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Designing Policies and Programs to Accelerate High Efficiency Appliance Adoption

Global Case Studies and Lessons Learned

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Executive Summary

Appliance efficiency standards, labeling, and incentive programs have been implemented globally to accelerate the market transformation of high efficiency products since the 1970s, raising the market share of efficient products and average efficiency of common household appliances in many countries. Yet recent analyses suggest that there is still significant potential for different markets to move towards higher efficiency products. To address challenges facing traditional efficiency policies and programs, large economies including China, Japan, Korea, the EU, and the U.S. have adopted effective regulatory, fiscal, and voluntary multilateral policies and programs to accelerate market transformation towards higher efficiency products. A review of nine international best practice case studies show that development and increased market adoption of top-of-the market efficiency and Best Available Technologies (BATs) can be accelerated through design changes in traditional standards and labeling programs, innovative incentive policies, and multilateral award programs. The key findings include:

Traditional standards and labeling programs can be advanced through target-setting, where future efficiency requirements are set based on pre-commercial ambitious efficiency levels of technologies not yet widely available on the market. By anticipating the near-term market penetration of pre-commercial, top-of-the market efficiency technologies and explicitly recognizing their role on the market ambitious future mandatory efficiency requirements, target-setting sends a clear signal to manufacturers to invest in super-efficient technology development. Global best practice case studies that have successfully demonstrated the target-setting approach include both EU's recently revised Ecodesign requirements for electric motors and Japan's Top Runner program, and the re-scaled EU Energy Label with top 2 efficiency grades reserved for BATs not yet on the market.

Incorporating innovative design elements in incentive programs for stimulating new appliance purchases can help meet specific programmatic goals and achieve additional socio-economic and environmental benefits. These benefits include economic stimulus and job creation through direct subsidies for the purchase of new efficiency products, increased product recycling and material recovery through "Old for New" programs, stimulating green consumerism and greening of supply chains through eco-credit programs (e.g., Japan's EcoPoints, South Korea's Green Credit Scheme), and retailer engagement and reduced programmatic costs through mid-stream, tiered incentive programs for efficient products.

Supporting multilateral award programs such as the Global Cooling Prize can help spur technological innovation by targeting manufacturers with a large award prize and global recognition, and showcases technological feasibility in significantly reducing climate impacts while being produced affordably and at scale.

Nine case studies of international programs have demonstrated that different types of market transformation towards high efficiency BATs are possible, ranging from targeting narrow but very ambitious efficiency improvements to enabling broader societal change towards more

environmentally-friendly supply and consumption. By making specific design changes to differentiate from traditional standards, labeling and incentive policies and programs, these nine examples effectively helped accelerate the market adoption of high efficiency and greener products and services and achieved additional socio-economic benefits.

1. Introduction

In recognition of the importance of raising residential energy efficiency, different regulatory and fiscal programs have been implemented globally to accelerate the market transformation of high efficiency products. In particular, appliance standards, labeling, and incentive programs have been established by national and subnational governments around the world to help increase the market penetration of high energy efficiency products since the 1970s. Minimum energy performance standards (MEPS) set minimum efficiency requirements for appliances and help push the overall market efficiency upwards by eliminating the production and import or sale of products that do not meet the minimum requirements. Both labeling and incentive programs help pull up the market efficiency by motivating consumers to purchase more efficient products through additional information on the relative efficiency of a product and direct or indirect reduction in incremental cost of a more efficient unit through a financial incentive.

Since the 1970s, appliance standards, labeling, and incentive programs have been widely adopted and existing programs have been expanded in the world's largest energy-consuming countries as critical policy tools to achieve energy savings through improved equipment efficiency. As a result, the market share of efficient products has increased in many countries, and the market-average efficiency of many common household appliances has quickly increased both as a result of effective policies and programs and technological improvements. Nevertheless, recent analyses comparing the latest market trends and best available technologies suggest that for many products, there is still significant potential for different markets to move towards higher efficiency products. This has presented challenges for some existing regulatory programs, as faster-than-expected market transformation are outpacing updates to existing regulatory efficiency requirements and incremental energy savings being captured by these programs are reduced. To address the changing role for regulatory programs and continue incentivizing consumer-driven demand for more efficient appliances, several large economies including Japan and the European Union (EU) have made updates to their existing standards and labeling programs. Other economies including the U.S., China, Japan, and Korea have launched incentive and global competition programs targeting retailers, consumers, and manufacturers that stand out from traditional subsidy programs. Together, these innovative program design changes are helping to accelerate the transformation of both their respective national markets and the global market towards significantly higher efficiency products for appliances and equipment. Additionally, some incentive programs focus on a broader range of environmental goals in addition to energy efficiency, and can help achieve additional socio-economic and environmental benefits such as economic stimulus and job creation, lifestyle and behavioral change, greening of supply chain, and transformation towards circular economy.

