Establishing Effective Industrial Energy Performance Improvement Targets

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ABSTRACT

The recent publication of ISO 50001- energy management system standard has focused the attention of both industry leaders and policymakers on the role of targets in driving continual energy performance improvement. Industrial companies develop targets to reduce their production costs and energy/carbon footprint in addition to comply with regulations/mandates. Governments, trade alliances, and other non-government organizations external to an industrial company utilize targets as a means to improve industrial energy performance and achieve wider sustainability goals. There are differences in the drivers and criteria behind the derivation of internal or external targets which may create barriers to effective collaboration between industry and the external organizations seeking to improve energy performance.

This paper investigates the drivers behind the establishment of energy performance improvement targets set by industrial companies and organizations external to industrial companies. Sources for this investigation include industrial energy manager interviews, company annual reports, and national target setting programs. The investigation results in a series of findings detailing a set of questions and processes to consider when developing energy performance improvement targets. Industrial energy managers and energy policy makers alike can use these indicators to develop targets that are achievable and reasonable.

Introduction

Setting energy reduction targets is well suited to industry where energy uses and savings opportunities are complex and varied, as targets typically do not specify activities that must be undertaken. Simple and achievable energy reduction targets provide motivation to implement energy saving actions, particularly where there are large opportunities for energy reduction.

There are many types of energy reduction targets including volume, physical efficiency, and economic. This paper focuses on the development of energy performance improvement targets for industrial companies. Energy performance improvements are the measurable results related to energy efficiency, use, and consumption (ISO 2011). Energy performance improvement targets may be based on absolute energy reduction or energy intensity improvement.

External organizations, such as government agencies, often establish energy performance improvement targets for industrial companies to help achieve national sustainability goals. These targets often serve the best interest of constituents as identified by the target setting organization.

Reasons for industrial companies to establish energy performance improvement targets include improving competitiveness through cost control, improving production throughput, or achieving public recognition for sustainability efforts. Discrepancies between energy performance improvement targets developed by industrial companies and external organizations often exist. For example, in the energy intensive steel sector, where energy costs represent a significant portion of production costs, companies proactively improve the energy performance of their production processes to remain competitive. As a result, energy performance

improvement targets for the steel sector may not be able to achieve the further large reductions in national energy consumption sought by external organizations.

This paper studies drivers for external organizations that lead to the development of energy performance improvement targets intended for industrial companies (referred to as 'external targets') and compares these to the drivers for industrial companies that set energy performance improvement targets for their own operations ('internal targets'). A profile of energy performance improvement targets is discussed, including key characteristics and target purpose. In order to better understand the creation of external targets, three public/private Voluntary Agreement Programs (VA) that employ energy performance improvement targets are examined: the United Kingdom's Climate Change Agreements, the Netherlands' Long Term Agreements, and the United States' Better Buildings, Better Plants program. The drivers for creating the energy performance improvement targets and the process used by the respective government to develop the targets for the participating industrial companies were examined. An in-depth study of an energy performance improvement target set by a US steel company provides insight into the drivers contributing to internal targets. By better understanding these internal and external drivers for establishing targets, a list of questions and processes is presented to consider during the development of energy performance improvement targets.

Purpose of a Target and SMART Targets

To better understand the establishment of energy performance improvement targets, it is necessary to understand the larger purpose the target will serve and characteristics of effective targets. Targets are used as milestones within plans for achieving a wider policy goal. Rietbergen and Blok (2010) describe a general policy goal design process as having 4 steps:

1. Determine the fundamental principles of the policy
2. Establish qualitative objectives for the policy
3. Decide upon policy strategies to achieve the objectives
4. Develop the tools to implement the policy strategy

Target setting accomplishes the fourth step by creating measurable milestones that if achieved would lead to the success of the policy and associated goals.

In order for targets to achieve the objectives of any policy, they must be Specific, Measurable, Achievable, Realistic, and Time-bound (SMART). Targets should be specific and clearly identify expected achievement. The target should be attainable at a reasonable level of cost and effort with compliance linked to quantifiable metrics.

Energy performance improvement targets, the focus of this paper, are frequently used as a proxy for CO_2 emission reductions because energy consumption typically represents the largest share of these emissions. As the number of limits and taxes on CO_2 emissions increase, energy performance improvement targets will likely become more ubiquitous because they provide measurable evidence of climate change mitigation due diligence.

