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ADB Working Paper Series

REVIEW OF VOLUNTARY AGREEMENTS ON ENERGY EFFICIENCY: IMPLICATIONS FOR ASEAN COUNTRIES

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Abstract

ASEAN countries need to consider more innovative, market-oriented approaches to accelerate energy efficiency improvement, and well-designed voluntary agreements will play a critical role in raising the awareness of companies and engaging them with the materialization of multiple energy efficiency benefits. This study reviews how successful voluntary agreements on energy efficiency in five countries (the People's Republic of China, Finland, Japan, the Netherlands, and the United Kingdom) achieved their targets in order to draw implications for designing future voluntary agreements in ASEAN countries. We find that three design elements, namely ambitious and realistic target setting, effectively enforceable incentives and penalties, and a strong monitoring and evaluation mechanism, are essential for well-functioning voluntary agreements in these five countries. In addition to these elements, the unique conditions of each country must be considered and transparency must be ensured to maximize the effectiveness of voluntary agreements.

Keywords: voluntary agreements, energy efficiency, energy efficiency policy, energy-intensive industry, ASEAN

JEL Classification: Q48, H32

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1. INTRODUCTION

The Association of Southeast Asian Nation (ASEAN) countries have been experiencing tremendous economic growth over the last two decades and consequently are facing increasingly pressing energy and environmental challenges. The aggregated gross domestic product (GDP) of ASEAN countries has increased almost fivefold from US\$0.6 trillion in 2000 to US\$3.0 trillion in 2018, with an average annual real GDP growth rate of 5.3% (ASEAN 2019). This growth rate is more than double that of the member countries of the Organisation for Economic Co-operation and Development (OECD), estimated at 2.2% over the same period. The accelerated growth has been coupled with a surge in energy demand, and the increasing trend is expected to continue. Indeed, the total final energy consumption in this region is projected to increase from 427 Mtoe in 2015 to 1,046 Mtoe in 2040 (ACE 2017), which will lead to an increase in carbon dioxide (CO₂) emissions from approximately 1.4 gigatonnes in 2018 to 2.4 gigatonnes in 2040 (IEA 2019).

Under these circumstances, improving energy efficiency is recognized as one of the most cost-effective solutions for addressing both energy security and climate change (ACE 2019a). For this, ASEAN countries have set up a collective energy efficiency target to reduce region-wide energy intensity to 20% by 2020 and 30% by 2025 based on the 2005 level (ACE 2015), alongside their individual national energy efficiency targets. So far, most of the regulatory and economic policy instruments implemented by ASEAN countries have adopted a top-down approach, such as government grants and standards, which may induce immediate compliance by companies, but will hardly lead to the continuous incentive for long-term behavioral change (Lindén and Carlsson-Kanyama 2002). Moreover, the pace of energy intensity reduction has been slackened since the mid-2000s. In order to accelerate energy efficiency improvement, ASEAN countries need to consider more innovative, market-oriented approaches together with the regulatory instruments currently in place.

A voluntary agreement refers to a contract between a public authority and a company or an industrial subsector to facilitate the participants' voluntary action based on their self-interest in achieving socially desirable outcomes encouraged by the government (Storey, Boyd, and Dowd 1999). Following various regulations and economic instruments, such as command and control, and tax and subsidy, voluntary agreements have been used as a new policy instrument to improve industrial energy efficiency and reduce energy-related greenhouse gas (GHG) emissions in many countries more recently since the 1990s (Abdelaziz, Saidur, and Mekhilef 2011). A voluntary agreement is regarded as a more efficient and flexible alternative than traditional regulatory approaches (Crocì 2005; Zhang et al. 2018a). Under a voluntary agreement on energy efficiency, the government and industrial participants usually negotiate and agree on energy-saving and GHG emission reduction targets, time schedules, action and technologies to achieve the targets, supportive measures, and penalties to ensure compliance (Fawkes et al. 2016; Rezessy and Bertoldi 2011; Tanaka 2011). The companies targeted by voluntary agreements were mainly large energy end users or industrial subsectors in the past, but recently have been gradually extended to small and medium-sized enterprises (Rezessy and Bertoldi 2011).

ASEAN countries have relied upon top-down approaches for energy efficiency management, with little experience and know-how on the implementation of voluntary agreements. However, more and more countries are considering voluntary agreements as a policy option, particularly in the industrial energy efficiency field. Therefore, this paper aims to review the design issues of voluntary approaches successfully

implemented by other countries and draw on lessons that are useful for charting a future voluntary agreement scheme for ASEAN countries.

2. MECHANISM OF VOLUNTARY AGREEMENTS

2.1 Implementation Process

As the first step of a voluntary agreement, the government should target a selected group of end consumers as potential participants. The participants, in general, include individual companies or industrial subsector associations. One of the prominent features of voluntary agreements is that the implementation of this policy instrument is rooted in the “voluntary” action of businesses, which distinguishes it from traditional regulation. Individual companies have the freedom to either participate or not in the agreements (Cornelis 2019; Zhang et al. 2018a).

Once a company or an industrial subsector association decides to participate in a voluntary agreement, the government needs to negotiate with all the participants on the conditions of the agreement. In general, the agreement should describe energy-saving or GHG emission reduction targets, the participants’ duties (e.g., energy-saving measures to achieve the targets), benefits as compensation for compliance, and the mechanism for monitoring, reporting, and evaluation. The negotiation process requires a horizontal relationship and continuous communication between the government and participants since they must reach a consensus on the contents of the agreement (Lindén and Carlsson-Kanyama 2002). Both individual companies and industry associations are eligible to join voluntary agreements. If an agreement is made between the government and an industry association, the targets at the subsector level should be fixed first, and then individual targets for each company member of the association are set accordingly (Rezessy and Bertoldi 2011).

Voluntary agreements typically cover 5–10 years. Unlike the command-and-control approach, legal punishment cannot be imposed on companies under voluntary agreements if they fail to meet the target or fulfill their agreed duties. Thus, the failures are also handled in the way pre-agreed by both parties (Lindén and Carlsson-Kanyama 2002).

2.2 Pros and Cons of Voluntary Agreements

If the government can introduce new taxes or regulations with little political resistance, voluntary agreements may be the second-best option because the regulatory measures will force companies to adopt more energy-efficient technologies while phasing down inefficient facilities from the market (Lyon and Maxwell 2003). Nevertheless, voluntary agreements have some advantages in terms of flexibility and cost-effectiveness compared to traditional regulation and economic instruments (Zhang et al. 2018a, 2018b).

