wider pool of capital. So, this is something that can help the situation.

Another challenge is that RBI rules require external commercial borrowing (ECB) to have an all-in cost. So, they have end-use restrictions, and they have minimum average maturity periods.

**How do we look at the role of public finance institutions with respect to enhancing the sovereign credit rating of India?**

**Mr. Lolla:** I think it is essential to understand how the financial world works. So, to put it simplistically, they all look at one thing, which is risk premium. The ultimate goal should be to reduce the risk premium in India. Reducing the risk premium is not one challenge that can be looked at in isolation. It is linked with multiple challenges. One is the non-performing assets and bad loan situations of the banks.

Another problem is the bureaucratic and administrative hurdles investors face in India, especially for foreign companies. Corruption makes investors averse to India. This pushes the risk premium up. To solve all these problems, there has to be a much more streamlined mechanism in terms of giving access to investors to the market itself, and this is where public finance institutions can play an important role. They do need support from the state governments.

**Between fossil fuel and clean energy, which sector is exposed to greater investment risk? What are the current policy measures to minimize the risks for clean energy and attract more investment?**

**Mr. Lolla:** The perception among generators and investors on coal is really bad right now, especially in the private sector. None of the newer coal power plants are funded by the private sector. It is all being driven by the government. In that sense, from a market point of view, there is a greater risk of investment in fossil fuels at the moment. It is clear that India wants to move to solar.

In terms of policy measures the first and foremost thing the government is trying to do is bring policy certainty. If there is policy certainty, the risk goes down. In the last five years, there is much effort that was gone in bringing policy certainty at the central level. We have clear targets, long-term goals, and things like that. Hence, our ability to convey policies is becoming better. If we look at National Electricity Plan 13 versus the draft National Electricity Plan 14, it is much more exhaustive.

The government is also trying to bring sector-specific policies, introducing Production link incentives, trying to talk about circular economy models based on recycling, etc. It is trying to address the supply side too. In that sense, we have come a long way in the last five years. The other thing which I think is a hurdle is the highly variable nature of wind and solar. We need a more flexible source. Right now, coal is serving as that flexible source. In recent months, the Power Ministry has indicated that India is moving towards battery storage systems. If India gets access to finance to build stand-alone battery storage systems, India will move away from coal. This is kind of signaling the fact that India wants to move towards that. So, from the policy perspective, it is pretty clear that they want to ensure that the grid is stable whereas battery storage systems ensure grid stability.

On top of that India is building green corridors and developing the infrastructure necessary to integrate solar. The government is taking several small steps. On the manufacturing side, they are trying to incentivize domestic manufacturing to set up base in India and expand the manufacturing capacity.

One of the biggest challenges to this is the land availability. The government-owned companies are using their relationships with state governments to secure government-owned land. For instance, in Rajasthan and Gujarat, NTPC has secured land for solar installations at the gigawatt scale. This is a planning side issue that they are trying to address.

**How have production-linked incentives supported the domestic manufacturing of renewables in the short and long term?**

**Mr. Lolla:** This is one scheme that I cannot make up my mind for. I can see the intention behind the PLI scheme, and the Indian government is trying to observe it, but this is one place where I would like to wait and watch. The PLI has been introduced to engender a small solar

manufacturing ecosystem in India. The purpose of it is two things. One is the primary customs duty on imports which is now 40% which discourages manufacturers from importing from China. On the other side it is trying to give subsidies to domestic manufacturers to develop an ecosystem. The government hopes to build a capacity of around 65 gigawatts in the next five years or so. The problem here is that China already has a much bigger manufacturing capacity. It is somewhere near 280 gigawatts.

For India, on the one hand, it is good to diversify and reduce the reliance on imports from countries like China, on the other hand, it will be very difficult for us to reach the price levels which China has already achieved. To do a thought exercise, China was selling solar panels at a cost of 0.18 dollars per watt, of course, it hiked up by 0.30 dollars post-COVID. India is competing with that price. So, this PLI scheme is reducing the cost by 4 cents. These are just rough numbers.

In order to be competitive with China India has to bring down the cost of solar panels to 0.22 dollars per watt. This is a challenge, and can we do this in the next 10 years? With this, there are uncertainties about whether PLI schemes are going to continue for the next decade or not and what happens if the customs duty varies or is removed. Right now, it is too early to say whether it's a grand scheme or not from the vision point of view. It is well-intentioned, how it will play out is just a guess right now.

**Are the state and central-level green industrial policies in coherence? Why are certain states successful in making a leap towards renewables and certain states struggling?**

**Mr. Aditya:** First and foremost, it has got to do with potential. If a state does not have the potential for renewable energy, it cannot build capacity. Some states have massive potential. Secondly, we have legacy issues. There are states which are entirely coal economies. They build the subsistence of their population based on coal. Hence, it is difficult for them to get out of that cycle. It is also something that the local DISCOMs and local governments are comfortable working with. They don't want to change the status quo. Hence there will be a resistance of sorts to anything new.

This is also linked with politics. Some political entrepreneurs can turn up and say that building renewables might mean losing coal jobs. Although it is now proven that the job in the renewable sector is much higher than in the coal sector. Also, stocking public outrage over a project is a reason. All these challenges are at the ground level.

At a higher policy level, as India is a federal structure, there is a state and a central government. State governments also have autonomy and power, some state governments do not agree with the central government's policies, and sometimes there is no rationale for that disagreement because of the way politics works.

The third challenge is the financial health of the DISCOMs. Some DISCOMs are struggling in terms of finances and paying the generators with whom they have power purchase agreements. DISCOMs are hesitant to break out of existing agreements because one undeniable fact about renewables is that one needs capital cost. Then the benefit of it will accrue over the years.

Another thing that does not get mentioned a lot is that the change in power every four years also has an impact. One government has plans and targets and sets up administrative bodies in line with them, and again after four years a new government is formed, and things change. So, these inconsistencies also pose difficulties.

**What are the measures that governments should take to improve clean energy access across urban-rural divides? How can clean energy help bridge this gap?**

**Mr. Aditya:** I would say 'yes'. I have a prejudice as I was working on solar electrification projects and saw that decentralized power could help. A lot of marginalized communities can access energy, to begin with, and it has implications for education and development. It has a significant role to play and also one thing to remember is that India is trying to move away from coal not just in Urban but rural areas also.

If not by 2030, by 2050 India will need to move to a 100% renewable energy, clean power system which is necessary to align ourselves with the 1.5-degree target. In this case, it makes sense to start building the ecosystem in rural areas, especially decentralized ecosystems in places where it is challenging to lay expensive grid lines. To answer the second part of the question, there are two types of rural areas, one which is rural but is not really remote and others are really remote like some villages do not have road connectivity forget grid connectivity.

In urban areas, it is conducive for industry players to come up and set up a big plan because there is much use which gives the necessary income to sustain the plant. But in rural areas, it becomes an issue of scale. There are several ways to address these issues, for instance, the government is thinking about developing mini-grids, hybrid solar, and wind plant for one village. It is running on a pilot scale basis.

All villages require different nature solutions. Broadly speaking from a strategy point of view decentralized power system is necessary. Since the Soubhagya scheme came into the picture, the government has been thinking about this. Also, when we talk about energy access, it is about cooking. There are multiple schemes like the Ujwala scheme where the government is trying to reduce the usage of biomass because of the indoor pollution it causes.

There are a lot of small-scale entrepreneurs who have been working on this for almost 20 years now. The government is trying to adopt all these methods, but at the end of the day, mini-grid are expensive and will need support.