Key Characteristics of Targets

Specific characteristics of energy performance improvement targets that will aid in the formation of a SMART target are:

1. Metric for measuring energy performance and a scope for energy accounting
2. Timeframe for achieving an energy performance improvement target
3. Boundary for inclusion in the energy performance improvement target
4. Quantitative reduction or milestone

Metrics for Measuring Energy Performance and Scope

Two common metrics for measuring energy performance are tracking energy intensity or absolute energy consumption. Energy intensity metrics are chosen so that energy consumption is related to its primary use and can account for changes in variables that directly impact the quantity of energy consumed. Common energy intensity metrics include energy consumption per unit of production, area, or value of shipments. The use of revenue as a unit of output is not desirable as it is subject to variables such as currency exchange rates and market factors unrelated to energy consumption.

The measure of output in an intensity metric may require extra data tracking, a potentially complicated task when multiple products are produced by a single company. In these cases, target-setting entities often use absolute measures to simplify the calculation of improvements. However, absolute energy consumption may change for a variety of circumstances unrelated to energy performance – changes in production, number of facilities, schedules, etc.

The scope of an energy performance improvement identifies energy uses and sources pertinent to the target. The scope of an energy performance improvement target may be influenced by a wider goal. For example, DuPont identified a wider goal to reduce dependence on fossil fuels. Consequently, DuPont's energy performance target uses the reduction of purchased non-renewable energy as a measure of energy performance (DuPont 2012).

Timeframe

Energy performance improvement targets usually prescribe a fixed "baseline" year against which improvements will be measured and a length of time after the baseline to achieve the target. Timeframes range in length but are generally set to be sufficiently long enough to allow for project planning, implementation, and results from energy saving actions to be measured (Price 2005).

Target timeframes are sometimes established based on legislation, treaties, or agreements that drive the creation of the target. The United Kingdom established programs with energy performance improvement targets in response to the Kyoto Protocol and internal legislation. The UK committed to reducing and sustaining GHG emissions during the 2008 – 2012 period. Partially in response to this, the UK established its Climate Change Agreements Program with the goal of reducing carbon emissions by 2010 (Price et al. 2008).

Energy Performance Improvement Target Boundary

ISO 50001 – energy management system standard defines a boundary as "physical or site limits and/or organizational limits as defined by the organization" (ISO 2011). Proper selection of a boundary for an energy performance improvement target will focus energy reduction efforts. Companies can either choose to set an energy performance improvement target for significant energy uses, a single facility, or across the entire company. If a company wide boundary is

chosen, the company may choose to apply the target globally or only across the boundaries in one country.

Quantitative Energy Performance Improvement Target Reduction

Establishment of a quantifiable energy performance improvement target provides a clear measure of progress. The numeric improvement may be established for the whole energy performance improvement target timeframe or be a series of shorter duration targets to be achieved in succession within the target timeframe. The development of the numeric value will depend on the wider goal served by the target.

Drivers for Energy Performance Targets and Their Establishment Process

The programs reviewed in this paper established energy performance improvement targets to improve energy intensity or reduce energy consumption of industrial companies. The drivers for these targets vary and depend upon the wider interests of the target setting organization. External targets established as part of industrial energy efficiency VA programs and internal targets developed by major energy intensive industries are investigated to better understand the creation of energy performance improvement targets.

External Targets Drivers

External organizations often establish VA programs to improve the energy utilization of industries via adoption of an energy performance improvement targets. The incentive for a company to partner with the program may be partly driven by any regulatory authority associated with the external organization. However, in the SMART scheme, targets must remain "achievable" and therefore need to be developed to serve the broader goals of the external organization while considering the potential for industry to meet the target.

VA programs are typically designed for one of three reasons: in conjunction with a tax or regulation, offset the threat of taxation or regulation, or to voluntarily partner with organizations to promote sustainability (Price 2005). Energy performance improvement target setting programs established within each of the above three categories are examined. The U.K.'s Climate Change Agreements include energy performance improvement targets set to lessen an existing penalty, The Netherlands' Long Term Agreements include energy performance improvement targets set to avoid potential regulation, and the U.S.'s Better Buildings, Better Plants Program include targets to voluntarily improve energy performance.

