# How have energy efficiency standards and labeling policies affected product manufacturers?

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## Abstract

Appliance energy efficiency policies, in particular minimum energy performance standards (MEPS) and comparative labels, are a proven pathway to energy savings. Countries that adopt these policies do so to achieve certain objectives—to reduce consumers' energy costs, reduce the overall demand for energy, delay the need to build new power plants, and mitigate greenhouse gas emissions, among other objectives.

What if these policies also serve to stimulate innovation in the industries producing the products in question and improve manufacturers' competitiveness? Mature standards and labeling (S&L) programs, such as those run by the United States Department of Energy and the European Commission, forecast the impacts on manufacturers of every proposed MEPS,[1] but there has been precious little examination of what the impacts of these policies on manufacturers actually have been.

This paper presents the findings from some new research into how energy efficiency policies for appliances, lighting, and industrial equipment have affected the manufacturers of these products. The paper will examine specific cases from countries around the world where MEPS, comparative labels, and complementary policies have been used to achieve energy savings while bolstering domestic manufacturers. Obviously results vary. Appliance policies are not an unqualified benefit to domestic manufacturing industries in all cases. This paper explores why manufacturers have fared well in some cases and not so well in others, and explains how complementary policies such as tax credits and direct technical assistance have been used to help manufacturers transition to producing more efficient products.

## Introduction

Minimum energy performance standards and labeling (S&L) programs for these products are proven pathways to energy savings and GHG emissions reductions. As of 2015, there were more than 1400 minimum energy performance standards, comparative labeling, and endorsement labeling policies in place in about 75 countries around the world (CLASP, 2016). Countries that adopt such policies do so to achieve certain objectives—to reduce consumers' energy costs, reduce the overall demand for energy, delay the need to build new power plants, and mitigate greenhouse gas emissions, among others. Multilateral institutions and global initiatives such as the International Finance Corporation, United Nations, International Energy Agency, and Clean Energy Ministerial are encouraging governments to introduce new or expand existing programs to control end-use energy consumption.

In just the last few years, a number of publications have appeared that present the existing evidence in favor of such policies. "Capturing the Multiple Benefits of Energy Efficiency" (OECD/IEA, 2014) discusses a wide range of benefits flowing from energy efficiency policies and programs across multiple sectors. "Achievements of Appliance Energy Efficiency Standards and Labelling Programs: A Global Assessment" (IEA 4E, 2015) also reviews the literature on a wide range

[1] The impact of S&L policies have been studied extensively in the past, but these assessments often focused on energy savings and emissions reductions rather than manufacturer impacts. A report by Zhou et al. provides a good review of the frameworks and common practices of impact assessments of S&L policies (2012).

of benefits, but with a focus on appliance S&L. Another paper in the proceedings of the 2016 IEPPEC reviews several ex post evaluations of S&L program impacts (IEPPEC, 2016). From these publications and others like them it is clear that the subject policies have been effective in reducing energy demand and power plant emissions, and even reducing the need for new generating capacity.

However, there has been little research into what effect these policies have had on the companies that manufacture energy-consuming products. To be sure, there are a large number of ex ante analyses forecasting the economic impacts of proposed appliance efficiency policies, both on the manufacturers and on the consumers of the regulated products. The United States Department of Energy (DOE), for example, is required to conduct a manufacturer impact analysis (MIA) for any new or amended energy conservation standard. This analysis includes qualitative and quantitative assessments of the expected impacts of a standard on competition among manufacturers, on direct employment, and on manufacturing capacity. The qualitative analysis addresses product characteristics, manufacturer characteristics, market and product trends, and the impact of standards on subgroups of manufacturers. For the quantitative analysis, DOE uses the Government Regulatory Impact Model (GRIM), an input-output model that takes industry cost structure, product shipments, and costs as its input parameters. Its output is the industry's net present value (INPV), which is estimated for standards and business-as-usual cases. The difference in INPV between the standards and the business as usual (BAU) cases, then, is a quantitative measure of the impact of the standard under consideration. (US DOE, 2014)

Some relevant ex post analysis of manufacturer impacts also exists. There are a number of studies of the innovation effects of environmental regulations, which tend to focus more on industrial processes than on the *products* of those processes. Nevertheless, this literature is helpful in pointing the way toward an analysis of the impacts of appliance policy. For a review of this literature, see the forthcoming publication from the International Finance Corporation (IFC) entitled "A Greener Path to Competitiveness." The European Commission has funded research into the innovation impacts of European appliance S&L policies. The final report, "Impact of Ecodesign and Energy/Tyre Labelling on R&D and technological innovation" (European Commission, 2014) presents the results from an analysis of R&D funding and patent filings coupled with data gathered through dozens of interviews with manufacturers and others. The study found that S&L policies had stronger effects on the deployment, commercialization, and diffusion of innovative energy efficiency technologies than on the initial stages of R&D research. Most of the companies interviewed reported that these policies did influence their innovation behavior.