**From your experience of working at the grassroots level in rural areas, what is the biggest challenge that you would like to flag to the government?**

**Mr. Lolla:** I was working in 12 different states and managed 20 different projects. I worked in Nilgiri forests in the south, some villages in Telangana, Jammu and Kashmir, Assam and Manipur too. It is difficult to point out one challenge so to speak. But one thing I would like to reiterate is that our diversity is incredible. And diversity also brings diversity in challenges.

We need to adapt to the issues. For instance, when I was in Nilgiris in the South, road connectivity was an issue. You cannot carry your material and equipment by vehicle. We had to hike up the forest which also was a tiger reserve with equipment in hand. But if I compare this with a state like Manipur where there are a lot of militant groups. We had to negotiate our way to carry materials across their camps. In Meghalaya, when we went to install the solar panel system, we got complaints after a week that the system was not working. We found out that people cut the wires of the battery and charged their phones which drained the battery completely. So, there is a lack of awareness among the people as well which is another big challenge.

**What kind of policy challenges has the pandemic presented to India in shifting to clean sources of energy?**

**Mr. Lolla:** Some of them are mentioned, but the biggest issue, as you know, has been the supply chain. Everything has been paralyzed for the past few months. So that meant that we fell behind in going ahead with constructing some of the plants. That's the big problem.

The second issue was that, because of the pandemic and post-pandemic economic recoveries, it has been a very turbulent period in terms of energy and global energy prices. For example, suppose a generator entered into an agreement with the state government to build a plant at a specific price point in 2019. That price point may not be possible now. In the two years, the work did not happen, and the work almost stopped because of the pandemic, which kind of put many projects in limbo.

So that's the first one, and then it's not directly related to the pandemic. Still, it related to the pandemic in the sense that we introduce primary customs duties to ensure that, no, we are building the "make in India" thing, which kind of takes off, and things like that, and that kind of started, which was seen as a way to ensure that our economy rebounds post-pandemic.

While it may be ideal in the long run, as with the PLI schemes and primary custom duties, and there are long-term things that may be good and work out, in the short term, it meant that, as you know, we are once again falling behind on that target. It meant we could not deliver on some of the projects for which the PS had already been signed. It also meant that the cost of solar energy had risen, among other things.

These are the main issues that the pandemic hasn't addressed. It didn't help that the Russia-Ukraine war came right after it, which meant that other prices also went up, like overall fossil fuel prices.

As a result, energy prices went up, and India couldn't import coal, which meant that India had to rely on domestic coal supplies. But they were monsoons, which clogged the supply lines, which meant a shortage. And again, it led to some kind of power shortage and power relations. Everything is interconnected, and what is clear is that we are in the midst of a turbulent or volatile period in the power sector, the energy sector, and so on.



**According to you, what should be a key challenge discussed in COP 27 and why?**

**Mr. Lolla:** Based on the discussions at COP 27, India wanted to talk about things like no loss and damages; they wanted to put some responsibility on developed countries to help developing countries ramp up the clean forward, and they wanted to bring accountability to the whole discussion. I think in that sense, India made progress there, and I wonder if there have been some transition deals that have happened between Indonesia and the West and then South Africa and the West.

These are all good signs, but what is happening is that the perception of climate compensation is different in different places. As a result, the West sees it as a form of concessional lending to developing countries. Developing countries will have to pay them back at some point. In contrast, countries like India and Indonesia want grants because they believe that because developed countries have already emitted a ridiculous amount of carbon, they should be compensated, as should some poorer and more vulnerable countries like the Maldives, which won't be able to pay back the loans. That's the one thing defining what the compensation should look like. I think that's the one thing that needs to be the center of attention, or it will likely be the central focus in the next few years.

In terms of what needed to be discussed, which was probably not discussed, I think this panel focused more on adaptation than mitigation. I think the focus was on adaptation, so optimal mitigation is my view.

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## Public Sector Undertakings and Public Financial Institutions as Catalysts

*As India simultaneously builds on its ambitious development and climate goals, conversations on renewable energy become increasingly relevant and necessary. The CIDS Team interviewed **Chandra Bhushan, President & CEO, iFOREST** to understand these issues in-depth. He places these ideas in the larger context of the energy transition with his insights on the demand and supply side issues faced by the sector and Indian administrative policies regarding them. Ensuring energy security for its booming population means that the renewable energy transition will have a defining impact on India's socio-economic landscape.*

*Bhushan further emphasizes that policy and technical redesign will be crucial to the 'renewables revolution' in the country. He paints an optimistic outlook for the evolving energy sector in India — contingent on our ability to combine our 'natural' and entrepreneurial potential with technology, financial resources, and progressive governmental policies.*

**Do you think the shift to renewable energy also requires a shift in administrative strategies? What do you think are some of the challenges that the Indian administration has and is facing with regard to scaling up clean energy resources?**

**Mr. Bhushan:** We have to be specific in terms of what administrative reforms we are looking at. There is a significant national policy aspect, then there are issues related to the generation, transmission, and distribution of energy. Finally, there are issues related to the demand and supply side of energy. All these aspects will require changes, but the nature of changes will be very different.

Broadly speaking, there will be changes required when we move from 'firm energy' which is fossil fuels, to intermittent energy which is renewable energy. Let's take the example of distribution companies which have to manage fluctuations in demand and supply. These companies know how to deal with demand fluctuation; they now have to manage the supply side. This will change the way supply is managed. We will require to set up an intermediary to forecast, record, monitor generation, and provide information immediately to the distribution companies. So, this kind of structural change will be required the moment we move away from a source of energy where electricity is being generated 24X7 to where electricity depends on the vagaries of nature. But with storage, management of the grid should become much easier, as the fluctuation in supply would reduce.

From a policy perspective, if we want to promote renewable energy, we have to focus on issues ranging from technology to finance, land, and jobs. Jobs are going to be very important, as both the number and nature of jobs will change significantly. In many ways, a renewable energy world would require us to redesign the techno-economic and socio-economic aspects of the energy sector.

Therefore, every part of 'administration' will require specific changes and those changes will be very different at different stages.

**How should India place itself between the trade-off of revenue generated from fossil fuels and its commitment to clean energy?**

**Mr. Bhushan:** There is a short-term trade-off, but it can be managed easily. Approximately 18% of central government revenue comes from taxes on fossil fuels, mainly on oil and gas and hence, fossil fuels contribute significantly to the exchequer. Nevertheless, earning revenue is all about proper tax planning - which sector we wish to tax and how much we want to tax can change depending on circumstances.

Currently, our government is taxing oil heavily. In a renewable energy world, we can shift that tax to electricity consumption because our automobiles will be charged using electricity. However, this will require innovative design, as electricity is a 'merit good'.

Overall, I am not that concerned much about revenue substitution. It will require a better design, and we have time to make this shift over the next two to three decades. If we are able to decarbonize the electricity sector by 2050, it would be an outstanding achievement. India will then be in a more straightforward position to meet its net zero targets by 2070.

**What do you think is the role of public sector undertakings and public finance institutions in India's path to renewable energy?**

**Mr. Bhushan:** I consider the public sector undertakings and public financial institutions as a catalyst in the growth of the renewable energy sector. The solar sector grew through the National Solar Mission promoted by the Ministry of New & Renewable Energy and Solar Energy Corporation of India (SECI).

Once the market was developed and the reliability of technology was established, the private sector took over. Currently, in the renewable energy sector, only about 10% of installation is by the public sector. Similar is the case with public funds. Initially, subsidies were provided to renewable energy, like accelerated depreciation for wind energy and preferential tariff mechanism in the case of solar energy. Hence, public investments as well as loans and support from public banks gave a boost to the sector when it was required.

