



# The electric future

and its implications for India

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# Foreword

The objectives of this thought paper are to identify the core trends that are likely to influence the structure and operations of the energy and natural resources (ENR) sector globally and in India in the coming decades, assess the potential impact and implications for the Indian nation, and point to a few specific calls for action from the government, industry and other key stakeholders.

India is a large young nation with distinct demographics, resource base and economic trajectory. With more than a sixth of humanity residing in the country, India's actions in the ENR sector has global implications in this carbon constrained and environmentally sensitive world. Its actions also massively influence the hugely populous neighborhood, especially when it comes to energy. At a time when there are massive and simultaneous changes to the demand and supply side dynamics, the choices made will have long term implications, especially since these decisions have a long period of influence.

We are clearly in midst of a global energy transition to cleaner sources of energy, accelerated by climate concerns as well as cost trends. A few trends that are defining this transition include (a) renewable energy scale-up (b) acceleration in

energy efficiency (c) decentralisation of resources (d) consumer empowerment and (e) electrification across the board. The characteristics of this new energy paradigm are often radically different from the past. Yet it is also equally true that the new depends on the crutches of the 'old' electricity paradigm to grow. Renewables must be balanced by conventional resources including fossil fuels; distributed generation can scale rapidly when it is grid interactive. ***Navigating the energy transition***, the theme of ENRich 2019, is hence of great importance.

Technology evolves in ways that are unpredictable, hence making it impossible to foresee beyond the horizon. Development cycles are shortening rapidly. However, the near to medium term future does point to accelerated electrification. Indications are that the overall energy sector is headed towards 'The electric future'. This thought paper brings out the various facets of that future and how those facets are intricately linked to each other and to the global priorities around decarbonisation, efficiency in resource use and evolving a virtuous circular economy. I do hope that this conveys thoughts and actions as it is intended to do.



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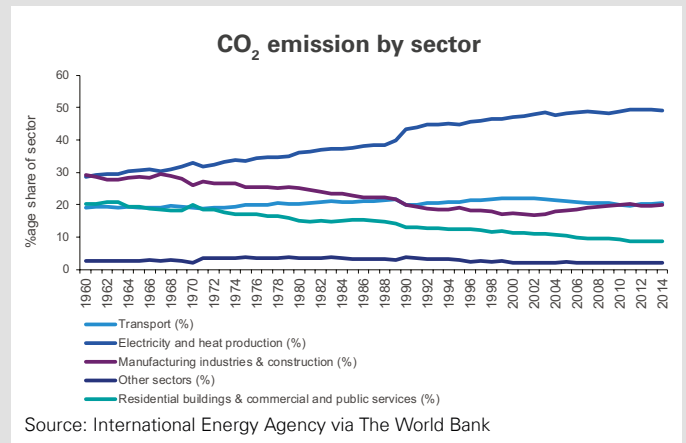
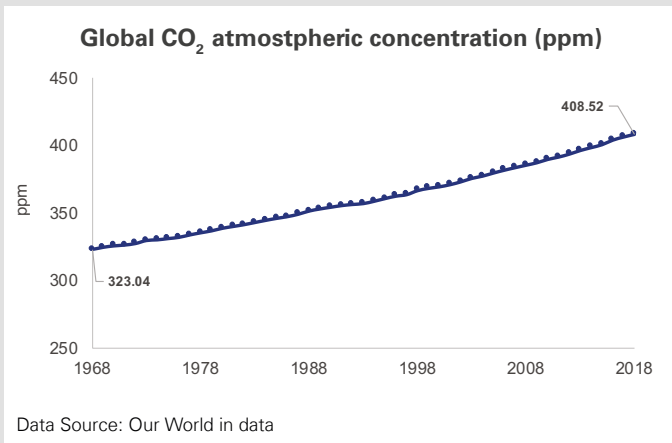
# 1. The electric future: The mega-trends





Present global CO<sub>2</sub> emissions are estimated at 34 Gt per annum<sup>1</sup>. To meet the Paris climate goals and keeping the temperature rise to well below 2 degree above pre-industrial levels, carbon emissions need to fall by around 45 per cent from present levels by 2040. This is in the backdrop of global economic

growth where due to increased prosperity, global Gross Domestic Product (GDP) is expected to double in this period. It is thus not just about slowing or containing carbon addition even as the world economy grows, but about reversing the direction of carbon accretion. For this, electrification is an imperative.



