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# THE ROLE OF FISCAL INCENTIVES IN PROMOTING ENERGY EFFICIENCY IN THE INDUSTRIAL SECTOR: CASE STUDIES FROM ASIA

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**Abstract**

In recent years, awareness about climate change and the need for cutting greenhouse gas (GHG) emissions 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 GHG emissions and EE strategies, namely the People's Republic of China (PRC), India, Indonesia, and Japan. The study first reviewed the types of instruments that can be used to reduce energy intensity, namely incentivizing policies (subsidies, tax reductions, voluntary agreements, ETSs and cooperative schemes), market-based instruments (MBIs) (white certificates and tendering schemes), and EE finance (special credit lines and risk-sharing facilities). Through a careful review of the literature, the study identified advantages and weaknesses, as well as the effectiveness of said policies in the case studies. The study highlighted the role of voluntary agreements and careful planning in successfully improving EE in the PRC. MBIs have also been shown to efficiently reduce energy intensity. On the other hand, direct subsidies represented a heavy burden on the government's budget, with limited results. Despite their lack of direct results, cooperative schemes and the role of finance in improving EE should not be overlooked.

**Keywords:** energy efficiency, energy policy, Asia, climate change

**JEL Classification:** Q48, Q54, Q56

# Contents

# 1. INTRODUCTION

Many of the post-2015 United Nations (UN) Sustainable Development Goals are connected to efficient use of energy in industries and households. Energy efficiency has an enormous impact on material well-being, public health, climate change, and the 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 to 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 highest greenhouse gas (GHG) emitters, it is especially interesting to study the strategies and incentives they have 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 for investments in EE technologies. These incentives also allow 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. These 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 PRC, India, and Indonesia. Due to the variation in policies and in the overall structure of the economies, including their income, sociocultural, and awareness status, the results are mixed. This research aims to explore the various EE schemes and incentives implemented in four Asian countries and is directed at the industrial sector, which accounts for the majority of energy consumption. Given the mixed results of some policies, this research also aims to evaluate the success of these initiatives, and eventually provide policy recommendations for other countries. The rest of the study is organized as follows: the second part provides a review of the literature on the topic; the third section introduces FIs, market-based instruments (MBIs), and energy efficiency finance (EEF) schemes implemented throughout the world, discussing their implementation, objectives, and results; the third section introduces the schemes in force in the selected four Asian countries; and the fourth and final section concludes this study.

# 2. LITERATURE REVIEW

EE is one of the keys to transforming 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 being key for a successful EE outcome, 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, Abadie, and Ansuategi 2013; Galarraga, Abadie, and Kallbekken 2016; Grösche and Vance 2009; Hou et al. 2016; Markandya et al. 2009; Nauleau, Giraudet, and Quirion 2015). The incentive for obtaining EE finance is larger than 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, Abadie, and Kallbekken 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 emission 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 (IEA), 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, Labandeira, and Löschel 2015). Governments and international organizations, in partnership, have projects operating across 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 (SEAD) initiative contributed to drastically improving the EE of household appliances and other energy-consuming equipment.

With a view to improving energy efficiency, 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 that are eligible due to their efficient use of energy. For example, governments provide tax incentives to households in purchasing home appliances, equipment, and home shell items such as window insulations. The incentive is also provided to the equipment manufacturers and businesses selling such energy-efficient equipment.

While literature, in general, provides pronounced support for the use of FIs for EE improvements, it shows some caution regarding 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 lead to overconsumption 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 FI, the co-evolution of technologies and societies, the irreversibility of some of the phenomena, and political reasons may trigger this rebound effect (Levett 2009). For instance, in Spain, the large-scale introduction of dishwashers in households through EE rebates reduced welfare in the economy (Galarraga et al. 2013).

While financial incentives may trigger overconsumption of some energy-efficient appliances and reduce welfare in the short term, they are 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-efficient instruments may have a rebound effect, a number of works suggest a mix of instruments as an effective tool for mitigating overconsumption (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 financial incentives. They argue that energy tax provides a price effect that forces consumers to invest in energy-efficient technologies. The bigEE project argues 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).

