Chapter 6
The Role of Fiscal Incentives and Market-Based Incentives in Promoting Energy Efficiency in the Industrial Sector: Case Studies from Asia

Tapan Sarker, Farhad Taghizadeh-Hesary, Aline Mortha, and Anjan Saha

Abstract In recent years, awareness about climate change and the need for cutting greenhouse gas has spread. Policymakers have hence chosen to promote the use of renewable energy, as well as encouraging improvements in energy efficiency (EE). This study analyzes the policy strategies of four Asian countries with large greenhouse gas emissions and EE strategies: the People's Republic of China, India, Indonesia, and Japan. The study first reviewed the type of instruments that can be used to reduce energy intensity, namely incentivizing policies (subsidies, tax reductions, and voluntary agreements) and market-based instruments (white certificates and tendering schemes). Through a review of the literature, the study identified advantages and weaknesses, as well as the effectiveness of said policies in the case studies. Fiscal incentives such as tax cuts and market-based instruments are shown to be efficiently reducing energy intensity. The study also highlighted the role of voluntary agreements and careful planning in successfully improving EE in the People's Republic of China. On the other hand, direct subsidies represented a heavy burden on the government's budget, with limited results.

Keywords Energy efficiency · Energy policy · Asia · Climate change

JEL Classification Q48 · Q54 · Q56

T. Sarker
Griffith Asia Institute, Griffith University, Brisbane, Australia

F. Taghizadeh-Hesary (✉)
Social Science Research Institute, Tokai University, Hiratsuka Japan
e-mail: farhad@tsc.u-tokai.ac.jp

A. Mortha
Waseda University, Tokyo, Japan

A. Saha
National Board of Revenue, Dhaka, Bangladesh

Y. Liu et al. (eds.), *Energy Efficiency Financing and Market-Based Instruments*, Economics, Law, and Institutions in Asia Pacific,
https://doi.org/10.1007/978-981-16-3599-1_6

6.1 Introduction

Many of the post-2015 United Nations (UN) Sustainable Development Goals are connected to the efficient use of energy in industries and households that have an enormous impact on material well-being, public health, climate change, and environment across the world. Energy is the dominant contributor to climate change, accounting for around 60% of the total global greenhouse gas emissions (UN 2018). By 2030, the UN expects double the global rate of improvement in energy efficiency (EE). The 2018 UN Environment Emissions Gap Report published in December 2018 highlighted fiscal policies as a key opportunity to reduce future emissions. In particular, a certain number of countries from Asia and the Pacific have committed to the use of efficient energy, through the Paris Agreement. Given that, this region includes many of the world's greatest greenhouse gas (GHGs) emitters, it is especially interesting to study their strategies and incentives implemented to increase EE, with a special focus on policies directed at the industrial sector.

Fiscal incentives play an important role in promoting investment in EE technology and are instrumental in the industrial sector development in Asia. Such incentives often provided via a country's tax system, offer tax subsidies, rebates, and tax holidays in investments in EE technologies. It also allows deductions and accelerated depreciation of capital expenditure in EE investments that include investment in research and development (R&D), and other related activities within the industrial sector.

To date, a number of Asian countries have adopted a range of fiscal incentives (FIs) in promoting investment in EE technologies. The FIs are aimed at industrial sector development using high-energy saving technologies and high-efficiency services. The intervention of FI policies is predominant both in developed countries such as Japan and in emerging economies such as the People's Republic of China (PRC), India, and Indonesia. Given the variation in policies and variation in the overall structure of the economies including their income, sociocultural, and awareness status, the results are mixed. This research aims at exploring the various EE schemes and incentives implemented in four Asian countries and directed at the industrial sector, which accounts for the majority of energy consumption. Given the mixed results of some policies, this study also aims at conducting comparative evaluation of the success of these initiatives, and eventually, providing policy recommendations for other countries. The novelty of this research lies in the analysis of Asian case studies, with a special focus on FIs and market-based Instruments (MBIs). This chapter paper is organized as follows. Section 6.2 provides a review of the literature on the topic. Section 6.3 introduces FIs, MBIs, and energy efficiency finance schemes implemented throughout the world, discussing their implementation, objectives, and results. Section 6.4 introduces the schemes in force in the selected four Asian countries. Section 6.5 concludes this study, and discusses various policy takeaways. Based on the case studies, this research highlights the positive impact of MBIs on EE, especially when combined with other instruments such as voluntary agreements and FIs.

6.2 Literature Review

EE is one of the keys to transform the future energy system (EC 2016). Empirical findings show that financial incentives increase EE investments (Datta and Filippini 2016; Datta and Gulati 2014; Markandya et al. 2009). Efficiency investments by industry and households and incentives for behavioral change will accelerate this transformation (EC 2011). Literature highlights financial incentives as key for successful EE outcomes, as financial funding motivates the growth and operation of energy-efficient products and technology, and incentives reduce initial investment costs and eliminate financial barriers to EE (Datta and Gulati 2014; Datta and Filippini 2016; Dubois and Allacker 2015; Galarraga et al. 2013; Galarraga et al. 2016; Grösche and Vance 2009; Hou et al. 2016; Markandya et al. 2009). The incentive of EE finance is larger in comparison with an equivalent increase in energy prices using taxes or tradable permits. Politicians are also keen to use this policy mechanism because of its popularity (Galarraga et al. 2016).

EE is related to energy pricing, the building of awareness, reduction of market barriers, and standardization of regulatory approaches. EE improvements lead to lower energy consumption and reduce the emission of greenhouse gases (UN 2019; IPCC 2019). The gap between the emissions target and actual emissions of each country is enormous. One of the reasons is that the amount consumers invest and the amount of expected investment in the interest of the consumers is large (Golove and Eto 1996). Governments, the International Energy Agency, and other international bodies are active in providing support to this end. Financial incentives play a major role in remedying the persistence of barriers to EE to change the market equilibrium towards an efficient equilibrium (de Miguel et al. 2015). Governments and international organizations, in partnership, have projects operating across the countries. Goulder (2013) explores the double dividend of fiscal incentives in EE finance. Fiscal incentives provide environmental improvement and a reduction in the costs of the tax system. Launched in 2010 by the Clean Energy Ministerial, the Super-Efficient Appliance and Equipment Deployment Initiative contributed to drastically improve EE of the household appliances and the other energy-consuming equipment.