I do not think renewable energy in India requires large public sector intervention today. However, interventions are required for batteries and equipment manufacturing, which the government has done. They have started Production Linked Incentives (PLI) schemes where they're giving capital subsidies to set up battery plants and other renewable technology manufacturing plants.

Therefore, the catalytic role is what the role of the public sector should be in any economic sector.

**The RBI has set up a sustainable finance group with the Department of Regulation. What challenges will this body face in terms of regulating sustainable finance with regard to the political and economic landscape of India?**

**Mr. Bhushan:** We are at a very early stage of sustainable finance. RBI has just come out with a draft taxonomy on sustainable finance. However, sustainable finances are a much more significant concept, of which taxonomy is the first step.

Sustainable finance requires banks to have a policy and a monitoring mechanism to see that their investments are only going to sustainable projects. For that, we will have to define what sustainable projects are and then have an effective tracking mechanism. Furthermore, banks are not the only entities that provide money for investment. There are large equity investors as well as the secondary market. All these markets will need to be aligned to the sustainability goals, say, the net zero goal, to which India is a signatory.

The regulatory environment will have to change to enable this ultimately. The share market will need to come out with standards on the definition of green companies. Public finance will have to distinguish between green investment and non-green investment. Similarly, the job market has to look at the green and non-green jobs separately. So, for sustainable finance, there is a broad spectrum of issues that will have to be addressed.

I just saw a few reports of international banks where that talk about sustainable finance. Unfortunately, their reporting and monitoring mechanisms are still at a nascent stage and are insufficient to accurately capture the reality of sustainability in the financial sector. A lot of them are greenwashing

Is nuclear energy a sustainable sector? Are large hydropower projects contributing to the net-zero target? Is investing in a biomass project which competes with the biomass needs of the poor a sustainable project? A company, from its perspective, can call all these three types of projects sustainable.

But the fact is that a large hydropower project in a highly ecologically sensitive area is not sustainable. Therefore, for a company to say that a project is sustainable, it should have a very strong measurement tool, which most companies don't have.

Greenwashing is also happening due to lack of knowledge. It is not always intentional. After all, we are asking our financial institution to do what they are not trained at, *i.e.*, measuring sustainability. They know how to count and invest money properly.

We are saying that the banks' investments should be value based and they should know, monitor, and report those values. This is an additional layer of work, and therefore, it will take time and hard work to properly develop this mechanism.

**Between fossil fuel and clean energy, which sector is exposed to greater investment risk? What are the current policy measures to minimize the risks for clean energy and attract more investment?**

**Mr. Bhushan:** The more significant risk lies with the fossil fuel sector. There are multiple reasons for this besides the obvious one of climate change. Firstly, the gestation period is relatively high. It takes five years to build a thermal coal power plant. Once you sign an agreement, you are not generating any revenue for the next three to five years. That is not the case with renewable energy — a renewable energy project can be started in six months. The second reason for higher investment risk in the fossil fuel sector is social acceptance. There are far more protests against a coal plant or a nuclear plant than against a solar plant. There are some protests against solar plants as well, because of the land requirements, but these are few when compared to fossil fuel plants.

The third reason is that market fluctuation is relatively high in fossil fuels. It is an inflationary fuel. On the other hand, renewables are not inflationary since once you invest in the capital, there is hardly any fuel cost and thus the inflation is very minimal. So, there is a lot more predictability in green energy. Therefore, even with traditional economic parameters, green renewable energy is far more stable and secure to the market than fossil fuels.

Now, if we further consider issues like climate change and air pollution, then obviously green energy is a better alternative than fossil fuels. The only question that arises with regard to the renewable energy sector is how we convert the intermittent source of energy into a 24/7 energy supply. This is where energy storage comes into play as the critical factor. I am very bullish on the energy storage opportunity in India simply because we know how energy storage works. It is only now that cities like Delhi have more or less a 24/7 electricity supply. About 5-7 years back, every household in Delhi had an inverter, and whenever there was an electricity cut, we used to get supply through battery storage.

And this is still the reality today in many small towns and cities in India. Indians know and have experience with electricity storage because millions of households have lived with decentralized energy storage devices. So, I am very confident about energy storage, the one current barrier to the renewable sector, because technology is evolving, and costs are coming down.

As for investments in fossil fuels, there is maybe this tiny window of opportunity for the next four or five years where people might get some economic returns. Any investment in the sector after that does not make sense and is sinking one's money because the risk of these investments turning into standard assets is very high.

**Are the state and central-level green industrial policies in coherence? Why are certain states successful in making a leap towards renewables and certain states struggling?**

**Mr. Bhushan:** The reason that few states are doing well in the green transition but others are not is because of the problems we have in our renewable policy. The problem is that we want to build the largest renewable energy plants at the cheapest cost. Moreover, there also exists a difference in

renewable energy potential across different parts of the country. Some states have relatively higher solar energy potential than others. However, even the part of the country with the lowest solar potential in India has 25% more potential than Germany. Yet, Germany has higher solar installations than India.

The reason I am giving this comparison is that people often say that the Western and Southern states of India have better solar insolation than the Eastern and Northern parts of the country. This difference does exist, but it is only about 10%, and the Eastern and Northern states still have about 25-30% more solar insolation than Germany.

Thus, every part of the country has a large solar power generation capacity, and we can have solar plants across the country. The problem does not lie here. It is in our policy that promotes renewable generation at the cheapest cost. This means that investors only go where the solar potential is the highest and large tracts of land are available. These conditions are in the western parts of the country, in the deserts of Rajasthan and arid areas of Gujarat and Maharashtra.

Furthermore, we have a policy of price equalization through the inter-state transmission charges waiver. This waiver allows consumers to buy renewable energy from any place and not pay the transmission charge. This has specific essential implications for the growth of the renewable sector across states. For example, an industry in Odisha need not install a renewable power plant in Odisha, as it can buy renewable power from Gujarat and not pay the transmission charge. Therefore, because of this price-equalizing subsidy, it doesn't make sense to set up a solar plant in Odisha. Likewise, no one wants to set up a renewable plant in Bihar, Uttar Pradesh, and Chhattisgarh. Everybody wants to install renewable plants in Gujarat because you can generate solar power at the cheapest price and then supply that to anywhere in the country using the benefit of the inter-state transmission subsidy.

So, there is a fundamental problem in our renewable policy design where we want to install hundreds of thousands of megawatts of renewable energy without understanding the regional implications of it. This is one of the biggest challenges in the renewable energy sector that we are facing in the country. For a balanced regional development in the renewable sector, the price equalization policy will have to go. I would encourage your readers to refer to my column on renewable energy disparity in the Financial Express to get more details on this issue.<sup>30</sup>

**What are the measures that governments should take to improve clean energy access across urban-rural divides? How can clean energy help bridge this gap?**

**Mr. Bhushan:** The electricity grid has reached 99% of villages and hamlets. Only 1-2% of areas need electrification. We can, therefore, provide universal access through grid supply. For remote places, we can use distributed energy systems like rooftop solar plants and mini-grids.

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<sup>30</sup> Chandra Bhushan, 'India's renewables disparity' (*Financial Express*, 21 October 2022) <<https://www.financialexpress.com/opinion/indias-renewables-disparity/2722845/>>

But we do not need to rely only on large renewable plants to feed the grid. We can install small solar and wind plants on rooftops and agricultural lands and feed clean energy to the grid. We can use these small plants for productive purposes like agro and food processing, irrigation, MSME sectors, etc. A combination of centralized and decentralized clean energy systems would quickly meet our energy access requirements.