# 3. REVIEW OF POLICIES FOR IMPROVING ENERGY EFFICIENCY

In order to analyze the policies implemented by Asian countries aimed at improving energy efficiency, this section discusses the various instruments that are available to policymakers, including their advantages, drawbacks, and issues concerning implementation. This section is divided into three parts: direct incentives, market-based instruments, and EEF.

## 3.1 Policies Incentivizing Energy Efficiency

The most straightforward instruments are direct incentives, such as subsidies, tax exemptions. This section also discusses agreements with firms or cooperation mechanisms through capacity building, data collection or 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 into innovative EE solutions. While direct subsidies may be effective in increasing EE, they come at the taxpayers' expense, as they are eventually the ones who finance the subsidies provided by the state. In addition, policymakers stumble upon a critical question in implementing direct subsidies, namely the appropriate 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 this new technology, while bearing in mind that the higher the amount, the greater the 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 requires a certain knowledge about "potential and corresponding costs of technical actions to be supported" (Tanaka 2011, 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 therefore tax exemptions can come along with 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 differentiates between medium and high energy-intensive industries, with a reduced rate being applied for the latter (Tanaka 2011, 6542). Tax exemptions for high energy-intensive industries can raise many questions, especially when it comes to the efficiency of the tax. Taxation of an industry to promote EE, cut emissions, and lose competitiveness is a tradeoff that every policymaker 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. In addition, the issue of fairness and equity, as well as efficiency, needs to be addressed as well. With the exemptions of large emitters in order to safeguard their competitiveness, tax exemptions

make us question 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, it goes without saying that the majority of them come together with other instruments. This is especially the case for voluntary agreements, which are "agreements between government and industry to facilitate voluntary actions with desirable social outcomes, which are encouraged by the government, to be undertaken by the participants, based on the participants' self-interest" (Abdelaziz et al. 2011, 163). 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 emission 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 (CCAs) in the United Kingdom. Following the implementation of the Climate Change Levy (CCL) in 2001, the government also proposed the CCAs: If firms were to adopt an energy or carbon target, they would be eligible to receive an 80% discount on the CCL. Eligibility restrictions, administrative costs, or even the stringency of targets would restrain self-selection by firms. While voluntary agreements tend to solve equity issues, their efficiency in reducing emissions and improving EE is questionable. From a macroeconomic perspective, 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 emission cuts thanks to the CCAs (Ekins and Etheridge 2006). Recent microeconometric evaluations of the CCL package provide more robust evidence of reductions in energy intensity and electricity use under the targets of the CCAs at the plant level (Martin, de Preux, and Wagner 2014). Certainly, the success of voluntary agreements in improving EE lies in the stringency of targets negotiated directly with firms.

In addition to subsidies and fiscal incentives, emissions cap and trade schemes or emission trading schemes (ETSs) have also emerged. Similarly to $CO_2$ taxes, they aim to set a maximum limit of emissions for firms and allow those with excess emissions to buy permits from those that emit far less than the target, creating a market for tradable permits. While ETSs are not directly aimed at improving EE, efficiency gains can be attained as firms are attempting to reduce their total emissions. This is not necessarily the case, however, as ETSs may result in fuel switching, as well as the use of carbon capture and storage (CCS) (Tanaka 2011). ETSs are currently implemented in the European Union (EU), Norway, Switzerland, New Zealand, Japan, the Republic of Korea, and some US states. The literature appears to concur that ETSs are a good instrument for achieving emission reduction in a cost-efficient manner (Ellerman and Buchner 2008; Tanaka 2011; Muüls et al. 2016). Nevertheless, ETSs' coverage is much narrower in sectors, targeting energy-intensive industries, for instance, and might "impose unacceptable costs on some industries" (Johansson 2006), while not necessarily resulting in EE improvements (Tanaka 2011).