All three VA programs set SMART targets as evidenced by the success of the targets (Blok et al. 2004, DECC 2011, MEA AI 2011a, Bardelline 2013, GOV.UK 2013b). These programs also set numeric milestones for energy performance improvement with timeframes for achievement and methods for measuring these improvements. All three programs have a high rate of participant target achievement indicating the targets were also achievable and realistic. Greater focus is given to the Netherland's program due to its long and well documented history with multiple program cycles providing insight into the evolution of the target setting process.

United Kingdom climate change agreements. The following discussion on the U.K. Climate Change Agreements program is taken from government publications unless otherwise noted

(GOV.UK 2013a, b). In 2000 the U.K. established the Climate Change Program to help meet the country's commitments to the Kyoto Protocol, including a 12.5% reduction in GHG emissions during the 2008 – 2012 period relative to a 1990 baseline. The program also outlined more aggressive domestic goals to reduce CO_2 emissions by 20% in 2010 and 60% by 2050 compared to a 1990 baseline. In order to meet these commitments, a tax on energy consumption, known as a Climate Change Levy (CCL), was introduced with the aim of delivering improvements in energy performance and CO_2 emission reductions in industry by increasing pressure on U.K. businesses to improve their sustainability. The CCL effectively increased the unit cost of energy, subsequently increasing the financial incentive to reduce energy use. In recognition of the negative impact the CCL posed to the competitiveness of energy intensive sectors, the U.K. government created Climate Change Agreements (CCA). The CCA was an agreement between energy intensive industrial sectors (as identified in Pollution Prevention and Control Regulations 2000) and the government whereby a sector agreed to meet a target to reduce energy consumption or CO_2 emissions within a certain timeframe in exchange for an 80% discount in the CCL (reduced to 65% in 2011 for all energy sources other than electricity).

During the first iteration of the CCA (2001 – 2010), energy performance improvement targets were set for each applicable sector through a negotiation process between an organization representing the sector (such as a trade alliance) and the U.K. government. Before beginning target negotiations, a government appointed advisory body evaluated the business-as-usual rate of improvement within an industrial sector if the CCA and CCL did not exist, as well as the total potential energy performance improvement for the sector achieved through cost-effective measures. This provided a lower and upper target bound, respectively, when negotiating targets with the sectors (Ekins and Etheridge 2006). Sector specific energy performance improvement targets were set with an achievement date of 2010 against a 1999 or 2000 baseline year. Sectors were allowed to select targets based on energy intensity (GJ/tonne of product), carbon intensity (tonne of CO_2/tonne of product), absolute energy (GJ), or absolute carbon (tonnes of CO_2). 40 of the 44 sectors opted for energy intensity targets.

In addition to sector targets, the UK government negotiated targets with target units (TU), or groups of similar facilities. TUs commit to a reduction in the same category (i.e. energy or carbon) as the sector target, but do not necessarily have to quantitatively match (relative or absolute) the sector target.

Energy performance improvement targets were re-examined in 2004 and 2008 and adjustments were made to account for changes in the sector structure. Target adjustments were also made to account for Emissions Trading Schemes adopted after the initiation of the CCA.

The reductions achieved by CCL alone would be dependent on a company's assessment of the financial value of energy and carbon use reductions. CCA created a structured mechanism to achieve national emissions reduction targets by financially incentivizing energy intensive companies to set energy or CO_2 reduction targets. The fundamental mechanism for setting energy performance or CO_2 reduction targets in CCA was to understand the potential for a sector to achieve improvements in energy performance or carbon emissions.

Netherlands' long term agreements. The Netherlands first implemented its Long Term Agreements (LTA) VA program in 1990 to reduce CO_2 emissions from its industrial sector. As of 2013, The Netherlands had progressed to its third generation of LTA. Through all three generations, agreements are made between representatives from the industrial sector and the Dutch Ministry of Economic Affairs (MEA). The industrial participant agrees to meet a

negotiated energy performance improvement target, and in return the Dutch government agrees to not impose new energy efficiency or CO_2 regulations on the industrial participant while the LTA is valid (Blok et al. 2004). The government also commits to help the participant achieve its target by sharing information related to energy performance improvement measures and providing financial incentives for implementing the same. These include tools, external consulting, tax incentives and subsidies for successful implementation of energy efficiency measures (Avest et al. 2007). Participants failing to meet their LTA target can be subjected to stronger environmental regulation and permitting requirements (Price et al. 2008, Blok et al. 2004). LTA agreements (past and present) include the LTA1, LTA2, Energy Benchmark Covenants, LTA3, and Long Term Agreements on Energy Efficiency for ETS Enterprises (LEE). Table 1 provides details of key characteristics for each LTA followed by a description of the drivers and the energy performance improvement target setting process for each.