In addition, it is imperative that we take advantage of all renewable resources we have in the country like wave energy and canal hydroelectric power, as well as exploiting the geothermal power potential.

**According to you, what should have been a critical challenge discussed in COP 27 and why?**

**Mr. Bhushan:** I believe that in many ways COP 27 has exceeded expectations. It agreed on a loss and damage fund, which means that now the international climate regime is complete. We have a deal on climate change mitigation and adaptation, and now we have a deal on loss and damage compensation. Mitigation is about averting the climate crisis; adaptation is about minimizing the damage and loss and damage is to compensate for the losses. Sharm el-Sheikh Climate Change Conference has completed the international climate negotiations cycle that way — a very important achievement.

It has also brought to the table the issue of fossil fuel phase-down. It was only last year at COP 26 in Glasgow that the coal phase-down was discussed. Now, at Sharm el-Sheikh, for the first time, there were conversations on the need to phase down all fossil fuels. Apart from these headliner conversations, there is also a workstream on Just Energy Transition, which indicates that countries are willing to cooperate and reach an international agreement on this very important issue. So overall, COP 27 has delivered results beyond expectations.

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## Renewable Energy Markets are Moving with Adequate Policy Support

*Sustainable energy is a critical component of sustainability, which is crucial for the growth and activity of humans. In India, the renewable energy sector was perceived to be riskier because it was a nascent sector. In contrast, the coal sector was a 'mature sector', so the perceived risk is lower, and any early-stage sector perceived risks are higher. However, now investments in renewable energy are becoming less and less risky because of many interventions by the government which are reflected by the law.*

*CIDS Team interviewed **Dr. Vaibhav Chaturvedi, Economist, Council on Energy, Environment and Water**, he emphasized the notion of fair and just transition in order to prevent economic repercussions due to the closure of coal-based plants and/or a sudden change in demand and production patterns. He highlights that in India, the growth rate is high, implying that everything needs to grow and reflects the potential demand that is expected across all sectors.*

**Do you think that the shift to renewable energy also requires a shift in administrative strategies? And what are the challenges that the Indian administration has with regard to scaling up clean energy sources?**

**Dr. Chaturvedi:** Two things need to be kept in mind. First is how the markets are moving presently. Second, what is the additional policy support you need? So now, why are markets moving? It could itself be an outcome of policy support.

For example, in 2016-17 India's renewable energy story wasn't so great. It was expensive, so the government intervened with a string of policies including the creation of Ultra Mega solar parks, comprising incentives that the government gave for renewable energy production.

Presently, renewable energy incentives are more significant. Targets placed in 2022-23 are assisting in the spurs happening in the market. The initial push has to be policy assisted and when it reaches certain economies of scale, putting the wheels in motion.

That is the job of policy *i.e.*, to know if there is a particular policy objective because ultimately many of these things at the ground level are implemented by market actors. Essentially, the investment pours in from the private sector, hence making these interventions by the government extremely important to ensure that the whole market is moving in the desired direction. This is why we are making much progress that we are seeing in the renewable energy space

The question now arises is whether the markets are already moving in a particular direction and whether we are expected to be achieving specific targets. If the next set of targets is more ambitious, then the government will have to think about some additional incentives or interventions. Thus, that interplay is always a continuous interplay between markets and policy.



## **How should India place itself between the trade-off of the revenue generated from fossil fuels and its commitment to clean energy?**

**Dr. Chaturvedi:** The fossil sector forms a big chunk of the tax revenue. Additionally, we see that India's growth rate is pretty high. At the same time, our current per capita electricity consumption is around 1200 kilowatts units per capita (annually), as opposed to per capita-annual consumption of electricity in developed countries that begins at 7000-8000 kilowatts! This indirectly reflects that we have much potential regarding electricity consumption.

Thus, we are very far from even matching their electricity consumption, which is reflective of India's low per-capita income. This also means much growth is yet to happen in India. We see a fast growth rate because we have a low base. It is reflective of the potential demand that is expected to happen across all sectors.

If we follow the general income-demand example, as people become more affluent, they start buying air conditioners, they start buying bigger houses. The same goes for the industrial sector. More demand means more expansion and factories need to be set up to meet this new demand. The way the circular flow of money operates is what leads to much higher electricity demand.

The demand for renewable energy is behaving in the same way. That does not mean that the demand for fossil fuels is going down. For a developed world economy, the situation is very different because they are growing at only 1.5-2%. The growth of renewable energy over there is replacing fossil fuels.

In India, that is not the situation because the growth rate is so high, implying that everything has to grow. Renewal is also growing at a swift pace, but so is Fossil Fuel, however at a much slower pace. It is not declining. The eventual concern that would arise in the next 25 years would be regarding the tax revenue forgone.

Thus, for a situation when the tax revenue would hit a declining stage as a result of renewable energy replacing fossil fuels, we have to be prepared with an alternative model of tax revenue generation. That situation is not happening now, but discussions are already happening in this direction.

## **What is the role of public sector undertakings and public finance institutions in India's path to the renewal of renewable energy?**

**Dr. Chaturvedi:** National Thermal Power Corporation (NTPC) produces most of our power. It has a lot of coal-based assets. It also owns and operates most of the coal mines in India right now. Now NTPC is a power generation company, and it is diversifying itself into the solar business because it is already reading the writing on the wall

Even Coal India Limited has started pouring into the solar business. This is interesting because their business is limited to mining and transporting coal. It is also seeing the future and of course,

knows that coal will not be so valuable and viable because of all the net zero targets we have taken as an economy and most importantly the climate debate. However, this may not be true in the case of others far more dependent on coal. These organizations need to ensure an upskilling of their current task force for them to adapt to the change being driven by net-zero commitments.

15 years is a very long time. There is a reason why 2070 has been chosen as a deadline for such a transition. It gives us reasonable time to prevent economic shocks to not just the economy but also the most vulnerable stakeholders, that is, families of the workers employed in such industries. Hopefully, we will be able to foresee and address all the vulnerabilities of these families and ensure that nobody vulnerable and low-income is hit during this transition process.

One may not be concerned about Coal India Limited existing in 2070, but we must bother about all the families employed by Coal India Limited.

**The RBI has set up a sustainable finance group with the Department of Regulation. What challenges will this body face in terms of regulating sustainable finance with regard to the current political and economic landscape of India?**

**Dr. Chaturvedi:** The term ‘sustainable finance’ does not have a globally accepted definition. After all, what is climate finance? The purpose of setting up such a sustainable finance group the RBI is to understand and define what sustainable finance is.

It is always said that the bulk of finance is available in the global north. In contrast, the bulk of demand is available in the global south, and this meeting is not happening because whenever this bulk of finance flows to places like India, the rates of interest are very high. Additionally, the cost of capital is very high because of the perceived risk or because the risk premiums, due to many underlying reasons, are very high. This is a significant impediment. Essentially what we need is low-cost capital.

There has to be a taxonomy, and with that, we need to identify who needs this finance, where should we, you know, what are the channels through which is financed should flow to these sectors, where it is required. And then where it is coming from, you know, and what are the terms and conditions? Is it low cost or is it like the usual money just being termed sustainable finance? Or where is this finance coming from?

The private sector or government grants or the World Bank or multilateral institutions? So, there are many open questions right now which are being answered just for us to define the term ‘sustainable finance’ better.

Once we are able to do so, we will be able to track many of these things efficiently and get a holistic picture.