## Methodology

This paper is based on original research that fed into a publication released by the IFC in June 2016 entitled "A Greener Path to Competitiveness," which examines how public policy can be used to fight climate change and improve industrial competitiveness at the same time. In the publication, as in this paper, the authors present case studies that together illustrate the variety of ways in which S&L and complementary policies can affect product manufacturers. These cases were identified in consultation with a broad range of experts active in the energy efficiency S&L field. They are drawn from the experiences of countries that have mature S&L programs such as India, Korea, Switzerland, and the United States. While it would be useful to also present cases drawn from economies with nascent S&L programs, such programs have not existed long enough to understand what impacts their policies have had on manufacturers.

Another important factor in the selection of cases was the relative strength of the "signal". In other words, is it possible to see the effect of the EE policy, which is just one of many factors at play in a given industry? Teasing out the impact of policy and attributing changes in the market to that single policy proved particularly challenging. As a result, our findings tend to be more suggestive than conclusive.

The authors consulted a range of sources to understand the dynamics of each case, including

shipment and import-export data, financial reports, government officials, industry representatives, and consultants. Rather than working from a pre-determined list of metrics, an open-ended research method was employed in an effort to uncover whatever manufacturer impacts a given policy (or suite of policies) may have had in any given case. Further research would be needed to drill down and quantify the relationship between policies and particular metrics or outcomes.

# Findings

## India AC Market

In response to growing usage of air conditioners (ACs) in India, India's Bureau of Energy Efficiency (BEE) launched a voluntary energy efficiency standards & labeling (S&L) program for ACs in 2006, which became mandatory in 2010. This case study explains how the S&L program for ACs enabled domestic manufacturers to better compete with global brands.

The room AC market in India is divided between two types of ACs: window units and split units.[2] The market was estimated to be close to 4 million units in 2014 with a compound annual growth rate (CAGR) of 14% between 2006 and 2014. Nonetheless, annual sales of ACs in India are still significantly lower than in countries like Japan and the US, which have annual sales of more than six million and nine million units, respectively.

In India, the ownership of ACs is estimated at between 4% and 5%. The remaining household penetration potential is still very large, and thus the market is expected to continue growing in the coming years. The AC market in India is dominated by LG, Voltas, and Samsung. In 2005, LG had a 21% market share followed by Voltas and Samsung with 19.4% and 11.2%, respectively. Another domestic manufacturer, Godrej, had a market share between 2% and 3% in 2005 and 2006. There were also some other smaller domestic manufacturers such as GujralAircon with limited geographical coverage and annual sales in the Indian market (Tathagat, 2015).

The Indian Bureau of Energy Efficiency (BEE) launched the comparative labeling program for room ACs in 2006 on a voluntary basis. Labeling was made mandatory in 2010. The energy efficiency of an AC model, which is measured by the energy efficiency ratio (EER)[3], is denoted by the number of stars displayed on the energy label. The label shows between a minimum of one and a maximum of five stars, with 1-Star being the least efficient and 5-Star being the most efficient.

S&L programs are typically designed to help consumers make better (i.e., more energy-efficient) choices by addressing information asymmetry problems. Labeling for ACs makes it easier for consumers to know and compare the electricity consumption and energy performance of multiple models. MEPS prohibit the sale of any AC whose energy efficiency ratio is lower than the 1-Star level. Thus, consumers who might have been tempted to purchase a low-cost appliance with very low energy efficiency are prevented from doing so.

Since the beginning of the S&L program for ACs, 2-Star and 3-Star ACs have remained the dominant product categories, though sales of 5-Star ACs have increased significantly in recent years due to increased consumer awareness. The S&L program for ACs in India has resulted in significant energy savings and GHG emissions reductions. BEE estimated cumulative electricity savings of over 42 billion kWh and avoided capacity of over 5,000 MW in 2014 alone (Diddi, 2015). The program is credited with having avoided more than 30 million tons of GHG emissions in the last eight years (Diddi, 2015).

The Indian AC S&L program has helped domestic manufacturers compete with global brands such as LG Electronics and Samsung Electronics. Two domestic manufacturers, Voltas (a TATA group

2 The term "window AC" describes a type of AC in which a single unit contains all the components of the air conditioning unit. A split AC incorporates two separate units: an indoor unit and an outdoor unit.

3 Energy Efficiency Ratio (EER) is a ratio of the cooling capacity in watts to the electricity consumption in watts when measured at full load at a specific outdoor temperature (usually 95 degree Fahrenheit).

company) and Godrej, used Star ratings as their marketing tool for increasing their sales. In one advertisement, Godrej claimed that its latest 5-Star rated AC uses less power than a hair dryer.[4] In a story released by the TATA Group in July 2013, Voltas mentioned that their research team realized that most customers were concerned with not just the AC's purchase cost but also its operating cost (Agrawal, 2013). This finding led to a change in the company's manufacturing and marketing strategy. Voltas's product development team found that they could make ACs more energy efficient at a marginally higher cost. Their marketing campaign then centered on energy efficiency and clearly communicated that an energy-efficient AC, though expensive upfront, would help consumers to save more money because of energy savings during usage.