For EE improvements, governments across the world are providing a range of incentives such as grants, loans, tax rebates, direct tax deductions, and exemptions. The incentives also include a reduction in sales tax on products eligible for efficient use of energy. For example, governments provide tax incentives to households in purchasing home appliances, equipment, and home shell items such as window insulation. The incentives are also provided to the equipment manufacturers and businesses selling the energy-efficient equipment.

While literature, in general, provides pronounced support for the use of FIs for EE improvements, it encourages a cautious approach, because of the rebound effect of FIs. A number of works note that energy-efficient improvements may lead to an overall increase in energy consumption, which may result in over-consumption of energy. The phenomenon is widely known as the rebound effect of financial

incentives (Jevons 1865; Greening et al. 2000; Freire González 2011). The unpredictability and complexity of the use of various forms of FIs, the co-evolution of technologies and societies, the irreversibility of some of the phenomena, and political reasons may trigger the rebound effect. For instance, in Spain, the large-scale introduction of dishwashers in households through EE rebates reduced welfare in the economy (Galarraga et al. 2013).

Financial incentives may trigger over-consumption of some of the energy-efficient appliances and reduce welfare in the short term, however they remain an important instrument in spurring investment in EE initiatives. They are part of the long-term solution for achieving EE. The most intriguing part is that FIs can overcome market barriers and complement other policies (ACEEE 2019). As energy efficiency instruments may have a rebound effect, a number of works suggest a mix of instruments as an effective tool to mitigate over-consumption (bigEE 2019; Boonekamp 2006; Braathen 2007; Child et al. 2008; Rosenow et al. 2015, 2016). Rosenow et al. (2016), for example, highlight the importance of using energy tax in conjunction with fiscal incentives. They argue that energy tax provides a price effect that forces consumers to invest in energy-efficient technologies. The big EE projects argue that a combination of the performance standard and financial incentives reinforces EE, where the financial barrier is high. EE instruments may have both reinforcing and mitigating effects, as detailed in a study by Weise et al. (2018).

6.3 Review of Policies Improving Energy Efficiency

To analyze the policies implemented by Asian countries to improve energy efficiency, this section discusses the various instruments that are available for policy makers, including their advantages, drawbacks, and issues in implementation. This section is divided into two parts: direct incentives and market-based instruments.

6.3.1 Policies Incentivizing Energy Efficiency

The most straightforward instruments are direct incentives, such as subsidies, tax exemptions, agreements with firms or cooperation with firms directly through capacity building, and data collection of benchmarking.

Subsidies can take many forms. They can be direct subsidies, provided to industry or individuals by lowering the price of a certain technology. Differentiated pricing can be seen as a reward for good practices (Tanaka 2011). Subsidies can also take the form of extensive R&D programs to promote research in innovative EE solutions. While direct subsidies may be effective in increasing EE, they come at the cost of taxpayers, who are eventually, the ones financing the subsidies provided by the state. In addition, policy makers stumble on a critical question in

implementing direct subsidies, namely, the proper price reduction that is to be provided by the state. As stated by Tanaka (2011), the amount must be high enough to encourage firms to switch to these new technologies, while keeping in mind that, the higher the amount, the more burden borne by taxpayers. When properly implemented, subsidies are efficient and do not require an extensive amount of data. However, the burden of the financing rests on the shoulders of taxpayers rather than polluters', and require a certain knowledge on "potential and corresponding costs of technical actions to be supported" (Tanaka 2011, p. 6547).

Fiscal policy, such as the imposition of taxes, tax rebates, and tax exemptions can also influence the development and promote the use of EE technology (Abdelaziz et al. 2011). Tax deductions for certain sectors for reducing the costs of energy investments can be found in Canada, Japan, the Netherlands, and the United Kingdom (Tanaka 2011). Praised by many economists, carbon pricing has been a popular policy instrument in many countries. However, many fear that carbon pricing endangers the industry's competitiveness, and for this purpose, tax exemptions can come alongside carbon pricing policies. For instance, in Sweden, manufacturing industries only pay 50% of the normal CO_2 tax rate. In Denmark the implementation of the carbon tax differentiated medium and high energy-intensive industries, applying a lowered rate for the latter (Tanaka 2011). Tax exemptions for high energy-intensive industries can raise many questions, especially when it comes to the efficiency of the tax. Taxation of the industry to promote EE, as well as cutting emissions and loss of competitiveness is a tradeoff that every policy maker needs to address before implementing the tax and its eventual exemptions. Similarly to pricing reductions, the exact amount of tax exemption requires a certain level of knowledge of the industry's cost structure. Besides, the issue of fairness and equity, as well as the efficiency needs to be addressed as well. With the exemptions of large emitters to safeguard their competitiveness, tax exemptions raise the question of why households and low and medium energy-intensive industries have to pay a higher share for their emissions.

While we have been discussing policy tools individually, clearly the majority of them come together with other instruments. This is especially the case for voluntary agreements. Following the implementation of a certain tax, regulation, or standard that may impede energy-intensive industries, voluntary agreements are proposed by governments, where volunteer firms agree upon a specific emissions reduction target and may receive a special discount from the tax, if the target is reached. Prime examples of voluntary agreements are Climate Change Levy Agreements (CCA) in the United Kingdom. While voluntary agreements tend to solve equity issues, their efficiency in reducing emissions and improving EE is questionable. Some studies found that results are mixed due to the lack of stringency of the targets (Cambridge Econometrics 2005), while others praised efficiency gains and emissions cuts thanks to the CCAs (Ekins and Etheridge 2006). Recent microeconometric evaluations of the climate change levy package provide more robust evidence of reductions in energy intensity and electricity use under the targets of the CCAs at the plant level (Martin et al. 2014). Indisputably, the success of voluntary agreements in improving EE lies in the stringency of targets negotiated directly with firms.

