INDIA'S ENERGY BASKET ANALYSIS:

TAKING INTO ACCOUNT TRANSITION FACTORING COP-21

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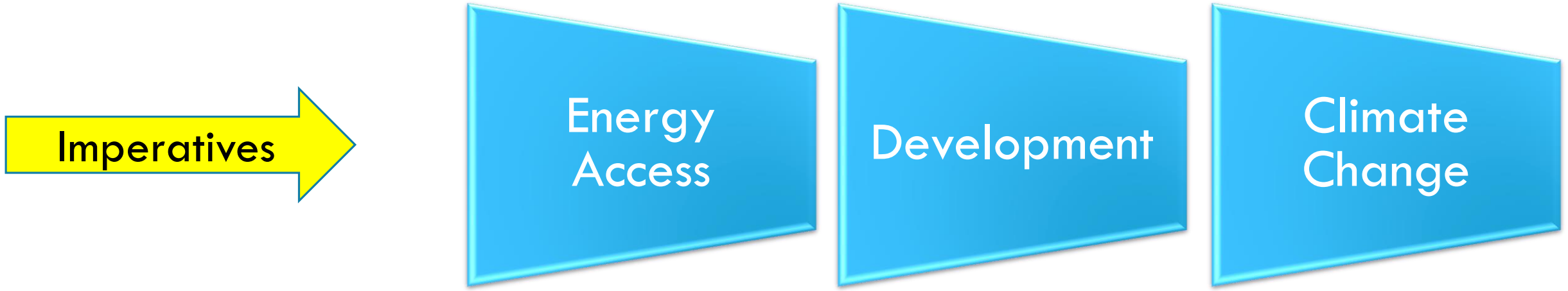
What will we see in the presentation?

Indian Energy Scene …



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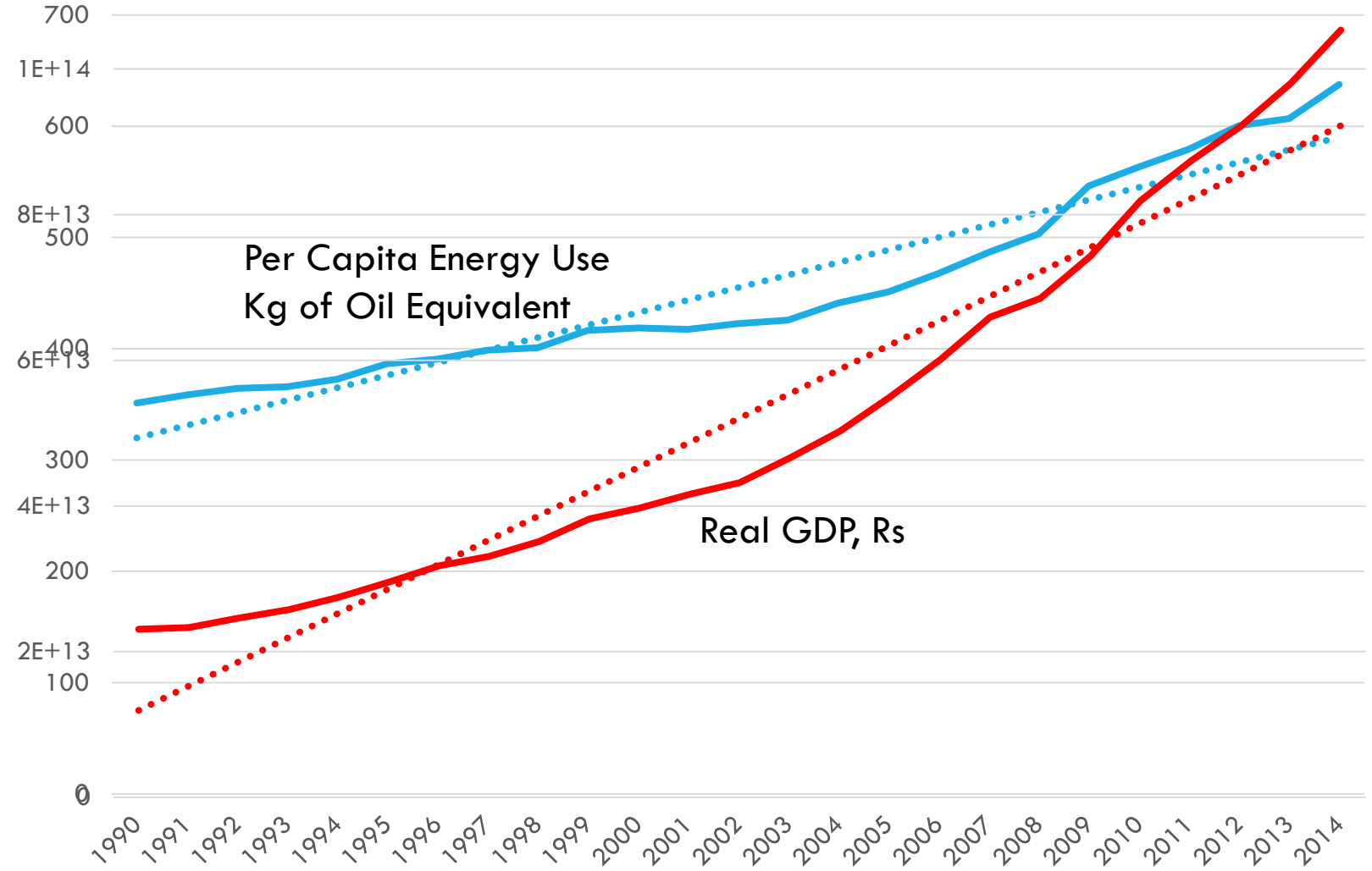
Large Scale shift in Global Energy Scene

- The rapid deployment and falling costs of clean energy technologies; in 2016, growth in solar PV capacity was larger than for any other form of generation; since 2010, costs of new solar PV have come down by 70%, wind by 25% and battery costs by 40%.
- The growing electrification of energy; in 2016, spending by the world's consumers on electricity approached parity with their spending on oil products.
- The shift to a more services-oriented economy and a cleaner energy mix in Indian and China.
- The resilience of shale gas and tight oil in the United States, cementing its position as the biggest oil and gas producer in the world even at lower prices.
- These shifts come at a time when traditional distinctions between energy producers and consumers are being blurred and a new group of major developing countries, led by India, moves towards center stage.