Finally, supportive policies are a form of incentive provided by the state and include identification opportunities, capacity building, and public disclosure. Identification opportunities are defined as "measures for identifying EE opportunities [that] include energy use surveying (with end-use technology details) and a statistics reporting, auditing, and benchmarking program" (Tanaka 2011, 6547), as well as capacity-building measures, such as "equipment labels, best-practice information sharing, advisory services, decision aids, and education and training" (Tanaka 2011, 6547). For instance, capacity-building measures include efficiency labels in manufacturing equipment and are used in Canada, the European Union (EU), and the United States. Public disclosure examples include energy performance sharing and rewards for exemplary firms.

Supportive measures are relatively well spread among wealthy countries, with public disclosure policies implemented in Australia, Canada, and the US. While supportive measures are relatively cheap compared to other policy instruments, their success in improving EE is quite hard to evaluate. Because supportive policies indirectly reduce energy intensity by spreading awareness and knowledge, their direct effect is hard to measure and is rarely evaluated by academic studies. Despite their lower costs, supportive policies can be unpopular tools, because of their questionable efficiency and results are often hard to measure.

## 3.2 Market-Based Instruments

As Rosenow, Cowart, and Thomas (2019) imply, market-based instruments (MBIs) have been playing an increasing role in promoting EE around the world. They are now present in the EU in the form of the Energy Efficiency Directive, set in 2012, as well as in various states in the US, Australia, Brazil, the PRC, the Republic of Korea, and South Africa. Following Rosenow, Cowart, and Thomas (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, 1380). One of the great strengths and efficiencies of MBIs comes from the focus on outcome as opposed to the means of delivery, which leaves market agents more freedom to meet their obligations. However, MBIs do not come without shortcomings and may be accompanied by 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, 1380).

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), and 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, 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 overfulfilling their targets and those that are falling short of 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 vary greatly between countries, which may be a result of differences in program designs, monitoring issues, and the 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 TWh of cumulative energy savings, and a penalty of €20 per MWh for noncompliers, and 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, several unexpected challenges came along with the implementation, namely a lack of sufficient competition in the market for white certificates, a lack of knowledge about the scheme, the high cost of monitoring, as well as other administrative costs to allow for a high degree of flexibility (IPEEC 2016).

The second type of MBI used to improve EE is an auction mechanism, also called "tendering schemes." It allows market actors to "submit bids for the planning and implementation of energy efficiency projects" (IPEEC 2016, 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 included in the bid (IPEEC 2016, 6), and the ratio between the projected energy saving and the budget is the "price" of the offer (IPEEC 2016, 6). Auctions can be funded through a great variety of streams, such as taxation (in the UK), a levy on energy bills (in Portugal) or on the transmission grid (Switzerland), or even from ETS schemes (Germany), which allows 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 relatively successful (IPEEC 2016), however results tend to differ greatly depending on the countries involved (Rosenow et al. 2019). IPEEC (2016) pointed out that one key element in the success of auctions lies in reducing the administrative burden in order to broaden participation, especially in the case of the UK.

## 3.3 Energy Efficiency Finance

According to the IEA (2011), a lack of finance is a key barrier to investment in EE projects. While tendering schemes and auctions may help to finance a few projects, energy efficiency finance remains an area that needs to be improved. To this end, this subsection describes various schemes that can help develop EEF. The majority of these schemes are public-private partnerships (PPPs), which are defined as "mechanisms that use public policies, regulations, or financing to leverage private sector financing for EE projects" (IEA 2011, 5).