Broad trends across the globe point to rapid electrification of consumption being underway already, driven by efficiency, cost and climate considerations. The ecosystem is already gearing around this future through accelerated deployment of renewables, new age storage solutions and conversion of the energy applications space to electricity in transport, household applications, food production storage and supply, etc. Electrification in a myriad ways is also aiding the convergence of demand and supply sides, improving conversion efficiencies and bringing in an element of seamlessness.

The pace of electrification of transport has now started to pick up globally. Massive investments are going into electric mobility in public and private transport and associated technologies (particularly battery technology) and infrastructure. The dual benefits in terms of likely reduction in local and global emissions are very large. With such massive dual benefits at a time when environment and climate have become the greatest concerns for humankind and with already comparable costs, the juggernaut is rolling.

This is not just about electrification of mobility. Even static applications of energy are turning electric at a rapid pace in industries and households. Case in point is the expanding electricity access across South Asia and Africa where a large proportion of population will have access to commercial energy for the first time and will contribute to electrification of the global economy.

In this section, we discuss the global energy transition around the following propositions:

1. Where and how energy is consumed is set to change massively
2. The pick-up of renewable energy has just about started
3. Storage will start evolving in tandem with renewables.

The section concludes by laying out the implications for India, which are then detailed out in the subsequent section.

<sup>1</sup> Data in this paragraph is from BP Energy Outlook, 2019. Paris climate goals refer to the goals set at twenty-first Conference of Parties (COP 21) in Paris in 2016.

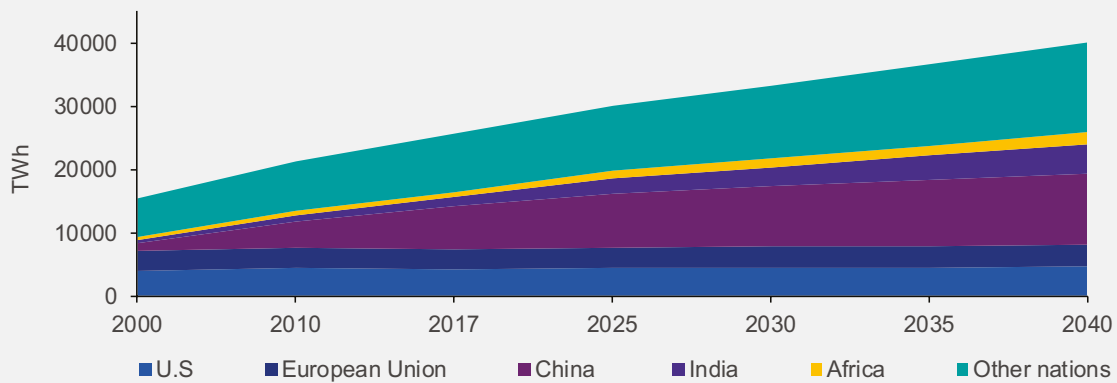


## Where and how energy is consumed is set to change massively

Global GDP is expected to double by 2040, led primarily by non-OECD<sup>2</sup> countries in Asia-Pacific and Africa<sup>3</sup> with an expected 33 per cent growth in energy demand. Developing economies will account for the

largest share of new energy demand, driven by rapid economic and population growth and the need for more goods and services.

Global electricity generation by region



Source: Data for New Policies Scenario, World Energy Outlook 2018, IEA and KPMG in India Analysis