Energy consumption has not kept pace with the growth in Economy:

1. Shift away from Bioenergy consumption in residential sector
2. Rising importance of service sector
3. Increase in end-use energy efficiency (12% less energy to produce one unit of GDP (1990 – 2013)



India has been responsible for 10% of increase in global energy consumption (2000 – 2013).

Global energy consumption will experience 30% increase during 2016 – 2040, and India's contribution to that will be 30%.

India's share of world energy consumption was 4.4% in 2000, increased to 5.6% in 2013 and is expected be 11% in 2040.

That is much less than 18% of share of India's population. (India-1.6 billion, World 9.1 billion)

<u>Per capita energy consumption (KGOE) in 2014</u>

India – 637
China – 2237
USA - 6960

Source: World Bank & WEC

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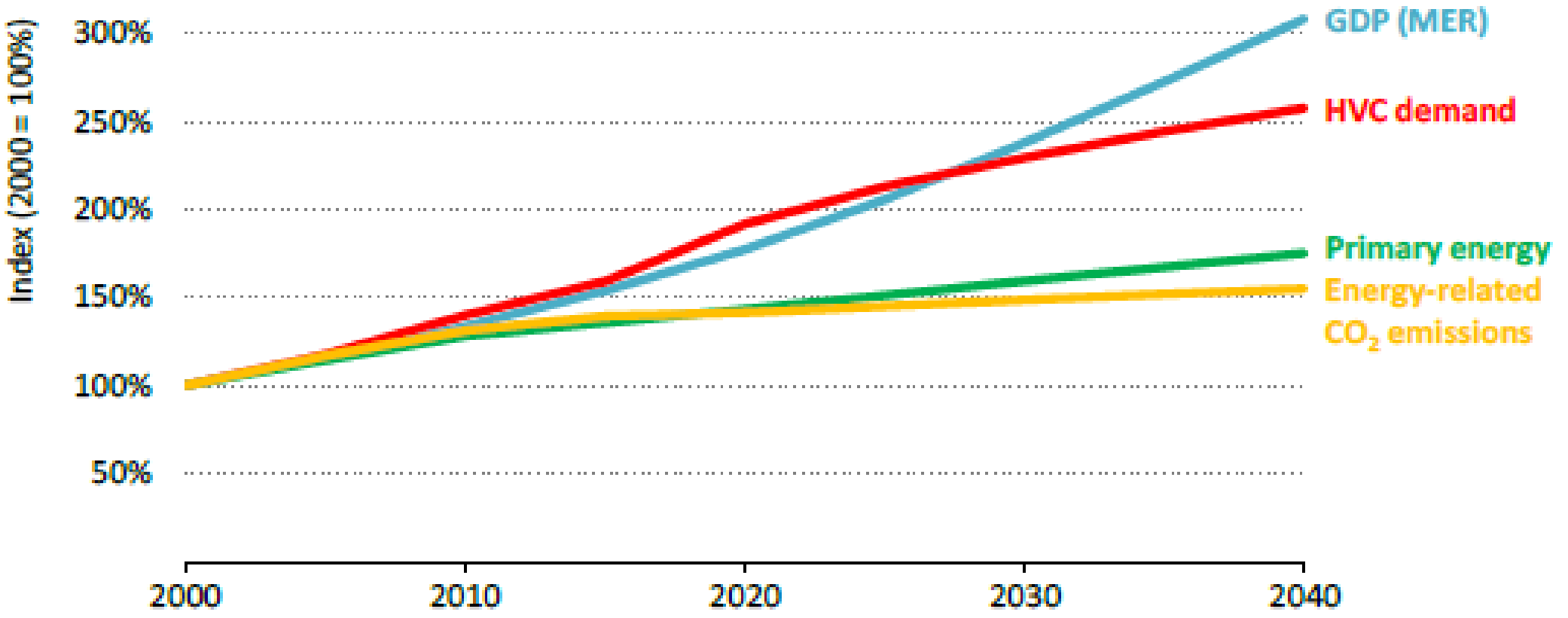
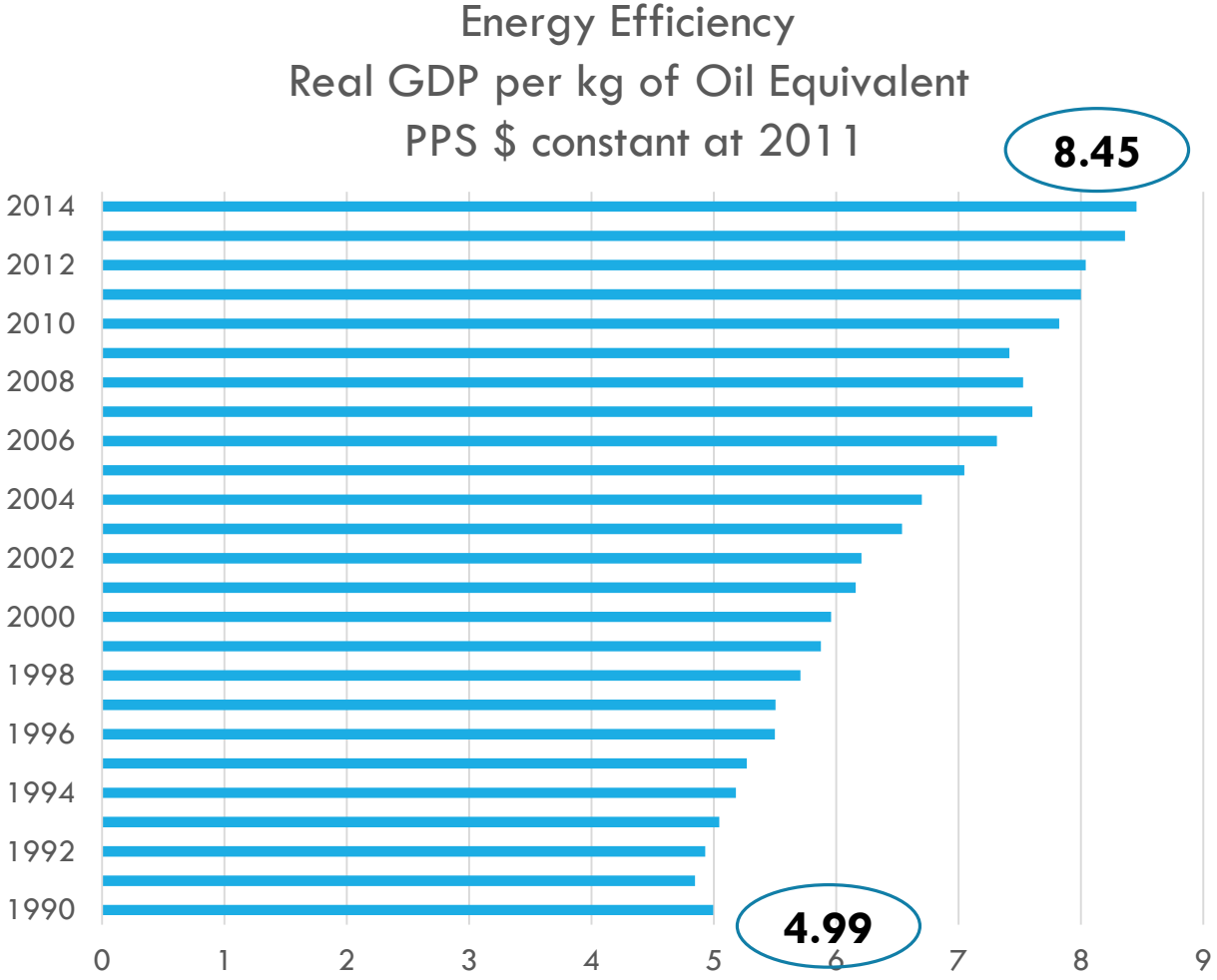
Figure 4.6 ▷ Global GDP, total primary energy demand, CO_2 emissions and chemicals demand trajectories in the New Policies Scenario