Firstly, voluntary agreements can overcome inefficiency caused by information asymmetry between the industry and the government. Given the heterogeneous nature of industrial facilities and technologies, it is almost impossible to set up differentiated objectives that suit the specific conditions of each company. Regulatory authorities often have poor knowledge of optimal technologies and the cost of employing them, so important factors such as the marginal cost of energy efficiency measures and specific challenges the company faces cannot be taken into consideration (Menanteau 2005). Unlike regulations allowing public authorities to set uncompromisable targets and issue

guidelines, voluntary agreements enable individual companies to establish their own plans and determine specific technologies and measures to achieve the agreed targets (Crocì 2005; Zhang et al. 2018b). Such greater autonomy and flexibility in decision-making can increase the level of interest in energy efficiency improvement among top executives of companies (Reinaud and Goldberg 2012). Having better knowledge of their current situation and available technologies, the companies can adopt the most cost-effective and suitable energy-efficient technologies.

Secondly, through information sharing among participants, voluntary agreements enable companies to save time and resources in collecting the information required to make corporate decisions (Crocì 2005; Zhang et al. 2018b). Indeed, disseminating information and best practice is an essential function of voluntary agreements (Lindén and Carlsson-Kanyama 2002). In many voluntary agreements, the government organizes networking and training sessions to provide participating companies with the information and capabilities necessary for energy efficiency improvement. In particular, when voluntary agreements engage an industry association, companies are encouraged to share information with other peers in order to meet the subsector-wide targets (Crocì 2005; Zhang et al. 2018b). Given that information searching and analyzing is a very time-consuming and costly process, a company is mostly unable to gain complete information. Thus, voluntary agreements are a great help to the participating companies in aiding them to build on their technical capacity through this collective learning process in a relatively short time and at a lower cost.

Thirdly, voluntary agreements can also lower administrative costs. During the negotiation and implementation stage, constructive dialogues among key stakeholders are usually maintained through various channels, including direct communication, educational and training sessions, and network meetings (Lindén and Carlsson-Kanyama 2002). The negotiation process may require the government and companies to spend enough time and effort to conclude a final agreement. However, it is still a faster and less burdensome process than enforcing new regulations by law (Tractbel ENGIE 2018). More importantly, proactive communication contributes to building trust between the parties, forming a consensus, and consequently reducing monitoring and enforcement costs (Crocì 2005).

On the negative side, one of the major disadvantages of voluntary agreements is associated with free riding. This situation may happen when the agreement engages an industry association. In this case, some individual companies may benefit from free riding the efforts of other companies in achieving the targets set at the subsector level (Menanteau 2005; Zhang et al. 2018b). These free riders will enjoy the reputation generated by the program while contributing little to meeting the given target (Storey, Boyd, and Dowd 1999). Another risk of voluntary agreements is that pre-agreed targets may not be ambitious enough, in some cases even below business-as-usual (BAU) level. Since stricter energy efficiency targets may have significant implications for operation and maintenance costs, companies usually have an incentive to lobby the government in order to set targets lower than the optimal level that the voluntary agreement can bring about to the society (Crocì 2005; Zhang et al. 2018b). To mitigate these risks, many countries opt to establish a penalty mechanism to discourage noncompliance, introduce third-party participation, and base target setting on the energy audit.

2.3 Company-Level Motivation to Participate in Voluntary Agreements

Commitment to voluntary agreements incurs costs for companies. Whereas companies have discretion as to whether to participate in voluntary agreements, they have to fulfill their duties, at their own expense, to meet the agreed targets once they enter into

the agreements. Therefore, companies will decide to participate only if they anticipate that the potential benefits of doing so can outweigh the costs. In many cases, rewards that the government promises to the participating companies are strong drivers for companies. For example, companies may engage an energy efficiency target in exchange for support from the government, including technical and financial assistance (Crocì 2005; Rezessy and Bertoldi 2011).

On the other hand, companies may participate in voluntary agreements for reputation purposes because this will help to enhance their reputation for societal responsibility through energy saving and environmental protection (Crocì 2005; Zhang et al. 2018b). Good environmental standing may help companies shore up their brand image and serve as a differential factor in marketing as consumers are increasingly aware of energy and environmental issues. Furthermore, as more and more companies choose to participate in a voluntary agreement, nonparticipation will become a kind of outlier behavior, and consequently increase the opportunity cost of the nonparticipation decision (Thollander et al. 2013).

Lastly, some voluntary agreements have been particularly successful thanks to an implicit threat of putting into place a new binding regulation or tax in case the targets cannot be achieved (Tanaka 2011). In other words, companies will consider adopting voluntary agreements in order to avoid stricter regulations or taxation that the government would have introduced otherwise (Crocì 2005).

3. ENERGY EFFICIENCY POLICIES OF ASEAN COUNTRIES

3.1 Energy Efficiency of ASEAN Countries

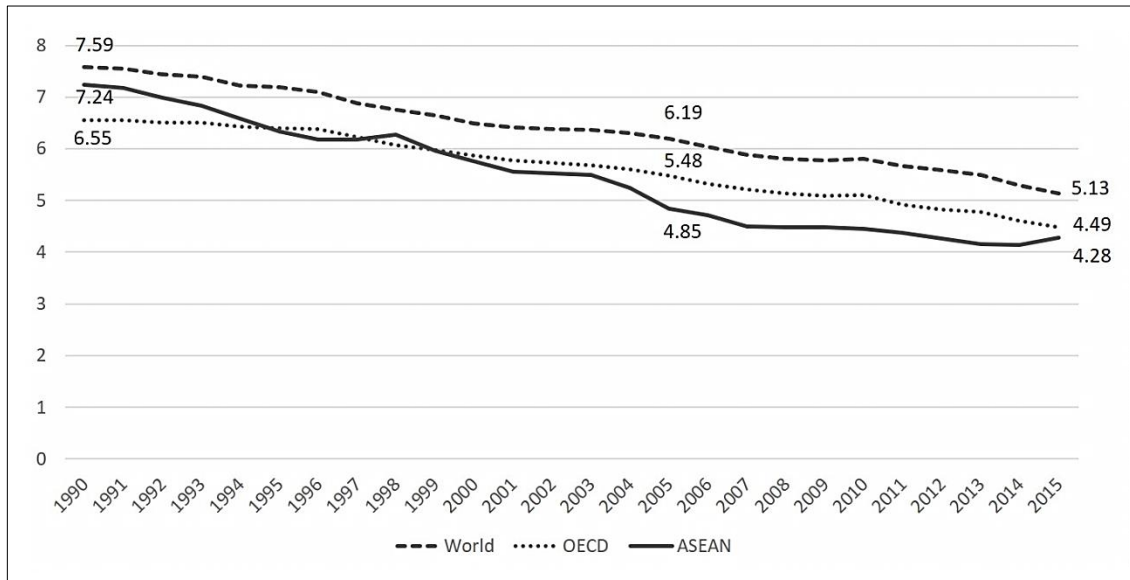
The rapid economic growth of ASEAN countries, coupled with a growing population and industrialization, has increased energy demand in this region. Between 2000 and 2017, the total final energy consumption in ASEAN countries increased approximately 1.8 times from 274 Mtoe to 486 Mtoe. Notably, the industry sector emerged as the largest end user in 2017 (150 Mtoe), while being the second-largest energy consumer in 2000 (76 Mtoe) (IEA 2019). Furthermore, the 5th ASEAN Energy Outlook (ACE 2017) expected the total final energy consumption in this region to grow 2.4 times from 427 Mtoe in 2015 to 1,046 Mtoe in 2040 under a BAU scenario, where the current energy demand patterns are locked in.