**Between fossil fuel and clean energy, which sector do you think is exposed to more significant risk investment now or in the future? What are the current policy measures to minimize the risks for clean energy and attract more investment?**

**Dr. Chaturvedi:** The renewable energy sector was perceived to be riskier because it was a nascent sector, whereas the coal sector was very much a 'mature sector', so the perceived risk is lower, and any early-stage sector perceived risks are higher.

Now, investments in renewable energy are becoming less and less risky because of many interventions by the government which is reflected by the lower (compared with the previous cost of capital). This is reflected by the underlying perception of resources wholly changed. This has acted as an indicator of the government's commitment to the renewable energy sector to investors.

Thus, the risk perception for renewable energy is completely changing. Now it is kind of neck to neck with fossil energy. Most of the major investors don't want to invest in a new coal power plant or new fossil energy, as it is always a 40-year-long investment, and the outlook is to keep their investment during the technical lifetime of the project itself.

To minimize risk, the government started doing something called the Ultra Mega Solar Parks. Now, Land Acquisition has always been a big challenge, it is the way the government exercises *eminent domain*, but even if you approve the project, acquiring the land itself by the developer takes 5 years. Hence, incorporating the procedure of bidding and providing compensation to the people from whom the land was acquired. Thus, what the government started doing is looking at what are the big pain points of the sector.

So, the purpose of this project is to minimize/remove such pain points. It introduces reverse bidding for better price discovery. This method ensures that the larger society gets the lowest price from these developers while also bringing better competition in the market.

Secondly, it has all the green infrastructure, a dedicated transmission and evacuation infrastructure, and a renewable purchase obligation (RPO) policy, which states the mandate of each state to purchase a certain amount of renewable energy. Their latest iteration of the RPO talks about wind, hydro, and all other renewable energy. It also has a solar rooftop, where there is always a capital subsidy being provided by the Government. So, if you look at these examples, there are different ways of interventions taking place.

Currently, one of the most critical interventions that the Government is doing is strengthening the legal and regulatory framework, and that's quite different because it seeks to ensure that all the investors who are putting their investments in this sector can see a level-playing field with regulatory and legal architecture that is clear for them, allowing business to be more predictable and inevitable. This is how it is trying to maintain the state of the sector.

**How is domestic manufacturing of renewables being supported by these production-linked incentives in the short and long term?**

**Dr. Chaturvedi:** Domestic manufacturing has always been our Achilles heel. If we talk in terms of the wind sector, the story is very different. In 2004-05 many wind power projects started happening in India because there was much support from carbon markets and international carbon markets, which are CDM (carbon offset markets) under the United Nations and the Kyoto Protocol. So, when there is a demand for wind power projects, there is a derivative demand that is ultimately for wind turbines. For example, in the solar business, if the demand is for installing a solar power plant, the derivative demand is for solar panels. India has had considerable success in manufacturing its own wind turbine. This is something that China lacked.

Unlike Solar Panels, Wind turbines are large and bulky, resulting in a high transportation cost. So it could not be manufactured there (China). The situation was not so different in India, but our domestic manufacturers were competitive. This perspective should be appreciated because, in the case of the solar power business, such an enormous transportation cost is unlikely or rarely occurs for the mere fact that solar panels are smaller in comparison to wind turbines.

If an Indian solar power developer wants to purchase solar panels from an Indian manufacturer versus a Chinese manufacturer. The landed cost of Chinese panels is lower than the cost of manufacturing in India, right and there are many reasons for it; incentives given by the Chinese Government, it's got economies of scale (which is extremely important for lowering the cost), electricity prices are lower than of India's. This ultimately makes Indian Solar Panels much more expensive, and this is where the PLI incentive scheme enters the picture. This has encouraged some big developers to enter the solar manufacturing game in India and accelerated action on the manufacturing front, which is excellent. Still, it's too early to furnish comments on the same. Promising developments are visible. The hope is that this will show good results soon.

**Do you think that the state and the central level policies for green industrialization are in coherence? And if so, then why are certain states successful in making a lead towards renewable and certain states are still struggling?**

**Dr. Chaturvedi:** Some states in India are heavily industrialized, like Gujarat, Maharashtra, Rajasthan, Karnataka, and Tamil Nadu. By industrialized, I mean industries operating there for a very long time, resulting in a close relationship between the government and the industry. The government is supportive of the development of these industrial clusters because it is great for economic development.

When a new enterprise comes in of course for entering a state where the industrial base is minimal, it is always perceived to be riskier as pared to a state where so many industries are already operating. So, what many of these states are doing is that they have created some additional incentives to engage with the set-up of such industries closely. For example, Uttar Pradesh is going the extra mile to engage with and spur the wheels of industrial development. Ultimately, at the end of the day, investors need to be reassured. States that have already developed an industrial front, do not

need to go out of their way to reassure investors. This is because the investors already know that it is an excellent field in which to invest their money.

States that don't have visibly been making an extra effort. Government ambassadors or delegates would invite entrepreneurs or industrial players, assure them of a level playing field, and respond to their needs by catering to all the needs and by setting up regulatory, legal, and architecture. In fact, anything that the industry may require.

**What are the measures that the government should take to improve clean energy across urban-rural divides? And how can clean energy help bridge the gap?**

**Dr. Chaturvedi:** The urban-rural divide here refers to the divide in energy access. Essentially, before we talk about the clean energy agenda, it is necessary to talk about energy access. Access to electricity is via a grid of electricity. The situation is drastically different now as far as energy access growth goes both on the LPG and the electricity front. What needs to be noted is that before clean energy, there needs to be access to electricity. Clean electricity is the second step. Our main challenge is attaining development, so the first leg is to provide electricity for that initial stage of development itself. By and large, the first leg has been done. The next step is to move towards cleaner energy, and it would be safe to acknowledge that the set-up of urban and rural areas is very different. The way we are thinking of incorporating clean energy in rural areas is by way of solar irrigation pumps.

Secondly, is distributed renewable-based livelihood generation and distributed renewable enterprises. Climate Watch has been documenting and doing much stuff in this distributed, renewable-based livelihoods space right there. Essentially many entrepreneurs want to run a very small, you know, enterprise, but the electricity was always very erratic. This is where we step in. Renewable-based electricity would help them with many things. For example, yarn-based enterprises could use solar dryers. Similarly, we see a lot of enterprises coming into the dry seasonal fruit market- like mango, pineapples, etc. This shows a potential place where solar dryers are being used and can be used.

It is pertinent to note that our renewable energy policy and climate policy revolve around the notion of development. It is not just for the climate's sake. We are not a developed nation yet. So, our best bet is to do both together.

**What kind of policy challenges has the pandemic presented to India in shifting towards clean sources of financing?**

**Dr. Chaturvedi:** The biggest challenge was that the growth was hit as we know, so the moment economic growth is hit the demand for renewable energy sources comes down. So, if our addition of solar energy to the grid was happening at a much faster pace, the occurrence of the pandemic resulted in a complete collapse of demand and then of course slowed growth thereafter. It's primary economic understanding that the need for further addition of solar energy reduces because your demand is much lower now.

Hence, in that sense, for about 1.5 years the pace of the addition of renewable energy, especially solar was hit. But that was not on account of any policy. It was a very general demand shock. One that was being witnessed worldwide. So post-pandemic, the sector is seeing a revival in demand for all renewable energy, solar, despite having much of our demand hit during the pandemic.