This paper reviews nine international case studies of recent regulatory, fiscal, and voluntary multilateral policies and programs that have shown to be effective in accelerating the market transformation towards higher efficiency appliances and equipment in the EU, the U.S., Japan, Korea, and China. For each case study, individual policies and programs are analyzed to identify the specific challenges being addressed, and broader lessons learned and success factors applicable to similar programs in other countries. We conclude with overarching key findings from across the multiple programs on emerging policy and program trends and best practices for

facilitating increased market adoption of the highest efficiency and best available technologies.

2. Mandatory Standards and Labeling Program Design

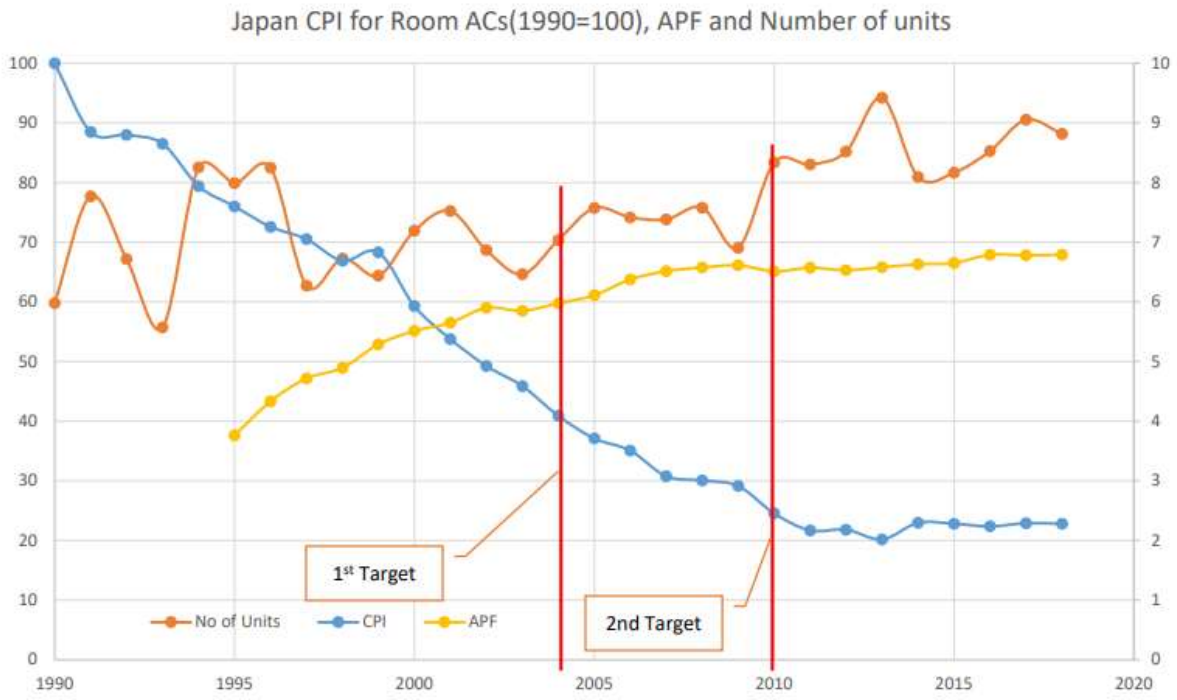
2.1 Japan Top Runner Program and Target-Setting

2.1.1 Challenge

Given an increasing energy consumption trend with limited domestic energy resources, Japan enacted the Law concerning the Rational Use of Energy ("Energy Conservation Law") in 1979 which provides a legal basis for energy conservation policies and activities. However, while the industrial sector's final energy consumption was curbed thanks to industry efforts after oil crises, the final energy consumption in the other sectors (residential, commercial, and transportation) increased continuously. In June 1998, Japan revised the Energy Conservation Law with the goal of strengthening the legal underpinnings of various energy conservation measures. The Top Runner Program was introduced in 1999 to establish energy consumption efficiency standards for appliances, equipment, vehicles, and other items in these sectors.