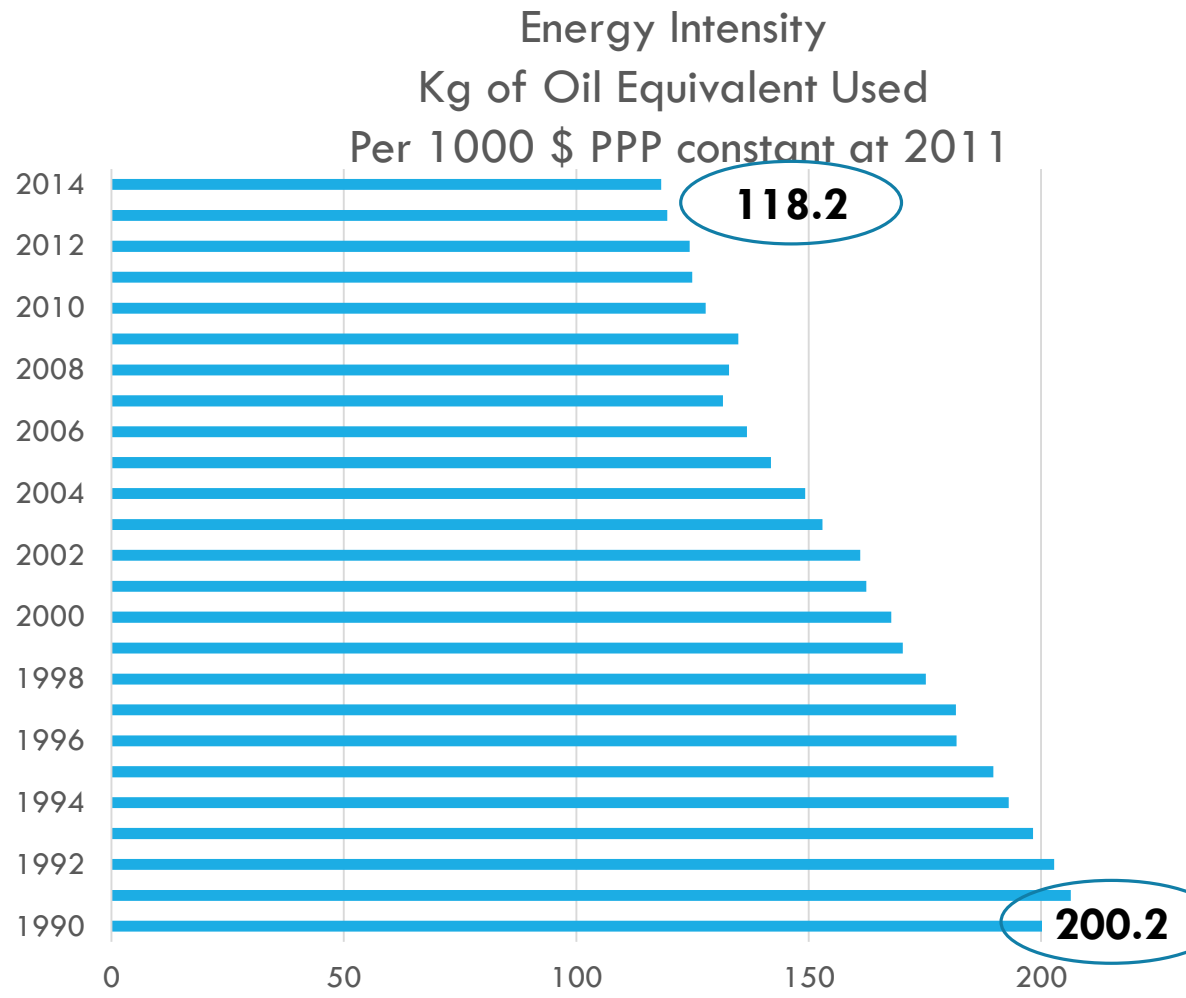


Demand for high-value chemicals tracks the trajectory of GDP more closely than primary energy demand and energy-related emissions

Note: HVC = high-value chemicals; MER = Market Exchange Rate.

