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China's numerical management system for reducing national energy intensity

Huimin Li [a], Xiaofan Zhao [b,*], Yuqing Yu [c], Tong Wu [b,d], Ye Qi [b]

[a] Beijing Climate Change Response Research and Education Center, Beijing University of Civil Engineering and Architecture, Beijing 100044, China
[b] School of Public Policy and Management, Tsinghua University, Beijing 100084, China
[c] Climate and Energy Area, Institute for Global Environmental Strategies, 2108-11 Kamiyamaguchi, Hayama, Kanagawa 2400115, Japan
[d] ecoSERVICES Group, School of Life Sciences, Arizona State University, Tempe, AZ 85287-4801, USA

HIGHLIGHTS

- We assess drawbacks of China's numerical management system for energy intensity.
- The national energy intensity target cannot be fully disaggregated without omissions.
- Data distortion is due to failures in statistics, monitoring and examination system.
- Lower-level governments' ability to meet energy target is weaker than their pressure.
- We provide three policy recommendations for China's policy-makers.

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ABSTRACT

In China, the national target for energy intensity reduction, when integrated with target disaggregation and information feedback systems, constitutes a numerical management system, which is a hallmark of modern governance. This paper points out the technical weaknesses of China's current numerical management system. In the process of target disaggregation, the national target cannot be fully disaggregated to local governments, sectors and enterprises without omissions. At the same time, governments at lower levels face pressure for reducing energy intensity that exceeds their respective jurisdictions. In the process of information feedback, information failure is inevitable due to statistical inaccuracy. Furthermore, the monitoring system is unable to correct all errors, and data verification plays a limited role in the examination system. To address these problems, we recommend that the government: use total energy consumption as the primary indicator of energy management; reform the accounting and reporting of energy statistics toward greater consistency, timeliness and transparency; clearly define the responsibility of the higher levels of government.

1. Introduction

China has taken consistent measures to reduce its energy intensity (defined as energy consumption per unit of GDP) since the 1980 s, initially due to serious energy shortages. More recently, reducing energy intensity has become China's central strategy for climate change mitigation (Raupach et al., 2007;Wang et al., 2005; Zhang et al., 2009). From 1980 to 2000, China assigned explicit targets for national energy intensity reduction in four consecutive National Economy and Social Development Five-Year Plans (hereafter FYP). In order to meet these targets, the government implemented a series of energy-saving policies and programs, including quota management of industrial energy use, shutdown of inefficient facilities, financial incentives for energy efficiency investments, establishment of energy conservation service centers, capacity building and propaganda initiatives (Sinton et al., 1998). These policies proved effective in bringing down the national energy intensity from 3.401 t of coal equivalent (tce)/10,000 Yuan in 1980 to 1.259tce/10,000 Yuan (at 2005 constant price) in 2010, a decrease of 62.97% (Fig. 1).

The 10th FYP period (2001–2005), however, witnessed a reversal of this two-decade trend of decreasing energy intensity (Fig. 1). From 2002 to 2005, average energy intensity increased by 14.34%, from 1.229tce/10,000 Yuan to 1.406tce/10,000 Yuan. Consequently, energy intensity in 2005 rose back to the 1997–1998

* Corresponding author.
E-mail addresses: liadan80@163.com (H. Li), xiaofanzhao618@gmail.com (X. Zhao), yu@iges.org.jp (Y. Yu), twu11@asu.edu (T. Wu), qi@tsinghua.edu.cn (Y. Qi).

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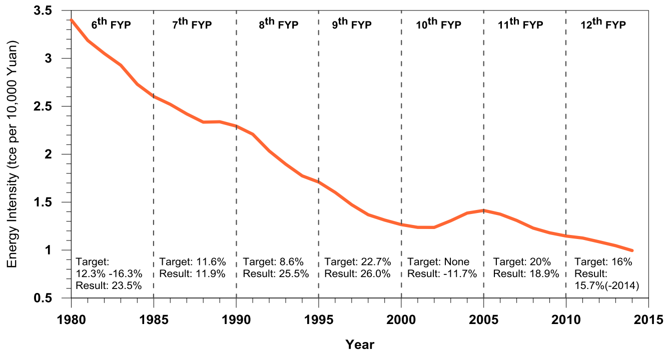

Fig. 1. The historic change of energy intensity in China. Note: Energy intensities are calculated based on 2005 constant price. *Sources:* NBS, 2015a, 2015b

level. Although rapid expansion of energy intensive industries was identified as a major factor (Chai et al., 2009; Liao et al., 2007), the lack of an energy intensity reduction target in the 10th FYP should be considered as another credible cause (Hu et al., 2010).