2.1.2 Overview

The program initially covered 11 product groups (including air conditioners and vehicles) and has expanded to 32 product groups which account for about 70% of the household energy consumption in Japan. It sets targets based on the most efficient performance within each product group on the market. Companies are required to achieve the targets in 3 to 10 years in terms of shipment-weighted average efficiency. The Japanese government assesses whether or not the energy efficiency improvement exceeds their initial expectations which are varying by product group. For example, the program stimulated an about 80% room air conditioner (AC) efficiency increase between 1997 and 2017. In addition to improved efficiency, during the same period, room AC prices dropped by about 68% in consumer price index (CPI) terms.



Source: Okada (2019)

Figure 1. Room AC Energy Efficiency and Price Trends in Japan

Since 2000, the program has been accompanied by the Energy Saving Labeling Program which requires manufacturers to produce each of their products with a label attached. The label must include a symbol showing the degree to which energy efficiency standards has been achieved, i.e., energy saving standard achievement rate, energy efficiency, and the target fiscal year. Since October 2006, the Uniform Energy-Saving Label has been applied to select products (including room ACs, TVs, refrigerators/freezers, etc.) to help retailers and consumers identify energy-efficient products based on expected annual electricity bill and multistage star ratings in addition to those with the Energy Saving Label.

Source: METI (2015)

Figure 2. An Example of Uniform Energy Savings Label (Refrigerators)

2.1.3 Policy Insights

In alignment with Japan's Top Runner approach, other countries could consider setting their minimum energy performance standards (MEPS) for select appliances and equipment in 3–10 years based on current best available technologies. This approach would provide a longer-term policy signal to manufacturers, enabling them to meet the efficiency targets cost-effectively by providing adequate time for investment planning. For example, for cooling equipment, the refrigerant transition under the Montreal Protocol already provides long-term policy certainty in consultation with the industry. Combining the transition toward sustainable refrigerants with a clear trajectory for energy efficiency improvement would allow the industry to exploit synergies in redesigning equipment and retooling manufacturing lines to achieve both goals simultaneously.

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2.2 Target-setting through Revised EU Ecodesign Requirements for Electric Motors

2.2.1 Overview

The EU Ecodesign and Energy Labeling framework was established in 2009 to develop mandatory ecodesign requirements to improve the energy efficiency and other environmental aspects of various products. The Ecodesign requirements specifically tackles complementary aspects to the energy label (see section 2.3) to ensure a level playing field within the EU market by providing consistent requirements across the EU, to drive investment and innovation in a sustainable manner, and provides benefits to the consumers by ensuring more efficient products enter the market. The Ecodesign requirements for covered products are set after conducting a comprehensive preparatory study that analyzes current market technologies, cost trends and expected technological developments.

2.2.2 Approach

One common product category that has been regulated is electric motor. Electric Motors consume 70% of industrial electricity consumption and 35% of non-residential building electricity consumption in the EU. The EU's current Ecodesign requirements for electric motors are set to be replaced by new requirements adopted in 2019, which reflect both an expanded coverage in product scope and also more stringent energy efficiency requirements. Under the new Ecodesign requirements, set to go into effect in July 2021, specific induction motors were added to the scope of covered products including: smaller motors between 120-750W, larger motors between 375-1000 kW, 60 Hz motors, and 8 poles motors. The revised Ecodesign requirements adopted a tiered approach, with two tiers of requirements going into effect in July 2021 and July 2023, respectively, in anticipation of continued efficiency improvements and diffusion of new technologies.

