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WHY WE NEED TO STUDY THE INDIAN ENERGY TRANSITION

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This article is about the why and how of studying the Indian energy transition as part of a global movement toward clean energy. With the Indian economy becoming more and more important at global scale, decisions on the country's socio-technical transition process are creating ever more attention. In this article, I am therefore providing guidance for the study of these decisions and their steering effects upon the incumbent energy regime with a special focus on investments and changes to installed capacity.

Introduction

Education for the changing energy mix hits a vital nerve in every political economy these days. Not only because the energy sector is undergoing fundamental changes globally but because the threat of climate change has opened up a dynamic field with vast opportunities for socio-economic development. Universities are special places for an inter-generational and multi-disciplinary dialogue on both the challenges and opportunities of the underlying societal (re)search process toward low-carbon societies. Universities are to provide the physical and intellectual space for the next generation of change agents whether they become law and policy makers, managers, engineers or professional academics. And finally, Universities are to guide the study of the socio-technical transition process in a reflected manner. Accordingly, the role of educators is to train students:

- Understanding and handling complexity
- Developing systemic, anticipatory and critical thinking skills
- Acting in a fair, collaborative, creative and solution-oriented manner

In this article, I will spell out some of these learning objectives using the example of global climate change and India's (re)search process for a changing energy mix in a world of shared but differentiated responsibilities for the prevention of serious if not irreversible human and environmental damage.

A complex issue in a complex world

It is evident that climate change is a complicated, global challenge with non-linear dynamics. Clear is also that human activities have a degrading effect on the globe's constitution and well-being as much as its inhabitants. And even if there was still scientific uncertainty over causal relations, article 15 of the Rio Declaration on Environment and Development (1992) remains valid in arguing that precaution has to prevail and cost-effective measures need to be taken sooner rather than later.

In the limelight of the debate stands the energy sector both as the cause of and cure to the matter. The first wave of industrialization featuring the invention of the coal powered steam engine began in England of the 1750s and is commonly referred to as the root cause for the disproportionate rise in GHG emissions globally. Later on, the invention of cars powered by petroleum derivatives and buildings being heated or cooled further cemented the carbon lock-in. To address the climate and other related challenges, Carl A. Fechner documentary from 2010 calls for "The 4th Revolution – Energy Autonomy" in his documentary from 2010.

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Such a revolution would reconfigure and systematically transform the incumbent fossil based energy regime. And for this to happen regime elements such as beliefs, search heuristics, investment patterns, regulations, etc. have to change accordingly. As a result to such regime changes, (niche) innovations would get adopted into existing systems to solve problems and accommodate external pressures ultimately leading to fundamental changes in the system architecture. (Geels and Schot, 2007) In this context and beyond, the World Economic Forum (WEF) speaks of the 4th Industrial Revolution and sees the Carbon Law gradually replacing Moore's Law. Along similar lines, climate change and other related environmental risks are manifesting their role in the WEF Global Risk Report since 2011. In the 2017 report, for example, extreme weather events and natural disasters are clearly leading the ranking both in terms of likelihood and impact, closely followed by the risk of men’s failure of climate change mitigation and adaptation. (WEF, 2017)

India today is the third largest emitter of greenhouse gases worldwide after China and the United States of America. Vikram Mehta (2016), Chairman of Brookings India, believes that 2016 was the year of inflexion for the oil industry. In contrast, in the Indian electricity sector expansions and improvements in supply are needed. This becomes evident when we look at population figures and growth rates. Among the 1.2bn people today which are bound to expand to 1.7bn until 2060, a majority is kept down with unreliable power supply. Approximately 100 million people have less than 4 hours of electricity per day and estimated 300 million do not have access to electricity at all. (Eco Business, Feb.24, 2017) To address these conditions, to further catalyze economic growth and related co-benefits conducive to Sustainable Development, it is also crucial that the sources of electricity are increasingly non-fossil.

I am arguing that the study of the underlying socio-technical transition process in a guided and reflected manner has become a necessity. The reason for this being that it requires more people, future leaders of this country, understanding the risks posed by all individual and systemic inadequacies together to the system as a whole. It is therefore absolutely necessary that we begin to perceive energy issues through an “integrated policy prism” (Mehta, 2016) and deliberate all related decisions within the limits of the earth system's guardrails. Accordingly, the Paris Agreement has given clear targets for temperature increase and researchers at the Council for Energy, Environment and Water (CEEW) have calculated the remaining carbon space correspondingly. (Ghosh & Chaturvedi, 2015) This carbon space defines one end to the search for a low-carbon future globally and can be used to guide deliberations of India's energy future as well.

In addition to that, the energy transition, in some sense, is a project bound to require the participation of all because its success is fundamentally determined by the societal research process, the debate about its findings and finally the implementation of these findings. (WBGU, 2012) This, in turn, makes it highly relevant for the social sciences where we regard the plurality and diversity of actors as well as the overall complexity of their interactions as an opportunity for policy and technology innovations through learning. (Jänicke, Schreurs, Töpfer, 2015)

With mankind adopting a clean energy agenda, we are not only attempting to mitigate the threat of climate change but also to provide access to clean power for all in an affordable and reliable manner (SDG 7). This is possible because low operation costs of renewable energies and declining material costs make a transition to clean sources of energy a generally sound investment in short-, medium- and long-term perspective while providing growing energy autonomy at individual, regional and national level.