Such trends of a sharp increase in energy consumption have prompted ASEAN countries to face the dual challenge of mitigating GHG emissions while meeting the growing energy demand. To deal with these challenges, ASEAN countries have identified energy efficiency and conservation as a cost-effective priority strategy and implemented various policy measures to improve energy efficiency (ACE 2019b).

As shown in Figure 1, the collective energy intensity of ASEAN countries displayed descending trends between 1990 and 2015 from 7.24 MJ/USD to 4.28 MJ/USD. As of 2015, the energy intensity of ASEAN countries was lower than the global average level (5.13 MJ/USD) and even performed better than OECD member countries (4.49 MJ/USD). Despite the remarkable improvement in energy efficiency in the 1990s and early 2000s, the progress has slowed down since the mid-2000s. While the energy intensity in the world and OECD countries decreased by 17.1% and 18.2%, respectively, between 2005 and 2015, that of ASEAN countries decreased by only 11.7% from 4.85 MJ/USD to 4.28 MJ/USD. It is noted that during the same period, the PRC

improved its energy intensity by 34.9%. Moreover, energy intensity in individual states varies greatly among ASEAN countries (Table 1). While Singapore, Myanmar, the Philippines, and Indonesia have shown significant improvement in energy intensity over the last decade, Viet Nam, Cambodia, Thailand, and the Lao People's Democratic Republic (Lao PDR) still have relatively high energy intensity. Moreover, the energy intensity in 2015 in Brunei Darussalam, Cambodia, and the Lao PDR increased compared to the 2005 level.

Figure 1: Energy Intensity of the World, OECD, and ASEAN Countries, 1990–2015
(MJ/\$2011 PPP GDP)



Source: World Bank Open Data (<https://data.worldbank.org/> [accessed March 2020]).

Table 1: Energy Intensity of ASEAN Countries
(MJ/\$2011 PPP GDP)

Country	2005	2008	2011	2013	2014	2015	Improvement (%)
Brunei Darussalam	3.39	5.28	5.54	4.39	4.75	3.65	−7.7
Cambodia	5.50	4.29	6.01	5.60	5.59	5.77	−4.8
Indonesia	4.86	4.25	3.94	3.75	3.68	3.53	27.5
Lao PDR	4.38	3.32	2.71	2.50	2.30	5.17	−18.1
Malaysia	5.77	5.65	5.13	5.33	5.13	4.68	18.9
Myanmar	5.68	4.13	3.04	3.03	3.13	3.12	45.0
Philippines	3.95	3.48	3.13	3.02	3.03	3.12	20.9
Singapore	3.42	3.23	2.83	2.62	2.48	2.39	30.0
Thailand	5.50	5.33	5.39	5.65	5.56	5.41	1.5
Viet Nam	6.02	5.86	5.97	5.62	5.75	5.94	1.2

Source: World Bank Open Data (<https://data.worldbank.org/> [accessed March 2020]).

Therefore, ASEAN countries need to make more effort to increase their energy efficiency and promote energy savings. In fact, the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016–2025 states that ASEAN countries will commit to reducing their collective energy intensity to 20% by 2020 and to 30% by 2025 based on the 2005 level (ACE 2015). In addition to this regional target, each country has set its own energy efficiency targets, as presented in Table 2.

Table 2: National Energy Efficiency Targets of ASEAN Countries

Country	Energy Efficiency Targets	
	Reducing Energy Intensity	Reducing Energy Consumption
Brunei Darussalam	25% by 2030 and 45% by 2035 based on the 2005 level	63% by 2035 compared to BAU
Cambodia		20% by 2035 compared to BAU <ul style="list-style-type: none"> • Garment factories: 20% • Ice factories: 70% • Residential: 50% • Commercial: 20%–30%
Indonesia	1% per annum up to 2025	<ul style="list-style-type: none"> • Industry: 17% (compared to BAU) • Transportation: 20% • Households: 15% • Commercial buildings: 15%
Lao PDR		10% by 2030 compared to BAU
Malaysia		8% by 2025 compared to BAU (electricity)
Myanmar		20% by 2030 compared to BAU (electricity)
Philippines	40% by 2040 based on the 2005 level	1% per year compared to BAU until 2040, equivalent to a 33% reduction in energy demand
Singapore	20% by 2020 and 35% by 2030 based on the 2005 level	
Thailand	30% by 2036 based on the 2010 level	
Viet Nam	10% by 2020 (energy-intensive industries)	8% by 2020 compared to BAU

Source: Adapted from ACE 2017.

3.2 Policy Instruments to Promote Industrial Energy Efficiency of ASEAN Countries

Most ASEAN countries have established their national plans and formed a legal framework for energy efficiency improvement. A variety of policy instruments have been adopted to promote industrial energy efficiency. A few countries, such as Brunei Darussalam, the Lao PDR, Myanmar, and Viet Nam, only started addressing energy efficiency issues in the early 2010s. Table 3 summarizes key policy measures aimed at increasing the industrial energy efficiency of each country. All countries implement a combination of regulatory, economic and fiscal, and information policy instruments. This means that a single policy instrument is usually insufficient to achieve multiple policy objectives; therefore, complementary instruments should be considered together. The most common policy instruments in ASEAN consist of standards and labeling, mandatory energy audit and management, and capacity building. For financial incentives, many countries have been using tax incentives and grants. However, Indonesia, Singapore, and Thailand have adopted more market-based financing mechanisms, including bank loans and risk-sharing schemes.