The Tier 1 Ecodesign requirements (to take effect in July 2021) sets the minimum efficiency level at the International Efficiency (IE) Level 3 (with IE1 being the lowest efficiency and IE4 being the highest) for three-phase motors with rated output between 0.75 kW and 1000 kW. Setting the minimum efficiency threshold at IE3, the Premium Efficiency level[1], reflects the leading MEPS in terms of stringency. Only two countries, the U.S. and China, currently mandate IE3 in their MEPS for motors.

EU's Tier 2 Ecodesign requirements further represents an example of target-setting in tiered MEPS, as three-phase motors between 75 to 200kW are required to reach IE4 efficiency by July 2023. This additional and more stringent efficiency requirement for a smaller subset of common motors to reach IE4 is the first of its kind, no national MEPS program currently mandates IE4 as the minimum efficiency threshold. In fact, IE4 motors are not yet widely available on the market.

2.2.3 Policy Impacts

By announcing a Tier 2 requirement at this highest efficiency level, the new Ecodesign

[1] IE3 corresponds to the Premium Efficiency class of motors under the National Electrical Manufacturers Association. IE1 corresponds to Standard Efficiency while IE2 corresponds to High Efficiency.

requirements take into consideration expected near-term efficiency improvements and diffusion of IE4 motors while providing manufacturers with a clear signal and sufficient time to prepare for the transition.

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2.3 Revising the EU Energy Label to Reflect Rapid Market Changes

2.3.1 Approach

As a mandatory categorical information label in use in the European Union (EU) since 1994, the EU Energy Label ranks appliance models on a scale from A (most efficient) to G (least efficient) based on its energy consumption relative to other models in the same product category. It was updated under the 2009 EU Energy Label Directive 2010/30/EU to add three additional classes (A+, A++, A+++) for differentiation when products saturated Class A and currently covers 14 product categories.

2.3.2 Impacts of EU Energy Label Policy

Impact assessment of the EU Energy Label in 2008 found that it achieved 3 million tonnes of oil equivalent of energy savings and 14 Mt CO_2 reduction annually between 1996 and 2004. The program has also been credited with increasing manufacturers' recognition of the value of energy efficiency and significantly raising consumer awareness. In fact, the labels have been so successful in encouraging consumer to purchase more efficient models and manufacturers to produce more efficient models that the top efficiency classes have become overpopulated, making it difficult to distinguish between models.

2.3.3 Lessons Learned from Past Challenges

The success and effectiveness of the EU Energy Label in promoting market transformation towards efficient appliances, with complementary support from the mandatory EU Ecodesign requirements, has also created challenges for the labeling program. As manufacturers respond to the label by selling more efficient products and production of less efficient products is discontinued due to Ecodesign requirements, most products available on the market now all fall in the top classes of the label. Because some products have had labels on display for over ten years, including refrigerators, dishwashers and washing machines, technological progress has outpaced the speed to which the label is updated. For these early product categories covered by the EU Energy Label, 90% of products on the market have already reached Class A. More than 95% of domestic cold appliances, for example, were already in Class A or above in 2010 in 10 Western European countries. Partly to address this problem and to further differentiate products in the higher efficiency classes, additional grades of A+, A++, and A+++ were introduced in 2010. However, this approach has proven to be confusing for consumers as products continue to migrate towards Class A and above. The empty bottom classes created a false impression that A-rated products are top performers, when some A-rated products could actually be close to the bottom of the market in terms of efficiency. In addition, the greater concentration of products in Class A or above makes it very difficult for consumers to distinguish between best performing products. Consumers may interpret Class A+ as very efficient product but depending on the product category and its pace of technological progress, Class A+ products may in fact be only the market average or even less efficient product on the market.

2.3.4 Improvements for the Future

In light of this ongoing challenge, the EU Commission adopted a revised energy labeling framework under EU Regulation 2017/1369 on July 4, 2017 to phase-out A+, A++, and A+++ grades for five product groups from 2021 onwards. Starting with dishwashers, washers, fridges, lamps, and electronic displays, the label will revert back to the original A to G efficiency classes. If products no longer fall into classes E-G, then this will be clearly communicated to consumers by labeling these empty classes in grey. In re-scaling the labels, the top class is left empty to encourage technological progress by setting a target efficiency level that the majority of models are not expected to reach until 10 years later. For products where rapid technological progress is expected, then no products should fall within the top two classes at the time of label rescaling. The Commission also included specific market transformation criteria for triggering a review for potential update before the mandated 10-year interval for reviews. An earlier review needs to conducted if 30% of units on the market reach Class A, or if 50% of units reach Class A or B. Product suppliers are expected to provide both the existing and rescaled labels to distributors in the four months prior to when the rescaled label goes into effect. The revised label also added a QR code with additional information available for consumers, and established a new product database to help improve the monitoring of national markets.

