

Energy Efficiency Series



THE BOARDROOM PERSPECTIVE: HOW DOES ENERGY EFFICIENCY POLICY INFLUENCE DECISION MAKING IN INDUSTRY?

INFORMATION PAPER



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INSTITUTE FOR INDUSTRIAL PRODUCTIVITY

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This information paper was prepared for the IEA Working Group for Energy Efficiency in October 2011. It was drafted by the Institute for Industrial Productivity (IIP) in collaboration with the IEA. This paper reflects the views of the International Energy Agency (IEA) Secretariat, but does not necessarily reflect those of individual IEA member countries. For further information, please contact Lisa Ryan, Energy Efficiency Unit at: lisa.ryan@iea.org or Julia Reinaud, IIP at: julia.reinaud@iipnetwork.org.

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International
Energy Agency

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Executive summary

Improving energy efficiency (EE) in the industry sector enhances competitiveness and productivity, and provides a range of ancillary benefits. While many investments bring some EE benefits, their aim generally is to enhance core business through an increase in production or replacement of old equipment rather than deliver energy efficiency improvements.

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The rationale for an individual company making an investment that will reduce energy consumption varies considerably and depends on a range of factors. These include the return on investment; market conditions; sector; company size; energy intensity; cost of energy relative to overall production costs, whether EE improvement is an incidental or ancillary benefit of a process or equipment upgrade (or part of a concerted effort to implement an EE programme); the financial state of the company, whether it is in a growth or sunset sector; and access to finance.

While recognition that energy efficiency is a powerful tool to cut operating costs, improve the economy and reduce environmental pollution has never been greater; the implementation of energy efficiency measures in the industry sector is slow to materialise (IEEFP, 2009). This is due to a range of barriers including insufficient information, competing priorities within the company and the lack of commercially viable financing options. Policies have a role to play to address many of the existing barriers.

Typical policies that target industrial energy efficiency include regulations and voluntary agreements that directly compel actions; economic policy instruments such as taxes and tax incentives, directed financial support (*e.g.* subsidies and loans) and differentiated energy prices that seek to influence the cost-effectiveness of technical actions; and informational policies, which help to establish a favourable environment for industry to implement EE actions.

This report explores the factors that influence companies to invest in energy savings and proposes a methodology to evaluate the effectiveness of a country's policy mix from the perspective of an industrial company's boardroom. In other words, are companies made more aware of EE benefits and more motivated to invest in energy efficiency projects – which are otherwise normally neglected – as a result of one or a combination of policies?

Essentially, the “boardroom perspective” delves into the major factors or driving forces that decision makers within a large industrial company take into account when deciding to make new investments. In order to assess whether policy packages are effective through this boardroom perspective, the corporate decision-making process is simplified and represented by using five driving forces as proxies:

- The **financial** imperatives of a company.
- The **policy obligations** placed on the company to achieve environmental compliance.
- The **knowledge** of energy-savings opportunities within the company.
- The **commitment** of the company to the environment and energy efficiency.
- The demands of the **public and market** to improve the company's environmental or energy performance.

The boardroom perspective reflects the premise that the effectiveness of energy and climate policies is ultimately determined by the ability of policies and the policy mix to stimulate the boardroom to maximise the implementation of energy efficiency measures when making investment decisions. By exploring policy effectiveness through the five driving forces, the report came to a number of findings. Depending on the type of EE investments, the relative importance

of drivers may be different. For example, a company may not know which simple no- or low-cost EE measures it could take, *i.e.* the knowledge driver may be more important than other drivers, for instance the financial driver.

In such a case, policies that require the appointment of an energy manager or information policies on energy management best practices may play an important role. By contrast, financial subsidies might not influence the level of skills of the energy manager or the attractiveness of existing no- or low-cost investments. As such, the needed policy mix might not be the same for all sectors and in all countries.

The fact is that policies and the overall policy mix cannot always be effective in triggering all drivers. Numerous commercial and business drivers (*i.e.* the public and market driver) may or may not be affected by policy. In order to assess the need for additional policy intervention for a given country, the evaluation methodology from the boardroom perspective would involve:

- Identifying the type of EE investments the industry needs to make to achieve the country's objective.
- Mapping the characteristics and circumstances of the country with respect to the different industrial sectors, and assessing the relative importance of the drivers of boardroom investment decisions, considering the sector's characteristics and the type of EE investment.
- Analysing the country's policy mix; assessing its impact on the drivers for investments in EE within a sector; and identifying whether policies could further influence the drivers.

Only by focussing at a sub-sectoral level can policy makers estimate whether policies have an effect on the most important drivers in that sector (*e.g.* financing, policy obligation or knowledge).

By applying the methodology to the industry sector as a whole in the Netherlands, this report found that the Dutch policy package addresses all five drivers to a greater or lesser extent. Currently, the main trend is that the impact (on commitment and knowledge) of the Dutch covenants in boardrooms is decreasing, whereas the financial and policy obligation impacts of European Union Emissions Trading Scheme (EU ETS) are growing as the greenhouse-gas (GHG) mitigation targets are becoming more stringent.

Could a stronger policy obligation for energy savings in combination with a change in economic policies be the key to improving the energy efficiency performance of companies in the Netherlands?

The analysis presented in this report should be considered alongside some caveats. The main framework used, namely the "boardroom perspective", is a theoretical perspective based on a literature review. While an illustrative application of the perspective has been undertaken for the Netherlands, several in-depth case studies and interviews with experts and quantitative policy evaluation studies – using the evaluation methodology described above – are needed to validate the boardroom perspective as an authoritative framework for evaluating policy packages to maximise energy efficiency levels.

The present assessment focuses broadly on industry as a whole, while the importance of the drivers is likely to be subsector-specific. A follow-up study could consider how these drivers operate in different sectors and if the policy maker can influence boardroom decisions on whether to invest or not. If additional policies are effective in triggering the drivers for investments, evaluating the costs and benefits of such policies would also help policy makers to design a new policy.

Introduction

Energy efficiency in industry

Industrial energy-savings measures are known to deliver benefits: cost savings from energy bills (*i.e.* in terms of energy cost per unit of product, though overall energy bills may still increase as production increases); minimising the impact of energy price rises; and increasing long-term productivity and competitiveness.

Energy efficiency also leads to benefits beyond a reduction in energy costs. Research among 95 companies conducted by the Pew Centre (Prindle, 2010) found that the benefits of energy efficiency go beyond dollars saved and carbon emissions reduced, to product quality and productivity improvements.

For many types of industrial investments, energy efficiency is an inherent benefit of facility upgrading. Investing in replacing old or obsolete technology brings about integrated improvements in productivity, product quality, overall plant efficiency, improved energy efficiency (*i.e.* measured as energy use per unit of production), and broader innovation and process improvements within a company (Prindle, 2010). For high-energy intensive industries such as primary aluminium, steel and cement, energy efficiency gains alone may be a sufficient driver for new investment.

Energy savings in industry can be achieved through better management as well as new investments. In some sectors, no- or low-cost improvements in energy management can lead to significant savings even before any investment is needed.

Energy efficiency projects refer to investments in equipment, systems and services that result in a reduced use of energy per unit of product or service generated (*e.g.* replacing an old boiler with a new boiler). Several types of investment increase the energy efficiency levels of companies:

- **Increase in process efficiency:** investment in projects that will increase the efficiency of the process.
- **Industrial process change:** where a plant of a higher production capacity but higher efficiency replaces an existing production line (with old units being retired).
- **Facility replacement:** a new facility replaces an old facility, regardless of its location, and thus the old facility is closed.
- **Electricity/gas – generation and distribution efficiency:** investments that reduce energy system losses and improve system efficiency.

Some investments will have a very short payback period, which is useful for demonstrating to senior management the benefits of energy efficiency improvements. Other investments will have higher costs, possibly leading to a change in production technology and process, resulting in additional gains on labour costs, and improvements to product quality. The different types of energy efficiency investment decisions are illustrated in Table 1.

Table 1 Energy efficiency action and investment examples with increasing costs

Level of investment	Action/investment
Simple housekeeping	<ul style="list-style-type: none"> • Turning off lights and other equipment when not in use • Organisational change, <i>e.g.</i> switching to low-rate overnight power, where available
Lower cost investment	<ul style="list-style-type: none"> • Replacement lights with compact fluorescent light bulbs (CFLs) • Variable-frequency drive (VSD) motors, new pumps
Medium cost	<ul style="list-style-type: none"> • Heating, Ventilation, and Air Conditioning replacement • New boilers, refrigerators • Back-up generator replacement • Co-generation
Higher cost	<ul style="list-style-type: none"> • Process equipment upgrades and selective equipment replacement
High cost	<ul style="list-style-type: none"> • Replacement of complete production lines • New power generation units, if off-grid, on-site renewable energy generation • On-site power transmission
Highest cost	<ul style="list-style-type: none"> • New plant, new facility

Source: Mason, 2011.

Co-benefits of investments that improve energy efficiency levels

Through the International Finance Corporation's (IFC) energy efficiency finance programme in Russia, a commercial bakery sought financing to replace outdated and energy inefficient ovens and boilers. The new equipment produced significant energy efficiency gains, but also produced a range of other benefits that had not been factored in, yet financially were just as significant, if not more so than the energy efficiency gains. The new ovens had an even temperature throughout, resulting in evenly baked products of better quality. Wastage from overcooked or under-baked products was reduced, resulting in less waste for disposal and savings in ingredients.

Source: IFC.

This report focuses on energy savings that are achieved through both changes in management practices (*i.e.* training staff on new energy management practices) and energy efficiency projects that require investments in technologies or equipment. As such, it explores whether companies have the capacity to continuously identify energy efficiency improvements as well as one-off technology choices.

Challenges to maximising the energy-savings potential in industry

Both on a regional and global scale, it has been estimated that economy-wide energy savings can potentially contribute up to half of the GHG abatement needed to achieve long-term GHG reductions in 2050 (Ecofys & Fraunhofer, 2010; IEA, 2010).

Although studies have shown that investing today in energy efficient technologies will generate fuel savings that significantly outweigh the initial investment cost over the lifetime of the purchase, companies often do not make investments that improve their energy efficiency levels to their maximum potential. Practicing energy efficiency management often makes economic sense, but may still not be adopted.

Investments that maximise energy efficiency are not undertaken due to economic, behavioural, technical and organisational barriers, or because companies prefer alternative investments in growth or business development above these. For example, when companies replace technologies, while some may bring additional benefits in terms of energy savings at small incremental cost, they often forego these options.

The extent of this paradox will depend on the market, the industrial sector, the size of companies, and their energy use as a proportion of their overall production costs. Sectors where energy represents a higher cost of production than others will have greater incentives to implement energy efficiency measures to enhance or maintain their competitiveness. Access to finance and the cost of capital are both key issues in emerging markets in particular.

When companies do not maximise energy efficiency levels when they make investment decisions, there may be a potential role for government policies.

The timely role of policy makers

Many [US] industries will eventually enter a new period of major capacity investment. This period will represent a major opportunity to influence the energy efficiency of these facilities for generations to come. The challenge is that [industrial energy efficiency policy] programme managers must begin engaging their industrial companies now, so the programmes are positioned to exploit a rare opportunity to change energy use patterns for the years to come.

Source: ACEEE, 2008.

Policy packages are necessary to fully stimulate energy efficiency investments

Investment in energy efficiency entails a complex process due to many barriers and decision-makers. To achieve a greater impact the implementation of several complementary measures that will help address all steps towards efficient deployment. These packages of measures should combine information and communication actions, regulations, subsidies, soft loans, training and certification and should be implemented simultaneously and not one after another.

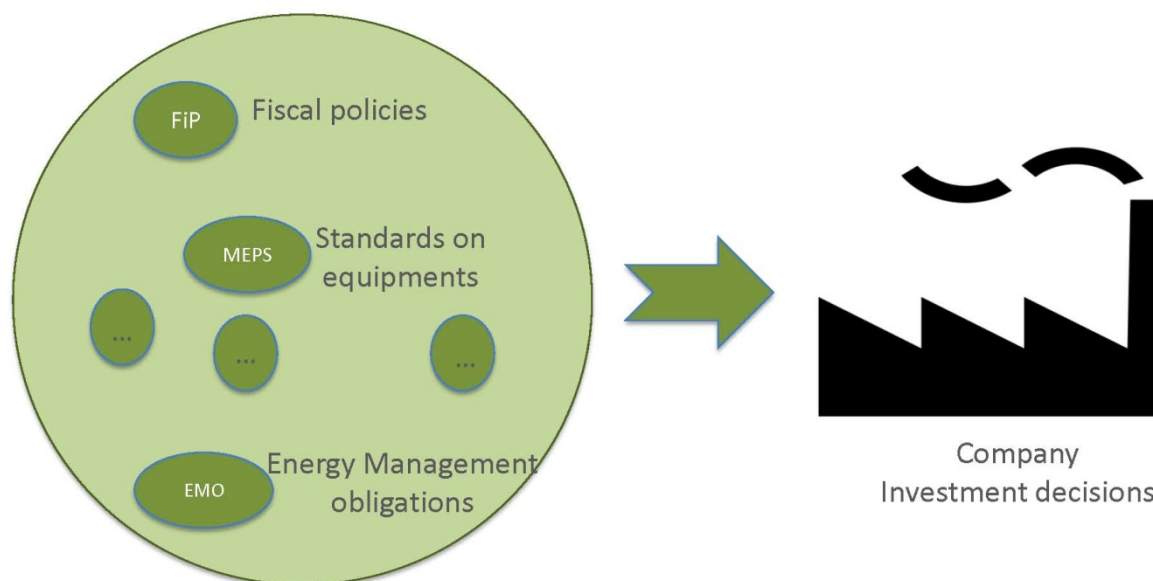
Source: World Energy Council, 2010.

Aim of the report

The aim of this report is to explore the factors that influence companies to invest in energy savings and develop a policy evaluation framework from an industry boardroom perspective.

A variety of methods are already applied in *ex-post* policy evaluation.¹ The methodology to evaluate policies presented in this report provides a new perspective: it assesses a country's policy package according to the industrial boardroom decision-making process.

