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Effective energy data management for low-carbon growth planning: An analytical framework for assessment

Bo Liu[a], Meredydd Evans[a,*], Sha Yu[a], Volha Roshchanka[b], Srihari Dukkipati[c], Ashok Sreenivas[c]

[a] Joint Global Change Research Institute, Pacific Northwest National Laboratory, 5825 University Research Court, Suite 3500, College Park, MD 20740, USA
[b] Earth System Science Interdisciplinary Center, University of Maryland, 5825 University Research Court, Suite 3500, College Park, MD 20740, USA
[c] Prayas Energy Group, III A & B, Devgiri, Joshi Railway Museum Lane, Kothrud Industrial Area, Kothrud, Pune, Maharashtra 411038, India

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ABSTRACT

Readily available and reliable energy data is fundamental to effective analysis and policymaking for the energy sector. Energy statistics of high quality, systematically compiled and effectively disseminated, not only support governments to ensure national security and evaluate energy policies, but they also guide investment decisions in both the private and public sectors. Because of energy's close link to greenhouse gas emissions, energy data has a particularly important role in assessing emissions and strategies to reduce emissions. In this study, energy data management in four countries – Canada, Germany, the United Kingdom and the United States – are examined from both organizational and operational perspectives. With insights from these best practices, we present a framework for the evaluation of national energy data management systems. It can be used by national statistics compilers to assess their chosen model and to identify areas for improvement. We then use India as a test case for this framework to assess how India may adapt and evolve its energy data management systems. Its government is working to enhance India's energy data management to improve sustainable growth planning.

1. Introduction

Climate change has been recognized as a common threat to both natural and human systems (IPCC et al., 2014). With years of negotiations on combating global climate change, the 21st Conference of the Parties (COP21) in Paris made history with an international agreement on transitioning to a low-carbon and climate-resilient future. As a major contributor to climate change, the energy sector accounts for approximately two-thirds of total anthropogenic greenhouse gas (GHG) emissions globally (IEA, 2015). Mitigating energy-related emissions plays a significant role in the future of sustainable development and low-carbon growth. However, accurately calculating GHG emissions requires activity-based data and reasonable accounting methods. Readily available and reliable energy data is fundamental to effective analysis and policymaking for the energy sector. Energy statistics of high quality, systematically compiled and effectively disseminated, ensure national security and evaluate energy policies and guide investment decisions in both the private and public sectors.

Quality assurance, for energy or other topics, requires a complex and multi-dimensional approach. Typically data quality includes assuring accuracy, completeness, timeliness, relevance and accessibility. Data quality also maintains objectivity and signals independence from political and other influence. That way public data users will

Abbreviations: AER, Alberta Energy Regulator; AGEB, Working Group on Energy Balances; APPA, American Public Power Association; BAFA, Federal Office of Economics and Export Control; BEE, Bureau of Energy Efficiency; BEIS, Department for Business, Energy & Industrial Strategy; BIS, Department for Business, Innovation and Skills; BMWi, Federal Ministry for Economic Affairs and Energy; CA, The Coal Authority; CBECS, Commercial Buildings Energy Consumption Survey; CCO, Coal Controller's Organization; CEA, Central Electricity Authority; CGPL, Combustion,Gasification and Propulsion Laboratory; DECC, Department of Energy and Climate Change; Destatis, Federal Statistical Office; DGH, Directorate General of Hydrocarbons; DLHS, District Level Household and Facility Survey; DOC, Department of Commerce; DOE, Department of Energy; DOTn, Department of Transportation; ECCC, Environment and Climate Change Canada; EIA, Energy Information Administration; ESCM, Energy Statistics Compilers Manual; FERC, Federal Energy Regulatory Commission; GSS, Government Statistical Service; IHDS, India Human Development Survey; InterEnerStat, Intersecretariat Working Group on Energy Statistics; IRES, International Recommendations for Energy Statistics; MNRE, Ministry of New and Renewable Energy; MoR, Ministry of Railways; MoRTH, Ministry of Road Transport and Highways; MoSPI, Ministry of Statistics and Programme Implementation; MoWR, Ministry of Water Resources; NEB, National Energy Board; NFHS, National Family Health Survey; NISE, National Institute of Solar Energy; NIWE, National Institute of Wind Energy; NRC, Nuclear Regulatory Commission; NRCan, Natural Resources Canada; NSSO, National Sample Survey Office; OEB, Ontario Energy Board; Ofgem, Office of Gas and Electricity Markets; OMB, Office of Management and Budget; ONS, Office for National Statistics; PPAC, Petroleum Planning and Analysis Cell; RECS, Residential Energy Consumption Survey; StatCan, Statistics Canada

* Corresponding author.
E-mail addresses: lbesf.chn@gmail.com (B. Liu), mevans@pnnl.gov (M. Evans), Sha.Yu@pnnl.gov (S. Yu), volha@protonmail.com (V. Roshchanka), srihari@prayaspune.org (S. Dukkipati), ashok@prayaspune.org (A. Sreenivas).

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Table 1
Principles of official statistics.