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2.4 Expanding EU Ecodesign Framework to Include Circular Economy Aspects for Products

2.4.1 Background

While the ecodesign requirements have historically focused most on energy consumption of products, the Ecodesign Working Plan for 2016-19 priorities marks a shift towards also supporting broader environmental goals of a circular economy when establishing new or revised requirements for products. This latest Working Plan contributes and supports the EU Commission's new Action Plan on a Circular Economy launched in February 2015 by promoting a transition towards circular economy through a series of measures to cover the entire life-cycle of products and materials.

2.4.2 Approach to Integrating Circular Economy Aspects

For seven new products and 23 existing product categories due for reviews, the Commission will systematically examine how aspects such as resource efficiency, reparability, recyclability, and durability can be incorporated into new or existing Ecodesign measures. EU Commission exploring possibility of establishing more product-specific and/or horizontal requirements related to resource and material efficiency through the development of a circular economy "toolbox" for ecodesign and development of standards on material efficiency:

- Durability: minimum lifetime of products or critical components
- Reparability: availability of spare parts and repair manuals, designs for repair
- Upgradeability
- Design for disassembly: easy removal of certain components
- Information: marking of plastic parts
- Ease of reuse and recycling: avoiding incompatible plastics

2.4.3 Policy Impacts

The development of a circular economy "toolbox" will help provide guidance on the inclusion of resource and material efficiency aspects for new and existing product measures, such as by providing concrete examples of how these aspects can be incorporated into product-specific or horizontal requirements. While many countries have indicated broad support for the principles of circular economy to support broader environmental goals, few concrete national policies or programs have been formulated to actually realize these principles. The Ecodesign Working Plan 2016-2019 represents one specific example of how circular economy goals can be incorporated into existing energy-using product policies. At the same time, general standards are being developed by the EU Standardization Organizations to cover aspects of extending product lifetime, ability to re-use components or recycle materials at end-of-life, and use of re-used or recycled materials in products.

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3. Innovative Financial Incentive Programs

Traditional financial incentive programs have historically provided a direct subsidy or rebate to consumers for purchasing qualifying products that meet certain energy efficiency criteria, or provide a subsidy to manufacturers to cover the higher incremental cost of producing more efficient products. However, as market transformation has been spurred by standards and labeling programs, traditional incentive programs may not be as effective in further accelerating the adoption of high efficiency products. Several countries including China, the U.S., Japan, and South Korea have adopted innovative incentive programs with new program design elements to increase the cost-effectiveness of incentives for high efficient products and to meet multiple objectives of stimulating the economy and promoting broader green consumerism, while supporting market transformation.

3.1 Achieving Multiple Objectives through China's Recent Incentive Programs

3.1.1 Program Goals and Impacts Realized

Since 2007, China has launched three different subsidy programs to simultaneously promote the market adoption of more efficient appliances and other socioeconomic goals, including supporting rural development, recycling of old appliances, and economic stimulus. These programs included the "Household Appliances to Rural Areas" subsidy program from 2007 to 2013, the "Old for New" subsidy program from 2009 to 2011, and the Energy Efficient Products "Benefits for the People" subsidy program from 2009 to 2013.

The first two subsidy programs were initiated as pilots in select province and cities, and promoted the new and replacement purchases of covered appliances. The rural subsidy program provided a rebate of 13% of the retail price of qualifying appliances to rural consumers, and was intended to help drive new appliance purchases by rural households in product categories such as air conditioners, water heaters, computers, color televisions, refrigerators, and cell phones. By the program's end in December 2012, a total of 298 million sets of home appliances had been sold in rural areas, with a sales volume of 720.4 billion yuan ($115.7 billion USD).

