

An Assessment of Energy Data Management in India



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Table of Contents

List of Acronyms.....	4
Executive Summary.....	5
1. Introduction	6
2. Organization of energy sector in India.....	6
3. Legal and administrative provisions in Indian EDM.....	7
4. Indian EDM institutions and processes.....	10
5. Strengths and weaknesses of Indian EDM.....	19
6. Suggestions to improve EDM in India	25
7. Conclusions	28
References	29
Appendix	31
A Acts/Rules/Regulations.....	31
B Supply side data	35
C Consumption side data	38

List of Tables

Table 1: Legal statutes governing EDM in India.....	7
Table 2: Policies, Rules and Regulations applicable to EDM.....	8
Table 3: Data sharing and dissemination – some good practices.....	19
Table 4: Data published in the Coal Directory	35
Table 5: Data reported in Petroleum and Natural Gas Statistics.....	36
Table 6: A non-exhaustive list of CEA reports.....	37
Table 7: List of NSSO surveys and energy data collected	38

List of Figures

Figure 1: Institutions involved in EDM along different stages of energy production and use	11
Figure 2: Data collection by CEA	13
Figure 3: Household Energy Consumption Indicators	22

List of Acronyms

ASI	Annual Survey of Industries
BEE	Bureau of Energy Efficiency
CCO	Coal Controller's Office
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CIL	Coal India Limited
CoS	Collection of Statistics
CSO	Central Statistical Office
DES	Directorates of Economics and Statistics
DGH	Directorate General of Hydrocarbons
DST	Department of Science and Technology
EDM	Energy Data Management
ERC	Electricity Regulatory Commission
IHDS	Indian Human Development Survey
ISI	Indian Statistical Institute
ISSP	Indian Statistical Strengthening Project
LDC	Load Despatch Centre
MNRE	Ministry of New and Renewable Energy
MoC	Ministry of Coal
MoP	Ministry of Power
MoPNG	Ministry of Petroleum and Natural Gas
MoSPI	Ministry of Statistics and Programme Implementation
NDSAP	National Data Sharing and Accessibility Policy
NSC	National Statistical Commission
NSSO	National Sample Survey Office
OMC	Oil Marketing Company
PFC	Power Finance Corporation
PPAC	Petroleum Planning and Analysis Cell
RE	Renewable Energy
RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
RLDC	Regional Load Despatch Centre
SERC	State Electricity Regulatory Commission
SLDC	State Load Despatch Centre
UNFC	United Nations Framework Classification

Executive Summary

Effective policy formulation in the energy sector relies on rigorous analysis of readily available, accurate, reliable and comprehensive data. Availability of such data requires institutional mechanisms and processes to collect, process and disseminate data in a timely manner. This report is a study of the legal and institutional structures and processes that form the basis of energy data management (EDM) in India.

Several government institutions have sufficient legal authority to collect energy data and share it among different departments for administrative reasons. However, they have limited mandate to disseminate this data to the general public. Apart from the Ministry of Statistics and Programme Implementation (MoSPI) which is responsible for disseminating statistics, only Central Electricity Authority (CEA) has the mandate to disseminate electricity data.

It is seen that collection and public dissemination of energy supply data is reasonably good though there is room for improvement in harmonization and reconciliation of data across energy sub-sectors. There are many gaps in energy consumption data because it is more difficult to gather this data, and because existing mechanisms to collect such data are insufficient. Several recent initiatives such as formation of the National Statistical Commission (NSC) and the National Data Sharing and Accessibility Policy (NDSAP) attempt to improve data collection, assessment, sharing and dissemination. While not specific to energy data, these initiatives can benefit energy data management.

Based on our analysis of Indian energy data management, we suggest various improvements to enhance coverage, accuracy and efficiency of data collection as well as to increase reliability and availability of energy data to the general public. These suggestions include simple improvements to operational processes, adoption of modern technology and larger institutional reforms. Operational process improvements include publishing data that is currently collected but not disseminated, and effectively using existing statutory powers and authority. Unavailability of data related to energy consumption and non-commercial energy sources are examples of existing data gaps which could be plugged through appropriately designed surveys. Reconciliation of data from multiple sources is a challenge in the current Indian EDM system. An institutional mechanism to perform this function is an example of reforms that can help improve Indian EDM. We believe that operationalizing these suggestions can help to improve Indian EDM significantly, and thus help more informed energy policy formulation and citizen engagement.

1. Introduction

Readily available, accurate, reliable and comprehensive data is essential for effective analysis, research and policy formulation in the energy sector. Such data is also useful for effective citizen engagement, business strategy formulation and performance evaluation of energy sector programs and agencies. This data is also crucial for modelling exercises used to study future energy scenarios and its various implications.

Provision of such data requires institutional mechanisms and processes to collect, store, validate and disseminate data in a timely manner. Henceforth referred to collectively as an energy data management (EDM) system, such mechanisms would need to be consistent with energy sector institutions and processes of the country.

Energy data for India is published by a number of sources such as Central Electricity Authority (CEA) reports, Energy Statistics published by the Ministry of Statistics and Programme Implementation (MoSPI) and Indian Petroleum and Natural Gas Statistics published by Ministry of Petroleum and Natural Gas (MoPNG) (MoSPI, 2014; MoPNG, 2013). While a lot of this data is focused on the supply side, some data is available on the consumption side through sources such as the Census and National Sample Survey Office (NSSO). Much of the data available is dispersed and difficult to collate due to differences in organization of data, use of incompatible definitions and formats and existence of gaps and inconsistencies (some examples are listed in Section 5).

A detailed study of the Indian EDM can help understand the institutional structure and processes of data collection and dissemination in India's energy sector, the shortcomings of the current system and lead to suggestions on how these can be addressed.

This report is a product of web based research and discussions with some data providers as well as data users spanning roughly two to three months. The scope of this study is limited to energy flows (resource assessment, extraction, conversion, transmission, distribution and consumption) and limited amount of financial data (prices, subsidies, taxes). Based on this research, this report provides some suggestions on improving Indian EDM by strengthening and improving existing institutional practices and structures in the country.

2. Organization of energy sector in India

The Indian Constitution categorizes different sectors into those administered by the central government, state governments or both. On the supply side, coal, oil and gas are notified as central subjects while electricity is a concurrent subject, i.e. administered by both. On the consumption side, some sectors such as railways and airways are central subjects whereas others such as agriculture are state subjects.

Energy administration in India is spread across five ministries within the central government, namely Ministry of Power (MoP), Ministry of Petroleum and Natural Gas (MoPNG), Ministry of Coal (MoC), Ministry of New and Renewable Energy (MNRE) and Department of Atomic Energy (DAE). These ministries (or their predecessors¹) were formed as independent ministries in 1992, prior to which there was a combined ministry named Ministry of Energy Sources². At the state government level,

¹ For instance, MNRE was earlier called Ministry of Non-Conventional Energy Sources. See <http://mnre.gov.in>.

² See http://powermin.nic.in/ministry_of_power/about_ministry.htm.

there is typically one combined department of energy. In addition, there are ministries at the central and state level that administer various energy consuming sectors, such as agriculture, industries and transport.

Energy supply in India is significantly managed by public sector undertakings (PSUs) though there is increasing private participation in some sub-sectors. Reforms initiated in the early 2000s such as the Electricity Act (2003) (also referred to as E-Act) led to unbundling of the State Electricity Boards (SEBs) and brought in private participation, independent regulation and enhanced transparency in the electricity sector. Domestic coal production is currently largely under government control through PSUs although there is some privatization in the form of captive coal mining. There is higher private sector participation in exploration, extraction, transformation and distribution of petroleum and natural gas as compared to coal, though this sector was also dominated by PSUs until the early 2000s.

MoSPI at the central government is responsible for laying down standards, evolving definitions and methodology of data collection, and processing and disseminating statistical data³. The Central Statistical Office (CSO) within MoSPI is the nodal agency responsible for coverage and quality aspects of statistics released in the country based on administrative sources, surveys and censuses. The ministry administers several surveys through the National Sample Survey Office (NSSO) and is the nodal ministry for fulfilling India’s data sharing responsibility with various international and multi-national bodies such as UN Statistics Division and IMF. CSO represents India in the UN Statistics Commission’s Oslo Group working on improving international standards and methods for official energy statistics.

3. Legal and administrative provisions in Indian EDM

3.1. Legal Provisions

Various legal provisions have been enacted over the years empowering the government to collect and disseminate various kinds of data including energy data. Table 1 lists some of these provisions. Excerpts from some of these statutes are provided in Appendix A .

Table 1: Legal statutes governing EDM in India

Act	Key Provisions
Oilfields (Regulation and Development) Act, 1948	<ul style="list-style-type: none"> Central government can make rules to mandate mine owners or lessees to submit periodical reports
Essential Commodities Act, 1955	<ul style="list-style-type: none"> Empowers the central government to collect any information or statistics necessary to ensure public interest Coal, including coke and other derivatives as well as petroleum and petroleum products are essential commodities under the Act.

³ See Allocation of Business Rules at http://mospi.nic.in/Mospi_New/site/inner.aspx?status=2&menu_id=7

Act	Key Provisions
Mines and Minerals (Development and Regulation) Act, 1957	<ul style="list-style-type: none"> Empowers the central and/or respective state governments to enter, inspect and survey any mine and inspect records
Census Act, 1948 amended in 1994	<ul style="list-style-type: none"> Formalizes administering of Census Questionnaires devised by the Census Commissioner Mandatory for all citizens to participate and answer questions to the best of their knowledge or belief
Energy Conservation Act, 2001	<ul style="list-style-type: none"> Bureau of Energy Efficiency (BEE) can recommend any energy user as a “designated consumer” Designated consumers can be directed to furnish information with regard to energy consumed
Electricity Act, 2003	<ul style="list-style-type: none"> Mandates CEA to collect and disseminate all electricity data Mandates all entities involved in generation, transmission, distribution, trading, etc. to provide the data required by CEA
Petroleum and Natural Gas Regulatory Board Act, 2006	<ul style="list-style-type: none"> Regulator, responsible for the downstream oil-gas sector, is also responsible for maintaining a data bank on activities within its purview Regulator has the power to verify data supplied by various entities Regulator shall maintain confidentiality with respect to any information received by it
Collection of Statistics Act, 2008	<ul style="list-style-type: none"> Grants central and state governments power to collect statistics related to any subject within their purview Central government can declare any subject as ‘core statistics’ and arrange for collecting and disseminating statistics on the subject Collecting agencies should avoid duplication Confidentiality should be ensured when publishing data Failure to provide data is punishable Expands on the provisions of Collection of Statistics Act, 1953

3.2. Administrative Provisions

Legal provisions are operationalized from time to time through a set of policies, rules and regulations. Table 2 lists some that apply to energy data management. The ministry that notified each policy is specified alongside the title of the policy. Excerpts from some of these statutes are provided in Appendix A .