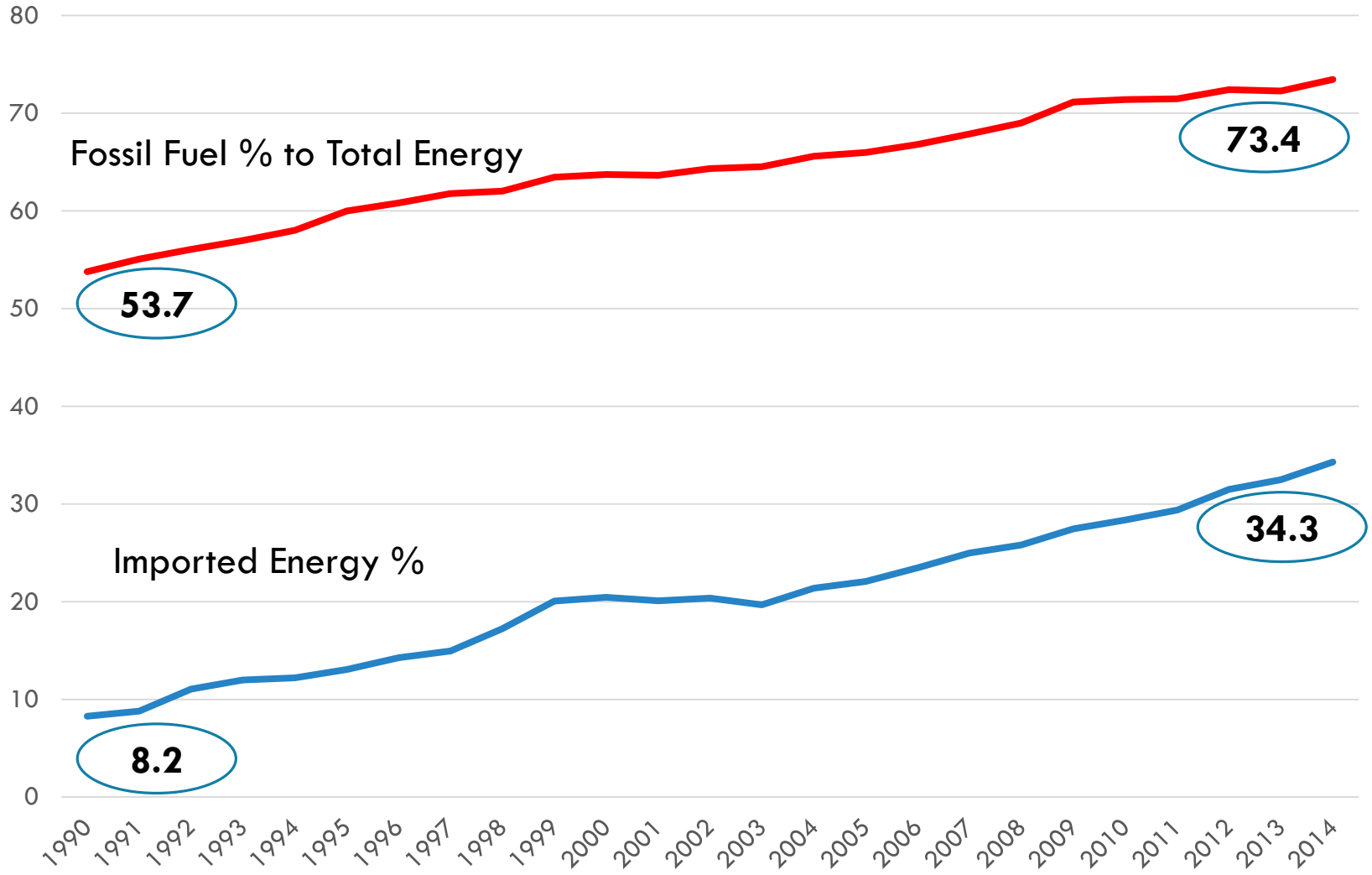
Global energy demand and specifically those of developing nations are increasing by the year. However, global energy intensity, i.e., the amount of energy used per unit of gross domestic product, has improved by 1.8% in 2015.





National Mission for Enhanced Energy Efficiency (NMEEE)
BEE,
Unnat Jeevan By Affordable LEDs and Appliances for All (UJALA) scheme is implemented by Energy Efficiency Services Limited (EESL),
UJALA, the world's largest zero-subsidy LED bulb program for domestic consumers

How much green and secured is our energy system?



Fossil fuels supply around three-quarters of India's primary energy demand. This high – and potentially growing – reliance on fossil fuels comes with two major drawbacks.

India's domestic production of fossil fuels, considered on a per-capita basis, is by far the lowest among the major emerging economies, meaning that India has a structural dependence on imported supply.

