



INSTITUTE FOR

**Industrial Productivity**

Sharing best practices for low carbon enterprises

# **Ten Key Messages for Effective Policy Packages**

*Sharing best practices in industrial energy efficiency policies*



# Ten Key Messages for Effective Policy Packages

*Sharing best practices in industrial energy efficiency policies*

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## Foreword

The Institute for Industrial Productivity (IIP) is a not-for-profit global organisation whose mission is to significantly reduce greenhouse gas emissions by giving business leaders and policy makers access to effective practices, technologies and tools to advance industrial productivity. IIP is developing a global database on the industrial energy efficiency and greenhouse gas (GHG) mitigation policies by country.

To date, the database contains the policy packages of China, India, Japan, the Netherlands, the United Kingdom and the United States. These countries were selected as case studies to demonstrate the approach and methodology in a diverse set of countries in terms of size, economic structure, level of development, culture and policy approach. The database builds on earlier work carried out by the IEA Energy Efficiency Policies and Measures database, the Mesures d'Utilisation Rationnelle de l'Energie (MURE) energy efficiency policy database for EU countries, the World Energy Council activities on energy efficiency policies as well as national sources and cross-country analyses.

The goal of the online database is to inform policy makers of the approaches that other countries have taken to achieve energy savings and reduce emissions in the industry sector. An important characteristic of the IIP database will be to shed light on industrial energy efficiency policies from an overall "policy package" perspective, focusing on policy interrelations, consistency of policy objectives and approaches, and completeness in terms of the barriers addressed. The database is scheduled to be available on IIP's website by September 2011.

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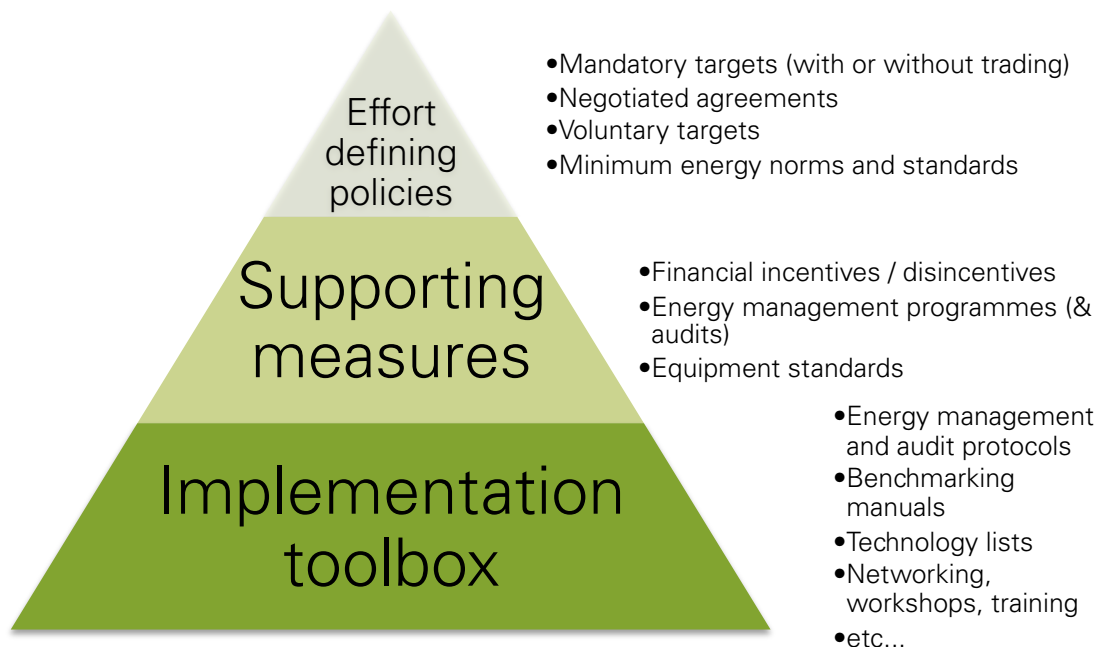
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## Executive Summary

This paper analyses the policy packages of China, India, Japan, the Netherlands, the United Kingdom and the United States that directly or indirectly affect industrial energy efficiency or greenhouse gas (GHG) emissions. The aim is to identify best practices and key messages that can inform the development of energy efficiency and GHG policies.

To explore whether policy packages can provide the necessary impetus to achieve ambitious improvements in energy savings and emissions reductions, the paper uses the “policy pyramid” methodology (illustrated below), which distinguishes among three levels of policy making: effort-defining policies; supporting measures (or complementary policies, either carrots or sticks) that help deliver that effort and address specific barriers identified; and tools, guidelines or mechanisms that help define and establish the policy implementation framework. This paper posits that an effective policy approach requires a policy package consisting of all three policy levels.



Although a range of context-specific factors affect policy effectiveness within a country, the policy pyramid is a means by which to analyse the policy approaches of different countries, and to assess whether certain minimum elements critical to the success of a policy package have been considered.

This paper proposes that an effective policy approach requires a policy package consisting of: (i) sufficiently ambitious effort-defining policies to outline energy efficiency and GHG reduction goals; (ii) supporting measures (*i.e.* in the form of carrots and sticks) that address the different barriers (if any barriers have been identified) and that are mutually reinforcing and encourage



action; and (iii) an implementation toolbox to support the execution of effort-defining policies and supporting measures in a transparent and efficient way.

The analysis of the policy packages of the countries surveyed (China, India, Japan, Netherlands, United Kingdom and United States) and other analysis drawn from the literature highlight certain experiences that could be of interest to other countries. These experiences include:

- China's minimum energy efficiency standards for industrial processes and energy efficiency appraisals for new large industrial projects;
- The negotiated agreements in the Netherlands and the United Kingdom, supported by a levy or tax in case of non-participation or non-compliance, energy management guidance to help achieve stated goals, and financial incentives;
- The concept of benchmarking (comparing one's business performance to that of peers) to define energy efficiency targets among companies, used in the Dutch-negotiated agreements and Phase 3 of the EU Emissions Trading System (ETS), and now being developed in India and Japan;
- A well-developed implementation toolbox, as in Japan, the United States, the United Kingdom and the Netherlands to help companies understand the challenges and opportunities available to them to manage and reduce energy use and GHG emissions; and
- India's Perform Achieve Trade scheme, an energy-savings trading (*i.e.* white certificates) scheme between energy-intensive enterprises, and the first scheme of its kind for industry.

The following ten key messages on how to design effective policies and policy packages and how to evaluate the effectiveness of existing policy packages are based on the analysis, including a literature review, provided in this paper:

**Message 1:** *As governments define their policy package to support their energy efficiency and climate mitigation goals, they need to start by defining the overall energy efficiency or emission reduction ambition levels through an effort-defining policy. As such, what matters is not the quantity of effort-defining policies but their quality and scope.*

**Message 2:** *Mandatory targets, such as cap-and-trade and white certificates schemes, negotiated agreements (when these are supported by rewards for participation or the threat of regulation), and industrial product/process standards can be viable effort-defining policies to encourage energy savings and GHG reductions.*

**Message 3:** *As effort-defining policies, targets and standards can be effective in combination with each other provided that they differ in scope (e.g. according to system boundary, participant definition, sectoral scope, primary objective etc.). In a combined application of targets and standards, minimum efficiency standards would work on the bottom-end of the market (in terms of efficiency) to establish a floor, while targets can go beyond these actions and aim for higher ambition levels.*



**Message 4:** *To define ambitious energy efficiency or GHG goals, governments, industry representatives and third-party experts should be involved in the design and negotiation process. Experience has shown that the hiring of third-party sector experts allows governments to negotiate more ambitious targets than would otherwise have been the case. A consultative process can also support more ambitious targets.*

**Message 5:** *Although the use of aggregated-level data can be challenging in setting ambitious differentiated targets, the inability to improve on this data immediately should not be a reason for delaying action. At the start of a scheme, policy makers need to ensure that the data collection requirements become more detailed through time. As governments become capable of collecting granular process-level data, targets can be fine-tuned over time to ensure ambitious efforts while maintaining the visibility of prices, policy decisions and the rules of the scheme to provide long-term certainty for investors.*

**Message 6:** *Where barriers to energy savings have been identified, supporting measures (in the form of carrots or sticks) are often needed to support effort-defining policies and encourage action. The choice and design of these supporting measures depend on the specific barriers of the country and sector, their interaction with other policies, and the political and cultural characteristics of the country in which the supporting measures are being developed.*

**Message 7:** *Energy management programmes, if cohesively linked to effort-defining policies and supported by training and incentives, can be very effective as supporting measures. Experience in European countries has shown that such programmes can usefully contribute to enhanced energy-savings performance, facilitate company achievement of effort-defining policies and ease the burden of compliance checks on the government.*

**Message 8:** *A comprehensive implementation toolbox is needed to support the implementation and achievement of effort-defining policies and supporting measures. An ideal situation is one where a country sets an effort-defining policy, and simultaneously, or quickly thereafter, develops a set of supporting measures and an implementation toolbox to facilitate the implementation of both policies and measures. In some cases, tools and guidelines can be developed first and can then form part of the implementation toolbox once policies and measures have been established.*

**Message 9:** *A transparent monitoring, reporting and verification process is needed to assess the effectiveness of the policy, allow ongoing evaluation and possible adjustment of the policy, and build trust.*

**Message 10:** *As policy makers define policies, governments need to identify, from the start, the parameters and indicators that will be monitored to allow ongoing and ex-post evaluations. Policy efficiency and free riding should be assessed, in addition to effectiveness, in ex-post policy evaluation to ensure that the policy is achieving the desired goals at lowest costs to society and the target group.*

## 1 Introduction and objectives

Energy efficiency is widely considered to be an important and often low-cost option to reduce GHG emissions. It also offers many other advantages (such as reducing energy costs and improving competitiveness, improving access to energy and security of supply, and reducing local air pollutants) and often brings a range of process improvements. These significant benefits and co-benefits make improving energy efficiency, in many cases, a no-regrets strategy, especially in developing countries, where such issues can hinder development.

Industry accounts for about a third of the world's final energy consumption. Substantial energy efficiency improvement potentials still exist within this sector, on the order of 31 EJ a year, equivalent to 26% of final industrial energy demand (IEA, 2009; UNIDO, 2010). However, various barriers to energy savings exist, preventing companies from changing their practices and making the necessary investments. Therefore, industrial energy efficiency policies have an important role to play in removing or reducing these barriers and in encouraging action.

The objectives of this paper are to:

- Describe the policy packages of individual countries using a “policy pyramid” methodology (see below);
- Explore the effectiveness of policy packages and whether individual policies are mutually reinforcing; and
- Identify and improve the sharing of best practices and key messages in the development of energy efficiency and GHG policies.

The current paper shares some of the initial key messages from analysing six countries (China, India, Japan, the Netherlands, the United Kingdom and the United States<sup>1</sup>) that could inform the design of effective policy packages and policies in other countries.

While this paper highlights the policy packages and discusses some key messages, the online policy databases (scheduled for September 2011) provide in-depth descriptions of policies and can enable further research to explore policy mixes.

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<sup>1</sup> Federal policies only.

## 2 Approach and methodology

This section describes the methodology and approach used to deliver the relevant contents to the policy database. The policy pyramid methodology, described below, aims to illustrate that a policy package approach is usually more effective in assessing policy effectiveness than assessing individual policies in isolation.

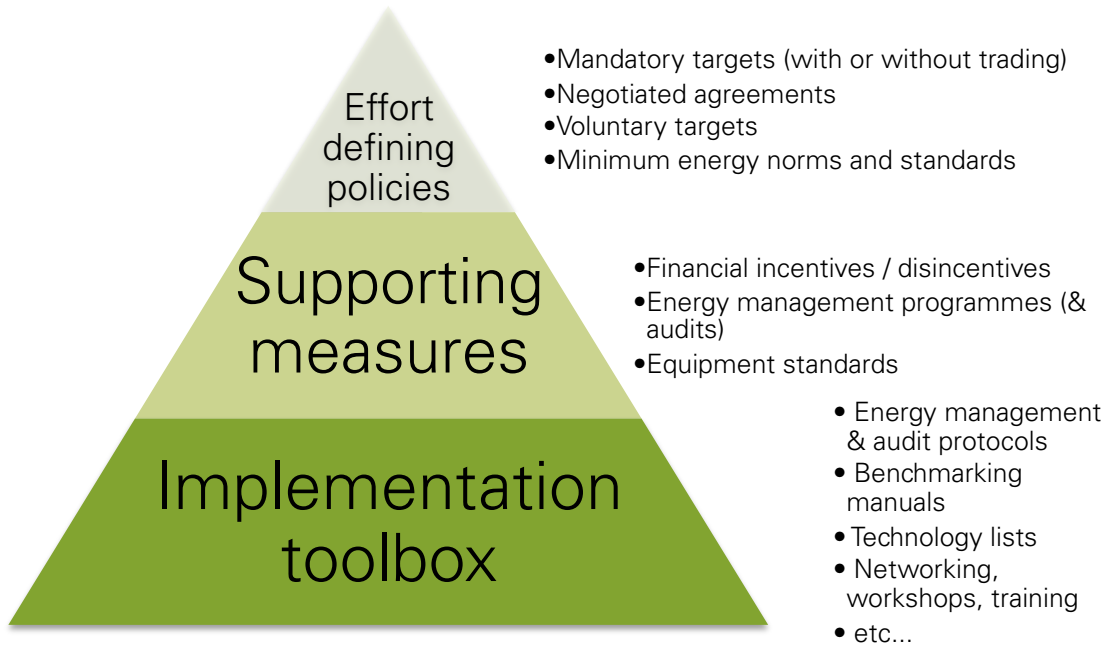
### 2.1 The policy pyramid

We propose that, in order to achieve ambitious energy savings and GHG emissions reduction goals, an effective policy approach requires multiple policies that are mutually reinforcing.