The first type of PPP for EEF is the existence of special credit lines for EE projects, which are established by a public entity (government or donor organization) and enable financing of EE projects by a private organization (IEA 2011, 5). Providing funds to local financial institutions at a low interest rate, the public entity encourages the institution to lend at a lower interest rate to parties interested in developing EE projects (IEA 2011). This type of credit requires an agreement between financial institutions and public entities so that loans can be co-financed, allowing for a certain level of risk sharing between public and private partners. Special credit requires a higher involvement from public sector financing as government or public agencies are the ones providing funding, and hence it is more applicable when commercial markets have a low level of maturity, as economic agents are less aware of the characteristics and benefits of EE projects (IEA 2011). As a result, prime examples of special credit lines can be found in the PRC, India, and Thailand. It is important to note, however, that some special credit programs may not necessarily ease access to credit but simply provide low-cost funds for reliable and creditworthy borrowers, which is the case in Thailand. Program design and especially risk sharing between private and public entities are crucial in implementing special credit lines, in order to avoid such effects (IEA 2011).

**Table 1: Summary of Policy Instruments for Improving EE**

| | Type | Advantages | Weaknesses | Example(s) |
|---|---|---|---|---|
| Subsidies | Policy incentive | • Efficient when well targeted | • Costly<br>• Implementation issues (proper amount of subsidies)<br>• 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)<br>• Lack of fairness as taxpayers bear the burden of the subsidies | Sweden, Denmark |
| Voluntary Agreement | Policy incentive | • Efficient | • Success relies on the stringency of targets, without endangering the firms' competitiveness | UK Climate Change Agreements (CCAs) |
| Emission Trading Scheme | Policy incentive | • Efficient in reducing GHG emissions<br>• Cost-efficient | • Not necessarily resulting in EE improvements | EU ETS |
| Cooperative and supportive policies | Policy incentive | • Cheap<br>• Awareness spreading and long-term effect | • Not necessarily resulting in EE improvements in the short term | Canada, EU, US, Australia |
| Energy Efficiency Obligations | Market-Based Incentive | • Cost-efficient<br>• Improvements in EE | • Unexpected costs may arise<br>• Need for proper monitoring | White Certificates in France |
| Tendering Schemes | Market-Based Incentive | • Cost-efficient<br>• - Improvements in EE | • - No overall saving target specified | Switzerland, Germany, Portugal, UK |
| Special credit lines | EE finance | • Relatively cost-efficient<br>• Awareness spreading and long-term effect<br>• Works best under financial markets at a low maturity | • Indirect improvements of EE<br>• May be terminated due to lack of funds<br>• - Efficient program design is crucial | PRC, Thailand, India |
| Risk-sharing schemes | EE finance | • Relatively cost-efficient<br>• Awareness spreading and long-term effect | • Indirect improvements of EE<br>• Requires a mature financial system | CEEF (Hungary, Czech Republic, Slovak Republic, Latvia, Lithuania, and Estonia) |

Source: Authors' compilation.

A second type of financing consists of risk sharing and credit guarantee schemes (CGSs). As defined by Tanaka (2011), a loan guarantee consists in an "agreement by a third party to pay some or all of the loan amount due in the case of nonpayment by the borrower." EE projects are traditionally seen as riskier investments by commercial banks

and financial institutions (IEA 2011, 20). Risk-sharing programs consist of the signing of a Guarantee Facility Agreement between a public agency or a government and financial institutions to cover a portion of their potential losses (IEA 2011). Financial institutions are then responsible for negotiating, conducting, and processing the loans with project developers, and later these projects need approval from the public agency involved. There are mostly three types of guarantee that can be offered: pro-rata guarantee, where the loss is shared between the public entity and the financial institution according to a certain predetermined percentage; first-loss guarantee, where losses are paid by the public entity up to a predetermined amount and are then borne by the financial institutions; and second-loss guarantee, where the government or agency pays for losses that exceed the nonguaranteed portion of the loan (IEA 2011, 21). The usefulness of CGSs in promoting finance for green investment has been highlighted by Taghizadeh-Hesary and Yoshino (2019), and successful examples include the Commercializing Energy Efficiency Finance (CEEF) program, covering Hungary, the Czech Republic, the Slovak Republic, Latvia, Lithuania, and Estonia, the China Utility Energy Efficiency (CHUEE) program, and the World Bank-financed China Energy Conservation II program (IEA 2011).