Principles	UN	EU	US
a. Proximity and relevance to policy issues and topics	√	√	√
a. Independence from political and other undue influences	√	√	√
a. Trust among data providers and confidentiality	√	√	√
a. Public perception and credibility	√	√	√
a. Timeliness and punctuality	√	√	√
a. Impartiality and objectivity	√	√	√
a. Cost effectiveness	√	√	√
a. Non-excessive burden on respondents	√	√	√
i. Availability, accessibility, and clarity to the public	√	√	√
a. Quality of data, products, methodologies, and procedures	√	√	√
a. Coherence and comparability		√	√
a. Adequacy of resources		√	√
a. Mandate for data collection		√	√
a. Coordination among various agencies/branches for consistency and efficiency	√		√
a. Use of international concepts, classifications, and methods	√		
a. Bilateral and multilateral cooperation	√		

believe the data, which in turn will increase the likelihood that a range of stakeholders make decisions based on the data. In addition, statistical agencies may be challenged by limited budgets and trade-offs between quantity and quality because of constraints on financial and human resources. Therefore assessing the quality of energy data requires an examination of the overall energy data management system. To maintain the effectiveness of data management systems, international organizations and governments have developed fundamental principles or codes of practices. There are three leading statements of principles that largely overlap (Table 1). The U.N. code of practice is a broad statement of principles; the others are statements of guiding principles regarding practices within two specific geographic regions.

Harmonizing the processes for preparing data will ultimately improve data in all countries and make energy data more compatible worldwide. Beyond the general principles that countries may follow, the United Nations Statistical Commission created the Oslo Group and the Intersecretariat Working Group on Energy Statistics (InterEnerStat) in 2005 to provide general guidance on compiling national energy statistics. The Oslo Group aims at addressing methodological issues and international standards; InterEnerStat focuses on coordination among international organizations and harmonizing definitions of energy products and flows (UNSD, 2015). Two major accomplishments of the Oslo Group since its inauguration include the development of the International Recommendations for Energy Statistics (IRES) and the Energy Statistics Compilers Manual (ESCM). The IRES serves as a common process framework. Its recommendations include definitions and classifications, data sources, data compilation strategies, data quality assurance, dissemination policies, and other topics (UNSD, 2011). The IRES presents definitions and guidelines from a theoretical perspective. The ESCM, which still has to be finalized, complements IRES in a more practical way by providing illustrative examples from one country or another. IRES and ESCM provide an overview of common standard practices that maintain consistency and increase comparability across countries. They are not a collection of best practices as much as they are a set of voluntary guidance, which provide examples that compilers of statistics might use. A key outcome of this U.N. work is harmonizing how surveys are done. That makes data much more compatible and comparable than when data harmonization is merely added on at the end of the process. However, neither IRES nor ESCM provide guidance for the evolution of effective energy data management in certain countries. There is still a need to explore how countries address energy data issues and how they overcome specific national challenges. That exploration is the organizational principle of our study.

Countries have adopted various models for national energy data management. These models depend on energy sector characteristics, economic structure, country size, a country's type of government, and other factors. No single energy data management system fits all countries, but a review of how several countries do it can suggest best practices for collecting, processing, and disseminating national energy data. With insights from these best practices, we present a framework for the evaluation of national energy data management systems. It can be used by national statistics compilers to assess their chosen model and to identify areas for improvement. To illustrate the framework's usefulness, we take India as a case study by investigating its national energy data management system.

2. Methodology and data

To assess national data systems, we compiled and compared available information from official government websites and documents, including information on how national systems developed and improved over time. We then integrated this with information obtained directly from national statistics officials or government representatives in order to verify the information and to identify when ambiguity exists.

This study examines models of energy data management from four countries – the United States (U.S.), Canada, the United Kingdom (UK) and Germany. We selected these countries to demonstrate the diversity and effectiveness across various models. These countries are all members of the International Energy Agency and all of them have energy data systems that are at a minimum several decades old. Thus, we describe the organization and operations of energy data management in these countries, especially how energy data are collected, processed, analyzed, and disseminated, and how these practices have changed as the countries have developed. We also discuss tools and practices used to overcome any challenges in their chosen models. This study's analytical framework is based on the processes and practices of energy data management in these four countries. However, the basic principles can be useful to a range of countries, including those with more recent histories of developing comprehensive energy statistics and energy balances.

India recognizes the importance of energy data in sustainable development and low-carbon growth planning and has been collaborating with the U.S. government to improve its energy data management. That led to the Sustainable Growth Working Group under the U.S.-India Energy Dialogue, in which energy data management is one of three focus areas. We use this analytical framework to assess the current energy data management in India and demonstrate the effectiveness of the framework in managerial assessment of national energy data management systems. At the same time, we feel this approach, which we have applied to India, might be helpful for a range of developing countries seeking to improve their energy data management systems.

3. Results and discussion

3.1. Models of energy data management: an organizational perspective

Countries share a common understanding of effective data management, but have adopted various models to satisfy their needs (Fig. 1). A country's political system, economic structure, size, and type of government can have a large influence over how its national energy data management system operates. Data management models can be centralized or decentralized, depending on how much responsibility for official statistics falls on a central agency or on specialized government agencies. Decentralization can take place in many ways, so that functions are distributed, for example, by region (Germany, UK) or agency specialization (Canada, Germany). The national policy context determines the design of a statistical system; in turn, the design can have an impact on the process of policymaking.