Policy Analysis of Incentives to Encourage Adoption of the Superior Energy Performance Program

Roderick K. Jackson, Oak Ridge National Laboratory
Marilyn A. Brown and Matt Cox, Georgia Institute of Technology

ABSTRACT

Given the significant energy reduction potential that energy management systems such as Superior Energy Performance (SEP) can generate, policy intervention at the Federal level may be worthwhile to help address the barriers that impede SEP market penetration. Specifically, we design and evaluate a policy incorporating a production tax credit for energy-efficiency savings, energy-efficiency credits for compliance with energy portfolio requirements, grants to subsidize initial certification costs, and recognition programs to incentivize SEP adoption in the US. The same policy components could serve as a model of Global Superior Energy Performance (GSEP) deployment. Grounded in an understanding of industrial decision-making and the barriers impeding efficiency improvements, this paper presents a detailed analysis of this policy option. This analysis includes examining the potential for leveraging of energy savings and CO_2 emissions with public investments, in addition to estimating more traditional benefit and cost metrics.

Introduction

Numerous studies document high energy-savings potential in energy-intensive industries in the U.S., which include an analysis by the McKinsey Group (Granade, 2009). In the chemicals industry, potential cost-effective energy savings are estimated to range from 3% to 18% of energy consumption in 2020. Larger potential savings are envisioned for the petroleum refining industry, ranging from 5% to 65% of energy consumption in 2020. The pulp and paper industry also represents a significant potential for energy savings through process improvements, ranging from 6% to 37% reductions in 2020 (Brown, Cortes, and Cox, 2010). The breadth of these industry-specific estimates of the potential to improve energy efficiency highlights the lack of consensus about the magnitude of this opportunity. Nevertheless, all of the studies concur that significant investment opportunities exist offering positive net present value (NPV). However, in the absence of policy intervention, most of this potential will likely go unrealized.

Cooperatively developed by U.S. industry and the federal government, the Superior Energy Performance[1] (SEP) program has an overall goal to provide industrial facilities with a roadmap for achieving continual improvement in energy efficiency while supporting global competiveness.[2] SEP seeks to foster a culture of continuous improvement in energy efficiency within a transparent system that validates energy performance improvements and management

[1] At the Clean Energy Ministerial in July, 2010, U.S. Secretary of Energy Steven Chu announced the launch of the Global Superior Energy Performance (GSEP) Partnership. GSEP is the global expansion of the Superior Energy Performance (SEP) program for industrial facilities, in addition to a broadening of its application to commercial buildings.

[2] http://www.superiorenergyperformance.net/pdfs/SEP_Overview.pdf

practices and also provides a verified record of savings. The strong measurement and verification (M&V) protocol encompassed within SEP affords an effective method to validate energy savings from efficiency improvements. The SEP M&V protocol gives a best practice methodology to 1) verify energy savings resulting from SEP implementation; 2) quantify energy savings from specific measures or projects; and 3) track energy performance improvements over time for the entire facility.[3] Through the strategic plan to continuously identify, measure, and verify energy-efficiency improvements, SEP creates a company-wide culture of sustainable and efficient energy stewardship. SEP program elements are currently being piloted in manufacturing facilities in Texas. The national launch of SEP is anticipated in Fall 2011.[4]

Elements of the Recommended Policy Approach

The Federal government could establish incentives that include the following:

- *Federal production tax credit for energy-efficiency savings of facilities that become SEP certified*. Consistent with existing federal renewable energy production tax credits (PTC), SEP facilities could receive a per-kilowatt-hour (kWh) tax credit for verified energy savings. For energy savings from non-electricity sources, an equivalent kWh, based on source energy, could be determined so that all fuel source energy savings are eligible for receiving the tax credit. A PTC rate of $0.011/kWh saved would be consistent with existing federal PTCs offered for renewable sources.[5] PTC eligibility for industrial facilities would occur for the first three years of their participation in the SEP program.
- *Allow verified energy savings of facilities that are SEP certified to be counted as an energy-efficiency credit in compliance with Energy Efficiency Resource Standards (EERS) or Renewable Energy Standard (RES) requirements.* The ability to count savings as an efficiency credit places a market value on energy efficiency, particularly in an environment where renewable and efficiency credits are traded. Consequently, energy efficiency can then generate top-line revenue growth, while continuing to increase bottom-line profits. As such, energy efficiency could better compete with other investments for corporate attention and capital. Similar to the manner in which the federal PTC would be determined, savings from all energy sources would be eligible to be counted as an efficiency credit by determining an equivalent kWh. While there is not an existing energy portfolio trading program in place on the national level, Pennsylvania and Nevada, for example, currently consider energy-efficiency measures as a part of portfolio standard compliance
- *Provide an energy-efficiency grant for 30% of eligible certification costs.* Similar to the grant authorized in the American Recovery and Reinvestment Act (ARRA, 2009) for 30% of eligible expenditures related to the installation of renewable technologies, the federal government could refund 30% of eligible costs associated with SEP certification to facilities. These costs would include audit costs for certification, in addition to the facility's cost of training one certified energy manager or energy management practitioner to facilitate SEP implementation. We estimate total costs of $25,000, such