<sup>2</sup> Organisation for Economic Co-operation and Development

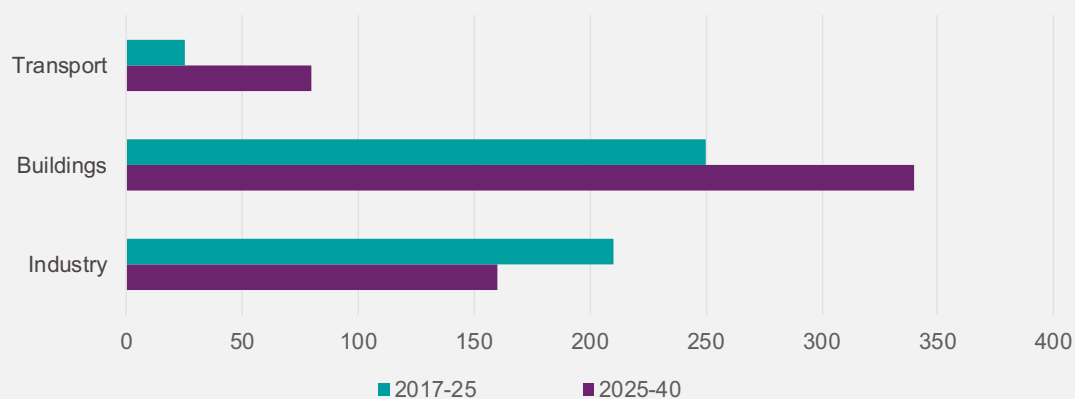
<sup>3</sup> BP Energy Outlook, 2019



According to BP's Energy Outlook 2019, around three-quarters of the increase in primary energy demand will be absorbed by the power sector. This is a forecast with inevitable unknowns and uncertainties. In practice,

the pace of change may well vary from forecasts, but the direction is clear. For a relatively short period of time this kind of change within a single generation in a mature sector like energy is indeed remarkable.

### Average annual increase in electricity consumption by sector



Source: World Energy Outlook 2018, IEA

On the demand side, this change will be largely driven by increasing use of electricity in industry, buildings as well as transportation. Buildings are the largest source of demand for electricity. However, considering the current policy push and evolution of technology, transport is expected to experience the fastest growth in electricity consumption. As per Global EV Outlook 2019, electric vehicle (EV) sales (excluding two/three-wheelers) are expected to reach nearly 23 million in 2030, about 30 per cent of present-day global car sales<sup>4</sup>, with China accounting for almost 50 per cent of this number. As history has demonstrated, China is very capable of making rapid modal switches for economic and environmental reasons.

It is anticipated as per BP Energy Outlook, 2019 edition, that electricity will power about 25 per cent of passenger vehicle kilometres by 2040. Globally, electricity demand from EVs is projected to reach

almost 640 terawatt-hours (TWh) in 2030<sup>5</sup> and 2333 TWh by 2040<sup>6</sup>, marking a rapid scale-up in a decade once the ecosystem for EVs settles in. Given that the decisions on energy production assets that will be in their mid-life in 2040 are being made, now the implications are significant.

India's stated policy is very EV friendly. EV technology itself is advancing fast and the ecosystem is developing rapidly. In the coming decades, the total number of EVs in India is expected to increase sharply from under two million<sup>7</sup> at present. India is also moving rapidly towards enhancement of public transport; particularly metro rail which will move energy demand from petrol and diesel to electricity, apart from relative reduction in energy consumption levels. While the pent-up transport demand in the country is large, such shifts inevitably impact status quo.

<sup>4</sup> "World Car Sales Will Fall More Than 4 Million In 2019", Forbes, by Neil Winton, dated 12<sup>th</sup> June 2019

<sup>5</sup> Global EV Outlook 2019- Scaling-up the transition to electric mobility

<sup>6</sup> BNEF EV Outlook 2019

<sup>7</sup> EV Market Scenario India, Society of Manufacturers of Electric Vehicles (SMEV) – This data includes two, three and four wheelers



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## Electrification: Dramatic pick-up

The electricity sector  
is witnessing its most  
dramatic transformation  
since its birth more than  
a century ago

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*Dr Fatih Birol,  
IEA Executive Director*