6.3.2 Market-Based Instruments

As Rosenow et al. (2019) imply, MBIs have been playing an increasing role in promoting EE around the world. They are now present in the European Union in the form of the Energy Efficiency Directive, set in 2012, as well as in various states in the United States, Australia, Brazil, the PRC, the Republic of Korea, and South Africa. Following Rosenow et al. (2019), we define MBIs as "instruments that set a policy framework specifying the outcome […] to be delivered by market actors, without prescribing the delivery mechanisms and the measures to be used." (Rosenow et al. 2019, p. 1380). One of the great strengths and efficiency of MBIs comes from the focus on outcome as opposed to the means of delivery, which leaves market agents more freedom to meet the obligations. However, MBIs do not come without shortcomings and may bring some challenges for policymakers, as they may lead to the concentration of a particular technology type. In addition, as instruments such as obligations are funded through energy prices, they may affect poorer households who tend to consume more energy as a proportion of their income (Rosenow et al. 2019).

The first type of MBI used for EE gains has many names: energy-efficiency obligations (EEOs), energy-saving obligations, energy-efficiency resource standards, energy efficiency performance standards (Rosenow et al. 2019) or white certificates (IPEEC 2016). It is a type of environmental commodity that "certif[ies] that a certain amount of energy savings has been achieved, when measured against a baseline or mandatory obligation, for instance, the energy efficiency obligation" (IPEEC 2016, p. 15). Under this scheme, and in compliance with the definition of MBIs stated above, white certificates or EEOs only define a given energy-saving target to be reached, leaving complete freedom to private sector agents to choose the means to attain it. Upon achieving a target, participants are awarded a white certificate, which can be traded between parties that are over-fulfilling their targets and those that are falling short on theirs (IPEEC 2016). In addition, white certificates can be traded between eligible parties and energy service companies (ESCOs) that do not have EEOs. Hence, EEOs are an accounting tool, used to keep track of energy saving achievements as well as a tradable commodity on the white certificates market (IPEEC 2016). The results of EEOs greatly vary between countries, which may be a result of differences in program designs, monitoring issues, and stringency of targets (Rosenow et al. 2019). For instance, a white certificate program was implemented in France from 2006 to 2009, with a target of 54 terawatts per hour of cumulative energy savings, and a penalty of €20 per megawatt hour for noncompliers, and was extended with more ambitious targets from 2011 to 2013 (IPEEC 2016). At the end of the program, about 84% of the target had been met, with lower costs than expected (IPEEC 2016). However, many unexpected challenges came along the implementation, namely the lack of sufficient competition in the market for white certificates, lack of knowledge about the scheme, and high costs of monitoring, and other administrative costs to allow for a high degree of flexibility (IPEEC 2016).

The second type of MBIs used to improve EE are auction mechanisms, which are called tendering schemes. They allow for market actors to "submit bids for the planning and implementation of energy efficiency projects" (IPEEC 2016, p. 6). The bid consists of the projected energy saving amount, as well as the budget required to achieve it: about 20% to 40% of the total costs (transaction, information, planning, design, investment, monitoring…) are comprised in the bid (IPEEC 2016), and the ratio between projected energy-saving and budget is the "price" of the offer (IPEEC 2016). Auctions can be funded through a great variety of streams, such as taxation (in the United Kingdom [UK]), a levy on energy bill (in Portugal), or on the transmission grid (Switzerland), or from emissions trading schemes (Germany), which allow for more flexibility than EEOs (Rosenow et al. 2019). However, unlike EEOs, they do not specify the overall saving target to be achieved, choosing the most appealing projects instead. Auction mechanisms are relatively new, and hence, hard to evaluate. The mechanism introduced by the UK in 2015 has been successful so far (IPEEC 2016), however, results tend to greatly differ depending on countries (Rosenow et al. 2019). IPEEC (2016) highlighted that one key element in the success of auctions lies in reducing the administrative burden to broaden participation, especially in the case of the UK.

This section detailed the various policy instruments that can be used to increase energy efficiency, which are summarized in Table 6.1. Direct incentives, such as subsidies, tax exemptions, and cooperative measures are relatively successful tools, however, they come with certain costs, which tend to be borne by the public sector, and hence taxpayers. MBIs, such as EEOs or tendering schemes can be efficient tools, but require careful implementation and unforeseen costs may arise.

Table 6.1 Summary of fiscal incentives and MBIs improving EE

	Type	Advantages	Weaknesses	Example(s)
Subsidies	Policy incentive	Efficient when well targeted	Costly Implementation issues (proper amount of subsidies) Lack of fairness as taxpayers bear the burden of the subsidies	Indonesia
Tax exemptions and rebates	Policy incentive	Efficient when well implemented	Implementation issues (proper pricing and amount of rebate) Lack of fairness as taxpayers bear the burden of the subsidies	Sweden, Denmark
Energy efficiency obligations	Market-based Incentive	Cost-efficient Improvements in EE Well-defined target	Unexpected costs may arise Need for proper monitoring	White certificates in France
Tendering schemes	Market-based incentive	Cost-efficient Improvements in EE Lower administrative burden	No overall saving target specified	Switzerland, Germany, Portugal, United Kingdom

EE energy efficiency, *MBI* market-based instrument. *Source* Authors' compilation

6.4 Energy Efficiency in Selected Asian Countries

The Asia and the Pacific region is one of the major emitters of CO_2. To reduce their carbon footprint and meet their Sustainable Development Goals targets, many countries in the region have opted for policies increasing energy efficiency. In this section, we detail the strategies, challenges, and effects of energy efficiency policies employed by four prominent Asian economies: the PRC, India, Indonesia, and Japan. Table 6.2 summarizes the key features of these economies.

From these figures, it is clear the four chosen economies are different in terms of development and maturity: Japan shows a high level of GDP per capita and low GDP growth rates while emerging countries such as India, Indonesia, and the PRC present high growth rates with relatively lower GDP per capita. It is important to keep in mind that developed and emerging countries also have different levels of maturity of their financial system, and hence, tend to use different types of instruments. Regardless of their level of development, these four economies also have different levels of endowments in natural resources. For instance, India and Indonesia are relatively well endowed and rely more on their renewable resources compared to the other three. Figure 6.1 shows the evolution of the energy intensity of GDP in the four countries, which will be more thoroughly discussed below.