Table 2: Policies, Rules and Regulations applicable to EDM

Policy/Order	Key Provisions
Collection of Statistics Rules, 2011 (MoSPI) – henceforth referred to as CoS Rules	<ul style="list-style-type: none"> Avoid duplication in collection of statistics Nodal officer designated by central and state governments responsible for

Policy/Order	Key Provisions
	<ul style="list-style-type: none"> ○ Improving statistical potential of administrative records ○ Issuing instructions for sharing of statistical information among different departments of central and state governments ● Consultation with nodal officer at the centre, the Additional Director General, Coordination and Publication Division of CSO (MoSPI), mandatory for conducting any survey
National Data Sharing and Accessibility Policy (NDSAP), 2012 ⁴ (Department of Science and Technology or DST)	<ul style="list-style-type: none"> ● Recognizes shareable and non-sensitive government data as a public resource ● Lays out common standards for collection and transfer of data ● Equitable access through an open data transfer policy ● Employ start-of-the-art IT tools for user friendly access to data ● All data holding organizations should <ul style="list-style-type: none"> ○ Appoint a data controller ○ Reclassify their data and prepare a negative list of sensitive information and periodically review this list ○ Verify and validate shareable data ○ Include metadata indicating data sets available with the organization along with information related to quality and data formats
Central Electricity Authority (Furnishing of Statistics, Returns and Information) Regulations, 2007 (MoP)	<ul style="list-style-type: none"> ● All entities involved in electricity generation, transmission, distribution and trading are mandated to furnish data to CEA in a timely manner and in the specified format
CERC (Procedure, Terms and Conditions for grant of trading licence and other related matters) Regulations, 2009	<ul style="list-style-type: none"> ● All inter-state trading licensees are mandated to <ul style="list-style-type: none"> ○ Furnish information in the format provided by Central Electricity Regulatory Commission (CERC) on a monthly basis and ○ Post this information on their website and make it available for at least two years
Energy Conservation (Form and Manner and Time for Furnishing Information With Regard to Energy Consumed and Action Taken on Recommendations of Accredited Energy Auditor) Rules, 2008 (MoP)	<ul style="list-style-type: none"> ● Every designated consumer is expected to submit to the designated agency, a report on the status of energy consumption for each financial year within 3 months ● Such data must be authenticated by an energy manager appointed by the designated consumer and furnished to BEE ● Designated consumers include those industrial units in the aluminum, cement, chemicals, chlor-alkali, fertilizers, gas crackers, iron and steel, naphtha crackers, pulp and paper, petrochemicals, petroleum refineries, sugar and textiles sectors

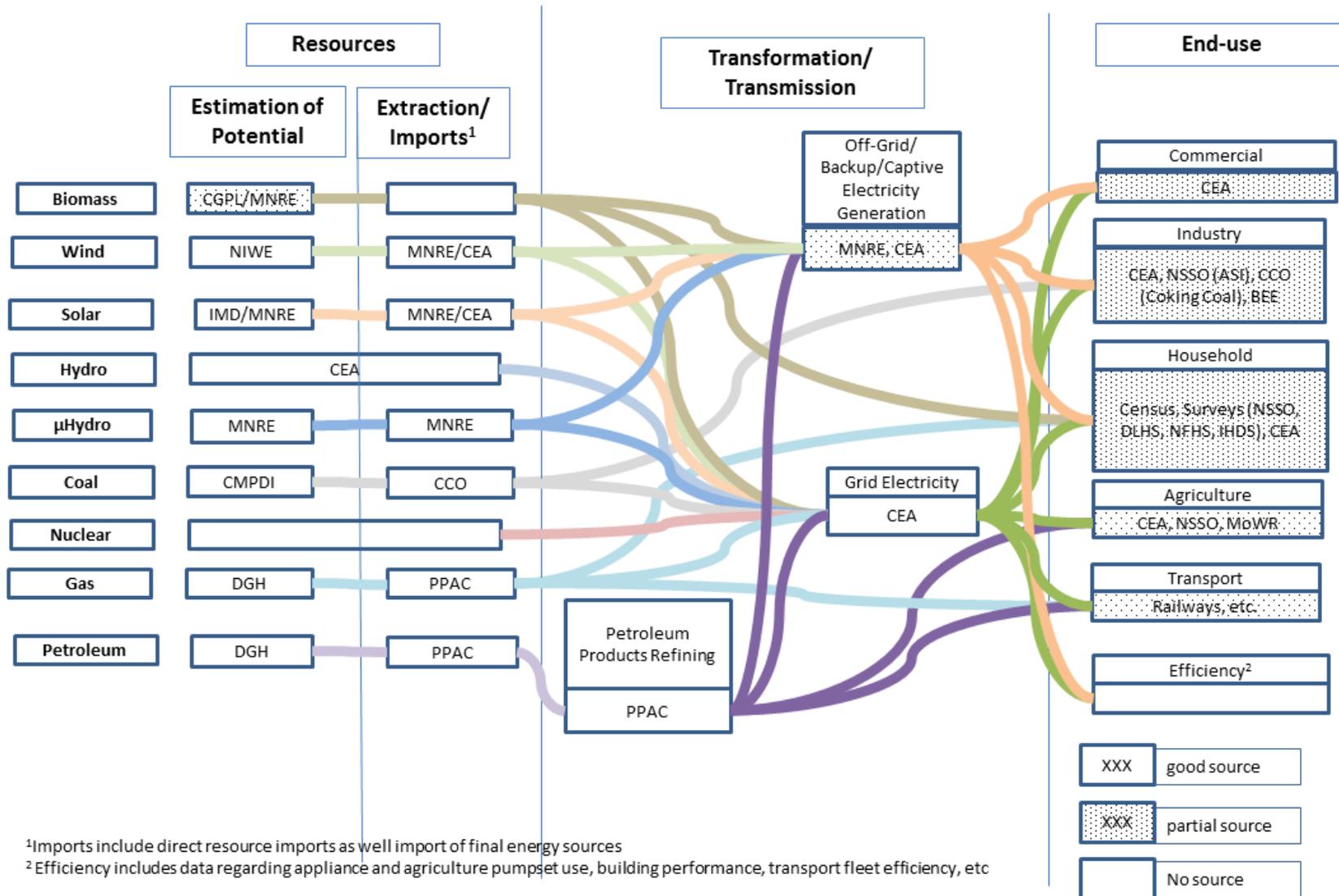
⁴ NDSAP does not appear to be the direct outcome of any legal statute. Instead, it is inspired by Section 4(2) of Right to Information (RTI) Act, 2005 and Principle 10 of United Nations Declaration on Environment and Development according to http://data.gov.in/sites/default/files/NDSAP_Implementation_Guidelines-2.1.pdf.

Policy/Order	Key Provisions
Petroleum and Natural Gas (Amendment) Rules, 2006 (MoPNG)	<ul style="list-style-type: none"> • Mandatory for lessee/owner to submit all physical and operational data related to extraction, production and transformation of petroleum and its products to the central or its designated agency. • Such data is the property of the central government • Under a separate notification, Director General of Hydrocarbons (DGH) is authorized to collect all geo-scientific data, reports and information from licensee or lessee pertaining to exploration, drilling, production and connected operations.
Colliery Control Rules, 2004 and Coal Mines (Conservation and Development) Amendment Rules, 2011 (MoC)	<ul style="list-style-type: none"> • Coal Controller can mandate anyone engaged in the business of coal production and distribution to provide information • Coal Controller or any officer authorized thereby is allowed to enter and inspect any colliery to ensure correctness of the class, grade or size declared
Census Rules, 1990 (Ministry of Home Affairs or MHA)	<ul style="list-style-type: none"> • Operationalize provisions of the Census Act, 1948 from time to time <ul style="list-style-type: none"> ○ Lay out methods that can be followed by central and state governments to ensure public participation in the Census ○ Census Commissioner is responsible for deciding the items on which data may be released and publishing Census statistics

4. Indian EDM institutions and processes

Figure 1 shows the different institutions involved in EDM activities in India from resource extraction to energy production to energy use. Areas where no institutions are named indicate gaps in data collection. Blocks that have one or more institutions listed, but filled with a dotted pattern represent partial data availability while blocks with institution names and solid fill represent full data availability. The following sections provide a brief overview of the various institutions and their data collection processes. We present institutions collecting and/or disseminating data in the following order: energy resource and supply data, energy consumption data, financial data related to energy and finally agencies collecting data from multiple sources and compiling them. Data is also available through avenues such as the Right to Information Act and annual reports of line ministries, but these are not considered here as data sources as they require considerable effort.

Figure 1: Institutions involved in EDM along different stages of energy production and use



4.1. Supply Data

Agencies responsible for collecting and disseminating energy supply data are typically part of the supply-side ministries such as MoP, MoC or MoPNG though these agencies may collect data from multiple public and private sources. In this section, we provide some details about the processes involved in collecting and disseminating energy supply data. Additional information can be found in Appendix B .

4.1.1. Coal data

Coal Controller's Organisation (CCO), a subordinate office of the Ministry of Coal is responsible for controlling production, distribution and pricing of coal. In addition, CCO is the primary agency responsible for collection, compilation, analysis and dissemination of coal statistics such as coal production, dispatch, imports/exports and consumption data. CCO submits monthly coal data to different ministries of central and state governments and international organizations. The primary public source of data regarding the coal sector is the annual "Coal Directory of India" published by CCO at a lag of 1.5-2 years (Coal Controller's Office, 2014).

Coal India Limited (CIL), the state owned coal mining company, has recently started publishing daily reports of coal dispatched to thermal power plants from its subsidiaries along with monthly cumulative dispatches. CIL also publishes occasional reports giving some information about Letters of Assurance (LoAs) and Fuel Supply Agreements (FSAs) with consumers. CIL is not mandated to publish this information but does so as part of a good practice.

One of the subsidiaries of CIL, the Central Mine Planning and Design Institute (CMPDI) was formed with the responsibility of estimating India's coal resource potential through geological exploration and modeling to help long-term planning of the coal sector. These estimates are published in the form of a coal inventory report, and are also published as part of the Coal Directory.

4.1.2. Hydrocarbons (Oil & Gas)

Petroleum Planning and Analysis Cell (PPAC)⁵ and the Directorate General of Hydrocarbons (DGH), both under MoPNG, are the primary institutions involved in collection and dissemination of hydrocarbon resource, extraction, import, refining and sales data.

DGH is an upstream advisory and technical regulatory body to promote and oversee exploration and production of hydrocarbons. In this role, it collects data regarding petroleum and natural gas exploration and reserves, and publishes some of it on its website.