Voltas achieved the market leadership position in 2012 with 19.4% market share, ahead of LG Electronics. Voltas was also the winner of the Ministry of Power's "National Energy Conservation Award in 2013," recognizing its efforts to promote and sell energy-efficient ACs in India. According to Voltas, its success in the Indian AC market arises from its leadership in Room ACs across India, coupled with its leadership in energy-efficient AC production in 2013. Voltas has remained the India AC market leader since 2012.

Godrej's sales of ACs in India increased at a CAGR of 20% from 2006 to 2014. In an interview with the Alliance for an Energy Efficient Economy (AEEE), Godrej claimed to have strategically invested in research and development (R&D) for the energy efficiency improvement of their products (Wadia, 2015). Godrej claimed that some of their ACs are designed to retain their 5-star rating through two future revisions of the energy label thresholds. Godrej is also the first brand in India to launch an AC with a 3.7 EER, significantly better than the minimum required of 5-Star ACs in 2014, and used a climate-friendly refrigerant with low global warming potential (GWP).

**Samsung Case Study - Korea**

The standards and labeling program in Korea has triggered the development of energy efficiency technologies and the expansion of related product markets by continuously strengthening its standards to differentiate highly energy-efficient products from others. The S&L program was launched in 1992; and standards have become more stringent every year since. The continuous ratcheting of standards led the private sector to develop technologies that can reduce the energy consumption of products, which in turn led to an increase in the supply of highly energy-efficient products (Level 1).

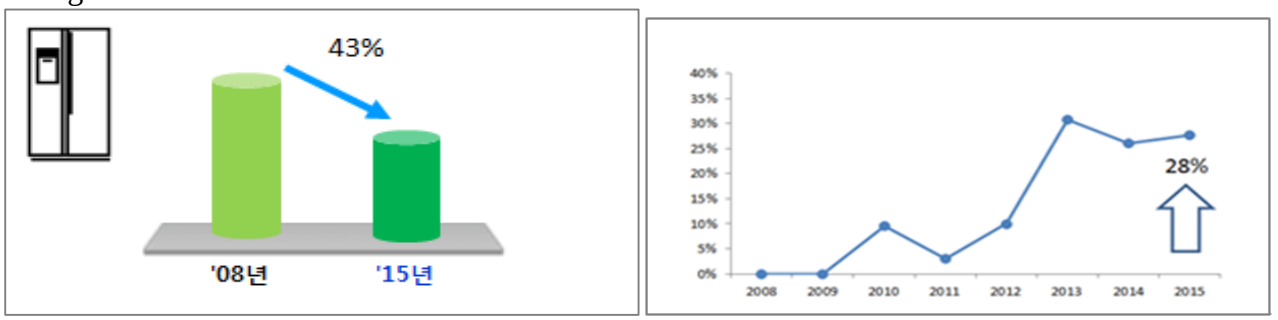
Samsung Electronics is a major manufacturer of consumer durables and electronics. Samsung has proactively developed energy efficiency technologies in order to meet energy regulations and increase the proportion of their products that qualify for Level 1 product certification. Samsung's proactive initiatives to be a leading manufacturer of Level 1 certified products in the market resulted in an average energy consumption reduction of 43% across its products between 2008 and 2015. Some examples of Samsung's leadership in the development of energy-efficient technologies are described below.

Cutting edge televisions such as Smart TVs and Ultra High Definition (UHD) TVs have recently been introduced to the market. In addition to the innovative functions to improve consumers' experience in TVs, Samsung developed energy conservation technologies such as DTV Low Power SoC to improve energy consumption per screen size by 9% for models in 2015 compared to ones in 2012.

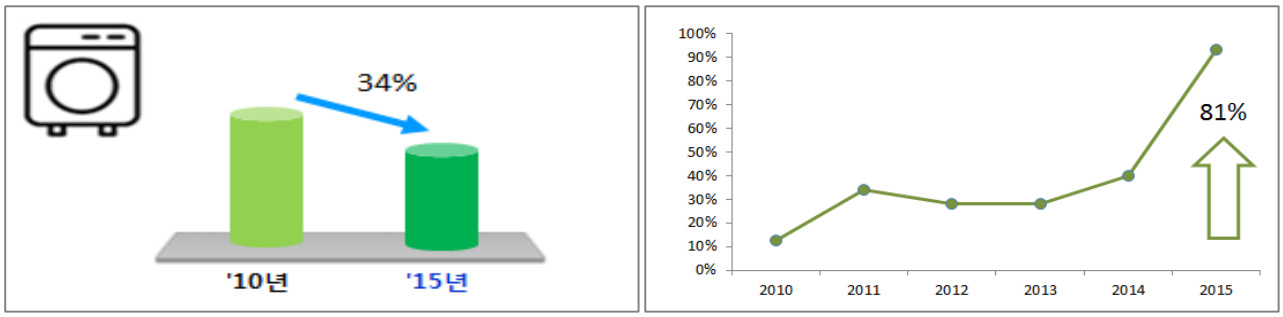
In the case of refrigerators, one of the highest energy consumers in homes, Samsung developed various energy conservation technologies including the Dual Compressor Refrigeration Cycle technology for their refrigerators. Application of such technologies reduced energy consumption (per liter) of current refrigerators by 43% compared to products in 2008 and also led to obtaining efficiency of Level 1 certification.