Figure 1 Policy effectiveness from a policy package perspective



The boardroom perspective reflects the premise that the effectiveness of energy and climate policies is ultimately determined by the ability of policies and the policy mix to stimulate the boardroom to maximise the implementation of energy efficiency measures when making investment decisions.

The relationships between the characteristics and design of a policy (**policy instrument characteristics**), a country's policy mix (**policy package**), and what drives a business to make the investments (**driving forces**) are critical in analysing the effectiveness of a policy package. The framework is developed to answer the question:

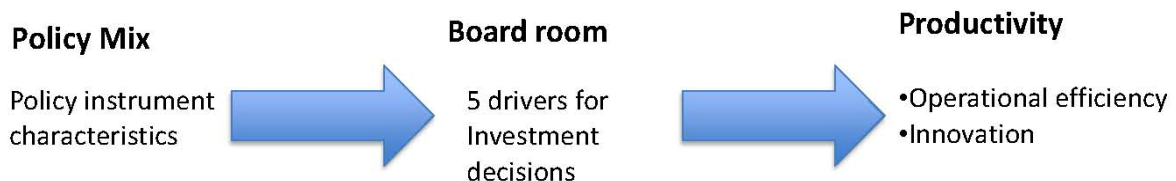
¹ Methods include:

1. Distance or progress, to target: analyses of aggregated indicators on energy consumption per sector or company are assessed against the policy target, *e.g.* a baseline development or an absolute target.
2. Effectiveness evaluations: focussing on the quantitative impact of policy packages in relation to targets set (including teasing out what the policy contributed to the progress to target, and which is due to external factors).
3. Efficiency evaluations: assess the costs of implementing policies, and whether the desired effects of the policy could have been realised at lower implementation or social costs.
4. Implementation evaluations: in which the whole policy implementation process of specific instruments or programmes is unravelled in detail (Khan *et al*, 2007). This reveals deeper insight into "where something went wrong in the process of policy design and implementation" and "where the keys are for improving the impact and cost-effectiveness" (Harmelink *et al*, 2008).

How balanced and effective is this country's policy package in stimulating the industrial boardrooms' decisions to invest in energy efficiency practices and technologies?

Section 2 introduces the boardroom perspective and explores which driving forces play a role in the industrial boardrooms' decision-making process for investments that maximise energy efficiency.

Figure 2 How policies influence boardroom decisions on energy efficiency



Section 3 introduces a policy instrument typology and describes how driving forces for energy efficiency investment decisions are influenced by the characteristics of these policy types.

Section 4 collates this information into a manual on how to apply the policy framework to assess the effectiveness of a country's policy package to increase industrial energy efficiency.

In Section 5, the evaluation framework is tested and applied to the Netherlands as a country example.

The Conclusions section summarises how policy makers can take into consideration the factors that drive industrial companies to make energy savings when designing policies.

The Appendix provides a list of questions to help policy makers characterise their country and industry sector in order to apply the boardroom perspective methodology. As an illustration, the questions are then applied to the industry sector in the Netherlands.

The effect of policies from a boardroom perspective

Competitiveness is the overall business case for increasing the energy efficiency of the industry sector. By investing in technologies or practices that improve the operational efficiency of plants, companies benefit from increased productivity, innovation and the creation of new streams of customer and shareholder value (Prindle, 2010). This paper proposes that the effectiveness of policy instruments and the overall policy package ultimately depends on whether energy efficiency policies influence companies' investment priorities. In other words, can policies help companies recognise the real value (in terms of benefits and returns) of normally neglected energy efficiency projects and change their investment priorities if one investment carries more energy efficiency benefits than another? This perspective differs from other policy evaluations that typically focus on barriers to the uptake of energy efficiency, rather than what drives companies to act.

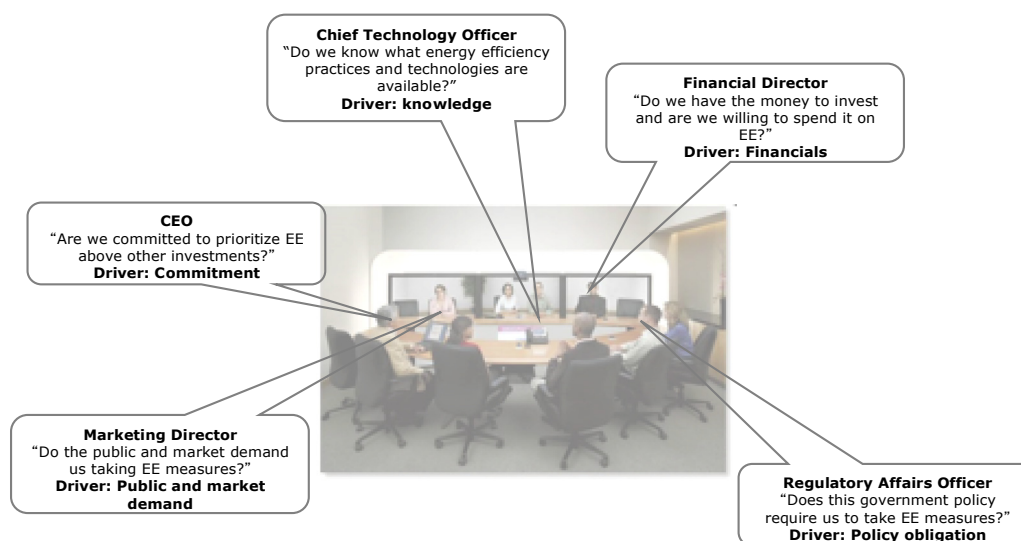
Essentially, the boardroom perspective delves into the major factors, or driving forces that decision makers within a large industrial company take into account when deciding on new investments. A driving force is defined, for the purpose of this study, as a mechanism that influences (either positively or negatively) the board's decision to invest in the most energy efficient practices or technologies. The five driving forces selected to represent the decision-making process are:

- Financials
- Knowledge
- Commitment to the environment and energy efficiency
- Public and market demands
- Policy obligation

Figure 3 provides an illustrative example of a boardroom where each director/officer is responsible for considering a particular driving force in the decision-making process:

- The **Financial Director** is responsible for conducting a thorough analysis of any financial decision that the company may take (e.g. capital investment requirements) and serves as a key advisor to company management.
- The **Chief Technology Officer** is responsible for maintaining the optimal knowledge on how to run and improve the production process.
- The **CEO** is the person in charge of the management of a company, including its commitments.
- The **Marketing Director** is responsible for communicating the level, timing and composition of public and market demand to decision makers, and advising the company on the course of action it should take to uphold its reputation.
- The **Regulatory Affairs Officer** has to ensure that the company complies with policy and legal obligations.

Figure 3 Illustration of the five drivers reflecting the boardroom's decision-making process



Source: Ecofys, 2011²

In reality, the structure of companies differs and the range of drivers that affect decision making is likely to be less clear-cut (e.g. not focus solely on energy efficiency). Moreover, the priorities of different businesses depend on the decision makers themselves. For example, even if the board agrees that there are financial benefits from investments that improve energy efficiency performance, the company will likely compare this investment decision against others competing

² Ecofys (2011). Material provided for this report.

for the company's resources. Further, a smaller firm may not have all these staff functions in place.

Despite these complexities, this perspective is a useful way to understand broadly how a typical industrial boardroom operates and thus constructively inform policy design so that policies can effectively stimulate boardrooms to maximise energy efficiency investments.

Selection of the five driving forces

An analysis of the literature provided the selection of five driving forces. In particular, two major studies influenced the choice:

- The policy analysis framework “Model Effectiveness of Policy Instruments for Energy-Saving in Industry” – developed by the Dutch RIVM institute and Utrecht University – describes seven factors (or drivers): policy pressure, the complexity of the technology, financial and economic pressure, market pressure, knowledge level, social pressure and the commitment to social issues like environment and energy (van Wijk *et al.*, 2001; Elzenga *et al.*, 2003).
- Corporate strategy analyses also detail the elements that influence the industrial environment. Grant (2010) describes six factors: policies, legal issues, technology, economics, natural environment and social issues.

While a broad range of possible driving forces exist and were examined, the selection was narrowed to five by organising the various drivers into major themes, and combining related drivers. This allowed a clearer analysis of how each driving force could be influenced by different policies. Narrowing the selection to five drivers was based on the following:

- The availability and the complexity of technology is a very important factor, mentioned in both studies. The scope of this work – evaluating the effect of policies on energy efficiency investments – assumed that energy efficiency technology is available. It is mainly the knowledge of the existing technologies that will play a role.
- Social and market demands were combined into one driving force.
- Social issues – within this study's scope – focus on environmental issues due to energy use.

Several examples of industrial practices are given throughout the report in text boxes that explain how the driving forces work in practice at the company level.

Swedish study on barriers and drivers for energy efficiency measures

Results from this study highlight a number of factors that inhibit the degree of implementation of energy efficiency measures in the Swedish non-energy intensive manufacturing industry, such as the cost and risk associated with production disruptions, lack of time and other priorities, lack of sub-metering in larger organisations, etc. The study also finds a number of drivers, such as the existence of people with real ambition and a long-term energy strategy at site level.

Source: Rohdin and Thollander, 2006.

Five driving forces impacting investment decisions

In this section, these driving forces are discussed separately, but in practice they interact. For example, when a long payback time (or low internal-rate-of-return, IRR) is applied, this may reflect the strong drivers of commitment, knowledge, policy obligations, and public and market demand.

Financial considerations

“Do we have the capability and/or willingness to self-finance or borrow money to invest and are we willing to spend it on the most energy efficient measures?” the Financial Director asks.

The financial situation of a company is determinative when it comes to making investment decisions regarding energy efficiency. This section identifies the key considerations of the financial decisions on energy-savings investments:

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- Internal sources of funding.
- Access to finance (borrowing from a bank and the institution’s willingness to lend for these investments).
- Financial viability of the energy efficiency projects (and other identified benefits, such as improved product quality, process efficiency and productivity).
- Priority of the energy efficient investment over other projects/investments that are competing for the company’s financial resources.
- Amount of investment necessary and whether it can be financed from the operating budget or as a capital expense.

Sources of funding

The primary financing options available for companies to finance energy efficiency projects are typically:

- Internal funding through the company’s operating and capital budgets. This is rare for major capital intensive projects in many private companies due to internal hurdle rates, requiring significant returns on investment. Using internal funds is not uncommon for smaller projects.
- Bank loans based on the company’s credit history and borrowing capacity. This allows the bank to have full recourse for loan repayment as an on-balance sheet transaction.
- Leasing from a third party.
- Shared and guaranteed savings structures offered by energy services companies (ESCOs) with a guarantee of cash flow for the company. These types of transactions are common in the United States (see box below).

To estimate which sources of funding will be used, the solvency ratio is often used. This ratio – a company’s after-tax income, as compared to its total debt obligations – indicates how much of the company’s assets are financed via own capital, instead of debt finance. In recent years, a solvency ratio of above 30% to 45% has been common with bigger companies (Ecofys, 2011).³ A bank will be less willing to lend if the solvency ratio is low.⁴ Typically, banks view lending for energy efficiency measures as they would view any other type of corporate loan, unless there is a major free-standing investment that could be financed through project finance that uses a special purpose investment vehicle.⁵ This would be financed off-balance sheet.

³ Nonetheless, different sectors have different solvency ratio levels. Bank lending will be based on a whole range of factors: assets, current debt, credit history, etc.

⁴ Acceptable solvency ratios will vary from industry to industry, but as a general rule of thumb, a solvency ratio of greater than 20% is considered financially healthy. (www.investopedia.com)

⁵ A project that is separated legally from the general activities of a corporation to permit lending and equity investments. Corporations can use such a vehicle to finance a large project without putting the entire firm at risk.

Internal sources of funding

Another criteria that will determine the extent to which companies will use equity to finance their investment, is the return on equity (ROE). ROE is a ratio that measures how much the shareholders earned from their investment in the company – and an important parameter for long-term investment decisions. The higher the ratio percentage, the more efficient management is in utilising its equity base, and the better the return is to investors. The ROE performance of a certain (national) production facility is an important indicator for the (international) parent company when deciding to provide investment capital. For most of the 20th century, the Standard & Poor's 500, a measure of the largest and best public companies in America, averaged a ROE of 10% to 15%. In the 1990s, the average return on equity was in excess of 20%.

Access to external finance

Energy efficiency/conservation investments often results in additional cash flow – not due to a new source of revenue, but by reducing cost. With an energy efficiency investment project, cash inflows are calculated on estimated savings that are based on actual energy usage measurements, historical energy usage records, and-validated and warranted equipment performance. Consequent reductions in maintenance and labour costs increase the ability of the company to repay the loan. These cost savings can be significant for many industries. Unlike power projects that generate a stream of additional revenue, energy efficiency projects generate a stream of savings. Thus, it is important for the company to identify and demonstrate to the bank the basis for the additional cash flow (which is then used for loan repayment).

Access to finance

Recognition of energy efficiency as a powerful tool to cut operating costs, improve the economy and reduce environmental pollution has never been greater; yet, the implementation of energy efficiency measures is slow to materialise. Once the necessary legal and regulatory environments, including availability of information, are in place, the single greatest reason for this slow progress around the world is the absence of commercially viable financing.

Source: IEEFP, 2009.

World Bank Group experience of working with financial institutions, both public and private, suggests that banks often do not have the in-house technical capacity to evaluate energy efficiency, renewable energy, or cleaner production investment projects. Banks can find it difficult to develop and structure appropriate financial products due to limited understanding of specific types of sustainable energy investments, making it difficult for them to estimate performance risk. In addition, energy efficiency equipment often has less collateral value than other investments. Normally, if a borrower defaults on an equipment loan the bank repossesses the asset financed. Energy efficiency equipment may be difficult to re-possess and has limited resale value.

Commercial banks in emerging markets may be relying on short-term deposits as capital, which limits their ability to structure financial products that allow flexibility in loan repayment terms. There are rarely any strategic partnerships between banks and technical service providers. This often results in a lack of recognition of the technical issues and technology involved.