**According to you, what should have been the critical challenge discussed at COP 27 and why?**

**Dr. Chaturvedi:** Climate impacts are happening, and this year the talk of the town was the Pakistan floods. As we know 1/3 of Pakistan was flooded which has led to much disruption in the lives and livelihoods of the people living there, along with the economic repercussions. That is, however, one event that happened in one country. India faces the fronts of cyclone year after year. Climate Watch research shows that about 75% of Indian districts are vulnerable to climate extremes. These climate extremes include floods, droughts, and hydrometeor disasters. We are very vulnerable. Heat waves are increasing. This year 50% of India was under heat waves in the middle of March! And by the end of the month, Heat waves were being borne throughout the country. This is unprecedented because we expect heatwaves in May or June, when Summer is at its peak, but never in March. This is a clear vision of global warming and its effects. Globally such loss and damage due to such extreme climate events only increase by the year.

The developed countries are historically responsible for the significant impacts we are facing. It was recognized that there is a need to create a loss and damage fund to support developing countries vulnerable to climate change. This is a very good win because this departs from the stance the first-world countries used to take, but at the same time, there is a long way to go. The vital question remains unanswered, who will pay? How much money will come in? How will this money be used?

The COP27 talked about climate financing and for the first time, mentioned human health from the perspective of human rights, it discussed rules on carbon markets, it talked about phasing-down-the usage of coal, reviving damaged ecosystems prominently discussed, etc. However, there needed to be more discussion on cutting down on rising emissions.

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## Sustainable Development Goals: India is busy Mimicking the West

*A potential renewables revolution depends as significantly on governmental policies, financing, and technology as it depends on the demand-side factors and consumer market for green energy. The CIDS Team interviewed **Professor Prof. (Dr.) Naresh Singh, Vice Dean & Professor, Centre for Complexity Economics and Applied Spirituality for Public Policy**, gave us an insight into societal attitudes towards sustainability and the need for the inclusion of relevant frameworks to understand consumer behavior better and thereby achieve the SDGs. Mitigation of consumerism is crucial in the sustainability discourse — Professor Naresh weighs in on it by emphasizing that the only way to move to a genuinely green economy is to “decouple consumption from the quality of life”.*

*He argues that technology and economics are not adequate answers to the problem; and that the long-term solution lies in understanding one’s own fundamental nature. Thus, Professor Naresh brings into focus how ideas of spirituality, ancient wisdom, religion, and cultural practices can be used to answer the issue of consumerism. Further, this green-centric thought is discussed in the context of policy and economic ideas such as the implementation of ‘carbon tax’, luxury and survival emissions, and climate mitigation responsibility that furthers the discourse and can aid sustainable practices.*

**Does the current Sustainable Development Goals framework address the issues of consumerism? What challenges does the framework face to mitigate consumerism?**

**Prof. Naresh:** Like with most things in sustainable development, the answer to this question is yes and no, both. So, Sustainable Development Goals are significant advances, as one might argue. If one compares the Sustainable Development Goals, for example, with the prior Millennium Development Goals, which were the preceding set—show a significant difference in global development goals. They were mainly focused on social development which was health, education, and poverty. Maternal and child health, for example, did not address some basic needs: they did not address economics, governance, conflict resolution, peace, or institutional change.

So that’s why the answer is yes and no because this set of 17 goals addresses all dimensions of sustainable development, including consumption very broadly. For example, SDG 8 talks about employment, and wisely, it is clubbed with employment, decent work, and economic growth together. And so, there is an attempt to address how growth will happen and sustainability.

The reason I would say ‘No’ is because it does not explicitly address human behavioral change as it should. The significant critique of Sustainable Development Goals is that they are all based on continuing economic growth. And therefore, in my view, they are bound to fail. There is no way that sustainable development goals can be fully achieved because of inherent contradictions.

For example, how do we have a certain level of economic growth and still be able to fight climate change when our growth is based on fossil fuel-driven capitalism? As a result, there are inherent

contradictions in the SDGs that are not explicitly addressed. They are based on a set of almost silent neoclassical growth assumptions, a fatal flaw. For mathematics to work, all of the assumptions made by neoclassical economics must be true, such as the assumption that all humans are the same, act in their own self-interest, and have complete rationality and information.

Complete information systems are silly and have nothing to do with reality. But they have to give us some insights in an artificial way. So that has to change, and the SDGs do not reflect that at this time.

What is the change that is required? That change, I would argue, and even a tiny improvement, would have come from behavioral economics. If we had a little bit more behavioral economics in the SDGs, they would have dealt with consumerism a bit better. But they do not do that. They are essentially silent. Therefore, the default position of the neoclassical economics paradigm is what is described in the SDGs. And hence, my answer to that one is yes and no.

### **How do you think consumer behavior affects sustainable development goals?**

**Prof. Naresh:** Consumerism, consumer behavior, or consumption at the individual level cannot, by itself, have any significant impact on a green transition. When you look at the data, it varies widely, like in the United States. As we all know, the individual impact in the United States is much more significant than, say, in India, China, or Africa. Even if all consumers in the United States were environmentally conscious, we would still have many problems in the big industries if manufacturing, transportation, and energy production were not transformed.

Consumer behavior change will not get us there, not even close. We have this nexus of production and consumption that needs to be addressed together. The consumer is gripped by a sense of better life, which is the same as greater consumption. We have this crazy ethic that we have to consume more and more in order to show others we are living well, which includes designer goods and larger automobiles. All kinds of conspicuous consumption are included in the definition. A default definition in most capitalist societies, and that's for most countries, including China. Quality of life and consumption has been linked to the definition of a good life.

The only way to move to a genuinely green economy is to decouple consumption from the quality of life. Now, if we stop and think for a moment, we will recognize that consumption and quality of life are not the same. Quality of life has to do with education. It has to do with a sound environment. Clean water, fresh air, the opportunity to express your views, and the freedom to think and associate—these are all fundamental human rights. The value of those things doesn't require high levels of consumption. And we are the determinants of life quality.

Many people have decided long ago that GDP per capita is not at all a measure of the quality of life. It was a crude measure of the overall economic performance of society, and its value is helpful in many ways, but it's not the same thing. So it is that distinction between overconsumption, over-consumerism, and quality of life that we need to break apart, and nobody has yet to do so successfully.



In contrast, recent literature in the United States has attempted to demonstrate that US consumers were breaking the link between quality of life and consumption. To be fair, “imported sustainability” should be considered, that is if you only used national accounts and ignored the fact that a lot of their stuff is imported from other countries where the products are not made sustainably. So, their ecological footprint is not limited to the United States; it’s limited to the rest of the world where all the supply chains are linked, the big issue is how do we decouple quality of life from consumption and start to understand that happiness and other dimensions of a good life are not coming only from more and more consumption?

In India, the problem is even worse. India is busy mimicking the West because it’s in a high growth phase and has 4 to 500 million people still living in poverty.<sup>31</sup> There is an alternative path to showing these 500 million people that quality of life does not have to mean more and more consumption over a certain threshold. They need to get enough calories and enough food, as well as decent clothing and quality housing.

**The world is entangled in multiple demand and supply relationships. How can one be motivated to shift towards responsible consumption of daily goods?**

**Prof. Naresh:** Now that is a very important question. I think that’s really what we need to figure out. My answer is going to be a little different from what you might expect. So let me tell you first what I am sure you’re expecting, which is that we have to put in place a bunch of economic incentives and disincentives, which include taxes and certain kinds of luxury or wants rather than needs. You figure that out, and you put in a disincentive, so people consume less.

The other thing you do is look at efficiency. If you have a house that you have to heat in the wintertime and the house is leaking cold air, you will continue to consume more and more energy, right? As a result, if you do, it would be equivalent to checking and insulating that house. You will use needless energy to heat it. Or, in the summertime, if you’re cooling, you want to use efficient cooling mechanisms. Energy efficiency mechanisms — retrofitting buildings — make buildings cool in the summer and maintain heat in the winter. Those efficiency measures and incentives for consuming less help a little, and that’s where the world tends to stop. But it will not work, in my view. Technology and economics, which is what we are saying, contribute and will help to a certain point, but they are not adequate.

