

Chapter

8

Sustainability and Energy



CHAPTER 8

Sustainability and Energy

Sustainability

The United Nations (UN) General Assembly, in its 70th Session held on 25th September 2015, adopted the document titled “Transforming our World: The 2030 Agenda for Sustainable Development” consisting of 17 Sustainable Development Goals (SDGs) and associated 169 targets. The SDGs are a comprehensive list of global goals integrating social, economic and environmental dimensions of development.

Realizing that Energy is critical for people deprived of the opportunity of access to sustainable energy, Goal 7 with the aim to ensure access to affordable, reliable, sustainable and modern energy to all was adopted as one of the 17 SDGs. The goal also stresses more focused attention to improve access to clean and safe cooking fuels and technologies, improve energy efficiency, increase use of renewable sources and promotion of sustainable and modern energy for all. Energy from renewable resources – wind, water, solar, biomass and geothermal energy – is inexhaustible and clean.

The targets adopted as a part of the Goal 7 of SDGs 2030 Agenda are as follows:

- I. By 2030, ensure universal access to affordable, reliable and modern energy services.
- II. By 2030, increase substantially the share of renewable energy in the global energy mix.
- III. By 2030, double the global rate of improvement in energy efficiency.
- IV. By 2030, enhance international co-operation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.
- V. By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states and land-locked developing countries, in accordance with their respective programmes of support.

This Chapter presents some of the concepts related to sustainable energy systems in continuation of the data presented earlier on renewable energy resources in the earlier chapters.

Further, “Energy Indicators for Sustainable Development: Guidelines and Methodology, 2005” by the International Atomic Energy Agency, United Nations Department of Economic And Social Affairs, International Energy Agency, Eurostat And European Environment Agency, has identified a core set of energy indicators, also called Energy Indicators for Sustainable Development, which are designed to provide information on current energy related trends in a format that aids decision making at the national level in order to help countries assess effective energy policies for action on sustainable development. While the importance of these various indicators is recognized and since Social and Environmental indicators require additional levels

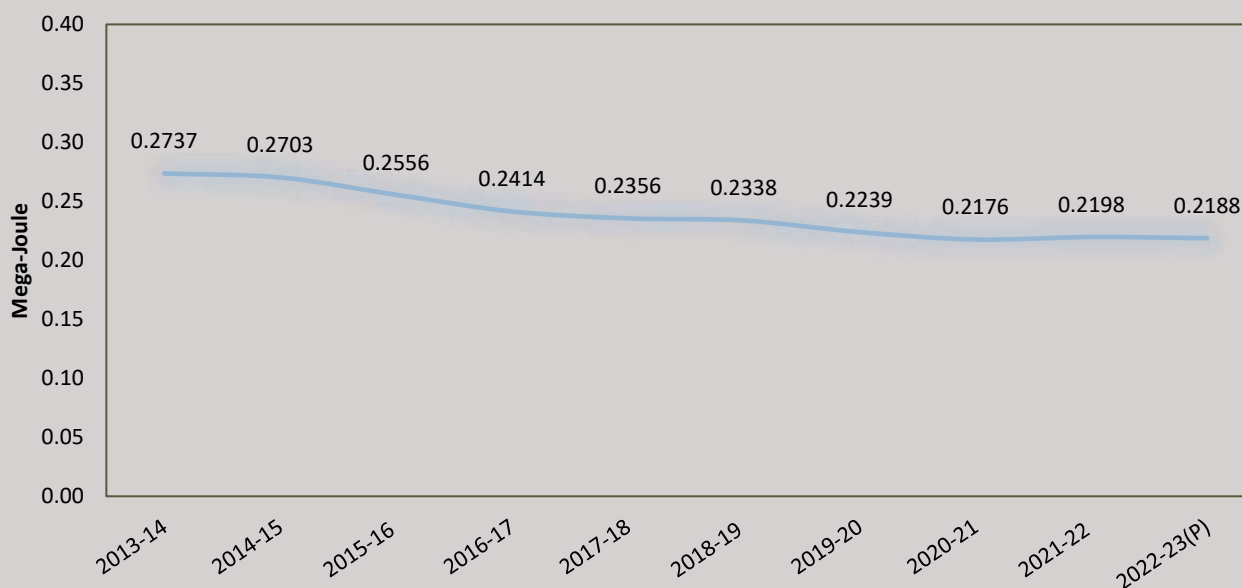
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of detail than that are presented in Energy Statistics this report is restricted to the economic dimension only and presents some of these indicators in this chapter. The details of the indicators - theme, definition, purpose and measurement method etc. are provided in the Annexures.

Highlights

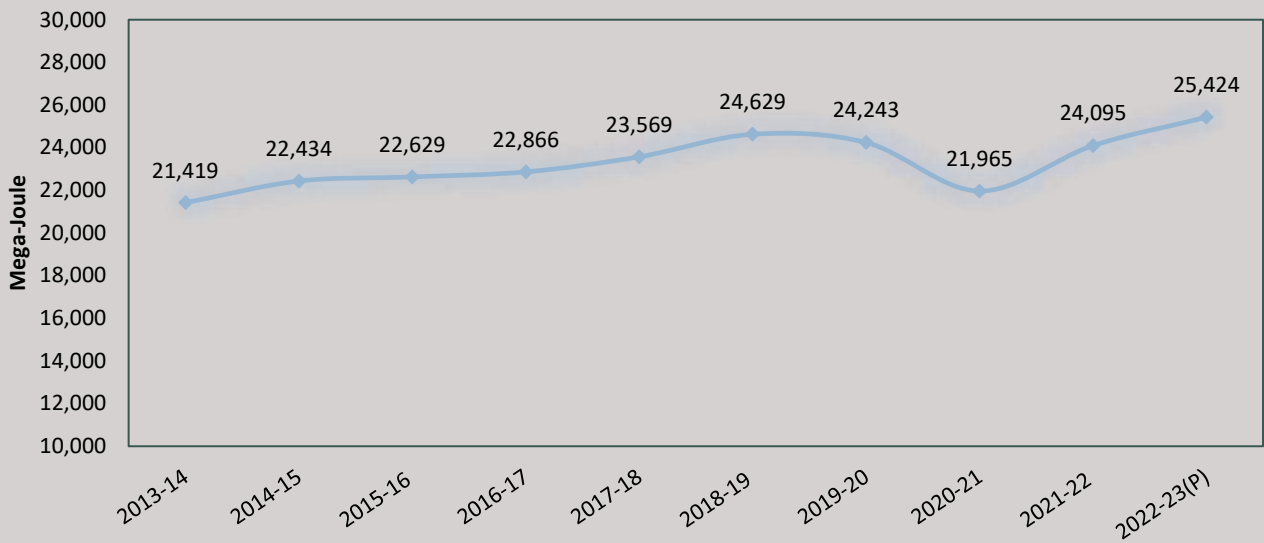
- One of the Targets identified by the Sustainable Development Goals focuses on making affordable, reliable and modern energy accessible to all people universally. To ensure the same India has been focusing on availability of electricity to all citizens of the country. As seen, state-wise number of villages electrified as on 31.03.2022 has reached 100% coverage (relative to 2011 census figures for total number of villages in the country). (Table 8.1).
- Sustainable energy systems also focus on increasing energy efficiency in the long run by improving energy intensity besides shifting to cleaner technologies, improving share of renewable energy in a countries energy mix etc.
- Energy Intensity is defined as the amount of energy consumed for generating one unit of Gross Domestic Product (at constant prices). Along with Energy Intensity, the indicator “Per Capita Energy Consumption (PEC)” is the most used policy indicator, both at national and international levels for this purpose. Per-capita Energy Consumption during a year is computed as the ratio of the estimate of total energy consumption during the year to the mid-year population of that year. In the absence of data on consumption of non-conventional energy from various sources, particularly in rural areas these two indicators are generally computed on the basis of consumption of conventional energy (Table 8.2).
- The Energy Intensity (at 2011-12 prices) decreased from 0.2198 Mega joules per rupee in 2013-14 to 0.2188 Mega Joules in 2022-23 (P).

Fig 8.1 : Energy Intensity in Megajoule per rupee from 201314 to 2022-23(P)



- Similarly, Per-capita Energy Consumption increased from 24,095 Mega joules in 2013-14 to 25,424 Mega joules in 2022-23(P).

Fig 8.2 :Per Capita Energy Consumption in India (Megajoule/Person) from 2013-14 to 2022-23(P)



- India's Total Emissions from the Energy Sector have increased from 16,51,928 GgCO₂ Equivalent in 2011 to 21,29,428 GgCO₂ Equivalent in 2016 as per the latest estimates by MoEFCC in February 2021. The major sector contributing to total emissions remains Energy Industries with its share increasing marginally from 55.95% in 2011 to 56.66 in 2016 (Table 8.3).