Global investment requirements

In the following sections, I will provide a few key frame figures rather than presenting a full-fledged analysis of the changes in investment patterns in relation to addressing climate change over time. I will perform a simple exercise in arithmetic with these frame figures to shed light at the disparity between actual and needed investment for both the global and Indian scenario.

According to a special report on Energy Investment by the International Energy Agency (IEA), the de-carbonization of the global power sector would require investments of roughly USD 20 trillion between 2015 and 2035 in order to meet targets stipulated in the Paris Agreement. (IEA, 2014) This would translate into one trillion USD per year for both supporting the build-up of clean energy technologies and unlocking high-emissions energy infrastructure (e.g. coal-fired power plants undergoing retrofitting, conversion or early retirement). Actual investments into renewable energies alone, despite record high USD 350bn channelled into renewable energy projects in 2015 globally, remain far behind the estimated requirement. On the other hand, investments into the fossil industry in 2015 were as low as USD 130bn which is likely to include spending on retrofitting or conversion measures. (BNEF 2017) For the year 2016, Bloomberg New Energy Finance records a decrease by 18 percent of new investments in clean energy which is partly explained by markedly falling equipment prices. This suggests that one trillion USD annually might actually well be overestimated if the model behind the calculation of the overall investment requirement did not factor in scale effects.

Given the level of sophistication of today's models and algorithms, this seems unlikely but requires further in-depth scrutiny.

RE Investment and climate targets in India

The Indian Government estimates that at least USD 2.5 trillion (at 2014-15 prices) will be needed to finance India's climate change actions as manifested in the country's Intended Nationally Determined Contributions (INDCs). In 2009, during the Copenhagen summit, the Indian Government announced a reduction of 20-25 percent GHG emissions per unit of GDP by 2020 and tightened its goal during COP21 in Paris to up to 35 percent reduction of GDP emissions intensity by 2030 on 2005 levels. In addition, 40 percent of total electric power (roughly 350GW installed capacity) would have to be provided from non-fossil fuel-based energy sources, mainly renewable energies. (UNFCCC, 2015) Prior to that, Prime Minister Modi announced an ambitious intermediate goal of 175 GW renewable energy capacity additions until 2022 during the UN Summit for the adoption of the post-2015 development agenda. (Niti Aayog, 2015)

The BNEF recorded investment of around USD 10bn in renewable energies in India in 2015 and 2016 each. In Fiscal Year 2017/18 the Indian Government alone allocates roughly USD 820 mill for mainly grid-interactive renewables and grants duty and tax exemptions for a variety of RE components. (IESA, 2017) When we also break down the estimated 2.5 trillion into equal annual contributions needed for the Indian Energy Transition to materialize as envisioned until 2030, the annual spending would amount to USD 167 billion, roughly two hundred times as much as currently spent by the Indian Government. This obviously leaves the industry wishing for more especially in times of high capital costs within India. However, this also explains why the Government of India emphasizes that successful implementation of its INDCs is contingent upon the means of implementation to be provided by developed countries, including technology transfer and capacity building.

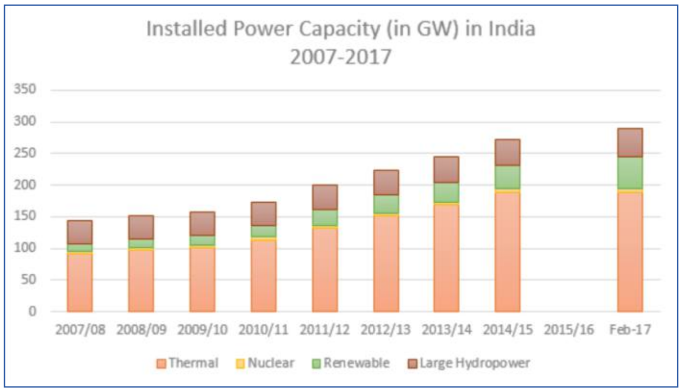
The extent to which international partners are contributing to climate friendly developments in the Indian energy sector, however, is still little researched and neither comprehensively reviewed nor systematically analyzed. The following section will therefore look at changes in volume and composition of the Indian power sector to keep track of policy outcomes relative to formulated goals.

Transforming the Indian power sector

Shortly after his election to Prime Minister of the Republic of India, Narendra Modi announced plans for a sharp increase in installed renewable energy capacity.

Until 2022, solar (100GW), wind (60GW), biomass (10GW) and small hydro power (5GW) shall provide 175GW installed electric capacity.