[3] http://www.superiorenergyperformance.net/MandV.html
[4] See footnote 2 above
[5] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US13F&re=1&ee=1

that a one-time grant for the initial SEP certification would be approximately $7,500 per industrial facility that adopts SEP and could be capped at $10,000 per facility.

- *Establish recognition program for SEP certified facilities***.** Following the lead of successful recognition programs, such as *Save Energy Now* LEADER Companies, ENERGY STAR® for Industry, and *Save Energy Now* Energy Champions, SEP awards could identify facilities as having demonstrated a strong commitment to efficient energy management. This would drive industry participation and innovation.

Policy Experience

In 2000, Denmark and the U.S. initiated the development of energy management standards, such as those included in SEP, through voluntary programs with industry. Shortly thereafter, Sweden, Ireland, and the Netherlands established comparable national energy management standards. Korea and Thailand followed, in 2008, with similar management standards for industrial energy consumption. The original U.S. standard, ANSI/MSE 2000, was crafted by the Georgia Institute of Technology (Georgia Tech). The most recent version of the U.S. standard, ANSI/MSE 2000:2008, reflects a broader stakeholder representation on the consensus board, expanded involvement of potential users, and increased implementation.

In the countries with national energy management standards, adoption is voluntary and targets larger industrial plants. However, incentives to encourage adoption have proven successful and beneficial when employed, and result in significantly improved participation rates and energy savings (Price, 2005). Unlike the U.S., Denmark, Ireland, the Netherlands, and Sweden all offer financial incentives for meeting compliance targets. These incentives typically include energy or tax relief (McKane et al., 2005). For example, heavy process industrial facilities in Denmark have a CO_2 tax of 3.35 €/ton CO_2, while facilities that have entered a voluntary agreement for efficient energy management pay a reduced tax of 0.40 €/ton CO_2 (an 88% savings). With the exception of Sweden, these countries also provide technical training on standards compliance.

The impact of incentives-based policies is significant. Ericsson (2006) notes that the voluntary agreements and associated incentives are a significant driver for encouraging energy efficiency through the use of energy management standards and cover 98% of the energy use in heavy industrial processes in Denmark. For Danish industry of all sizes, energy management standards guide 60% of energy use (McKane et al., 2005). Energy intensive companies under Danish voluntary agreements must commit to implementing all energy-efficient measures related to heavy processes with a payback period of four years or less, while other companies must implement measures with a payback period of six years or less for compliance. A 2002 evaluation of the voluntary system in Denmark found that half of the participating companies reduced their energy use by 20% (McKane et al., 2005). Companies under the voluntary agreements also cited better product quality, increased production capacity, and increased employee engagement as other benefits of participation.

Sweden offers an energy tax exemption for companies that establish a standardized energy management system and undertake energy-efficiency improvements through voluntary agreements with the Swedish government. Companies that do not elect to participate pay a $0.0006 per kWh tax (SEA, 2007). The Swedish program requires a five-year commitment with benchmarking requirements. After two years, a company must implement an energy management standard certified by of an accredited certification body. As of January 2007, companies representing 50% of all industrial electricity use in Sweden participated in the program (McKane et al., 2007).