Now, what is the long-term, fundamental solution? In my opinion, and I teach courses on this subject here at Jindal, humans must take action. A deeper look is needed to gain a deeper understanding of their own true nature. If I ask you, are humans by nature greedy? Your answer to that question is going to be yes. 99% of the people I ask that question, whether it is in Canada where I sometimes live, or the United States, Europe, or India, will tell you humans are by nature

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<sup>31</sup> Mohd Rameez Raza & Raj Shekhar, ‘Sustainable Development Goals and India: A Pursuit of Achieving the Unachievable’ (*Centre for Advocacy and Research in Environment and Animal Protection, National University of Study and Research in Law*, 23 September 2020) <<https://careapnusrl.wordpress.com/2020/09/23/sustainable-development-goals-and-india-a-pursuit-of-achieving-the-unachievable/>>

greedy. I used to believe that as well, up until about 6-7 years ago, when I came to understand that by studying a range of cultures.

Advaita Vedanta is a deeply traditional way of thinking.<sup>32</sup> Still, it also goes deep into Christianity, Buddhism, Daoism, those wisdom traditions from 3000 years ago, and modern science, modern cognitive neuroscience, quantum physics, and complexity theory. All of this we work with here in a center that I run, the Center for Complexity Economics, Applied Spirituality, and Public Policy.<sup>33</sup>

What I just covered in my research and my own search for meaning and self-realization of what was my own true nature. I concluded that humans think that they are greedy only when they do not understand their own true nature. When they think they are just a physical body, a mind-body organism, they have all kinds of insecurities about the future or the present. They don't have a deeper understanding of their true nature, which is not the body. So yes, you are embodied. It's clear that we have a body, but we are not the body. So that means you need to begin to understand who you indeed are.

If you follow Indian philosophical traditions, you quickly learn that you have to go deeper and deeper to the point at which you come to an understanding of what you are not, and then maybe you will get an insight into what you are. That part is not so easy. Some words they use are "consciousness", "awareness", and that kind of thing. When you come to that understanding, you will then begin to consume what you need to keep the body healthy, fit, and functional, and, you know, a lot less consumption is often better for health than more consumption.

We have all kinds of problems now associated with affluence. Of course, there are issues associated with poverty, and the two significant issues of sustainability are overconsumption on the one hand and underconsumption on the other, which are related to poverty. I think it is the human realization of their own true nature, which can be called wisdom, tradition, or spirituality. Right now, we are busy playing around the edges with technology and economics, and it's not going to get us to the final solution, it's going to buy us a little time. That's what we're busy doing now, the ultimate answer, and that's why I mentioned that I run a course in Jindal on applied spirituality and sustainable development policy.

**How do you think this ongoing shift towards a tech-centric lifestyle affects carbon emissions?**

**Prof. Naresh:** We are starting to believe that all solutions come from technology and that we can fix it. Now, that attitude was adopted by humans from the time of the Newtonian Revolution to the days of our three famous scientists: Newton, Descartes, and Bacon. They sort of pioneered the scientific revolution of the 1700s. That science, which is linear reductionist science, has given

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<sup>32</sup> Jayaram V, 'The Concept of Advaita Vedanta' (*Hindu Website*)  
<<https://www.hinduwebsite.com/hinduism/concepts/advaitaconcept.asp>>

<sup>33</sup> 'About Us - Center for Complexity Economics, Applied Spirituality, and Public Policy' (*O.P. Jindal Global University*) <<https://jgu.edu.in/jsgp/centre-for-complexity-economics-applied/>>

us a lot of what we have today, which is that we can become addicted to technology for a long time. It fixes so many problems.

To give you an example, I was working in about 80 countries around the world. When I worked with poor people, I used to be the Principal Advisor on Poverty and Sustainable Livelihoods at the United Nations. I was in Yemen one day. While talking to people on a hot sunny day under a tree in Adam - I told these people living in poverty that when I work with people who think they are poor, I first start with what they have, not what they need. Those people were shocked. What do you mean that you will start with what we have? We don't have anything. That's why we are poor.

All right let's look into that - I said. We have some fish, we catch them in the sea, and half of it will spoil because we don't have any preservation, no refrigerators, and we can't do anything with them, they explained. So, if we make it to market, we'll be lucky. If we don't, the fish will spoil. Then I asked, "What about the sun?" - the sun is a significant asset. Why are you not using the sun? So, we started talking about the sun and photovoltaic cells, and we said - "Okay, now this one can keep the house cool, not hotter".

You can even put the fish out to dry, and it will be preserved for months to come. So, the technology works. Now, when you use technology efficiently, a lot of people believe you save energy, and I used to believe that too until I saw people begin to use more and more of the technology, and then total consumption increased. So, energy efficiency has a perverse impact where people who have less will consume more because they are paying less for all these various reasons — our faith in technology and our belief that the world was a machine that could be fixed. We are now learning it doesn't work like that.

The ecosystem doesn't work like that. It's not a machine; it's a living system. They follow different laws, so a tech-addicted society that believes faithfully and almost blindly that technology will solve problems will end up in serious disaster.

Because it's a different world, both economic and social system is not machinery, they're powered by humans. The ecosystem is a living system. All of these together constitute the world in which we live. You consider the physical world to be the largest of all that you encounter. Now think a little bit more deeply and see what has the most influence. When you look at the world, you will see that the physician has a minute influence compared to chemicals, which are transformations. Biology is more potent than chemicals.

We now have physical in the middle of biological. It's a small circle. That is surrounded by chemicals, biology is more significant than that, and the mind, psychological, is even more prominent. You can influence humans much more through psychology than you can through physics.

The most giant circle of it all, beyond the psychological, is spiritual. Now I'm telling you this because the obsession with technology is contained within that small circle in physics. That is how

your technology works. The actual powerful forces are way beyond technology, and we will fail if we continue.

### **Of the two - production and consumption, which sector needs better policy regulation and why?**

**Prof. Naresh:** It's not that one needs more direction than the other, what we do is recognize that public policy is required in order to shape the industry and the corporate sector. For example, people are going to continue to use gasoline cars until the government intervenes and shifts the incentives. Thus, the Government of India can put in some economic incentives and disincentives that will drive the market towards electrical cars.

This is how regulation plays a vital role in changing the consumption, and production behavioral patterns of the market, driving technological innovation, to drive the market. Most of all I believe that this country is the perfect place to begin to teach humans to investigate their own true nature, which is a private sphere. Now, of course, spiritual development is considered a private matter, and people will naturally behave defensively toward their private affairs. Still, we need to ask questions because we are going to sync together or stay afloat together and because we humans share an ordinary consciousness.

It's more education and awareness than policy regulation at the individual level. That's the kind of policy awareness education, more yoga, and a focus on yogic practices. All of these will help to shift consumer behavior and consumption behavior. While in the case of production, macro policies will push the market in the right direction, so it's not a matter of which needs more policy. It is the different kinds of policies that we need to identify and not falsely assume that the same policy is required more for one.

### **How can carbon tax help in regulating the behavior of producers as well as consumers?**

**Prof. Naresh:** The Carbon Tax is one of the most powerful market instruments used to move the consumption from fossil fuel. It's kind of transparent it helps to make it to meet the shift. When the Carbon Tax is implemented, the prices of fossil fuels and the NIFTY price will naturally go up, eventually reducing its usage and consumption by people. The question that arises is — do we transfer the tax burden only upon the consumer? The answer is no because we live in a capitalistic society that is fossil fuel driven which may result in inflation. So, a differential tax should be implemented at the refinery stage too.