Table 1. Summary of Dutch LTAs

Program	Year Created	Eligibility	Program focus	Negotiating partner	Incentive for industry to partner	Target	Baseline Year	Achievement Year
LTA1	1990	Sectors consuming >1 PJ/yr	Improvements in process efficiency	Industrial sectors	Immunity from new CO_2 and Energy Efficiency regulation	Legally binding 19% improvement in energy efficiency	1989	2000
LTA2	2000	Facilities consuming <0.5 PJ/yr	Process efficiency, supply chain, sustainable energy use	Industrial companies, sectors, or Competent Authorities	Same as LTA1 plus easier environmental permitting	Specific to company and legally binding	2001	2012
Energy Benchmark Covenants	2000	Facilities consuming >0.5 PJ/yr	Process efficiency, supply chain, sustainable energy use	Industrial companies, sectors, or Competent Authorities	Same as LTA1 plus easier environmental permitting	Legally bound to be among the most energy efficient of similar facilities in the world	2001	2012
LTA3	2007	Facilities consuming <0.5 PJ/yr	Process efficiency, supply chain, sustainable energy use	Industrial companies, sectors, or Competent Authorities	Same as LTA1 plus easier environmental permitting	30% overall; 20% within the company and 10% within the supply chain; legally binding	2005	2020
LEE	2007	Facilities consuming >0.5 PJ/yr	Process efficiency, supply chain, sustainable energy use	Industrial companies, sectors, or Competent Authorities	Same as LTA1 plus easier environmental permitting	Company specific		Series of four year plans

The driver behind the creation of the LTA1 was to stabilize CO_2 emissions to 1990 levels in 1994/1995 with further reductions of 3 – 5% in 2000 compared to a 1989/1990 baseline (Rietbergen, Farla, and Blok 2002). Targets were negotiated with each industrial sector based on the overall LTA energy performance improvement target (see Table 1). Potential energy efficiency measures were identified for the sector by a third party working on behalf of the MEA performing Energy Potential Scans, or energy audits. These were used to establish an energy performance improvement target and a plan for achieving the target (Blok et al. 2004).

Upon its conclusion, the average improvement in energy efficiency for sectors in the LTA1 was 22.3% (Blok et al. 2004). Due to this success, a new set of LTA was proposed to industry through 2012 in order to further improve the energy performance of the industrial sector. Two sets of agreements were designed: LTA2 for small and midsized facilities (<0.5 PJ/year or ~ 474,000 MMBtu/yr) and Energy Benchmark Covenants for large facilities (>0.5 PJ/yr). Under Energy Benchmark Covenants, industrial facilities committed to becoming one of the world's most efficient facilities in regions similar to the Netherlands or be in the top 10% of the most energy efficient plants in the world, with both benchmarks determined by the facility (Price et al 2008). The demarcation of 0.5 PJ/yr was chosen because it was determined that it

could potentially capture 80% of Dutch industrial energy consumption in the Energy Benchmark Covenants (Commissie Benchmarking 2013).

As stated by the Dutch government (MEA AI 2011b, c) LTA2 did not have a firm program-wide energy performance improvement target, but participating companies agreed to develop an Energy Conservation Plan every four years which set the energy performance improvement target for the company No evidence was found suggesting a legislative driver for LTA2, such as the CO_2 emissions reduction target associated with the first LTA. The lack of a wider GHG target could explain the lack of a specific program-wide energy performance improvement target. The incentive for industry LTA2 participation was increased by considering it when granting environmental permits required for operation of a company's facilities. In recognition of the increasing difficulty of achieving further energy performance improvements in process energy uses beyond LTA1, the focus was expanded beyond energy improvements to also include increased sustainable energy use, improvements in the supply chain, and energy efficient product development (Avest et al. 2007). The government also required companies to 1) implement an energy management system within three years of signing the agreement and 2) carry out all energy efficiency measures with less than a five year payback, as identified by the Dutch government.