6.4.1 People's Republic of China

The magnitude of the PRC's energy consumption, outstanding growth rate, role in the region, and significance to global climate mitigation makes the country essential in our analysis. In addition, the PRC government announced in 2005 its intention of reducing energy consumption per unit of GDP by 20% between 2005 and 2010

Table 6.2 Comparison of four Asian economies in 2014

Indicator	PRC	India	Indonesia	Japan
Size of economy (GDP in current trillion $)	10.44	2.04	0.89	4.85
GDP per capita (current $)	7,651.37	1,573.88	3,491.63	38,109.41
Economic growth (%)	7.30	7.41	5.01	0.38
Energy use (thousands kg of oil equivalent per capita)	2,236.73	636.57	883.92	3,470.46
Fossil fuel energy consumption (% of total)	87.67	73.58	66.09	94.41
Energy intensity level of primary energy (2011 PPP GDP)	7.10	4.96	3.68	3.87
Renewable energy consumption (% of total energy consumed)	12.22	36.65	37.45	5.63

GDP gross domestic product, *PPP* purchasing power parity, *PRC* People's Republic of China.
Source World Bank database rounded to two decimals

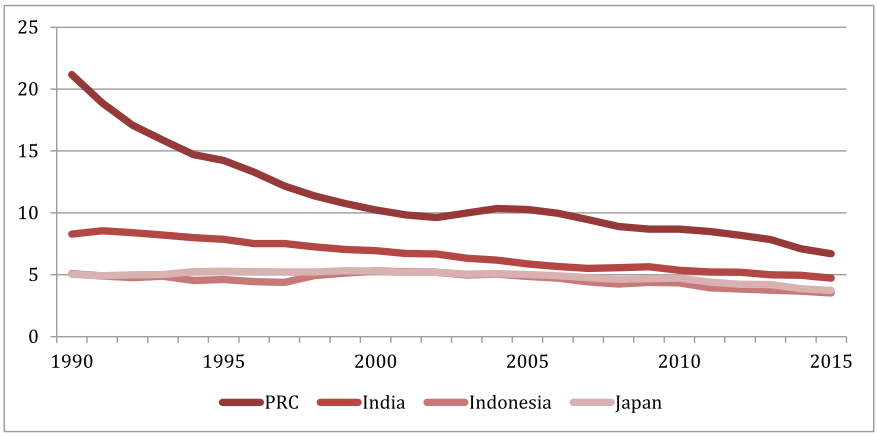

Fig. 6.1 Evolution of energy intensity of GDP in four Asian countries. *PRC* People's Republic of China. *Source* World Bank database

(Price et al. 2010). As illustrated by Fig. 6.1, the evolution of the country's energy intensity has been falling dramatically over the years, thanks to numerous schemes and policies to increase energy efficiency.

Many policies and subsidies schemes have been put in place, in addition to increasingly severe regulations and standards. For instance, the country provides "subsidies as a small portion of […] energy efficiency investment and rewards according to the amount of energy saved" (Zhu and Chertow 2017, p. 12). Since 2016, a fund to support projects in smart manufacturing, consumer goods, and green manufacturing has been put in place, under the supervision of the Ministry of Finance and the Ministry of Industry and Information Technology (IEA 2019), and grants loans, credit guarantees, insurance, and subsidies to relevant projects. Decentralization is also key, as financial support is granted to provincial energy conservation centers (Xinjiang, Ningxia, Qinghai, Gansu, Yunnan, Guizhou, Sichuan, Shanxi, Guangxi, Liaoning, Heilongjiang, Jilin, Hubei, Henan, Shannxi, Hunan, Anhui, Chongqing) both by central and local governments (Price et al. 2010).

Tax rebates for exports of energy-intensive products have also been used. In 2006, the PRC's Ministry of Finance reduced export tax rebates for low value-added but high energy-consuming goods. The rebate varied depending on the product: 11% to 8% for steel, from 13 to 8% for cement, from 13 to 11% for glass, and from 13 to 5%, 8% or 11% for some nonferrous metal products (Price et al. 2010). A different electricity pricing policy has also been applied since 2004. Industries are placed in four categories of energy efficiency—encouraged, permitted, restricted, and eliminated—and are charged higher electricity rates to discourage and "phase out inefficient enterprises" (Price et al. 2010). Between 2004 and 2006, approximately 900 firms and 380 firms in the eliminated and restricted

categories respectively, have closed, invested in EE, or changed their production processes (Price et al. 2010).

Apart from fiscal incentives, the PRC also introduced MBIs. In 2010, the PRC also introduced energy efficiency obligations to attain 14,578 gigawatt hours of energy saving per year (IEA 2019). Obligated grid companies were forced to reach a savings of 0.3% of electricity sales compared to the previous year. ESCOs were also targeted through energy-saving performance contracts (EPSCs), and provided financing and initial management in EE projects, gathering information and data with the contracted firm. EPSCs had a great impact on mitigating concerns over high upfront costs and helped share expertise in EE (Zhu and Chertow 2017). Since 2011, the National Development and Reform Commission (NDRC) also started a pilot program of emissions trading in Beijing and six other provinces, and the first carbon emissions quota trading market was launched in Shenzhen 2 years later. At the end of 2014, the seven pilot regions had a cumulative trading quota of 30.53 million tons of CO_2, with a turnover of CNY814 million (International Energy Charter 2018).