Table 3: Key Policy Measures for Industrial Energy Efficiency Improvement

Country	Category	Key Policy Measures
Brunei Darussalam	Regulation	<ul style="list-style-type: none"> • Standards and energy labeling for products and appliances • Mandatory energy management
	Economic	<ul style="list-style-type: none"> • Electricity tariff reform

	Information	<ul style="list-style-type: none"> • Awareness-raising events (e.g., energy awards, energy week) • Capacity-building workshops in collaboration with local and international organizations
Cambodia	Economic	<ul style="list-style-type: none"> • Financial incentives (e.g., tax incentives, grants) for energy service companies (ESCOs) and companies interested in implementing energy efficiency projects
Indonesia	Information	<ul style="list-style-type: none"> • Training programs to support energy audit
	Regulation	<ul style="list-style-type: none"> • Mandatory energy management for companies that consume more than 6,000 toe/year • Standards and energy efficiency labeling
	Economic	<ul style="list-style-type: none"> • Financial incentives (e.g., tax incentives, grants, insurance) for energy efficiency projects • Energy-saving performance contracts
Lao PDR	Information	<ul style="list-style-type: none"> • Training programs for energy managers and energy auditors
	Economic	<ul style="list-style-type: none"> • Financial incentives (e.g., tax incentives) for energy efficiency projects
Malaysia	Information	<ul style="list-style-type: none"> • Training programs on energy efficiency
	Regulation	<ul style="list-style-type: none"> • Mandatory energy management for companies that consume 3 million kWh or more of electricity for six months • Minimum energy performance standards and labeling for selected equipment and appliances
	Economic	<ul style="list-style-type: none"> • Financial support (e.g., loans, tax incentives, grants) for energy audit and energy efficiency projects • Energy performance contracts
	Information	<ul style="list-style-type: none"> • Awareness-raising campaigns including events and web-based information portal • Training programs on energy efficiency
Myanmar	Regulation	<ul style="list-style-type: none"> • Standards and labeling for lighting and appliances • Energy audit
	Economic	<ul style="list-style-type: none"> • Financial incentives (e.g., tax incentives) for energy efficiency projects
	Information	<ul style="list-style-type: none"> • Training programs for increasing awareness of energy efficiency • Certification
Philippines	Regulation	<ul style="list-style-type: none"> • Minimum energy performance standards for electric motors and similar devices
	Economic	<ul style="list-style-type: none"> • Financial incentives for energy efficiency projects
	Information	<ul style="list-style-type: none"> • Training programs for energy management experts and system optimization experts
Singapore	Voluntary	<ul style="list-style-type: none"> • Voluntary partnership with the business sector
	Regulation	<ul style="list-style-type: none"> • Mandatory energy management
	Economic	<ul style="list-style-type: none"> • Economic incentives (e.g., loans, tax incentives, grants, insurance) for energy efficiency projects • Carbon tax on large emitters of GHGs
	Information	<ul style="list-style-type: none"> • Training programs for energy managers (the Singapore Certified Energy Manager program)
	Voluntary	<ul style="list-style-type: none"> • Voluntary partnership between government and companies (Energy Efficiency National Partnership)
Thailand	Regulation	<ul style="list-style-type: none"> • Mandatory energy management • Minimum energy performance standards and labeling for equipment, appliances, and energy conservation
	Economic	<ul style="list-style-type: none"> • Economic incentives (e.g., loans, tax incentives, grants, joint venture) for energy efficiency projects and ESCOs
	Information	<ul style="list-style-type: none"> • Training programs for ESCOs and companies
	Voluntary	<ul style="list-style-type: none"> • Voluntary agreements to save energy between public agencies and business associations and large-scale business
Viet Nam	Regulation	<ul style="list-style-type: none"> • Minimum energy performance standards and labeling for equipment and appliances
	Economic	<ul style="list-style-type: none"> • Economic incentives (e.g., loans, tax incentives) for energy efficiency projects
	Information	<ul style="list-style-type: none"> • Training programs on energy audit • Publishing a guidebook on energy efficiency
	Voluntary	<ul style="list-style-type: none"> • Pilot voluntary agreements between government and companies

Source: Author's summary based on ACE 2019a, 2019b; APERC 2017; ERIN Secretariat 2016.

Although various policy measures are being implemented in ASEAN countries, some existing obstacles make continuous improvement of energy efficiency still challenging.

Some countries, such as Brunei Darussalam, Cambodia, the Lao PDR, and Myanmar, still have a limited institutional capacity to support energy efficiency financing. Even in countries establishing support frameworks for energy efficiency financing, including Indonesia, Malaysia, Singapore, and Thailand, a rudimentary understanding of the policies and an ineffective enforcement system have often hindered the active implementation of these policies (ACE 2019a, 2019b). In ASEAN countries, many companies still see energy efficiency projects as an additional cost factor rather than a commercially viable investment opportunity (ACE 2019b). Thus, voluntary agreements will play a critical role in raising the awareness of companies and engaging them with the materialization of multiple energy efficiency benefits.

3.3 Voluntary Agreements on Industrial Energy Efficiency

As mentioned in the above sections, ASEAN countries still rely heavily on traditional energy efficiency policies. While voluntary agreements are one of the most common instruments for improving energy efficiency in many other industrialized countries in Europe and East Asia, no other ASEAN countries except Singapore have yet formally implemented valid voluntary agreements. However, it is important to note the recent actions taken by the ASEAN countries to introduce and pilot voluntary agreements.

In Singapore, the National Environment Agency launched an industry-focused Energy Efficiency National Partnership program (EENP) in April 2010. This is a voluntary partnership program for companies interested in becoming more energy efficient to increase their long-term business competitiveness and minimize their carbon footprint. It comprises three subprograms: Energy Management System, EENP Learning Network, and EENP National Recognition Scheme. Through these programs, the EENP helps partner companies to save their energy consumption by providing relevant information by organizing workshops and training sessions, incentives, and recognition (APERC 2017). As of February 2020, the EENP had established partnerships with 291 companies.

The Philippines has designated voluntary agreements as a subprogram of the National Energy Efficiency and Conservation Program. The Ministry of Energy establishes partnerships with the private business sector. Under these partnerships, the government disseminates information about available technologies and relevant programs, provides energy audit services, and holds seminars. The companies carry out their own energy efficiency and conservation measures and monitor their energy consumption.

Viet Nam initiated a pilot voluntary agreement program on energy efficiency and saving in December 2016. Agreements were signed by the Ministry of Industry and Trade and seven companies: Ricoh Imaging Products Vietnam, Annora Vietnam Footwear, Vinh Hue Paper, Colusa-Miliket Foodstuff, Dong Xuan Knitting, Saigon Milk Factory of Vinamilk, and Vietnam Food. The main objective of this program is to promote active energy saving in the industry sector by supporting their efforts to increase energy efficiency and reduce production costs. These seven companies are eligible to receive the government's financial support to cover 100% of their first energy audit. The Vietnamese government announced that the program would be scaled up to a national level after the completion and evaluation of the pilot program (VNEEP 2017).

In addition, according to the Thailand 20-Year Energy Efficiency Development Plan (2011–2030), Thailand will execute voluntary agreements as a measure for Energy Conservation Promotion and Support. The agreement is made between the public agency and the industrial sector, particularly industry associations and large companies. The Indonesian government has also communicated with energy-intensive industries

including the fertilizer, cement, pulp, and steel industries (Kementerian ESDM RI and ECN 2016).

Most of the voluntary agreements in place in ASEAN countries are still at a nascent stage compared to those in other, more advanced economies. Also, as voluntary agreements have not been mainstreamed in the energy efficiency landscape, the number of participants is still limited. Thus, ASEAN countries need to improve the design of current voluntary agreement schemes as well as expanding them to increase the effectiveness of the voluntary agreements.