4https://www.youtube.com/watch?v=fc14G1UFhhs

Refrigerators:




Front-load washing machines:




Air conditioners:

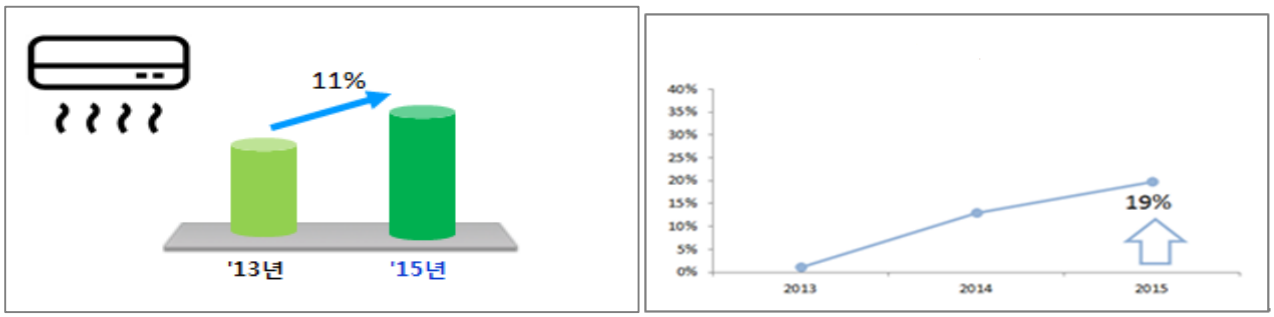



**Figure 1**. The charts on the left show average reduction energy consumption for respective product. The charts on the right show the average percentage of Samsung's Level 1 certified products in the market (Data Source: Samsung Electronics).

Samsung also developed efficient air conditioners with 11% improvement in cooling efficiency. ACs can consume a large amount of energy in countries with tropical climates.

The above examples show how energy efficiency standards & labeling policies in Korea have served to stimulate the development of energy-efficient technologies in order to enhance product energy efficiency. Samsung Electronics responded to Korea's S&L program very proactively, which gave them a leadership position not only in Korea but also in other countries where S&L programs were in place. In India, for example, Samsung was the first company to use the energy label on its refrigerators.

## High Efficiency Motors

In the most recent IEC standards for motors, IEC 60034-30-1:2014, a new efficiency class, IE4 "Super Premium Efficiency," was introduced. The IE4 class is more efficient than the previous most efficient class of IE3. The introduction of IE4 class allowed manufacturers to better market high

efficiency motors and also expanded the market for high efficiency motors.

Siemens, who held the second largest share of the global market for low-voltage electric motors—9.5% (by revenue) in 2013 (Meza, 2014), responded to the introduction of the new IE4 efficiency level by leveraging its existing R&D capacity and quickly developing super-efficient motors that met IE4 requirements, despite the fact that IE4 efficiency was not required. Now IE4 efficiency products are available in many of Siemens' product lines. By investing in developing the super-efficient IE4 products that exceeded the efficiency requirements of current EU regulations, Siemens is well-prepared for any future S&L policy updates and at the same time is maintaining its position as the leader of high-quality and high-efficiency motor manufacturers.

The introduction of IE4 efficiency class allows product differentiation by efficiency levels. Manufacturers may use efficiency as a primary selling point when marketing their products. Many manufacturers, including Siemens, took such opportunities to educate the market about the benefits of energy efficiency and to help clients focus on the real challenge behind motors: lifecycle costs vs. procurement costs. It has been observed that Siemens took advantage of the energy efficiency regulations to brand itself as the leader among high-quality, super-efficient motor manufacturers. Efficiency has now become an integral part of Siemens' marketing strategy. Energy efficiency and energy cost are highlighted as key messages and selling points in Siemens' marketing materials (Figure 2).

It should be noted that it is possible that organizations such as Siemens who are ahead of the curve on efficient technologies may have manufactured and marketed super-efficient motors even without IE4, but the creation of IE4 certainly helped them to distinguish the super-efficient motors (IE4) from the highly-efficient motors (IE3). The newly introduced IE4 class also provided Siemens with the opportunity to brand itself as the leader of super-efficiency motors. In addition, the existence of MEPS, which generally become more stringent over time, in several economies around the world meant that the market for high-efficiency motors would only grow over time.