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Table 8.1: State-wise Number of Villages Electrified

Sl. No.	States/ UTs	No. of villages as per 2011 Census	Villages Electrified as on 31.3.2022	Villages Electrified as on 31.03.2023
1	Andhra Pradesh	16158	All Villages have been Electrified	
2	Arunachal Pradesh	5258		
3	Assam	25372		
4	Bihar	39073		
5	Chhatisgarh	19567		
6	Goa	320		
7	Gujarat	17843		
8	Haryana	6642		
9	Himachal Pradesh	17882		
10	Jammu & Kashmir	6337		
11	Jharkhand	29492		
12	Karnataka	27397		
13	Kerala	1017		
14	Madhya Pradesh	51929		
15	Maharashtra	40956		
16	Manipur	2379		
17	Meghalaya	6459		
18	Mizoram	704		
19	Nagaland	1400		
20	Odisha	47677		
21	Punjab	12168		
22	Rajasthan	43264		
23	Sikkim	425		
24	Tamil Nadu	15049		
25	Telangana	10128		
26	Tripura	863		
27	Uttar Pradesh	97813		
28	Uttarakhand	15745		
29	West Bengal	37463		
30	Andaman & Nicobar	396		
31	Chandigarh	5		
32	Dadar & Nagar Haveli	65		
33	Daman & Diu	19		
34	Delhi	103		
35	Lakshwadeep	6		
36	Puducherry	90		
Total		597464		

Source: Central Electricity Authority

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Table 8.2: Per-Capita Energy Consumption and Energy Intensity

Year	Energy Consumption in petajoules	Midyear population (in Thousands) *	GDP at 2011-12 prices (Rs. crore) **	Per Capita Energy Consumption (in Megajoules)	Energy Intensity (Megajoules per rupee)
2013-14	26,822	12,52,267	98,01,370	21,419	0.2737
2014-15	28,453	12,68,310	1,05,27,674	22,434	0.2703
2015-16	29,063	12,84,350	1,13,69,493	22,629	0.2556
2016-17	29,713	12,99,434	1,23,08,193	22,866	0.2414
2017-18	30,966	13,13,815	1,31,44,582	23,569	0.2356
2018-19	32,712	13,28,206	1,39,92,914	24,629	0.2338
2019-20	32,548	13,42,586	1,45,34,641	24,243	0.2239
2020-21	29,807	13,56,980	1,36,94,869	21,965	0.2176
2021-22	33,018	13,70,311	1,50,21,846	24,095	0.2198
2022-23(P)	35,159	13,82,894	1,60,71,429	25,424	0.2188
Growth rate of 2022-23 over 2021-22 (%)	6.48	0.92	6.99	5.52	-0.47
CAGR 2013-14 to 2022-23 (P) (%)	3.05	1.11	5.65	1.92	-2.46

P: Provisional
 Energy Intensity=Amount of energy consumed for producing one unit of Gross Domestic Product.
 * Mid-Year (as on 1st October) population has been taken from Population Projections for India and states 2011 – 2036; Report of the Technical Group On Population Projections, July, 2020
 ** GDP estimates are at base 2011-12 price as per the National Accounts Division, NSO, MoSPI.

Table 8.3 India's Total Emissions related to Energy Sector

GHG sources and removals	(GgCO2 Equivalent) *					
	2011	2012	2013	2014	2015	2016
A. Fuel Combustion activities	16,04,503	17,04,639	17,74,788	18,71,709	20,55,017	20,92,250
1. Energy Industries	9,24,258	10,05,813	10,53,981	11,40,983	11,97,123	12,06,587
2. Manufacturing industries & construction	3,38,816	3,43,603	3,56,771	3,51,910	3,94,092	3,97,739
3. Transport	2,21,202	2,36,020	2,41,253	2,50,173	2,61,517	2,74,434
4. Other sectors	1,20,228	1,19,202	1,22,783	1,28,643	2,02,286	2,13,490
B. Fugitive emission from fuels	47,426	43,047	38,771	38,057	37,084	37,179
1. Solid fuels	16,388	16,086	15,568	16,547	16,614	17,121
2. Oil and natural gas	31,037	26,961	23,203	21,511	20,470	20,058
Total Energy (A+B)	16,51,928	17,47,686	18,13,559	19,09,766	20,92,102	21,29,428

Source: India Third Biennial Update Report to The United Nations Framework Convention on Climate Change, Ministry of Environment, Forest and Climate Change, February 2021
 *GgCO2 Equivalent: Gigagrams of carbon dioxide equivalent

Energy Indicators:

- Energy indicators describe the links between energy use and human activity in a disaggregated framework. They are essential measures of energy consumption and identifying the underlying factors driving that consumption; using these data the analyst commonly constructs ratios of the energy consumed per unit of a given output (energy intensities) in order to calculate changes in energy efficiency. Using index number methodologies, the indicators can be used to measure the impact of changes in energy intensities or changes in mix of activities on total energy use. The indicators are not meant to be normative; they are descriptive and analytical. Indicators help to show how energy use is shaped by economic and technical factors, such as energy prices, economic growths and new technologies. Disaggregated measures of energy intensities are necessary to determine the impact of prices, policies or other factors on reducing energy consumption and hence transcending the system from efficient to sustainable.

- Addressing the energy security is also one of the major objectives in the sustainable development criteria of many countries. Interruptions of energy supply can cause serious financial and economic losses. To support the goals of sustainable development, energy must be available at all times, in sufficient quantities and at affordable prices. The continuous monitoring of the Sustainable Energy Indicators is the key to ensure the same. Secured energy supplies are essential to provide reliable energy services to the society for maintaining the economic activity. The monitoring of trends of net energy imports and the availability of appropriate stocks of critical fuels are important for assessing energy security.

Sustainability Energy Indicators of Economic Dimension:

- The publication *“Energy Indicators for Sustainable Development: Guidelines and Methodology, Vienna, 2005, IAEA”* presents a list of indicators on Social, Economic and Environment dimensions associated with sustainability in Energy.

- While the importance of these various indicators is recognized and since Social and Environmental indicators require additional levels of details than that are presented in Energy Statistics, thus this report is restricted to the economic dimension only.

The Sustainable Energy Indicators on the Economic Dimension is useful,

- i) To determine the sectorial energy intensity of all the major sectors of economic growth;
- ii) To determine the fuel-specific energy dependency of a nation;
- iii) To evaluate the efficiency of the supply system of energy;
- iv) To determine the import dependency of the nations for catering the energy need;
- v) To frame sustainable policies of a nation.

- The economic indicators have **two themes: Use & production patterns and Security**. The first has the sub theme of Overall Use, Overall Productivity, Supply Efficiency,

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Production, End Use, Diversification (Fuel Mix) and Prices. The second has the sub themes of Imports and strategic Fuel stocks.

List of Sustainability Energy Indicators of Economic

Theme	Sub-theme	
Use and Production Pattern	Overall Use	Energy use per capita
	Overall Productivity	Energy use per unit of GDP
	Supply Efficiency	Efficiency of energy conversion and distribution
	Production	Reserves-to-production ratio
		Resources-to-production ratio
	End Use	Industrial energy intensities
		Agricultural energy intensities
		Transport energy intensities
	Diversification (Fuel Mix)	Fuel shares in energy and electricity
		Non-carbon energy share in energy and electricity
		Renewable energy share in energy and electricity
Prices	WPI of energy sources	
Security	Imports	Net Energy Import Dependency
	Strategic fuel stocks	Stocks of critical fuels per corresponding fuel consumption

- An overview of each of the Sustainable Energy Indicators are given below:

THEME: Use and Production Pattern

1. SUB THEME: OVERALL USE

A. Energy Indicator: Energy Use per Capita:

Purpose and Measurement methodology: This indicator measures the level of energy use on per capita basis and reflects the energy-use patterns and aggregated energy intensity of a society.

The indicator is defined as:

$$\frac{\text{(Total annual supply or use of energy)}}{\text{(mid-year population)}}$$

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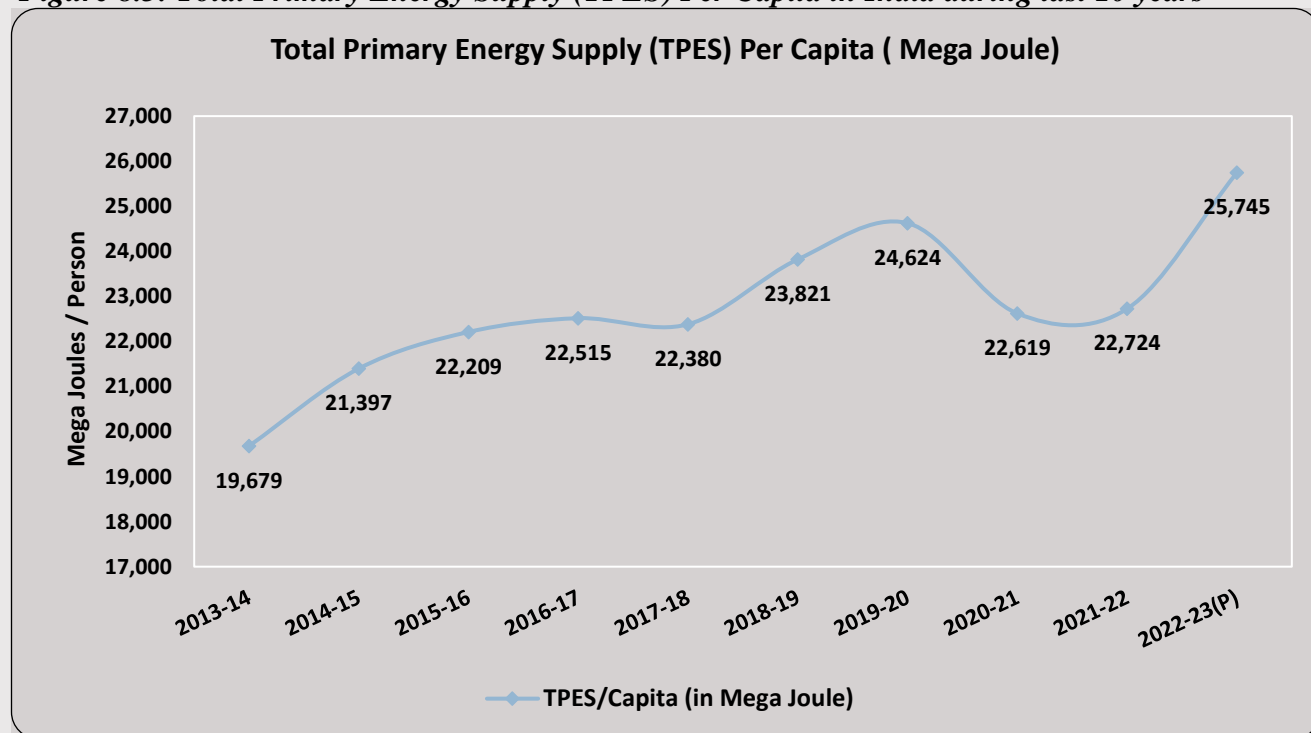
It is calculated as the ratio of the total annual use of energy to the mid-year population. It may be further classified into three (3) categories, which are given as below:

- a) Total Primary Energy Supply (TPES) per capita
- b) Total Final Consumption (TFC) of energy per capita
- c) Electricity consumption per capita

Table 8.4: Energy Use per Capita in India during last 10 years.

Year	TPES per capita (Mega Joule)	Total Final Consumption per capita (Mega Joule)	Electricity consumption per capita (KwH)
2013-14	19,679	13,839	698
2014-15	21,397	14,682	748
2015-16	22,209	15,212	780
2016-17	22,515	15,284	817
2017-18	22,380	15,896	855
2018-19	23,821	16,896	911
2019-20	24,624	16,635	930
2020-21	22,619	15,634	907
2021-22	22,724	15,754	961
2022-23(P)	25,745	16,699	1015

Figure 8.3: Total Primary Energy Supply (TPES) Per Capita in India during last 10 years



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Figure 8.4: Total Final Consumption (TFC) per Capita in India during last 10 years

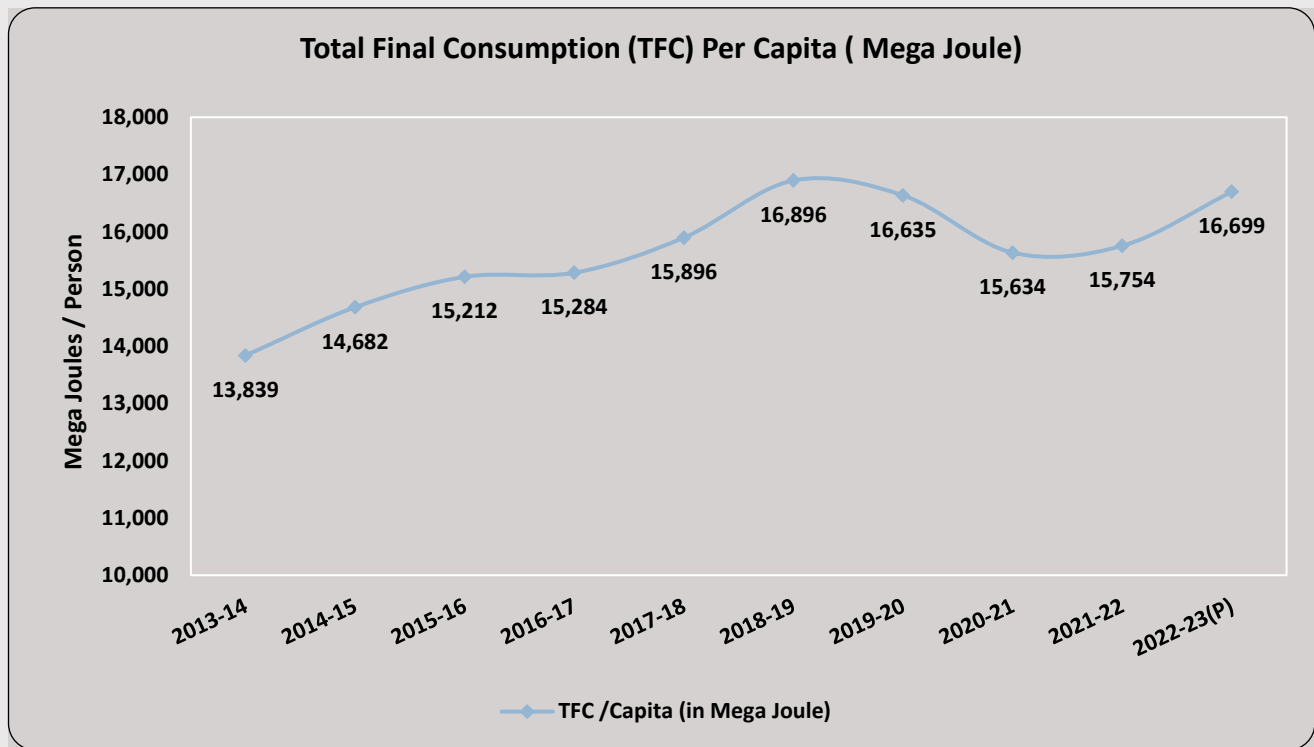
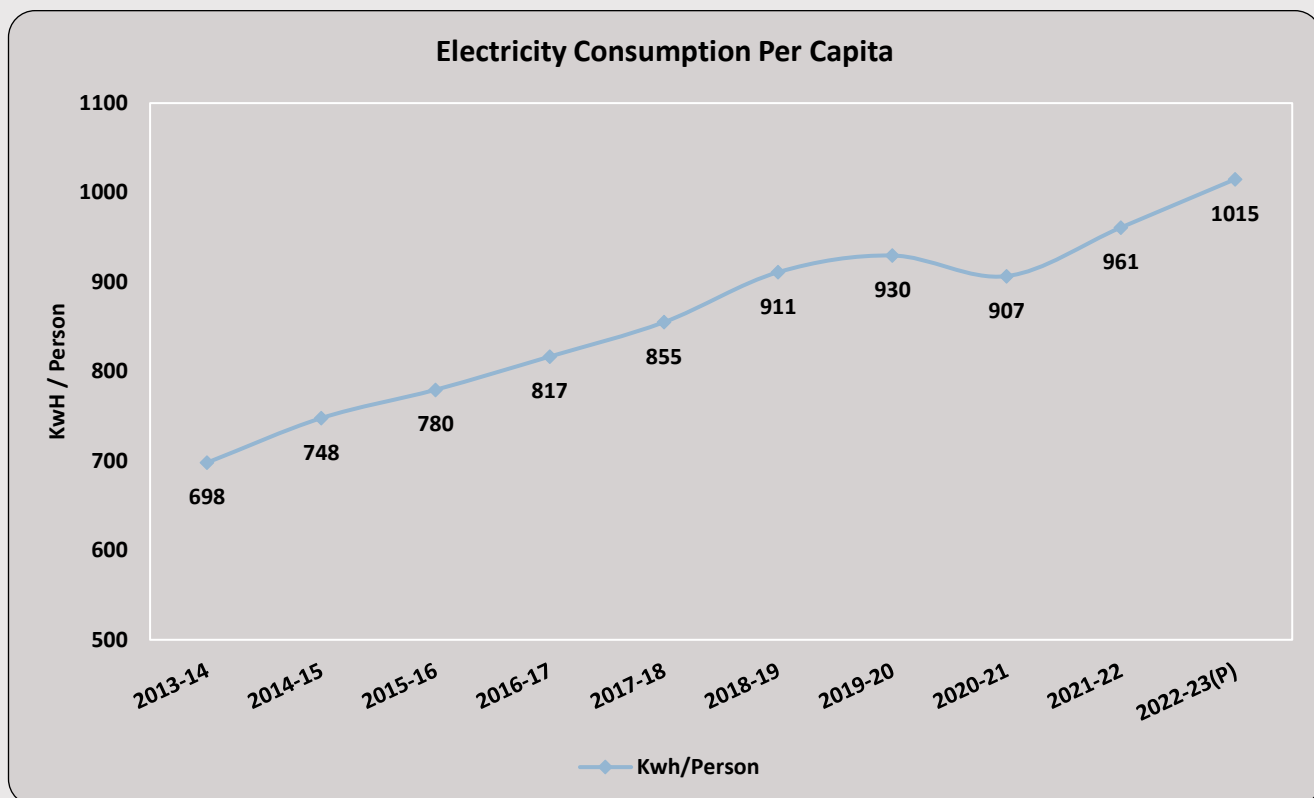


Figure 8.5: Electricity Consumption per Capita in India during last 10 years



2. SUB THEME: OVERALL PRODUCTIVITY:

A. Energy Indicator: Energy Use per Unit of GDP:

Purpose and Measurement methodology: This indicator reflects the trends in overall energy use relative to GDP, indicating the general relationship of energy use to economic development.