This section details the various policy instruments that can be used to increase energy efficiency, which are summarized in Table 1. Direct incentives, such as subsidies, tax exemptions, and cooperative measures, are relatively successful tools; however, they come with a certain cost, which tends to be borne by the public sector, and hence taxpayers. Trading schemes, on the other hand, are cost-efficient instruments but are not directly designed for increasing EE, and hence may have mixed results. MBIs, such as EEOs or tendering schemes, can be efficient tools, but require careful implementation and unforeseen costs may arise. Finally, EEF, such as the creation of special credit lines or risk-sharing agreements, is a good way to encourage EE projects by easing their financing, although their direct impact on EE is harder to measure.

# 4. ENERGY EFFICIENCY IN SELECTED ASIAN COUNTRIES

Asia and the Pacific is one of the major emitters of $CO_2$. To reduce their carbon footprint and meet their SDG targets, many countries in the region have opted for policies aimed at increasing energy efficiency. In this section, we detail the strategies, challenges, and effects of energy efficiency policies employed by four prominent Asian economies, namely the PRC, India, Indonesia, and Japan. Table 2 summarizes the key features of these economies.

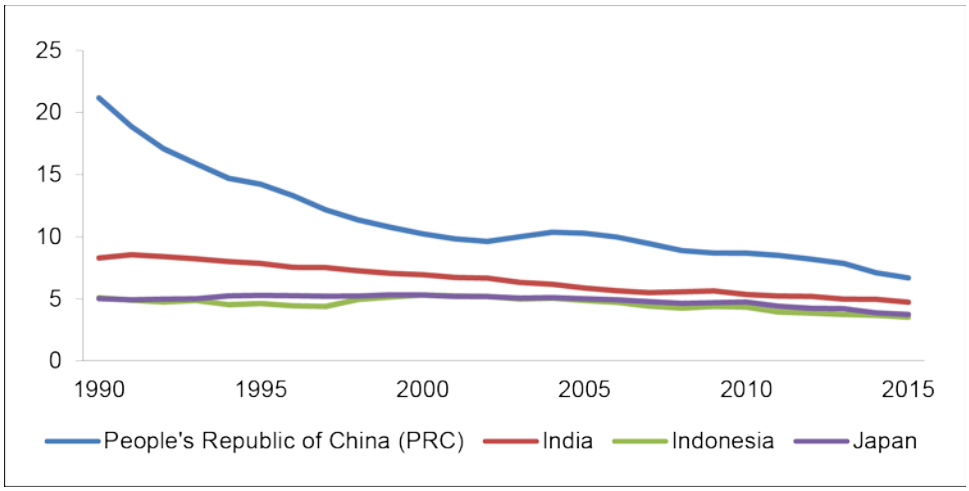
**Table 2: A Comparison of Four Asian Economies in 2014**

| Indicator | PRC | India | Indonesia | Japan |
|---|---|---|---|---|
| Size of economy (GDP in current trillion USD) | 10.44 | 2.04 | 0.89 | 4.85 |
| GDP per capita (current USD) | 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 |

Source: World Bank database, rounded to two decimal points.

From these figures, it is clear that the four chosen economies are very 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 bear 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 than the other two. Figure 1 shows the evolution of the energy intensity of GDP in the four countries, which will be more thoroughly discussed below.

**Figure 1: Evolution of Energy Intensity of GDP in Four Asian Countries**




Data source: World Bank database.

## 4.1 PRC

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 Chinese government announced in 2005 its intention to reduce energy consumption per unit of GDP by 20% between 2005 and 2010 (Price et al. 2010). As illustrated by Figure 1, the evolution of the country's energy intensity has been falling dramatically over the years, thanks to numerous schemes and policies aimed at increasing energy efficiency.