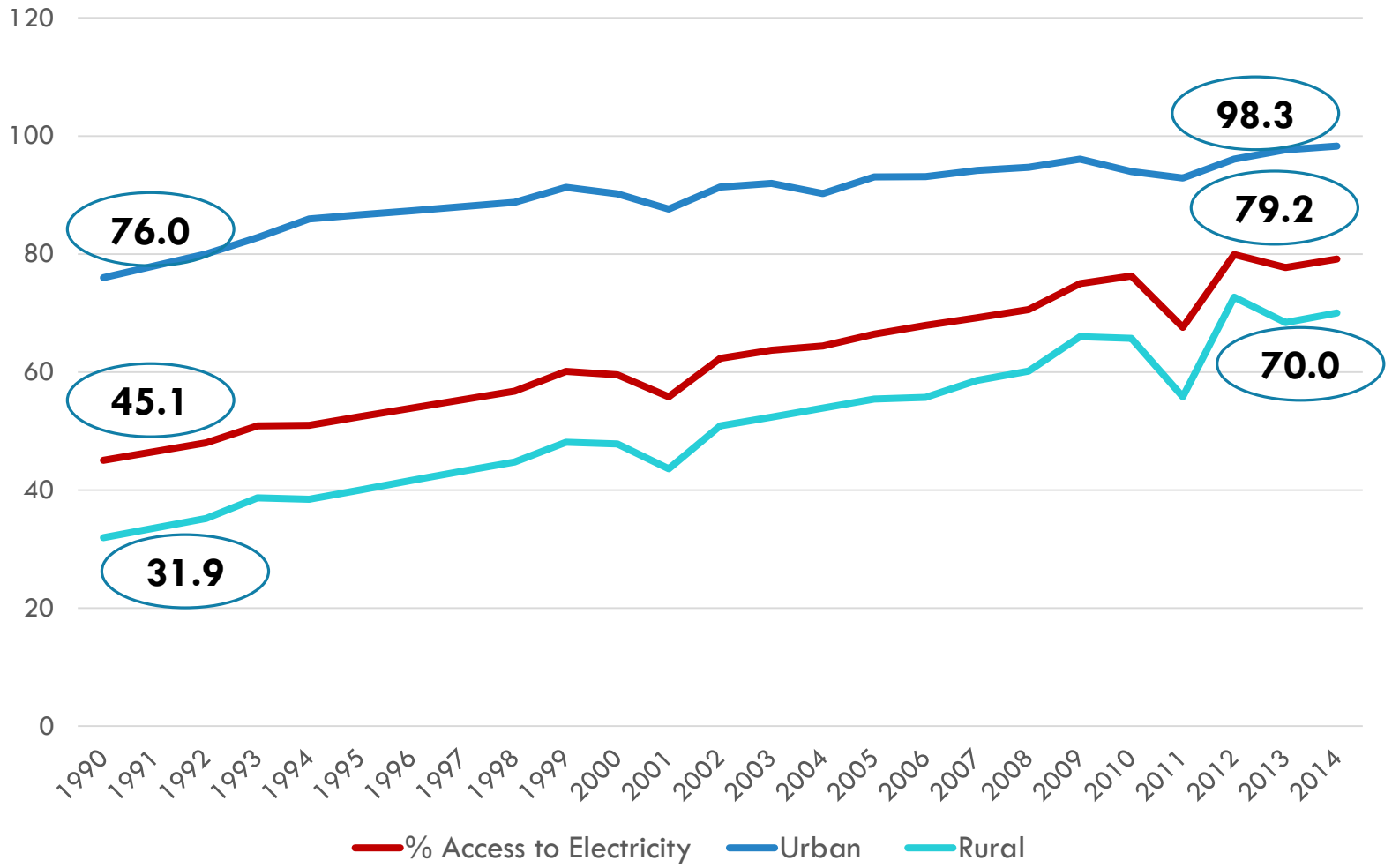
Combustion of coal and oil products contributes to pressing air quality problems in many areas, as well as to global greenhouse gas (GHG) emissions.

10% reduction in import of Crude oil is envisaged:

- Renewables,
- Energy use efficiency.
- HELP, DOF

Source: World Bank

Access to Electricity



In 2013, there were 240 million people (approximately 48 million households) – 20% of population were without access to electricity. (WEC, 2015)

As of October 2017, the number has come down to 35.3 million. (MoP, GoI)

Lack of rural electrification is pulling down the national average.

Availability, reliability, affordability are the issues.

<u>Schemes</u>
<u>(Generation, Transmission & Distribution)</u>

- YDAY
- Deen Dayal Upadhaya Gram Jyoti Yojana
- Saubhagya scheme
- Incentives for Solar, Wind

Source: World Bank

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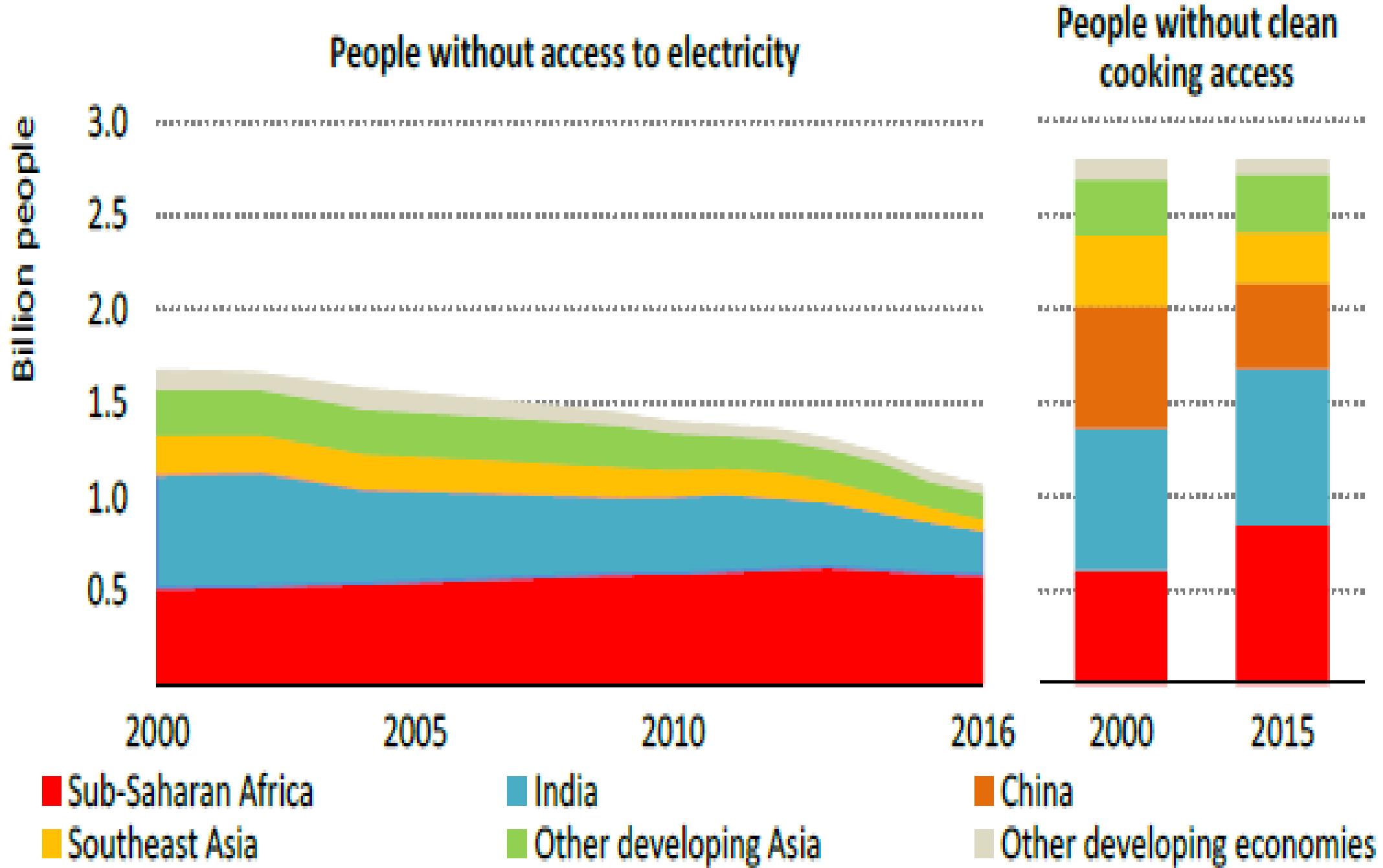