These multiple policies can be analysed through a policy framework that distinguishes among three policy levels: effort-defining policies that define the required effort, supporting measures that help deliver that effort; and tools or guidelines that define and establish a policy implementation framework and help companies implement policies in a transparent, uniform and efficient way:

- Effort-defining policies in each country are those government interventions that drive reductions in energy consumption (and/or GHG emissions) across sectors, in addition to existing market incentives.
- Supporting measures are carrot-and-stick policies that encourage action and address or alleviate certain country- or sector-specific barriers to efficiency improvements, including financial, technical, information and/or research and development barriers. They are needed to increase the effectiveness of the effort-defining policies and, as such, should be consistent with the direction of the effort-defining policies.
- Implementation toolbox (supporting mechanisms, guidelines, tools and templates) include a wide variety of often generic/cross-cutting, or smaller measures that help define and establish the implementation framework. They support one or more of the above policies.

The above framework is illustrated in a policy pyramid in Figure 1.



*Figure 1 Example of a policy pyramid*

The policy pyramid can help in analysing the policy package of a given country, especially regarding completeness (does the policy framework adequately address all relevant barriers by using the three parts of policy framework represented by the three levels?) and internal consistency (do the supporting measures comply with the overall approach of the effort-defining policies?). It also facilitates cross-country comparisons and sharing of lessons learned across countries.

## 2.2 Drivers, barriers and policy responses

The policy pyramid serves as an important method to analyse the effectiveness of a country's policy package. Policies are needed where barriers to energy savings exist. Barriers refer to all obstacles that prevent financially and technically feasible energy efficiency measures from being implemented (IPCC, 2001).

Governments can implement different types of policy instruments to reduce or remove these barriers. For governments to make the right policy decisions in this regard, they need to have good insight into:

- The type and magnitude of the barriers that exist in the various sectors;
- The drivers for actors to implement energy efficiency measures; and
- The effectiveness of various policies to overcome these barriers.

There is an extensive body of empirical evidence on the existence of barriers, providing insights into the drivers for implementing energy efficiency measures. A survey of this literature (Rohdina *et al.*, 2007; de Groot *et al.*, 2001; Masselink, 2008; de Beer *et al.*, 2000; Anderson and Newell, 2004; Harmelink *et al.*, 2010; Tanaka, unpublished 2009) reveals the following:

Important *financial barriers* include:

- Investments in energy efficiency projects do not meet financial criteria within companies;<sup>2</sup>
- Companies lack access to capital; and
- Investments impose too high a financial risk.

Important *information and institutional barriers* include:

- Companies lack knowledge of how energy is managed within their operations and of the actual costs and benefits of implementing energy options;
- Energy efficiency improvement is not a major driver for most companies; instead companies focus on their core activity such as production expansion or improvement;
- Energy efficiency is not treated as a separate investment decision.

A broader understanding of barriers can also be explained through behavioural economics and sociological perspectives. For example, “bounded rationality” posits that decision-making is limited by factors such as insufficient time, attention, resources and ability to process information. Similarly, attitudes, power relations and culture can also be reasons why economically rational decisions are not taken (Crittenden *et al.*, 2011).

On the other hand, numerous *drivers* also exist for companies to invest in energy efficiency projects. Some important drivers for companies include:

- Improving productivity, realising cost reductions;<sup>3</sup>
- International competition;
- Availability of financial support for investments in energy efficiency;
- Compliance with current policies and regulations;

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<sup>2</sup> As noted by UNIDO (2010), in some sectors, high capital cost of investment in new and efficient plants or equipment is a major limitation on the rate of energy efficiency improvement in industry. This limitation is particularly the case in countries where the economy is unstable, and where interest rates are high.

<sup>3</sup> This driver can include cost reductions due to material efficiency, labor efficiency, improved product quality, reduced waste, increases in production, decreases in product reject rates, reduced maintenance and operating costs, improved working environment, decreased liability, delaying or reducing capital expenditures (IPCC 2007 Fourth Assessment Report; industry chapter). These are often referred to as non-energy benefits (NEBs).

- Public pressure and company image;
- Pursuit of a long-term strategy towards greener image;
- Other co-benefits such as improved product quality and reduced waste products.

The above overview illustrates that the barriers and drivers are very diverse and that a sweep of policies may be needed to alleviate them (*i.e.* one policy cannot address all barriers). A separate paper prepared jointly by the Institute for Industrial Productivity and the International Energy Agency, titled *Drivers for industrial efficiency investments and interaction with policy packages*, explores these drivers and the way in which policies can influence boardroom decision-making.

The literature listed above also reveals that the relative importance of barriers differs between companies, sectors and countries. Therefore, “best practice policies” per se cannot be specifically defined. Which policy approach and policy mix works best depends on the specific barriers and drivers within a country and sector, as well as on how much effort has already been spent on energy efficiency improvements in the past.

Although “best practice policies” vary according to context and national circumstances, one can identify specific practices and processes to select the most appropriate policy instruments and to put in place the conditions for their successful implementation.

Table 1 explores in which circumstances (*i.e.* existing barriers and drivers) different policies are likely to have the greatest chance of success and the policy characteristics that can further enhance the success rate of policies.

Table 1 Typical circumstances in which to apply different types of instruments

Type of instrument	Typical circumstances in which to apply this instrument	Characteristics that typically determine the success
Energy performance standards for buildings, appliances, equipment, or production process	<ul style="list-style-type: none"> <li>When dealing with a target group that is:               <ul style="list-style-type: none"> <li>unwilling to act (e.g. voluntary agreement of producers not fulfilled)</li> <li>difficult to address (e.g. landlord-tenant problem)</li> </ul> </li> <li>When aiming at removing the most energy-consuming products, services, or production facilities from the market</li> </ul>	<ul style="list-style-type: none"> <li>Is the standard well justified? (e.g. through life-cycle cost studies)</li> <li>Is the target group well prepared for the standard? (e.g. through information campaigns, demonstration projects, feasibility studies, training programmes etc.)</li> <li>Is the target group sufficiently skilled to apply the standard?</li> <li>Is the target group resistant to the standard's application?</li> <li>Are sufficient resources (knowledge, capacity, time, budget, priority) in place to enforce the legislation?</li> <li>Are penalties in place for non-compliance?</li> <li>Are penalties at sufficiently high level to stimulate meeting standards?</li> <li>Is the standard timely adjusted to technology progress?</li> </ul>
Mandatory targets, tradable certificates for energy savings or GHG emissions	<ul style="list-style-type: none"> <li>When aiming at energy savings in a broad range of sectors</li> <li>When knowledge, financial and institutional barriers play a role.</li> <li>When governments want certainty on the outcome of their energy efficiency or emissions goals</li> <li>When trying to regulate a diverse (and heterogeneous) number of emitters</li> </ul>	<ul style="list-style-type: none"> <li>Is the target clearly set beyond business-as-usual?</li> <li>Are measurement and verification of savings possible at low cost, e.g. by standardization of energy-saving measures?</li> <li>Is the cost-recovery mechanism (energy companies' costs passed to end-users) clear and transparent?</li> <li>Are there penalties in case of non-compliance (or are other incentives in place to prevent non-compliance)?</li> <li>Are penalties set at such a level that target achievement is stimulated?</li> <li>Are financial incentives needed to stimulate companies to implement energy efficiency measures</li> <li>Is the market for tradable certificates transparent, reliable and liquid?</li> <li>Is there undesired overlap with other instruments?</li> </ul>



<p>Voluntary or negotiated agreements</p>	<ul style="list-style-type: none"> <li>• Early in the country and target group's experience in the policy issue</li> <li>• Political challenge to impose mandatory targets</li> </ul>	<ul style="list-style-type: none"> <li>• Can the goals of the agreement be negotiated between equally footed partners?</li> <li>• Does the target group have enough information on what technologies and practices it can employ?</li> <li>• Are goals clearly set beyond business as usual?</li> <li>• Are third-party experts involved in the negotiation of targets?</li> <li>• Are financial incentives needed to stimulate companies to implement energy efficiency measures?</li> <li>• Are companies encouraged to participate because of contingent regulation in case of non-participation?</li> </ul>
<p>Labelling of appliances, products etc.</p>	<ul style="list-style-type: none"> <li>• When a knowledge / information barrier exists</li> <li>• When dealing with large groups in consumer or service sector</li> <li>• When dealing with rather uniform technologies</li> <li>• When large differences in performance exist between similar units</li> </ul>	<ul style="list-style-type: none"> <li>• Is it planned to adjust the label to technology progress and market transformation?</li> <li>• Is the label well-justified by respective life-cycle cost studies?</li> <li>• Is the target group timely and sufficiently informed, e.g. through information campaigns?</li> <li>• Is the label clear and transparent?</li> <li>• Are there supporting incentives (eco-tax, subsidy, tax exemptions) for stimulating action?</li> </ul>
<p>Financial or fiscal instruments, e.g. soft loans, subsidies, investment deduction schemes, or rebates</p>	<ul style="list-style-type: none"> <li>• When a financial barrier is in place</li> <li>• When an informative instrument (e.g. energy audit) needs financial incentives to attract the target group</li> </ul>	<ul style="list-style-type: none"> <li>• Is the target group aware of the existence of the instrument?</li> <li>• Is the financial support sufficient to attract new investments or to carry out energy audits?</li> <li>• Is the annual budget for the instrument linked to the target?</li> <li>• Is the procedure for getting financial support sufficiently known by the target group and simple enough?</li> <li>• Is it clear to the target group which technologies are eligible for financial support?</li> <li>• Is the list of technologies regularly updated to limit free riders?</li> <li>• Is the instrument implemented for a long time period to ensure security for investors?</li> </ul>
<p>Energy tax or energy tax exemption</p>	<ul style="list-style-type: none"> <li>• When dealing with large target groups</li> <li>• When aiming to internalize external costs</li> </ul>	<ul style="list-style-type: none"> <li>• Is the target group well-informed on existence and planned future development of the energy tax?</li> <li>• Is use of tax income properly justified and marketed to market actors?</li> <li>• To what extent does the energy tax take account of global or European-wide competition aspects (e.g. by tax exemptions for large industries)?</li> <li>• To what extent are energy tax exemptions used as an incentive for implementing energy efficiency measures (e.g. in a voluntary agreement scheme)?</li> </ul>



Information, knowledge transfer, education, training	<ul style="list-style-type: none"><li>• When a knowledge barrier exists</li><li>• When dealing with large target groups</li></ul>	<ul style="list-style-type: none"><li>• Is the information well-linked to the customer type within the target group?</li><li>• Is the information clearly linked to other instruments (regulation, financial/fiscal, voluntary agreement, etc.)?</li></ul>
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*Source: Adapted from Harmelink et al., 2008.*

Within the context of the proposed policy pyramid, the first three categories of instruments shown in Table 1 are effort-defining policies, and the remainder are supporting measures, although information measures may also be part of the implementation toolbox. For example, as a supporting measure, subsidies to companies for installation of energy efficient equipment can reduce their cost of achieving GHG emission targets, an effort-defining policy. The implementation toolbox can play an important role in establishing the success factors mentioned in the third column. In this same example, the development of energy efficient technology lists and links to equipment suppliers (as tools in the implementation toolbox) may accelerate applications for the subsidy.

### 3 Country analyses

The country analyses in this section summarise the policy packages of China, India, Japan, the Netherlands, the United Kingdom and the United States, using the policy pyramid framework available in IIP's database. Each country analysis also includes a timeline, showing when policies were introduced or terminated in that country and the different phases of policies. In the pyramids, effort-defining policies and supporting measures are numbered. The numbered tools or guidance materials in the implementation toolbox correspond to the specific effort-defining policy or supporting measure that they underpin.

For each country, the online policy database provides:

- GDP, energy consumption and GHG emissions data for the industry sector
- Overall policy package and timeline
- Individual factsheets on each policy, containing information such as:
  - general description of the policy;
  - objective and targets of the policy;
  - monitoring, reporting, verification and enforcement regimes;
  - costs to the target group and the government;
  - ease of implementation;
  - other policy requirements; and
  - estimated impacts and major conclusions.

### 3.1 China

Economy-wide targets under the Central Government's Five-Year Plans (FYPs) are a key driving force in all industry-related policies and measures. The target in the 11<sup>th</sup> FYP was to reduce energy use per unit of GDP by 20% between 2006 and 2010. According to the 12<sup>th</sup> FYP goals, China will also have mandatory targets to:

- cut energy consumption per unit of GDP by 16% from 2010 levels by 2015, and by 3.5% by the end of 2011
- cap energy use at 4 billion tonnes of coal equivalent (tce) by 2015
- reduce emissions from energy use per unit of GDP by 17% from 2010 levels by 2015.

To meet FYP targets, a wide array of policies has been implemented: elimination of backward technology, mandatory energy-saving targets and efficiency standards, financial support and rebates, as well as electricity pricing mechanisms (Figure 2). The 12<sup>th</sup> FYP contains additional preferential measures for developing energy-efficient technology. Implementation of these measures is still being defined and designed at the provincial level.

Mandatory requirements in China are quite common, and can be defined in relatively prescriptive terms, which are less common in Western industrialised economies. These requirements include elimination of backward technology and mandatory energy-efficiency standards for industry by production process, and product standards for appliances. The level of enforcement of the mandatory requirements, however, is not always clear.

The Top-1 000 Program, the key policy for the largest energy-intensive industries, has been successful in achieving, and even surpassing, the programme goal of achieving energy savings of 100 million tonnes of coal equivalent (Mtce) over the 11<sup>th</sup> FYP period. The programme is now being expanded into a Top-10 000 Program (Price *et al.*, 2011).

To underpin the Top-1 000 and Top-10 000 Programs (and provincial policies that target "key enterprises"),<sup>4</sup> a number of key supporting measures have been promulgated, including requirements for (i) assignment of energy managers, (ii) energy consumption data reporting, (iii) most key enterprises to have completed energy audits, and (iv) subsidies for energy-saving retrofits.

In addition, a new measure introduced late in 2010, requires energy efficiency appraisals for new large industrial projects (fixed asset investments) to be completed. All new investments must undergo independent assessments and government reviews on whether they are

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<sup>4</sup> China's energy conservation law and many subsequent regulations employ the term "key enterprises," which includes all industrial enterprises with annual energy consumption of over 10 000 tonnes of coal equivalent (tce), and, if also so designated by provincial/local governments, enterprises with annual energy consumption of over 5 000 tce. All Top-1 000 enterprises and all Top 10 000 enterprises are key enterprises.

energy-saving before being approved by regulators. Projects that pass will be subject to government supervision, and managers are required to submit energy reports (Xinhua, 2010).