The country also multiplied the use of other types of instruments, such as voluntary agreements and EE finance. Since 2006, the PRC has implemented the Top 1000 Industrial Energy Conservation Program, a voluntary agreement between the government and large-scale enterprises in nine energy-intensive fields (iron and steel, petroleum and petrochemicals, chemicals, electric power generation, non-ferrous metal, coal mining, construction materials, textiles, and pulp and paper) that each consumed a minimum of 180,000 tons of coal equivalent in 2004 (Price et al. 2010). The agreement set targets of energy efficiency for these top 1000 enterprises to achieve approximately 100 million tons of coal equivalent savings. Evaluation of the program fell under the purview of provincial governments. This program is reported to have saved 20 metric tons of carbon equivalent (Mtce) in 2006 and 38 Mtce in 2007, for a total of 58 Mtce savings (Price et al. 2010). Energy agreement also contributed to the implementation of an energy audit, identifying energy-saving potential. It also encouraged informal information sharing about advanced technologies and national policies in place between public and private actors (Zhu and Chertow 2017). This particular example shows that, in addition to fiscal incentives, voluntary agreements can help achieve large EE gains. Furthermore, the China Energy Efficiency Financing Program (CHEEF) was established by the World Bank, which provided $100 million each to two participating local financial institutions: Exim Bank and Huaxia Bank (IEA 2011). After including Minsheng Bank in a second phase, the program has now been expanded to a third phase with additional financing for ESCOs, the building sector, and an increased leverage ratio. The risk-sharing scheme in the form of the International Finance Corporation (IFC) and the Global Environment Facility (GEF) China Utility Energy Efficiency (CHUEE) Program also started in 2006 and supported marketing, project development, and equipment financing, bringing together financial institutions, utility companies, and suppliers of EE equipment. The IFC/GEF insured 75% of the first loss, and 40% of second losses, leaving the remaining

burden to commercial banks (IEA 2011). The program is estimated to reduce emissions by 14 million tons per year, providing $197 million worth of guarantee (IEA 2011).

6.4.2 India

Compared to the other countries in the study, India has a long history of energy efficiency policies. The Companies Act encouraged industries to disclose energy efficiency, energy consumption, value-added amount of their major products as early as 1988 (Abdelaziz et al. 2011). In 1991, the liberalization of the regulatory regime helped increasing industrial competitiveness, and since this date, energy intensity has been steadily decreasing, as illustrated by Fig. 6.1 1995 marked the year where the government officially adopted a policy to improve energy efficiency by "allowing the accelerated depreciation for energy efficiency and pollution control equipment" (Yang 2006, p. 3108), and in 1997, the public invested $12 billion in the forms of subsidies for industrial energy efficiency.

A turning point of India's EE policy came with the enforcement of the Energy Conservation Act of 2001, allowing energy-intensive 5 years to comply with mandatory provisions, such as norms for energy consumption, mandatory energy audits, efficiency standards and labeling, and mandatory appointment of energy managers (Abdelaziz et al. 2011; Yang 2006). While this act is an example of command and control policy rather than an incentive, it remains a turning point in Indian policy and contributed to improving EE.

In more recent years, a special emphasis has been put on easing access to finance for EE projects through special credit lines and risk-sharing systems for small and medium-sized enterprises (SMEs). The Kreditanstalt fur Wiederaufbau Bankengruppe (KfW) of Germany has created a special credit line and dedicated €50 million to the "Small Industries Development Bank of India (SIDBI) to finance EE projects in micro, small and medium enterprises (MSMEs) in India" for projects that achieve a minimum level of energy savings and GHG emissions reduction (IEA 2011, p. 18). The KfW is also in charge of providing technical assistance to SIDBI to identify targets, setting up credit lines, and conducting awareness campaigns in MSMEs throughout India (IEA 2011). The objective of this program is to reduce 25 tons of GHG emissions for every ₹1 million invested (IEA 2011). Also, two risk guarantee funds are implemented in recent years. Since 2016, the Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) provides a 50% guarantee of loan amounts for EE projects from government buildings and private buildings. So far, the five financial institutions taking part in the project are: Andhra Bank, Yes Bank, Tata Cleantech Capital Ltd., IDFC Bank, and IndusInd Bank (IEA 2019). The Venture Capital Fund for Energy Efficiency (VCFEE) established in 2017, invests in EE projects in the form of equity. The fund provides last-mile equity, limited to 15% of total equity or ₹20 million (IEA 2019).

Nevertheless, subsidies programs are still implemented in the country. The National Energy Conservation Award rewards industries that have significantly reduced energy consumption and increased EE since 1991 (IEA 2019). Implemented in 2015, the Facility for Low Carbon Technology Deployment (FLCTD) is a joint grant program, supervised by the Bureau of Energy Efficiency, the United Nations Industrial Development Organization, and supported by the Global Environment Facility (GEF). The FLCTD conducts an annual competition to identify the best low carbon technologies and solutions to improve EE, and winners are awarded special grants from GEF and FLCTD (IEA 2019). The GEF also funds the Creating and Sustaining Markets for Energy Efficiency, implemented by the Asian Development Bank and Energy Efficiency Services Limited since 2017. This project is aimed at expanding the market for LED and street lighting, and providing competitive grants to pilot projects (IEA 2019).

Finally, India has created a program of energy saving certificates, called the Perform, Achieve, Trade (PAT) since 2011. The first cycle of the PAT scheme targeted 400 energy-intensive firms, known as the designated consumers, and reduced their consumption by 9.4%, far above the initial target. The trading of the savings certificates is key to the success of the PAT program and served as an incentive to reach and even surpass the mandatory targets. Each certificate is equivalent to 1 ton of oil equivalent of energy savings, are given based on quantified energy savings verified by an energy auditor, and are then traded on the energy-saving certificate market, regulated by the Central Electricity Regulatory Commission (IEA 2019).

6.4.3 Indonesia

Indonesia is eager to use energy subsidies to promote the development of energy efficiency among other things, despite it being extremely onerous on the government's budget. In 2012, the Indonesian government allocated Rp137 trillion to fuel subsidies and Rp65 trillion for electricity subsidies, leaving only 20% of the budget for food subsidies, fertilizer subsidies, seed subsidies, credit subsidy programs, and tax subsidies (Setyawan 2014). To save part of this budget, Indonesia's Ministry of Finance has been attempting to provide fiscal incentives to encourage energy savings in the form of providing tax incentives and different facilities on components/spare parts and raw materials for energy-efficient appliances (Setyawan 2014). Despite such efforts, these incentives did not result in EE gains (Setyawan 2014). As shown in Fig. 6.1, Indonesia's energy intensity has been relatively stable over the years, with a slightly decreasing trend.