The indicator is defined as:

$$(Total\ supply\ or\ use\ of\ energy / GDP\ at\ constant\ price)$$

It has been further classified into three (3) categories, which are given as below:

- a) Total Primary Energy Supply (TPES) per 000’ rupees of GDP
- b) Total Final Consumption (TFC) of energy per 000’ rupees of GDP
- c) Electricity Use per 000’ rupees of GDP

Table 8.5: Energy Consumption per 000’ rupees of GDP during last 10 years

Year	TPES (Mega Joule) / '000 Rs.	TFC (Mega Joule) / '000 Rs	Electricity Consumption (Kwh)/ '000 Rs
2013-14	251.43	176.81	8.92
2014-15	257.78	176.88	9.01
2015-16	250.88	171.84	8.81
2016-17	237.70	161.36	8.62
2017-18	223.69	158.88	8.55
2018-19	226.11	160.37	8.65
2019-20	227.46	153.66	8.59
2020-21	224.13	154.91	8.98
2021-22	207.29	143.71	8.77
2022-23(P)	221.53	143.69	8.73

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Figure 8.6: Total Primary Energy Supply (TPES) per '000 Rs. of GDP during last 10 years

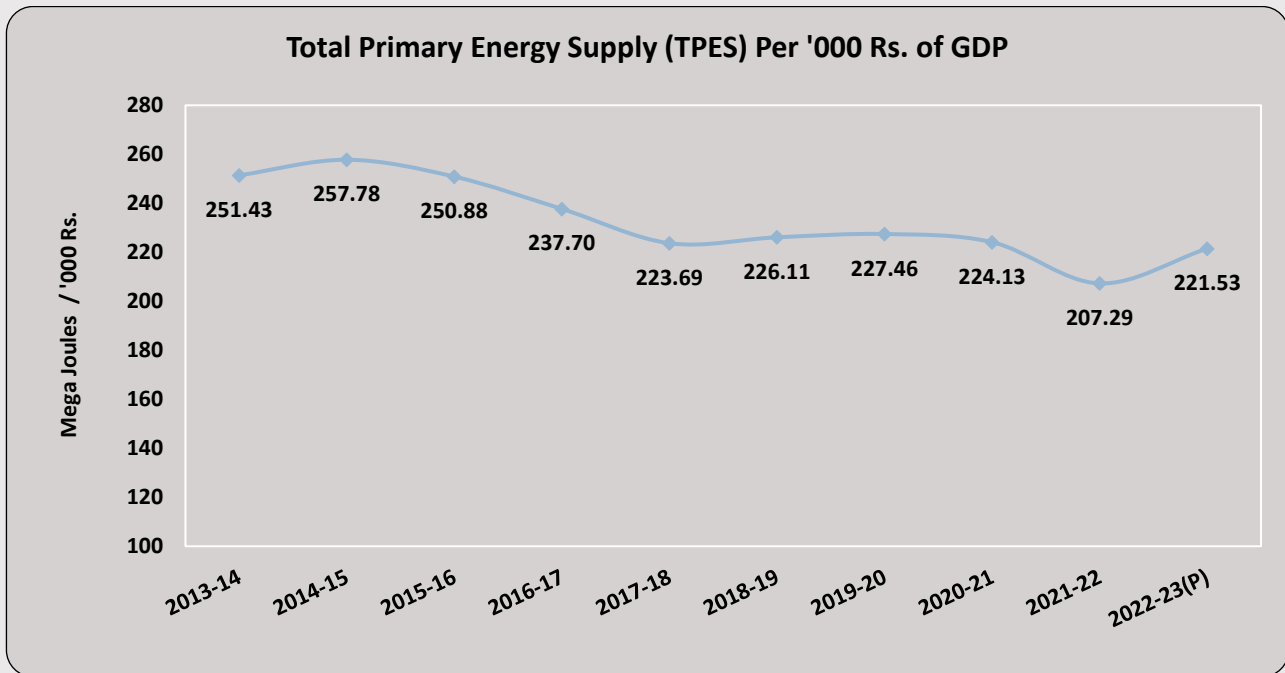
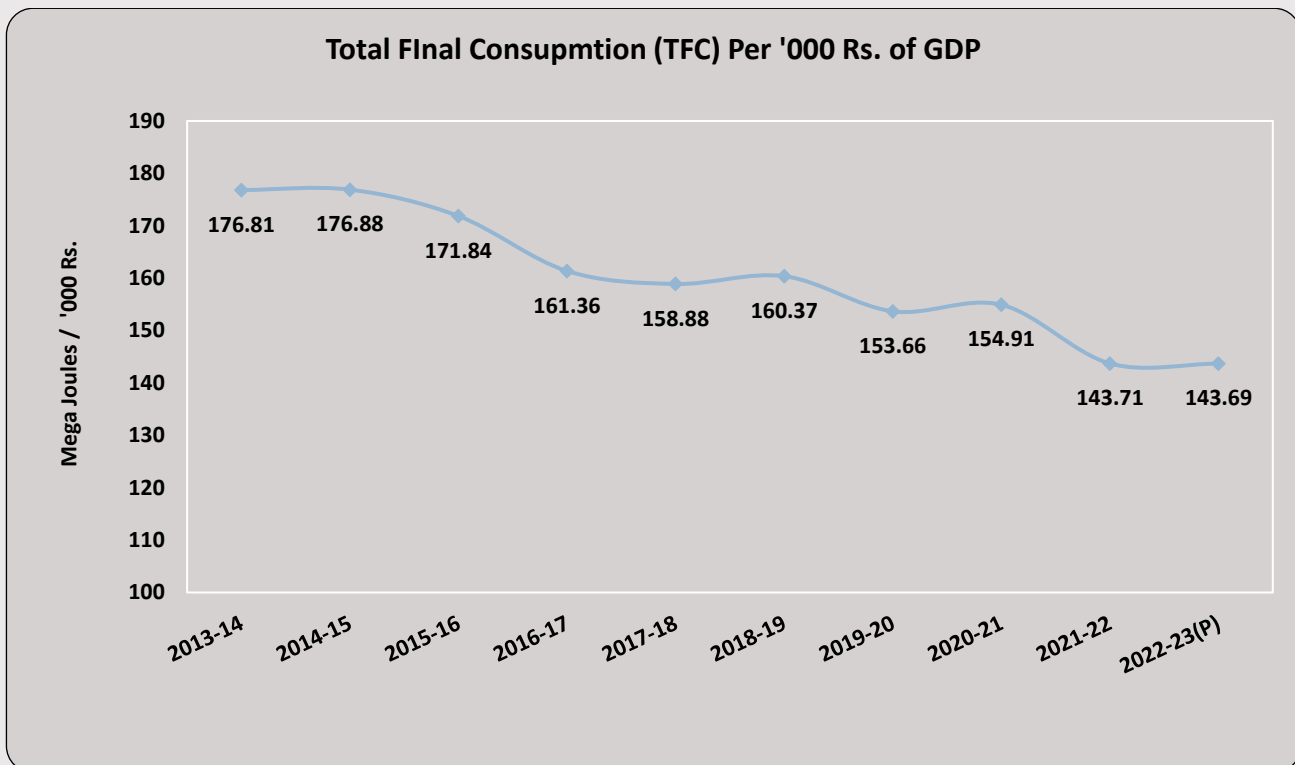


Figure 8.7: Total Final Consumption (TFC) per '000 Rs. of GDP during last 10 years



3. SUB THEME: SUPPLY EFFICIENCY

A. Energy Indicator: Efficiency of energy conversion and distribution:

Purpose and Measurement methodology: – This indicator measures the efficiency of energy conversion and distribution systems in various energy supply chains including losses occurring during electricity transmission and distribution, and gas transportation and distribution. Due to constraint of data availability only the losses in transmission of electricity are used.