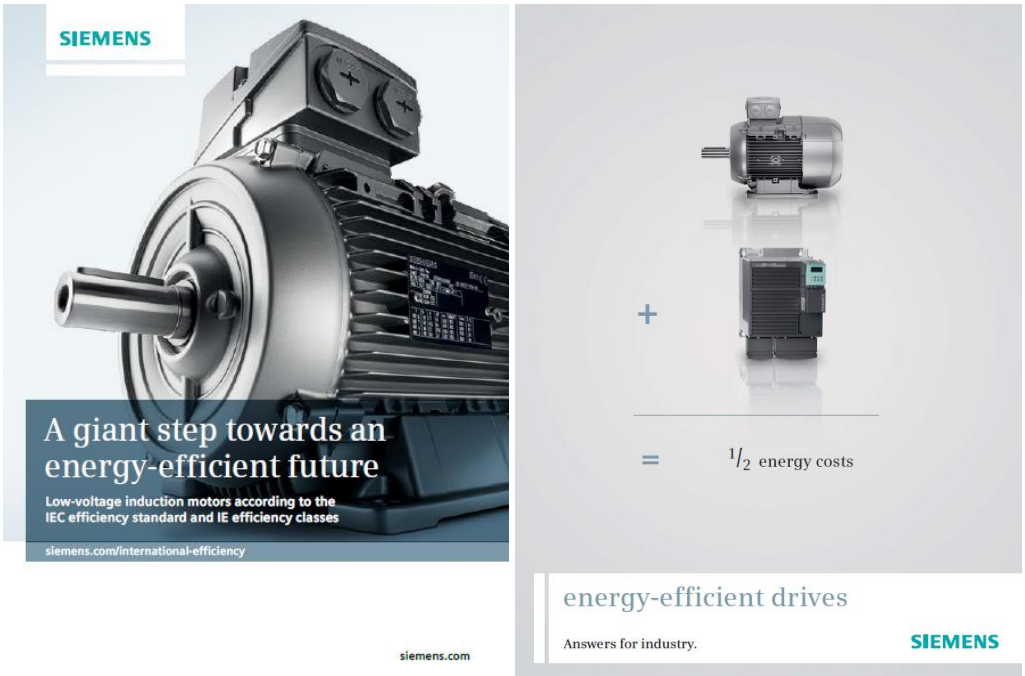



**Figure 2**. Examples of marketing materials from Siemens

Another important change in the market, due at least in part to the introduction of the IE4 efficiency level, is the rapid growth of the super-efficient IE4 motor market. The global market for IE4 motors is expanding at double-digit rates and is expected to increase from US$115 million in 2013 to almost US$300 million in 2018—almost tripling in size in five years. By investing in developing IE4

products at an early stage, Siemens staked its position as a first mover and can more easily maintain its leadership position in this new market.

## U.S. production tax credits

S&L programs are often coupled with financial incentives to accelerate the uptake of high-efficiency products. One of the best examples is the Energy Star program and the production tax credit program in the United States. This example demonstrates that S&L policies and incentive programs can be complementary to each other and help bring positive impact to manufacturers.

In the case of U.S. production tax credits, manufacturers were eligible to receive a tax credit for each unit they produced in the United States that met certain efficiency requirements at or above the prevailing Energy Star level. As more high efficiency appliances were produced and the market share of high efficiency appliances increased, the Energy Star requirements were revised and tightened. The revised Energy Star requirements would then become the new baseline for the tax credits program. In order to receive the new tax credits, manufacturers must meet the more stringent energy efficiency requirements. This iterative process continuously encouraged manufacturers to produce high efficiency appliances and improved average appliance energy efficiency in the US market.

Take clothes washers, for example. Before the availability of the tax credits, it was reported that only 153 out of 258 (59%) Energy Star qualified clothes washer models available in 2005 could meet the tax credit requirement of 1.72 MEF (Gold and Nadel, 2011). The tax credits motivated manufacturers to produce more high efficiency products. By 2007, 100% of the Energy Star clothes washers met or exceeded 1.72 MEF, which became the new Energy Star efficiency level (Gold and Nadel, 2011). Refrigerators followed a similar trajectory. **Error! Reference source not found.** shows how the energy efficiency levels of refrigerators and clothes washers improved over time as the tax credit requirements became more stringent. It can be inferred from the improvement of both Energy Star and MEPS efficiency levels that the market average efficiency increased as well, due in part to the positive contribution from the tax incentives.