In order to do so, many policies and subsidy 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, 12). Since 2016, a fund to support projects in smart manufacturing, consumer goods, and green manufacturing has been 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, Helongjiang, Jilin, Hubei, Henan, Shannxi, Hunan, Anhui, and 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 Ministry of Finance reduced export tax rebates for low-value-added but high-energy-consuming goods. The rebate varied depending on the product: from 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, 8). Between 2004 and 2006, approximately 900 and 380 firms in the eliminated and restricted categories, respectively, closed, invested in EE, or changed their production processes (Price et al. 2010).

Since 2006, the PRC has implemented the Top-1000 Industrial Energy Conservation Program, a form of voluntary agreement between the government and large-scale enterprises in nine energy-intensive fields (iron and steel, petroleum and petrochemicals, chemicals, electric power generation, nonferrous metal, coal mining, construction materials, textiles, and pulp and paper), which each consumed a minimum of 180,000 tce 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 Mtce (0.6 EJ) in 2006 and 38 Mtce (1.1 EJ) in 2007, for a total saving of 58 Mtce (1.7 EJ) (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).

The country also strives to develop EEF. The China Energy Efficiency Financing (CHEEF) program was established by the World Bank, which provided USD100 million each to two participating LFIs, 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. A risk-sharing scheme in the form of the IFC/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 International Finance Corporation (IFC) and Global Environment Facility (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 USD197 million worth of guarantee (IEA 2011).

In 2010, the PRC also introduced energy efficiency obligations to attain 14,578 GWh of energy saving per year (IEA 2019). Obligated grid companies were forced to reach a saving 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).

Finally, in 2011, the National Development and Reform Commission (NDRC) started a pilot program of emission trading in Beijing and six other provinces, and the first carbon emission quota trading market was launched in Shenzhen two years later. At the end of 2014, the seven pilot regions had a cumulative trading quota of 30.53 Mt of $CO_2$, with a turnover of CNY814 million (International Energy Charter 2018).

## 4.2 India

Compared to the other countries in the study, India has a relatively long history of energy efficiency policies. The Companies Act encouraged industries to disclose energy efficiency, energy consumption, and the value-added amount of their major products as early as 1988 (Abdelaziz et al. 2011). In 1991, the liberalization of the regulatory regime helped to increase industrial competitiveness, and since this date, energy intensity has been steadily decreasing, as illustrated by Figure 1. The year 1995 was when the government officially adopted a policy to improve energy efficiency by "allowing the accelerated depreciation for energy efficiency and pollution control equipment" (Yang 2006, 3108), and in 1997, the public invested USD12 billion in the form 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 an energy-intensive five 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 enterprises (SMEs). The Kreditanstalt fur Wiederaufbau Bankengruppe (KfW) of Germany has created a special credit line and dedicated EUR50 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 emission reductions (IEA 2011, 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 eliminate 25 tons of GHG emissions for every INR1 million invested (IEA 2011). In addition, two risk guarantee funds have been implemented in recent years. Since 2016, the Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) has provided a 50% guarantee of loan amounts for EE projects for government buildings and private buildings. So far, five financial institutions have taken part in the project, namely 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 the total equity or INR20 million (IEA 2019).

Nevertheless, subsidy 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 and the United Nations Industrial Development Organization (UNIDO), 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 the GEF and FLCTD (IEA 2019). The GEF also funds "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, providing competitive grants to pilot projects (IEA 2019).

Finally, India has operated a program of energy-saving certificates, called “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 (toe) of energy savings, is given based on quantified energy savings verified by an energy auditor, and is then traded on the energy-saving certificate market, regulated by the Central Electricity Regulatory Commission (IEA 2019).

## 4.3 Indonesia

Indonesia has been very keen on using 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 IDR137 trillion to fuel subsidies and IDR65 trillion to electricity subsidies, leaving only 20% of the budget for food subsidies, fertilizer subsidies, seed subsidies, credit subsidy programs, and tax subsidies (Setyawan 2014, 38). In order to save part of this budget, the 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 Figure 1, the energy intensity in the country has been relatively stable over the years, with a slightly decreasing trend.