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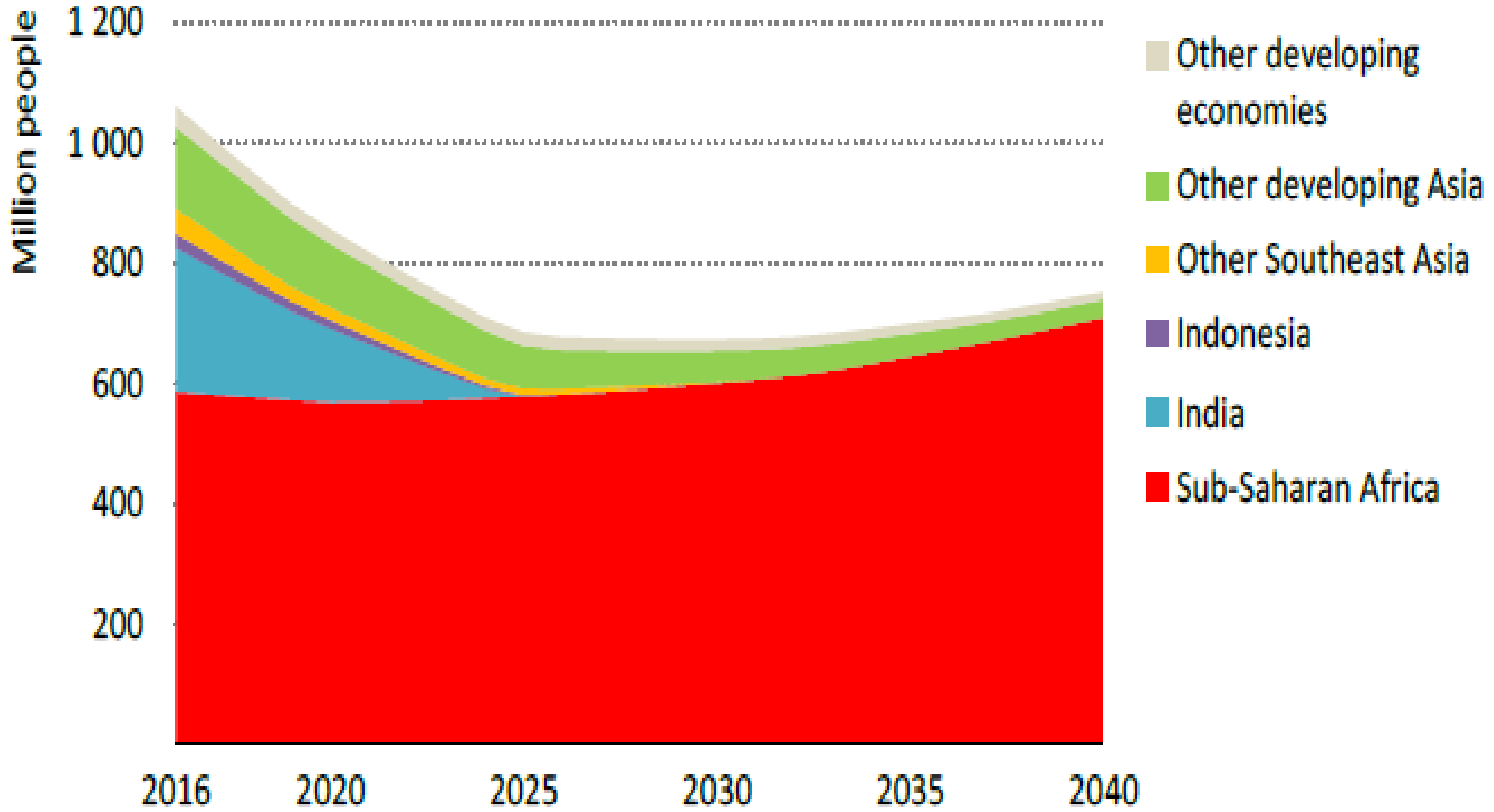
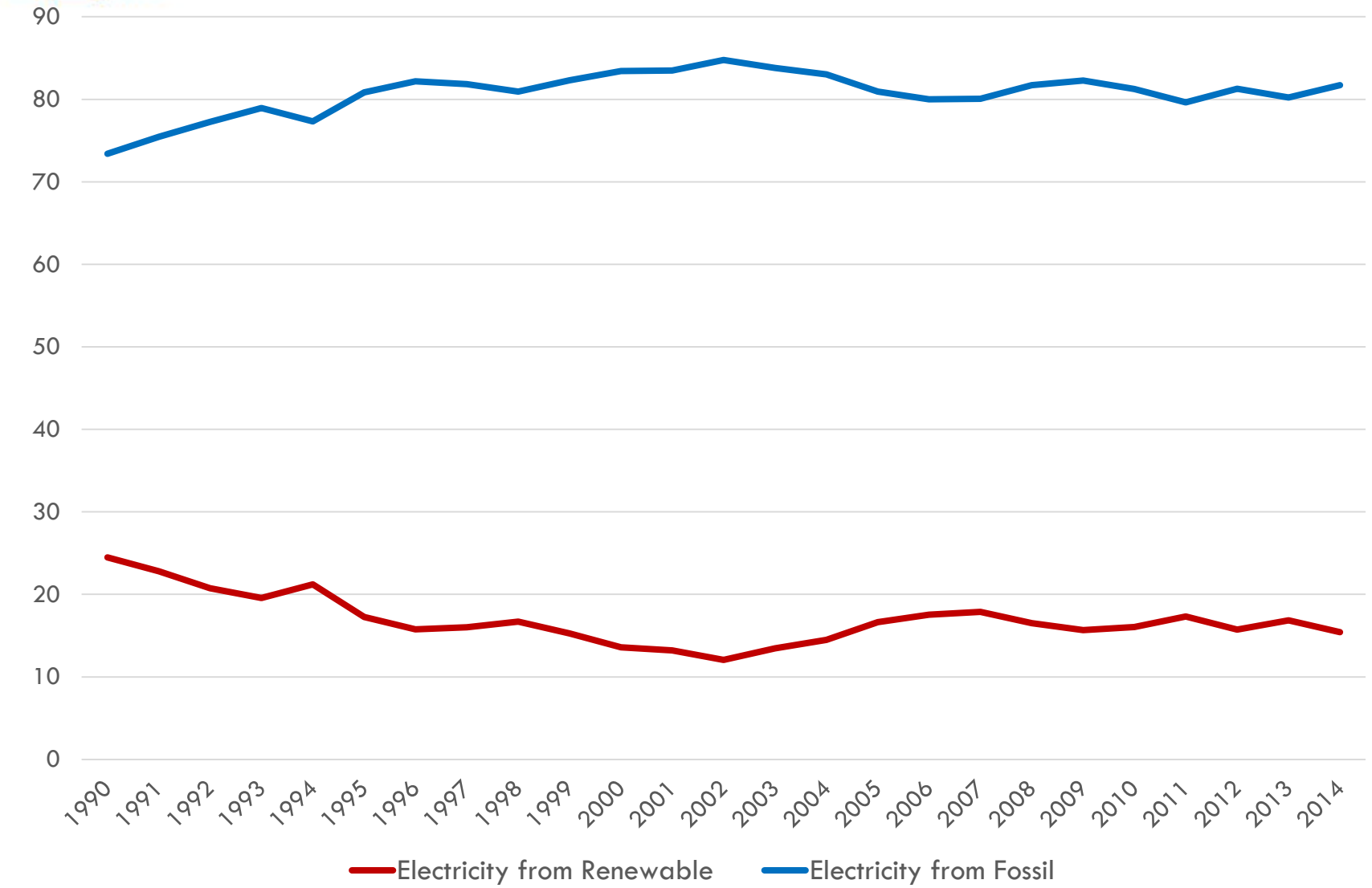
People without Access to Electricity