Canada is a federal system like India. The central government or the federal government decided that they, as a country, recognize that carbon emissions are a cause of global warming and that something needs to be done about it. We must acknowledge that Canada is a cold country and burns many fossil fuels to warm houses in winter. Hence, the government decided that technology will have to improve and that to change consumption behavior, they will need to implement Carbon Tax. However, this is at the federal level. Oil-producing provinces like Alberta resisted the tax because their markets would shrink as a result of the contraction of consumption.

Similarly, in India, the states hold much power in India, and so the Prime Minister was having much trouble imposing this tax. Hence, what they did was give back the proceeds received through the carbon tax money as a subsidy to the people (*via.* bank accounts), where this money can be used for education or to buy environmentally sound goods and so on.

We were paying more at the gas tank, but now we are getting a cheque back, which helps because we have to pay more for gasoline. You see it that way, if you are smart, you'll drive less, take more public transportation, and then get some extra money to buy some other stuff that you need. Now if you continue to do more and more consumption which is not produced in an environmentally sound way, then you will offset the benefit. Hopefully, with some education, it will be better. Hence, there are ways of doing the Carbon Tax work.

What I found around the world is that the Conservatives or the Republican side, believe in free markets, regulated markets, and lower taxes and they are typically opposing carbon taxes. While the other side is typically in favor. But we can always have a middle ground on the way forward. I think carbon taxes are helpful and necessary, but they must be implemented and executed sensibly and smartly.

### **What effect do culture and religious activities have on reducing carbon emissions?**

**Prof. Naresh:** If you do a root cause analysis, what causes too much carbon dioxide in the atmosphere? Fossil fuel-based capitalism. Yet we continue to consume more and more because we feel we need more and more. In essence, we are greedy. To understand our own true nature, we need to ask the question — 'who am I?' where the goal fruit is the self-realization process and not what the body is saying. This sort of leaves us ultimately to understand that we are more than just our body or our mind.

When you get to that understanding of your own true nature, you develop confidence. You are not driven by these egoistic motives which are what leads to more and more consumption which eventually results in such pollution.

India is culturally rich and has many festivals, which ultimately leads to high pollution because much non-organic material that cannot be restimulated is being used. So, to make it green, both the energy consumption and the products must be designed and produced in a renewable manner. I've been reading some recent literature on the pollution of the rivers that occur whenever there is a significant festival, However, awareness is going on.

Recently, I went over to my neighbor's house during Ganesh Puja, who invited me over and they explained that all the statues that they have in their house are made with clay and not plastic and that after the festival is over, the idols will go back into the natural environment. This shows there are more and more ways in which these religious festivals do not have to be polluting. In that way, both the production and the final product become a source of sustainability and hence reduce carbon emissions.

## **What can India learn from its historical practices of consumption and sustainable living?**

**Prof. Naresh:** Continuing on the links I had drawn earlier in our conversation, India's wisdom from 3000 years ago is very much pertinent to this question. If you go back to the Harappan Civilization and see the scriptures and the teachings, they all show how people only consumed what was required and did not overconsume. They recognized that they were one with the natural environment.

Over the years, and especially since the scientific revolution, we now believe we are separated from nature. The damage to nature is extensive because we think we are separated from nature, and we can exploit nature in any way for our own convenience. This was not the case 3000 years ago. The ancient wisdom and historical practices were highly sustainable. Another factor was, of course, that the population was much smaller. Now, we are in the Anthropocene. So, we need even more sustainable livelihoods and sustainable behavior.

I am not saying that you have to live in a primitive way. The philosophical understanding of the nature of reality has been lost. We now believe and as we discussed before that we are technology masters and that we can solve all problems using technology. This belief fails because our philosophical framework is that we are separated from each other and nature. Where does one have this self-realization? — what I call 'applied spirituality'. When you go deep into yourself, you find that your body and nature are one and the same.

Look at what we are made of. I was trained in the natural sciences, and therefore I studied the nature of the human body, that we are made of long chains of carbon molecules (DNA). And we are the same as nature, but we start coming up with this ego, believing that we are supreme and dominating over nature. You are supreme, but if you let your ego inflate and become supreme, it is the worst possible thing. Therefore, we all have the historical wisdom we need, and currently, we have all the technology we need. It's just that we are not bringing wisdom and technology together.

## **Do you think countries of the global north have a higher responsibility toward achieving Sustainable Development Goals? How is this translated into actions?**

**Prof. Naresh:** Again, the answer to this question is a yes and no. So yes, in some of the Sustainable Development Goals (SDGs), the developed and the more affluent countries have a greater responsibility. You are probably aware that in the climate change negotiations, we have a famous phrase — “common but differentiated responsibility”. That remains the same. We all have a responsibility, but those of the developed countries that have already cut down their forests, whose *per capita* consumption has been high over the years, and whose economy is heavily fossil fuel-based, have created the climate problem.

They have generated a more significant percentage of the carbon dioxide emission build up in the atmosphere. Therefore, they have a greater responsibility to reverse this problem. In my view, this responsibility lies in allocating resources to help developing countries not pursue a dirty path of

development but to help them develop cleaner technologies. Now, they can transfer this technology quickly because a lot of it is mainly developed by private sector corporations, while some are developed by governments.

Governments can put in place official aid, and they can support technology transfer by having trade agreements with different countries. So, aid and trade need to work hand in hand through which the developed North needs to support the developing South in order to become developed, but in a clean way. That is the responsibility of the global North.

The ‘no’ part of my answer is that the South needs to recognize that they also have a very important responsibility. Now, India is already the 5th largest economy in the world, and they are likely to become the 3rd largest economy by 2030. So, India has surpassed the United Kingdom, and they are likely to be just behind China and the USA. Prime Minister Modi often talks about this growth path, and we hope it will be done through a ‘green revolution’ as he promises it to be. So, they have this responsibility as well, but the rich North has a greater responsibility both financially and technologically to help solve this problem.

**How does one distinguish between luxury emissions and survival emissions? One country’s survival could be another country’s luxury.**

**Prof. Naresh:** I will distinguish between luxury and survival emissions by asking a fundamental question — if I remove the source of that emission, will somebody die or have less to eat? Take the example of the poor villagers in this country who burn cow dung, coal, or charcoal as fuel. They also chop down pieces of wood in the forest, burn that to cook, and in the process, produce carbon dioxide. If I cut down on these emissions, they would not be able to cook, and that would result in starvation. For me, this is a fundamental consumption and not a luxury consumption. Now, I have a small car, and I may want to purchase a bigger car. We can make justifications for such kinds of consumption as we can afford it. Since this fall in the sphere of wants and not needs, this is a luxury consumption.

However, it doesn’t mean necessary consumption needs to be dirty or polluting. Burning coal in a small hut or rural India not only contributes carbon dioxide to the global atmosphere but also pollutes the household with smoke. So, even essential consumption should be clean and need not be dirty. For example, people can cook with electricity and electric stoves. Even if they cook with fire, they can use CNG instead of charcoal. This is how I distinguish between luxury and essential consumption at the level of individuals.

From a country-level perspective, many people have failed to decouple quality of life from consumption, especially in wealthy countries. This is the heart of luxury consumption. Therefore, the solution is for people to understand that they can have an improved quality of life with reduced consumption. This will automatically take care of the luxury consumption problem.

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