Changes to the Indian power sector since then but also prior to the 2014 plans are evident both in terms of volume and composition. According to the Central Electricity Authority (CEA) the country's overall installed capacity has more than doubled from 143GW to 289GW since FY 2007/08 as the chart below shows. In the area of renewable energies alone, the year 2016 witnessed additions of grid-interactive renewables by more than 10GW to above 50GW total RE installed capacity. (CEA)



Source: Central Electricity Authority (CEA).
Data for 2015/16 is not available as of March 25th 2017

When speaking of installed capacity the data is hiding that actual power generation varies greatly from fuel to fuel due to a number of factors. The Central Electricity Authority, however, does not provide data for power output generated from renewables other than large hydro power plants, yet. Instead, the Central Electricity Regulatory Commission (CERC) assumes a capacity utilization factor (CUF) of 19 percent for solar PV only. This is mainly the result of limited hours of sunlight and scattering effects caused by clouds, haze, dust, etc.. In other words, 100GW installed solar PV is likely to generate only 19GW power output. Similarly, wind energy generates power output in the range of 20-32 percent depending on the zone in which wind turbines are installed. (TERI, 2017)

This being said, one climate dilemma is power output in coal-based power plants being generally markedly higher than in solar power plants and other renewables. Nevertheless, coal remains one of the major villains of the climate challenge. To this point, a recent study on "Transitions in the Indian Electricity Sector. 2017-2030" by The Energy and Resources Institute (TERI) concludes that no additional investments into coal capacity will be needed to meet power demand, other than what is already underway. The report also develops the prospect of entirely renewable power generation capacity after 2023-24 when renewables will be fully cost competitive and sufficient battery storage can balance RE power supply and demand. (TERI 2017)

At the Annual Conference of the Indian Energy Storage Alliance in January 2017, a competitive price for renewables plus storage requirement was seen at Rs 5 per KW/h. A solar tariff of unprecedented Rs 2.97 per KW/h was recorded in early February 2017 for the 750 MW Rewa solar park. (ET Energyworld Feb. 11, 2017) But storage equipment is far from available at Rs 2 per KW/h.

More realistic would be a price of above Rs 10 per KW/h for battery storage which leaves the industry waiting for a major breakthrough in car battery prices.

Nevertheless, TATA Power Delhi Distribution Limited (Tata-Power DDL) recently signed the contract for India's first 10 MW grid-scale energy storage array. The installation will demonstrate a number of functions to solve critical infrastructure challenges related to reliable supply including peak load management. In this context, the idea of electric vehicle (EV) batteries as grid-service provider becomes interesting. In the form of stationary battery swapping systems, EV batteries could be used to store access electricity and stabilize the grid while also being used for mobile purposes in cars. For example, the DisLog Project of the Transport Technology Division of the Fraunhofer Institute for Production Systems and Design Technology (IPK) in Berlin studied modular battery swapping systems for commercial electric vehicles in multiple shift operations. The Fraunhofer researchers were testing a quasi-stationary battery container with installed capacity of 0,5MW/h. A result of the study is that the containers could become an important contribution to grid stability, if it will be possible to build up a network of such swapping stations in the 200km radius of the Berlin area. A second study by Fraunhofer IWES, Volkswagen, LichtBlick and SMA Technology also looked into how to connect electric vehicles intelligently to the electricity grid. The results showed that EVs can provide a reliable and short term power reserve. However, the dual use of the battery would lead to an accelerated ageing of the battery, conversion losses and additional electricity costs for battery-based storage. At the same time, the study did not factor in savings in the form of avoided new (conventional) power plants, in the form of classic stationary battery storage, demand-side management and other necessary flexibility options. In any case, the looming mobility transition toward electric vehicles seems to have the potential of conserving resources through such cross-sectoral integration of the transport and power sector.

Conclusion

Lastly, India is at a critical juncture. But the signs are good that the Indian people will manage to address the challenges of its energy transition in collaboration with international partners.

In the end, it is domestic decision-makers who are in the driver's seat, hopefully hold the steering wheel and drive toward their goals. But research and education, whether from within or outside a University, are central to preparing next-generation leaders for the underlying transformation process. There are no 'one-fits-all' solutions and in the end the right path has to be discovered and prepared in a manner acceptable and beneficial to a critical mass of the Indian population and at best the largest possible number of people. ■

References:

- BNEF (2017) Global trends in clean energy investment. Bloomberg New Energy Finance. (Jan. 12, 2017).
- Ghosh, A. & Chaturvedi, V. (2015) For a few degrees more. In: Business Standard, Vol XXII, Issue 176, 22. December 2015.
- Geels, F. & Schot, J. (2007) Typology of sociotechnical transition pathways, In: Research Policy 36 (2007) 399-417.
- IESA (2017) IESA on the Union Budget 2017-18: Post Budget Review. Indian Energy Storage Alliance Newsletter. Feb. 10, 2017.
- Jänicke, M.; Schreurs, M.; Töpfer, K. (2015) The Potential of Multi-Level Global Climate Governance, IASS Policy Brief, 2/2015.
- Mehta, V. (2016) 2016, the year of inflexion for the oil industry? Indian Express, Feb. 6, 2017.
- TERI (2017) Transitions in Indian Electricity Sector. The Energy and Resources Institute. Feb. 13, 2017.
- WBGU (2012) Research and Education: Drivers of Transformation. German Advisory Council on Global Change, Factsheet No. 5, Research, February 2012.
- WEF (2017) The Global Risks Report 2017, 12th edition, World Economic Forum, Geneva.

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