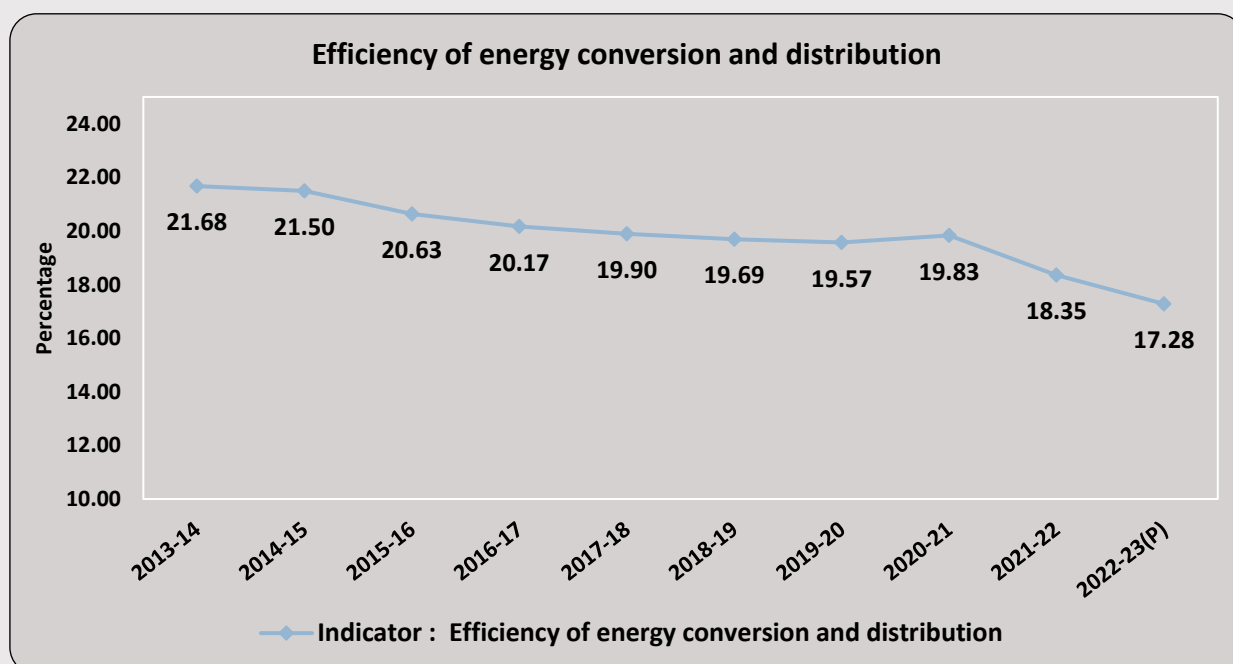
The indicator is calculated as:

$$\left(\frac{\text{Losses in transmission of electricity}}{\text{Gross generation of electricity}} \right)$$

Table 8.6: Efficiency in energy conversion and distribution

Year	Percentage of Losses (w.r.t Production) in Electricity
2013-14	21.68
2014-15	21.50
2015-16	20.63
2016-17	20.17
2017-18	19.90
2018-19	19.69
2019-20	19.57
2020-21	19.83
2021-22	18.35
2022-23(P)	17.28

Figure 8.8: Percentage of ‘Loss’ in Electricity in India during last 10 years.



4. SUB THEME: PRODUCTION

A. Energy Indicator: Reserve-to-Production Ratio:

Purpose and Measurement methodology: – The purpose of this indicator is to measure *the availability of national energy reserves with respect to corresponding fuel production*. Reserves are generally defined as *identified resources* (demonstrated and inferred) that are economically recoverable at the time of assessment. The indicator provides a basis for estimating future energy supplies in years with respect to current availability of energy reserves and levels of production.

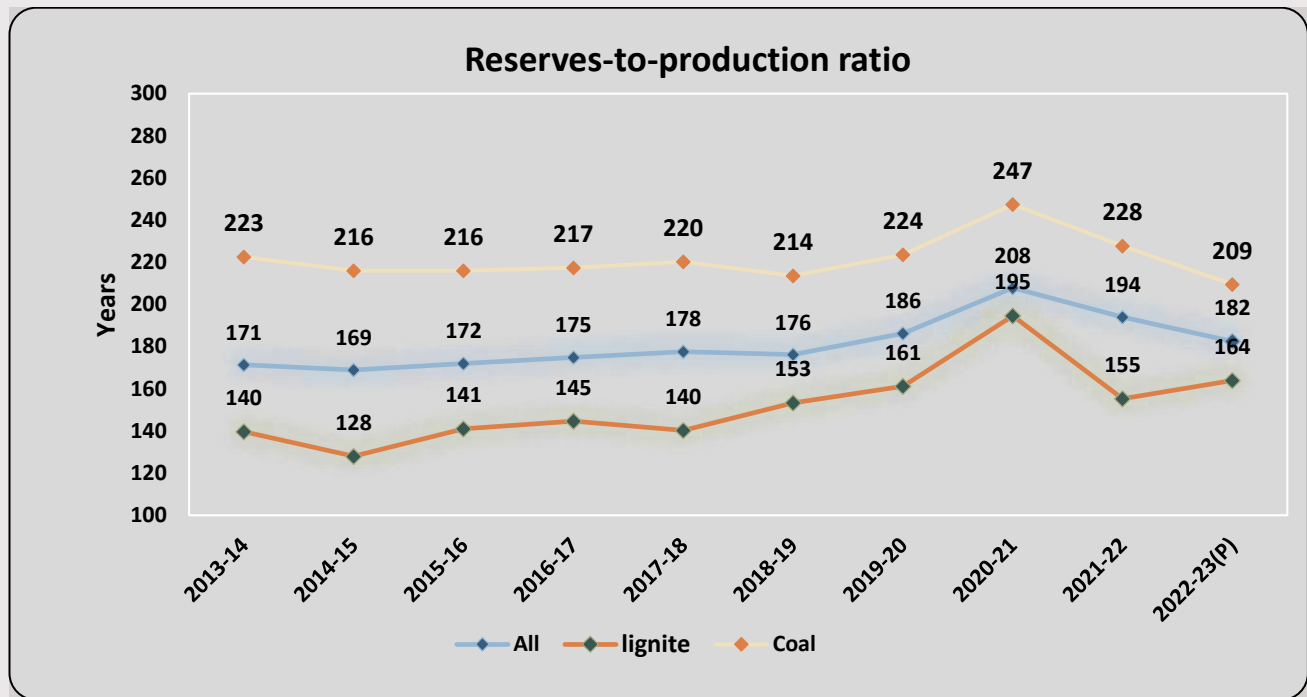
The indicator is computed as:

$$\left(\frac{\text{Proven energy reserves of a commodity at the end of a year}}{\text{Total production of that commodity in that year}} \right)$$

Table 8.7: Reserve to Production Ration of Coal, Lignite and All (Coal, lignite, Crude Oil and Natural Gas) during last 10 years (in Year)

Year	Reserves to Production Ratio (Coal)	Reserves to Production Ratio (Lignite)	Reserves to Production Ratio (All)
2013-14	223	140	171
2014-15	216	128	169
2015-16	216	141	172
2016-17	217	145	175
2017-18	220	140	178
2018-19	214	153	176
2019-20	224	161	186
2020-21	247	195	208
2021-22	228	155	194
2022-23(P)	209	164	182

Figure 8.9: Reserve to Production Ratio during last 10 years



B. Energy Indicator: Resources to Production Ratio:

Purpose and Measurement methodology: – The purpose of this indicator is to measure the availability of national energy resources with respect to corresponding fuel production. *Total resources include reserves, and hypothetical and speculative undiscovered resources.* It provides a relative measure of the length of time that resources would last if production were to continue at current levels.

The indicator is measured as:

$$\left(\frac{\text{Proven energy resources of a commodity at the end of a year}}{\text{Total production of that commodity in that year}} \right)$$

Table 8.8: Resource to Production Ratio of all Energy Commodities during last 10 years (in Year)

Year	Resources to Production Ratio (Crude Oil)	Resources to Production Ratio (Natural Gas)	Resources to Production Ratio (Coal)	Resources to Production Ratio (Lignite)	Reserves to Production Ratio (All)
2013-14	20	40	533	977	423
2014-15	17	37	503	914	408
2015-16	17	38	483	1017	400
2016-17	17	40	479	988	400
2017-18	17	41	472	979	397
2018-19	18	42	448	1033	385
2019-20	19	44	471	1093	408
2020-21	19	48	492	1214	429
2021-22	20	40	452	969	399
2022-23(P)	22	33	405	1027	366

5. SUB THEME: END USE

A. Energy Indicator: Sectoral Energy Intensities

This indicator aims to measure the sectoral energy-intensity of major energy-consuming sectors. How efficiently the technologies are being used in different sectors to improve the efficiency of energy-generation, gets captured in this Indicator. The use of sophisticated and environment-friendly technology in generating the revenue of any sector will imply lesser use of energy to do so.

The indicator has been measured as:

$$\left(\text{Amount of energy consumed against a sector} / \text{GVA of that sector} \right)$$

The indicator is computed against the following major consuming end-use sectors of Energy:

I. Industrial Energy Intensities-

This set of indicators measures the aggregate energy use of the industrial sector and selected energy intensive industries per corresponding value added. Intensities provide information about the relative energy use per thousand units of output. The set is used to analyze trends in energy efficiency and evaluating trends in technological improvements. It is measured as Energy Use per thousand units of value added by industrial sector and by selected energy intensive industries.

II. Transport Energy Intensities

This indicator is used to monitor trends in energy use in the Transport sector. It is measured as Energy Use per thousand units of value added by Transport sector. The transport indicators measure how much energy is used for moving both goods and people. Transport is a major user of energy, mostly in the form of oil products, which makes transport the most important driver behind growth in global oil demand.