Commercial banks may be reluctant to lend money for energy efficiency projects, which typically do not involve physical assets that would have a ready re-sale market or conventional revenue

streams. Despite cost savings, relatively low capital costs and short payback times, energy efficiency projects still have some upfront cost barriers such as the cost of an investment grade energy audit, which entails preparing an investment plan and a schedule of investment projects. This is especially the case for SMEs and residential consumers. The fundamentals of energy efficiency projects are usually sound, so often it is a case of overcoming typical SME lending barriers in these countries. Where SMEs are supported by bank lending, the SME financing and project financing may be linked to similar loan conditions: short-term loans only with a high collateral coverage; and a higher equity to debt ratio. Even banks with project finance capability, i.e., the capacity to appraise projects and lend on cash flow may be unwilling to do so for energy efficiency projects owing to their small size and doubts about savings cash flows (IEA 2010a).

The International Energy Efficiency Financing Protocol

The International Energy Efficiency Financing Protocol provides local banks and financial institutions (LFIs) with standard methods to evaluate risks and quantify the benefits of energy efficiency investments. The objectives of IEEFP are to create a better understanding amongst LFIs of:

- how energy efficiency projects generate reliable savings in operating costs of end-use energy consuming facility owners (Hosts), and
- how such savings equate to new cash flow and increased credit capacity for Hosts to repay energy efficiency project loans and investments.

Source: IEEFP, 2009.

Financial scale is another challenge to investment as these projects are typically small, thus resulting in disproportionately high transaction costs. This can make energy efficiency finance unattractive. For larger emerging market companies, additional investment for energy efficiency or production improvements is likely to be sought through corporate loans where the company has a strong enough balance sheet. Beyond bank loans, energy services companies (ESCOs), as described in the box below, can also offer external funding for energy efficiency projects.

Energy Service Companies (ESCOs)

The US National Energy Service Company Association (NAESCO) describes an ESCO as a business that “develops, installs, and arranges financing for projects designed to improve the energy efficiency and maintenance costs for facilities”. The ESCO business model relies on achieving the identified energy savings directly as a result of the project. The types of performance contract are described as shared savings (where the ESCO and company have a share of energy costs saved) or guaranteed (ESCO is paid a fixed remuneration based on achieving defined energy savings). ESCOs or banks may bear the risk of the energy-savings performance, or it may be shared. This depends on the business model being used and may be defined by regulation.

ESCOs provide energy efficiency finance services to companies/utilities unable to finance energy efficiency projects themselves. They offer to reduce a company’s energy use, which is usually financed through performance contracting. With these contracts, energy savings are measured and produce cash flows that pay for the purchase and installation of any new equipment, and provide a return for the ESCO. The main drawback with many ESCOs is that they are unlikely to have a large enough balance sheet to support the debt they must take on to purchase the equipment, unless the ESCO is sufficiently well capitalised, or backed by a larger parent corporation.

Source: Mason, 2011.

Financial viability criteria

When financial capital is available, either from the bank, the (international) parent company or own capital, the question is what criteria are used to calculate whether an energy- savings measure is profitable. Some of the commonly used criteria include payback period, internal-rate-of-return, net present value, and return on investment.

Many energy efficiency projects can reduce a company's operating costs sufficiently to cover 100% of the required debt service.

The simple payback period is length of time required to recover the cost of an investment – and is the rule-of-thumb criterion, widely used in firms for assessing smaller projects. However, this method does not take into account the longer term benefits of energy efficiency projects. Most firms have fairly short payback period cut-offs (see Table 2).

Based on a survey amongst almost 800 manufacturing firms in six European countries, CPI & Climate Strategies (2011) reported that, on average, firms apply a payback time for energy-savings measures of up to four years. Firms at the 90th percentile allow a payback time of seven years, whereas firms at the tenth percentile require a payback period of one and a half years. Payback times also vary systematically among sectors and countries (CPI & Climate Strategies, 2011). Blok (2007) reported similar data (see Table 2).

Table 2 Distribution of required payback periods by firms in the Netherlands and Germany

		1-2 yrs	3 yrs	4 yrs	5 yrs	> 5 yrs
% of companies	Germany	8%	27%	13%	27%	15%
	Netherlands	12%	15%	31%	29%	12%

Source: Blok, 2007 (reproduced with permission from Techne Press).

For larger investments, it is common practice to use internal-rate-of-return (IRR) criteria instead of simple payback criteria.⁶ The IRR of an investment is the interest rate at which the net present value of costs (negative cash flows) of the investment equals the net present value of the benefits (positive cash flows) of the investment. Companies typically demand IRR values to be higher than 10% up to 25%.

However, IRR is not a complete guide. In an example from IFC (Figure 4), a company identified a portfolio of measures and projects that need to be implemented to reduce energy consumption. The costs of the measures vary, as do the individual returns on investment (ROI). The new power unit has a return on investment of 30%, but is more expensive than some of the other cheaper measures that have poorer return on investments which may be insufficient to meet internal project financing approval. However, if the company does implement new ovens, lighting and HVAC, then the energy savings may result in a smaller and cheaper new power unit. Overall, the portfolio of measures has a reasonable ROI of 22%, which may meet the company and bank's eligibility requirements.

Overall, even where an energy efficiency project or new series of energy efficiency investments may seem realistic, the question of access to finance arises. This section illustrated only some of the issues small companies have to deal with. Policy makers may want to consider how and if

⁶ The payback time and IRR are related, although the lifetime of the project is not accounted for in the payback period. As a rule of thumb, the IRR is slightly higher than the inverse of the payback period for projects with a lifetime of more than 15 years.

policies and incentives could be developed to encourage banks to lend for projects with a significant energy efficiency potential. However, this is beyond the scope of this report.

Figure 4 IFC's portfolio of measures and policies

Prioritising EE finance opportunities: Portfolio approach

Project	Cost	Annual energy savings	ROI
Pipeline leakages	100	30	30%
Clean power/Biomass	10 000	3 000	30%
Variable speed drives	1 000	200	20%
Ovens	5 000	500	10%
Lighting	1 000	100	10%
HVAC @warehouse	1 000	100	10%
PORTFOLIO	18 100	3 930	22%

How would you prioritise?

Source: Mason, 2011.

Knowledge

“Do we know what energy efficiency practices and technologies are available?” asks the Chief Technology Officer.

In order to invest in energy efficiency measures, it is critical for companies to gather information on all available technology options, the benefits and cost of each option and the impact efficient technologies will have on production processes (e.g. discontinuation of the production process).

In practice, to identify energy efficiency opportunities, a company will often engage an energy consultant or auditor. In many countries e.g. Thailand, Vietnam, the United States of America, this service may be subsidised to encourage the uptake of energy efficiency audits. An initial energy use review (often performed first) may then lead to a detailed energy audit being commissioned.

The energy efficiency audit specifies the range of measures (including energy management, plant operation and investments needed) from low to higher cost. Detailed audits should include sufficient information so that the company's management team can make an investment decision. Typically, this should cover both the technical and project financing components:

- Details of proposed energy efficiency measures.
- Financial analysis: estimated savings and breakdown of costs.
- Savings calculation methodology.
- Energy management and operating standards.
- Funding options and cash flows.
- Implementation plan with maintenance procedures and energy use monitoring.

A firm's access to knowledge can be estimated through a number of indicators. Firstly, the share of energy in the total production cost is an indicator since energy intensive companies tend to spend more resources on identifying energy efficiency technologies and equipment vendors. The presence of energy management practices within a company is another indicator, such as the assignment of energy and/or environment managers or coordinators, the implementation of an energy management system, or the capability and training of staff to manage energy. Finally, the presence of sector-specific research institute(s) or knowledge centres can indicate that firms have access to the information they need to make decisions on energy efficiency.

The need to increase knowledge of energy efficiency measures

About 30% of the firms indicate that they are not, or only to a lesser extent, aware of existing new technologies that are not yet being used in practice by any firm. Of course, a smaller percentage of 20% have only limited knowledge of technologies that are currently used by other firms. These results suggest that future policy can improve the situation by providing firms with relevant information on investment possibilities in energy saving technologies.

Source: De Groot *et al.* 1999.⁷

Commitment to the environment and energy efficiency

"Are we committed to giving priority to investments with energy efficiency benefits over other investments?" asks the CEO.

Investments to improve energy efficiency are likely to bring about numerous benefits. The challenge is to identify the range of measures and investments and then prioritise them according to cost, company investment policy, simple payback and IRR. A commitment to environmental protection determines whether or not companies will make energy savings a priority. This commitment facilitates the approval of efficiency projects compared to other investment options (Prindle, 2010). This driver is defined as the degree of willingness within a sector or company to invest in energy saving measures. Frontrunners show clear leadership when it comes to energy efficiency objectives. When there is little or no commitment, firms will have a natural tendency to prioritise other, more financially appealing investments (using conventional financial analyses) over energy savings, such as increasing production rather than reducing operating costs. Actions such as participation in business-NGO partnerships show a high level of commitment.

Commitment is needed to make energy efficiency a priority

High commitment shows when CEOs talk about energy: they are eloquent, committed, and know key facts. Committed firms make energy savings a priority, and force the organisation's decision makers to reset their investment priorities to favour efficiency. Commitment helps efficiency projects to get approved even when conventional financial analyses make them appear less favourable compared with other investment options.

Today's best energy efficiency strategies of companies break down walls between functional units, business units, and other organisational domains.

Source: Prindle, 2010.

⁷ Based on a survey among 135 industrial companies in the Netherlands.

World Wildlife Fund Climate Savers programme promotes corporate commitment

Leading corporations are partnering with WWF to establish ambitious targets to voluntarily reduce their greenhouse gas (GHG) emissions. Collectively, Climate Savers partners will reduce CO₂ emissions by over 50 million tonnes by the end of 2010. By increasing efficiency, Climate Savers companies are saving hundreds of millions of dollars, proving again that protecting the environment makes good business sense.

Source: WWF, 2011.

Commitment is needed at all levels

But Dow shares with other companies the challenge of persuading production managers to consider changes in operating practices and technologies. Production staff are focussed on product quality, production volume, and reliability of equipment and systems. Energy improvements, be they changes in operating or maintenance procedures or new technologies, pose potential risks to these ironclad principles.

Source: Prindle, 2010.

Demands of the public and the market

“Does the market or the public require us to take energy efficiency measures?” asks the Marketing Director.

Pressure and demands from the public and the market play a crucial role in driving investments in energy efficiency projects. The “public and market demands” refers to the pressure from institutions such as non-governmental organisations, shareholders, the media and market on companies to save energy.

There are three types of demands:

- Public awareness of CO₂ emissions, energy use or pollution issues. The public is increasingly concerned with the environmental performance of businesses.
- The pressure of peers or competitors that increases a company’s awareness of its competitive position. This can originate from:
 - benchmarking the energy or emissions performance of companies, which is often an integral part of the policy (e.g. benchmarking under the EU Emissions Trading Scheme (EU ETS));
 - the publication of carbon exposure risks by credit-rating companies. The investor community is increasingly requesting such data; and
 - corporate initiatives e.g. the Carbon Disclosure Project, which identify companies that are actively taking steps toward a low-carbon economy.
- Pressure from the production chain. Suppliers or clients may request emissions reductions or energy conservation efforts. Suppliers of industrial equipment may also be subject to regulations that require more efficient equipment/appliances being produced.

Companies act on environmental issues to keep up with their competition

A CEO who waits for [government] guidance on these issues will lag behind a competitor who takes a more active approach [...]. In the end, [energy] inefficiencies show up as business costs [...]. Even though the primary driver may be public policy, business benefits from the exercise.

Source: Dell and Techtargent, 2010.

The global investor community continues to request more data on direct and indirect emissions as well as climate change progress, effectively raising the carbon disclosure bar. Institutional investors are moving beyond corporate commitments, assessing investments in forward-looking, climate change related business strategies.

Source: CDP, 2009.

Policy obligation

“Do policies require us to take the most energy efficient measures?” asks the Regulatory Affairs Officer.

Policy obligation is defined as the regulatory pressure companies face to improve their energy performance (e.g. behavioural energy efficiency standards or obligations). Regulatory obligations can be technology prescriptive as in the case of equipment standards and process configuration prescriptions; management-prescriptive regarding auditing, conservation planning and energy management standards; or performance-oriented as in plant, firm or sector regulation to achieve absolute energy savings.

Regulations for Equipment Retrofitting and Replacement in China

Within the 11th Five-Year Period (2006 to 2010), China's strategic plan for energy efficient industrial processes involves equipment renovation, and the design and implementation of process optimisation and management measures. As regards specific equipment, the Chinese government also mandated the efficient use of exhaust, pressure and heat from mining and industrial processes. For example, iron and steel enterprises should apply: coke dry quenching (CDQ) and top-pressure recovery turbine (TRT), renovate all blast furnace gas power generation, and implement converter gas recovery to save 2.66 million tonnes of standard coal; and install each year 30 sets of medium and low-temperature exhaust heat power generation equipment in concrete production lines with a daily yield of 2 000 tonnes.

In 1999, the central government asked that all shaft kilns in the cement industry with a diameter of less than 2.5 meters be shut down for both energy efficiency purposes and slowing down economic development. Many shaft kilns were retrofitted to larger diameter ones because there was a strong demand for from the market (Wang, 2006). Although the government adopts administrative methods to promote or limit development in some aspects, the market force plays the decisive role.

Source: IEA, 2008b.

Within the boardroom perspective framework used in this paper, this driver refers to companies' obligations to undertake energy efficiency measures in-house. While other policies (e.g. subsidies for efficient equipment or taxes on energy use) may motivate a company to take energy-savings actions, such policies do not hold specific targets or obligations for energy savings, or require companies to take measures.

Regulations for the use of Best Available Control Technologies (BACT)

The Clean Air Act requires that all new “major sources,” and all major sources undertaking modifications that result in a “significant” increase in emissions, obtain pre-construction permits and install “best available control technology” (BACT) for all pollutants subject to regulation. Large industrial facilities – such as power plants and oil refineries – will require a permit as of early 2011 for projects that increase GHG emissions substantially.