The U.S. has adopted a different approach to encouraging the adoption of energy management standards in industry. The U.S. has not explicitly promoted adoption of its national energy management standard or offered financial incentives or regulatory penalties, but has educated industry about facility energy-efficiency opportunities. As of 2007, market penetration of the energy management standard was distributed in less than 5% of the total industrial energy use (McKane et al., 2007). This small adoption percentage is particularly unfortunate given the ability of companies that have used energy management approaches to achieve major energy intensity improvements. For example, Dow Chemical achieved 22% improvement (over $4 billion in aggregate savings) between 1994 and 2005 and is now seeking an additional 25% improvement from 2005 to 2015 (Scheihing, 2009). United Technologies reduced global GHG emissions by 46% per dollar of revenue from 2001 to 2006, while Toyota's North American Energy Management Organization has reduced energy intensity by 23% since 2002 and saved $9.2 million in energy costs since 1999 (Scheihing, 2009). In the absence of widespread adoption of formal energy management standards, the U.S. has developed significant technical capability in industrial energy efficiency, particularly with regard to motor, steam, and process heating systems (McKane et al., 2007). Federal activities and programs led by DOE's Industrial Technology Program (ITP), such as *Save Energy Now*, Industrial Assessment Centers, and Best Practices have played a key role in fostering this increased energy efficiency in industry. However, larger, sustained efficiency improvements can be achieved by implementing energy management protocols as companies such as Dow Chemical, United Technologies, and Toyota have demonstrated.

Policy Rationale and Description

U.S. efforts to increase energy efficiency in industrial facilities have historically included a large focus on component level improvement rather than system optimization. This approach tends to yield short term and unrealized potential since energy efficiency in industry is mostly achieved through improvements in how energy is managed versus simply through the installation of new technology. As noted by engineers in Georgia Tech's Energy and Environmental Management Center, energy savings realized by energy-efficient projects often were not sustained.[6] Even when energy-efficient recommendations resulted in significant savings between 15% and 30%, the operational and behavioral changes needed to sustain the savings were lost over time. Employing energy management standards helps to reverse the trend of lost energy savings with time. Through the strategic plan to identify, measure, and verify continuous energy-efficiency improvements, energy management standards create a company-wide culture of sustainable and efficient energy stewardship.

As a partner of the U.S. Council for Energy-Efficient Manufacturing (U.S. CEEM), DOE's ITP has been working with U.S. industrial companies, the American National Standards Institute (ANSI), EPA, the U.S. Department of Commerce (DOC), and Texas Industries of the Future on the development of SEP. Central to SEP is implementation of ANSI/MSE 2000-2008,

[6] www.innovate.gatech.edu/default.aspx?tabid=2008

which is the accepted American National Standard for the development of a management system for energy. Forthcoming is ISO 50001, which will replace ANSI/MSE 2000-2008 as the guiding energy management standard for SEP. Similar to ISO standards for quality management (ISO 9001) and environmental management (ISO 14001), ISO 50001 will be an internationally accepted management standard. ISO 50001 conformance includes the implementation of sustainable energy management systems, baseline energy consumption verification, and a corporate commitment to continual energy performance improvement.

While ISO 50001 and other energy management standards are effective systems to identify methods and pathways to achieve energy savings, when employed alone they do not offer sufficient mechanisms to ensure that energy performance improvements are achieved. However, the M&V system contained within SEP does enable a certifiable approach to facilitate actual achievement and accountability of energy saving goals. As a second primary criterion for acquiring certification, the SEP M&V protocol gives a best practice methodology to 1) verify energy savings resulting from SEP implementation; 2) quantify energy savings from specific measures or projects; and 3) track energy performance improvements over time for the entire facility.[7]

To encourage greater energy savings, SEP offers silver, gold, and platinum performance level designations through either an energy performance or mature energy pathway.[8] The energy performance pathway is likely the method that most companies will choose to achieve initial SEP certification. Facilities that wish to attain a silver performance level must achieve a 5% or better energy performance improvement over the last three years. Gold and platinum levels must achieve energy performance improvements of 10% and 15% respectively.

Achieving these percentages of energy performance improvements will be more challenging for plants that have already implemented significantly high levels of energy-efficiency improvements, either through earlier SEP certifications via the energy performance pathway or through other energy management systems. For these plants, the mature energy pathway takes into account both a plant's energy management system and continued efforts to improve energy performance. Companies that become SEP certified through either pathway will have made an accountable commitment to improving energy performance and maintaining a culture of efficient energy use and management. SEP will help the industrial sector move beyond energy performance objectives to proven results. These incentives described in this policy are envisioned to accelerate and deepen the levels of participation in the SEP program.