PPAC receives data directly from refineries and oil marketing companies (OMCs) in electronic form by the first week of each month. It also collects fuel import data from customs, reconciles this with data reported by OMCs and publishes a monthly "Industry Sales Review Report" with data on sales of various petroleum products and various determinants of demand for them such as vehicle sales, power generation, liquefied petroleum gas (LPG) and city gas connections (PPAC, 2014). In addition to this, PPAC also performs other functions such as administering subsidy on kerosene and LPG, analyzing trends in international oil market and domestic prices, forecasting and evaluating petroleum import and export trends, and operationalizing sector-specific surcharge schemes.

⁵ PPAC was formed under an MoPNG resolution which authorized dismantling of the administered pricing mechanism (APM). One of PPAC's stated functions is maintenance of an information data bank.

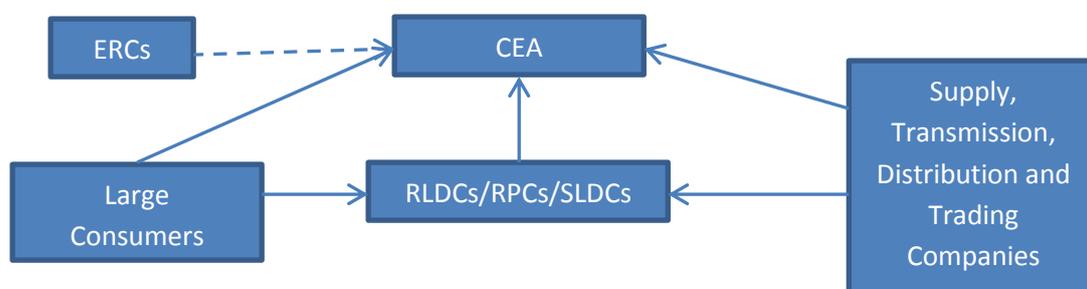
PPAC recently commissioned the Indian Statistical Institute (ISI) to study its data management practices and suggest improvements. This resulted in a statistics manual and a suggestion for a software system to include statistical checks at the time of data entry. It is expected that these will be used by PPAC to improve their EDM systems.

The data collected by PPAC and DGH is published in the form of an annual Petroleum and Natural Gas Statistics report by MoPNG (MoPNG, 2013). Recently, MoPNG has also begun publishing monthly and weekly reports on production and refinery activity on its website.

4.1.3. Electricity

As per the Electricity Act, 2003, CEA is the statutory body responsible for collection and dissemination of electricity-related data, in addition to planning for the electricity sector, developing technical standards, monitoring performance and advising MoP on various technical matters. CEA compiles data from a multitude of sources as shown in Figure 2.

Figure 2: Data collection by CEA



The collected data is published as daily, monthly and yearly reports covering parameters such as unit-wise generation, coal stock position at thermal power plants, reservoir levels and installed capacity. CEA also publishes an annual “All India Electricity Statistics (General Review)” report (CEA, 2012) containing aggregated data from the daily and monthly reports, and including other data such as captive generation (> 1 MW capacity) and system losses. While the daily and monthly reports are available soon after the reference period, the General Review is typically published with a 1.5 to 2 years lag and is available only in paper form. In addition to the above, CEA also publishes long-term demand forecasts through the Electric Power Survey (EPS) once every 5 years to coincide with the Indian planning cycle (Central Electricity Authority, 2013).

In addition to CEA, State Load Dispatch Centres (SLDCs), Regional Load Dispatch Centres (RLDCs) and Electricity Regulatory Commissions (ERCs) also collect and/or report some kinds of data. SLDCs and RLDCs report operational data such as technology-wise generation at various frequencies. SLDCs also typically display a snapshot of real-time data on their websites. Some SLDCs also provide hourly generation and frequency data.

While ERCs at the central and state level deal with a lot of electricity related data as part of regulatory processes and publish annual reports on utilities’ performance, their mandate does not include dissemination of data. However, as ERC proceedings are often transparent, a lot of useful data can be discerned from petitions, orders and other documents though it may take significant effort. In fact, CEA compiles and publishes annual consumer tariff data from CERC/SERC tariff orders (Central Electricity Authority, 2014).

As per CERC regulations (CERC, 2010), power exchanges publish daily prices and volumes for electricity and renewable energy certificate (REC) trades and historic prices up to a year. Inter-state trading licensees facilitating bilateral short- and medium-term power purchase publish monthly summary of prices and volumes of trades transacted by them on their website⁶. Based on this, CERC publishes monthly market monitoring reports analysing market trends with a lag of roughly 3 months (CERC, 2014). Reports published by the Power Finance Corporation (PFC) include data about transmission and distribution losses for various public sector utilities (Power Finance Corporation Ltd., 2013).

4.1.4. Renewable Energy (RE)

Ministry of New and Renewable Energy (MNRE) is the nodal ministry dealing with renewable energy. MNRE tracks month-wise RE capacity additions in collaboration with state nodal agencies (SNAs), and obtains this data from various stakeholders such as state governments, developers, non-governmental organizations (NGOs) and private entrepreneurs. This data is published at an aggregate level on the MNRE website.

CEA uses capacity data reported by MNRE and estimates electricity generation using assumed capacity utilization factor (CUF), and reports it in its General Review. Recently, MNRE and CEA have initiated a process to collect actual generation data from RE generators connected to the transmission or distribution networks through SLDCs, who in turn collect this data from meters at grid inter-connection points. It is hoped that all SLDCs will come on board soon and this program will mature and stabilize.

There is currently no reliable process to track off-grid systems, though there is some tracking of projects that are subsidized. There is little to no monitoring of off-grid systems, making it unclear as to how many of these are even functional.

Estimation of renewable energy potential is undertaken by MNRE with help of various organizations. Wind potential in the country is estimated by National Institute of Wind Energy (NIWE)⁷, an autonomous organization under MNRE, based on some assumed land availability and wind power density ranges. Data from these surveys are published in the Indian Wind Atlas and Wind Energy Resource Surveys, which are available at a price.⁸ Similarly, solar insolation data is collected by NIWE in collaboration with Indian Meteorological Department (IMD) and sold at a price according to the Solar Data Sharing and Accessibility Policy, 2013.⁹ MNRE also estimates small hydro power and biomass resource¹⁰ potential in the country.

⁶ Under CERC (Procedure, Terms and Conditions for grant of trading licence and other related matters) Regulations, 2009, trading licensees are mandated to furnish this information to CERC as well as to publish it on their website for at least 2 years

⁷ Formerly known as C-WET (Centre for Wind Energy Technology)

⁸ See http://cwet.res.in/web/html/departments_ps.html

⁹ See http://cwet.res.in/web/html/departments_srta.html, http://www.business-standard.com/content/manufacturing-industry/concentrating-solar-power-in-india-an-outlook-to-2024-114091500273_1.html and <http://social.csptoday.com/markets/india-braces-investor-grade-solar-resource-data>

¹⁰ Spatially enabled biomass resource assessment was done by Combustion Gasification and Propulsion Laboratory (CGPL), Indian Institute of Science with support from MNRE. See <http://lab.cgpl.iisc.ernet.in/> for more details.

Under the 'Green Energy Corridors' plan, it is proposed to establish Renewable Energy Management Centres (REMCs) at RLDCs and SLDCs, particularly in states with high RE potential (PGCIL, 2012). These centres will be equipped with infrastructure to receive wind and insolation data from the field and sophisticated forecasting tools to make hour-ahead, day-ahead and long term predictions of RE generation particularly wind and solar, to assist system operation as well as transmission planning (PGCIL, 2012).

4.1.5. Atomic Energy

Department of Atomic Energy (DAE) is the nodal agency for all uses of atomic energy from power to medicine. Nuclear Power Corporation of India Limited (NPCIL) operates all nuclear power plants in the country. Both DAE and NPCIL publish and share installed capacity and power generation data with the CEA. CEA also publishes this data through its various reports. No other information is disseminated.

4.2. Consumption Data

Collecting consumption data and making demand projections based on the data are typically harder than collecting supply data, though it is equally critical to planning and policy formulation of the sector. In this section, we broadly present the various surveys and other methods of collecting energy consumption data in India. Additional details can be found in Appendix C .

4.2.1. MoSPI Surveys

The National Sample Survey Office (NSSO) within MoSPI is responsible for conducting large scale all-India sample surveys to collect socio-economic data. Some of these surveys are periodic, typically quinquennial, while others are conducted occasionally. Although none of these surveys are specific to energy, many include questions related to energy use.

NSSO's household consumer expenditure surveys collect data on primary sources of energy for lighting, cooking and heating, quantity of fuels consumed and expenditure on them, and information on appliance and vehicle ownership. At the village or community level, the Common Property and Facilities Surveys collect information about electrification of public/community places, source of drinking water supply, presence of biogas plants, source of fuel-wood collection, type of approach road, distance to nearest community facilities and non-conventional energy use.

A one-time survey on the Situational Assessment of Farmers conducted in 2003 collected data about use of agricultural pumps, other tools and equipment, sources of irrigation and expenses incurred thereof and reasons for inadequacy of irrigation. Other surveys targeted at enterprises, such as the Unorganized Manufacturing Enterprises Survey, Service Sector Survey and the Unorganized Service Sector Survey, collect data related to availability of modern energy, energy consumption and expenditure, availability of computer/internet, nature of energy related problems faced by the business, and type of vehicle used along with vintage, payload capacity and distance covered.

The **Annual Survey of Industries (ASI)**, conducted by the Central Statistical Office (CSO) is the main source of industrial statistics in the country. The survey is a mix of a census (of certain units deemed as 'large' in states with significant manufacturing, or all eligible units in other states) and a sample survey (of the remaining establishments). The ASI includes energy related questions such as the type of motive power used, electricity generated, consumed, purchased and sold, consumption and

purchase of fuels, energy conservation measures and loss of production due to non-availability of electricity.

4.2.2. Other Surveys

A few other agencies conduct surveys, again not directly related to energy, but which capture some energy related information. These are briefly discussed below.

Census: The Office of the Registrar General & Census Commissioner under the Ministry of Home Affairs conducts a decennial census, through state level directorates of census operations, which collects a variety of statistical information about the people of India. The census data elements relevant to the energy sector are primary source of lighting and cooking, household asset ownership and main source of drinking water.

DLHS and NFHS: The Ministry of Health and Family Welfare (MoHFW) commissions two quinquennial household surveys - District Level Household & Facility Survey (DLHS) and National Family Health Survey (NFHS) – which collect answers to some questions relevant to the energy sector. These include the main source of lighting and cooking, main mode of transport to the health facility, main source of drinking water and methods used to treat water at the household and village levels.