In 2006, the European Member States agreed upon GHG emissions reductions for industrialized nations by 2020 against a 1990 baseline. In response to this, the Netherlands passed legislation in 2007 with the goal of creating the most energy efficient industrial sector in the EU by 2020. To achieve this, the Netherlands set a 2020 goal to reduce GHG emissions by 30% against a 1990 baseline and to double the national energy efficiency improvement rate to 2% per year. To support this legislation, a more aggressive LTA was created, LTA3, to replace LTA2. Similar to LTA2, individual companies are required to establish an Energy Efficiency Plan (EEP) every four years, mapping out a company's strategy and timeline for achieving energy performance improvement targets. Companies must provide a rationale if their target is less than the overall program target of 2% per year (MEA 2008). The incentives for participation in LTA2 carried over to LTA3 and were expanded to include participation in the development of Sector Roadmaps that created a vision and a path for remaining competitive in 2030.

In 2009, EU Emissions Trading Schemes required companies to meet CO_2 reduction requirements. This posed a threat to the competitiveness of the Dutch industrial sector. In the legislation creating the Energy Benchmark Covenants, the Dutch government agreed to consider the impact of any new climate or energy policy for the EU on Dutch industry and adjust the covenants accordingly (MEA 2008). In response, the Netherlands replaced the Benchmark Covenants with LEE Covenants. LEE strives for an energy performance improvement target of 2% per year. Companies worked with the Netherlands to establish energy efficiency plans for the next two years (MEA AI 2011a).

Through five programs and three generations, LTAs have in general been driven by national goals to reduce GHG emissions or a desire to be a world leader in industrial energy efficiency. In order to achieve their goals, the Dutch government has provided incentives for industry to enter into agreements by promising both future stability of and ease of complying with environmental regulations and permitting, as well as technical and financial assistance. Energy performance improvement targets were set through a balance between understanding the energy performance improvement measures available to industry, the need for industry to stay economically competitive, and the desire to achieve program goals.

US Department Of Energy better buildings, better plants program. The Energy Policy Act of 2005 allows the US Department of Energy (US DOE) to create a VA program to reduce industrial energy intensity by entering into public/private partnerships with companies from the industrial sector to reduce their energy intensity by no less than 2.5% annually between 2007 and 2016 (United States 109th Congress 2005). The Better Buildings, Better Plants (BBBP) program was established in 2011 as an on-going VA program that establishes public/private partnerships between industrial companies (partner companies) and US DOE.

The BBBP program requires partner companies to pledge to improve their corporate-wide US industrial energy performance by 25% within ten years against a fixed baseline. In return, the Secretary of Energy can offer national recognition for achievements and provide technical assistance towards achieving the reduction target. Both incentives are employed as partner companies are offered technical assistance (guidance for tracking energy performance improvements, software tools, plant level energy performance improvement trainings), yearly public statements of achievements from the US DOE upon achieving an annual 2.5% energy intensity improvement target, and recognition from the Secretary for achieving the overall 25% energy performance improvement target in ten years.

Partner companies are given flexibility when choosing their baseline for tracking energy performance improvements and may select any consecutive 12-month period between the pledge signing year and three years prior. When appropriate, adjustments to baseline energy use can be made to account for facility or process shutdowns, facility openings, re-structuring, mergers, or divestures. Partners are allowed to select their energy performance metric. Common metrics include energy per unit of physical output and absolute energy consumption. Targets are not legally binding and companies are allowed to terminate the partnership at any time without any repercussion or public announcement.

In lieu of penalties for energy use and CO_2 emissions, the US government sought reductions in CO_2 emissions through non-binding partnerships with industry to reduce energy use without affecting competitiveness. The recognition and technical assistance provided through the partnership is generally sufficient incentive for partner companies engaged in BBBP.

Internal Drivers

Industrial companies set a variety of targets to address sustainability issues such as energy consumption and CO_2 emissions reduction. Energy performance improvement targets are established to help address these issues and the specific needs of the company.

A review of publicly stated current energy performance improvement targets for several large energy intensive companies was conducted (Alcoa 2011, Cemex 2011, Dow 2012, DuPont 2012, ExxonMobil 2011, International Paper 2011, PepsiCo 2012, 2013, PPG 2011, Verallia 2012). Nearly all of the targets are easily communicated with numbers rounded to the nearest 5% and timeframes of 10 years. Rounding numbers creates a more easily understood quantitative metric, while the 10-year timeframe allows for planning and implementation of energy performance improvement measures and realization of energy savings from these efforts. Further, the selected energy performance metric provides insight into the focus and method for improvement. For example, International Paper excludes onsite-generated fuels such as black liquor from its energy performance metric, opting to use purchased energy only. Increasing the use of biomass is one method companies within the paper sector employ to reduce GHG emissions.