The use of differentiated electricity pricing, in which electricity prices are higher for companies with higher electricity intensity, differs from common practice in other countries.

Market-based mechanisms are being increasingly developed. For example, an energy service company (ESCO)-based programme, in development, targets projects with energy savings between 100 and 10 000 tce overall, and between 500 and 10 000 tce in industry. Incentives are directed to ESCOs, who must advance more than 70% of the capital in projects, and agree to share the energy savings with the clients. The programme will support boiler/furnace retrofitting, waste heat and waste pressure utilization, motor system energy conservation, energy system optimization, green lighting and energy conservation in buildings (MOF, 2010; NDRC, 2010).

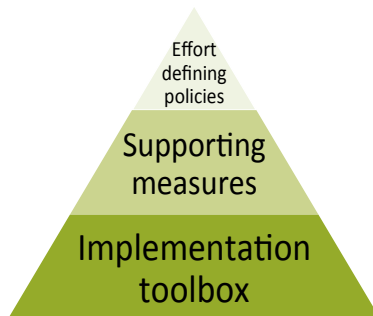
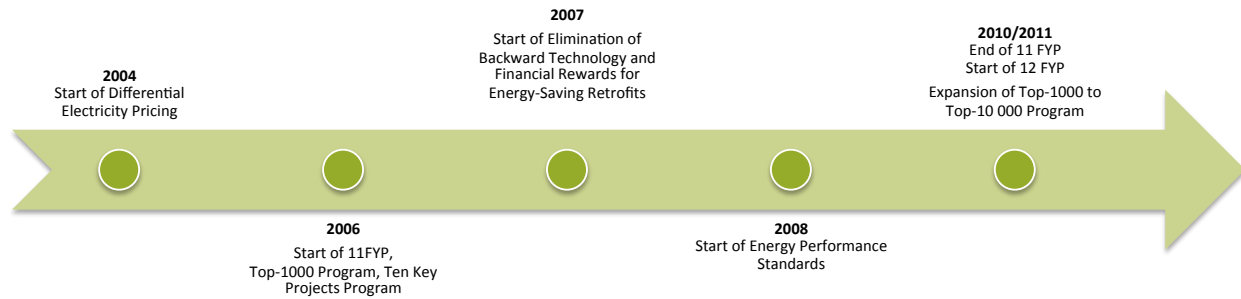
In support of China's effort-defining policies and supporting measures, the implementation toolbox in China contains, among others:

- elaborate training programmes and standards for energy management and audits (under the Top-1 000 Program);
- lists with closure thresholds and efficiency standards for different types of industries (elimination of backward technology and the industrial performance standards) and guidelines for validation;
- lists of qualified ESCOs;
- an energy performance contracting standard (for the financial rewards programme).

Note that this is not an exhaustive list, and numerous additional tools are present other than those listed in the above and in the policy pyramid.

Energy auditing in China is currently more focused on accounting (how much energy is used where), and less on identifying energy-saving potentials. In terms of monitoring and reporting, many requirements exist in China. However, transparency and public availability of the reported data are limited, and it is often unclear whether the data are actually used for policy evaluation and revision purposes.

Of the reported impacts of different policies, it is often not easy to assess the extent to which the results are actually attributed to that individual policy, to other policies or to other trends that influence energy efficiency and energy use (e.g. changes in economic structure or product mix). Even so, China has initiated a remarkable number of energy-saving policies and programmes in the last five years, many of which seem to have reached their own stated goals in support of the overall national goal to reduce economic energy intensity by 20% (Levine *et al.*, 2010).



Effort-defining policies:

- Targets under the 11th and 12th Five-Year Plans
- CN-1: Top-1 000 Energy-Consuming Enterprise Program
- CN-3: Industrial energy performance standards

Supporting measures:

- CN-1: Mandatory assignment of energy managers
- CN-1: Mandatory energy consumption data reporting
- CN-1: Mandatory energy audits
- CN-2: Elimination of backward technology
- CN-4: Ten Key Projects
- CN-5: Financial Rewards for Energy-Saving Technical Retrofits
- CN-6: Differential Electricity Pricing for Industry
- CN-7: Energy efficiency appraisals for new large industrial projects

Implementation toolbox:

- CN-1: Information systems, trainings, standard for energy management and auditing, training
- CN-5: Guidelines for validation, list of qualified ESCOs, energy performance contracting standard
- etc.

Figure 2 China's policy package (main initiatives, not all are included)

## 3.2 India

India has made reasonable progress in terms of improving its energy efficiency in recent years. However, a major part of this improvement is attributed to the structural change that occurred in the Indian economy (economic structure shifting to less energy-intensive activities and products) (Balachandra *et al.*, 2010). Despite this factor, the energy intensity of industry is, on average, still relatively high compared to other regions in the world. In addition, energy performance varies widely among installations within industrial subsectors due to a wide range of vintages, production capacity, the quality of raw materials and product mixes. In the cement and fertiliser sectors, for example, India has some of the best-performing plants in the world. This wide variation poses a challenge to policy makers in designing effective and targeted policies. India's policy package is illustrated in Figure 3.

The Energy Conservation Act (ECA) of 2001 provided for the establishment of the Bureau of Energy Efficiency (BEE), the development of energy efficiency standards by industrial product/process, and the requirement to have energy audits carried out by an accredited energy auditor and assign a certified energy manager in energy-intensive and other larger energy consumers (known as "designated consumers").

In practice, industrial energy efficiency policy was, until recently, limited to the mandatory energy management component of the ECA. The impact of the mandatory energy management policy is difficult to assess because of the lack of policy evaluation studies (Bhattacharya and Cropper, 2010). However, according to local experts,<sup>5</sup> the capacity of the instruments within the policies to drive energy efficiency is limited. The characteristics of the instruments themselves would support this view: there is no obligation to implement identified savings measures from the audits.

The development of energy consumption standards by production process began in 2001, but was slow to be implemented for all sectors because of difficulties encountered within the diversity of India's industries. Standards were developed for the cement and pulp and paper sectors, but they were not widely implemented. These standards now appear to feed into the specific energy consumption (SEC) targets established under a new white certificate scheme (trading of energy savings) currently under development. This so-called Perform Achieve and Trade (PAT) scheme is a comprehensive policy scheduled for introduction in 2011, following the 2010 amendment to the ECA. The PAT could constitute an effective mix of regulation by setting mandatory energy-intensity targets for energy savings, combined with a flexible market mechanism, the trading of energy saving certificates ("white certificates") to secure overall cost-effectiveness.

The overall objective of the PAT scheme is to save 10 million metric tonnes of oil equivalent (mMtoe) in the first PAT cycle until 2014 (within the 23 mMtoe target of the overarching

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<sup>5</sup> Anonymous representative from academic, non-governmental organization (NGO) and former Indian government background.

*National Mission On Enhanced Energy Efficiency*) (Dhingra, 2011). The company targets currently under development are based on the mandatory energy efficiency standards initiated previously by the Bureau of Energy Efficiency.<sup>6</sup> However, its design is challenging under Indian conditions because of the lack of good quality energy consumption data and the limited time available for preparation (less than two years), as well as the large differences in energy efficiency and plant characteristics within one sector (Thapliyal, 2011). In addition, solid monitoring, reporting and verification (MRV) and enforcement systems will be needed to make the scheme a success.

In 2011, India also introduced a range of financing mechanisms administered by the India Renewable Energy Development Agency (IREDA) and preferential loans, venture capital funds and guarantees administered by the Energy Efficiency Services Limited (EESL) under the Framework for Energy Efficiency Economic Development (FEEED). It is too early to assess the impact of these new mechanisms.

The implementation toolbox is strongly focused on energy management and auditing, with certification and training of auditors, an energy audit and management support programme from the Bureau of Energy Efficiency, and energy management and auditing protocols.

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<sup>6</sup> Pers. comm. Shakti Foundation representative.

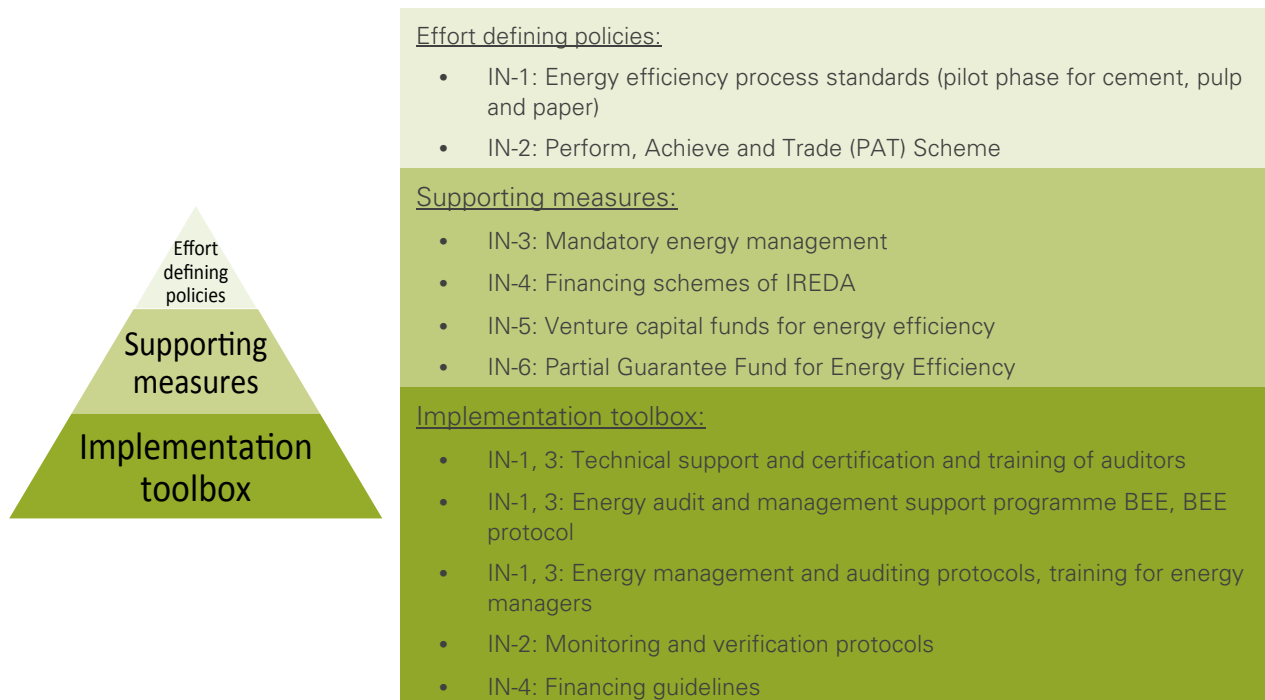
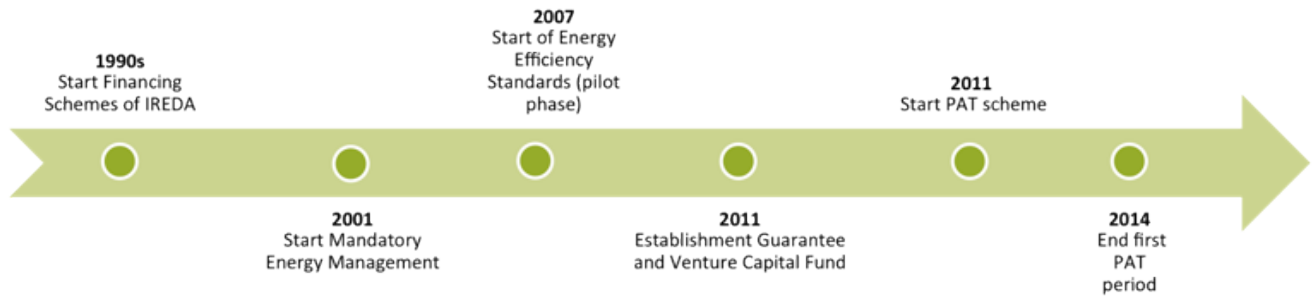


Figure 3 India's policy package

### 3.3 Japan

Over the past 40 years, since the oil crisis of 1973, industrial energy efficiency in Japan has improved significantly (IEA, 2008). Key drivers have been the lack of domestic energy resources, rapid economic development and high energy prices. In energy efficiency policy over the past decades, the government has strongly relied on voluntary approaches, particularly within industry. This choice is partly based on the concern that the competitive position of Japanese industry could be at risk under a heavy regulatory regime.

Japan's policy package is illustrated in Figure 4. The Keidanren Voluntary Action Plan (VAP) in industry is considered a key pillar in Japan's industrial energy and emissions policy by the government, although its targets are set unilaterally by industry, and oversight is also mainly carried out by industry. In itself, the VAP is comprehensive in coverage (40% of Japan's total emissions and 80% of industrial emissions) and successful in terms of reaching the targets that it has set for itself. It has, however, met criticism by academics and NGOs,<sup>7</sup> particularly on whether those targets were defined with sufficient ambition, the low level of assurance that the targets will be met, and the lack of transparency and independent oversight in monitoring and compliance. As a result, not enough verifiable insight is available regarding the remaining potentials for efficiency improvement in industry.

In addition, the current emissions trading system in Japan addresses companies not covered by the VAP and currently has 80 target participants from various industry and non-industry sectors. It is also voluntary in terms of participation and uses targets unilaterally set by industry. For several years, the Ministry of Environment has been pushing for a mandatory cap-and-trade system, but this system is strongly opposed by industry as well as by the Ministry of Economy, Trade and Industry. In December 2010, the government officially postponed plans for a national (mandatory) emissions trading scheme.<sup>8</sup>

The above suggests there is clear room to strengthen and complement the existing voluntary measures with mandatory effort-defining policies.<sup>9</sup> In recent years, different types of policy instruments have been under development, including an energy efficiency obligation, defined in benchmarking terms (top-of-the-world efficiency level, similar to the Dutch Benchmarking agreement) and piloted by a limited number of industry sectors. At this stage, it is too early to evaluate the impacts of this policy, because many provisions are still unclear. In principle, however, the obligation has the potential to establish a stronger role for the government in defining ambition levels and enforcing compliance, without losing sight of the competitive position of Japanese industry.