IHDS: The Indian Human Development Survey (IHDS) is a periodic household level panel survey conducted by National Council of Applied Economic Research (NCAER) and University of Maryland, USA. It is designed to complement the other surveys and hence includes some questions that are not asked in the others such as hours of power supply, relative use of multiple fuels in households, agricultural expenditure related to energy, improved chulha beneficiaries, ownership of appliances and generator set .

Minor Irrigation Census: The Ministry of Water Resources conducts an occasional census of minor irrigation schemes which collects data on indicators such as sources of irrigation, types of wells under use, water distribution and application methods employed, source of energy, horse power of lifting device (if employed) and number of days of operating pump during different seasons.

4.2.3. Other agencies and efforts

Bureau of Energy Efficiency (BEE) is a statutory body¹¹ housed within MoP to develop policies and strategies to reduce the energy intensity of the Indian economy. To discharge its functions, BEE is authorized to collect energy production and consumption data from “designated consumers”¹² as per the Energy Conservation Act. Such consumers have to send data to BEE in a designated format on a periodic basis. BEE also monitors and records energy consumption of industries participating in the Perform-Achieve-Trade (PAT) program through third party, certified energy auditors. However, such data from designated consumers is currently not published, though it may be possible for BEE to publish it in aggregate form.¹³

¹¹ BEE was established under the Energy Conservation Act, 2001

¹² Designated consumers are large energy consuming industries, and the list is notified by MoP.

¹³ Companies (Disclosure of Particulars in the Report of Board of Directors) Rules, 1988 notified by the Ministry of Corporate Affairs declares a list of 21 industries that are mandated to submit energy consumption and conservation data. However, it is not clear whether this data is being collected and if it is used anywhere.

The Planning Commission produces an annual report on the working of public sector utilities that includes data such as status of power sector programs and physical and financial performance of utilities (Planning Commission, 2014).

Various Government of India ministries dealing with sectors that are significant energy consumers, such as agriculture, surface transport, aviation and industry, collect data about the respective sectors for administrative purposes. This data includes some energy related data and is shared through their annual reports.

The Ministry of Micro, Small and Medium Enterprises (MoMSME) conducts a quinquennial MSME Census covering all registered MSMEs and a sample survey of unregistered enterprises. This includes questions on the main source of power to enterprises, power shortages faced by them, enterprises involved in electricity and gas supply and details of fuel consumed during the last financial year.

In addition, there are two other efforts worth mentioning here. One, village level electrification data and average hours of supply are available from the website of Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), the central government's flagship rural electrification program. Two, a one-time diesel and petrol consumption survey was commissioned by PPAC in 2013 to measure category-wise consumption trend of the primary road transport fuels (Nielsen, 2014).

4.3. Financial Data

Some financial data about the energy sector such as prices, subsidies etc. are also important for analysis and policy formulation.

MoC and MoPNG publish price information of coal and petroleum products in their flagship reports, namely the Coal Directory and the Petroleum and Natural Gas Statistics (Coal Controller's Office, 2014; MoPNG, 2013). CEA publishes electricity tariff information in its "Tariff and Electricity Supply" report (Central Electricity Authority, 2014). In addition, Planning Commission publishes consumer category-wise average tariffs, utility-wise cost of power supply and breakup of distribution utility costs (Planning Commission, 2014).

The Power Finance Corporation (PFC), which finances and monitors several state power utilities or distribution companies, publishes an annual report on the financial and operational performance of utilities which contains information on subsidy booked and received by these utilities, average cost of supply and average revenue realized (Power Finance Corporation Ltd., 2013). The Planning Commission also publishes data on subsidy provided by utilities for agricultural and domestic consumers, subsidy received from state governments, uncovered subsidy and subsidy to sales ratio (Planning Commission, 2014). MoPNG publishes actual subsidy incurred vis-à-vis subsidy budgeted, under-recoveries and burden sharing of under-recoveries for petroleum products (MoPNG, 2013).

Some information about taxes, royalties and duties are available in reports from CEA (Central Electricity Authority, 2014), Planning Commission (Planning Commission, 2014), MoC (Coal Controller's Office, 2014) and MoPNG (MoPNG, 2013).

4.4. Other energy data compilation / collection agencies

In addition to the above agencies, some other non-energy agencies involved in Indian EDM are MoSPI, Department of Science and Technology (DST) and Directorates of Economics and Statistics (DES) in states.

CSO publishes the annual “Energy Statistics” (MoSPI, 2014) based on data collected from various ministries within the central government. CSO is the nodal agency for a planned development of the statistical system in the country and for bringing about coordination in statistical activities among statistical agencies in the Government of India and State Directorates of Economics and Statistics.¹⁴ The Computer Centre within MoSPI is responsible for collating and disseminating data through the data warehouse under the National Policy on Dissemination of Statistical Data¹⁵.

The Additional Director General, Coordination and Publication Division of the CSO is designated as the nodal officer (under the CoS Rules) responsible for collecting information on statistics available with various departments of the central government and nodal officers in states. Nodal officers appointed at state governments have similar functions within their jurisdictions. Any department of the central or state governments that collects statistics under the CoS rules should consult with the nodal officer, who would ensure that there is no duplication in data collection.

The National Statistical Commission (NSC), housed within MoSPI, was constituted in 2006 to

- critically examine the country’s statistical system in terms of timeliness, reliability and adequacy;
- recommend measures to correct the deficiencies;
- recommend effective coordinating mechanisms for ensuring integrated development of the decentralized statistical system in the country;
- review the existing organization of MoSPI and other statistical units of the Government and to make recommendations on their staffing and training requirements to enable them to cope with the increase and development of statistical services; and
- recommend any other measures to improve the statistical system in the country.

NSC appears to be an advisory body¹⁶, hence its recommendations are not binding on any department or ministry. Even so, NSC can play a vital role in improving data collection, dissemination and quality.

Department of Science and Technology (DST) is the nodal agency responsible for coordination and monitoring of the National Data Sharing and Accessibility Policy (NDSAP) and National Informatics Centre (NIC) is responsible for development and upkeep of data.gov.in – the portal through which NDSAP is being implemented. NDSAP recommends that data should be shared in open formats that are machine readable (NIC, 2014).

¹⁴ See description of Indian Statistical System at http://mospi.nic.in/mospi_new/upload/iss_14.html

¹⁵ Under this policy, MoSPI is mandated to make validated unit-level data from official statistics available to data users after deleting identification particulars

¹⁶ See point (k) under functions of NSC at http://mospi.nic.in/Mospi_New/site/inner.aspx?status=2&menu_id=84

Directorates of Economics and Statistics (DES) are responsible for statistical activities at the state level. They are the state level counterparts of MoSPI's National Statistical Office (NSO) and assist with administering NSSO surveys within their respective states. They may also undertake separate surveys to study specific areas that are applicable to those states. However, it appears that DESs do not collect any energy sector data on their own.

5. Strengths and weaknesses of Indian EDM

Based on the discussion thus far, one can identify some strengths and weaknesses of Indian EDM. Table 3 lists some of the good practices followed in Indian EDM. As can be seen from Figure 1, collection and public dissemination of energy supply data is reasonably good, though there could be some improvements there too, while there is significant room for improvement in consumption EDM.

In the rest of this section, we present an indicative, and not exhaustive, list of data gaps in the current EDM, and point out some areas of improvement in the institutional structure and data collection and dissemination processes.

Table 3: Data sharing and dissemination – some good practices

Category	Good practices
Legal provisions and Institutional Processes	<ul style="list-style-type: none"> • CoS Rules and NDSAP have enabling provisions for improving data quality, coordination among agencies and data dissemination processes • E-Act mandates dissemination of data by CEA. This has resulted in good data availability in the electricity sector. In addition, E-Act includes several transparency provisions due to which a lot of data is available from regulatory proceedings. • CERC regulations mandate inter-state power trading licensees and markets to publish data • Efforts to improve EDM, such as the data quality study by ISI for PPAC, can be emulated in other institutions
Operational Practices	<ul style="list-style-type: none"> • CEA data collection and dissemination is fairly comprehensive and regular. • CSO has recently started making an attempt to publish an energy balance table in its annual Energy Statistics. This is a good attempt at connecting and reconciling data received from different sub-sectors and needs to be strengthened. • CEA has recently initiated an online data collection portal whereby duplicate data sharing by reporting institutions is avoided. • Data reporting by OMCs is regular, complete and in a format that is easy for PPAC to process • IHDS survey data is made available in Stata/SPSS/SAS formats making it readily usable

5.1. Data gaps

We provide an indicative set of weaknesses in the existing data, including data that is missing or inaccurate. Data is also often scattered across multiple sources making it harder to collect and use it. Since many of the weaknesses are related to data about energy consumption, they are listed separately for convenience.

1. Consumption data

- Utility data on electricity use in **agriculture** is unavailable or unreliable, since agricultural feeder separation with automatic metering has not happened in all states or feeder level data is not disseminated. Such aggregate, feeder level data can provide useful insights into consumption patterns, load shedding practices, more accurate demand estimation and better targeting of subsidies and efficiency programs.
- **Household consumption data** is largely available through surveys whose primary purpose is not to inform energy sector analysis. For example, there is no data on appliance efficiency and hours of use. In addition, it is suspected that data collected on appliance ownership is inaccurate. For example, the latest survey round suggests that 24% of urban households use either an air-conditioner or an air-cooler, which appears highly unlikely. In addition, there is no attempt to capture seasonal variations.
- There is no **disaggregation of sale of petroleum products** at retail outlets according to vehicle types or by end-use sector. The one time survey commissioned by PPAC is very useful in this regard, but is not conducted on an ongoing basis.
- There is no data available on energy consumption for **space heating/cooling** or on building energy performance with respect to Energy Conservation Building Code (ECBC).
- Data about energy consumption in the service (tertiary) sector is unavailable or scattered, possibly because service sector enterprises are spread across various consumer categories.

2. Other missing data

Data is incomplete on the supply side as well. Following are a few examples

- **Useful life of coal mines** under operation and their remaining reserves is not published.
- CIL publishes intermittent daily **dispatch data** to individual power plants but it is difficult to match this against expected coal supplies as per Fuel Supply Agreements. In addition, grade-wise dispatch data is not provided.
- Information about **captive generation** and use of electricity is incomplete. CEA publishes capacity and generation at captive power plants with capacity 1 MW and above on an annual basis. Electricity generation from smaller captive systems or any captive power plants that are not registered with CEA are surveyed under ASI. It would be useful if any captive generation data from ASI is integrated with the rest of the captive generation data and reported in one place.
- **Intra-state electricity trading data** is not available since SERCs have not published regulations governing these transactions, unlike inter-state transactions which are disclosed as mandated by CERC's regulations.