Sources of Electricity Production



National Energy Policy

Targets for electrification (universal "24x7" access for all by 2022);

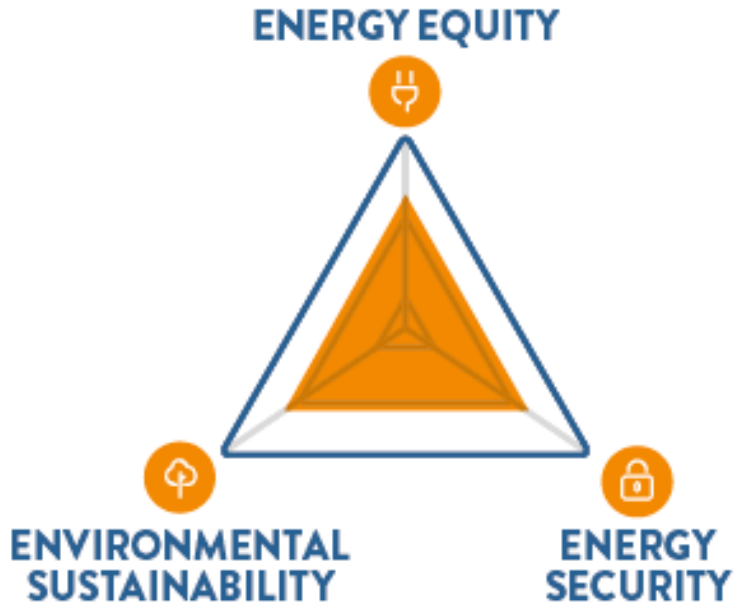
Higher share of manufacturing in GDP and

Reduction in oil imports;

175 gigawatts (GW) of renewable capacity by 2022;

Reduce the emissions intensity of the economy by 33-35% by 2030 (from the 2005 baseline)

To boost the share of non fossil-fuel capacity in the power sector to 40% over the same period.



THE THREE DIMENSIONS OF THE ENERGY TRILEMMA

Energy security: Effective management of primary energy supply from domestic and external sources, reliability of energy infrastructure, and ability of energy providers to meet current and future demand.

Energy equity: Accessibility and affordability of energy supply across the population.

Environmental sustainability: Encompasses achievement of supply- and demand-side energy efficiencies and development of energy supply from renewable and other low-carbon sources.

Source: World Energy Council, 2017

TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

92

SCORE

CCC

	2015	2016	2017	Trend	Score
Overall rank and balance score	**92**	**91**	**92**	▶	**CCC**
Energy performance					
Energy security	60	51	66	▶	C
Energy equity	93	93	96	▶	C
Environmental sustainability	96	97	92	▶	C
Contextual performance	105	100	86	▲	

Source: World Energy Council, 2017

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TRENDS AND OUTLOOK

- With a drop of 1 place this year, India ranks 92 overall. The country performs equally on all dimensions resulting in a balance score of CCC.
- India's Intended Nationally Determined Contributions (INDCs) include; reduction of emission intensity of GDP by 33−35 % by 2030 from 2005 levels; approximately 40% cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030, with the help of technology transfer and low-cost international finance from the Green Climate Fund (GCF); creation of additional carbon sink of 2.5-3 billion tonnes of CO_2 through additional forest cover by 2030.
- Recent policy directions and impacts include: 1) goal to reduce crude oil import dependence by 10% by 2022 via increasing domestic production through unified E&P policy under HELP, new fuel efficiency standards effective from April 2017, promotion of EVs (all new cars to be electric by 2030), and new biofuel policy; 2) raise the share of gas in the energy mix to 15% by 2022; 3) increase RE power capacity to 175 GW by 2022 and 275 GW by 2027; 4) new hydro policy; 5) interventions under UDAY improving DISCOMS; 6) on track for 100% village electrification by 2018; 7) EPAR compliance being implemented; 8) gradual phasing out of subsidies for kerosene with targeted subsidy via DBT; 9) second cycle of PAT for industrial energy efficiency and SEEP for super-efficient appliances; 10) DSM through large-scale replacement by LEDs; 11) smart cities.
- Key challenges include: 1) integrating large RE capacity 2) Regulations and policies keeping pace with technology; 3) improving operational performance of DISCOMS; 4) growth in manufacturing through Make-in India; 5) clean energy for all.