4. LESSONS FROM SUCCESSFUL VOLUNTARY AGREEMENTS

4.1 Selected Voluntary Agreements

Since the Netherlands introduced voluntary agreements in the energy efficiency field for the first time in 1991 (Cornelis 2019), they have been widely used for the industrial sector to meet specific energy efficiency and energy-saving targets. Significant environmental and economic benefits have been produced through these voluntary agreements. Drawing on lessons on how these voluntary agreements have achieved their targets can provide useful guidance for ASEAN countries to design future voluntary agreements. The successful voluntary agreements examined in this paper include:

- **Top-10,000 Energy-Consuming Enterprises Program in the PRC (former Top-1,000 Energy-Consuming Enterprises Program in the PRC):** This is the most representative industrial program and sets company-level energy performance improvement targets in the PRC (Zhao et al. 2016). It also provides lessons on the setting of mandatory targets and imposing of clear penalties for failure. The program was launched in 2005 as one of the key programs aimed at achieving the Chinese energy efficiency target of reducing energy consumption per unit of GDP by 20% below 2005 levels by 2010. The program aims to strengthen the energy management of the largest energy-intensive companies in the PRC. The targeted companies expanded from 1,000 companies to 10,000 companies in the 12th Five-Year Plan starting from 2010.
- **Energy Efficiency Agreement for the Industrial Sector in Finland:** The program was launched in 1997 as a key policy tool to fulfill EU energy efficiency obligations set for Finland. The program has made satisfactory progress in all areas (Gynther and Suomi 2017). In particular, it provides lessons on establishing a proper monitoring and evaluation system, as well as communicating results to motivate further improvement.
- **Keidanren Voluntary Action Plan on the Environment in Japan:** The program was launched by the Nippon Keidanren (Japan Business Federation) in 1996 to contribute to meeting the Japanese CO₂ reduction target under the Kyoto Protocol, and currently has the goal of halving GHG emissions by 2050. It has achieved the targets successfully (Thollander et al. 2015). The success factors consist of setting robust targets consistent with the government's long-term projects and maintaining transparency and credibility.
- **Long-Term Agreements on Energy Efficiency (LTA/LEE) in the Netherlands:** The program is often known as the best practice in Europe and for including exemplary voluntary agreements (Abdelaziz, Saidur, and Mekhilef 2011; Cornelis

2019) and thus lends lessons for the monitoring of results and the provision of incentives. The LTA aims to increase energy efficiency and encourage the use of renewable energy in the industry, agriculture, and service sectors. The program was initiated in 1992, with the third phase starting from 2008. From the third phase, the agreements were separated into the LTA dedicated to companies not participating in the EU Emission Trading System (EU-ETS) and the LEE for companies participating in the EU-ETS.

- **Climate Change Agreement (CCA) in the UK:** The program was initiated in 2001 as part of the Climate Change Levy (CCL) package. Under this agreement scheme, companies can get a discount on the CCL if they meet agreed carbon reduction targets. It has been effective at improving energy efficiency and raising awareness (Li et al. 2018) and provides lessons on how to implement a stick-and-carrot approach.

The key achievements of the above five voluntary agreements in the PRC, Finland, Japan, the Netherlands, and the UK are summarized in Table 4.

Table 4: Key Achievements of Selected Voluntary Agreements

Country	Achievement in Energy Savings
PRC	<ul style="list-style-type: none"> • 150 Mtce reduction between 2005 and 2010 (50 Mtce more than the target) • 309 Mtce reduction between 2011 and 2014 (20% more than the target of 250 Mtce)
Finland	<ul style="list-style-type: none"> • 9,897 GWh reduction by the end of 2016 • In the energy-intensive industries, the cumulative savings in 2016 accounted for 8.3% of the sectoral total final energy consumption.
Japan	<ul style="list-style-type: none"> • The uniform target in the industry sector (8.6% reduction in CO₂ emissions from 2008 to 2012 compared to 1990 level) was overachieved by 12.2%. Keidanren concluded that efficiency improvement was the vital driving force to meet the target.
Netherlands	<ul style="list-style-type: none"> • LTA 1 and 2: 1.8–2.0 %/year reductions between 1992 and 2008 • LTA 3 (non-ETS industry): 1.8%/year reductions between 2008 and 2016 • LEE (ETS industry to consume more than 0.5 PJ/year): 1.2%/year reductions between 2008 and 2016 • Cumulative savings: 63.4 PJ in 2016
UK	<ul style="list-style-type: none"> • 10.5 Mtce/year in CCA TP5, 4.9 Mtce/year in CCA2 TP2 (against baseline year emissions) • 82% of sectors and 53% of target units met their target in CCA2 TP2 (2015–2016)

Source: Author's summary based on Cornelis 2019; Environment Agency 2017; Fawkes et al. 2016; Gynther and Suomi 2017; NDRC 2015; Thollander et al. 2015; Veum 2018.

4.2 Comparison of Design Elements

4.2.1 Sector Coverage

Voluntary agreements may vary significantly across the sectors they cover (Table 5). The main target of voluntary agreements has been large energy-intensive companies in the industry sector since the late 1990s, but today, an increasing number of countries are expanding voluntary agreements to nonenergy-intensive companies and other sectors as well (Rezessy and Bertoldi 2011). For example, the service sector, including the public and commercial sector (PRC, Finland, Netherlands, UK), the agriculture sector (Finland, the Netherlands, the UK), and the transport sector (PRC, Finland, Japan, Netherlands, UK), has become the new target sector of voluntary agreements. Finland, the Netherlands, and the UK are the countries that have the most comprehensive sectoral coverage.

Furthermore, the target group of voluntary agreements must cover a significant part of an industry, in terms of the number of companies or share of total industrial energy consumption, to ensure a substantial impact (Rezessy and Bertoldi 2011). For example, in Finland, Japan, and the Netherlands, the participating companies' energy consumption accounts for 80–85 % of the total industrial energy consumption in these countries.

Table 5: Sector Coverage of Selected Voluntary Agreements

Country	Number of Participating Companies	Industry (large)	Industry (SME)	Public	Commercial	Transport	Agriculture
PRC	17,000	V (energy consumption > 10,000 tce/year)		V	V	V	
Finland	460 (85% of industrial energy use)	V	V	V	V	V	V
Japan	114 associations (80% of industrial CO ₂ emissions)	V	V		V	V	
Netherlands	1,100 (> 80% of industrial energy use)	V (energy consumption > 0.5 PJ/year)	V (energy consumption < 0.5 PJ/year)	V	V	V	V
UK	3,184	V	V	V	V	V	V

Source: Author's summary based on Abeelen, Harmsen, and Worrell 2016; EC 2017; Environment Agency 2017; Fawkes et al. 2016; Gynther and Suomi 2017; Li et al. 2018; Wakabayashi and Arimura 2016.