Source: International Energy Agency

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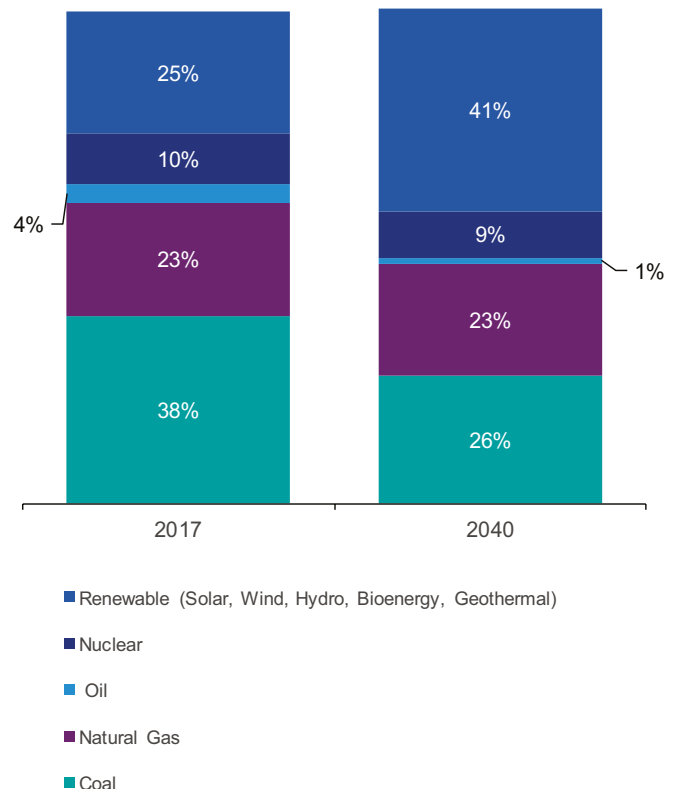
## The pick-up of renewable energy has just about started

There is still a debate on the trajectory of growth of EV population on the roads, not so much because of the technology itself, but more for the infrastructure needed for them to flourish, and the cost trends. There is a vibrant ongoing debate on battery charging and swapping infrastructure, which has more real estate than electric dimensions. There is no such debate on the future of coal. New coal fired plants at scale are just not financeable in many parts of the world. Gas fired plants are expanding, but only where there is cheap natural gas available on tap, as it is in United States and some geographies. In contrast, wind and solar economics have improved rapidly.

According to the BP Energy Outlook 2019, renewable energy accounts for the fastest growing energy sector, which is estimated to grow at 7.1 per cent annually. Its share in global primary energy is expected to grow almost fourfold to 15 per cent by 2040 from its current share of 4 per cent. In terms of contribution to the electricity generation basket, renewables are set to grow above 40 percent, reversing positions with coal<sup>8</sup>.

<sup>8</sup> BP Energy Outlook, 2019

Share of fuel in world electricity generation



Source: World Energy Outlook, 2018, International Energy Agency





In the recent past, investments in renewable energy have been led by the European Union. The EU expects to meet over half of its power requirement through renewable energy (RE) by 2040. Emerging economies such as Brazil and India are also accelerating deployment of RE in power generation. Brazil, one of the leading energy consumers, has the highest share of renewables, which account for an approximate 45 per cent<sup>9</sup> of country's total energy consumption. China plans on generating 35 per cent of its electricity consumption from renewables by 2030. The major oil exporting nations in the Middle East are also making investments in renewable energy. The recent downturn in oil prices has prompted investors to turn towards renewable energy projects as an investment avenue. Saudi Arabia is expected to invest about USD1.5 trillion in the country's renewable energy sector. By the end of next decade, the country plans to generate 60 GW<sup>10</sup> from renewable sources<sup>11</sup>.

In India, the new targets for RE by 2030 could be in the order of 350 to 500 GW<sup>12</sup>. Coal is expected to continue as the major fuel source for electricity generation in India. However, the share of electricity generated from coal is expected to decline and the share of electricity generated from renewables is expected to increase from about 16 per cent in 2017 to 38 per cent in 2040<sup>13</sup>. Less than a decade ago, this would have been considered a fantasy. Agencies, including KPMG in India, in its 2012 publication, 'The Rising Sun', laid out the construct for the rise of solar power, and that eventually solar would overtake conventional power in commercial attractiveness. That eventuality has happened. India has been witnessing a rapid fall in prices that have hovered for the past year in the stable range of INR 2.44 – 2.89 per kWh. More countries are increasingly committing to elimination of fossil fuels and providing

<sup>9</sup> International Energy Agency

<sup>10</sup> Gigawatts

<sup>11</sup> Published media articles, KPMG in India Analysis

<sup>12</sup> Energy Storage System- Roadmap for India: 2019-2032 by ISGF and IESA.

<sup>13</sup> World Energy Outlook, 2018, International Energy Agency (IEA)