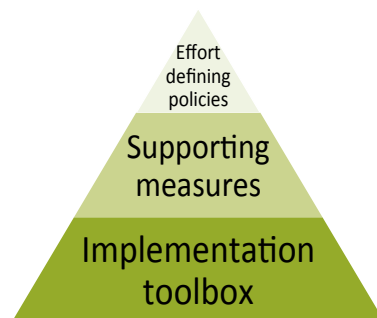
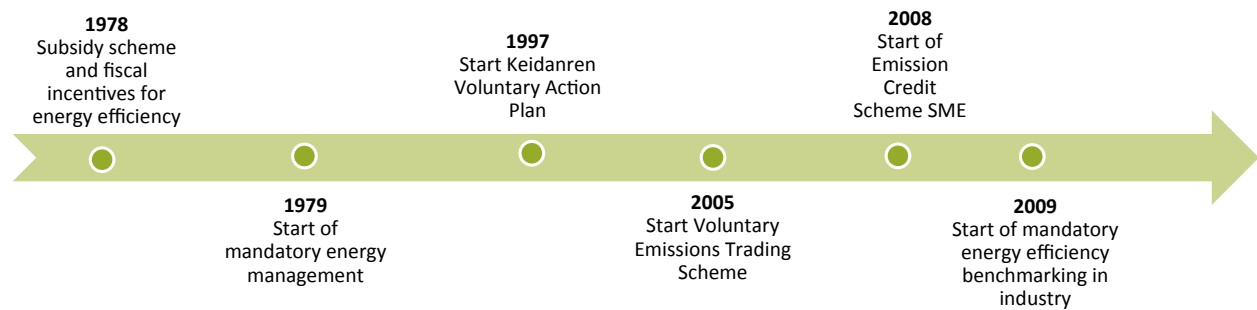
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<sup>7</sup> CAN Japan, Kiko Forum, Chiba University of Commerce.

<sup>8</sup> Statement of Japan's National Strategy Minister, Koichiro Gemba. December 28, 2010. Available at: [www.reuters.com/article/2010/12/28/us-climate-japan-idUSTRE6BR06120101228](http://www.reuters.com/article/2010/12/28/us-climate-japan-idUSTRE6BR06120101228).

<sup>9</sup> This is also supported by the OECD's *Energy Policies of IEA Countries. 2008 Japan Review*. Retrieved from: [www.iea.org/w/bookshop/add.aspx?id=342](http://www.iea.org/w/bookshop/add.aspx?id=342).

The implementation toolbox has a relatively strong focus on energy management and auditing, with guidelines, training and an energy audit support programme. In addition, guidelines are available for the allocation of permits in JVETS, guidelines for benchmarking in the new efficiency standards, and use is made of the tools made available by the United Nations Framework Convention on Climate Change in the Emission Credit Scheme for SMEs.



Effort defining policies:

- JP-1: Keidanren Voluntary Action Plan (VAP)
- JP-2: Japanese Voluntary Emissions Trading Scheme (JVETS)
- JP-3: Mandatory energy efficiency benchmarking in industry

Supporting measures:

- JP-4: Mandatory energy management
- JP-5: Fiscal incentives for energy efficiency
- JP-6: Subsidy scheme for energy efficiency
- JP-7: Emission Credit Scheme for Small and Medium-Sized Companies

Implementation toolbox:

- JP-1: Guidelines and protocols for energy management and energy audits
- JP-1: Energy audit support programme
- JP-2: Allocation, benchmarking and MRV methodologies, IT system, transaction contract forms
- JP-3: Guidelines benchmarking methodologies
- JP-4: Guidelines for factories to rationalize energy use
- JP-4, 5: Guidelines and training of energy managers
- JP-7: UNFCCC Clean Development Mechanism (CDM) rules and procedures (transposed)

Figure 4 Japan's policy package

### 3.4 Netherlands

Dutch industry's energy-intensive economic structure (in combination with a very open export-oriented economy) has led to long-standing and ongoing attention to industrial energy efficiency. The Netherlands' policy package (**Erreur ! Source du renvoi introuvable.**) has had a strong emphasis on negotiated agreements,<sup>10</sup> with, in recent years, a significant role for the mandatory EU emissions trading system (EU ETS).

In the agreements, targets have been negotiated between industry and government, with third-party experts involved to review the accuracy of the stringency of the targets. For heavy industry, the definition of targets shifted from a rate of change (%/year) to a performance level to be reached (*i.e.* a benchmark expressed relative to that of competitors). A wide range of supporting measures is required, such as the obligation to carry out an Energy Efficiency Plan and make investments deemed "profitable" according to government-defined guidelines. The scope of the agreements has grown over time, in terms of sector coverage as well as the eligibility of measures to meet the targets, having been extended from on-site energy efficiency only to off-site (or chain) efficiency.

Under Phases 1 and 2 (to 2013) of the EU ETS, which also covers Dutch heavy industry, allocation methods were devolved to each EU member state for determination. For Dutch industry, allocations in the EU ETS have so far largely mirrored the targets in their negotiated agreements. However, from 2013, benchmarking will be used at the EU scale to define allocation levels for companies, which is expected to be the principal driver of efficiency improvements, superseding the incentive to act under the negotiated agreements.

A range of other policy instruments, including various subsidies and fiscal incentives, exemption from energy and carbon taxes, and technical support, supports the negotiated agreements.

Disincentives are used to a relatively limited extent in the Dutch policy mix. If companies do not meet the targets set out in their agreements, and their requirement to implement measures with a payback of five years or less, they are required to comply with energy efficiency improvements in their environmental permit under the Environmental Management Act and are subject to an energy/carbon tax. This sanction is not often used, because companies usually achieve with their targets. In cases where companies do not meet their targets, or do not participate in a negotiated agreement, a recent evaluation showed that

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<sup>10</sup> Negotiated agreements are policies in which the targets and main requirements of the policy are negotiated between the industry sector (companies themselves or industry associations) and governments. Third parties may also be involved. They differ from voluntary policies, which are recognized and often supported by the government but in which the targets and goals are unilaterally defined by the industry sector.

requirements laid down in the permit are often not ambitious, and enforcement is weak (CE/Vrom Inspectie, 2010).<sup>11</sup>

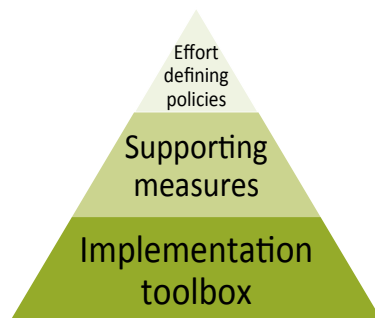
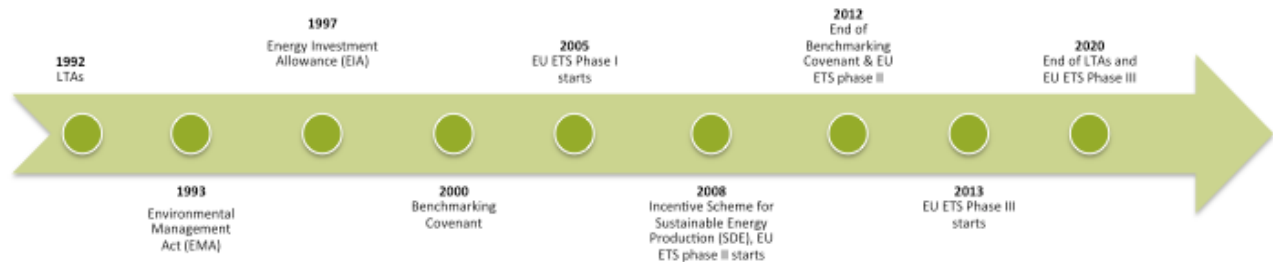
In the first ten years, the negotiated agreements were quite successful in driving efficiency improvements; however, recently the rate of improvement has slowed. No significant charges, levies or energy/carbon taxes are used as part of the Dutch policy package for industry. This absence may be one of the reasons why the impact of the policy package is diminishing over time. This diminished impact is, in part, a sign that improvement potentials are becoming smaller (the “low-hanging fruit” has been picked), but it also suggests that stronger measures may be needed to drive continuing efficiency improvements.

The implementation toolbox in the Netherlands is well equipped, with a broad array of support tools, including:

- Technical support from the energy agency, including training and workshops;
- Checklists for implementing energy management under the negotiated agreements;
- Methodologies and manuals for benchmarking;
- Guidelines, templates and examples for Energy Efficiency Plans;
- Lists of profitable measures;
- Technology eligibility lists for subsidies; and
- Monitoring and reporting protocols (including a system of Guarantees of Origin for combined heat and power [CHP]).

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<sup>11</sup> Exclusion does not automatically lead to energy or CO<sub>2</sub>/taxes, as is the case in the United Kingdom. There would need to be a specific policy decision made to do this, which is not very likely to happen.



Effort-defining policies:

- NL-1: Benchmarking Agreement
- NL-2: Long-Term Agreements (LTAs)
- NL-5: EU Emissions Trading Scheme (EU ETS)

Supporting measures:

- NL-1 & NL-2: requirement to carry out an Energy Efficiency Plan (EEP), an Energy Management System (for LTAs), implement profitable measures, and report data
- NL-3: Energy Investment Deduction Scheme (EIA)
- NL-4: Environmental Management Act
- NL-5: Annual monitoring and reporting requirements
- NL-6: Incentive Scheme for Sustainable Energy Production (SDE)
- Energy tax exemption for participants Negotiated Agreements and EU ETS
- Subsidies for energy audits, feasibility studies

Implementation toolbox:

- NL-1, 2, 5: Monitoring protocols, EEP templates
- NL-1: Benchmarking manuals
- NL-2: Checklist for requirements of energy management, lists of profitable measures
- NL-3, 6: Technology eligibility list
- NL-6: Guarantees of origin for monitoring
- Support from experts from Energy Agency: technical advice, workshops, and training.

Figure 5 The Netherlands' policy package

### 3.5 United Kingdom

Compared to other industrialised countries (including the Netherlands), the UK industry accounts for a relatively smaller proportion of national energy consumption. Industrial energy consumption constitutes about 22% of total final energy consumption, and about 55% of this energy use is by energy-intensive sectors, mainly iron and steel, chemical, paper and pulp, non-metallic minerals, food production and non-ferrous metals. This proportion might explain why the UK government, from the start of its energy efficiency policies, has focused on heavy industry as part of a broader perspective that considers all sectors (Figure 6).

Central in the UK industrial energy efficiency policy mix are the Climate Change Agreements (CCAs), negotiated between the government and industry associations, with third-party experts, which help the government assess the ambition of industry's suggested targets (AEA Technology, 2004).<sup>12</sup> An important incentive for companies to enter into the CCAs with the government is the exemption from the paying for the full value of the climate change levy (CCL).<sup>13</sup> Prior to 2011, when companies complied with their targets, they received an 80% discount. From 2011 onward, the discount is reduced to 65%.

To date, the targets set under the CCAs have been significantly exceeded. This large over-achievement casts some doubts about the ambition level of the CCAs. After the introduction of the EU ETS, ETS participants preferred to continue to take part in the Climate Change Agreements as well, because the discount on the Climate Change Levy was financially significant, and especially so for energy-intensive industries. Thus far, the EU ETS has had few impacts in the UK industry sector beyond those already produced by the CCAs. Note that this result is not unique to the United Kingdom; most countries show a limited tendency to go beyond existing policy efforts for industry in Phase I-II of the EU ETS (Phylipsen *et al.*, 2005; 2007).

The CCAs are supported by advice on energy saving, carbon management and financial support from the Carbon Trust, guidance on monitoring, and a fiscal stimulus by means of the enhanced capital allowance scheme. These factors provide an comprehensive package that addresses most of the barriers and drivers faced by the industry.

The Pollution Prevention and Control (PPC) Act also mandates the use of Best Available Technology. However, because companies that enter into a CCA with the government are

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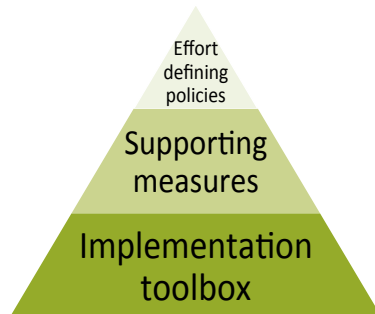
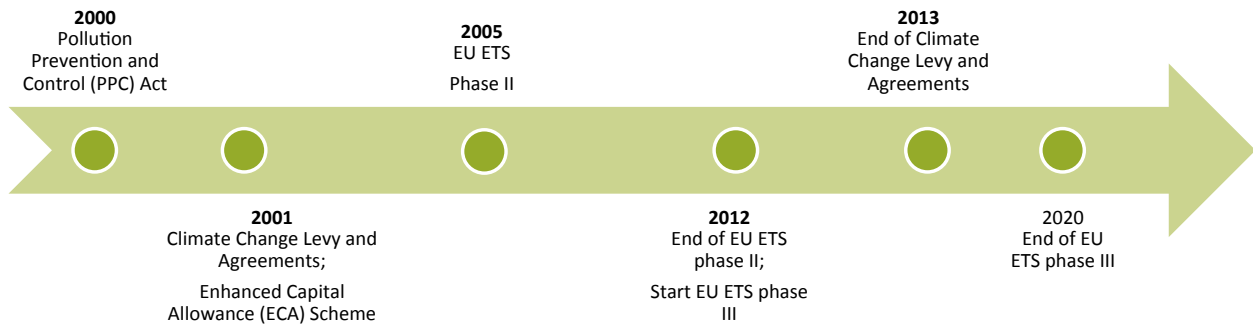
<sup>12</sup> The UK Government's Department for Environment, Food & Rural Affairs (Defra) was the principal negotiator in the Climate Change Agreements process. It contracted Future Energy Solutions (FES, formerly known as ETSU) to provide independent technical advice and policy support for the development and operation of the agreements. FES has assessed all milestone data provided by the sectors and made recommendations on the results to Defra. The Department of Energy and Climate Change (DECC) now administers the UK's Climate Change Programme including the CCAs.

