

## || 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

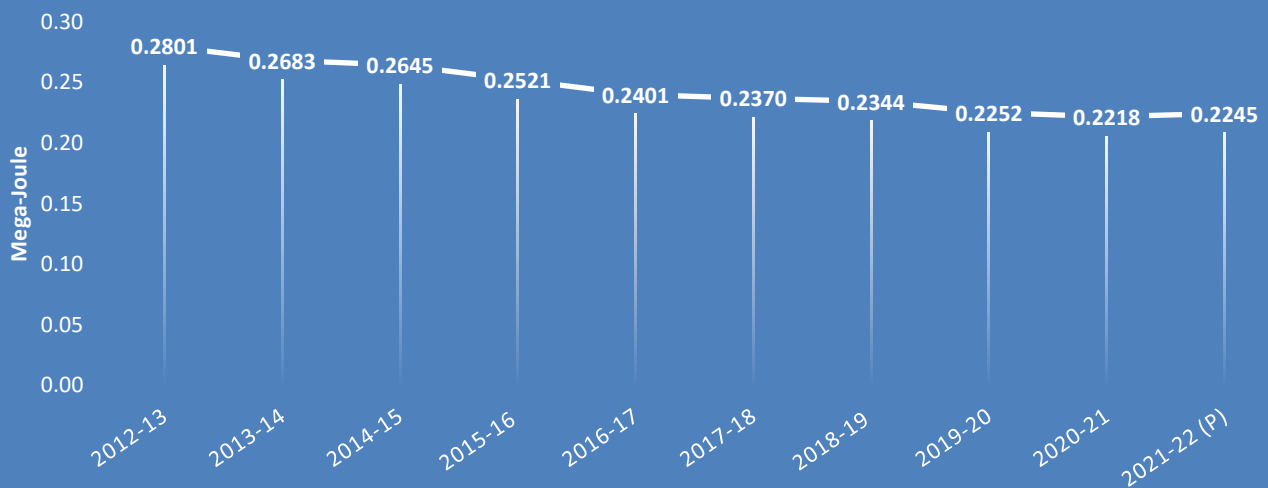
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of detail than that are presented in Energy Statistics this report is restricted to the economic dimension only and presents some of these indicators in this chapter. The details of the indicators – theme, definition, purpose and measurement method 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 0.2801 Mega joules per rupee in 2012-13 to 0.2245 Mega Joules in 2021-22 (P).

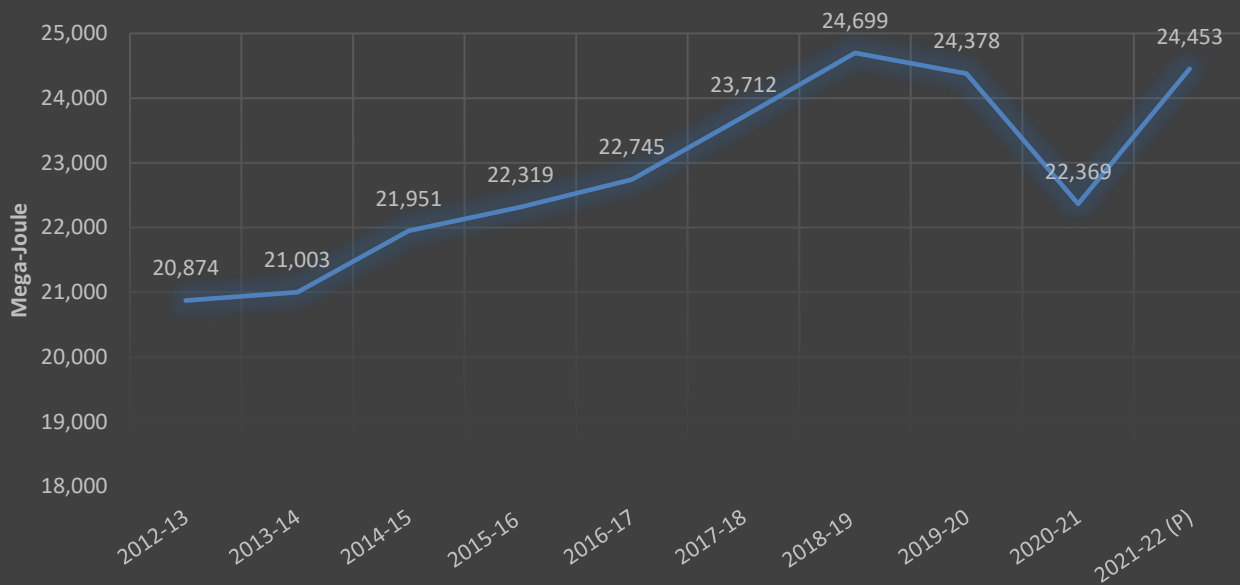
**Fig 8.1 : Energy Intensity in Megajoule per rupee from 2012-13 to 2021-22(P)**



- Similarly, Per-capita Energy Consumption increased from 20,874 Mega joules in 2012-13 to 24,453 Mega joules in 2021-22(P).



Fig 8.2 :Per Capita Energy Consumption in India (Megajoule/Person) from 2012-13 to 2021-22(P)



- India's Total Emissions from the Energy Sector have increased from 16,51,928 GgCO<sub>2</sub> Equivalent in 2011 to 21,29,428 GgCO<sub>2</sub> 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).
- The Energy Indicators for Sustainability have been re-calculated for the FY : 2012-13 to FY : 202-21, based on the domestic conversion factors and final, audited figures as available from different energy Ministries. The same has been attached under *Annexure- VI*.