Source: Danish et al., 2010.

Clarity on future policy obligations makes companies act

To remain effective, standards must be regularly updated. Indeed, there is no incentive for manufacturers/constructors to go beyond what is required if no stricter standards have been planned for the future. It is therefore essential to review and reinforce standards at regular intervals as a way of stimulating technical progress and to ensure a steady improvement in energy efficiency.

Source: World Energy Council, 2008.

In the next section, the concept of driving forces is elaborated upon and shows how policies and the characteristics of each can affect the different drivers of investment decisions for energy efficiency.

Illustration of drivers influencing decisions

The rationale behind an individual company’s decision to make an investment that reduces energy consumption varies considerably across sectors. Decisive factors include: the size of a company; energy intensity; cost of energy related to overall production costs; whether energy efficiency improvement is an incidental benefit of process equipment upgrade – or part of a concerted effort to implement an energy efficiency programme; financial state of the company; whether it is in a growth or sunset sector; and whether it has easy access to finance.

Industrial companies can undertake different types of energy efficiency measures: each driver will influence the decision-making process differently. For example:

- When companies consider one-off investments (*e.g.* equipment upgrading) are they aware of the most efficient technologies (**knowledge**)? Do they have the financial capacity (**financials**) and willingness (**commitment**) to invest in technology that may be more expensive than others?
- To continuously identify energy efficiency improvements (*e.g.* through an energy manager) do companies know which energy management practices are optimal (**knowledge**)?

However, the **relative importance of each driver** may not be the same, and depends on the sector’s characteristics and the type of energy efficiency measures. For example, for simple housekeeping measures or low-cost investments, the main barrier to investment may be a lack of **knowledge** of energy efficiency opportunities if a policy does not oblige and hence help companies to invest in these “low-hanging fruits”. As the cost of investments increases, **financing** becomes a more significant barrier to investment decisions.

To illustrate, consider a situation (see Table 3) where three options with the same investment costs compete for a single investment decision: (1) a production line for a new sustainable product (*i.e.* impacts the environment less than its substitute products); (2) improve energy efficiency of the existing production line; or (3) installing air pollution abatement technology.

Table 3 Illustration of driving forces competing for a single investment decision in the boardroom

Driving force	Investment		
	(1) Production line for a new sustainable product	(2) Improve energy efficiency of production line of existing product	(3) Last stage of installing air pollution abatement technology on production site
Financials	<ul style="list-style-type: none"> • Access to money is difficult and financing only provided if the investment improves business prospects. • Payback time of about 5 years. • IRR about 17% with a project depreciation period of 20 years. 	<ul style="list-style-type: none"> • Access to money is difficult and financing only provided if the investment improves business prospects. • Payback time < 2 years. • IRR of about 40% with a project depreciation period of 5 years. 	<ul style="list-style-type: none"> • Access to money is difficult and financing only provided if the investment improves business prospects. • Measure has a negative payback time and IRR.
Knowledge	Production line is standard and bought under guaranteed performance conditions.	Several on-site projects; most are technically straightforward; will improve overall performance.	Established abatement technology. Bought under guaranteed performance conditions.
Commitment to environment and energy efficiency	Sustainability (broad definition, e.g. reducing footprint) is really the new company's profile.	There is still commitment for energy savings, on site, as part of a voluntary agreement.	Reducing air pollution was the commitment of the past. The firm now considers itself a clean producer; no further investments are needed to confirm this position.
Public and Market demands	Increasing call for sustainable products from clients and the public. The company's peers are also considering setting up innovative production lines.	The public is not interested in energy efficiency. Some peer pressure from participating in a voluntary agreement. In the future, clients may demand higher energy efficiency products.	The public and the market do not pressure the company to make new investments in efficient technology.
Policy obligation	None	There is a voluntary agreement on energy efficiency, but no real obligation to act.	Obligation to install between now and next 5 years. In practice, there is medium enforcement of the obligation and the 5-year limit may be negotiable.

In the example, the energy efficiency improvement (2) is most advantageous in financial terms. By contrast, the commitment to invest and the demands from the market and public are pointing towards investing in a new production line for a sustainable product (1). At present, policies do not oblige the company to invest in any of the three options, but installing air pollution abatement technology (3) will probably be enforced within the next decade.

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This arbitrary example illustrates the complexity of conditions and drivers that set the priorities in the board's decision and also underlines the need for a mix of tailored policies to prioritise energy savings.⁸ In order to make any investment decision, the company has to be in a healthy, commercially viable state, independent of the type of energy efficiency investment. Another key factor may also be continuing belief in government policy and its implementation or lack of it, for promoters and financiers to make longer term investment decisions. Furthermore, the choice of technology and whether a company is energy efficient are likely to be driven by other factors such as compatibility, ease of maintenance, life cycle cost, and overall cost-effectiveness, of which energy consumption may be a part, but not the sole reason.

In the next section, the concept of driving forces is elaborated upon and it is shown how different policies can impact the driving forces of investment decisions for energy efficiency.

⁸ Apart from the difficulty of finding finance for energy efficiency, companies often prioritise investing capital or utilising their credit capacity to finance core business activities. Even energy efficiency projects with very high IRRs of 25% to 30% can find it difficult to compete with one-year internal hurdle rate of returns projected for core business investments of many large industrial companies –even though the risk factors associated with projected returns on core business investments are much higher than the low risk of investing in energy efficiency.

Evaluating energy efficiency and GHG mitigation policies using the boardroom perspective model

In this section, the way the characteristics of different policies influence the five driving forces are described, according to a policy instrument typology.

Policy types

A country's policy package can be classified in different ways: prescriptive (or regulatory), economic, and information instruments. Within our framework, this policy instrument typology is proposed to simplify the diverse range of different policies, thereby enabling an analysis of how different policies, and the characteristics of each policy, can influence the driving forces of corporate decision making described in Section 2.

Table 4 Different policy instrument types

Type	Sub-types	
Prescriptive	Norms/standards	Equipment
		Production process
		Product
	Mandatory targets	
	Voluntary targets (negotiated agreements)	
	Obligations/commitments	Energy auditing
		Energy management
		Technology implementation
		Technology phase-out
	Other	
Economic	Taxes	Energy
		CO ₂ / GHG emissions
	Incentives and subsidies	Subsidies and grants
		Preferential loans
		Early depreciation
		Third party financing
		Tax credits and exemptions
	Tradable permits	GHG emissions
White certificates		
Information	Labelling	
	Other	Education and outreach
		Data collection and audits
		Capacity building

Source: Adapted by IIP and SQ Consult from Tanaka, 2009.

Various types of policies and policy instrument characteristics have different effects on the driving forces. For each policy type, its impact on the five driving forces for company decision making is analysed.

Prescriptive policies

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Policies that involve regulation can either communicate expectations or oblige industry, companies and/or associations to take action. These can be technologically prescriptive, for example, equipment standards and process configuration prescriptions; management prescriptive as in the case of auditing, conservation planning and energy management standards; or performance oriented as in the case of plant, firm or sector regulation, and agreements concerning benchmark targets and absolute energy-savings goals.

Norms and standards

Norms and standards impose minimum efficiency performance standards on equipment, products and the production or energy management process. Regulations on equipment efficiency – which commonly take the form of minimum efficiency performance standards (MEPS) or Top-Runner type programmes in Japan – are generally applied to products in the residential, commercial and automotive sectors.

In industrial practice, most regulations are applied to broadly used equipment or processes, such as electric motors and boilers. Regulations affect equipment manufacturers and importers most directly, thus preventing them from selling inefficient equipment.

Several governments (*e.g.* Denmark, Ireland, the Netherlands, Sweden and the United States) prescribe generic compliance with energy management (standard) procedure (*e.g.* ISO energy management standards).

Table 5 illustrates the impact norms and standards can have on the five drivers. It is evident that the highest impact is on the “Policy obligation” driver.

Obligations and commitments

Several governments require companies to implement energy efficiency actions through commitments or obligations, for example, through mandatory energy auditing or energy management programmes.⁹ Such programmes require the appointment of a certified energy manager in companies, or obligatory, regular energy auditing, as in China and India. Again, this category of policy instruments has the highest impact on the driving force “Policy obligation” (Table 6).

⁹ Energy management (EM) is a loose collection of business processes, carried out at plants and firms, and designed to encourage and facilitate systematic, continuous improvement in energy efficiency. They help managers and staff to identify, carry out, monitor and learn from technical actions. Among the typical elements are: strategic plans; maintenance checklists; manuals documenting projects; energy purchase, use and disposal procedures; measurement processes; performance indicators and benchmarks; progress reporting; energy coordinators; and demonstration projects (Price et al, 2007).

Table 5 Different norms and standards

Driver	Impact on driver	Description and policy characteristics influencing the impact on the driver ¹⁰
Financials	Low	Norms and standards do not directly influence the economics of energy efficiency options, therefore the impact on the financial driver is low.
Policy obligation	High	As norms and standards usually impose minimum efficiency performance standards, the policy obligation is high. In practice, the effect of the policy obligation depends on the following characteristics: <ul style="list-style-type: none"> • Ambition level: are levels based on average firm performance (-) or top-runner (+). Are the levels revised periodically (+)? • Legal force: does non-compliance result in sanctions? • Level of execution and enforcement.
Knowledge	Medium	A high level of execution and enforcement will increase the level of knowledge concerning energy efficiency.
Commitment	N/A	Very case specific.
Public & market demands	Low	Public and peer pressure, or pressure from the chain does not play a significant role in norms and standards. If norms are set for consumer products, they could indirectly affect the demands on energy efficient production.

Obligations to report energy efficiency opportunities

Under Australia's Energy Efficiency Opportunities (EEO) programme, companies that use more than 0.5 petajoules (PJ) of energy per year are required to undertake energy assessments. These identify opportunities for projects of up to four years payback, quantify these opportunities and state the company's business response to these opportunities. The results of the assessments must then be periodically communicated to the public and the government.

Source: DRET, 2010a.

¹⁰ The information and questions in the third column of the tables in this section provide a guideline for an in-depth policy evaluation of case studies. (+) indicates an increase of the instruments effect on a driving force; (-) indicates a decrease.

Table 6 Different obligations and commitments

Driver	Impact on driver	Description and policy characteristics influencing the impact on the driver
Financials	Low	Obligations and commitments do not influence the economics of energy efficiency options. So, the impact on the financial driver is low.
Policy obligation	High	The scope of the obligation and the level of enforcement determine the actual impact of a specific policy instrument. After receiving an energy efficiency audit report, many companies may confine themselves to only implementing no- or low-cost measures, and may miss out on major energy improvements that require significant investment.
Knowledge	Medium	Obligations on energy management or audits will increase the understanding on energy efficiency options and opportunities.
Commitment	N/A	This policy does not directly affect a company's commitment.
Public & market demands	Low	Obligations to improve a company's internal processes do not influence the public or market. So, the impact on this driver is low.

Voluntary targets and negotiated agreements

Negotiated and voluntary agreements often involve contracts (or covenants) between industrial sectors and governments, which outline energy use or CO₂ emissions targets and schedules for industry. Such agreements are in place in Japan, the Netherlands and China.

Industrial energy efficiency programmes increase access to knowledge

Countries with strong industrial energy efficiency programmes provide information on energy efficiency opportunities through a variety of technical information sources, including energy efficiency databases, software tools, and industry or technology specific energy efficiency reports. [...] In the LIEN programme in Ireland, seminars and workshops are held to share information from experts and other specialists, to demonstrate tools and resources for implementing or improving energy efficiency, and to address specific issues such as plastics processing, energy markets, renewable energy for industry, and staff awareness campaigns. In the Netherlands, knowledge sharing is supported through networks that focus on energy efficiency improvements in specific areas that help to prepare roadmaps for sectors.

Source: Horvath *et al.* 2010.

Table 7 Different voluntary and negotiated agreements

Driver	Impact on driver	Description and policy characteristics influencing the impact on the driver
Financials	Low	<p>The impact of voluntary or negotiated agreements on the financial driver depends on whether the government provides financial incentives or penalties to implement the programme.</p> <ul style="list-style-type: none"> Supply of resources could be part of the program (+) or a levy in case of non-participation (-).
Policy obligation	Low	<p>Generally, policy obligation is low as participation in negotiated agreements is, in principle, voluntary.</p> <ul style="list-style-type: none"> The threat or penalty (<i>e.g.</i> no tax exemption) in case of non-compliance (+). The exemption from other policies is an incentive in Denmark, Finland, Germany, Switzerland, the Netherlands, United Kingdom and United States. Threats of future regulation, should the negotiated energy or CO₂ targets not be met, are the basis of negotiated agreements in Belgium, Japan, Korea and the Netherlands. The stringency of the energy or CO₂ targets of negotiated agreements vary: from very ambitious (+) to less so (-). The covenant programme requires that, on average, companies will need to double the energy efficiency improvement rate compared to business as usual. The presence of an energy agency has the role of helping to enforce the negotiated agreements and covenants (+). The threat of publicising non-compliance information, thus tarnishing industries' or companies' public images (+). This is an incentive in negotiated agreements in Japan, Sweden and the United States.
Knowledge	High	<p>In general, negotiated agreements strongly focus on knowledge building, usually through the following:</p> <ul style="list-style-type: none"> Support from government institution (Energy Agency or consultancies) to facilitate the implementation of the agreement (+). Preparation of sectoral roadmaps (+). Preparation of knowledge exchange platforms or activities, <i>e.g.</i> workshops, development of tools (+). Requirement to undertake energy management as part of agreements; sometimes this is standardised.
Commitment	Medium	<p>Voluntary agreements positively affect commitment, as they are multilateral instruments, whereby government and industry work together on improvements.</p> <ul style="list-style-type: none"> Is the target ambition set by the sector/firms (+) or more or less imposed (-)? Does the agreement include preferential treatment, <i>e.g.</i> exemptions from taxes (+)?
Public & market demands	Medium	<p>Voluntary targets influence the market mainly via peer pressure, as companies within a sector compare their performance with others. The effect on this driver is mainly determined by the extent to which a sector's performance is made public. More public information will generate increased public and market pressure.</p>

Mandatory targets

The analysis of the impact of mandatory targets on the driving forces is the same as above (for voluntary targets and negotiated agreements), except that the policy obligation is high.