4.2.2 Administrative Framework

Table 6 lists the main stakeholders involved in these voluntary agreements and key administrative processes of the implementation. Although some studies argue that flexibility is crucial for a successful voluntary agreement, many researchers point out that powerful and competent authorities still play a vital role in enabling the participating companies to meet their obligations (Cornelis 2019). Except for Japan, all voluntary agreements have been managed by the government. The ministries or the government agencies are responsible for the target setting, providing supporting policies, signing agreements, and monitoring and evaluating energy savings. The government manages the voluntary agreements directly, such as in the Netherlands and the UK, or authorizes other public organizations to manage agreements as in the PRC and Finland. For example, the local governments in the PRC have been authorized to supervise the progress of the program at the level of local companies, and Motiva, contracted by Finland's Energy Authority since 1997, has carried out administrative functions, such as marketing, monitoring, and assessment based on the government guidelines.

The PRC and Japan have formed a network among the participating companies. Creating a network and holding regular network meetings are useful for catalyzing and expanding the efforts of companies to achieve energy efficiency improvements by providing relevant information to assist with corporate decision-making and reduce transaction costs. In particular, participating companies can share their experiences, including their achievements and difficulties, and learn the expertise of invited experts and other participating companies in the network meetings. Also, peer learning and

indirect competition to achieve the targets among participants can facilitate the diffusion of innovative measures to improve energy efficiency among network members (Schlomann et al. 2015).

Table 6: Administrative Framework of Selected Voluntary Agreements

Country	Main Actors	Networking/ Information	Training/ Consulting	Monitoring/ Evaluation
PRC	<ul style="list-style-type: none"> National Development and Reform Commission Provincial and municipal governments (implementation, supervising) Companies 	V	V	V
Finland	<ul style="list-style-type: none"> Energy Authority (administrative body) Motiva (contractor, implementation, monitoring) Companies/municipalities 		V	V
Japan	<ul style="list-style-type: none"> Keidanren (administrative body) Industry associations Companies 	V	n/a	V
Netherlands	<ul style="list-style-type: none"> Ministry of Economic Affairs (administrative body) The Netherlands Enterprise Agency (monitoring) Companies 		V	V
UK	<ul style="list-style-type: none"> Department of Energy and Climate Change (currently Department for Business Energy and Industrial Strategy) (administrative body) Environment Agency (monitoring) Industry associations 		n/a	V

Source: Author's summary based on Abdelaziz, Saidur, and Mekhilef 2011; EC 2017; Gynther and Suomi 2017; Li et al. 2018; Veum 2018; Wakabayashi and Arimura 2016; Zhao et al. 2016.

4.2.3 Target Setting

In most cases, the targets of voluntary agreements are reasonably quantifiable, but comparing the target level between countries is difficult because of the differences in timelines, calculation methods, and units. Thus, such a comparison focuses on the structure and process of target setting, rather than the absolute level of the targets. Table 7 summarizes the key elements of the target setting in selected agreements.

The PRC, Finland, and the UK have both sector-level and individual company-level agreements. When voluntary agreements are signed with industry associations, the targets of individual companies are set within the sectoral targets, and later individual companies report their achievements to the associations to which they belong (Rezessy and Bertoldi 2011). Regardless of whether they are sectoral targets or company-level targets, the targets in the voluntary agreements are usually determined through negotiation between the government and the target group. The UK's CCA between the former Department of Energy and Climate Change (now the Department for Business Energy and Industrial Strategy) and the industry associations illustrates the typical target-setting process of voluntary agreements. The government collected information about the energy efficiency potential of energy-intensive industries and identified the ten largest energy-consuming sectors. Then, individual companies in the sector assessed their potential to improve energy efficiency and reported the targets that they can achieve to their trade associations. After that, each industrial sector offered collective sectoral

targets to the government, and the final targets for the next two years were determined through negotiations between the government and the trade associations (Abdelaziz, Saidur, and Mekhilef 2011). The targets varied widely, ranging from 25% for the laundry industry to 2.8% for the aluminum industry.

Table 7: Target Setting of Selected Voluntary Agreements

Country	Expression	Sector-level Target	Company-level Target	Mandatory	Process
PRC	Energy intensity reduction (tce)	V (local level)	V	V (Companies are allowed to aim for more ambitious, voluntary standards.)	Local provinces propose their total energy-saving targets estimated based on energy-saving potentials of local companies reported by each company. After the review of the central government, final targets are determined through the negotiation between provincial and central governments.
Finland	Energy savings (GWh/year)	V	V		The government and the Confederation of Finnish Industries sign the Framework Agreement. Then, sector-specific action plans, including sectoral targets, are established.
Japan	Various (Each industry can select.)	V	n/a		The government does not directly engage in negotiations to set the targets. Each industry association discusses the sector-wide target based on the investigation of member companies to assess their feasibility to meet the target.
Netherlands	Relative energy savings	n/a	V		Participating companies submit an Energy Efficiency Plan every four years containing the qualitative and quantitative targets.
UK	Various (majority: relative energy savings)	V	V		The industry association offers a sector-wide target to the government. Then, they agree on the sector targets through negotiation.

Source: Author's summary based on Abeelen, Harmsen, and Worrell 2016; EC 2017; Environment Agency 2017; Gynther and Suomi 2017; Li et al. 2018; Thollander et al. 2015; Veum 2018; Wakabayashi and Arimura 2016; Zhao et al. 2016.

Although the agreements are voluntary, energy-saving targets may be regarded as binding in some countries. The PRC's Top-10,000 Energy-Consuming Enterprises Program set up mandatory company-level targets, in terms of the amount of energy saved. Moreover, the program also encouraged companies to set voluntarily more ambitious energy intensity standards beyond the mandatory target. On the other hand, the UK's CCA makes the target virtually mandatory by connecting the achievement of the targets with the CCL. Given that noncompliance leads to the payment of a full tax rate under the CCL, participating companies have been forced to achieve their targets even though the targets themselves are not mandatory (Li et al. 2018).

4.2.4 Incentives and Penalties

Tax exemption and cost recovery through the provision of subsidies have been mainly used to incentivize companies' compliance (the PRC, Finland, Netherlands, the UK).

Meanwhile, penalties included in the voluntary agreements vary across the country (Table 8).

Table 8: Incentives and Penalties of Selected Voluntary Agreements

Country	Incentive	Noncompliance Penalty
PRC	<ul style="list-style-type: none"> Financial support for energy-saving projects (200 RMB/tce/year) 	<ul style="list-style-type: none"> Notice of criticism Mandatory energy audits adjustment/retrofit Approval of capital projects or additional land use requests may be suspended. (company, local governments)
Finland	<ul style="list-style-type: none"> Subsidies (€10,000 – €500,000) 	<ul style="list-style-type: none"> Repayment of subsidies
Japan	<ul style="list-style-type: none"> Public information disclosure 	<ul style="list-style-type: none"> Public information disclosure
Netherlands	<ul style="list-style-type: none"> Tax rebate Subsidies 	<ul style="list-style-type: none"> Tightened environmental license
UK	<ul style="list-style-type: none"> Tax (CCL) rebate 	<ul style="list-style-type: none"> Discontinuation of tax rebate Financial penalties for minor infringements

Source: Author's summary based on Abdelaziz, Saidur, and Mekhilef 2011; Fawkes et al. 2016; Li et al. 2018; Veum 2018; Wakabayashi and Arimura 2016; Zhao et al. 2016.