**Table 8.1 : State-wise Number of Villages Electrified**

Sl. No.	States/ UTs	No. of villages as per 2011 Census	Villages Electrified as on 31.3.2020	Villages Electrified as on 31.03.2021
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

Source: Central Electricity Authority

**Table 8.2: Per-Capita Energy Consumption and Energy Intensity**

Year	Energy Consumption in petajoules	Mid year population (in Thousands) *	GDP at 2011-12 prices (Rs. crore) **	Per Capita Energy Consumption (in Megajoules)	Energy Intensity (Megajoules per rupee)
2011-12	24,121	12,20,171	87,36,329	19,769	0.2761
2012-13	25,805	12,36,220	92,13,017	20,874	0.2801
2013-14	26,302	12,52,267	98,01,370	21,003	0.2683
2014-15	27,841	12,68,310	1,05,27,674	21,951	0.2645
2015-16	28,665	12,84,350	1,13,69,493	22,319	0.2521
2016-17	29,556	12,99,434	1,23,08,193	22,745	0.2401
2017-18	31,153	13,13,815	1,31,44,582	23,712	0.2370
2018-19	32,805	13,28,206	1,39,92,914	24,699	0.2344
2019-20	32,729	13,42,586	1,45,34,641	24,378	0.2252
2020-21	30,354	13,56,980	1,36,87,118	22,369	0.2218
2021-22 (P)	33,508	13,70,311	1,49,25,840	24,453	0.2245
<b>Growth rate of 2021-22 (P) over 2020-21(%)</b>	<b>10.39</b>	<b>0.98</b>	<b>9.05</b>	<b>9.32</b>	<b>1.23</b>
<b>CAGR 2012-13 to 2021-22 (P) (%)</b>	<b>2.94</b>	<b>1.15</b>	<b>5.51</b>	<b>1.77</b>	<b>-2.43</b>

(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 Divisions's, NSO, MoSPI.

**Table 8.3 India's Total Emissions related to Energy Sector**

(GgCO<sub>2</sub> Equivalent)\*

GHG sources and removals	2011	2012	2013	2014	2015	2016
<b>A. Fuel Combustion activities</b>	<b>16,04,503</b>	<b>17,04,639</b>	<b>17,74,788</b>	<b>18,71,709</b>	<b>20,55,017</b>	<b>20,92,250</b>
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>B. Fugitive emission from fuels</b>	<b>47,426</b>	<b>43,047</b>	<b>38,771</b>	<b>38,057</b>	<b>37,084</b>	<b>37,179</b>
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
<b>Total Energy (A+B)</b>	<b>16,51,928</b>	<b>17,47,686</b>	<b>18,13,559</b>	<b>19,09,766</b>	<b>20,92,102</b>	<b>21,29,428</b>

Source: India Third Biennial Update Report to The United Nations Framework Convention on Climate Change, Ministry of Environment, Forest and Climate Change, February 2021

\*GgCO<sub>2</sub> Equivalent : Gigagrams of carbon dioxide equivalent

**Table 8.4 Energy Indicators for Sustainability**

Theme	Sub-theme	Indicator	Category	Unit	2021-22 (P)
Use and Production Pattern	Overall Use	Energy use per capita	TPES	toe/person	0.5396
			TFC	toe/person	0.3836
			Electricity	Kwh/person	945.9896
	Overall Productivity	Energy use per unit of GDP	TPES	toe/000'rupees	0.0050
			TFC	toe/000'rupees	0.0036
			Electricity	Kwh/000'rupees	8.7971
	Supply Efficiency	Efficiency of energy conversion and distribution	All	%	19.63
	Production	Reserves-to-production ratio	All	years	202
			coal	years	240
			lignite	years	155
		Resources-to-production ratio	All	years	409
			Crude oil	years	22
			Natural Gas	years	33
			Coal	years	464
			Lignite	years	973
	End Use	Sectoral Energy Intensities	Industry	toe/000'rupees	0.00661
			Agriculture	toe/000'rupees	0.00095
			Transport	toe/000'rupees	0.00916
		Sectoral Electricity Intensities	Industry	Kwh/000'rupees	13.264
			Agriculture	Kwh/000'rupees	10.656
			Transport	Kwh/000'rupees	3.17
	Diversification (Fuel Mix)	Fuel shares in TPES	Crude Oil	%	33.40
			Natural Gas	%	8.11
			Coal	%	56.13
			RE & Others	%	5.52
		Fuel share in TFC	Oil Products	%	39.58
			Natural Gas	%	6.47
			Coal	%	32.74
			Electricity	%	21.21
		Fuel share in electricity	Thermal	%	77.99
			Nuclear	%	2.74
			Hydro	%	8.84
			RE (other than Hydro)	%	10.43
Security	Imports	Net energy import dependency	Overall	%	40.90
			Crude Oil	%	87.71
			Natural gas	%	47.49
			Coal	%	27.95
			Electricity	%	0.44
	Strategic Fuel Stocks	Stocks of critical fuels per corresponding fuel consumption	Coal	%	6.70

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