Economic instruments

Economic policy instruments include taxes and tax reductions, directed financial support (e.g. subsidies and loans), greenhouse gas (GHG) prices with GHG emissions cap-and-trade schemes, and differentiated energy prices which seek to influence the cost-effectiveness of technical actions. These instruments can be focused on specific sectors or applied generally across multiple sectors.

The financial flows (and sometimes tax reductions) can be technology prescriptive as in the case of equipment-specific subsidies or management prescriptive as in the case of subsidised audits. In general, taxes and tax reductions, and cap-and-trade schemes are performance oriented, aimed at energy savings or energy-intensity improvement goals, but lack any prescription for technologies or management practices.

Taxes¹¹

All IEA member countries tax fuel and/or electricity with value-added tax (VAT) and excise duties. Denmark, Finland, the Netherlands, Norway, Sweden, Switzerland and the United Kingdom also have taxes on the CO₂ content of energy.

Abolishing energy subsidies, which were initially designed and applied to stimulate national economic development, can have the same impact on energy efficiency as introducing an energy tax. Higher energy prices through energy taxes or the abolishment of subsidies raise energy costs as a share of a company's operating costs and sends a stronger price signal to the company to reduce energy consumption.

While there is a trend among OECD countries to cut these subsidies, energy prices for industry may be distorted in many emerging economies, thus remaining low or subsidised. Consequently, investments in improving energy efficiency are unlikely to be a key priority for industry. This policy intervention is treated in the same way as applying energy tax, and is likely to have the same effect on decisions made in the boardroom.

Energy taxes increase energy costs by 5% to 15%

In most OECD countries and for most fuels, the share of energy taxes in total energy costs for industry is between 5% and 15%, up to 30%. In a few exceptional cases, this share is more than 40%, whereas some countries have very low or no taxes for certain fuel sources.

Source: IEA, 2011.

¹¹ Import duties/taxes on energy efficiency related technology are not considered in this report. Nonetheless, they represent a significant barrier in some emerging countries where these taxes are high.

Energy price subsidy cuts

In many emerging economies where energy prices for industry may be distorted, remaining low or subsidised, investments in improving energy efficiency are unlikely to be a key priority for industry. Consequently, energy conservation and efforts to encourage energy efficiency need to be supported by an energy policy and energy pricing framework. Tariff arrangements need to be robust so that separate cost components for generation, transmission, distribution, and businesses can be identified. If not, then tariffs may not be updated periodically to pass-through changes in supply costs and reflect the cost for each business. In Vietnam, for example, electricity prices jumped 11% in 2009 soon after cross-subsidies were cut.

Source: Mason, 2011.

Table 8 Different taxes and their impact on the drivers

Driver	Impact on driver	
Financials	High	Taxes directly influence the financial parameters of investment in energy efficiency. The impact depends on the share of energy cost in an industry sector and the size of the tax.
Policy obligation	Low	Although companies are obliged to pay taxes, such policies do not force companies to take the most energy efficient measures. So, the policy obligation on energy efficiency measures is low.
Knowledge	Low	Taxes do not affect the knowledge level of energy efficiency.
Commitment	N/A	This policy does not directly affect a company's commitment.
Public and market demands	Medium	Taxes have little influence on the public demand for energy-savings measures. Typically, the first order effect of fuel tax is to improve the fuel efficiency of the fuel user; as a second order effect, firms or consumers downstream may also be affected by prices being passed down the chain. The potential impact on their energy efficiency performance is less direct.

Incentives and subsidies

The industrial sector often receives reductions from energy or CO₂ taxes, due to concerns about the impact of taxes on international competitiveness. Sometimes, countries tie favourable tax treatment to industry's energy-saving efforts, such as meeting sectoral energy or CO₂ targets (e.g. in negotiated agreements) and making energy efficiency investments.

Governments also use other, non-tax, financial incentives, such as subsidies, preferential loans and research and development funds to encourage companies to identify energy efficiency opportunities and make energy efficiency investments. Subsidies are very popular measures in many countries. Preferential loans or loan guarantee schemes for energy efficiency investment are used in fewer countries but are on the rise. Table 9 demonstrates the impact of subsidies on the drivers and shows that, as can be expected, the biggest impact is on the financials driver.

Table 9 Impact of different subsidies on the drivers

Driver	Impact on driver	
Financials	High	<p>Subsidies directly influence the financial parameter of investments in energy efficiency measures.</p> <ul style="list-style-type: none"> The impact of the subsidy or incentive depends on the value of the subsidy on technology costs: by how much are costs for energy efficiency measures reduced and their effect on payback periods and IRR. In case of technology specific subsidies, the more the list is targeted and updated, the higher the chance that these will create additional investments and lessen “free rider” behaviour. Free riders use the subsidy for investments they would have taken anyway. <p>Subsidies for energy audits will also reduce their costs.</p>
Policy obligation	Low	Applying for subsidies is voluntary and the instrument does <i>not require</i> industry to take energy efficiency actions. Hence, the policy obligation is low.
Knowledge	Medium	<p>Incentives and subsidies have an effect on companies’ knowledge of energy efficient options, because it draws their attention to energy efficiency opportunities (in the case of subsidised audits), and to those technologies that are eligible for the subsidy. Other specific policy characteristics affecting knowledge are:</p> <ul style="list-style-type: none"> if the subsidy is for a new technology (+) or for technology that is well known and on the market (no effect); and the availability of technology lists and descriptions available under the subsidy (+).
Commitment	N/A	This policy does not directly affect a company’s commitment.
Public and market demands	Low	Technology subsidies have a limited effect on the public and market demands.

Prescriptive subsidies should be precisely targeted

Technology-specific subsidies can be substantially improved in terms of their effectiveness by avoiding the subvention of technologies that are already profitable without the subsidy. In other words, the characteristics of the subsidised technology have to be an important steering factor when designing subsidy programmes.

Source: Blok *et al.*, 2004.¹²

¹² Based on survey of >800 firms in the Netherlands.

Developing new technologies through subsidies

The government of the Netherlands currently promotes the use of energy efficient technologies. For this reason, the Ministry of Economic Affairs has decided to make a five million euro subsidy available for building the Hisarna test plant. "This is not a full-scale blast furnace, but it isn't a laboratory set-up either," says project leader, Koen Meijer. The main question that needs to be answered is whether Hisarna can compete with existing blast furnaces economically and also its impact on the environment.

Source: Tata Steel, 2010.

Tradable permits

Greenhouse gas emissions trading schemes (ETS) are now running in the European Union, Norway, north-western United States (RGGI) and New Zealand. In other countries, schemes are being prepared or piloted.

The Indian "Perform Achieve Trade" (PAT) scheme (launched in 2011) will set specific energy consumption (SEC) targets for large industrial and power installations. Those exceeding their energy performance goals can sell the surplus credits to those installations that fail to meet their required cuts.

Different designs of ETS schemes are possible. The main design parameters include:

- The implementation of an absolute emissions cap (the "cap-and-trade" GHG schemes) (in the European Union) or caps relative to output ("baseline-and-credit" schemes or performance targets) (in India) (see IEA 2010b for more details).
- The volume of "offsetting" that is allowed in the scheme. This refers to the number of permits from outside the scheme that can be used for compliance.
- Whether permits are allocated free of charge or auctioned.

Table 10 shows that tradable permits can have a high impact on the financials driver but also to a lesser extent on the policy obligation and public and market demands drivers.

ETS regulation stimulates the creation of publically available information

Allowance prices represent information about the economy wide marginal cost of emissions reductions that has never been available previously to regulators, but thus far programmes have not found a way to readily adapt, given this information.

Source: Burtraw et al., 2009.

Table 10 Impact of tradable permits on the drivers

Driver	Impact on driver	
Financials	High	<p>What are the costs of the permits that need to be bought for compliance?</p> <ul style="list-style-type: none"> • If all permits are auctioned, participants in the trading system will have to pay for all emission (or energy) permits. This will have a high impact on the finances of the company (Reinaud and Philibert, 2004). • In some cases, below an absolute GHG emissions (or energy) cap, permits will be provided for free (<i>e.g.</i> based on historical emission levels, called “grandfathering”). This will lower the impact ETS have on the finances of a company (Reinaud, 2008).
Policy obligation	Medium	<p>If the cap-and-trade scheme covers GHG emissions, the instrument does not require industry to take energy efficiency actions immediately. However, companies will consider the opportunity costs of reducing emissions versus taking responsibility for its emissions elsewhere through trading. Two design features will increase this effect:</p> <ul style="list-style-type: none"> • An ambitious cap, and consequent high CO₂ price will put in-house energy efficiency measures forward as the best compliance option. • A high level of execution and enforcement – usually the case for tradable permits – will increase the policy obligation. <p>If the cap-and-trade scheme (or baseline and credit scheme) covers energy use, companies will be immediately required to improve their efficiency levels or purchase permits from those who have over-achieved relative to their target.</p>
Knowledge	Low	<p>In general, the effect of tradable permits on a company’s knowledge of energy efficiency measure is small.</p> <ul style="list-style-type: none"> • In case of benchmark based allocation, the interaction of government and sectors – in establishing the benchmarks - increases individual companies’ knowledge of their relative performance.
Commitment	N/A	<p>This policy does not directly affect a company’s commitment.</p>
Public and market demands	Medium	<ul style="list-style-type: none"> • Typically, the first order effect of tradable permits is to improve the energy or carbon efficiency of the fuel user and/or carbon emitter. As a second order effect, companies or consumers downstream may also be affected by forwarded price signals (though the potential impact on their energy efficiency performance is less immediate). • The policy instrument increases peer and public pressure on companies through the <i>public disclosure</i> of companies’ emissions or energy performance.

Information policy instruments

Information policies (or measures) aim to increase knowledge of energy efficiency opportunities and consist of informational, analytical and institutional measures which help to establish a favourable environment for industry to implement energy efficiency actions. Examples of information policies or measures are: identification of opportunities (*e.g.* energy use data collection, energy audits and benchmarking) and best practices, capacity building, labelling, public disclosure, and cooperative measures (*e.g.* government-industry challenges and partnerships).

Labelling

Different types of labelling exist: labels that indicate the energy or GHG emissions performance of appliances; footprint labels that cover the performance of a product throughout its production and distribution phase; and the energy performance of production facilities. Efficiency labels for manufacturing equipment (*e.g.* motors) are used in Canada, the European Union and United States. Other capacity building programmes are used in Ireland, Germany and the United States (Tanaka, 2009).

Korean governmental institute introduces carbon footprint label

Following a nine-month pilot programme, the Korea Environmental Industry and Technology Institute (KEITI)¹³ introduced a carbon label in February 2009. So far, more than 230 goods and services have been labelled. The labelling covers, amongst others, consumer goods, transport services, electronic appliances and production goods. In May 2010, the law for Low Carbon Green Growth became effective. It obliges the state to invest at least 2% of Gross Domestic Product (GDP) in low-carbon production and consumption.

Source: PCF World Forum, 2011.

The ENERGY STAR label for manufacturing plants

An ENERGY STAR qualified facility meets strict energy performance standards, set by EPA, and uses less energy; is less expensive to operate; and causes fewer GHG emissions than its peers. To qualify for the ENERGY STAR, a building or manufacturing plant – cement plants, container glass manufacturing, flat glass manufacturing, and petroleum refineries – must score in the top 25% based on EPA's National Energy Performance Rating System.

Source: EPA, 2011.

Other information policies and measures

Information policies entail best practice information sharing, consultancy services, decision aids, and education and training. They are often supported by energy efficiency opportunity identification tools (*e.g.* data collection, energy audits and benchmarking). These policies help companies lacking the resources or interest to build their own in-house expertise to assess and implement technical measures to improve energy efficiency. Moreover, they help companies to assess their performance compared to their peers. In some cases, capacity building is used in

¹³ KEITI is a subsidiary governmental institute. The main role of the KEITI is to promote the projects for the development of green environmental technology and the promotion of the environmental industry.

combination with prescriptive (e.g. in Portugal and Turkey) and economic measures (e.g. in Canada and New Zealand) (Tanaka, 2009).

Table 11 Impact of labelling on the five drivers

Driver	Impact on driver	
Financials	Low	Labelling does not influence the economics of energy efficiency options. So, the impact on the financial driver is low.
Policy obligation	Low	As labelling does not prescribe that energy efficient measures or technologies should be applied, the policy obligation is low.
Knowledge	Low - High	The labelling of a consumer product, e.g. a carbon label triggers the knowledge driver of a “downstream” firm (i.e. one close to the market). This effect decreases when going “upstream” (e.g. to a steel or aluminium producer). The labelling of the energy performance of industrial facilities has a much more direct impact on the knowledge driver of production industry. The labelling of industrial equipment’s energy performance may help companies identify the most efficient equipment.
Commitment	N/A	This policy does not directly affect a company’s commitment.
Public and market demands	Low - High	Labelling products (e.g. a CO ₂ footprint label) aims to influence consumer choices. When labelling really affects consumer’s choices, it will give a market signal to producers to improve the energy efficiency throughout the production chain.

Table 12 Impact of information policies and measures on the drivers

Driver	Impact on driver	
Financials	Low	In general, information policy instruments do not influence the economics of energy efficiency options. So, the impact on the financial driver is low.
Policy obligation	Low	Information policies do not prescribe that energy efficient measures or technologies should be applied. So, the policy obligation is low.
Knowledge	High	Information policies are designed to increase knowledge, so, the impact on this driver is potentially high. If an information policy involves benchmarking a company’s performance, it can better identify projects with potential for savings, and help assess the effectiveness of any investment recommended to improve performance.
Commitment	N/A	This policy does not directly affect a company’s commitment.
Public & market demands	Medium	If an information policy is designed to affect energy efficiency improvements through the production chain, this policy may influence the public driver.