Implementation of SEP will address existing barriers to industrial energy efficiency. Energy typically receives a low level of awareness and attention from senior management at industrial companies (Granade et al., 2009), but successful SEP implementation would instill a culture of sustainable and efficient energy stewardship throughout the organizational structure. Because continual energy performance improvement is a requirement of SEP, employees at all levels in the organization must communicate and practice efficient energy management. SEP facilitates a broader dispersion of the "institutional memory" associated with energy-efficient industrial process operation and management than is typically achieved when technical expertise is localized with individuals within the facility. Since sustained SEP achievement requires a broader group of personnel within the organization with technical and/or management expertise to efficiently manage energy performance, SEP will also address the lack of workforce

[7] See footnote 3 above.
[8] See footnote 2 above.

knowledge and specialized skills. Elevated hurdle rates and capital allocation for energy-efficiency improvement measures will also decrease under SEP. Finally, energy-efficient improvements in industrial facilities are often short-lived. SEP addresses this barrier to sustained energy savings from energy-efficient upgrades by encouraging a system level approach that includes the operational and behavioral changes needed to achieve optimal energy performance. SEP can also improve energy data, since capturing and analyzing energy data is a key component of an energy management program (Brown and Key, 2003).

Since May 2008, DOE has worked with the University of Texas at Austin to pilot SEP at various industrial facilities. This pilot enabled field testing of the processes, standards, and performance criteria to ensure they were 1) practical and achievable, 2) a benefit to the industrial facility, and 3) a reliable method to verify that proposed certification criteria were met.[9] Five facilities were certified to Superior Energy Performance in this pilot at performance levels of silver (3 facilities), gold (1 facility), and platinum (1 facility).[10]

While implementation of SEP has significant promise to address many barriers to industrial energy efficiency, without incentives such as those described by this policy option, it is likely that the adoption of SEP will not achieve the desired penetration into the industrial sector. Past rates of adoption of energy management standards in the U.S. contrast sharply to European countries with strong incentives to support this conclusion (McKane et al., 2005). Because most facilities will initially become SEP certified through the energy performance pathway, early investment costs in energy efficiency will be significant. The federal grant to partially cover original SEP certification costs along with the PTC will provide industries an initial incentive to enroll in the voluntary SEP program by offsetting some of the inaugural investment costs. Moreover, the ability to count energy-efficiency savings as credit for EERS/RES compliance could place a revenue value on efficiency gains that will incite a market-driven push for energy-efficiency credits from industrial facilities with SEP certification. Because of the difficulty in effectively evaluating energy saved from energy efficiency in the industrial sector, quantifying the value of a unit of conserved energy has been a continuing challenge. However, the strong M&V protocol embodied within the SEP framework facilitates a higher economic confidence in the initial and continued savings from energy-efficient measures. The top-line revenue generated from trading efficiency credits will foster sustained enrollment in the SEP program long after federal financial incentives have ended. Finally, rewards and competition will also drive participation. As such, the incentives described in this policy option are consistent with national and international activities to encourage energy-efficient practices

Stakeholders and Constituencies

Important stakeholders include industrial firms and manufacturers, environmentalists, the general public, consumer groups, utilities and regulators, energy service companies, along with local state and federal governments. They are summarized in the table below.

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[9] http://www.superiorenergyperformance.net/texas_pilot.html
[10] See footnote 2 above.

Table 1. Stakeholder Assessment of Incentives to Encourage the Superior Energy Performance Program

Stakeholder	Pros	Cons	Dominant Position
Industrial Firms and Facilities	Will reduce energy bills and provide additional revenue stream through the sale of energy efficiency credits	Significant capital investment required	Favorable
Environmentalists	Through increased energy efficiency, SEP will improve the environmental performance of participating facilities	None	Favorable
General public and consumer groups	SEP implementation will positively impact the local and national economy through increased project and employment	Consumer groups may resist Federal funding to incentivize industrial energy efficiency since industrial firms directly reap the energy savings	Favorable
Utilities and regulators	By allowing energy savings to count towards EERS compliance, gas and electric utilities will have an additional partner and pathway to procure energy credits	Without decoupling, energy efficiency can negatively affect balance sheets	Unfavorable
Energy Service Companies	Through increased demand for energy efficiency, ESCOs can increase their industrial sector penetration	None	Favorable
Local, State, and Federal Government	Prospects of increasing industrial productivity through energy efficiency would lead to policy support by many government agencies	Emphasis on federal debt reduction will cause scrutiny of proposals to expand government subsidies	Favorable