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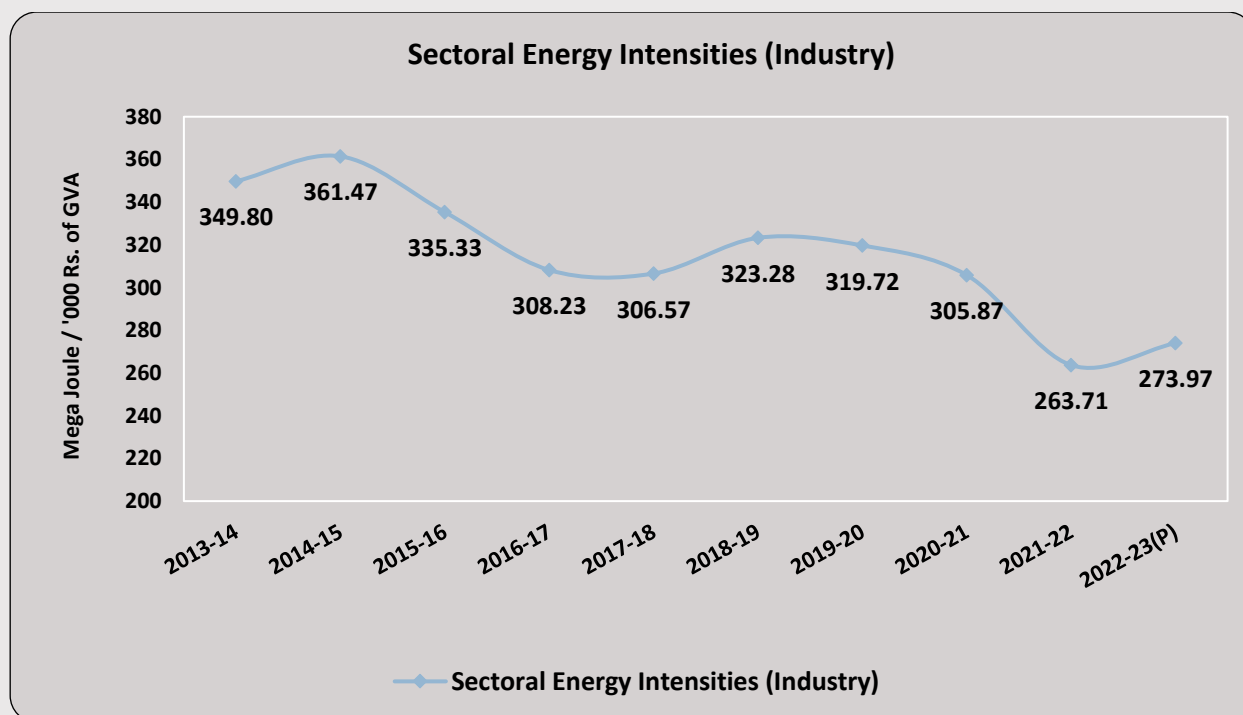
II. Agricultural Energy Intensities:

This indicator is a measure of aggregate energy intensity in the agricultural sector that can be used for analyzing trends, particularly in renewable and non-commercial energy use. It is measured as Energy Use per thousand units of value added by Agriculture sector.

Table 8.9: Energy Intensity (in MJ/'000 Rs. of GVA) of major sectors during last 10 years

Year	Industry	Agriculture	Transport
2013-14	349.80	36.00	322.35
2014-15	361.47	40.02	328.72
2015-16	335.33	40.88	346.76
2016-17	308.23	41.95	366.52
2017-18	306.57	40.99	376.60
2018-19	323.28	43.04	385.37
2019-20	319.72	40.11	399.66
2020-21	305.87	40.20	422.84
2021-22	263.71	39.48	395.01
2022-23(P)	273.97	39.16	410.13

Figure 8.10: Sectoral Energy Intensity of Industry Sector during last 10 years



B. Energy Indicator: Sectoral Electricity Intensities

This indicator aims to measure the sectoral electricity-intensity of major energy-consuming sectors. The indicator is closely related to the *Sectoral Energy Indicator*. It aims to measure how efficiently the technologies are being used in different sectors to improve the efficiency of electricity consumed.

The indicator has been measured as:

$$\text{(Amount of electricity consumed against a sector / GVA of that sector)}$$

The indicator is also computed against the following major consuming end-use sectors of Energy:

I. Industrial Electricity Intensities:

This Indicator aims to represent the average use of electricity per thousand units of output. It is worth noting that the specific functions of agriculture as an energy producer and agro. ecosystem regenerator are important components of sustainable development programmes in some countries.

II. Agricultural Electricity Intensities:

This Indicator aims to measure the effective use of electricity in the field of Agriculture. How efficiently we are able to make use of the energy resources to generate a greater amount of electricity in the field of Agriculture over time can be measures using this Indicator.

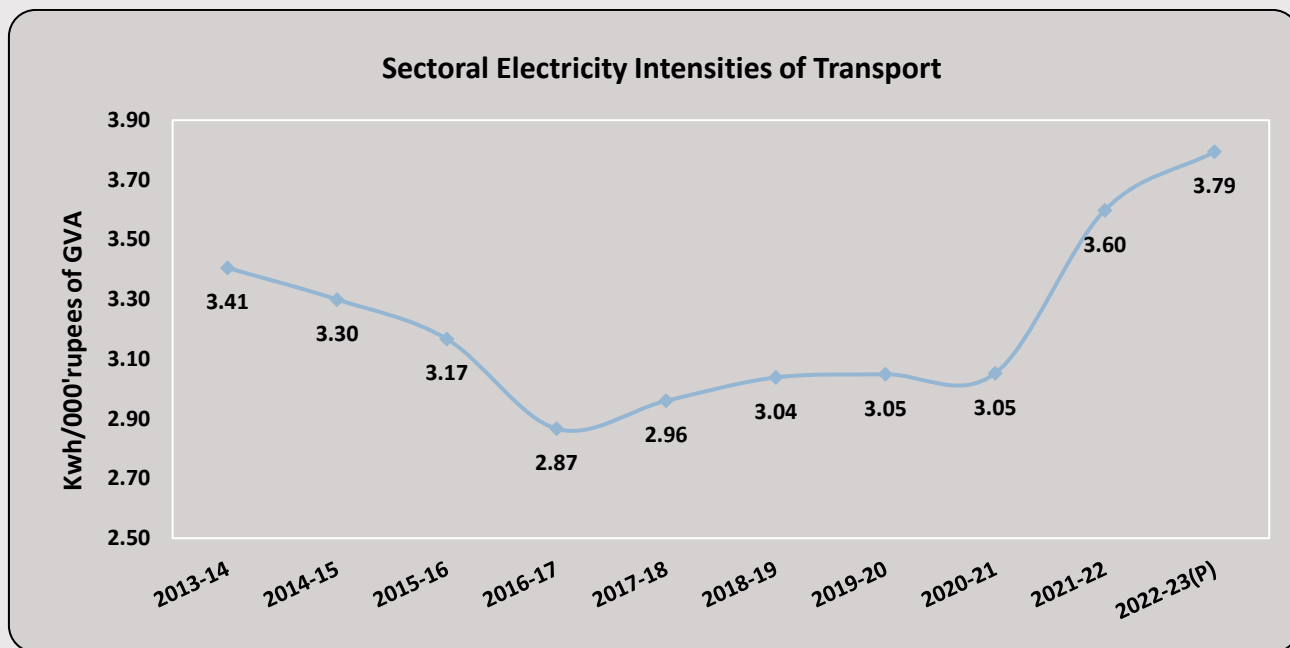
III. Transport Energy Intensities:

This Indicator aims to measure the effective use of electricity in the field of Transport. How efficiently we are able to make use of the energy resources to generate a greater amount of electricity in the field of Agriculture over time can be measures using this Indicator.

Table 8.10: Electricity Intensity (in Kwh / '000 Rs. of GVA) of major sectors of Economy during last 10 years

Year	Industry	Agriculture	Transport
2013-14	14.65	9.49	3.41
2014-15	14.90	10.52	3.30
2015-16	13.72	10.72	3.17
2016-17	13.26	11.07	2.87
2017-18	13.38	10.83	2.96
2018-19	14.10	11.36	3.04
2019-20	14.72	10.59	3.05
2020-21	14.07	10.67	3.05
2021-22	13.69	10.53	3.60
2022-23(P)	14.42	10.60	3.79

Figure 8.11: Sectoral Electricity Intensity of Transport sector during last 10 years



6. SUB THEME: DIVERSIFICATION (FUEL MIXED)

A. Energy Indicator: Fuel share in Total Primary Energy Supply (TPES):

This indicator aims to measure the share of different energy-commodities in the Total Primary Energy Supply (TPES). The indicator depicts the dependency of the nation over a particular fuel and also helps us to understand that in a country like India what is the trend of fuel-specific dependency over time. How much we have been able to shift from fossil fuel to non-fossil fuel.