- There is an estimated 90GW¹⁷ of **backup generation capacity** in the country due to power supply quality issues. While IHDS collects data on ownership of generator sets, there is no data available regarding the capacity and use of these generators.
- There is no mechanism for estimating availability of **non-commercial** energy sources such as biomass and dung-cakes, and use of **non-motorized** transport.
- There is no data on use of biomass in enterprises. MSME census only asks if traditional energy/firewood is the main source of energy, but doesn't check if it is a secondary source.

3. Data Accuracy

- There are concerns regarding the accuracy and vintage of **rural electrification** data published by the RGGVY program¹⁸.
- Where electricity distribution utilities provide feeder level data, there are concerns regarding **data integrity** due to manual recording of meter readings.
- Data available on **off-grid systems** is not reliable, comprehensive or current. This applies to diesel as well as renewable power plants. It is unclear whether data from MSME census can be used to fill this gap.
- There are teething issues with the new process to collect **RE generation data** through CEA and SLDCs. Not all SLDCs have appointed the nodal officers responsible for this process¹⁹.
- **Accuracy of data** submitted by captive generators to CEA, private enterprises to ASI and sectoral consumption data reported by utilities is questionable as this is self-reported and there is no process to ensure accuracy of this data through independent audits or other checks.
- **Household electricity data** is not accurate because there are a large number of unmetered households whose consumption is estimated.

These weaknesses in data availability make it difficult for a policy maker or researcher to analyze the energy sector objectively, in order to identify challenges or trends and propose solutions. The following box illustrates this difficulty through a simple case study of a researcher analyzing household energy consumption.

¹⁷ See for instance, CERC's Advisory Committee meeting minutes at http://www.cercind.gov.in/2014/advisor_commette/19.pdf

¹⁸ RGGVY publishes village-level electrification status at <http://rggvv.gov.in/rggvv/rggvvportal/electrification-status-villages.html>. The data provided here does not match with observations on the field either because the data is outdated or there are procedural lapses (Prayas observations and (Greenpeace, 2011)). Also, report by the Comptroller and Auditor General of India on RGGVY indicates that the rural electrification numbers that formed the basis of electrification targets were unreliable (CAG, 2013).

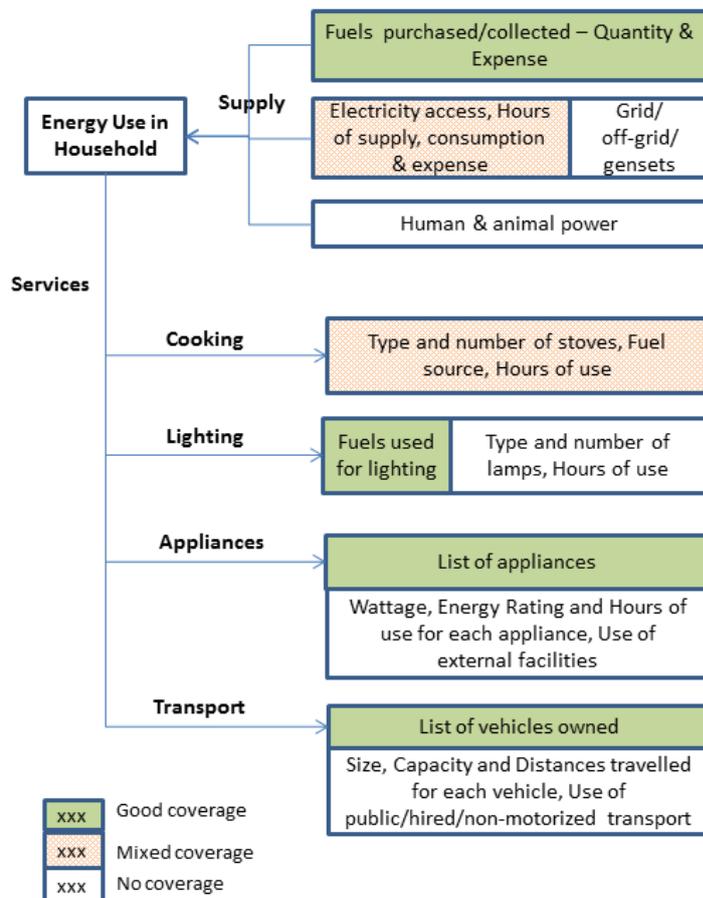
¹⁹ See http://www.cea.nic.in/reports/articles/god/data_renewable.pdf for a 2013 letter from CEA to SLDCs urging them to appoint nodal officers and http://www.erpc.gov.in/uploads/news_pdf/140438439898OCCMINUTES.pdf for meeting minutes from June 2014 urging some states to appoint nodal officers.

Harvesting Household Energy Data

An analyst interested in understanding household energy consumption patterns in India has to harvest data from a multitude of sources, and may still not get all the data she needs. Over 10 different surveys provide data regarding household consumption in India. Appendix C provides more detail regarding these surveys.

Indicators related to both supply of energy as well as service obtained therefrom are important in analysing household energy consumption. As illustrated in Figure 3, important household data is

Figure 3: Household Energy Consumption Indicators



missing, such as:

- breakup of households with grid-based and off-grid electricity supply,
- hours of use of cooking, lighting and other appliances, and
- disaggregation of distances travelled by public, hired and own transport.

Moreover, data across these surveys are not always consistent with each other, possibly due to differences in survey methodologies. For example, the 2011 census reports that only 55% rural households in India use electricity as the primary source for lighting, but the NSSO household expenditure survey of 2011-12 reports a figure of 74% for rural households using electricity as the primary source of lighting.

As can be seen, household energy consumption data is either not available or is scattered across multiple sources, making it difficult to integrate and analyze this data meaningfully.

5.2. Institutional aspects

There are some aspects about the EDM institutions, their structures, capacities and processes that need to improve to address some of the challenges with Indian EDM. These are listed below.

1. **Institutional capacity and mandate:** The current institutional structure is such that much of the statistical and data-related expertise resides within MoSPI while the technical domain knowledge resides within individual ministries. This separation of the skills required for

effective EDM makes it difficult to effectively combine best data practices with sufficient domain knowledge about the data being collected, organized and disseminated.

- MoSPI can be more effective in integrating data received from various line ministries with enhanced energy sector expertise.
 - Line ministries and their agencies with the sector knowledge collect data for administrative purposes rather than to collect, organize and disseminate high quality data for use in policy relevant analysis by others. Therefore, data organization and dissemination is not among their priority areas of interest. Among the energy sector institutions studied, only CEA has the mandate to disseminate data. This is further compounded by a lack of sufficient human and technical capacity within the various agencies.
 - There appears to be a wide variation in capabilities of DESs at the state level in spite of the “Indian Statistical Strengthening Project” (ISSP) which is intended to improve capacity of DESs.
2. **Use of technology:** There are very few systems in place for automated sharing of data between reporting and collecting institutions. For example, CEA is understood to have initiated development of an Information Management System (IMS) to enable various electricity licensees to easily provide information to CEA electronically over the Internet. However, even though this effort began in 2006, it does not appear to have materialized yet. Data is typically shared through spreadsheets over email. Similarly, CCO requires coal and lignite companies to provide data by email or post for its annual survey²⁰.
3. **Coordination:** While multiple ministries and departments have their own data collection processes, there do not seem to be sufficient processes in place to
- harmonize data from different sources that may be expressed in different units, have different definitions, etc.;
 - collate data from scattered sources;
 - integrate and cross-check based on different data sets;
 - facilitate coordination among multiple agencies involved in data collection; and
 - incorporate data such as business/trade/investment numbers and project implementation details.
- Although CSO is responsible for coordinating between statistical agencies in the central government, it appears that they are unable to carry out this function as they are not sufficiently empowered and do not have sufficient capacity to fulfill this function.
4. **Overlapping functions:** The data warehouse under MoSPI and data.gov.in under DST appear to have overlapping functions with respect to data collation and dissemination. It is unclear whether the data warehouse will be restricted to MoSPI data and if there will be any coordination between MoSPI and DST.
5. **Effectiveness of Nodal Officer:** The nodal officer appointed under CoS Rules is expected to compile administrative data available with various departments, suggest ways to improve quality of such data, reduce duplication in data collection and to reconcile inconsistencies between different sources. The officer is expected to submit an annual report to the central

²⁰ See http://www.coalcontroller.gov.in/coal_admin/files/Statistics/Statistic-9.pdf for a recent communication regarding the 2013-14 survey (last accessed September, 2014)

government on the above actions. However, it is unclear what improvements have taken place.

6. **Institutionalization of analysis:** Another important area that needs improvement is analysis of data and the data collection systems. This effort involves processing the data collected and providing meta-analyses that can result in better understanding of the sector as well as improved data collection through administrative means, surveys or reduced duplication. A couple of examples follow:
 - Periodic analysis of trends in demand, supply and market prices can help decision making as well as future projections.
 - Questions related to primary source of lighting and biomass use are asked in several surveys. However, results from different surveys are not analyzed to understand differences if any, and using the analysis to improve the surveys (methodology, questionnaires, etc.).

5.3. Data Dissemination

There is room for improvement in the way data is disseminated, such as its classification, format and frequency. These are discussed below.

1. **Data consistency:** There are problems with consistency of data from multiple sources, and the way data is reported as shown in the following examples.
 - UNFC is an internationally accepted means of classifying coal reserves and adopted by the Government of India in 2001 (Sreenivas & Bhosale, 2013). However, all Indian coal reserves are still not classified using the UNFC methodology. In addition, GCV-based coal grades²¹ are not uniformly reported though this is the means used by CIL to price its coal.
 - Household and village electrification rates vary significantly across sources. For example, Census 2011 and NSSO expenditure survey of 2011-12 differ in household electrification rates, possibly due to differences in the nature of these surveys (IHDS, 2010).
 - Some questions appear to be dropped from later rounds of the same survey. For example, the “Unorganized Manufacturing Enterprises Survey” in 1989-90 and 1994-95 had detailed choices for source of energy used in the enterprise including biomass, oil, electricity, animal power, etc., but this question was not asked in the rounds in 2000-01 and 2005-06.
2. **Timeliness:** There are significant time lags in availability of some data, making some research dated by the time the data becomes available. CEA General Review and CCO’s coal directory are released 1.5-2 years after the reference year – probably due to administrative delays rather than time taken for compilation and reconciliation.
3. **Ease of access:** Data should be easy to access and process in order to facilitate quality research. However, there are some shortcomings on this count as illustrated below.
 - There is no one place where comprehensive data can be found²². Hence, one needs to use data from multiple sources which requires considerable effort to integrate and use. The portal data.gov.in is an attempt to fill this gap. But currently, this is merely a

²¹ Gross Calorific Value or GCV-based pricing of coal is internationally practiced

²² This is in contrast to sources such as the EIA for the USA and DECC/DUKES for the UK.

collection of data from a variety of sources rather than a repository with harmonized, reconciled and interconnected data.