Summary of policy impact on driving forces

In this section, the way policies and their characteristics typically affect the driving forces of investment decisions are summarised. This analysis can be used as a default and tailored to a country's sector specific situation. Only the high and medium impacts on the drivers are given, leaving out policy types that have a low impact or no relationship with the driving force.

Table 13 General evaluation of the interaction between driving forces and different types of policies

Type		Financial	Policy obligation	Knowledge	Commitment	Public and market demands
Prescriptive	Norms/standards		High	Medium		
	Negotiated agreements			High	Medium	Medium
	Obligations/commitments <i>e.g.</i> mandatory energy audits		High	Medium		
Economic	Taxes	High				
	Incentives and subsidies	High		Medium		
	Tradable permits	High	Medium			Medium
Information	Labelling			High		High
	Other information measures			High		Medium

The conceptual evaluation methodology can help initiate a discussion on policy improvements; *i.e.* whether the current policy package addresses the key drivers of boardroom decision making. In general, a suite of complementary policies is needed to effectively address all driving forces identified in this study (see Table 13). However, an analysis of the relative importance of each driver within each sector is lacking, as some might be more important than others, depending on the type of energy efficiency investment that is required (*i.e.* low- or high-cost investment).

Furthermore, individual policies may have no or limited effect on the various driving forces, in some cases. A company's decision to make an investment may depend principally on a different set of factors, ranging from the broad investment climate established by the government to the market and the company's financial health.

Best practices combine tax and fiscal policies

Overall, the best practices internationally are those that combine tax and fiscal policies into an integrated programme that provides clear economic signals and incentives that raise management awareness so that industries are motivated to reduce the costs associated with consumption of polluting energy sources and to improve the energy efficiency of their facilities.

Source: Price *et al.*, 2005.

In practice, the impact of policies on each driver will depend on their specific characteristics such as the ambition level (targets and standards), legal force, compliance flexibility, level of enforcement and magnitude of financial incentives and taxes. Despite this, the authors found that certain policy types are more likely than others to influence particular driving forces.

Impact on financials

Several economic policy instruments can affect the financial parameters of investments in energy efficiency measures. Subsidies can be used to incentivise clean technologies, while pricing aims to discourage GHG emissions or energy use.¹⁴

Here, financial constraints *e.g.* taxes, cutting energy price subsidies, or emissions trading, are differentiated from positive financial incentives, *e.g.* subsidies, loan guarantees, tax exemptions, tax reduction provisions, or accelerated depreciation.

Important instrument *characteristics* are:

- The **level** of the financial incentive. Ideally, this instrument characteristic would be assessed against data such as:
 - the total required investments to significantly enhance energy savings (*e.g.* double energy savings) for positive incentives such as subsidies and tax deductions¹⁵; or
 - energy costs: for policy incentives like taxes or carbon prices.
- A **tailored** design of the incentive:
 - For technology specific subsidies: the more governments target a specific technology, the greater the chances that these will trigger additional investments and reduce free rider behaviour (*i.e.* subsidies are used by a company for investments that are already financially feasible).

Impact on energy-saving obligations

“Hard” policies such as standards, obligations or tradable permits affect the **energy-savings obligation** driving force. Companies are either incited to comply with the policy requirements for fear of a hefty penalty or loss of licence, or to undertake in-house measures to meet their targets within a cap-and-trade (or baseline-and-credit) scheme if there is a high price.

Whether policies oblige a firm to take in-house energy efficiency measures is determined by the following characteristics of a policy instrument:

- **Coverage:** does the policy cover GHG emissions or energy savings.
- **Ambition level:** the effort required from companies (distance to target) or the extent to which the policy instrument requires a change in behaviour.

¹⁴ Possible policy interventions could also focus on encouraging banks to increase their energy efficiency loans. This would merit further analysis, but it is beyond the scope of this study.

¹⁵ How does one judge the size of a financial policy incentive? Is a 100 million euro per year government subsidy for industrial energy efficiency a significant amount? Ideally such a number should be compared against the total investments that are required to substantially increase savings, for example a doubling of energy savings rate from 1% per year under business as usual conditions to 2% per year. A ballpark estimate of the required investments may be obtained from the following data and assumptions: sectoral primary energy use data, oil price, the targeted additional savings and the payback time of these investments. For the Netherlands, this leads to a ballpark estimate of: 20 Million tonnes of oil equivalent (toe, annual primary industrial energy use) x 0.01 (1% extra savings/yr) x 65 (oil price €/barrel) x 7.2 barrel/toe/1000 x 5 (payback time) = € 450 million per year of investments. Note, that a more detailed estimate should, for example, include fuel taxes.

- **Legal force:** what will happen if companies do not comply with the policy requirements? Does the policy instrument include sanctions, such as penalties? For example, the consequences for evading taxes or the emissions trading schemes are often considerably greater than the consequences for defaulting on a covenant.
- **Compliance flexibility:** the limitations that different policy instruments place on a company's choices. For example, technology prescriptive policies provide little flexibility whereas sectoral targets under a covenant provide somewhat more. Emissions trading schemes often provide the greatest degree of flexibility.
- **Level of execution and enforcement:** how rigidly do public bodies monitor a company's efforts to comply with policies? How strictly is compliance enforced and non-compliance reprimanded?

A number of policy instruments do not specify targets for energy savings or require energy saving actions such as information policies, and economic policy instruments (*e.g.* subsidies or taxes to be undertaken within the company). These policy instruments, however, may affect energy use through the financial driver. Within the scope of this framework, these policy instruments do not contribute to the 'policy obligation' driver.

An exception is GHG emissions trading, an economic policy instrument with strong regulatory characteristics that affect the policy obligation driving force. GHG emissions trading does not require direct energy efficiency measures. However, the indirect energy efficiency requirements of this policy instrument are potentially higher than all other economic policy instruments, if the ambition level is high; public reporting systems are transparent; and the execution and enforcement regimes are robust.

Impact on knowledge

Most regulatory and information policies such as norms, obligations and labelling instruments affect the knowledge driving force. Subsidies for energy audits also raise awareness of energy efficiency opportunities. Regulatory policies are likely to incite companies to be informed of opportunities available as to remain in compliance, whereas information policies are "soft" policies that support companies through information and technical resources, should they wish to implement energy-saving actions. Some policies build capacity and actively increase knowledge, including pilot project subsidies, energy management requirements, benchmarking obligations and technology catalogues or lists.

When policies are strongly enforced, the search for and acquiring of knowledge is enhanced. For instance, the more frequently an authority or auditor visits a company and the more knowledgeable that auditor, the more knowledge of energy savings can be exchanged between company and auditor.

National energy efficiency agencies, or other entities that administer industrial energy efficiency programmes, play an important role in promoting knowledge exchange and data collection.

Examples of execution and enforcement

Several lessons from the SO₂ and NO_x [US emissions trading] markets emerge for the regulation of other pollutants such as CO₂ [...]. Transparent data systems, public access to information, and strict and certain penalties for noncompliance have led to a virtually perfect compliance record.

Source: Burtraw *et al.*, 2009.

Monitoring, Reporting & Verification requirements differed by programme. Participants in the Irish EAP are required to have their compliance with the energy management standard certified by a third party. The members of the French AERES programme committed to publish their current emissions on an annual basis, which was verified by an independent organisation. In the Netherlands, participating companies were required to provide their energy-savings plans, monitoring reports, and company level energy efficiency index calculations to NOVEM where they were reviewed for accuracy and completeness.

Source: Horvath *et al.*, 2010.

We have examined regulation for small and medium enterprises in the Netherlands (General Administrative Order, requiring all energy-savings measures that can be “reasonably asked”). We found that in the overwhelming majority of cases the responsible agency (*i.e.* the municipality) is not very active in enforcing compliance. The agency’s knowledge of the problem seems to be limited and low priority is given to energy efficiency improvement.

Source: Blok *et al.*, 2004. Chapter 4.¹⁶

[Translated from Dutch] According to the Voluntary Agreements between government and industry, a participating firm should immediately implement all measures with a payback time under five years. In practice though this is an empty formality [...]. We simply don’t have ‘compliance cops’ in this area.

Source: Vroege Vogels.

Standards for Energy Management System (EnMS) as part of voluntary/negotiated agreements

Several countries have developed EnMS standards as a core requirement of energy-savings agreements between government and enterprises. The proper adoption of EnMS standards greatly facilitates the identification of energy-saving opportunities, especially through changes in operating practices, which go far beyond what the enterprises had been able to achieve through self-designed systems. Companies that obtained certification often realise energy savings beyond the expectation of the agreement, typically savings of 10% to 20% within the first five years.

Denmark, Sweden and Ireland are currently using the European standard EN 16001 to underpin their energy-savings agreements. The ISO 50001, due for release in the third quarter of 2011, could serve as a significant underpinning for government led energy-savings programmes with industry. Based on experience in Sweden, Ireland and Denmark, standardised EnMS may achieve its highest value, if implemented as a core, interrelated part of the government-enterprise energy-savings agreement and related activities. For example, the Superior Energy Performance programme is being set up in the United States to serve as a means to encourage ISO 50001 adoption by enterprises.

Source: Goldberg *et al.*, 2011.

¹⁶ Survey of 11 municipalities in the Netherlands.

Impact on the commitment to the environment and energy efficiency

The effect of policies on the **commitment** driving force is less clear cut.

However, policies developed through stakeholder processes and extensive consultations, especially at an early stage, create company ownership and, therefore, increase the commitment of a company to a policy (referred to as a multilateral policy). Certain policy instruments have a more multilateral nature than others. Typically, governments interact quite strongly with industrial stakeholders when discussing and deciding on the distribution rules of permits under the ETS, or developing a negotiated agreement.

Policy instruments developed multilaterally improve commitment

Staff members of SenterNovem in the Netherlands conveyed that in their experience, companies provided arguments against such programmes prior to their commencement. The companies stated that they already knew what they could achieve; they had already implemented all possible measures; or they would need to close due to the restrictiveness of the agreements. Now, after participating in the programme for a number of years, the companies are “very enthusiastic” about the Dutch Long Term Agreements (LTAs), especially because no similar support based programmes are offered through the European Union Emissions Trading Scheme, in which some of them participate. The companies especially see the benefits of the knowledge sharing platforms in the LTA programme.

Source: Horvath *et al.*, 2010.

Policies can also improve commitment by requiring that decision makers from top management become involved:

Reporting and decision making under Australia’s EEO Programme

The EEO programme takes a whole-of-business approach that involves staff from across different functions including senior managers. The results of the assessments must be properly considered by decision makers, who are then required to make clear decisions on timing and implementation of energy efficiency opportunities. In addition, the company must communicate the results of the assessments and associated business decisions to its board, internal employees and the public.

Source: DRET, 2010a.

Reporting to the Board and CEO was identified as being helpful to force senior management/executives to make decisions on energy efficiency, rather than leaving this with operational teams (although not all corporations adhered, and some identified the on-going need to further engage senior management).

Source: DRET, 2010b.

Similarly, labelling may positively affect company commitment as company efforts to save energy can be showcased via the label.

Impact on the demands of the public and the market

Finally, many policy types can affect the **public and market demand** driving force in different ways. The impact on the energy efficiency of products and production processes is generally indirect.

One can distinguish different types of policies that affect public and market demands for greater energy efficiency:

- Policies that oblige firms to make energy or carbon data publically available, *e.g.* within ETS schemes, and “naming and shaming” policies will increase public awareness of good and bad performers.
- Policy incentives to benchmark the energy or CO₂ performance against competitors will increase peer pressure, forcing firms to improve their efficiency.
- Regulations on industrial equipment suppliers will inevitably affect the industrial buyers of these technologies.
- The effect is similar for energy efficiency labels or carbon footprinting, although the impact may be smaller or less immediate than that of regulations. Such policies aim to increase the demand for more energy efficient products across the supply chain of industrial equipment. Nonetheless, it is unclear whether such labels have an impact on the energy intensity of commodities (*e.g.* steel and aluminium slabs); pressure from the market will ultimately drive efficiency levels of these companies.

Regulations on industrial equipment suppliers

The European Commission adopted today four ecodesign regulations to improve the energy efficiency of industrial motors, circulators, [...]. The regulation on motors sets energy performance requirements for most of the electric motors used in industrial applications. Furthermore, it will foster the use of "variable speed drives" adjusting the motor output to the actual needs, instead of operating always at full capacity. The energy savings triggered by the motor regulation are about 135 TWh per year by 2020.

Source: European Commission, 2009.

Public reporting under Australia's EEO Programme

The aim of the public reports under Australia's EEO programme is to increase business and community awareness of the potential energy savings, financial benefits and reductions in greenhouse gas emissions that can arise from the corporations' energy efficiency assessments. Both reports demonstrate legislated compliance with the programme.

Source: DRET, 2010a.

A positive factor regarding corporations' approach to energy efficiency is the public and community awareness of environmental and sustainability issues, which is creating greater expectations of and within corporations with respect to environmental sustainability and climate change issues.

Source: DRET, 2010b.

How to apply the evaluation methodology

In this section, the information of the previous two sections is consolidated into a guideline for applying the policy evaluation methodology to industry. The framework described can be applied on multiple scales:

- a firm;
- a group of firms (*e.g.* frontrunners or laggards);
- a group of firms with similar products or characteristics (a sector or sub-sector); or
- a country's industry as a whole.

Ideally, the methodology will be applied to a sector or group of firms with similar characteristics in a single country.

Applying our framework in a policy evaluation includes the following steps:

- **Identify the type (and costs) of energy efficiency investments** that the industry has to make to meet the particular country's objective.
- Map the **characteristics and circumstances of the country**, with respect to the different industrial sectors, and **assess the relative importance of the drivers** of boardroom investment decisions, considering the sector's characteristics and the type of energy efficiency investment.
- **Analyse the country's policy mix, assess its impact** on the drivers for investments in energy efficiency, and **identify whether policies could further influence the drivers**.

An in-depth policy evaluation will be based on many different sources (literature, internet, expert knowledge, etc.). Ideally, the results should be tested by means of interviews with the following **experts**:

- Key representative(s) from industry (the boardroom's perspective).
- Key representative(s) from the government (the policy maker's perspective).
- Key experienced policy evaluator(s) (the evaluator's perspective).