Besides, Indonesia has been doing some efforts in raising awareness. Since 2016, the Kampanye Potong 10% (10% Cut of Energy Use Campaign) targets stakeholders in the energy sector (government institutions, industry, nongovernment organizations, general public, etc.) to encourage them to reduce their energy consumption by 10% (IEA 2019). Also, the Konservasi Energi Goes to Campus

(Energy Conservation Goes to Campuses) is an awareness-raising program directed at university students and introduces them to the basic principles of energy efficiency, and presents job opportunities in the sector (IEA 2019). In general, many cooperative schemes are implemented in the country, from capacity building programs to technical assistance (Indonesian financial support [INFIS], green building program, ESCO program, and first movers program until 2017) (APEC 2017).

Much has been attempted in the country to provide financial assistance: concessional credit lines such as loans to EXIM Bank jointly with the Asian Development Bank, EE concessional loans (provided by the Ministry of Energy and Mineral Resources and Agence Française de Développement), the EE revolving fund, and Industrial Efficiency and Pollution Control (IEPC) (supported by KfW and Ministry of Energy and Mineral Resources have been stopped due to the lack of fund availability and limited results (APEC 2017). Nevertheless, the Joint Credit Mechanism, together with the Japanese government, still acts as a fund for technology subsidies. The Clean Technology Fund (CTF) also promotes EE initiatives since 2012, with a budget of $400 million. The plan mostly aims at expanding geothermal power plants and increase EE through risk-sharing facilities for small and medium investments (IEA 2019).

6.4.4 Japan

After the two consecutive oil shocks of the 1970s, Japan was severely affected and undertook several policies to promote energy security through the promotion of renewable energy (Sunshine Project) and the promotion of energy conservation technologies (Moonlight Project) as early as 1978 (IEEJ 2016). In addition to R&D subsidies, Japan has been providing special loans for enterprises for efficient energy use since the mid-1970s, in addition to special tax depreciation for energy-saving facilities, which still exist nowadays in the form of the green investment tax cut (IEEJ 2016). The tax consists of a price reduction of 30% on targeted equipment, or 7% of tax reduction for SMEs (IEA 2019). Also, SMEs have benefited from preferential financial measures (loan, tax, subsidies) since 2010. For instance, special interest rates are applied for energy efficiency facilities and for installing EE equipment. Special interest rate loans are also granted for EE projects by the Japan Finance Corporation (IEA, 2019). Finally, the government allocated ¥41 billion in subsidies (IEA 2019).

Following the Kyoto Protocol, the Keidanren (Japan Business Federation) voluntarily presented the Keidanren Voluntary Action Plan on the Environment (Keidanren 1997). Thirty six industries in various sectors (manufacturing, energy, distribution, transportation, construction, foreign trade, nonlife insurance, etc.), represented by 137 organizations pledged to combat global warming by setting targets of energy reduction and emissions reduction on their own (Keidanren 1997). Concrete measures undertaken by industries include “the formulating of careful and detailed innovations relating to operations control, including energy conservation in

offices; making improvements in equipment and processes; and engaging in and implementing the developments from technological research." Industries also engage themselves in annual reviews on the efficiency of the plan. If initially only 36 industries were included, 114 industries in commercial, manufacturing, transportation, and energy conversion sectors took part in the plan in 2012 (METI 2014). Since 1997, the Ministry of Economy, Trade and Industry estimated that "Japan had improved efficiency levels by approximately 33% as a result of energy-saving efforts since the oil crises" (METI 2014, p. 7).

Japan introduced the J-Credit Scheme in 2008, a program that promotes GHG emissions reduction through energy-saving and forestry management. The reduction in GHG emissions is approved by the state and recognized as a "credit". Credit issuers can be SMEs, farmers, owners of the land, or local governments, which, through the installation of energy-efficient equipment, investment in renewable energy or proper forestry management, achieved GHG emissions cut. They can sell their credits to large corporations, other SMEs, or local governments, which are encouraged to buy J-credits for good public relations and corporate social responsibility, as well as receiving praise from ministry officials (Japan Credit 2019). Finally, Japan provides cooperative schemes in the form of audits for SMEs, as well as information sharing. Since 1997, the country provides free energy audits for SMEs, conducting about 10,000 between 2004 and 2014 (IEA 2019). Besides, the Energy Conservation Centre Japan has been publishing technical guidebooks and implementation guidelines for energy management in factories since 2001 (IEA 2019).

6.5 Conclusion and Policy Recommendations

With rising awareness about climate change, many countries in Asia pledged to reduce their GHG emissions, through international channels such as the Kyoto Protocol, the Paris Agreement, or the UN Sustainable Development Goals, or simply through targets set at the national level. As the Asia and Pacific region remains the largest contributor to GHG emissions, this region also includes many countries that implemented many strategies to reduce their emissions, whether by promoting renewable energy or by stimulating EE. This study attempts to analyze the policies incentivizing EE from four Asian countries: the PRC, India, Indonesia, and Japan.

The study first reviewed various instruments that can be used to increase EE. Incentivizing policies, such as subsidies and tax exemptions can be very efficient if well-targeted, however, remain costly and the burden of emission reductions is borne by taxpayers rather than polluters. Voluntary agreements, on the other hand, can be efficient tools but need careful planning, monitoring, and their outcome heavily depend on the stringency of the targets negotiated between the governments and the private sector. As other types of incentive, emissions trading schemes and cooperative policies may also be used, although their outcome is more uncertain

and may not necessarily result in EE gains in the short term. MBIs such as EEOs or tendering schemes are also cost-efficient instruments that can reduce energy intensity. Nevertheless, monitoring remains a problem during implementation. Finally, special credit lines or risk-sharing scheme, are both programs that can encourage EE projects by unlocking funding that may normally not be available due to the belief that EE projects are riskier.

The study then moved to the analysis of the EE strategies of four Asian countries. While India and the PRC, in particular, have experienced a spectacular decrease in energy intensity, Indonesia and Japan have been stable. Table 6.3 summarizes the various instruments and policies promoting EE in the four countries.