Policy Evaluation

In order to evaluate the estimated impact of incentivizing SEP adoption, we assumed that the primary groups of facilities that will implement SEP are medium to large industrial sites (facilities with energy consumption of at least 300 billion British thermal units (Btu) of combined energy per year, or its equivalent, and generally more than 250 employees). According to the Manufacturing Energy Consumption Survey, (EIA, 2006) as of 2006, there were approximately 10,000 facilities in this classification, accounting for 67% of U.S. industrial energy consumption. While it is probable that other medium and possibly small industrial sites will adopt SEP, the primary impact will be from large facilities, given their significant proportion of energy use in the industrial sector. For analysis, we assumed two different policy scenarios to describe a higher and lower penetration of SEP into the industrial sector. In the first policy scenario (PS1), 60% of facilities that comprise the large category, or about 5,760 sites, will adopt the SEP program. This is equivalent to approximately 40% of the total U.S. industrial energy consumption. This level of participation was chosen as a primary policy scenario because it is within the range of international adoption of energy management standards in countries with government sponsored strong incentives (McKane et al., 2005). The policy sensitivity assumes a lower penetration, 30% of large facilities (i.e. 20% of industrial energy use).

In both policy scenarios, we predict that approximately 35% of facilities that become SEP certified will achieve a performance level of silver, while an additional 30% will achieve gold, and 15% will achieve a performance of platinum. Descriptions of the requirements for certification for different performance levels are detailed in Brown et al (Brown, 2011). Performance level estimations are based on a survey enquiring of executives the level of LEED certification their company would most likely seek (Turner Construction, 2008). LEED has a similar performance level structure, and insight with regard to the performance level executives would seek is a reasonable measure of future SEP performance level attainment.

These scenarios are compared to the reference case of AEO 2010 (EIA, 2010). Based on the historical adoption rate of energy management standards in the U.S., in the absence of the incentives provided in this policy, we assume that 5% of large facilities would become SEP certified and are hereafter modeled as "free riders". Analysis of the policy and its sensitivity scenario in this report will exclude the benefits and costs of projected free riders. Additionally, the impact of business as usual (BAU) energy efficiency improvements forecasted by *AEO 2010* (EIA, 2010) was also determined and removed from benefit projection and cost effectiveness evaluation.

Significant energy and carbon dioxide emissions reductions projected as a result of this policy are shown in Table 1, which illustrate the impact on industrial energy consumption relative to private costs – as a result, we call this the "industrialists'" perspective. While BAU annual energy consumption is forecasted to grow by an average of 0.5% annually from 2011 to 2035 (an increase of 3,760 TBtu) the annual energy saved would reduce this anticipated increase by 2,380 TBtu (a 63% reduction). To place the forecasted energy saved in perspective, the projected 2,380 TBtu of energy savings in 2035 account for 8% of total industrial energy consumption. Additionally, almost 49 quads of energy savings are estimated from 2011 to 2055. For comparison, the policy sensitivity is expected to result in approximately 22 quads over the same period.

Table 2. SEP Program Impact from the Industrialists' Perspective* (40% SEP Penetration)

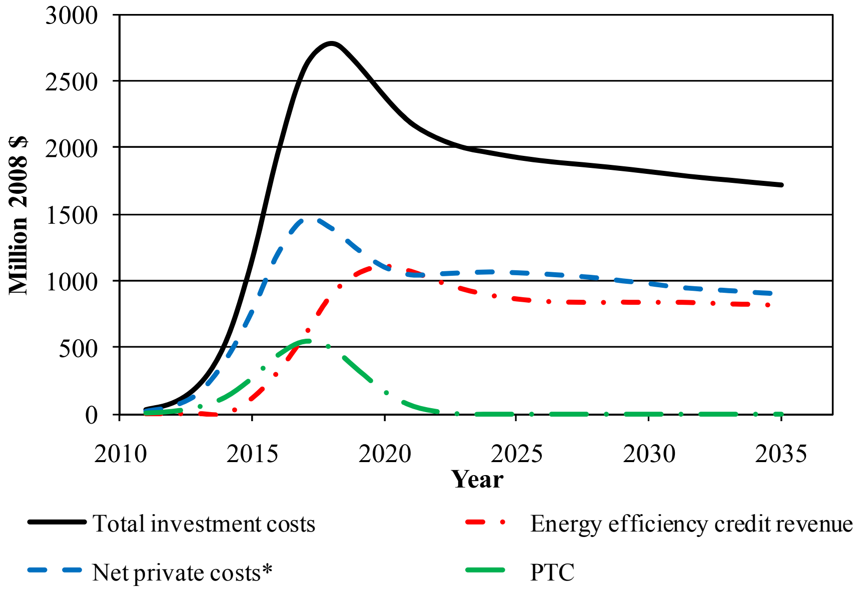
Year	BAU Energy Consumption**	Annual Energy Savings			Cumulative Energy Savings***		Annual Private Cost	Cumulative Private Cost
	Trillion Btu	Trillion Btu	$M (2008)	%	Trillion Btu	$M (2008)	$M (2008)	$M (2008)
2011	27,000							
2020	29,800	656	2,220	2.2	2,050	7,600	769	3,300
2035	30,800	2,380	3,180	7.7	26,300	55,100	227	10,200
2055	---	---		---	48,800	74,800	---	10,200