Identifying energy efficiency investment needs by industrial sector

The first step is to determine the level of energy savings (or GHG emission reductions) that a country seeks to reach per industry, and identify the types (and costs) of energy efficiency investments needed to meet the country's objective. For example, does the country aim to have the most competitive industry and, thus encourage companies to achieve the energy intensity levels of international best practice? Is the country's prime interest to reduce GHG emissions, in which case energy efficiency investment might not be the prime focus?

The absence of detailed baseline energy consumption data in many companies is a major barrier to identifying projects with a savings potential and later for assessing the effectiveness of any investment recommended to improve performance. For many energy intensive industrial sectors such as steel, metals such as aluminium, cement and glass, typical gross energy consumption data per unit of product are widely available internationally.

For most of these sectors, there are industry benchmarks against which potential projects can be assessed. Data for less energy-intensive sectors are less frequently available and may pose significant challenges in trying to identify energy efficiency projects.

Mapping the characteristics and circumstances of the country and sectors

The second step is to map the characteristics of a given country's industrial sectors (*i.e.* share of small versus large companies, energy-intensive versus light sectors, etc.) and assess the relative importance of the five driving forces considering the sectors' characteristics and type of energy efficiency investment. Questions available in Appendix 1 may help identify the drivers most pertinent to the industrial sector in the country under consideration.

Assessing the impact of a country's policy mix on the drivers for investments in energy efficiency (ideally within a sector), and identifying whether policies could further influence the drivers

In the third step, the overall mix of industrial energy efficiency policies in the country is identified as well as the impact these policy instruments have on the drivers for investments in energy efficiency within a sector.

Description of the policies should first focus on the characteristics that affect the different driving forces (*e.g.* policy type, enforcement, ambition level, compliance flexibility, size of financial incentives, etc.) and then be analysed within the context of a country's overall policy mix. Outcome of the analysis could point to whether additional policies are needed and effective in stimulating the drivers.

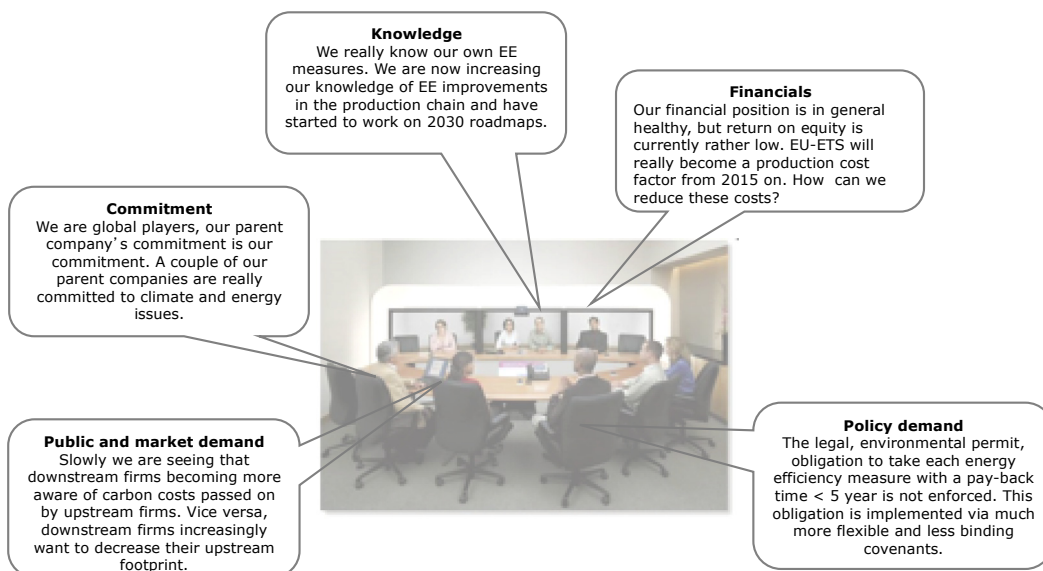
The following unit applies the framework to one illustrative example, the Netherlands, on the scale of the overall industry (*i.e.* not at a sub-sector level).

Application of the framework to a test case study: the Netherlands

In this section, the results of applying some elements of the evaluation methodology to a country are discussed. This test case serves as an illustration of the methodology, rather than a comprehensive policy evaluation. In order to make the analysis complete, the case study would have to include the type of energy efficiency investments the industry needs to make (first step), and provide a summary of the circumstances and relative importance of the different drivers through a sectoral analysis (second step). However, it is not possible to include this level of detail here.

The focus is on the policies and drivers affecting all industries in the country case study. Additional information on the country's characteristics and circumstances is provided in Appendix 1.

Figure 5 Illustration of the five drivers reflecting industrial boardroom's decision-making process on energy efficiency measures in the Netherlands today



Source: Ecofys, 2011¹⁷.

The policy mix in the Netherlands

EU Emission Trading Scheme (EU ETS)

Since 2005, the majority of industry in the Netherlands must meet GHG emission reduction obligations established under the EU ETS.

¹⁷ Material provided for this report.

- **Enforcement** of the EU ETS obligations (monitoring, reporting, annual compliance) is strong and falls under the National Emissions Authority (there are currently 60 to 80 full-time employees).
- **Ambition level.** Since 2005 and until phase 3 (starting in 2013), the ambition level of ETS for companies in the Netherlands is fairly low. The reason is that participants, who received a more generous amount of free permits in phases 1 and 2 of the scheme, will be able to bank these allowances for future compliance after 2012. However, from 2015, Dutch firms expect a shortage of allowances. Today, the extent of this shortage and the associated production cost rise are still unknown.¹⁸
- **Compliance flexibility.** A characteristic of the ETS is its high compliance flexibility, as participants can meet their obligations either by reducing emissions within their own installation or by purchasing permits generated from reductions elsewhere (whichever is most cost effective). Some firms report that the ETS in phase 3 will incentivise additional energy-savings measures because a larger share of measures becomes profitable. This is because energy savings lowers energy bills, but also carbon costs. Others may search for alternative compliance strategies, such as fuel shift or buying additional allowances on the market.¹⁹

Negotiated agreements for energy intensive industry

Industry in the Netherlands has participated in a series of negotiated agreements since 1991. The main features throughout the long-term agreements are that firms are required to develop energy efficiency plans; execute measures with a payback period of less than five years; and the continuous support of the government energy agency to implement measures. The agreements are divided into three phases:

- **1991-2000:** The long-term agreements (called MJA) set energy-savings targets of 20% in 2000 compared to 1989 for the sectors overall. Firms had to implement cost-effective measures (*i.e.* with a payback period of five years or shorter).
- **2000-2010:** Individual benchmark obligations were contained under the voluntary benchmarking covenant for larger industrial companies (called covenant benchmarking). The target for signatory companies was to be among the top 10% in the world in terms of energy efficiency in 2012. Target setting at the firm level implied lower compliance flexibility compared to the previous period, which set sectoral (rather than individual) targets and required firms to implement both “cost-effective measures” and “less cost-effectiveness measures”.
- **2010-2020:** Long-term agreements on energy efficiency for companies are subject to the EU ETS (called MEE). These long-term agreements do not include specific targets, but firms should “significantly contribute to improving energy efficiency”. Compared to the previous covenant, the scope is extended by including efficiency improvements in the production chain and establishing long-term energy efficiency roadmaps for 2030.

Negotiated agreements for smaller firms

For a smaller number of industrial firms (*i.e.* those not under EU ETS), the voluntary, long-term agreements will continue to 2020 (policy name: MJA3). The most important features of the agreement are:

¹⁸ In this case, the possible pass-through of the cost of freely obtained emission allowances (opportunity costs) was ignored (Bruyn *et al.*, 2010).

¹⁹ Information gathered from EU ETS participants in Ecofys’ network.

- A target to improve average energy efficiency by 30% from 2005 to 2020.
- Sector organisations must set roadmaps for their sector.
- Government helps businesses and trade associations to set up roadmaps; monitor energy savings; implement energy management; and organise seminars.

Economic instruments

Tax deduction and flexible depreciation for energy efficiency investments (called EIA and VAMIL) have been in place since 1997 in the Netherlands. The tax deduction leads to a drop in investment costs by 11% to 14% on average. Flexible depreciation allows for flexibility to spread depreciation costs over years. The government budget, determined annually, was a minimum EUR 150 million in 2010.

Environmental Management Act

The European Integrated Pollution Prevention and Control (IPPC) Directive (now merged with the recent Industrial Emissions Directive) provides the legal framework for requiring companies to obtain environmental permits under the Environmental Management Act (policy name: “Wet Milieubeheer, WMb). The Directive states that for installations participating in the EU ETS, “Member States may choose not to impose requirements relating to energy efficiency in respect of combustion units or other units emitting carbon dioxide on the site” (Directive 2008/1/EC, Article 9(3)). Beyond the IPPC requirements, the Environmental Management Act requires the implementation of energy-savings measures with a payback time of up to five years. In practice, firms comply by participating in a covenant whereby they establish an Energy Efficiency Plan (EEP) and an annual progress report (co-ordinated by the Energy Agency, “Agentschap NL”). The local or regional environmental authority, responsible for the environmental permit can, if needed, take legal action in case of non-compliance with the covenants and provisions in their EEP. In practice though, enforcement of EEP provisions appears to be weak.

Firms that do not participate in covenants use between 10% and 20% of the overall energy supplies in the Netherlands. These are low-energy intensive firms, such as supermarkets and healthcare institutions. In principle, the Dutch environmental permit requires these firms to take energy-savings measures up to the payback period of five years (similar to the requirements under the covenants). Recent evidence shows that the implementation and compliance of this legal obligation are poor, because of a lack of knowledge, priority and “implementation tools” administered by local authorities (VROM inspectie, 2010).

Equipment standards

Increasingly, the European Eco-design Directive is setting equipment standards common to all EU Member States for the energy efficiency of “cross-cutting” technologies in industry. The Directive stipulates that whenever minimum energy performance standards (MEPS) are considered, so should mandatory labelling. So far, no labelling has been established under the Eco-design Directive for Industrial Appliances.

For electric motors in Europe, a voluntary labelling scheme exists which was developed by the European Committee of Manufacturers of Electrical Machines and Power Electronics (CEMEP). Most electric motors are sold to original equipment manufacturers (OEMs). These OEMs could be manufacturers of refrigerators, washing machines and other appliances where electric motors are incorporated into the units. As the OEMs are not the end-users of the appliances, they are likely to focus on cost and reliability of these motors rather than on the cost of electricity used to run

them. Though in many cases, better designed, more energy efficient motors may be less liable to fail or require repair during the OEM equipment warranty period.

This leads to a weak system compared to other international initiatives. As a result, from July 2011, the label will no longer be valid. Instead, an internationally recognised testing method will be used to ban the worst performing electric motors on the EU market.²⁰

Overall assessment

A summary of the Dutch energy efficiency policy package for industry from 2010 and its overall impact on the industry driving forces is presented in Table 14. National policies strongly focus on increasing knowledge and commitment in the boardroom via voluntary agreements, supported by positive financial incentives and several information measures. To date, the policy obligation to invest in the most energy-efficient measures has not been strong. Despite the lack of policy obligation, the policy package has supported the Dutch industry in becoming comparatively energy-efficient producers.

Table 14 Netherlands: Interaction between driving forces and different types of policies (status: 2010)

Type		Financial	Policy obligation	Knowledge	Commitment	Public and market demands
Prescriptive	Norms/standards (Environmental Management Act)		Low-medium	Low		
	Negotiated agreements (MEE, MJA-3)			High	Medium	Low
Economic	Incentives and subsidies (EIA/VAMIL)	Medium		Medium		
	Tradable permits (EU ETS)	Low-medium	Low-Medium			Low-Medium
Information	Labelling (voluntary labelling for electric motors; EU Eco-design not implemented in Netherlands)			Low		
	Outreach and information provided by Agentschap NL (e.g. tools, guidebooks)			High	Medium	

A preliminary analysis indicates that policies in the Netherlands have a medium positive effect on the **financial driver**. Financial support for energy efficiency investments through tax deductions and flexible depreciation have been in place since 1997, providing a stable signal through time that investing in energy efficiency measures is attractive. The impact of the EU ETS on the

²⁰ Using International Electrotechnical Commission "IEC" standards.

financial decisions in the boardroom is increasing. From this test case, however, the authors do not have sufficient information to identify the impact of these instruments on the financial driver in more detail and come to definitive conclusions. Many companies would invest based on energy efficiency improvements alone (for competitiveness purposes), but, equally, the other cost, benefits and implications would also be taken into account. Certainly more research on whole life and associated costs/benefits will be needed, including the cost difference between the most and least efficient equipment and whether existing financial incentives affect the decision to invest in the most efficient technologies.

The subsequent voluntary agreements, and the implementation support by the energy agency (Agentschap NL), have increased the **knowledge** level of the Dutch industry significantly. This driver seems to be well addressed as Agentschap NL provides on-going support to companies to identify energy efficiency options. The use of benchmarking under the covenants has also ensured that companies are aware of peer performance and top performing companies in the world. The direct effect of norms or labelling policies on the knowledge levels of industry appears to be low. The actual implementation of the norms is done through the negotiated agreements.

The voluntary agreements, which have been developed in partnership with industry (*i.e.* multilateral policies) and supported by prolonged financial policy incentives, have positively affected the **commitment** of Dutch industry to energy efficiency. Increasingly though, their globally operating parent companies determine the commitment for climate and energy matters. This can interfere with the commitment shown by industry leaders within the Netherlands. The Carbon Disclosure project showed that a limited number of the major Dutch companies fully integrated climate-related priorities into their business strategy. It is unclear whether additional policies would be needed to enhance Dutch industry's commitment to the environment and energy, as the Dutch companies have already demonstrated their active participation in setting the voluntary targets.

The latest covenants with industry and the upcoming impact of EU ETS (passing through of carbon costs in the production chain) are examples of increasing **public and market pressure** pushing for energy savings. Here, it is unclear to what extent the market, peers or the public have encouraged energy efficiency improvements within Dutch companies.