The "Old for New" subsidy program provided household subsidy of 10% of the retail price for trading in an old appliance for a new appliance in five covered product categories, as well as freight and disassembly treatment subsidies to promote proper disposal and recycling of appliances and components. As a result of the program, China sold 81.3 million new televisions, refrigerators, clothes washers, air conditioners and computers, driving 30.4 billion yuan of direct expenditure. At the same time, appliance recycling, disassembly and proper disposal also increased under this program, with 83.73 million units of old appliances successfully recycled and 66.21 additional million units disassembled and properly disposed of. This resulted in the recycling and recovery of 970,000 tons of steel, non-ferrous metals and plastics.

After China successfully subsidized energy efficiency lighting products in 2007, the "Benefits for

the People" subsidy program was initiated in June 2009 by the Ministry of Finance and National Development and Reform Commission (NDRC) to promote high efficiency air conditioners. The program was expanded to cover 15 products including industrial and transportation products by 2013, and specifically targeted certified energy efficiency products (i.e., Grade 1 and 2 under the mandatory China Energy Label[2]). Different subsidies were provided for Grade 1 and 2 products based on the price differential between high efficiency and baseline products, and the subsidies were provided to manufacturers to lower the sales price for consumers. The "Benefits for the People" subsidy program ended in May 2013, and successfully promoted the market adoption of high efficiency appliances.

3.1.2 Policy Impacts

Both the "Household Appliances to Rural Households" and "Old for New" successfully stimulated consumer purchases of new appliances, including higher efficiency appliances. While these two incentive programs did not focus explicitly on efficient appliances, they achieved additional programmatic goals of increasing rural electrification and increasing the recycling and proper disposal of old, inefficient appliances. The "Benefits for the People" subsidy program focused explicitly on promoting market transformation towards higher efficiency appliances. For air conditioners, the market share of high efficiency products increased from 5% before the program to about 80%. It helped ease the implementation of new air conditioner energy efficiency standards, and the production of the old Grade 3~Grade 5 low-efficiency room air conditioners was essentially terminated. The overall energy efficiency of the air conditioner industry increased by 24% from 2019 to 2013. The program was estimated to have boosted domestic demand by 580 billion yuan, reduced over 70 billion kWh of electricity, or equivalent to 31.51 million tons of standard coal.

3.1.3 Lessons Learned

Through China's recent incentive programs, market transformation through new product purchases can occur different program designs, including direct consumer rebates and rebates to manufacturers that translate into lower prices for consumers. These incentive programs were implemented with different target consumers in mind, based on different program goals that ranged from improving rural livelihoods to increased product recycling and material recovery to increasing energy efficiency product adoption. Regardless of the intended goals, each program resulted in significant scale of new product purchases and economic stimulus through increased expenditure and demand. Additional benefits of increased recycling and electricity savings were also achieved in the "Old for New" and "Benefits for the People" subsidy programs, with notable market transformation of the energy efficiency levels of the air conditioner industry by 2013.

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[2] The China Energy Label is a mandatory energy label that covers over 30 products, including many common household appliances. Product models are ranked from Grade 1 (most efficient) to Grade 3/5 (least efficient) relative to other models in the same product family. Grade 3 or 5 (depending on the product) is aligned with the MEPS level, while Grades 1 and 2 are designated as efficient products under national subsidy and procurement programs.

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3.2 Stimulating Sustainable Consumption through Japan's EcoPoints Program

3.2.1 The Challenge and Solution

To reduce greenhouse gas emissions from the residential sector by increasing consumer environmental awareness and to stimulate consumer spending following the 2008 global economic recession, Japan introduced a national Eco-point program. The Eco-point program was launched in May 2009 by Japan's Ministry of Environment, Ministry of Economy, Trade and Industry, and Ministry of Internal Affairs and Communication with 290 billion yen in funding. The program was originally scheduled to end in March 2010, but was extended with supplemental funding through March 2011 due to popular demand. The goal of the program was to promote private demand related to more sustainable consumption, economic rejuvenation, and increase in the adoption of energy efficient domestic appliances.