* Present value of costs and benefits were calculated using a 7% discount rate.
** Reference case industrial energy consumption excludes refining
***Investments stimulated from the policy occur through 2035. Energy savings are then modeled to degrade at a rate of 5% after 2035, such that all benefits from the policy have ended by 2055.

The investment incentives suggested by this policy and their associated impact on private and federal costs are illustrated in Figure 1 for the primary policy where 40% of industrial energy consumption is assumed to be SEP certified. Net private costs shown in the figure are equal to the total investment costs minus the PTC and revenue from energy-efficiency credits. The PTC and revenue generated from energy-efficiency savings have the overall combined impact of mitigating the private investment costs of energy-efficiency measures by roughly half throughout the modeled period. As seen in the figure from 2011 through 2018, the PTC helps to offset the high initial investment costs of industrial sites as they first gain SEP certification through the energy performance pathway. The energy performance improvement goals in the energy performance pathway range from 3% to 15%, as described earlier. Details of how different facilities are modeled to pursue SEP certification are described in Brown et al (Brown, 2011).

Because there is currently not a national EERS or RES framework, revenue from energy-efficiency credits is not modeled to begin until 2015. We estimate this framework to be in place by this time. We also assume that energy-efficiency savings have a contract period of four years, such that efficiency measures are able to generate revenue for a four-year period under our assumptions. Beginning in 2015, the revenue from energy-efficiency credits increases with energy-efficiency savings. After the initial period of savings accumulation, the revenue from energy-efficiency credits begins to level off and subsequently experiences a slight decrease in later years, as SEP sites transfer from making large energy improvement gains (i.e., energy improvement pathway) to utilizing industrial best practices to efficiently manage energy consumption (i.e., mature energy pathway).

Figure 1. Impact of PTC and Energy Efficiency Credits on Total Investment Costs



The benefits and costs of this policy are shown in Tables 2 and 3. With a 40% SEP penetration rate, this policy is expected to generate $75 billion in cumulative energy savings from cumulative private investments of $10.2 billion that are leveraged from approximately $2.2 billion in federal funding. Moreover, these public expenditures lead to energy savings of approximately 49 quads. This yields an energy leveraging ratio of 23 TBtu/million $2008 or MMBtu/$2008. Similarly in the policy sensitivity case, $1.1 billion in public investments generate $35.8 billion in cumulative energy savings. This yields an energy leveraging ratio of 21 TBtu/million $2008 or MMBtu/$2008.

Table 3: Leveraging of Energy Savings from Cumulative Public Investments in Incentives to Promote SEP in Industry

Year	Public Costs*				Cumulative Energy Savings	Leveraging Ratio*
	Million $2008				TBtus	MMBtu/$
	Annual Administration Cost	Annual Investment Cost	Total Annual Costs	Total Cumulative Costs		
2020	0.4	127	127	2,100	2,050	
2035	0.1	0	0.1	2,160	26,300	
2055	---	---	---	2,160	48,800	23

*Ratio of cumulative energy savings in MMBtu to cumulative public costs in $2008. Present value of public costs were calculated using a 3% discount rate.