Policy obligations for industrial energy savings are regarded as medium to low. Beyond EU legislation, the Dutch Environmental Act requires ambitious energy savings. However, local or regional authorities do not directly enforce this: the obligation is implemented via voluntary agreements. Whether the EU ETS affected companies' energy efficiency investment decisions is unclear; the scheme provides companies with flexibility as to how they reduce their GHGs.

Current policy trend

Dutch industry was, in general, among the world's best energy performers, but is losing its position (Verificatiebureau Benchmarking Energie-efficiency, 2006). In this context, the current policy package and its trends may not be able to restore its frontrunner position.

Currently, the Dutch policy package addresses all five drivers to a greater or lesser extent. The main trend is that the impact (on commitment and knowledge) of the Dutch covenants in the boardrooms is currently decreasing, whereas the financial and policy obligation impacts of EU ETS are growing and will significantly affect Dutch energy efficiency investment decisions from approximately 2015. Could a stronger policy obligation for energy savings in combination with a change in economic policies be the key to improving the energy efficiency performance of Dutch companies? Policy makers can estimate the relative importance of the driving forces and whether

additional policies have an effect on the most important drivers in that sector only by focusing on a sub-sector level. Additional policies were effective in triggering the drivers for investment. It would be useful to evaluate the costs and benefits, thus helping policy makers decide whether to design a new policy or not.

Conclusions

In seeking to understand how policies can be designed to stimulate companies to save energy, this report has provided some insights into the industrial boardroom's decision-making process for investing in energy efficiency. The rationale for an individual company making an investment that will reduce energy consumption varies considerably and depends on a range of factors. These include the sector, company size, energy intensity, cost of energy relative to overall production costs, whether energy efficiency improvement is an incidental or ancillary benefit of a process or equipment upgrade (or as part of a concerted effort to implement an energy efficiency programme), the financial state of the company, whether it is in a growth or sunset sector, and whether it has easy access to finance.

A company may upgrade equipment to increase production in a growth market, to simply replace worn-out equipment, or to remain competitive in its markets. In these cases, the upgrade is likely to be more energy efficient than the replaced equipment. In the case of technology investment choices, whether a company goes for the *most* energy efficient option or not is likely to be driven by a range of factors such as compatibility, ease of maintenance, life cycle cost and overall cost-effectiveness, of which energy consumption may be a part of decision-making but not a sole reason.

While companies are diverse in terms of the above-mentioned factors, the boardroom decision-making process for energy efficiency investments proposed in this report can be understood by policy makers in terms of five driving forces: financials, knowledge, commitment to the environment and energy efficiency, public and market demands, and policy obligations.

To help companies make investments with the highest energy efficiency benefits, the report proposes that policy makers need to understand how and which policies can influence these driving forces. The relative importance of each driving force will depend on the factors noted and may positively or negatively affect any investment option, thus prioritising any investment is a complex decision.

Financials

The financial situation of a company is integral to making energy efficiency investment decisions. The financial driver is determined primarily by the access a firm has to its capital and the profitability to invest in energy efficiency measures. Given the constraints on finance for many companies and their need to carefully prioritise investment – unless the company has a high energy use or where energy represents a significant percentage of its operating costs – a board may not be convinced of the energy efficiency argument alone. If investments are presented as a range of measures to improve productivity, reduce costs, and reduce energy consumption, then the board may be more interested.

The cost of energy is driven by both market forces (*e.g.* the prices of international oil) as well as government intervention. Where energy costs are rapidly increased, then companies may look closely at energy conservation. Energy pricing, subsidies and other such incentives can enhance a company's willingness to invest in practices and technologies with energy efficiency benefits above those that lack such benefits.

A preliminary analysis of the impact of policies on the financial driving force in the Netherlands has shown that a stable mix of financial incentives (the EIA and VAMIL) since 1997 has helped companies to implement energy efficiency technologies, and has supported their participation in other policies, such as the benchmarking covenants.

Knowledge

A company's energy efficiency actions depend on its level of knowledge of energy efficiency opportunities available to it. A range of policies and policy characteristics can help increase levels of knowledge within the industry. For example, policies that are effectively enforced, such as the EU ETS, will encourage companies to stay informed and compliant. Public energy agencies and information policies provide obvious support, such as technology lists, as in the Netherlands.

Commitment to the environment and energy efficiency

A company's commitment to the environment and energy efficiency will definitely influence a company's energy efficiency actions. Positive relationships with government policies, such as multilateral policy development and extensive consultation, can help policies garner acceptance from industry and encourage greater corporate commitment to energy efficiency. For example, the voluntary agreements between industry and governments in the Netherlands led to a high degree of industry ownership and commitment towards becoming world leaders in energy efficiency.

Public and market demand

A company will be more willing to implement energy efficiency practices and technologies, if its peers, the public or the market place demands it. Policies that encourage companies to benchmark their performance relative to their peers (*i.e.* benchmarking) or provide for production chain improvements beyond the bounds of the target group can stimulate public and market pressure for industrial companies to act. For example, the benchmarking covenants in the Netherlands show high and low performers, encouraging low performers to improve.

Policy obligation

Finally, the policy obligation that industrial companies are subject to also influences their implementation of energy efficiency technologies and practices. "Hard" policies such as norms and standards are likely to create greater incentives to implement energy efficiency improvements than voluntary initiatives. Effective enforcement and high ambition levels will also encourage action.

This report has shown that putting policy makers in the shoes of boardroom decision makers can assist policy makers in designing new policies and improving existing policy packages. The innovative evaluation methodology proposed in this paper does not focus on barriers to investment, but rather points to elements that can influence policy makers. No single policy can stimulate all the necessary drivers that will stimulate companies to maximise their efficiency levels. Instead, the policy mix needs to be designed to address, to the utmost, the driving forces of boardroom investment decisions. To help policy makers prioritise those policies that will fill a gap, the report encourages sectoral analysis and discussions with sector representatives, which will help identify the relative importance of drivers in each sector. The reality is that boardrooms do not weigh all drivers equally. In most cases, only two to three drivers will be of significant importance, *e.g.* financing, policy obligation and knowledge.

The fact is that policies and the overall policy mix cannot always be effective in triggering all drivers. Only by focussing at a sub-sector level can policy makers estimate whether additional policies have an effect on the most important drivers in that sector, *e.g.* financing, policy obligation or knowledge.

Appendix 1

Information on country characteristics and circumstances: the Netherlands

These questions may help policy makers characterise their country and industry sector. These were applied to the Netherlands, covering the whole industry.

Characteristics of the industry

- What is the structure of the country's industry sector?
- What is the (average) share of energy in the production costs?
- How does the energy performance of the sector/firm compare to those in other countries?

Financial

- What are the investment criteria for energy efficiency improvements, if any? Is there a specific payback time or internal rate of return for energy efficiency measures that applies to an individual company, sector or country?
- How do these vary across sectors: large versus small industries; or highly or less energy intensive industries?
- Does the industry have ready access to capital or loans for investments in energy efficiency projects? Do solvency ratios for each sector play a key part in securing finance?
- Are commercial banks willing to lend to energy efficiency projects which typically do not involve physical assets and conventional revenue streams?

Knowledge

- Do sub-sectors within the industrial sector (*e.g.* cement and steel) have their own knowledge centres and/or research institutes? Are sub-sectors in close contact with international research institutes?
- Do firms already have energy managers, as opposed to general environment and safety coordinators?
- Is there a national institution (*e.g.* an energy agency) that supports the implementation of policies and measures?

Commitment

- Is the industry active in corporate sustainability policies?
 - How does the industry score on sustainability indices like the Dow Jones Sustainability Index (DJSI) or the Carbon Disclosure Project (CDP)?
- To what degree are CEO bonuses related to environmental performance?
- To what degree is the energy performance of firms or sectors pro-actively reported in the public domain and on the web?
- To what extent is the sector partnering with NGOs?
- Do sectors or firms have their own energy efficiency targets, set independently of policies?

Market and public demand

- Is there pressure from the public to improve their energy or GHG efficiency? (e.g. Greenpeace's "climbing the chimneys" programme)?
- Is there peer pressure, through public disclosure of competitors' performance, which can stimulate energy efficiency actions?
- Is there pressure from up- or downstream the production chain or shareholders?

Policy obligations, tradition and ambition

A stable policy mix builds trust and reduces investment uncertainty. Can the policy mix be characterised as: 1) stable > 10 years; 2) stable 5-10 years); or 3) changing every 5 years? Does the country have a long-term climate or energy strategy?

Characteristics of the Netherlands

Dutch industry can be characterised as energy intensive with dominant sectors such as refineries, chemicals and base metals. The Netherlands has an inherent competitive advantage due to its location with a strategically situated port and access to sea transport.

At the start of the 21st century, Dutch industry was among the world's best performers on energy efficiency. At the same time, it was reported that this leading position was weakening (Verificatiebureau Benchmarking Energie-efficiency, 2006). No up-to-date statistics are available to determine the Dutch industry's current performance.

Financial

The return on equity of Dutch firms in 2010 and (expected) 2011 is recovering to reach 9% to 9.5% after the economic crisis of 2009 (see Figure 6). The low(er) profits supply firms with fewer resources to finance investments (CPB, 2010).

Overall, the solvency of Dutch firms is good, though the situation differs within and between sectors (see Table 15). Firms are likely to finance part of their investments with debt finance. Currently, banks are reluctant to release their criteria for debt financing (CPB, 2010). The table indicates the share of firms that uses certain solvency and return on equity criteria.

Energy-savings investment criteria

The Dutch Environmental Management Act requires implementation of energy-savings measures with a payback time of up to five years. The same limit is used in the Dutch energy-savings covenants, which serve as an implementation rule for the legal environmental obligation. In industrial practice in Europe, average payback periods of around four years are applied (Martin *et al.*, 2011; Blok, 2006).

Table 15 Solvency and return on equity of Dutch industrial sectors, 2006-2008

		Return on equity		Solvency		
		0-10%	>10%	0-20%	20-35%	>35%
Paper	2006	57	43	24	41	36
	2007	43	57	20	27	54
	2008	64	36	9	36	55
Chemical industry	2006	39	61	22	22	56
	2007	44	56	18	18	64
	2008	43	57	23	17	60
Base metal	2006	37	63	33	33	33
	2007	30	70	10	30	60
	2008	63	38	13	25	63
Building materials	2006	48	52	5	48	48
	2007	35	65	6	35	59
	2008	38	62	19	29	52

Note: no recent data available.

Source: CBS, Statline (2011).

Knowledge

The Dutch Agency (*Agentschap NL*) helps companies to implement voluntary agreements and benchmarking covenants, by setting up roadmaps, monitoring, implementing energy management and organising seminars. Their 2010 budget for assisting the industry was EUR 105 million (*Agentschap NL*, 2011). An estimated 100 full-time employees (FTEs) are allocated to this work.

Commitment

Major Dutch companies such as AkzoNobel and DSM traditionally rank high in the chemical sector of the Dow Jones Sustainability Index and have “green” bonuses for their CEOs. The majority of Dutch industries today are subsidiaries of an international, often globally operating, parent company. The parent company’s commitment to energy savings is not always clear.

The Carbon Disclosure Project’s (CDP) global reporting mechanism identifies companies which are actively taking steps toward a low-carbon economy. Thirty-one out of the 50 largest Dutch companies contributed to the most recent Carbon Disclosure Report²¹ for the Netherlands (CDP, 2010). Twenty-five of the 31 respondents (81%) received a performance score. Of the companies that received a performance score, three (12%) are included in performance band “A” (Leading); 15 (60%) in performance band “B” (Fast following); and seven (28%) in performance band “C” (On

²¹ Respondents under the CDP project include firms in the industrial as well as the services sector.

the journey). Companies in band 'A' show the highest level of integration of their climate-related priorities into their overall business strategy. They frequently disclose targets and the highest number of actions taken to reduce their emissions. These companies also recognise the importance of providing transparent and quality information to their stakeholders.

Market and public demands

There is a growing trend to decrease energy use and CO₂ emissions throughout the production chain, rather than for a single product, service or process. Several policies and initiatives are shifting focus accordingly. The latest covenants with industry (see the Netherlands case study), the impact of EU ETS (carbon costs being passed through the production chain) and corporate initiatives (e.g. Unilever's carbon footprinting of products they deliver to the market) are examples of this.²²

The public pressure for industrial energy is small, except through initiatives such as the Carbon Disclosure Project. Part of the reason is that information on the energy efficiency performance of companies is, in general, not made public. While NGOs pressure companies to operate in an environmentally friendly manner, attention is given to visible measures and not so much to process improvements in energy intensive industries.

Dutch Friends of the Earth successfully target energy efficiency of refrigerators

Friends of the Earth is campaigning for supermarkets to cover their coolers. They measured and published the area of open refrigerators per supermarket. The NGO reports that six chains (representing 65% market share) have taken action to cover their coolers.

Source: Dutch Friends of the Earth.

Policy obligation, stability and ambition

Overall, the Netherlands' policy package for energy efficiency in industry can be described as stable. The major policies are the voluntary agreements, which have been in place since 1992 and will run until 2020.

On a more generic, cross-sectoral level, the Netherlands has an economy-wide, energy-savings target of 2% per year between 2011 and 2020 (ECN, PBL, 2010). The target is non-binding and not directly connected to sector policies. The Netherlands has no greenhouse gas or energy targets beyond 2020.

The government of the Netherlands at all levels (national, regional and local) has an active policy of sustainable procurement of products and services. Their target is to achieve 100% procurement using sustainability criteria by 2015.

²² Conclusion based on hands-on Ecofys activities in this field.

Acronyms, abbreviations and units of measure

Acronyms

ESCO	Energy Services Company
EU ETS	European Union emissions trading system
VSD	Variable-frequency drive

Abbreviations

CO ₂	carbon dioxide
GHG	greenhouse gas
EE	energy efficiency
ROE	return on equity
GDP	Gross Domestic Product

Units of measure

PJ	Petajoules
Gt	Gigatonne
GJ/t	Gigatonne per tonne
Gtoe	Gigatonnes of oil equivalent
TWh	Terawatthours

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