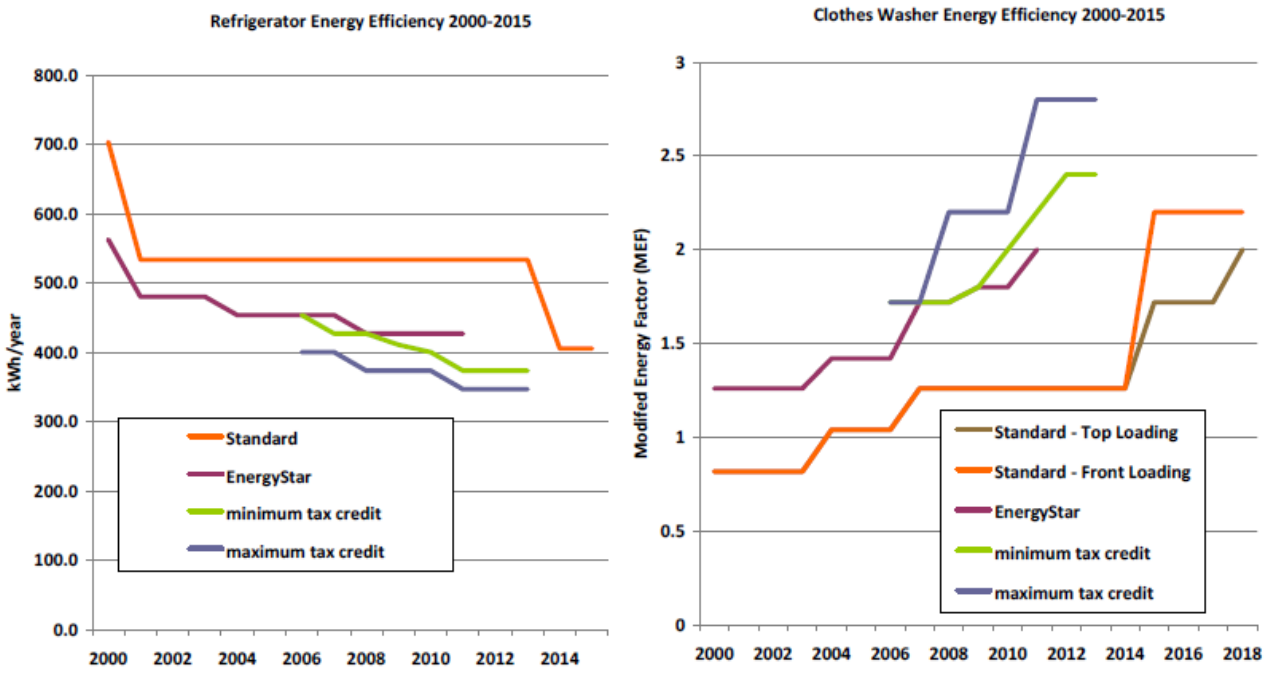



**Figure 1.** Transformation of refrigerator and clothes washer markets in the United States: 2000-2015 (Gold and Nadel, 2011)

As manufacturers were encouraged to produce more high efficiency products, the market share

of high efficiency products significantly increased. For example, after the tax credit was extended in 2008, market data from the Association of Home Appliance Manufacturers shows that the market share (by units) of products eligible for the tax credits increased dramatically in all three product categories (Figure 4). The increased market share of high efficiency products allowed the Energy Star program to tighten its energy efficiency requirements.

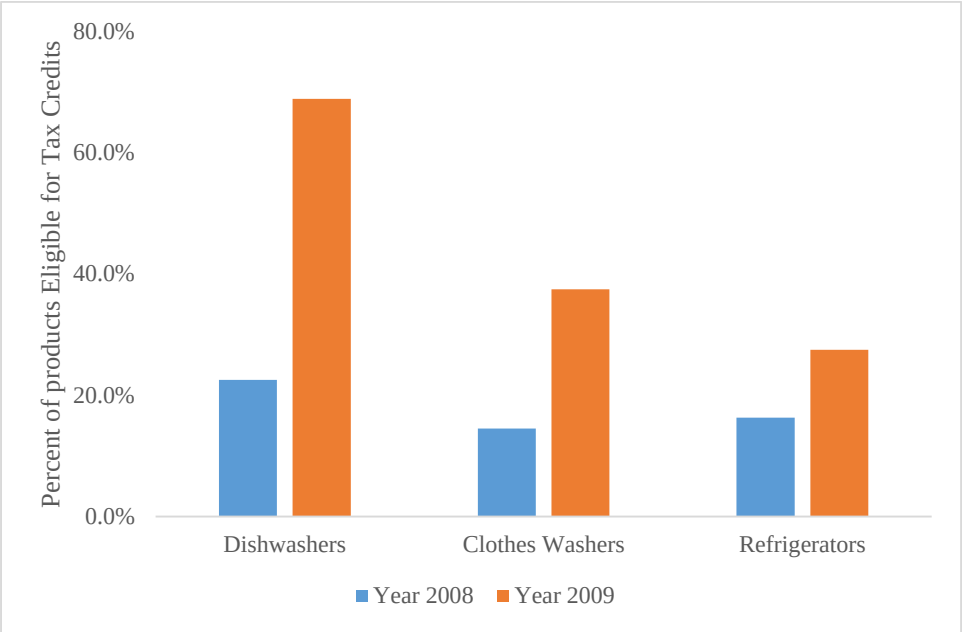



**Figure 4.** Percent of units produced in 2008 and 2009 that were eligible for the production tax credit (Graph created with data from Table 6 of Gold & Nadel, 2011)