Table the ability of the public sector to leverage carbon dioxide savings in the industrial sector with incentives to promote the adoption of SEP. In 2035, public expenditures lead to CO_2 savings of 107 metric tons, representing 8% of the business-as-usual CO_2 emissions in the industrial sector that year. Over the lifetime of the equipment installed by 2035 as a result of this policy change, 2,230 metric tons of CO_2 emissions are avoided, yielding a carbon-dioxide leveraging ratio of one ton per dollar. For the policy sensitivity, a cumulative total of 1,040 metric tons of CO_2 is avoided through 2055 via leveraging of 0.9 metric tons per dollar of public investment.

Table 4. Leveraging of CO_2 Emission Reductions Cumulative Public Investments in Incentives to Promote SEP in Industry

Year	Public Costs	CO_2 Emission Reductions			Leveraging Ratio*
	Million $2008	Million Metric Tons CO_2			
	Cumulative Costs	Annual MMT Saved	% Annual Emissions	Cumulative MMT Saved	Metric Tons/$
2020	2,100	31	2.2%	98	--
2035	2,160	107	7.7%	1,210	--
2055	2,160	--	--	2,230	1.0

*Ratio of cumulative emission reductions in million metric tons to cumulative public costs in $2008. Present value of public costs were calculated using a 3% discount rate.

Additional benefits from avoided air pollution damages due to the combustion of less fossil energy are also a significant benefit. Four criteria pollutants were considered, namely NO_x, SO_2, PM_{10} (excludes pollutant damages from petroleum and coal for industrial heat), and $PM_{2.5}$. The avoided damage values are based on the National Research Council report estimating damages from energy production and consumption in the U.S. (NRC, 2010). We determined the financial value of reduced CO_2 emissions in each year by multiplying the decrement in emissions by the "social cost of carbon" (SCC) for that year. The SCC is defined as an estimate of the monetized damages caused by each incremental ton of CO_2 emitted. The SCC used in this analysis is based on the central value estimates of the U.S. Government Interagency Working Group on the Social Cost of Carbon (EPA, 2010). Included in Table 5 are estimated monetized benefits for the avoided air pollution damages from the four criteria pollutants and CO_2.

Table 5. Total Social Benefit/Cost Analysis of Cumulative Public Investments in Incentives to Promote SEP in Industry

	Cumulative Social Benefits (Billions $2008)				Cumulative Social Costs (Billions $2008)			Benefit/Cost Analysis	
Year	Energy Savings	Value of Avoided CO_2	Value of Avoided Criteria Pollutants	Total Social Benefits**	Public Costs	Private Costs	Total Social Costs**	Social B/C Ratio	Net Societal Benefits (Billions $2008)
2020	10.1	2.1	3.8	19.0	2.10	4.34	6.4		
2035	103	23.8	34.4	172	2.16	17.1	19.2		
2055	165	40.8	57.7	274	2.16	17.1	19.2	14.3	255

* Present value of costs and benefits were calculated using a 3% discount rate.
**Total costs and benefits do not include various non-monetized values (e.g. mercury pollution reduction, increased productivity, water quality impacts, etc.).

Cumulatively, the principal policy option described in this report facilitates a present value of $40.8 billion in avoided CO_2 costs, while $19.2 billion in avoided CO_2 costs are achieved in the policy sensitivity. Considering the benefits of avoided CO_2 and damage from criteria pollutants in pollution reduction along with cumulative energy savings, the total discounted savings derived from the primary policy through 2055 are $274 billion. The social benefit/cost ratio is estimated to be approximately 14.3 with an estimated net societal benefit of $255 billion. In the case of the policy sensitivity, approximately $120 billion in net societal benefits are estimated, with a social benefit/cost ratio of 14.5.

Summary

The energy management standard provided within SEP is an important tool to give industrial facilities a roadmap to efficient energy management. Because SEP combines this energy management standard with a strong M&V protocol, SEP can yield a certifiable approach to facilitate actual achievement and accountability of energy saving goals in the industrial sector. As U.S. and international experience indicates, penetration of energy management standards into the industrial sector tends to be minimal in the absence of incentives to encourage adoption. Overall, SEP will have some challenges, but offers significant long-term potential. We estimate that incentivizing SEP adoption in the industrial sector could facilitate approximately 48.8 quads and $255 billion of cumulative present value savings when energy savings and the social costs of avoided emissions are considered. With a total present value cost of Federal and private investments to provide these savings approximated as $19.2 billion, this policy has both significant potential benefits and a high ratio of benefits to costs.

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