The UK's CCA is renowned for its “stick-and-carrot” approach as part of the coordinated action under the CCL (Li et al. 2018). Even though participation in a CCA is entirely voluntary, the government conditions companies' compliance to manifest incentives and penalties within the agreement. The CCA allows the participants to receive a rebate on the CCL of up to 90% for electricity and 65% for gas and other fuels if they fulfill their obligations (Cornelis 2019; Environment Agency 2017). By contrast, if the energy-saving targets are not achieved over a two-year period, the discount will not be renewed for the next two-year target period. Companies that still intend to claim the CCL discount despite their failure to meet the targets have two alternatives: either using banked surpluses accrued through overachievement during the previous target periods or paying a “buy-out fee” to the government (Environment Agency 2017; Li et al. 2018). The CCA also sanctions financial penalties for minor infringements such as missing the reporting deadlines or reporting inaccurate data.

The PRC's Top-10,000 Energy-Consuming Enterprises Program has implemented the stiffest penalties among the five countries. “Notice of criticism” is issued to companies failing to achieve their targets. The penalties for these companies include suspension of approval of requests for capital financing or industrial land use and other economic sanctions. Not only the companies but also local government officials are subject to the penalties. If their jurisdictions do not meet the targets, the relevant government officials will be disqualified from promotion and honorary rewards or titles (Fawkes et al. 2016).

4.2.5 Monitoring, Reporting, and Evaluation

Table 9 provides an overview of the stakeholders in charge of monitoring energy savings and methods for evaluation and verification. Each participating company reports its annual performance to the evaluation organization (mostly the government agency). The evaluation organization reviews the reports and confirms the results. In addition, the voluntary agreements in Finland and the UK have developed an online platform for data collection and tracking of the implementation status. This web-based reporting system can reduce administration costs, and improve processing efficiency and transparency (ATEE 2017).

Table 9: Monitoring and Evaluation of Selected Voluntary Agreements

Country	Monitoring Organization	Verification (Evaluation) Organization	Verification Methods
PRC	Company	Local energy-saving offices	• Desk-based review
Finland	Company	Motiva (contractor)	• Web-based monitoring system
Japan	Company, industry association	Industry association, Keidanren	• The collected information is shared among the member companies and made public.
Netherlands	Company	Netherlands Enterprises Agency	• Desk-based review by external consultants
UK	Company	Department for Business Energy and Industrial Strategy, Environment Agency	• Electronic register
			• Audits on selected facilities and sector associations (random or risk-based)
			• Desk-based or full-site

Source: Author's summary based on Abeelen, Harmsen, and Worrell 2016; EC 2017; Gynther and Suomi 2017; Li et al. 2018; Thollander et al. 2015; Veum 2018; Wakabayashi and Arimura 2016; Zhao et al. 2016.

The five countries show differences in the methods used to verify the results reported by the companies. First, the UK confirms the results based on both desk-based reviews of reports submitted and on-site inspections. The target companies for on-site inspections are selected randomly or decided using a risk-based approach (Li et al. 2018). Second, the Netherlands and Japan do not conduct on-site inspections, but they require companies to comply with their targets by hiring external consultants or disclosing the results to the public. The external consultants check all the monitoring reports submitted to the Netherlands Enterprise Agency to confirm their completeness and correctness. This is done by comparing the reported data about energy use and production and projected data (Abeelen, Harmsen, and Worrell 2016). On the other hand, Japan's Keidanren not only shared the collected information among the member companies but also made the industry's action plans and progress publicly available through their websites to improve the transparency of evaluation.

4.3 Lessons for ASEAN Countries

Table 10 summarizes the critical success factors and challenges of voluntary agreements of these five countries. It is found that target setting, incentives and penalties, and monitoring are the most important success factors. There is a consensus in the existing literature that the following three conditions are necessary for successful implementation of various voluntary agreements: 1) ambitious but realistic targets, 2) enforceable incentives and penalties, and 3) strong monitoring and evaluation (Cornelis 2019; OECD/IPEEC 2016; Rezessy and Bertoldi 2011).

Table 10: Success Factors and Challenges of Selected Voluntary Agreements

Country	Success Factors	Challenges/Limitations
PRC	<ul style="list-style-type: none"> • Mandatory target setting • Clear penalties for failing to achieve the targets 	<ul style="list-style-type: none"> • Small coverage during phase 1 (Top-1,000 Energy-Consuming Enterprises program)
Finland	<ul style="list-style-type: none"> • Proper monitoring and evaluation, strong results and communication of results → increasing motivation and further improving results 	<ul style="list-style-type: none"> • Ensuring timely submission of good-quality data requires a lot of administrative work.
Japan	<ul style="list-style-type: none"> • A robust target, which is consistent with the government's long-term projections • The quality of the plan is secured based on Plan-do-check-act (PDCA). → Reliable transparency and credibility compared to other measures that have no review process 	<ul style="list-style-type: none"> • Narrow sector coverage: It includes only large-scale enterprises that are members of the Keidanren. • Enforcement: No public administrative organization is explicitly engaged in compelling compliance.
Netherlands	<ul style="list-style-type: none"> • Incentives: tax exemption and automatic compliance with the energy-related provisions under the Environmental Management Act • All data in the monitoring reports are verified for their completeness and correctness by external consultants. 	<ul style="list-style-type: none"> • Since the LTA and LEE are part of a combination of policy instruments for energy efficiency improvement, measuring and isolating their effect is challenging.
UK	<ul style="list-style-type: none"> • A stick-and-carrot approach: setting up a monitoring and assessment system to provide a discount on the tax and impose a penalty for noncompliance • Two-tier target setting structure → Instead of direct interactions between the government and the companies, the subsector associations are responsible for the operations and communication, which enhances administrative efficiency and facilitates effective sharing of sector-specific expertise. 	<ul style="list-style-type: none"> • A combination of collective and individual liability decreases fairness and accountability. → An incentive for individual companies to free ride

Source: Author's own elaboration.

4.3.1 Ambitious but Realistic Targets

Setting energy-saving targets is one of the most critical steps in designing an effective voluntary agreement scheme. The targets in terms of energy savings or CO₂ emission reduction should be sufficiently ambitious to guarantee the effectiveness and integrity of the scheme (Cornelis 2019). At the same time, they should be realistic so that companies and industries can achieve the target with a range of economically and technically feasible measures.