<sup>13</sup> The Climate Change Levy (CCL) is a tax on the use of energy in industry, commerce and the public sector. By introducing this levy, the cost of energy consumption increases, which in theory should lead to more investments in energy efficiency measures because they become economically more attractive. Up until 2011, CCA participants got a 80% discount on the levy, conditional on meeting the targets set. Now the discount on the levy is 65%.

exempt from PPC requirements, the Act's contribution to UK industrial energy efficiency policy is, at best, the added incentive that it provides for companies to enter into CCAs.

In the United Kingdom, the implementation toolbox is well equipped with a broad range of tools, including:

- guidance on how to determine targets;
- guidance on setting up monitoring plans;
- reporting annual achieved savings guidelines;
- Best Available Technologies (BATs);
- technology and product eligibility lists for financial support;
- guidance on monitoring and reporting of annual GHG emissions;
- base-year data validation;
- permitting for the EU ETS; and
- energy saving and carbon management advice and financial support from the Carbon Trust.



Effort-defining policies:

- UK-1a: Climate change agreements (CCAs)
- UK-4: EU Emissions Trading Scheme

Supporting measures:

- UK-1a and UK-4: Data-reporting requirements with independent crosschecks
- UK-1b: Climate Change Levy
- UK-2: Pollution Prevention and Control (PPC) Act
- UK-3: Enhanced Capital Allowance (ECA) Scheme

Implementation toolbox:

- UK-1b: Levy Exemption Certificate
- UK-1a: Guidance papers on how to determine targets, set up monitoring plans, and report on annual achieved savings
- UK-2: Guidance on Best Available Technologies (BAT)
- UK-3: Energy Technology Criteria List, Energy Technology Product List
- UK-1a and 4: Guidance on monitoring and reporting of annual GHG emissions, base year data validation, how to apply for allocation of permits (and changes in allocation).
- Energy saving, carbon management advice, and financial support from the Carbon Trust

Figure 6 The United Kingdom's policy package

### 3.6 United States (Federal)

Energy production and transport represent a large share of total GHG emissions in the United States, and overall energy efficiency is low in comparison to other OECD countries. Nevertheless, in recent years, the energy intensity of heavy industry has improved more than other sectors of the US economy. The US policy package is illustrated in Figure 7.

State legislation makes up for the majority of US energy efficiency policy. Only a small number of federal policies are in place that directly target energy efficiency and/or emission reductions. Federal policies and programmes consist principally of the Clean Air Act (CAA), the US Department of Energy's (DOE's) Industrial Technologies Program, and the US Environment Protection Agency's (EPA's) Climate Leaders<sup>14</sup> and ENERGY STAR Programs for Industry.

Except for the Clear Air Act, all policies have a purely voluntary character, with industries committing to a level of effort. Significant government resources support companies' efforts to fulfil their commitments. Calculation tools and monitoring formats are provided, and companies receive free technical support to establish and implement energy management schemes. In addition, various financial incentives are available to support companies in the uptake of energy efficiency improvements. These incentives include a tax credit scheme, an accelerated depreciation scheme, and a loan guarantee programme.

The voluntary character of the programmes, in combination with extensive free government support to address financial and technical barriers, has resulted in a high acceptance level within industry. The programmes result in actual emission reductions, but how much the programmes cause the level of emissions reduction compared to what would have happened anyway (i.e. the additionality) is unclear. Because the actions are all voluntary, it is likely that companies mainly participate when the expected reduction measures meet their internal payback requirements. Moreover, the cost-benefit ratio of the measures is unbalanced, because the government covers the majority of costs (for identification of reductions, setting up energy management systems, and target setting), and the participating companies enjoy all of the benefits.

The schemes have very limited outside involvement in terms of evaluating the identified potentials and targets. Very limited monitoring of progress toward achievement of the voluntary targets (such as the Industrial Technologies Program, the Climate Leaders or the ENERGY STAR Program for Industry) takes place, and no penalty exists for non-compliance.

In addition, the cost-effectiveness of policies is not assessed in a structured way. As a result, information is lacking to support potential improvements to individual policies or to identify better-performing or better-suited policies.

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<sup>14</sup> In September 2010, EPA announced that the Climate Leaders programme will phase down its services. No budget has been reserved for it in the new budget period. EPA will encourage and assist the transition of partners in the Climate Leaders programme into non-federal programmes (i.e. programmes at the state level or local level).

The CAA is the only federal policy with a mandatory element. From 2011, it requires selected (existing and new) installations to obtain a permit for polluting emissions to air and to install the Best Available Control Technology (BACT) to control GHG emissions. In addition, it sets various emissions standards, among which are the emission standards for boilers, process heaters, and certain solid waste incinerators, the so-called Boiler Maximum Achievable Control Technology (Boiler MACT) rule.<sup>15</sup>

Because the permitting procedures for GHG emissions have yet to start and the specification of BACTs is not yet completed, no information is available on how energy efficiency improvements and corresponding emission reductions will be dealt with. Recent developments suggest MACT implementation will be slow for two reasons. First, the EPA has extended the reporting deadline for GHG emissions from large emitters and fuel suppliers, originally set for March 31 to sometime midyear 2011.<sup>16</sup> Second, a package of spending cuts passed by the House of Representatives would see reductions in billions of dollars from the EPA's budget, and includes an amendment to deny 2011 funds for EPA's GHG regulations.<sup>17</sup>

As with all permitting policies, the effectiveness and efficiency of the CAA provisions for GHG emissions will strongly depend on the stringency of the actual provisions that would drive energy efficiency improvements or GHG emission reductions. Because these provisions have not yet been specified, the effectiveness of the permitting requirements under the CAA to drive energy efficiency is still unclear.

A new certification programme, the Superior Energy Performance Program (SEP), is an American National Standards Institute (ANSI)-accredited initiative currently in development and scheduled for introduction in October 2011, following a number of demonstration projects in 2008-2010. It will provide companies with a framework for implementing the international standard for energy management systems (the ISO 50001 standard). The certification system also provides a method for recognising energy performance achievement after validation, and establishes a silver, gold and platinum badge system.

The US federal government will leverage the SEP to deploy federal energy programmes such as the Save Energy Now LEADER program (participating LEADER companies are given priority access to energy assessments and other resources).

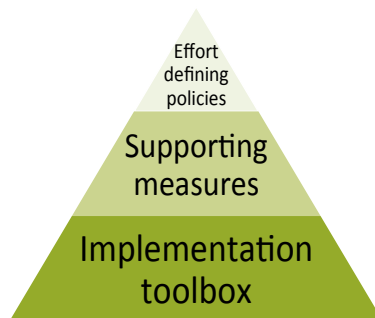
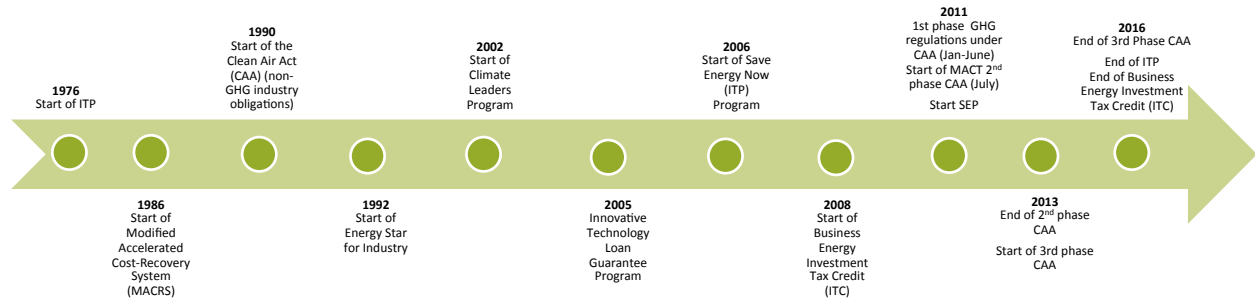
Most US policies are supported by an extensive implementation toolbox, comprising various technical support tools, including tools and guidance for GHG inventories, technical assistance to develop and/or implement energy/GHG management plans, and technical assistance such as best practice guidebooks, training and webinars

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<sup>15</sup> Under the CAA, various standards have been set for various types of emissions and activities. (e.g. the Reasonably Available Control Technology (RACT) requirements for Marine Vessel and Barge Loading). However, MACT covers the largest set of activities.

<sup>16</sup> See <http://www.environmentalleader.com/2011/03/02/epa-delays-deadline-for-ghg-reporting/>.

<sup>17</sup> See <http://www.environmentalleader.com/2011/02/22/house-approved-budget-blocks-epa-rules/>.



Effort-defining policies:

- US-1: Clean Air Act
- US-2: Industrial Technologies Programs (ITP) and Save Energy Now
- US-7: Climate Leaders
- US-8: Climate Vision

Supporting measures:

- US-2 requirements: Voluntary pledge, baseline, energy management plan, energy manager, report data to Department of Energy (DOE)
- US-3: ENERGY STAR Program for Industry including requirement to follow energy management guidelines
- US-4: Business Energy Investment Tax Credit (ITC)
- US-5: Modified Accelerated Cost-Recovery System
- US-6: Innovative Technology Loan Guarantee Program
- US-7: Requirement to follow a five-step implementation programme
- US-8: Requirements developed by industry associations
- US-9: Superior Energy Performance

Implementation toolbox:

- US- 1: Applicability Tool, Code of Federal Regulations
- US-2: Energy assessments, software tools (Quick PEP), energy management training and coaching, webinars
- US-3: Guidelines and industry-specific tools for energy management, ENERGY STAR Industrial Benchmarking Tools, Target Finder, Energy Tracking Plan (ETP) template, monitoring protocols
- US-4: Form 3468
- US-5: Normal federal tax depreciation rulebooks and tools
- US-7: Tools and guidance for GHG inventories, for development of Inventory Management Plans (IMP), guide to GHG management, and technical assistance webinars
- US-8: Training centres, software tools, GHG reporting guidelines
- US-9: Certified practitioners, ISO 50001 standard, Energy Quickstart website.

Figure 7 Federal policy package of the United States.

## 4 Comparison of the policy packages of the six countries

This section analyses the policy packages of the six countries according to the policy pyramid framework, and identifies some best practices and key messages.

### 4.1 The role of effort-defining policies

In general, countries are increasingly implementing effort-defining policies. This trend is likely based on several elements, including: the growing body of experience and lessons learned regarding the effectiveness of policy packages that have no effort-defining policies, the need to achieve further efficiency improvements to mitigate climate change and achieve energy security, and the momentum of international climate change discussions.

Of the countries surveyed in this paper, China, the Netherlands and the United Kingdom have set mandatory energy efficiency or GHG emission targets. In India, Japan and the United States, such mandatory effort-defining policies are now emerging, albeit with political challenges stemming from domestic resistance and diminished international coordination.

Until recently, India had made little use of regulation linking policy objectives to the practical details of policy design, implementation and enforcement, as demonstrated by the complexity of developing energy efficiency standards and the resulting lack of progress in the development and deployment of the standards. Beyond support for energy auditing and energy management, the implementation toolbox in India is still relatively bare. Although India imposed mandatory energy management, it did not go so far as to require companies to actually implement the identified energy efficiency measures or to improve performance. A new effort-defining policy is under development, the Perform, Achieve and Trade (PAT) scheme. The mandatory energy management scheme will have a supporting role in meeting its targets.

In Japan, mandatory benchmarking efforts for the industry sector are also under development and should compel industrial companies to go beyond efforts under the voluntary schemes dominated by industry-set targets.

The United States has only a very limited focus on effort-defining policies, which hampers the effectiveness of its policy packages. The recent BACT requirements under the Clean Air Act have the potential to drive efficiency improvements and reduce emissions; however, the political will and the resources to deploy the new CAA provisions are still uncertain.

**Message 1:** *As governments define their policy package to support their energy efficiency and climate mitigation goals, they need to start by defining the overall energy efficiency or emission reduction ambition levels through an effort-defining policy. As such, what matters is not the quantity of effort-defining policies but their quality and scope.*

## 4.2 The choice of effort-defining policies

In terms of effort-defining policies, countries have generally implemented mandatory standards, mandatory targets, negotiated agreements, voluntary agreements or a combination of these. China's large-sized industry is subject to targets both under the Top-1 000 Program and under industrial energy performance standards. India initiated the definition of norms for its sectors, and these norms have now been modified as targets under the PAT scheme. The United Kingdom and the Netherlands have targets under the EU ETS and the negotiated agreements. Japan has voluntary targets under the Kaidanren Voluntary Action Plan.

### 4.2.1 Mandatory targets

From an economic efficiency perspective, many governments have introduced, or are now considering introducing, market-based instruments in the form of emissions trading or white certificates scheme to address environmental externalities. Such pricing of emissions or energy savings, in principle, strengthens the financial incentives to improve energy efficiency by pricing the marginal cost of GHG emissions/energy.

Of the countries surveyed, EU member states, the Netherlands and the United Kingdom have the greatest experience with emissions trading schemes, because they have been subject to the EU ETS since 2005, and the United Kingdom has had its voluntary UK ETS since 2002. Japan has a small voluntary ETS scheme, and the United States has some regional schemes and detailed draft federal legislation, although passing of the federal legislation looks highly unlikely at present. India's PAT scheme is a pioneer among white certificates that apply to the industry sector.<sup>18</sup> Although emissions trading schemes can drive both energy efficiency improvements and emissions reductions, white certificates schemes can drive only energy efficiency improvements and do not distinguish between energy sources, thus creating uncertainty as to how the policy will drive GHG emissions reductions overall.

If countries strive for economic efficiency, they may choose to implement emissions trading or white certificates schemes. The concept of benchmarking, where a target is defined relative to the performance of competitors either nationally or internationally as introduced in the Dutch Benchmarking Agreement, is increasingly used in policymaking, including in the EU ETS post-2012 and the Japanese energy efficiency benchmarking scheme.

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<sup>18</sup> Several European countries also have experience in white certificates trading, and industrial energy efficiency improvements are usually eligible for white certificates. However, the energy efficiency obligation is put on energy utilities, producers or distributors rather than on industrial installations.