In addition, Indonesia has been putting some effort into raising awareness. Since 2016, the Kampanye Potong 10% (10% Cut of Energy Use Campaign) has targeted stakeholders in the energy sector (government institutions, industry, NGOs, general public…) in order to encourage them to reduce their energy consumption by 10% (IEA 2019). In addition, 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 (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 banks, jointly with ADB), EE concessional loans (provided by MEMR and AFD), the EE revolving fund, and IEPC (supported by KfW and MEMR) 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) has also promoted EE initiatives since 2012, with a budget of USD400 million. The plan is mostly aimed at expanding geothermal power plants and increasing EE through risk-sharing facilities for small and medium investments (IEA 2019).

## 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 a 7% tax reduction for SMEs (IEA 2019). In addition, SMEs have benefited from preferential financial measures (loan, tax, subsidies) since 2010. For instance, special interest rates are applied for energy-efficient 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 has allocated JPY41 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…), represented by 137 organizations, pledged to combat global warming by setting targets for energy reduction and emission 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). In 1997, METI estimated that "Japan had improved efficiency levels by approximately 33% as a result of energy-saving efforts since the oil crises" (METI 2014, 7).

In 2008, Japan introduced the J-Credit Scheme, a program that promotes GHG emission reduction through energy saving and forestry management. The reduction in GHG emission is approved by the state and recognized as a "credit." Credit issuers can be SMEs, farmers, owners of land, or local governments, which, through the installation of energy-efficient equipment, investment in renewable energy, or proper forestry management, have achieved a reduction in GHG emissions. They can sell their credits to large corporations, other SMEs, or local governments, which are encouraged to buy J-credits for good PR and CSR, as well as receiving appraisals 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 has provided free energy audits for SMEs, and conducted about 10,000 between 2004 and 2014 (IEA 2019). In addition, the Energy Conservation Center Japan (ECCJ) has regularly published technical guidebooks and implementation guidelines for energy management in factories since 2001 (IEA 2019).

# 5. CONCLUSION

With rising awareness about climate change, many countries in Asia have pledged to reduce their GHG emissions, through international channels such as the Kyoto Protocol,

the Paris Agreement, or the UN SDGs, or simply through targets set at the national level. As Asia and the Pacific remains the largest contributor to GHG emissions, this region also includes many countries that have 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, namely 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 they 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 and monitoring, and their outcomes depend heavily on the stringency of the targets negotiated between the governments and the private sector. As another type of incentive, ETSs 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 schemes 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: the PRC, India, Indonesia, and Japan. While India and the PRC, in particular, have experienced a spectacular decrease in energy intensity, Indonesia and Japan have been relatively stable. Table 3 summarizes the various instruments and policies promoting EE in the four countries.

From this table, it is clear that part of the success of the PRC could be 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. In addition, the literature praised the effectiveness of voluntary agreements such as the Top-1000 Industrial Energy Conservation Program in the PRC (Price et al. 2010) and the Keidanren Voluntary Action Plan on the Environment in Japan (METI 2014). On the other hand, extensive subsidies have been shown to be 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.

**Table 3: Summary of Incentives Promoting Energy Efficiency in Four Asian Countries**

| | PRC | India | Indonesia | Japan |
|---|---|---|---|---|
| Subsidies | Subsidies since 2005<br>Special fund since 2016 | Subsidies since the 1990s | Subsidies since 1997 | Since 1978 |
| Tax and Tax Exemptions | Tax rebates for exports of energy-intensive products<br>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 |
| Emission Trading Schemes | Pilot program since 2011 in seven provinces | | | |
| 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<br>Tendering Schemes | EEOs since 2010 | PAT 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<br>VCFEE since 2017 | Clean Technology Fund | |
| Others | Energy Saving Performance Contracts (EPSCs); Top Runner Program (regulation and standards) | Strong regulations and standards | | J-Credit Scheme since 2008; Top Runner Program (regulation and standards) |

Source: Authors' compilation.

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