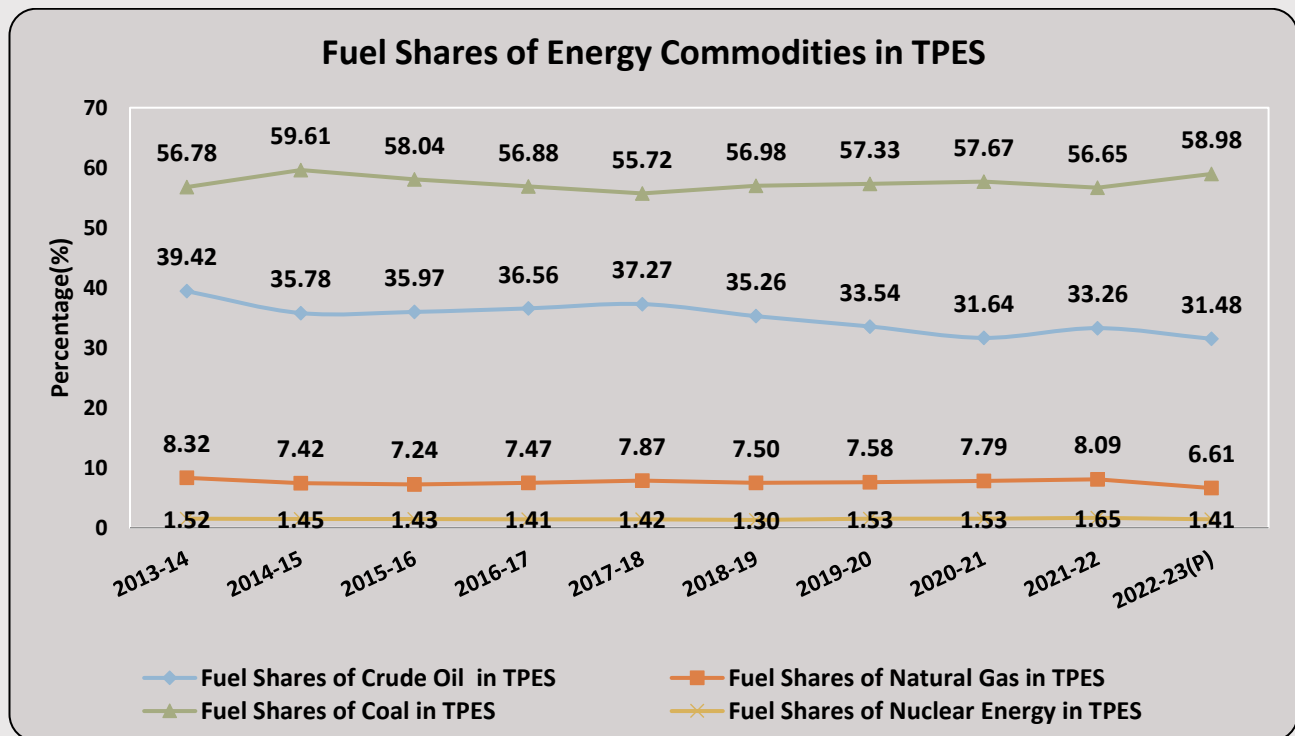
This indicator is measured as:

$$\text{(Energy supplied by a particular energy-commodity / Total Primary Energy Supply (TPES))}$$

Table 8.11: Fuel share of major Energy Commodities in TPES during last 10 years (in percentage)

Year	Crude Oil	Natural Gas	Coal	Nuclear	Renewable Energy
2013-14	39.42	8.32	56.78	1.52	2.96
2014-15	35.78	7.42	59.61	1.45	2.73
2015-16	35.97	7.24	58.04	1.43	2.39
2016-17	36.56	7.47	56.88	1.41	2.54
2017-18	37.27	7.87	55.72	1.42	2.82
2018-19	35.26	7.50	56.98	1.30	3.02
2019-20	33.54	7.58	57.33	1.53	3.28
2020-21	31.64	7.79	57.67	1.53	3.58
2021-22	33.26	8.09	56.65	1.65	3.81
2022-23(P)	31.48	6.61	58.98	1.41	3.79

Figure 8.12: Fuel share of energy commodities in TPES during last 10 years



B. Energy Indicator: Fuel share in Total Final Consumption (TFC):

This indicator aims to measure the share of different energy-commodities in the total consumption of energy. The indicator depicts the dependency of the nation over a particular fuel and also helps us to understand that in a country like Indian where we are having an increasing demand of energy, how much we have able to meet from which energy-commodity.

This indicator is measured as:

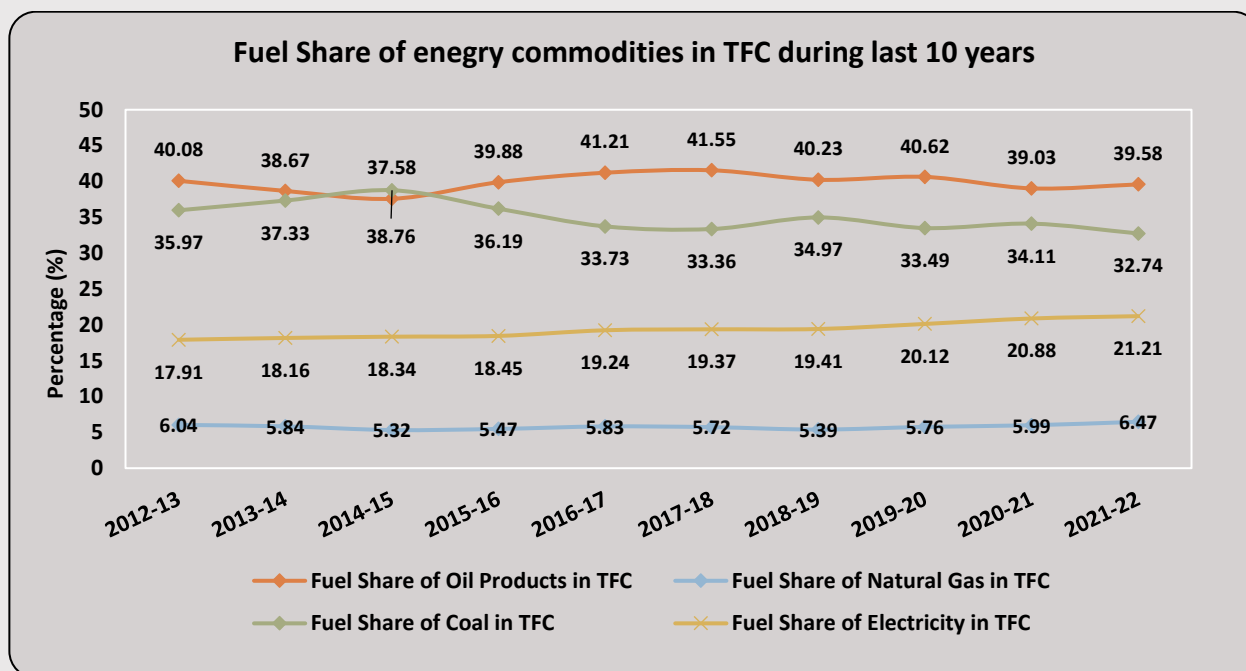
$$\left(\frac{\text{Energy consumed from a particular energy-commodity}}{\text{Total Final Consumption (TFC)}} \right)$$

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Table 8.12: Fuel share different energy commodities in TFC during last 10 years (in Percentage)

Year	Oil Products	Coal	Natural Gas	Electricity
2013-14	38.67	37.33	5.84	18.16
2014-15	37.58	38.76	5.32	18.34
2015-16	39.88	36.19	5.47	18.45
2016-17	41.21	33.73	5.83	19.24
2017-18	41.55	33.36	5.72	19.37
2018-19	40.23	34.97	5.39	19.41
2019-20	40.62	33.49	5.76	20.12
2020-21	39.03	34.11	5.99	20.88
2021-22	40.01	31.43	6.60	21.96
2022-23(P)	41.18	30.55	6.39	21.88

Figure 8.13: Fuel share of energy commodities in TFC during last 10 years



C. Energy Indicator: Fuel share in Electricity:

This indicator aims to measure the share of different energy-commodities in the total generation of electricity. The indicator depicts the dependency of the nation over a fossil fuel, what is the trend of use of thermal/non-thermal source in the generation of the electricity in India.

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Table 8.13: Share of different fuel in Total Generation of Electricity (in percentage)

Year	Thermal	Nuclear	Hydro #	RE (Other than Hydro)
2013-14	79.87	2.91	11.48	5.73
2014-15	81.10	2.82	10.12	5.96
2015-16	83.03	2.80	9.09	5.08
2016-17	82.64	2.69	8.71	5.96
2017-18	81.88	2.59	8.51	7.02
2018-19	80.86	2.39	8.53	8.23
2019-20	78.61	2.86	9.62	8.91
2020-21	78.22	2.69	9.43	9.66
2021-22	77.75	2.78	8.97	10.49
2022-23(P)	77.18	2.49	8.81	11.52

Note: # Large Hydro

Table 8.14: Share of Renewable and Non-Renewable energy resources in total Electricity

Year	Non-Renewable (%)	Renewable (%)
2013-14	82.78	17.22
2014-15	83.92	16.08
2015-16	85.83	14.17
2016-17	85.34	14.66
2017-18	84.47	15.53
2018-19	83.24	16.76
2019-20	81.47	18.53
2020-21	80.91	19.09
2021-22	80.53	19.47
2022-23(P)	79.66	20.34

8. SUB THEME: IMPORTS

A. Energy Indicator: Net energy import dependency

Purpose and Measurement method: – This indicator measures the extent to which a country relies on imports to meet its energy requirements.