To set realistic but ambitious targets satisfying both the government and the participating enterprise or industries, a consensus-seeking approach through multiple stakeholder engagement plans will be fundamental in the process of target setting and rule definition for the voluntary agreement (ATEE 2017). In the UK, the government often tended to require industry associations to adjust the targets to a more challenging level during the negotiation of the CCA (Abdelaziz, Saidur, and Mekhilef 2011).

If ASEAN countries introduce or expand voluntary agreements in the future, the energy-saving targets should be ambitious enough to achieve national energy efficiency targets. Collective regional targets of ASEAN should be reflected and adjusted as well. Also, the negotiations to determine the energy-saving targets are likely to be strengthened. Talks

between the government and partner companies will enable the government to seek more ambitious targets. However, it should be noted that the targets have to be commensurate with the technical and financing capabilities of the companies and government. Therefore, it is essential for the government to have a better understanding of the technical and economic potential of energy efficiency in specific industries (Fawkes et al. 2016).

4.3.2 Effectively Enforceable Mechanism

While it is acknowledged that voluntary agreements have been successfully implemented to some extent, a lower participation level is still observed in many jurisdictions compared to the coverage of other regulatory or economic instruments (Price 2005). As shown in the voluntary agreements of these five countries, successful voluntary agreements have designed government support conditional on both the participation and penalty associated with noncompliance.

The incentive most frequently used in voluntary agreements is financial assistance, including subsidies and tax rebates. Companies are often reluctant to make additional investments but expect to receive financial support from the government in exchange for their energy efficiency initiatives. Thus, the financial assistance mechanism needs to be carefully investigated to avoid free riders while motivating companies to join the voluntary agreements.

Access to information, including training programs and network meetings, is also an important incentive for companies. In Japan, industry associations have helped participating companies to develop a shared understanding of the targets and feasible measures by providing them with periodic training sessions. According to a survey conducted by the Japanese Ministry of Economy, Trade, and Industry, 64% of companies recognized the information provided by the industry associations under the Keidanren Voluntary Action Plan as being useful (Wakabayashi and Arimura 2016). In most cases, small and medium-sized enterprises will benefit more from networking as they are often confronted with the constraints of time, budget, and capacity in collecting relevant information and best practices in the given industry.

In addition to these incentives, most of the voluntary agreements combine penalty mechanisms, including repayment of subsidies and discontinuation of tax rebates, to discourage noncompliance with pre-agreed commitments. The penalties may make the voluntary agreement scheme function as a mandatory measure to associate pressing threats with nonachievement of the targets. Although mandatory targets may induce a high compliance rate and program effectiveness, setting a binding target can spark strong opposition within the industry sector. Also, the “voluntary” nature of voluntary agreements makes it challenging to incorporate any legal penalties in the sanction schemes. The cases of Finland and the UK may provide good examples. With the same approach, the other countries can also make companies choose to either achieve the target and enjoy financial benefits or not achieve the target and give up the benefits. Thus, this may lower the resistance of companies compared to regulatory measures by relieving their legal burden for compliance.

Thus, voluntary agreements of ASEAN countries need to improve their effectiveness with the introduction of a well-designed enforcement system to provide participating companies with both negative and positive incentives. Also, it is worthwhile considering nonfinancial incentives together with financial incentives. For example, a regular network meeting where the network members exchange information and their experiences should be promoted. Furthermore, the threat of disclosing noncompliance results can also work as a negative incentive as in the Japanese case.

4.3.3 Strong Monitoring and Evaluation Mechanism

Reporting, monitoring, and evaluating are considered the weakest points of voluntary agreements because the evaluation of voluntary agreements has relied on self-reporting from the industry in many cases. Thus, employing transparent and confirmable procedures for monitoring and evaluation is critical for the successful operation of voluntary agreements (Rezessy and Bertoldi 2011; Tanaka 2011). Indeed, all five cases show that successful voluntary agreements have ensured a reliable monitoring and evaluation mechanism, including robust indicators, third-party verification, and information disclosure to the public.

The voluntary agreements of the five countries may provide lessons for designing monitoring and evaluation mechanisms for future voluntary agreements. First of all, the results reported by each company need to be verified by a specialized group comprised of external consultants and experts. Overdependence on self-reporting by industry may exacerbate the existing information asymmetry between the government and the industry. To address this issue and improve the accuracy of self-reported data, an independent third-party verifier, responsible for checking baseline and monitored data, needs to be hired before the agreement is enforced (Rezessy and Bertoldi 2011). The Japanese approach offers an alternative if hiring external consultants is likely to cause a significant burden on the companies and the government. Under the Keidanren Voluntary Action Plan, an Evaluation Committee was set up in 2012 to verify data and assess the progress of the program. The Committee was composed of seven to ten members from the academia, media, NGOs, and labor unions.

An online reporting system should also be considered to simplify the reporting process and ease the administrative burden of the participants (Rezessy and Bertoldi 2011). Finally, better incentives are required to ensure that companies provide reliable data (Veum 2018). The Finnish government has stated that one of the challenges faced by the Finnish Energy Efficiency Agreements for the Industrial Sector was related to the quantity and quality of data. The program observed a lack of data and difficulty in producing good-quality data within the due date of submission due to the intensive administrative work (Gynther and Suomi 2017). Thus, it is important to put in place appropriate logistics to enable participating companies to provide timely and accurate data during the reporting process. In addition, once the voluntary agreements are implemented, a thorough cost-benefit analysis to evaluate their impact and outcomes should be conducted to provide feedback for the continuous improvement of the program (Tractbel ENGIE 2018).

5. CONCLUSION AND POLICY IMPLICATIONS

ASEAN countries are set to make major strides towards improved energy efficiency, given the growing energy demand. The current regional and national energy efficiency improvement targets are not ambitious yet. It is thus necessary to strengthen the efforts of energy efficiency with a more bottom-up approach. Voluntary agreements to improve industrial energy efficiency can be an effective policy option for ASEAN countries, given the engagement of multiple stakeholders on a voluntary basis.

Voluntary agreements can contribute to alleviating information asymmetry by enabling the government to estimate technically and economically feasible energy-saving potential through a dialogue with industries. Also, voluntary agreements are flexible enough to be integrated into the existing policy mix, and their effectiveness tends to increase when they are combined with other policy instruments, such as energy audits, educational programs, and subsidies (Lindén and Carlsson-Kanyama 2002; Zhang et al.

2018b). This means that ASEAN countries may easily initiate voluntary agreements without significant institutional change compared to other traditional regulatory and fiscal instruments.

Based on the five countries' experience, this paper suggests three major design elements, namely ambitious and realistic target setting, effectively enforceable incentives and penalties, and a strong monitoring and evaluation mechanism, as essential factors for well-functioning voluntary agreements. Besides, tailoring the design of the program to the unique conditions of each country is necessary to maximize the effectiveness of voluntary agreements. Lastly, transparency must be ensured because voluntary agreements can only be most effective when trust and cooperation exist between the government and target companies.

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