From Table 6.3, it is clear that part of the PRC's success is attributed to the multiplication of instruments and its overall planning strategy. Both the PRC and India have successfully implemented MBIs in the form of EEOs or white certificates, which could also explain their recent EE improvements. Besides, the literature praised the effectiveness of voluntary agreements such as the Top 1000 Industrial Energy Conservation Program in the PRC (Price et al. 2010) or the Keidanren Voluntary Action Plan on the Environment in Japan (METI 2014). On the other hand, extensive subsidies are burdens and barely contributed to EE improvements in the case of Indonesia (Setyawan 2014). While all countries in the case studies have subsidies for EE, they remain marginal and are not at the core of the EE strategy, except in the case of Indonesia. Finally, it is complicated to assess the effectiveness of the case of cooperative schemes or EE finance, although they remain crucial for spreading awareness about EE in the long term. Nevertheless, EE finance programs are often terminated due to a lack of funding (APEC 2017). Spreading awareness about EE plays a decisive role in improving EE, and, despite its lack of accountability, should not be overlooked.

The review conducted in this study provides several important policy recommendations. The extreme reliance on subsidies proved to have little effect on EE, as shown by the case study of Indonesia. Of the remaining countries in the case study, those that relied on subsidies to promote energy efficiency used them as a marginal measure. The study also highlighted the effectiveness of MBIs, as exemplified by the spectacular EE improvements in the PRC and India. The review also showed the effectiveness of policies that act as complement of fiscal incentives, such as voluntary agreements, as shown by the success of the Japanese Keidanren and the PRC's top 1000 program. In fact, the example of the PRC reveals that the multiplication of EE policy instruments and carefully crafted planning strategy can lead to drastic EE improvements. In general, case studies proved that energy efficiency policies cannot be successful on their own, and produce better results when used complementarily. Nonetheless, it remains difficult to generalize the effectiveness of EE policies, as their success depends on the country of application, and on the level of financial development in said country. For instance, MBIs and tax incentives are more easily applicable in economies with mature financial systems. If not properly implemented, these types of policies may have a harmful effects on the economy. Simulation of policy implementation, and quantitative policy evaluation are left for further studies on the topic.

Table 6.3 Summary of incentives promoting energy efficiency in four Asian countries

	PRC	India	Indonesia	Japan
Subsidies	Subsidies since 2005 Special fund since 2016	Subsidies since the 1990s	Subsidies since 1997	Subsidies since 1978
Tax and tax exemptions	Tax rebates for exports of energy-intensive products Different carbon pricing policies, sanctioning energy-intensive industries		For commercial buildings	Mainly directed at SMEs
Voluntary agreements	Top 1000 Industrial Energy Conservation Program			Keidanren Voluntary Action Plan on the Environment
Emissions trading schemes	Pilot program since 2011 in seven provinces			Tokyo and Saitama prefectures only since 2010
Cooperative schemes	Energy audit and information sharing since 2006	Mandatory audits since 2001	Information sharing, technical assistance, capacity building	Free energy audit for SMEs and information sharing
White certificates tendering schemes	EEOs since 2010	PAT scheme since 2011		
Special credit lines	China Energy Efficiency Financing Program	KfW	Joint Credit Mechanism	Mainly directed at SMEs
Risk-sharing schemes	IFC/GEF China Utility Energy Efficiency since 2006	PRGFEE since 2016 VCFEE since 2017	Clean Technology Fund	
Others	Energy saving performance contracts Top runner program (regulation and standards)	Strong regulations and standards		J-Credit Scheme since 2008 Top runner program (regulation and standards)

EEO energy efficiency obligation, *GEF* Global Environment Facility, IFC International Finance Corporation, *PAT* Perform Active, Trade, *PRC* People's Republic of China, *PRGFEE* Partial Risk Guarantee Fund for Energy Efficiency, *SMEs* small and medium-sized enterprises, *VCFEE* Venture Capital Fund for Energy Efficiency. *Source* Authors' compilation

References

Abdelaziz E, Saidur R, Mekhilef S (2011) A review on energy saving strategies in industrial sector. Renew Sustain Energy Rev 15(1):150–168. https://doi.org/10.1016/j.rser.2010.09.003

American Council for an Energy Efficient Economy (ACEEE) (2019) Energy efficiency financing. https://aceee.org/topics/energy-efficiency-financing. Accessed 3 Jan 2019

Asia-Pacific Economic Cooperation (APEC) (2017) Energy efficiency finance in Indonesia–current state, barriers and potential next steps. APEC Secretariat, Singapore

bigEE (2019) Bridging the information gap on energy efficiency in buildings. How policies need to interact in packages: bigEE recommendations on which measures to combine for effective policy. Wuppertal Institute for Climate, Environment and Energy, Wuppertal. http://www.bigee.net/media/filer_public/2013/11/28/bigee_txt_0006_pg_how_policies_need_to_interact_2.pdf. Accessed 7 Jan 2019

Boonekamp PGM (2006) Actual interaction effects between policy measures for energy efficiency—a qualitative matrix method and quantitative simulation results for households. Energy 31 (14):2512–2537. https://doi.org/10.1016/j.energy.2006.01.004

Braathen NA (2007) Instrument mixes for environmental policy: how many stones should be used to kill a bird? Int Rev Environ Resour Econ 1(2):185–235. https://doi.org/10.1561/101.00000005

Cambridge Econometrics (2005) Modelling the initial effects of the climate change levy. HM Customs and Excise, London

Child R, Langniss O, Klink J, Gaudioso D (2008) Interactions of white certificates with other policy instruments in Europe. Energy Effi 1(4):283–295. https://doi.org/10.1007/s12053-008-9025-7

Datta S, Filippini M (2016) Analysing the impact of ENERGY STAR rebate policies in the US. Energ Effi 9(3):677–698. https://doi.org/10.1007/s12053-015-9386-7

Datta S, Gulati S (2014) Utility rebates for ENERGY STAR appliances: are they effective? J Environ Econ Manag 68(3):480–506. https://doi.org/10.1016/j.jeem.2014.09.003

de Miguel C, Labandeira X, Löschel A (2015) Frontiers in the economics of energy efficiency. Energy Econ 52:S1–S4. https://doi.org/10.1016/j.eneco.2015.11.012

Dubois M, Allacker K (2015) Energy savings from housing: ineffective renovation subsidies vs efficient demolition and reconstruction incentives. Energy Policy 86:697–704. https://doi.org/10.1016/j.enpol.2015.07.029