- Most data is provided in pdf and sometimes scanned pdf (i.e., image) formats. Examples of PDF documents include daily, monthly and yearly reports from CEA and LDC, MoSPI's Energy Statistics, Petroleum and Natural Gas Statistics, Coal Directory and PFC reports. Still others such as the General Review, Thermal Performance Review (Central Electricity Authority, 2011-12) and Electric Power Survey from CEA are not even provided in electronic format. . This increases the cost and effort of analysis since such data has to be transcribed into useful electronic forms.
- Census and NSSO micro data are provided in difficult to process formats, though recent rounds have at least provided dictionary files. Moreover, scripts written to extract this micro-data in statistical tools such as Stata or R for one round do not work with another round since the formats of the micro data keep changing. In contrast, IHDS provides data in Stata, SPSS and SAS formats. It is desirable that Census and NSSO also provide data in similar easily accessible formats.
- Information on costs in the RE sector such as capital and operating costs and prices discovered through bidding is not compiled in one place.

6. Suggestions to improve EDM in India

In this section, we propose some suggestions on how to address the weaknesses listed above. We have classified these suggestions into various categories such as suggestions for improvement in operations, organizational efficiency, plugging gaps and deficiencies, and institutional changes.

6.1. Operational improvements

This category of suggestions only require organizations to rigorously follow existing norms, rules and processes, and perhaps adopt some practices for process improvement.

1. Some simple process improvement steps could be adopted as suggested below.
 - a. A quarterly workshop could be convened by a nodal agency, say CSO, involving all EDM institutions for harmonization and validation of recently collected data. This will ensure continuous synchronization of multiple data processes and early detection of any inconsistencies.
 - b. Similarly, the same nodal agency could convene an annual workshop where the various EDM institutions could share their experiences and learn from each other. Exercises such as the effort by PPAC to engage ISI to improve its EDM processes can also be attempted.
 - c. The quality and coverage of data collected should be periodically assessed. Similarly, wide consultations should periodically be held with data user communities to understand their needs. The lessons from such an assessment and consultation process should be incorporated into future data collection and dissemination cycles.
2. Institutions should publish data that is already collected by them in a timely and easily accessible manner. Examples include:
 - a. Quarterly coal sector data collected by CCO and shared with MoC.
 - b. Field-wise monthly production and dispatch data for national resources such as coal, oil and gas.
 - c. Energy consumption data collected by BEE under PAT, in an aggregated form.

3. Institutions should effectively use statutory powers and authority already vested with them to ensure better availability of data in the public domain. For example,
 - a. SERCs should mandate trading licensees to publish data regarding intra-state trades similar to CERC regulations for inter-state trades.
 - b. There are concerns of non-cooperation regarding data collection for ASI and other surveys, though such data sharing is legally mandated.
4. Some data that can be easily collected should be made available either freely or at a reasonable cost. Some examples are given below.
 - a. Flows of coal, oil and gas throughout the extraction, transformation and use stages should be tracked and published.
 - b. Non-sensitive, government owned data should be a public resource as envisioned in NDSAP. For example, wind and solar resource data should be priced modestly, if at all, so as to recover costs of data dissemination (rather than data collection and processing).
5. Forward looking data should be updated frequently to reflect trends in the sector. For example, forecasts such as the CEA's EPS should be dynamically updated based on latest available data rather than once in five years.

6.2. Improving organizational efficiency

Suggestions under this category broadly include ideas for technology adoption and streamlining some processes to improve organizational efficiency.

1. Adoption of modern technology to enable automatic data collection to the extent possible could help improve EDM significantly. Examples include
 - a. Automated metering at electricity interconnection points where generators supply to the grid can help transmit such information to the SLDC²³. Similar systems could be thought of for coal, oil and gas as well.
 - b. Electricity distribution utilities should codify consumers by category and thus report aggregate consumer category-wise consumption even at substation level. This could be further disaggregated with little effort into below poverty line (BPL) and non-BPL sub-categories for the domestic category.
 - c. The smart grid development under consideration should incorporate sufficient design elements to enable collection of consumption side data efficiently and comprehensively.
2. Technology could also ease the task of data providing agencies (such as industries, utilities, SLDCs etc.) if
 - a. Data formats are designed in such a way that it is easy for the data provider to give the requisite data
 - b. Uniform data formats are designed for all data providers with similar roles (say SLDCs, ERCs or iron-and-steel units), based on best practices from across the country. Examples of such practices include hourly generation data as well as daily backing down reports published by the Maharashtra SLDC and real-time availability of RE capacity published by the Gujarat SLDC.

²³ Effective implementation of programs such as the Restructured Accelerated Power Development and Reforms Program (R-APDRP) would have helped to address this issue to some extent, as R-APDRP was supposed to automate data collection at the distribution transformer level through installation of appropriate meters. However, this has not happened.

- c. Data can be submitted electronically through systems requiring minimal intervention – such as the SAP-based system reportedly used by PPAC.
- 3. Institutions should make effective use of the internet and web technology to disseminate data in a timely and user-friendly manner. For example, CCO website should be made functional and at least brought on par with the websites of CEA and PPAC, by providing appropriate human and technical resources if required.
- 4. Data disseminating agencies should conform to uniform dissemination standards along the lines of UN’s International Recommendations on Energy Statistics (UN, 2011)²⁴ with an advance release calendar, data quality assessment and punctual dissemination, to achieve good data coverage; periodic and timely data; public access to the data; data integrity; and data quality.

6.3. Plugging gaps and deficiencies

These suggestions relate to addressing the issues related to data gaps, formats etc. discussed earlier.

1. Unavailability of energy consumption data is one of the major data gaps in Indian EDM. This can be addressed by one or more of the suggestions given below.
 - a. Capacity of state level statistical agencies could be strengthened along the lines of the ISSP, so that they can design and execute state-specific surveys.
 - b. Central data collection processes could be deepened by
 - i. enhancing NSSO survey questionnaires or
 - ii. adding an NSSO energy round covering all energy consuming sectors or
 - iii. regularly conducting separate sector-specific surveys such as the one commissioned by PPAC to collect disaggregate consumption data of petroleum products
2. There is very little data on non-commercial energy sources such as biomass and non-motorized transport although these modes fulfil significant energy needs. This gap can be plugged by measuring energy use with the help of focused surveys and estimating potential using scientific methods.
3. Information currently available but difficult to access could be made available with some extra effort. For example, the rich information in publicly available regulatory proceedings should be consolidated and made available to the public. CEA could be empowered and mandated to do this beyond extracting just consumer tariffs from regulatory orders. In addition, CEA’s mandate could be expanded to integrate captive generation data collected through ASI with data reported directly to CEA by consumers generating >1 MW.
4. Data should be disseminated in open formats that are machine readable such as those recommended for NDSAP implementation (NIC, 2014). Census and survey data should be provided in one or more of formats such as Stata, SPSS and SAS. Alternatively, scripts could be provided with each data-set to convert it into usable formats.
5. More data should be collected from government subsidized projects and disseminated. A good example is the Renewable Energy for Rural Economic Development (RERED) project in Sri Lanka²⁵ set up with assistance from World Bank.

²⁴ Following these recommendations, UN Statistics Division is also developing an Energy Statistics Compilers Manual with practical guidance on compilation of energy statistics and energy balances. See <http://oslogroup.org/>.

²⁵ <http://www.energyservices.lk/>

6.4. Institutional changes

The final category of suggestions focuses on strengthening institutions and institutional processes, and creating better means of collation and coordination of data.

1. While the current institutional setup has many gaps and areas for improvement, it appears that institutions that can address some of these gaps are not sufficiently empowered. In addition, there are multiple agencies or initiatives with overlapping mandates and jurisdictions. Some examples are given below.
 - a. According to the most recent annual report from NSC (National Statistical Commission, 2012), “Action Taken Reports (ATRs) submitted by the Government to the Parliament on the recommendations given in NSC’s annual reports were not satisfactory”. Given the important role NSC can play in improving data management within the country, NSC should be empowered such that its recommendations are considered more seriously.
 - b. Given the breadth of official statistics collected, it may be more effective to appoint sector-wise nodal officers at the central and state government levels.
 - c. There is confusion about the exact relationship between the data warehouse activity under MoSPI and DST’s NDSAP and data.gov.in initiatives. It may be useful to think of how these two activities can be aligned better or perhaps even integrated into one national data warehousing and dissemination program.
2. Notwithstanding the above suggestion, a single well-defined and staffed agency to collate, harmonize, reconcile and publish energy data from multiple sources is highly desirable. Such an agency should have expertise in data, statistics and their management, domain expertise related to energy and also have the powers to suggest refinements to census and survey questionnaires to fulfill any data needs. Further study is required to determine whether such an agency needs to be a full-time agency or a part-time one. In any case, the given requirements suggest CSO is perhaps the right institution to house such an agency, though it should be guided by NSC and supported with expertise from corresponding line ministries.
3. Currently, data collection by line ministries is undertaken more for administrative purposes rather than for dissemination and policy research. Data management needs to be recognized as an important function by the various line ministries and assigned dedicated and suitably qualified staff. Such staff can also then liaison with the central EDM agency suggested above.
4. In addition to a central agency responsible for managing data, there is also need for a separate and autonomous energy analysis office to analyse energy sector data and inform policy formulation. Such a policy-focused analysis body could exist within the Planning Commission in its current or newly envisioned form.

7. Conclusions

Effective data collection, organization and dissemination is a key input to effect policy research and formulation. An analysis of India’s EDM shows that it has some strengths and many weaknesses. Some recent initiatives, such as the formation of NSC and rolling out of NDSAP, aim to address some of the deficiencies.

A wide range of options are available to help Indian EDM systems move towards global best practices. These include simple improvements to operational processes, adoption of modern technology for increased efficiency, plugging data gaps, and institutional reforms. Operational

process improvements include publishing data that is currently collected but not disseminated, and effectively using existing statutory powers and authority. In the medium term, systems to collect more comprehensive energy data such as appropriately designed surveys can be considered. Longer term institutional reforms such as setting up a specific mechanism to reconcile data from multiple sources will improve the quality of Indian EDM.

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Appendix

A Acts/Rules/Regulations

A brief summary of some of the important legal and administrative provisions applicable to EDM in India is given below.

A.1 Collection of Statistics

Collection of Statistics Act, 2008 provides central and state governments the power to collect statistics related to any subject within their purview. It supersedes the Collection of Statistics Act, 1953 and expands the range of statistics that can be collected under the act. Central and state governments need to synchronize collection of statistics under this act to avoid duplication. The central government can declare any subject as 'core statistics' from time to time and arrange for collecting and dissemination of statistics on the subject. Failure to provide data that is required under the act is punishable with a fine of up to five thousand rupees per day. Any information collected under the act should only be used for statistical purposes and confidentiality should be ensured when publishing the information. The central government can make rules to lay out principles for effective coordination, form and manner in which the information is shared.