#### **4.2.2 Mandatory standards**

There is a clear role for industrial energy performance standards (e.g. emissions or energy per tonne of clinker/cement). These standards may be more straightforward to develop and implement than cap-and-trade (or similar) schemes, although they also may be less cost-effective and provide less flexibility in implementation (see section 0).

#### **4.2.3 Voluntary targets and negotiated agreements**

Not all governments have implemented mandatory energy efficiency or GHG emission targets or standards as a first choice. Some countries have implemented negotiated agreements or voluntary targets first (or instead).

Reasons for implementing voluntary targets include cultural and competitiveness concerns, and the maturity/history of energy efficiency or GHG policies in the country. This has been the case, for example, in Japan and the United States, where the transition to negotiated or mandatory targets has not yet been feasible due to opposition from industry and some government departments.

Negotiated agreements, such as in the Netherlands and the United Kingdom, have also been employed before mandatory targets or as an alternative to other environmental regulations and can be an important way to get industry buy-in. In these countries, industry is now also subject to mandatory targets under the EU ETS.

To encourage participation in negotiated agreements, some countries have chosen to apply a mandatory measure less preferable to the target group in case of non-compliance or non-participation in the voluntary/negotiated agreement. Put another way, companies that choose to take part in the agreements receive rewards for doing so by being exempted from a less preferable measure. In the United Kingdom, for example, companies choose to comply with the negotiated targets established under the Climate Change Agreements to receive a partial exemption from the Climate Change Levy (65% from 2011, previously 80%). If they do not comply with the agreements, they are responsible for paying the full levy. In the Netherlands, the Long-Term Agreement (LTA) participants are exempt from environmental permitting requirements and partially exempt from the broad-based energy/carbon tax.<sup>19</sup>

Experience has shown that negotiated agreements supported by the threat of regulation or rewards for participation are much more effective than purely voluntary agreements and can

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<sup>19</sup> Although LTA/benchmarking participants are not technically “exempt” from the energy component of the permit, they just have to prove their compliance with the covenants in order to be granted compliance with the energy-related provision of the permits of the Environmental Management Act (EMA) (so basically the obligations under the Negotiated Agreements are adopted as the EMA obligations). Similarly, the permit and obligations under the EU ETS act as the GHG emissions part of the EMA (as agreed in the relation between EU ETS and the Intergovernmental Panel on Climate Change [IPCC]).

be as effective as mandatory targets, if not more effective, because the target group is usually more involved and, therefore, perceives negotiated agreements more favourably than mandatory instruments.

**Message 2:** *Mandatory targets, such as cap-and-trade and white certificates schemes, negotiated agreements (when these are supported by rewards for participation or the threat of regulation), and industrial product/process standards can be viable effort-defining policies to encourage energy savings and GHG reductions.*

### 4.3 Combinations of effort-defining policies

In the previous sections, we highlighted the role and choice of effort-defining policies. Here, we focus on whether and how the two major types of effort-defining policies, targets and standards, can or should be combined.

The implementation of minimum efficiency standards is considered worthwhile to remove the least efficient technology, production processes and equipment from the market. In a combined application of targets and standards, minimum efficiency standards would work on the bottom-end of the market (in terms of efficiency), while targets can go beyond these actions and aim for higher ambition levels.

In this context, “targets” can be voluntary, negotiated or mandatory targets for energy efficiency or carbon-intensity improvements, energy savings or emission reductions. These targets are sometimes accompanied by tradable permits (white certificates schemes or emissions trading permits).

Standards, here, are defined as minimum efficiency standards (or maximum energy consumption or emission standards), defined either at the level of equipment (motors and drives or steam boilers) or processes or products (production of cement and steel).<sup>20</sup> Some examples of combined targets and standards, currently implemented or under development, include:

- The BACTs being currently defined for boiler efficiency under the Clean Air Act in the United States, in combination with the voluntary programmes in place such as Climate Leaders;
- The definition of industrial efficiency performance standards in China, where a minimum efficiency performance standard is defined for process and equipment, in combination with a more ambitious voluntary (“reach”) standard, energy efficiency appraisals for

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<sup>20</sup> Minimum efficiency standards can also be implemented voluntarily. In addition, different standards are possible, *i.e.* prescribing the implementation of certain technology or components, limiting size, etc. However, for simplicity and because these standards are not as common, they are not covered here.

new large industrial projects, and the broader mandatory targets under the Top-1 000 Enterprise Program;

- The maximum heat losses defined in Germany's Small-Scale Combustion Plant Ordinance (with capacity up to 10 MW), which can, in part, overlap with the EU ETS.<sup>21</sup>

Generally, standards apply from the moment they are implemented, while targets are formulated to be reached over or by a certain period.<sup>22</sup>

A *standard* is usually relatively narrow in scope (in terms of the coverage of energy use or emissions). This is because the performance of the equipment or process has to be suitable for standardisation across the population (*e.g.* steam boiler standards need to specify the temperature and pressure of the produced steam). Standards can be used to address a part of energy consumption that would otherwise be difficult to target, because that part occurs very diffusely across many sectors and players. Exceptions exist to this pattern, however, such as standards on energy management and standards on products such as China's industrial energy performance standards (*e.g.* steel slabs).

*Targets* can be defined either narrowly (*e.g.* energy savings in the production of food cans) or broadly (*e.g.* total industrial energy consumption) and cover energy use or emissions in the target group more comprehensively (Figure 8).

In general, targets and standards can be complementary (*i.e.* synergistic and hence desirable) as long as they differ in scope, *i.e.* if the total amount of energy use and/or emissions that are affected by the instruments is different, or if they affect energy use and/or emissions from different sources.

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<sup>21</sup> <http://www.iea.org/textbase/pm/?mode=pm&id=1524&action=detail>.

<sup>22</sup> Though standards can also be defined for a future compliance date, *e.g.* the fuel efficiency and CO<sub>2</sub> emission standards for cars. In addition, targets can also be defined as annual improvement rates.

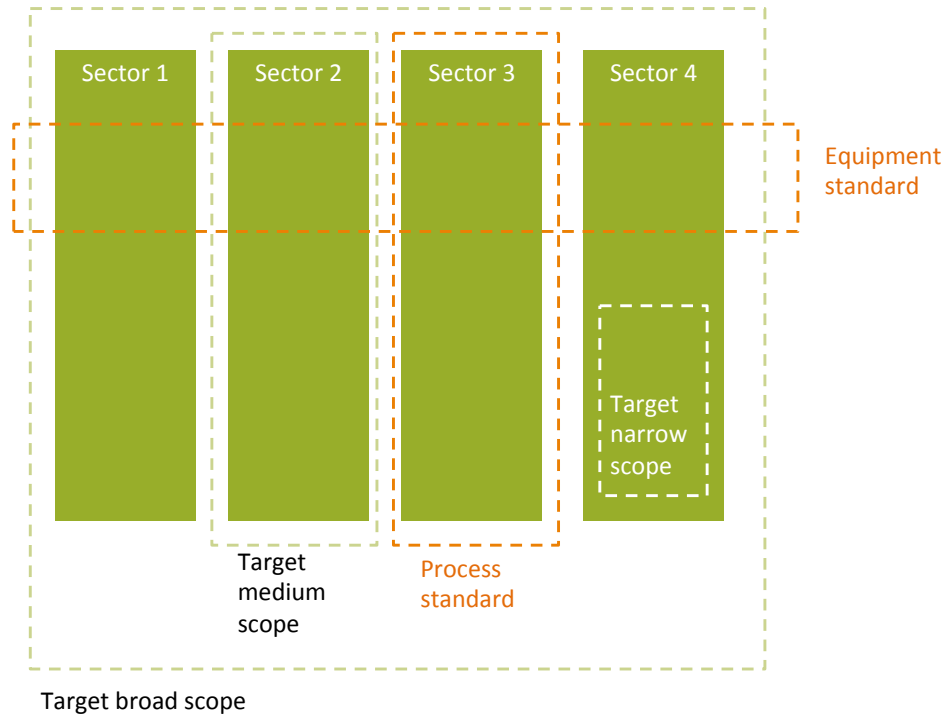


Figure 8 Relationship between targets and standards

The overall impact of a standard or target is determined by a number of different elements, such as which equipment or processes it covers, which sectors and sources are affected (only energy-related emissions, total energy use or emissions, or only for certain equipment and processes; only on-site energy use or also purchased electricity or energy in transport), and which participants are included (all companies or only those over a certain size). These various elements could jointly be considered to define the scope of the policy instrument.

In addition, the primary driver of the instrument (energy or emissions) and the implementation mode (voluntary or mandatory targets; absolute or relative targets<sup>23</sup>) determines the overall impact that a target or standard can have. Targets defined in absolute GHG emissions (rather than energy efficiency, or relative targets, per unit of production) have a wider scope, because they can employ a wider set of measures to meet the target and have a bigger impact on total emissions (including fuel switch, material efficiency improvement, structural changes in product mix, behavioural changes, and reduced demand for products).

<sup>23</sup> Absolute targets define a total quantity/percentage of energy conservation or emissions reduction to be achieved (at a certain date, or annually). Relative targets are usually intensity-based, *i.e.* per unit of production, expressed in either a reduction in intensity (at a certain date, or annually) or a certain value to be achieved (*i.e.* a benchmarking or other specific GJ/t value).

Table 2 shows the most important elements of the scope of standards and targets, with examples of narrow-to-broad definitions for the various elements.

*Table 2 Different elements of targets and standards\**

Element	Type 1	Type 2	Type 3
<b>Obligation level</b>	Voluntary	Negotiated	Mandatory
<b>Definition of effort</b>	Relative (per unit of input or product)		Absolute
<b>Primary objective</b>	Energy efficiency	Energy savings	CO <sub>2</sub> or GHG emissions
<b>Sectoral scope</b>	One sector or subsector	Multiple sectors	Cross-cutting
<b>Participant definition<sup>24</sup></b>	Subset of companies in target group, e.g. only SMEs	Subset of companies in target group, e.g. only installations > than 20 MW	All companies in target group
<b>System boundary</b>	Only part of on-site energy consumption and/or emissions, <sup>25</sup> e.g. energy use from boilers and CHP installations	Only part of on-site energy consumption and/or emissions, <sup>26</sup> e.g. energy use in stationary sources	Total energy consumption and/or emissions, e.g. emissions from fuel combustion and process emissions

When the effectiveness<sup>27</sup> and efficiency<sup>28</sup> of a (combination of) policy instrument(s) are being evaluated, several issues are important to consider. The first issue is that, without sufficient control and enforcement, standards become ineffective, and might not add much value to, for example, a voluntary target. The second issue is that a lack of participation could undermine the effectiveness and efficiency of voluntary and negotiated targets. Real or perceived fairness<sup>29</sup> by different target groups can also be an important factor in the overall effectiveness of policies. Adding additional transaction costs for the second instrument could effectively lead to an unnecessary administrative burden (perceived or real) and, therefore, a negative impact of combining targets and standards.

In light of the above, Table 3 presents a number of scenarios in which standards and targets are combined, looking at the effectiveness and efficiency of the combined policies. For the various elements of the scope of each instrument described above, positive and/or negative

<sup>24</sup> E.g. SMEs versus non-SMEs, participation thresholds (e.g. in terms of energy use, emissions, production, capacity, turnover), certain regions or countries.

<sup>25</sup> E.g. only certain type of equipment or certain processes, installations over a threshold size, certain GHGs.

<sup>26</sup> E.g. only certain type of equipment or certain processes, installations over a threshold size, certain GHGs.

<sup>27</sup> Does the policy lead to meeting the target?

<sup>28</sup> Or cost-effectiveness: Does the policy lead to meeting the target at lowest overall cost?

<sup>29</sup> In case efforts in different target groups are perceived as very different.

interactions between the two are presented. Note that a greater number of scenarios exist, but only the main ones are included for simplicity.

From Table 3, we can conclude that synergy between standards and targets can be achieved if the difference in scope in terms of energy use or emissions covered is large, *i.e.* when the standard only covers a smaller part of the energy and emissions covered by the target. When the scope is similar between targets and standards, the added value of combining both instruments becomes limited and can lead to effects such as reduced support for either instrument, increased transaction costs or duplication of efforts, negatively affecting both effectiveness and efficiency.

Minimum energy performance standards for equipment are considered worthwhile in all combinations and types of targets and standards. However, industrial product standards and targets, if too similar in scope and ambition, can create unnecessary duplication and undue compliance burden.

*Table 3 Combinations of targets and standards according to the scope of each instrument*

Note: Colour coding indicates the potential for a more effective/efficient combination (darkest shade), a less effective/efficient combination (lightest shade) or no effect (mid shade). Examples provided are, in most cases, theoretical.

Element of the instrument's scope	Interactions
<b>Voluntary or mandatory</b>	<b>Standard is voluntary, target is mandatory:</b>
	Limited to no impact on the effectiveness of the target.
	Existence of voluntary standards could increase awareness of potential measures to reach the target. Mandatory target could stimulate increased compliance with voluntary standard.
	<u>Example:</u> A <i>mandatory</i> 2%/year energy efficiency improvement target and a <i>voluntary</i> standard for compressors.
	<b>Standard is mandatory, target is voluntary:</b>
	Standard can support reaching the target.
	Potential to reduce support for the target, because standard reduces participants' freedom to choose the least-cost option to reach the target.
<b>Definition of effort: absolute or relative</b>	<b>Standard is relative, target is absolute:</b>
	Target could stimulate increased compliance with standard. Standards can support target achievement. Synergy is larger for equipment standards and targets. For process standards, synergy is larger when the effort definition of the standard in terms of the amount of energy use and emissions affected is narrower than the target, and when the potential measures to meet the standard or target are different.
	The more similar the definition of effort between a process standard and target ( <i>e.g.</i> both relative, based on product), the lower the added value, with increased transaction costs lowering efficiency of the combined instruments.