EC (2016) Clean energy for all Europeans. COM(2016) 860. http://eur-lex.europa.eu/resource.html?uri=cellar:fa6ea15b-b7b0-11e6-9e3c-01aa75ed71a1.0001.02/DOC_1&format=PDF. Accessed 10 Jan 2019

Ekins P, Etheridge B (2006) The environmental and economic impacts of the UK climate change agreements. Energy Policy 34:2071–2086

European Commission (EC) (2011) Energy roadmap 2050. COM(2011) 885. http://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:52011DC0885&from=EN. Accessed 10 Jan 2019

Freire-González J (2011) Methods to empirically estimate direct and indirect rebound effect of energy-saving technological changes in households. Ecol Model 223(1):32–40

Galarraga I, Abadie LM, Ansuategi A (2013) Efficiency, effectiveness and implementation feasibility of energy efficiency rebates: the "renove" plan in Spain. Energy Econ 40:98–107. https://doi.org/10.1016/j.eneco.2013.09.012

Galarraga I, Abadie LM, Kallbekken S (2016) Designing incentive schemes for promoting energy-efficient appliances: a new methodology and a case study for Spain. Energy Policy 90:24–36. https://doi.org/10.1016/j.enpol.2015.12.010

Golove WH, Eto JH (1996) Market barriers to energy efficiency: a critical reappraisal of the rationale for public policies to promote energy efficiency. Preprint. Lawrence Berkeley National Laboratory, Berkeley

Goulder L (2013) Climate change policy's interactions with the tax system. Energy Econ 40 (Supp. 1):S3–S11. https://doi.org/10.1016/j.eneco.2013.09.017

Greening LA, Greene DL, Difiglio C (2000) Energy efficiency and consumption—the rebound effect—a survey. Energy Policy 28:389–401
Grösche P, Vance C (2009) Willingness to pay for energy conservation and free-ridership on subsidization: evidence from Germany. Energy J 30(2):135–153
Hou J, Liu Y, Wu Y, Zhou N, Feng W (2016) Comparative study of commercial building energy-efficiency retrofit policies in four pilot cities in China. Energy Policy 88:204–215. https://doi.org/10.1016/j.enpol.2015.10.016
IEA (2019) Policies database. https://www.iea.org/policies. Accessed 1 Jan 2020
Institute of Energy Economics Japan (IEEJ) (2016) Japanese energy efficiency improvement achieved and planned. https://eneken.ieej.or.jp/data/7069.pdf. Accessed 1 Jan 2020
International Energy Agency (IEA) (2011) Joint public–private approaches for energy efficiency finance
International Energy Charter (2018) China energy efficiency report. https://www.energycharter.org/fileadmin/DocumentsMedia/EERR/EER-China_ENG.pdf. Accessed 1 Jan 2020
International Partnership for Energy Efficiency Cooperation (IPEEC) (2016) Analytical report on instruments for energy efficiency. https://ipeec.org/upload/publication_related_language/pdf/142.pdf. Accessed 1 Jan 2020
IPCC (2019) IPCC guidelines for national greenhouse gas inventories, vol 4
Japan Credit (2019) J-credit scheme. https://japancredit.go.jp/english/. Accessed 1 Jan 2020
Jevons WS (1865) The coal question. Macmillan and Co, London
Keidanren (1997) Outline of the Keidanren voluntary action plan on the environment. https://www.keidanren.or.jp/english/policy/pol058/outline.html. Accessed 1 Jan 2020
Markandya A, Ortiz RA, Mudgal S, Tinetti B (2009) Analysis of tax incentives for energy-efficient durables in the EU. Energy Policy 37(12):5662–5674. https://doi.org/10.1016/j.enpol.2009.08.031
Martin R, de Preux B, Wagner UJ (2014) The impact of a carbon tax on manufacturing: evidence from microdata. J Public Econ 117(C):1–14
Ministry of Economy, Trade and Industry (METI) (2014) Report of the committee for the comprehensive review of the voluntary action plan on the environment. https://www.meti.go.jp/english/policy/energy_environment/global_warming/voluntary_approach/pdf/comprehensive_review.pdf. Accessed 2 Jan 2020
Price L, Wang X, Yun J (2010) The challenge of reducing energy consumption of the top-1000 largest industrial enterprises in China. Energy Policy 38(11):6485–6498
Rosenow J, Fawcett T, Eyre N, Oikonomou V (2015) Energy saving policies and energy efficiency obligation schemes. D5.1 combining of energy efficiency obligations and alternative policies. http://enspol.eu/sites/default/files/results/D5.1Combining%20of%20Energy%20Efficiency%20Obligations%20and%20alternative%20policies.pdf. Accessed 5 Apr 2017
Rosenow J, Fawcett T, Eyre N, Oikonomou V (2016) Energy efficiency and the policy mix. Build Res Inf 4(5–6):562–574. https://doi.org/10.1080/09613218.2016.1138803
Rosenow J, Cowart R, Thomas S (2019) Market-based instruments for energy efficiency: a global review. Energ Effi 12(5):1379–1398
Setyawan D (2014) Formulating revolving fund scheme to support energy efficiency projects in Indonesia. Energy Procedia 47(C):37–46. https://doi.org/10.1016/j.egypro.2014.01.194
Tanaka K (2011) Review of policies and measures for energy efficiency in industry sector. Energy Policy 39(10):6532–6550. https://doi.org/10.1016/j.enpol.2011.07.058
UN (2019) Emissions gap report 2018. https://www.unenvironment.org/resources/emissions-gap-report-2018. Accessed 3 Jan 2019
United Nations (UN) (2018) Sustainable development goals. https://www.un.org/sustainabledevelopment/energy/. Accessed 20 Dec 2018
Weise C, Larsen A, Pade LL (2018) Interaction effect of energy efficiency policies. Energy Effi 11:2137–2156

Yang M (2006) Energy efficiency policy impact in India: case study of investment in industrial energy efficiency. Energy Policy 34(17):3104–3114. https://doi.org/10.1016/j.enpol.2005.05.014

Zhu J, Chertow M (2017) Business strategy under institutional constraints: evidence from China's energy efficiency regulations. Ecol Econ 135:10–21. https://doi.org/10.1016/j.ecolecon.2017.01.007