High cost is considered a major barrier to the transformation of markets toward high-efficiency appliances. Manufacturers are sometimes reluctant to produce high efficiency products, fearing that demand for these products will be insufficient and the economics will be unfavorable. The production tax credits successfully addressed the barrier of high cost, by rewarding manufacturers to produce high efficiency products. For example, in 2011 Whirlpool claimed over $379 million in US government tax incentives, which included the production tax credits.[5] The tax credits effectively accelerated the production of high efficiency products. Manufacturers reported that tax credit availability allowed them to increase production of high efficiency products earlier than they would have otherwise (Calabrese, 2006). In the presence of the tax incentive, manufacturers have to plan and expand production lines for high efficiency products, but they do not have to bear high risks for production expansion because of the availability of the tax credits. Once the production lines for high-efficiency products are assembled or expanded, manufacturers are unlikely to revert to producing low-efficiency products, thus creating long lasting energy savings effects (Calabrese, 2006).

The production tax credits also positively impacted the competitiveness of US appliance manufacturers by encouraging innovation. In order for manufacturers to meet the continuously tightened requirements for the incentives, they needed to invest in innovations for high efficiency products. The availability of the tax credits can also offset some of the R&D investments.

Significantly, the tax credits translated into a net increase in jobs; ACEEE estimated that over 40,000 jobs were created due to the production tax credits, including 19,000 direct jobs and 27,000 indirect jobs from supply chain/support (ACEEE, 2010).

5 Whirlpool SEC filings 10-K from 2011. Accessed on Feb 18, 2016. http://investors.whirlpoolcorp.com/sec.cfm?DocType=Annual&Year=&SortOrder=Date+Descending&FormatFilter=

**Heat Pump Clothes Washers in Switzerland**

When tumble dryers were first introduced in Switzerland, the market was dominated by energy-intensive electric resistance heating technology. Highly efficient heat pump clothes dryers were not developed until 1997. However, due to its comparatively high cost and low awareness of energy conservation among consumers, heat pump clothes dryers initially were unable to gain traction in the Swiss clothes dryer market, despite their high efficiency. The market share of heat pump clothes dryers was reported to be merely 2% in 2004 in Switzerland.

Recognizing that rising energy demand from the fast growing clothes dryer market would require an enormous expansion in power generating capacity, the Swiss government put in place a comprehensive energy saving scheme to encourage the adoption of super-efficient heat pump dryers. With a combination of well-designed energy efficiency policies, including an S&L program, financial incentives, and public awareness campaign, and well-coordinated stakeholder engagement among policymakers, manufacturers, utilities, NGOs, and consumers, the Swiss government completely transformed the landscape of an industry towards higher efficiency heat pump clothes dryers while maintaining the competitiveness of the appliance industry.

Labeling was the very first policy attempt to drive the clothes dryer market toward higher efficiency. Within the EU, an ambitious labeling program for dryers was implemented by the European Commission as early as 1995. The label categories ranged from "A" through "G" with "A" class representing the most efficient clothes dryers (ECEEE, n.d.). However, no dryer models qualified for class "A" during the first few years of the program, so manufacturers were engaged and motivated to invest in bringing such products to market.

The high risk during product development and initial commercialization is one of the primary reasons cited for inadequate investments of financial and intellectual capital in R&D. To overcome this, the government of Switzerland launched the Sustainable Public (technology) Procurement program in 2005, which encouraged manufactures to engage in research and innovation for super-efficient model development (UNEP). The guaranteed demand from the procurement program allows manufacturers to focus on researching and developing high efficiency products. The procurement program brings together product development and marketing functions to decide how an optimal product should be designed, given an assumed price and market potential. It thus drastically reduces risk for manufacturers during the critical product commercialization stage.

As part of the market upgrade scheme, starting in 2003, the city of Zurich initiated laboratory testing of all dryer models available on the Swiss market and the consumer satisfaction in everyday life was analyzed. The consistently positive experiences with heat pump driers convinced the city of Zurich to officially favor heat pump driers. In 2005 Zurich instituted a rebate program promoting heat pump driers. These products had a wide national market introduction because of Zurich's policy (Nipkow and Bush, 2009).

Taking advantage of the favorable situation, the Swiss government and its Federal Office of Energy made an effort into the efficient future: they set labeling class A as the minimum efficiency performance standard (MEPS) for laundry dryers from 2012 onwards. As a result, only heat pump tumble dryers and nonconventional dryers have been sold in Switzerland since that time.

In addition, the Topten program[6] was launched in Switzerland in 2000 to better disperse product information and facilitate consumer education. The program certifies and labels the most efficient models on the market. It helps improve their public visibility by coordinating the efforts of a coalition of manufacturers, governments, utilities, and NGOs on both the national and international levels. It also provides technical expertise to stakeholders in order to promote standards, subsidies, and

6 The Topten program, established in 2000 in Switzerland, is a consumer-oriented online search tool that integrates info disclosure, stakeholder engagement and education to inform consumers of the best appliances in terms of efficiency in various categories of products.

procurement schemes. Since its inception, it has been instrumental in all phases of Europe's dryer market evolution.