	<p><u>Examples:</u></p> <p>A minimum efficiency standard for generators or compressors (intensity-based) and an absolute energy savings target for paper production installations.</p> <p>A minimum efficiency standard in GJ/tonne of cement and an absolute energy savings target for cement production installations.</p>
<p><b>Primary objective: energy efficiency, energy use or emissions</b></p>	<p><b>Standard in energy, target in emissions or vice versa:</b></p> <p>Standards and targets can be complementary. Synergy is larger for equipment standards and targets. For process standards, synergy is larger when the scope of the standard in terms of the amount of energy use and emissions affected is narrower than the target, and when the potential measures to meet the standard of target are different</p> <p>The more similar the scope between a process standard and target, the lower the added value, with increased transaction costs lowering efficiency of the combined instruments.</p>
	<p><u>Examples:</u></p> <p>Minimum efficiency standard for CHP and a CO<sub>2</sub> emission reduction target for paper production</p> <p>Minimum efficiency standard for cement production and an emission reduction target for energy-related emissions per tonne of cement.</p>
	<p><b>Different sectors are covered by target and standard:</b></p> <p>No overlap, therefore no interaction. Both separate measures contribute to their objectives in their respective sectors.</p> <p>Main potential effect: a (perceived) unequal playing field between different sectors (in particular if they are in competition with each other), especially in case of strong differences in the share of energy consumption or emissions covered, the stringency of the instrument, or one being voluntary, the other mandatory between different sectors.</p>
	<p><u>Examples:</u></p> <p>Steel sector with a strict emission reduction target, with a lenient minimum efficiency standard for smelters in aluminium production (competing sectors in certain applications and markets, e.g. building materials).</p>
	<p><b>Standard and target apply to different participants:</b></p> <p>No overlap, therefore no interaction. Both separate measures contribute to their respective objectives.</p> <p>Main potential effect: a (perceived) unequal playing field between different participants, especially in case of strong differences in the share of energy consumption or emissions covered or the stringency (level of the target or standard; voluntary or mandatory) between target groups. If the target is perceived more stringent than the standard, support for the targets will be reduced.</p>
<p><b>Participant definition: all companies or only a subset</b></p>	<p><u>Examples:</u></p> <p>Steel sector with a strict emission reduction target for installations with a production capacity of larger than x tonnes/day, with a lenient minimum efficiency standard for smaller installations.</p>
<p><b>System boundary: all sources or only part of the sources</b></p>	<p><b>Standard and target use different system boundary:</b></p> <p>Target could stimulate increased compliance with standard and vice versa. Synergy is larger between equipment standards and targets, because the former has a narrow system boundary and the latter has a broader system boundary. For process standards, synergy is</p>

	larger when the system boundary of the standard is narrower than the target.
	The more similar the system boundary between process standard and target, the lower the added value, with increased transaction costs lowering efficiency of the combined instruments and potentially creating undue administrative burden.
	<u>Examples:</u>
	A minimum efficiency standard for electricity-powered transport equipment on-site of a steel producer, with an emission reduction target for combustion plants.

**Message 3:** *As effort-defining policies, targets and standards can be effective in combination with each other provided that they differ in scope (e.g. according to system boundary, participant definition, sectoral scope, primary objective etc.). In a combined application of targets and standards, minimum efficiency standards would work on the bottom-end of the market (in terms of efficiency) to establish a floor, while targets can go beyond these actions and aim for higher ambition levels.*

## 4.4 Setting ambition levels

Three influential factors in defining and maintaining the level of ambition of energy efficiency and GHG goals of policies are:

1. The relative involvement of industry, government and third parties;
2. The data availability, quality and transparency; and
3. Enabling the goals of a policy to be strengthened over time.

### 4.4.1 Negotiation process

The level of involvement of different stakeholders in setting goals varies between countries. In Japan (the Keidanren Voluntary Action Plan) and the United States (Industry Technologies Program, the Climate Leaders or the ENERGY STAR Program for Industry), targets are set unilaterally by industry. Japan has a number of effort-defining policies, but the role of the government is relatively limited due to the mostly voluntary and unilateral character of the various programmes.

In the Netherlands and the United Kingdom, on the other hand, the negotiations are between more-or-less equally strongly positioned partners. In the United Kingdom, the Climate Change Agreements (CCAs) were negotiated between industry, the Department of Energy and Climate Change (DECC), the Carbon Trust, and other third parties in an iterative negotiation process. Third parties provided the government with information on industrial business as usual (BAU) emissions and cost-effective and technologically possible efficiency measures; industry representatives proposed targets based on their own assessment of their mitigation potential (Price *et al.*, 2008). They then entered into negotiations with the government using industrial

efficiency experts as third parties (the Energy Technology Support Unit, now AEA Technology) to assess the ambition of the proposed targets (AEA Technology, 2004).

In the Netherlands, negotiations occurred between industry representatives and the government, and in most cases third-party experts were selected to review the accuracy of “the top 10%” energy efficiency performance level.

In the Top-1 000 Program in China, industry and third parties were little involved in defining the ambition of the energy efficiency agreements. Targets were set relatively rapidly by the National Development and Reform Commission (NDRC) for each enterprise to support the provincial-level targets and to reach the overall programme savings target. The targets were not based on detailed assessments of energy-savings potential of each enterprise or each industrial sector due to time constraint, and it is unclear to what extent governments are aware of the energy efficiency opportunities (*i.e.* asymmetry of information) (Price *et al.*, 2011).

Consultation with wider stakeholders, including the public, can also assist governments in implementing more ambitious policies.

**Message 4:** *To define ambitious energy efficiency or GHG goals, governments, industry representatives and third-party experts should be involved in the design and negotiation process. Experience has shown that the hiring of third-party sector experts allows governments to negotiate more ambitious targets than would otherwise have been the case. A consultative process can also support more ambitious targets.*

#### **4.4.2 Good quality and detailed data**

Setting targets and standards should be informed by energy efficiency potentials within each sector. However, in the absence of good quality and detailed data, it is difficult to estimate, with sufficient precision, current and projected emissions, mitigation/improvement potentials and costs, and, therefore, it is difficult to set targets that will deviate significantly from business-as-usual emissions.

Phases 1 and 2 of the EU emissions trading scheme (ETS) illustrate this point, where a lack of industry data prior to Phase 1, and associated information asymmetries, partly explained the over-allocation of allowances and the corresponding low price of European allowances (EUAs). The same could occur in Phase 1 of India’s PAT scheme, because the government is initially using Specific Energy Consumption data, which varies widely for each industrial subsector (Thapliyal *et al.*, 2011).<sup>30</sup>

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<sup>30</sup> Due to the diversity within subsectors in India, such as scale of production (installed capacities), use of raw material, process technology, vintage, operation and management practices, and type of product output.

Even though the emissions price was very low in Phase 1 of the EU ETS, companies learned how to use the scheme and the government-collected data. For Phase 3 of the EU ETS, much more data was being used to determine benchmarking and allocation levels. For India's PAT scheme in Phase 2, the collection of subprocess level data could help inform further targets.

However, although starting a scheme without a certain minimal amount of information on abatement potentials and costs would make the target setting rather random, waiting for ideal and comprehensive data may also be unworkable and unrealistic.

#### **4.4.3 Strengthening goals over time**

Good quality and detailed data can help to inform further refinement and continuous improvement in the ambition level of policies over time. Policies that are designed to allow targets to be updated will drive continuous energy efficiency improvements.

To provide certainty to investors, policy makers need to create visibility of policy design decisions, such as the effects on emissions prices, as a continuous process, so that price visibility is maintained at least ten years ahead (IEA, 2007). Setting aspirational targets for the very long term (e.g. to 2050), without providing milestones for this key midterm period, does not significantly help reduce investment risk. However, simply defining a policy goal over a ten-year period is not sufficient: credibility that the policy will not be changed over this period is also important (*ibid*).

In addition, policy makers need to establish clear rules, and give companies the confidence that these rules will be applied consistently over a long period.

**Message 5:** *Although the use of aggregated-level data can be challenging in setting ambitious differentiated targets, the inability to improve on this data immediately should not be a reason for delaying action. At the start of a scheme, policy makers need to ensure that the data collection requirements become more detailed through time. As governments become capable of collecting granular process-level data, targets can be fine-tuned over time to ensure ambitious efforts while maintaining the visibility of prices, policy decisions, and the rules of the scheme to provide long-term certainty for investors.*

## **4.5 The role of supporting measures**

### **4.5.1 Supporting measures for effort-defining policies**

As indicated in section 3, the policy packages of the countries surveyed are diverse. The analysis indicates that effort-defining policies on their own are not able to achieve stated goals and that a range of supporting measures (in the form of either carrots or sticks) tailored to the specific country and industry characteristics is needed to encourage action.

An optimal set of supporting measures to underpin effort-defining policies depends on a range of factors including: the barriers specific to the country and the industry; their interaction with effort-defining policies and with each other; and the country's cultural and political characteristics. Although the cultural and political factors are not fully examined in this paper, they are important considerations. Cultural and political traits that play a role include acceptability of regulation, the level of cooperation between different stakeholders, governance arrangements, and attitudes towards the environment and resource use.

#### 4.5.2 Supporting measures are needed to address specific barriers to energy efficiency

Although effort-defining policies set and define energy conservation and emissions reduction goals for the industry sector, subsectors or across sectors, supporting measures generally address specific barriers, where barriers exist. The characteristics of the policy should match the specific barriers identified (Table 4). Table 4 provides an example of a supporting measure that addresses a specific barrier from each of the countries surveyed. Note this is an illustration, not an exhaustive list, and further research is needed to claim that such barriers exist.

*Table 4 Examples of supporting measures addressing specific barriers*

Country	Example of Supporting measure	Possible barrier addressed	Rationale
China	Differential energy pricing for industry	Signal of market energy prices not effective in driving energy savings/environmental externalities not taken into account.	Less efficient plants are faced with higher electricity prices to stimulate efficiency improvement or, alternatively, to close down due to prohibitively high electricity costs.
India	Mandatory industrial energy management	Lack of information. Decision-making regarding energy efficiency is dispersed among different actors within a company.	India's sectors are very diverse. Even within a specific subsector, (e.g. steel or cement production), energy performance varies widely. It has, therefore, been technically and politically difficult to regulate. It has, to date, been easier to mandate a process than an outcome.
Japan	Emissions credit scheme for SMEs	Limited opportunities to reduce emissions inside the firm (high abatement costs) or perceived industry attitudes to that effect.	Credits from scheme can be used to meet targets under the Kaidanren action plan. This arrangement provides participants in the voluntary scheme with greater flexibility to comply with their targets under the Voluntary Action Plan.
Netherlands	Energy Investment Deduction Scheme	High costs	Industrial energy efficiency in the Netherlands has been high on the agenda for a long time, and many cheap improvement options have already been taken. This tax relief programme makes companies more able to afford energy efficient technologies to further improve

			efficiency.
United Kingdom	Climate Change Levy	Signal of market energy prices not effective in driving energy savings in industry.	Similar to the Netherlands above.
United States	ENERGY STAR Program for Industry	Limited access to information (both target group and consumers), bounded rationality, relatively efficient performers have no means to communicate this.	The program gives a range of guidance and support tools to companies to assist them in improving their energy performance and provides recognition opportunities to highlight industrial companies' energy efficiency efforts.

### 4.5.3 Consistency within the policy package

Although the task of teasing out all relationships between different types of effort-defining policies and supporting measures may be impractical and context-specific, we can distinguish some general interactions where the policy interaction can be mutually reinforcing or counterproductive. The following interactions, both positive and negative, can be observed.

Information policies are complementary to virtually all other policies (Gunningham and Sinclair, 1999) and can assist the implementation of other policies in variety of ways. Information provided by the regulator to industry may encourage compliance and best practice.

Information provisions under voluntary agreements designed to create accountability and transparency generate independent performance information and increase trust that the scheme is robust. In the UK's Climate Change Agreements, the reporting required to sector associations is an essential part of its credibility. In the case of tradable permits and other economic instruments, information about emissions reduction action will ensure that industry can make rational economic decisions. For example, firms are better able to estimate the impact that a carbon price might have on their business by having a list of costed energy efficiency projects (Crittenden *et al.*, 2011).

Incentives and subsidies, such as accelerated depreciation and soft loans, are likely to be a good match with mandatory effort-defining policies, such as emissions trading schemes and standards, although free riding<sup>31</sup> can be a significant issue. A combination of standards and technical subsidies are a case of mutually reinforcing policies. In China, companies that save energy above a certain threshold are rewarded, and, independently, they receive incentives for when they invest in the 10 Key Projects (Technical Rewards for Energy-Saving Technical Retrofits), which supports performance beyond the minimum energy performance standards (MEPS). The Enhanced Capital Allowance Scheme in the United Kingdom and the Energy Investment Deduction Scheme are complementary to the EU ETS.

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<sup>31</sup> In this context, free riding refers to a circumstance whereby a company may make use of a subsidy or financial incentive (i.e. a public good) to help it finance an energy efficient project or technology, but that company would have made that investment anyway (without the use of the incentive).

**Message 6:** *Where barriers to energy savings have been identified, supporting measures (in the form of carrots or sticks) are often needed to support effort-defining policies and encourage action. The choice and design of these supporting measures depend on the specific barriers of the country and sector, their interaction with other policies, and the political and cultural characteristics of the country in which the supporting measures are being developed.*

#### **4.5.4 Energy management programmes as part of a wider policy or programme**

Programmes to promote Energy Management Systems (EnMS) and similar energy management requirements have been shown to be particularly effective as supportive measures of broader effort-defining policies. Such programmes usually specify how energy management should be carried out, for example, through standardised methods such as the upcoming international ISO 50001 or the European EN 16001 standards, or through other requirements such as the Netherlands' energy management specifications under the LTAs.

EnMS enable organisations to establish systems and processes necessary to achieve operational control and continual improvement of energy performance (O'Sullivan, 2011). Implementation of an EnMS assists a company to develop a baseline of energy use, actively manage energy use and costs (in particular as energy prices are becoming increasingly volatile), reduce emissions without a negative effect on operation, and continue to improve energy use/product output over time (Scheiing, 2009). EnMS help companies more easily implement and meet the obligations of a range of (usually) effort-defining policies, and facilitate trade in markets that are demanding more traceability, quality and environmental credentials from their suppliers. Companies that have implemented EnMS standards have often achieved savings beyond the expectation of effort-defining policies, and typically making savings of 10-20% within the first five years. In addition, a common experience of companies that use EnMS effectively is that many other significant non-energy benefits are also uncovered (such as productivity, non-energy operating costs, equipment life, maintenance costs, waste generation) (Hall and Roth, 2003).