Collection of Statistics Rules, 2011 were notified by MoSPI under the Collection of Statistics Act, 2008. Under these rules, a nodal officer designated by the Central Government is responsible for

- *“improving the statistical potential of administrative records to avoid conducting separate statistical surveys”* and
- for issuing instructions for *“sharing of statistical information including unit-level data among different Departments of the Central Government and States to avoid unnecessary duplication of programmes of collection of statistics”*.

Nodal officers appointed by State Governments have similar responsibilities. Avoidance of duplication in collection of statistics as envisaged under these rules has an important consequence. As per these rules, the consultation of nodal officer of central government is mandatory for conducting any survey.

A.2 Fuels

Essential Commodities Act, 1955 empowers the central government to collect any information or statistics with a view to regulating or prohibiting commercial or financial transactions in essential commodities that are likely to be detrimental to public interest. Coal, including coke and other derivatives as well as petroleum and petroleum products are essential commodities under this act.

Mines and Minerals (Development and Regulation) Act, 1957 (as amended up to May, 2012) empowers the central or state government to authorize any person to enter, inspect and survey any mine, inspect records and examine any person in control of the mine.

Coal Mines (Conservation & Development) Act (1974) authorized the Government of India to take over the powers of the Coal Board as part of nationalization of coal production, supply and distribution.

Coal Mines (Conservation and Development) Amendment Rules, 2011 amend the Coal Mines (Conservation and Development) Rules, 1975 framed under the Coal Mines (Conservation and Development) Act, 1974. They make it mandatory for every owner, agent or manager to furnish information on

- *“production and dispatch of coal, washery and process products and working conditions in the mines”;*
- *“opening, re-opening and closure of mines and any other information as may be as required by the Coal Controller”.*

In addition to the above rules, the **Colliery Control Rules, 2004**, set up under the Mines and Minerals (Development and Regulation) Act, 1957, the Coal Controller can mandate anyone engaged in the business of coal production and distribution to provide information. The Coal Controller or any officer authorized thereby is allowed to enter and inspect any colliery to ensure correctness of the class, grade or size declared. In this process, the Coal Controller can draw samples.

The Oilfields (Regulation and Development) Act, 1948 authorizes the central government to make rules for conservation and development of mineral oils on many subjects, among which include *“the submission by the owners or lessees of mines of special or periodical returns and reports, and the forms in which and the authorities to whom such returns and reports shall be submitted”*.

According to the **Petroleum and Natural Gas (Amendment) Rules, 2006** – an amendment to the Petroleum and Natural Gas Rules, 1959 created under The Oilfields (Regulation and Development) Act, 1948 – it is mandatory for the lessee/owner to submit to the central government/designated agency *“geological, geophysical, geochemical, petrophysical, engineering, well logs, maps, magnetic tapes, cores, cuttings and production data as well as all interpretative and derivative data, including reports, analyses, interpretations and evaluation prepared in respect of petroleum operations”* as soon as possible and free of cost. The rules also state that such data shall be the property of the central government.

Petroleum Products (Maintenance of Production, Storage and Supply) Order, 1999 – created using powers conferred by Essential Commodities Act, 1955 – requires oil refining companies to provide data on *“actual production of each petroleum product and total crude throughput in each refinery”* every month and *“product-wise production programme and expected crude throughput in respect of each refinery”* for the next month to the central government. The order also states that oil refining companies may be asked to furnish *“procurement, stocking, movements (on-shore or off-shore), transfers, exports, imports and sales of crude oil and or all products”* as may be required from time-to-time.

Resolution No. P-20029/22/2001-PP of the Ministry of Petroleum and Natural Gas, authorizes the **creation of Petroleum Planning and Analysis Cell (PPAC)** to be attached to the ministry, which is expected to discharge, among many functions, the *“maintenance of information data bank”*.

Notification S.O. 1391(E) issued by the Ministry of Petroleum & Natural Gas in 2006 under the Petroleum and Natural Gas Rules, 1959 authorizes the **Directorate General of Hydrocarbons (DGH)** to *“ask for and maintain in a readily retrievable form all geo-scientific data, reports and information*

from licensee or lessee and store and preserve data and samples pertaining to petroleum exploration, drilling, production and connected operations”.

Scheduled Industries (Submission of Production Returns) Rules, 1979 – created under Section 30, Industries (Development and Regulation) Act (1951) – allows the collection of data from refineries among many other industries

The Petroleum and Natural Gas Regulatory Board (PNGRB) formed under **The Petroleum and Natural Gas Regulatory Board Act, 2006** –

- is responsible for maintaining “*a data bank of information on activities relating to petroleum, petroleum products and natural gas*”, essentially any activity that falls under the purview of the board;
- has the “*power to verify the data supplied by the entities and appoint any person or persons for the purpose and take such measures as it may consider necessary*”;
- “*shall maintain confidentiality in respect of any information and record received by it from the entities and shall not disclose information contained therein to any person or authority except on the grounds of public interest*”.

A.3 Electricity

The **Electricity Act, 2003** continues the functioning of Central Electricity Authority, a statutory organization created under the Electricity (Supply) Act (1948). In addition to its technical functions, CEA is responsible for collection and dissemination of electricity-related data. CEA is conferred powers to require any entity involved in electricity generation, transmission, distribution, trade and use to provide data in the form specified by CEA. Under Section 73 of the act where functions and duties of the CEA are detailed out, CEA shall

- *collect and record the data concerning the generation, transmission, trading, distribution and utilisation of electricity and carry out studies relating to cost, efficiency, competitiveness and such like matters;*
- *make public from time to time information secured under this Act, and provide for the publication of reports and investigations;*

In addition, Section 74 confers upon CEA the power to require statistics and returns:

- *It shall be the duty of every licensee, generating company or person generating electricity for its or his own use to furnish to the Authority such statistics, returns or other information relating to generation, transmission, distribution, trading and use of electricity as it may require and at such times and in such form and manner as may be specified by the Authority.*

In addition, CEA is authorized to “*make regulations consistent with this Act and the rules generally to carry out the provisions*” of the Act such as “*the form and manner in which and the time at which the State Government and licensees shall furnish statistics, returns or other information under section 74*”.

ERCs are mandated to make public, at least on an annual basis, the information shared by licensees with respect to standards of performance regulations such as performance achieved and any penalties imposed for non-achievement.

Central Electricity Authority (Furnishing of Statistics, Returns and Information) Regulations, 2007 govern who the CEA collects statistics from, the procedure for collecting these statistics and penalties for non-compliance. These regulations apply to *“all the licensees, generating companies, person(s) generating electricity for its or his own use and person(s) engaged in generation, transmission, distribution, trading and utilization of electricity”*. The regulations provide a detailed list of entities that are mandated to furnish information to the CEA along with the formats, frequencies and target dates for such information.

Under the **CERC (Power Market) Regulations, 2010**, power exchanges are mandated to display on their websites, prices, volumes and historic prices in a downloadable format and all relevant price sensitive information.

A.4 Energy Conservation

Under the **Energy Conservation Act, 2001**, BEE has the power to *“recommend to the Central Government to notify any energy user or class of energy users as a designated consumer”*. As part of the powers conferred by the act to enforce efficient use of energy and its conservation, the state governments may *“designate any agency as designated agency to coordinate, regulate and enforce provisions of this Act within the State”* in consultation with the BEE. The act then empowers the central and state governments *“to direct any designated consumer to furnish to the designated agency ... information with regard to energy consumed”*. In addition, the designated agency may appoint inspecting officers who have the power to enter any place of the designated consumer where energy is used and require access to perform an audit of equipment, production processes, etc.

According to **Energy Conservation (Form and Manner and Time for Furnishing Information with Regard to Energy Consumed and Action Taken on Recommendations of Accredited Energy Auditor) Rules, 2008**, every designated consumer is expected to submit in electronic form as well as hard copy to the designated agency, a report on the status of energy consumption for each financial year within 3 months of the close of that financial year. Such data must be authenticated by the energy manager appointed or designated by the designated consumer, and must also be furnished (both electronic form and hard copy) to BEE. Designated consumers include all those who are involved in any of the following sectors – aluminum, cement, chemicals, chlor-alkali, fertilizers, gas crackers, iron and steel, naphtha crackers, pulp and paper, petrochemicals, petroleum refineries, sugar and textiles.

The **Companies (Disclosure of Particulars in the Report of Board of Directors) Rules, 1988**, notified under the Companies Act, 1956, mandate that a list of 21 energy consuming industries should furnish annual data on energy conservation measures undertaken as well as total and specific energy consumption to Ministry of Corporate Affairs in the specified format. Although these rules precede the EC Act and the list of industries is larger than the list of designated consumers under EC Act, it is unclear whether this information is collected.

A.5 Census

Census Act, 1948, last amended in 1994, was enacted to better define the scheme of conducting the census as well as the duties and responsibilities of census officers. The census was conducted on an ad-hoc basis until 1948. As per the act, the census schedules or questionnaires are devised by the

Census Commissioner and the same are published by state governments and union territory administrations in their respective gazettes in canvas of the census. The act makes it mandatory for all citizens to participate in the census and provide answer questions to the best of their knowledge or belief. The central government can make rules to carry out the purposes of this Act. **Census Rules, 1990** lay out the functions of the various census officers and provide the Census Commissioner with the responsibility to decide which the items on which Census data may be released.

B Supply side data

B.1 Coal Controller's Organisation

Table 4 lists the data reported in CCO's Coal Directory.

Table 4: Data published in the Coal Directory

Data Category	Disaggregation
Mine Statistics	sector (public/private), mine type (opencast/underground), captive/non-captive
Reserves	Grade-wise, field-wise, depth-wise
Exploration	Exploration agency-wise, coal company-wise
Production	Coal product-wise, mine type-wise, captive/non-captive, company-wise, grade-wise
Despatch & Off-take	Coal product-wise, consumer category-wise, mode of transport-wise, some monthly data as well
Captive Coal & Lignite Blocks	Allocation – Year-wise, state-wise, sector-wise, consumer category-wise reserves, list of blocks
	Production – Year-wise consumer category-wise
Pit-head Closing Stock	Month-wise, company-wise, classification-wise (coking/steam), coal products-wise (washed/middlings) stock
Trade	Import
	Export – Coal only (i.e., no lignite)
Consumption in steel, power and cement plants – Coal Only	Stocks (Opening/Closing)
	Receipt
	Consumption
	Washerries
	Cement Sector - Coal Receipt & Consumption
Pit-head Value, Price & Duty	Value – State-wise, captive/non-captive
	Run of mine prices – company-wise, grade-wise, classification-wise, historical
	Consumer prices – year-wise coking for industry, steam coal for power, industry
	Royalty – state-wise, grade-wise, classification-wise
	Import duty rates – year-wise

Note: Data is provided for some, not all, combinations of the above mentioned disaggregations.