As a result, the European residential clothes dryer market is undergoing a transformation driven by highly efficient heat pump dryer technology. The market share of heat pump driers in Switzerland jumped from 1.7% in 2004 to 100% in 2012. Annual energy savings is expected to reach 11.5 TWh by 2030, in comparison to a scenario in which conventional dryers dominate the market. The long-term efficiency scheme also benefits utilities in that it helps to prevent or forestall the need to add new generation capacity.

The profound market transformation of dryers in the Swiss market is attributable to the Swiss government's consistent and sustained support, through technology procurement, information distribution & consumer education via the Topten program, enhanced by the timely and stringent EE S&L polices. The consistency and credibility of the government efficiency package clearly marks new trends towards significantly improved efficiency of products available on the market. See Figure 5.

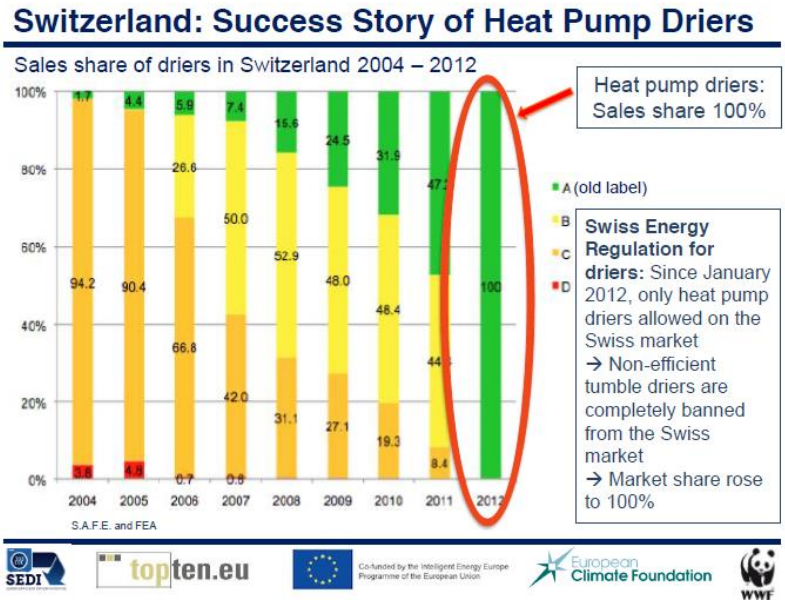



**Figure 5.** Clothes dryer sales in Switzerland by energy label category (Source: Topten)

A major appliance manufacturer in Europe, Electrolux, which won the heat pump dryer technology procurement program, benefited from this market transformation. Electrolux reports that the company increased its production capacity with lower product costs as barriers during the initial commercialization stage were overcome. Since entering the European market, heat pump dryers have experienced steady market growth, continued efficiency improvements, and decreased costs (Bush et al., 2015).

## Conclusion

In this paper we examined the impact of S&L policies on manufacturers through a series of case studies. While it is difficult to quantify exactly how S&L policies have affected manufacturers, we have drawn the following lessons from the case studies.

In the case study of the India AC market, we see that with strategic R&D investment in energy efficiency and successful marketing strategy, small manufacturers such as Godrej are able to take advantage of newly introduced S&L policies to gain market share against large-scale international manufacturers.

Similarly, Samsung electronics leveraged S&L policies in Korea to position itself as a producer of highly efficient products. By proactively developing energy efficiency technologies, Samsung

achieved significant reduction in energy consumption across its major product categories.

The product differentiation created by S&L policies allows manufacturers to distinguish their high efficiency products from others. In the case of Siemens motors, the newly introduced IE4 efficiency class allowed Siemens to better market its high efficiency motor products. In addition, the introduction of IE4 class has created a new market, which is expected to grow significantly in the next few years.

The US production tax credit program shows that S&L policies coupled with appropriate financial incentives can facilitate market transformation towards high efficiencies. At the same time, the energy efficiency levels of the S&L program can be increased as high efficiency products gain market share.

Similar to the manufacturer tax credit case study, the Switzerland clothes dryer case study shows that a completely new market for a new technology can be created based on a broad suite of S&L and related policies. With a combination of MEPS and labeling program, public procurement program, rebate program and public awareness program, a completely new heat pump clothes dryer market was created.

Through the examination of a series of case studies, this paper shows that S&L and related policies can have significant manufacturer impacts, such as the creation or expansion of a market, technology innovation, and improved visibility for high efficiency product manufacturers. Energy savings, peak demand reductions, and emissions reductions are typically the primary goals for S&L policies, and therefore are the impacts most likely to be assessed to provide support for a new policy and later to evaluate its impacts. Policymakers would do well to also consider the impacts on manufacturers—including employment, productivity, profitability, aggregate industry value, export share, R&D investment, and number of patents—both before and after implementation.

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