EnMS standards and programmes to promote EnMS can benefit:

- Companies by uncovering energy-savings opportunities, facilitating their achievement of effort-defining policies and by taking advantage of governmental incentives (in the form of financial incentives, training or technical assistance), where these measures have been built into the programme; and
- Government by easing the burden of compliance checks and supervision, in addition to increasing companies' implementation success of effort-defining policies, such as negotiated agreements and targets.

EnMS standards and similar requirements can be effective as stand-alone initiatives, but are more important for their enhancement of higher-level effort-defining policies such as energy savings agreements between industrial enterprises and government.

In European countries (Sweden, Denmark and Ireland, with some discussion of the Netherlands and the United States reviewed in a separate IIP paper<sup>32</sup>), EnMS requirements are a core, mandatory part of the broader energy conservation agreement packages between governments and industrial enterprises. Enterprises participate in the broader energy conservation agreements to receive the tax benefits, technical support and/or reputational benefits that these agreements bring. Providing training on the EnMS as well as case studies is also a key to drive successful implementation of EnMS. Promoted this way, the results, in terms of enterprise uptake of EnMS, are exceptionally good, typically making savings of 10-20% within the first five years.

**Message 7:** *Energy management programmes, if cohesively linked to effort-defining policies and supported by training and incentives, can be very effective as supporting measures. Experience in European countries has shown that such programmes can usefully contribute to enhanced energy-savings performance, facilitate company achievement of effort-defining policies and ease the burden of compliance checks on the government.*

## 4.6 Implementation toolbox

As well as ensuring a country has an ambitious effort-defining policy in place with supporting measures that address specific barriers and are mutually reinforcing, an implementation toolbox is a key element for ensuring an effective policy package. The implementation toolbox may be either developed within the regulations of an effort-defining policy or a supporting measure, or may underpin them as separate tools.

These tools are the instruments that assist the target group in meeting the requirements of the policy effectively and efficiently. The tools may be definitions, standardised methods, lists of eligible technologies or practices, information on options for meeting obligations, or guidelines for how to monitor and report data; the tools should specify the target group, entities, roles, responsibilities, rules, monitoring, penalties, policy assessment indicators and the policy evaluation cycle.

The Netherlands, Japan, the United Kingdom and the United States have relatively elaborate toolboxes, with well-defined rules and modalities, and guidance documents. In the United States, the Department of Energy (DOE)'s Industrial Assessment Centers (IACs) help companies to perform in-depth evaluations of potential savings from energy efficiency improvements. The DOE's Industrial Technologies Program also provides trained energy experts to perform Energy Savings Assessments at the most energy-intensive manufacturing facilities (Levine *et al.*, 2010).

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<sup>32</sup> Goldberg, A., Reinaud, J., & Taylor, R.P. (2011). Promotion Systems and Incentives for Adoption of Energy Management Systems in Industry: Some International Lessons Learned Relevant for China (June 2011). Retrieved from [http://iipnetwork.org/publications\\_and\\_links.php](http://iipnetwork.org/publications_and_links.php).

In other cases, policies have been defined without the necessary support of an implementation toolbox. China's energy auditing obligations under the Top-1 000 Program are an example where energy auditing became mandatory but no protocols defining energy auditing processes were developed. The Lawrence Berkeley National Laboratory (LBNL) notes the lack of standards and guidance for energy auditing and lack of capacity both within enterprises and within other organizations that perform energy audits (Levine *et al.*, 2010; Shen *et al.*, 2010).

Effective and mutually reinforcing results may be achieved more easily in a case where policies from the three different levels in the pyramid are designed at the same time than in a case where existing instruments are "re-used" or developed in a piecemeal fashion.

The implementation toolbox should be clear at the point of adoption of effort-defining policies or at the point of implementation at the latest. Clarifying the implementation toolbox at a later stage will create uncertainty, reduce the support and delay the implementation of efficiency improvement measures. In some cases, establishing a set of tools and guidelines can form part of the implementation toolbox of policies and measures once these policies and measures are established.

**Message 8:** *A comprehensive implementation toolbox is needed to support the implementation and achievement of effort-defining policies and supporting measures. An ideal situation is one where a country sets an effort-defining policy, and simultaneously, or quickly thereafter, develops a set of supporting measures and an implementation toolbox to facilitate the implementation of both policies and measures. In some cases, tools and guidelines can be developed first and can then form part of the implementation toolbox once policies and measures have been established.*

#### **4.7 Monitoring, reporting and verification; compliance and enforcement**

Not all policies have monitoring, reporting and verification (MRV) regimes, yet MRV is an essential part of policy making. MRV measures energy efficiency actions, ensures that firms adhere to the requirements of the policy, keeps accurate records of compliance and allows a cost-benefit analysis of the policy to be undertaken. Without system-wide measurement, it is impossible to know what is being achieved or whether the programme is successful (OECD/IEA, 2010).

MRV regimes differ according to the type of policy. In the case of labelling and standards for example, targeted measurement of individual product suppliers is needed to monitor which suppliers are compliant and which are not. In the case of emissions reduction commitments, MRV obligations under the UNFCCC have to date focused on quantitative aspects (such as emissions by source and trade-in emissions credits), but also includes qualitative aspects (such as reporting on policies and measures, as well as on national systems for monitoring, tracking of emissions and quality control) (OECD/IEA, 2008).

Requiring public reporting by target group participants encourages senior managers to be cognisant of the amount of energy they could save and their business response and go

beyond one-off audits that identify and implement opportunities over a finite period (Crittenden *et al.*, 2011). Reporting needs to be undertaken at regular intervals and using standardised metrics. External verification provides companies with objective feedback and builds trust between governments and industry, as well as public trust in the policy overall.

In most countries, annual monitoring and reporting on achieved energy efficiency improvements is required, and some type of standardised protocol is available. However, the provisions for independent oversight and the role of governments vary greatly. For example, in Japan, companies report unilaterally. China and India's MRV processes are not transparent, although the role of the Bureau of Energy Efficiency (BEE) and Designated Energy Auditors (DNA) in the MRV requirements of India's PAT scheme will improve accountability and transparency. Independent verification is not required in many countries, making it hard to provide a solid assessment of the actual energy efficiency improvements achieved.

Enforcement is an issue in some countries and consequences of non-compliance can be limited. For instance, in the United States, most effort-defining policies lack enforcement and have no penalty setting. Regular compliance checks and enforcement with penalties will increase the incentives of companies to maintain up-to-date information on energy efficiency best practice.

**Message 9:** *A transparent monitoring, reporting and verification process is needed to assess the effectiveness of the policy, allow ongoing evaluation and possible adjustment of the policy, and build trust.*

## 4.8 Ex-post evaluation

A quantitative evaluation of policy effectiveness and efficiency is absent in many countries, other than the Netherlands and the United Kingdom. This absence makes it difficult to determine whether changes are needed to improve the impact of the policy or policy package, and which changes should be made.

Only the Netherlands and the United Kingdom have developed something of a "tradition" in *ex-post* policy evaluations, regarding the assessment of target achievement, effectiveness and efficiency of industrial energy efficiency and GHG policies. Major policies are occasionally evaluated individually by their implementing bodies or general government oversight bodies *ex-post* and are regularly evaluated *ex-ante*.

In the other countries, this evaluation is done to a limited extent. Even if the effectiveness of a policy is assessed, often only the trend of the affected driver is tracked (*e.g.* total energy consumption, energy efficiency, and total emissions), not the extent to which the observed trend is attributable to the policy versus to other circumstances.

Free riding is also an important consideration when evaluating policies. Free riding can be a problem, particularly in incentives and subsidy programmes, where participants benefit from the programme but would have purchased more efficient equipment even in its

absence. Regular updates and phasing out of tax incentives for technologies and products that become well-known and have good market penetration can help reduce free riding (IEA, 2010).

The *efficiency* of policies (the cost-benefit analysis of the policy) is addressed even less frequently than policy *effectiveness*. This is an important limiting factor in improving existing policy instruments or considering whether alternatives could achieve the same results at lower costs to society and the target group.

**Message 10:** *As policy makers define policies, governments need to identify, from the start, the parameters and indicators that will be monitored to allow ongoing and ex-post evaluations. Policy efficiency and free riding should be assessed, in addition to effectiveness, in ex-post policy evaluation to ensure that the policy is achieving the desired goals at lowest costs to society and the target group.*

## 5 Conclusions

This paper analyses the policy packages of China, India, Japan, the Netherlands, the United Kingdom and the United States to identify best practices and lessons learned across countries in the development of energy efficiency and GHG policies. Using the “policy pyramid” methodology described in section 0, the paper explores whether the effort-defining policies, supporting measures and the implementation toolbox of these countries can provide the necessary impetus to achieve ambitious energy efficiency levels.

In the industry sector, considerable and diverse barriers to energy efficiency investments still prevent the full potential to realise energy savings and emissions reductions. “Best practice policies” and the effectiveness of the policy package in achieving ambitious energy efficiency levels are dependent on a range of factors specific to the context: the specific barriers and drivers within a country and sector, how much effort has already been spent on energy efficiency improvements in the past, and a country’s cultural and political traits.

Notwithstanding these context-specific factors, the policy pyramid is a means by which to analyse the policy approaches of different countries, and to assess whether certain minimum elements critical to the success of a policy package have been considered. An effective policy approach requires a policy package consisting of ambitious effort-defining policies to define energy efficiency and GHG reduction goals, supporting measures (either as carrots or sticks) that address the different barriers and encourage performance, and an implementation toolbox to support the implementation of effort-defining policies and supporting measures (illustrated in the policy pyramid in Figure 1). When the goal or effort required is not defined, the effectiveness of all policies, both effort-defining policies and supporting measures, is compromised.

The analysis of the policy packages has also enabled us to highlight certain experiences that could be of interest to other countries. These experiences include:

- China’s minimum energy efficiency standards for industrial processes and energy efficiency appraisals for new large industrial projects;
- The negotiated agreements in the Netherlands and the United Kingdom, supported by a levy or tax in case of non-participation or non-compliance, energy management guidance to help achieve stated goals, and financial incentives;
- The concept of benchmarking (comparing one’s business performance to that of peers) to define energy efficiency targets among companies, used in the Dutch negotiated agreements and Phase 3 of the EU ETS, and now being developed in India and Japan;
- A well-developed implementation toolbox, as in Japan, the United States, the United Kingdom and the Netherlands to help companies understand the challenges and opportunities available to them to manage and reduce energy use and GHG emissions; and



- India's Perform Achieve Trade scheme, an energy-savings trading (i.e. white certificates) scheme between energy-intensive enterprises, and the first scheme of its kind for industry.

## 5.1 Key Messages

The paper provides the following recommendations on how to design effective policies and policy packages and how to evaluate the effectiveness of existing policy packages:

**Message 1:** *As governments define their policy package to support their energy efficiency and climate mitigation goals, they need to start by defining the overall energy efficiency or emission reduction ambition levels through an effort-defining policy. As such, what matters is not the quantity of effort-defining policies but their quality and scope.*

**Message 2:** *Mandatory targets, such as cap-and-trade and white certificates schemes, negotiated agreements (when these are supported by rewards for participation or the threat of regulation), and industrial product/process standards can be viable effort-defining policies to encourage energy savings and GHG reductions.*

**Message 3:** *As effort-defining policies, targets and standards can be effective in combination with each other provided that they differ in scope (e.g. according to system boundary, participant definition, sectoral scope, primary objective etc.). In a combined application of targets and standards, minimum efficiency standards would work on the bottom-end of the market (in terms of efficiency) to establish a floor, while targets can go beyond these actions and aim for higher ambition levels.*

**Message 4:** *To define ambitious energy efficiency or GHG goals, governments, industry representatives and third-party experts should be involved in the design and negotiation process. Experience has shown that the hiring of third-party sector experts allows governments to negotiate more ambitious targets than would otherwise have been the case. A consultative process can also support more ambitious targets.*

**Message 5:** *Although the use of aggregated-level data can be challenging in setting ambitious differentiated targets, the inability to improve on this data immediately should not be a reason for delaying action. At the start of a scheme, policy makers need to ensure that the data collection requirements become more detailed through time. As governments become capable of collecting granular process-level data, targets can be fine-tuned over time to ensure ambitious efforts while maintaining the visibility of prices, policy decisions, and the rules of the scheme to provide long-term certainty for investors.*

**Message 6:** *Where barriers to energy savings have been identified, supporting measures (in the form of carrots or sticks) are often needed to support effort-defining policies and encourage action. The choice and design of these supporting measures depend on the specific barriers of the country and sector, their interaction with other policies and the political and cultural characteristics of the country in which the supporting measures are being developed.*

**Message 7:** *Energy management programmes, if cohesively linked to effort-defining policies and supported by training and incentives, can be very effective as supporting measures. Experience in European countries has shown that such programmes can usefully contribute to enhanced energy savings performance, facilitate company achievement of effort-defining policies and ease the burden of compliance checks on the government.*

**Message 8:** *A comprehensive implementation toolbox is needed to support the implementation and achievement of effort-defining policies and supporting measures. An ideal situation is one where a country sets an effort-defining policy, and simultaneously, or quickly thereafter, develops a set of supporting measures and an implementation toolbox to facilitate the implementation of both policies and measures. In some cases, tools and guidelines can be developed first and can then form part of the implementation toolbox once policies and measures have been established.*

**Message 9:** *A transparent monitoring, reporting and verification process is needed to assess the effectiveness of the policy, allow ongoing evaluation and possible adjustment of the policy, and build trust.*

**Message 10:** *As policy makers define policies, governments need to identify, from the start, the parameters and indicators that will be monitored to allow ongoing and ex-post evaluations. Policy efficiency and free riding should be assessed, in addition to effectiveness, in ex-post policy evaluation to ensure that the policy is achieving the desired goals at lowest costs to society and the target group*

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