Interviews with an Energy Manager from a large steel company ('Steel Company') with operations in the U.S. provided insight into the processes used when setting energy performance improvement targets for a company within an energy intensive sector.

Example of internal energy performance improvement target development. Sustainability has been an ongoing focus of Steel Company and they sought to partner with a VA program that offered public recognition for their energy reduction efforts. Steel Company began to consider their potential for energy performance improvement as a prerequisite for partnership with a VA program. Steel Company also recognized the financial incentives for reducing energy consumption. Energy accounts for 20% of operation costs for steel companies. While the North American steel sector has reduced its energy intensity (energy/production unit) by 27% since 1990, additional opportunities for improvement have been identified (Worrell et al. 2010, American Iron and Steel Institute 2013).

The Steel Company energy manager interviewed has proposed a 1% annual energy performance improvement (energy/unit production) at US based industrial facilities for senior management approval. The energy performance improvement target would also help to achieve a wider company GHG target, which energy management was responsible for achieving. The energy performance improvement target was developed using a bottom-up approach of potential energy efficiency improvements of processes used by Steel Company, including segregation of improvement potential by energy intensive operations such as Electric Arc Furnace (EAF) and integrated operations at US based facilities. This was done because EAF and integrated operations have significantly different energy performance improvement potential (Worrell et al. 2010). The proposed 1% target is an aggregation of separate energy performance improvement targets for integrated operations and all other operations (i.e. EAF processes, building energy use) based on what is perceived to be achievable.

For Steel Company, sector-wide targets would not be wholly applicable without allowances for operational differences such as integrated and EAF processes. The US DOE projects a 1.6% annual improvement in energy intensity (energy/dollar value of shipments) for the Iron and Steel sector through 2035 (DOE 2012). However, the improvement projected by the US DOE largely represents sector wide production shifts from integrated operations to EAF operations, a process that is nearly 4 times less energy intensive (US EPA 2007). EAF processes recycle scrap steel for conversion into new steel, whereas integrated operations use iron ore as the feedstock for producing new steel. Therefore, unless any particular company projects large shifts from integrated operations to EAF processes, the improvements projected by the US DOE cannot be used to set company specific energy performance improvement targets.

Discussion of Findings on Target Development Processes

Through studying the development of energy performance improvement targets for three VA programs and the development of an internal target for a steel manufacturer, a set of questions and process steps to follow to develop SMART energy performance improvement targets was developed and is presented in Table 2. Pertinent criteria for industrial companies and external organization in relation to the questions and processes have also been identified. Addressing these questions and following the steps outlined in Table 2 will increase the likelihood of establishing an energy performance improvement target agreeable to both external programs and the industrial companies they serve.

Table 2. Questions and processes to identify criteria for external and internal target setting bodies

	Criteria	
Questions/Process	**External Organization**	**Internal to Company**
What is the purpose of the target?		
Reduce costs		X
Cleaner production process	X	X
Increase adoption of energy efficient technologies	X	
Reduce dependence on fossil fuels	X	X
Provide milestones for achievement of wider goal	X	X
Make sustainability efforts communicable	X	X
Who are all relevant stakeholders to engage during target setting process?	Government and sector representatives such as trade associations	Facility and corporate management
Who are the parties the executers of the target are responsible to?	Constituents, International community via treaties and agreements	Senior management, costumers, supply chain, and shareholders
Determine the energy efficiency potential for the intended target group	Determine sector or industry wide opportunities	Use bottom-up analysis of realized and remaining opportunities
Re-examine or allow for adjustments to be made mid-target timeframe to account for changes to industry	X	X
Develop mechanism for adopting target		
Incentives for achieving target	Offer recognition, no new regulation, reduced tax, technical assistance, and national recognition to participant	Increased capital funding for projects, internal recognition
Consequences to industry for not achieving targets	Varies from none to increased regulation and tax	May be tied to staff financial incentives and/or internal recognition

Conclusion

Energy performance improvement targets can be an effective motivator to achieve energy savings within the industrial sector. This paper reviews the drivers behind the establishment of internal and external energy performance improvement targets and presents results in a comparative table identifying key considerations for both (Table 2). An interesting and promising result is the dual benefits for internal and external stakeholders associated with establishing and meeting energy performance improvement targets. Ultimately, setting and meeting energy performance improvement targets improves sustainability while also increasing company profitability.

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