The increase in energy intensity during the 10th FYP period accelerated the growth of carbon emissions and caused serious environmental impacts. In response to the climate change and environmental consequences of growing energy consumption, the Chinese government assigned a mandatory target of a 20% reduction in energy intensity by 2010, relative to the 2005 level, in its 11th FYP; this was followed by a target of a 16% reduction by 2015, relative to the 2010 level, in its 12th FYP. A series of command-and-control policies and market-based measures such as energy performance contracting and emissions trading were put in place to ensure target attainment (Dai and Bai, 2012; Ke et al., 2012; Qi, 2011, 2014; Zhou et al., 2010). As a result of these policies, China's energy intensity returned to a decreasing trend: energy intensity continuously declined from 1.406tce/10,000 Yuan in 2005–0.986tce/10,000 Yuan in 2014. China successfully met its 11th FYP energy savings target (Price et al., 2011; Yu et al., 2015), and is expected to meet the 12th FYP target.

Underlying this improved performance is the establishment of the energy savings target responsibility system (TRS) in 2007. In the 1980 s and 1990 s, the implementation of energy-saving policy in China relied on numerous national ministries in charge of different industries, which is generally referred to as a line (*tiao*)-based governance structure (Qi, 2013). With these ministries abolished by 2000 as a result of administrative reorganization and adaptation to a market economy, energy savings governance was neglected. In 2007, TRS was established as the basic energy policy implementation mechanism in China. It reinforced the role of the local government as the main implementer of energy policies, which marked the transition of China's energy savings governance structure from a line-based system to a block (*kuai*)-based one (Qi and Wu, 2013). Under TRS, the national energy intensity reduction target was to be met using "responsibility contracts," which assigns energy saving targets to lower levels of government and key energy-consuming enterprises, and then keeps track of and evaluates target performance through the Statistics Indicators, Monitoring, and Examination (SME) system (Li et al., 2013). In *China: A Macro History*, Ray Huang introduced the idea that numerical management is a key indicator of modern governance (Huang, 2015). The explicit energy intensity target setting with an integrated SME system exactly constitutes a Chinese numerical management system for reducing national energy intensity.

The existing literature on the implementation of energy policies in China, particularly with respect to TRS, has focused on how the central government has translated the national energy intensity reduction target into local priorities (Ma, 2012; Qi et al., 2008; Zhang et al., 2011), and how local governments have assisted industrial enterprises in achieving energy savings targets (Lund, 1999; Zhao et al., 2014). The TRS established the mechanisms and protocols for implementing energy policies, and plays a fundamental role in meeting the national target of reducing energy intensity (Li et al., 2013). However, few studies have evaluated the drawbacks of China's numerical management system of reducing energy intensity. A thorough understanding of the drawbacks in this system is integral to furthering energy saving in China, since the present system will continue to be used to meet future energy intensity reduction targets.

This paper uses the concept of numerical management to summarize the key features of China's energy governance and illustrate its drawbacks. Policy recommendations are proposed at the end. This paper is structured as follows: **Section 2** summarizes the institutional framework and the pressure-transfer system of reducing energy intensity. **Section 3** illustrates the SME system as the primary information feedback mechanism in the numerical management system for reducing energy intensity. **Section 4** evaluates the drawbacks of the numerical management system. **Section 5** provides policy recommendations.

2. Institutional framework for reducing national energy intensity

2.1. Institutional arrangements

Fig. 2 shows China's institutional framework for reducing national energy intensity. In China, the central government, which is composed of the Central Committee of the Chinese Communist Party (CPC), the State Council (SC) and the National People's Congress (NPC), is the key policymaking body. Once the CPC proposes the national target of reducing energy intensity, the SC formulates the implementation scheme, followed by legislation by the NPC. In practice, the National Leading Group on Energy Saving and Pollution Reduction (NLGESPR) is authorized to implement specific energy policies.

As a unitary system, China's government consists of five layers, with the central government at the top of the hierarchy and provincial, municipal, country-level and township governments below it. Higher-level governments usually meet their targets by allocating them to lower levels of government. Under TRS, the national target is disaggregated among all provinces, and each province, in turn, distributes its target among the municipalities,

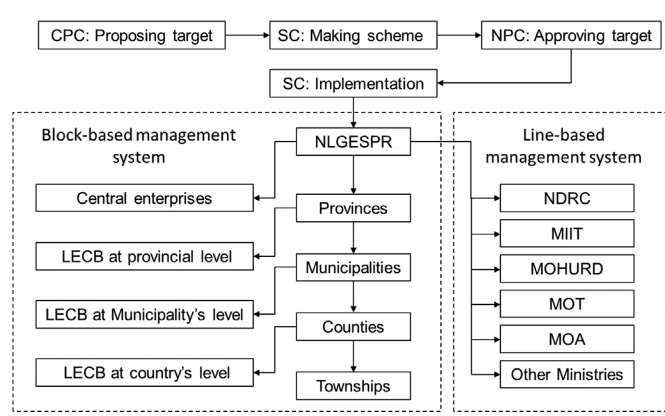

Fig. 2. Institutional framework for reducing national energy intensity. Note: CCP: the Central Committee of the Chinese Communist Party; LECB: the largest energy-consuming businesses; MIIT: Ministry of Industry and Information Technology; MOA: Ministry of Agriculture; MOHURD: Ministry of Housing and Urban-Rural Development; MOT: Ministry of Transport; NDRC: National Development and Reform Commission; NLGESPR: the National Leading Group on Energy Saving and Pollution Reduction; NPC: National People's Congress; SC: the State Council.