This indicator is computed as:

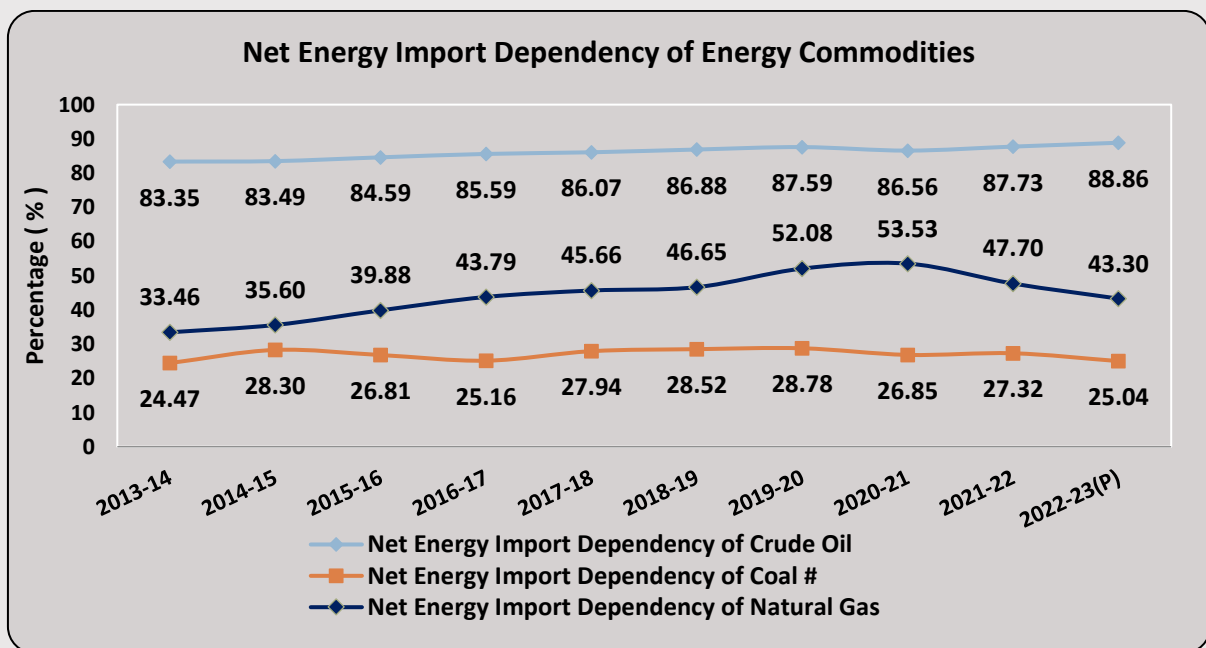
$$\left(\frac{\text{Net imports of the energy commodity}}{\text{Total Supply of that energy commodity}} \right)$$

Petroleum products are excluded as India is net exporter of them and have considered only the import value of different energy sources to calculate the indicator.

Table 8.15: Net Energy Import dependency of energy commodities during last 10 years

Year	Crude Oil (%)	Coal (%)	Natural Gas (%)
2013-14	83.35	24.47	33.46
2014-15	83.49	28.30	35.60
2015-16	84.59	26.81	39.88
2016-17	85.59	25.16	43.79
2017-18	86.07	27.94	45.66
2018-19	86.88	28.52	46.65
2019-20	87.59	28.78	52.08
2020-21	86.56	26.85	53.53
2021-22	87.73	27.32	47.70
2022-23(P)	88.86	25.04	43.30

Figure 8.14: Net Import dependency of all energy commodities during last 10 years



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Table 8.16 : Energy Indicators (Economic Dimension) for Sustainability from FY : 2012-13 to FY : 2022-23(P)

Theme	Sub-theme	Indicator	Category	Unit	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23(P)
Use and Production Pattern	Overall Use	Energy use per capita	TPES	toe/person	0.4700	0.4700	0.5111	0.5305	0.5378	0.5345	0.5690	0.5881	0.5402	0.5428	0.6149
			TFC	toe/person	0.3202	0.3305	0.3507	0.3633	0.3650	0.3797	0.4035	0.3973	0.3734	0.3763	0.3988
			Electricity	Kwh/person	666.79	698.10	747.86	779.53	816.65	855.09	910.98	929.61	906.58	960.92	1014.83
	Overall Productivity	Energy use per unit of GDP	TPES	toe/000rupees	0.00631	0.00601	0.00616	0.00599	0.00568	0.00534	0.00540	0.00543	0.00535	0.00495	0.00529
			TFC	toe/000rupees	0.00430	0.00422	0.00422	0.00410	0.00385	0.00379	0.00383	0.00367	0.00370	0.00343	0.00343
			Electricity	Kwh/000rupees	8.95	8.92	9.01	8.81	8.62	8.55	8.65	8.59	8.98	8.77	8.73
	Supply Efficiency	Efficiency of energy conversion and distribution	All	%	22.00	21.68	21.50	20.63	20.17	19.90	19.69	19.57	19.83	18.35	17.28
	Production	Reserves-to-production ratio	All	years	167	171	169	172	175	178	176	186	208	194	182
			coal	years	221	223	216	216	217	220	214	224	247	228	209
			lignite	years	133	140	128	141	145	140	153	161	195	155	164
		Resources-to-production ratio	All	years	416	423	408	400	400	397	385	408	429	399	366
			Crude oil	years	20	20	17	17	17	17	18	19	19	20	22
			Natural Gas	years	33	40	37	38	40	41	42	44	48	40	33
			Coal	years	537	533	503	483	479	472	448	471	492	452	405
	Lignite	years	930	977	914	1017	988	979	1033	1093	1214	969	1027		
	End Use	Sectoral Energy Intensities	Industry	toe/000rupees	0.00818	0.00835	0.00863	0.00801	0.00736	0.00732	0.00772	0.00764	0.00731	0.00630	0.00654
			Agriculture	toe/000rupees	0.00089	0.00086	0.00096	0.00098	0.00100	0.00098	0.00103	0.00096	0.00096	0.00094	0.00094
			Transport	toe/000rupees	0.00820	0.00770	0.00785	0.00828	0.00875	0.00899	0.00920	0.00955	0.01010	0.00943	0.00980
		Sectoral Electricity Intensities	Industry	Kwh/000rupees	14.47	14.65	14.90	13.72	13.26	13.38	14.10	14.72	14.07	13.69	14.42
			Agriculture	Kwh/000rupees	9.67	9.49	10.52	10.72	11.07	10.83	11.36	10.59	10.67	10.53	10.60
			Transport	Kwh/000rupees	3.28	3.41	3.30	3.17	2.87	2.96	3.04	3.05	3.05	3.60	3.79
	Diversification (Fuel Mix)	Fuel shares in TPES	Crude Oil	%	39.16	39.42	35.78	35.97	36.56	37.27	35.26	33.54	31.64	33.26	31.48
			Natural Gas	%	9.23	8.32	7.42	7.24	7.47	7.87	7.50	7.58	7.79	8.09	6.61
			Coal	%	55.09	56.78	59.61	58.04	56.88	55.72	56.98	57.33	57.67	56.65	58.98
			Nuclear	%	1.47	1.52	1.45	1.43	1.41	1.42	1.30	1.53	1.53	1.65	1.41
			Renewable Energy	%	2.56	2.96	2.73	2.39	2.54	2.82	3.02	3.28	3.58	3.81	3.79
		Fuel share in TFC	Oil Products	%	40.08	38.67	37.58	39.88	41.21	41.55	40.23	40.62	39.03	40.01	41.18
Natural Gas			%	6.04	5.84	5.32	5.47	5.83	5.72	5.39	5.76	5.99	6.60	6.39	
Coal			%	35.97	37.33	38.76	36.19	33.73	33.36	34.97	33.49	34.11	31.43	30.55	
Electricity			%	17.91	18.16	18.34	18.45	19.24	19.37	19.41	20.12	20.88	21.96	21.88	
Fuel share in electricity		Thermal	%	81.42	79.87	81.10	83.03	82.64	81.88	80.86	78.61	78.22	77.75	77.18	
		Nuclear	%	2.96	2.91	2.82	2.80	2.69	2.59	2.39	2.86	2.69	2.78	2.49	
		Hydro	%	10.27	11.48	10.12	9.09	8.71	8.51	8.53	9.62	9.43	8.97	8.81	
		RE (other than Hydro)	%	5.34	5.73	5.96	5.08	5.96	7.02	8.23	8.91	9.66	10.49	11.52	
Security	Imports	Net energy import dependency	Overall	%	34.08	35.40	36.86	37.82	38.62	39.88	40.45	42.06	41.74	40.67	39.27
			Crude Oil	%	83.00	83.35	83.49	84.59	85.59	86.07	86.88	87.59	86.56	87.73	88.86
			Natural gas	%	30.22	33.46	35.60	39.88	43.79	45.66	46.65	52.08	53.53	47.70	43.30
			Coal	%	22.68	24.47	28.30	26.81	25.16	27.94	28.52	28.78	26.85	27.32	25.04
			Electricity	%	0.42	0.33	0.04	0.01	-0.08	-0.14	-0.26	-0.19	0.00	-0.08	-0.13
	Strategic Fuel Stocks	Stocks of critical fuels per corresponding fuel consumption	Coal	%	8.84	7.51	7.22	7.81	9.18	6.90	5.95	8.52	12.03	10.61	7.57

Note: The difference in the figures computed by MoPNG and MoSPI arises due to methodological differences - MoSPI using data from supply side and MoPNG using consumption side.