Source: World Energy Council, 2017

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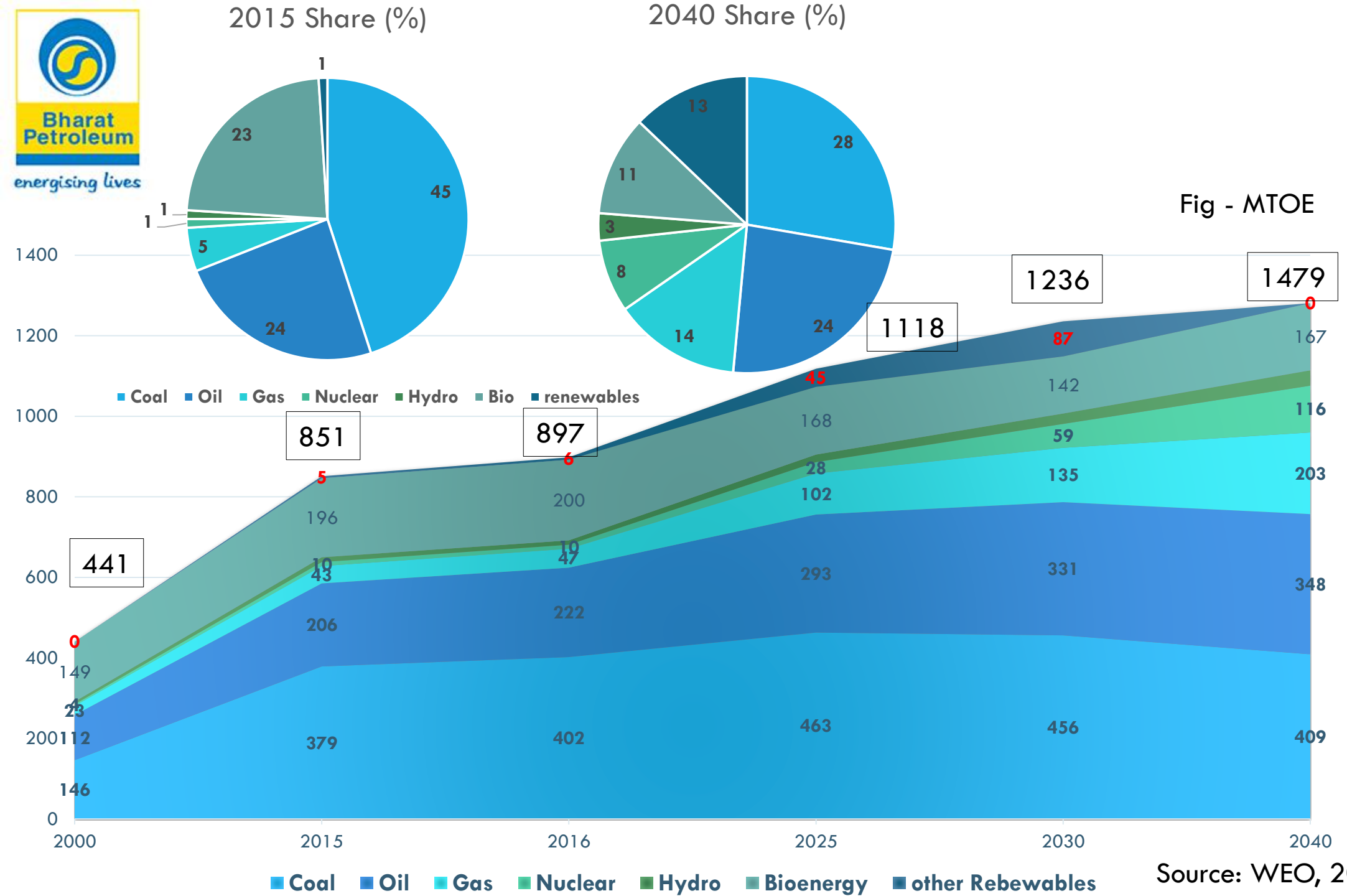
Drivers for the Grand Transition

- Policy & Regulation
- Technology Innovation
- Private Sector Initiative
- Bottom up pressure exerted by Society



CAGR % (2016-2040)

Total	2.1
Coal	0.1
Oil	1.9
Gas	6.3
Nuclear	10.9
Hydro	5.2
Bio	- 0.8
RE	15.9

Source: WEO, 2017, IEA

Some key Assumptions

CAGR %				
	2000-2016	2016-2025	2025-2040	2016-2040
GDP	7.2	7.7	5.7	6.5
Population	1.5	1.1	-	0.9

	2016	2040
Population (Million)	1327	1634
Urbanization (%)	33	45

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Three Scenarios

The New Policies Scenario is designed to show where existing policies as well as announced policy intentions might lead the energy sector. The way that policy intentions, including the NDCs, are reflected in the New Policies Scenario depends on the extent to which their realisation is supported by specific policies and implementing measures.

The Current Policies Scenario provides considering only those policies and measures enacted into legislation by mid-2017. IT excludes the realisation of announced, new policy targets and considers only the impact of those policies and measures that are firmly enshrined in legislation as of mid-2017.

And the Sustainable Development Scenario examines what it would take to achieve the main energy-related components of the "2030 Agenda for Sustainable Development" adopted in 2015 by member states of the United Nations. The three energy-related goals are: to achieve universal energy access to modern energy by 2030; to take urgent action to combat climate change; and to dramatically reduce the pollutant emissions that cause poor air quality.

Fig in MTOE

Comparison of Different Scenario in 2040

Primary Energy	Current Policy	New Policy	Sustainable Development
Coal	1060	860	409
Oil	492	450	348
Gas	139	157	203
Nuclear	52	72	116
Hydro	29	32	38
Bioenergy	210	218	167
Other Renewable	91	112	199
Total	2073	1901	1479

Source: World Energy Council, 2017

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