B.2 MoPNG

MoPNG publishes weekly statistics on production of crude oil and natural gas grouped into Oil and Natural Gas Corporation (ONGC), Oil India Limited (OIL) and Private/ Joint Venture Companies (JVC).

In addition weekly statistics also include overseas production of crude oil and natural gas by ONGC Videsh Ltd (OVL).

MoPNG also publishes monthly statistics of company-wise state-wise crude oil production, natural gas production and location-wise refinery crude throughput (actual vs target) along with any reasons for shortfall. These statistics are grouped into production by ONGC, OIL and Private/ JVC. Reliance India Limited (SEZ) provides its refinery throughput numbers for exported products at a lag of 3 months, hence these numbers are provided on a pro rata basis.

Data reported in the annual Petroleum and Natural Gas Statistics is listed in Table 5.

Table 5: Data reported in Petroleum and Natural Gas Statistics

Data Category	Product(s)	Disaggregation
Reserves	Crude Oil, Natural Gas	State-wise, on-shore/off-shore
Exploration	Crude Oil, Natural Gas – Wells, Rigs, Metreage	State-wise, on-shore/off-shore, company-wise, basin-wise
Production/Refining	Crude Oil, Natural Gas	State-wise, on-shore/off-shore, company-wise
	Petroleum Products – Refining Capacity	Company-wise, refinery unit-wise
	Petroleum Products – Crude Throughput & Production	Company-wise, refinery unit-wise, petroleum product-wise, source-wise, month-wise
	LPG – Production – Indigenous (Refineries & Fractionators)	Aggregate
	LPG – Imports	Aggregate
	LPG – Bottling Capacity	Aggregate
Transportation	Pipelines – Length	Company-wise, product-wise
	Pipelines – Capacity & Throughput/Utilization	Company-wise, product-wise, pipeline-wise
	Pipelines – Status under Execution	Company-wise status at beginning of financial year
	Pipelines – PNG pipelines	Company-wise, Consumer-category-wise, city-wise
	Tankers – Numbers & DWT ²⁶	Company-wise, carrier-type-wise
	Ports	Port-wise
	Railways – Traffic Handled & Earnings	Aggregate
	Railways – Freight Rates	Distance-wise
Sales	Number of Retail Outlets	State-wise, company-wise
	Number of LDO/Kerosene Dealers	State-wise, company-wise
	Number of LPG Distributors	State-wise, company-wise
	Number of LPG consumers, markets; Quantity of domestic production (refineries, fractionators), imports	Year-wise
	CNG stations by station type, vehicle stock by vehicle type, price, average daily consumption	State-wise, city-wise

²⁶ Dead Weight Tonnage

Data Category	Product(s)	Disaggregation
Consumption	Petroleum products	Product-wise, year-wise, public/private sector, state-wise
	Consuming sector-wise	Year-wise, product-wise (LPG, Kerosene, Naphtha, HSDO, LDO, FO, LSHS/HHS)
	Share of OMCs	Year-wise
	Deliveries to international coasters/bunkers	Year-wise, product-wise (FO, HSD., LDO)
	Per-capita Sales	Year-wise, state-wise, product-wise

Note: Historic data for the last 8-10 years is provided for some items above. Data is provided for some, not all, combinations of the above mentioned disaggregations.

B.3 Central Electricity Authority

CEA comprises 6 wings focusing on planning, thermal, hydro, grid operation & distribution (GO&D), economic & commercial and power system. All of these wings are involved in data collection and dissemination processes in their respective areas. Regional power committees (RPCs), also formed under the Electricity Act (2003) for facilitating integrated operation of the power systems in a region, report to the GO&D wing of the CEA and publish operational data for the region on a regular basis. SLDCs report data to the Operations Performance Monitoring (OPM) division within GO&D wing.

Table 6 provides an indicative list of the reports published by CEA and the frequency of their publication.

Table 6: A non-exhaustive list of CEA reports

Data	Frequency
Unit-wise Generation and Outages	Daily for thermal, nuclear and hydro across all sectors (central, state, private)
Coal Stock Position at Thermal Power Plants	Daily for imported as well as domestic coal
Hydro Reservoir Level	Daily
Installed Capacity	Monthly for thermal, nuclear, hydro and renewable
Capacity Addition Status/Review	Monthly for thermal power plants
Transmission line Length and Substation capacity	Monthly aggregated at voltage-wise sector-wise
Unit-wise Generation and PLF with year-on-year comparison	Monthly for thermal, nuclear and hydro across all sectors (central, state, private) and fuel –wise
Power supply position	Monthly for energy as well as peak requirement
Captive Generation	Annual
Outage Plan for next year	Annual
Performance of thermal power stations	Annual
Performance of hydro power stations and hydro power potential	Annual

Data	Frequency
Baseline CO ₂ database for CDM consisting of all generating units, net generation during the last year and absolute CO ₂ emissions	Annual or as needed

C Consumption side data

C.1 MoSPI Survey Questionnaires

Surveys conducted by MoSPI that include energy related questions are listed in Table 7 along with a non-exhaustive list of key energy related indicators collected in these surveys.

Table 7: List of MoSPI surveys and energy data collected

Category	Surveys	Indicators collected
Household	Household consumer expenditure	<ul style="list-style-type: none"> • Primary source of energy for cooking and lighting • Consumption of energy sources during last 30 days
	Employment/unemployment situation	<ul style="list-style-type: none"> • Whether enterprise where the person is employed uses electricity for its production • Free collection of firewood, cow-dung, cattle feed etc. for household consumption • Preparation of cow-dung cake for use as fuel in household
	Housing condition & amenities	<ul style="list-style-type: none"> • Source of cooking fuel • Source of lighting • Is house electrified? • Appliance ownership • Vehicle ownership
Enterprises	Annual Survey of Industries (ASI)	<ul style="list-style-type: none"> • Type of Power used • Electricity generated, consumed, purchased and sold • Consumption, purchase of fuels and water • Energy conservation measures • Fuel consumed (imported and domestic) • Loss of production due to non-availability of electricity
	Unorganized manufacturing enterprises	<ul style="list-style-type: none"> • Amount of electricity and fuel consumed – quantity & value
	Unincorporated non-agricultural enterprises	<ul style="list-style-type: none"> • Whether problem faced of power cut or erratic power supply • Operating expenses including electricity and fuel
Agriculture	Land and livestock holding	<ul style="list-style-type: none"> • Types of agricultural machinery used (1992)
	Situational assessment of farmers (one time in 2003)	<ul style="list-style-type: none"> • Device used for irrigation • Reasons for inadequacy of irrigation if any (shortage of power, issue with equipment etc) • Primary & secondary sources of energy (if secondary is used) for ploughing, irrigation, harvesting, threshing, cane crushing, transport, cooking and lighting • Expenses on non-farm business (petrol, diesel & lubricants, electricity charges, fuel other than

		<ul style="list-style-type: none"> electricity, traveling, freight & cartage expenses) • Expenditure on conveyance
Services	Service sector	<ul style="list-style-type: none"> • Nature of problems faced. Whether <ul style="list-style-type: none"> ○ Non-availability of electricity connection ○ Power cut faced ○ Fuel – unavailable or unaffordable • Freight transport ownership during last 30 days • Passenger land transport ownership during last 30 days • Energy-related expenses for non-financial enterprises
	Unorganized service sector	<ul style="list-style-type: none"> • Nature of problems faced. Whether <ul style="list-style-type: none"> ○ Non-availability of electricity connection ○ Power cut faced ○ Fuel – unavailable or unaffordable • Amount of electricity and fuel consumed – quantity & value
Public Amenities	Common property & facilities	<ul style="list-style-type: none"> • Number of bio-gas plants in village • Section of population collecting fuelwood • Mode of commuting, distance and average journey time and expense • Average collection, consumption and sale of fuelwood and fodder in the last month and year • Does the household own any diesel and/or electric pump for irrigation? • Change in condition of electricity & street lights within slum during last 5 years • Non-conventional energy use • Distance of nearest possible facility of various types
Tribal Welfare	Economic activity of Tribals	<ul style="list-style-type: none"> • Fuel charges incurred for irrigation • Ownership of stove/electric heater • Ownership of electric fan
	Level of living of Tribals	<ul style="list-style-type: none"> • Purchase of kerosene for last 30 days • Quantity and value of kerosene purchase from PDS and other Sources • Source of lighting

C.2 IHDS

IHDS is a nationally representative household level panel survey covering 41,554 households in 1503 villages and 971 urban neighbourhoods across India. This survey is organized by the University of Maryland, USA and National Council of Applied Economic Research (NCAER), New Delhi. This is a multi-topic survey covering over 15 topics – one of them energy use – that is designed to complement existing surveys conducted by the Indian government. Since IHDS is a panel survey, it can provide useful information on trends in energy consumption and perhaps behavioural data and the effect of informal institutions. Following is an illustrative list of energy related questions asked by the IHDS:

1. Hours of power supply (last 7 days)
2. Expenses on electricity (last month)
3. Vehicle ownership (cycle/bicycle/2- and 4-wheeler, etc)

4. Conveyance expenditure (last month)
5. Vehicle or vehicle spare parts purchased (last year)
6. Asset ownership (large list)
7. Appliances purchased/repared (last year)
8. Type of chulha (cook-stove) used
9. Government support for smokeless/improved chulha
10. Different fuels used
11. Main use of each fuel
12. Hours of usage of each fuel
13. Hours spent in collecting those fuels
14. Expenditure on fuels (last month)
15. Source of obtainment for each fuel
16. Ownership of biogas plant
17. Ownership of agricultural machinery
18. Two most important sources of irrigation

C.3 Consumption Ministries

Ministry of Railways publishes fuel consumption and intensity as well as fuel costs as part of its annual statistical summaries in its yearbook. Ministry of Road Transport and Highways publishes passenger kilometers performed, vehicle productivity (kms/bus/day) and fuel efficiency (km/litre of HSD) for State Road Transport Undertakings. Ministry of Shipping reports commodity-wise material handled (including energy commodities) through ports and inland waterways in its annual statistics. Ministry of Chemicals and Fertilizers reports energy consumption of urea plants vis-à-vis norms under New Pricing Scheme (NPS)-III. Ministry of Steel reports specific energy consumption of steel plants in its annual reports. Surveys conducted by Ministry of Health and Family Welfare and Ministry of Water Resources provide some data on energy use in provision of health and irrigation services respectively.