The EcoPoints program initially targeted air conditioners, refrigerators, and televisions, which together accounted for half of residential household CO_2 emissions. Eligible products were based on Japan's existing energy rating label, and EcoPoints could only be earned by purchasing products with four or five stars[3]. A total of 2000 types of products were eligible for earning EcoPoints with new purchases, with each EcoPoint worth one yen spent on the purchase, and additional points could be earned by returning old products for the purchase of a new qualifying product. The EcoPoints can be exchanged for coupons and prepaid cards to purchase other green products and the purchase of other energy-efficient products.

3.2.2 Impacts and Lessons Learned

By April 2011, 44 million eco-point applications were submitted with total value of 621 billion yen in redeemable eco-points. Statistics in June 2011 showed a corresponding large increase varying from 15% to 76% in the share of green home appliances with ratings of four or more stars in total sales. The Japanese government also estimates that the EcoPoint program contributed to 2.7 million tonnes of CO_2 reduction per year, and helped create 320,000 new jobs.

Although the EcoPoints program served a similar function as subsidies in incentivizing new purchases of more efficient products, it has additional benefits in raising broader environmental awareness by providing consumers with additional flexibility in how they choose to redeem the EcoPoints through other green purchases. The higher probability of a known termination for the program also helped accelerate the replacement of old products by signaling to consumers an endpoint in the program. The success of this program has led to the development of similar green credit programs in South Korea and Taiwan.

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[3] Japan's energy rating label ranks products from one to five stars, with one star being the least efficient and five stars being the most efficient.

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3.3 South Korea's Green Credit Program - An integrated platform for promoting green lifestyle and supply chain

3.3.1 Challenges and Energy Policies Context

The Republic of Korea ("South Korea") has achieved rapid economic growth and industrialization throughout the late 20th century, which affected increased greenhouse gas (GHG) emissions and consumption in energy and resources. Given South Korea imports more than 90% of its energy resources from other countries, the country is very vulnerable to fluctuations in international energy prices and supplies.

Following the oil shocks of the 1970s, the Korean government enacted the Rational Energy Utilization Act in 1979 with several revisions in 2000s, including the introduction of Corporate Average Fuel Efficiency (CAFE) standards, voluntary agreements with industry, promotion of energy efficiency labels, and certification of energy-efficient equipment. In addition, the Support for Environmental Technology and Industry Act (formerly, the Development of and Support for Environmental Technology Act, 1994) and the Act on Promotion of Purchase of Green Products (2005) encouraged the market toward sustainable consumption and production through relevant policies such as eco-labeling, green public procurement, green building certification, green credit card, etc.

3.3.2 Overview

In South Korea, the Ministry of Environment introduced a carbon point scheme in 2008, which was operated by municipal governments with technical support from the Korea Environment Corporation. The carbon point scheme, based on the amount of saved electricity, gas and tap water in the building sector, was incorporated into the green credit card scheme in 2011 by the Ministry of Environment and the Korean Environmental Industry and Technology institute. The Green Credit Card is an economic incentive scheme that provides economic rewards to credit card users for i) purchasing low-carbon and eco-friendly products, ii) using public transport; and iii) discounts on utility bills including electricity, water, and gas. Green Credit Card users are rewarded with points that can be converted into cash or donated to environmental funds. The Green Credit Card recently offers discounts for electric car charging services and the purchase of recycled automobile parts. As of December 2016, more than 15 million cards (which is equivalent to 55% of the economically active population of South Korea) were issued in the country, encouraging users to pursue low-carbon lifestyle choices.

3.3.3 Policy Insights

This policy scheme illustrates the effectiveness of using monetary value to quantify benefits for consumers to make lifestyle changes by taking eco-friendly actions. By engaging in coordinated partnership with players in the private sector such as credit card companies, manufacturers, distributors and retailers, governments can set up an integrated platform that expand the scope of the scheme and maximize the net impacts for consumers. Participating businesses are expected to commit a certain portion of their profit to help finance the carbon point scheme, which can be a

financial burden, and national policies further supplement the green credit card scheme by providing subsidies to stores specializing in selling green products.

3.3.4 Policy Impacts

The integrated platform helps consumers manage their carbon points across different sectors (building, transport, product purchasing) via a single credit card by easily tracking the CO_2 emission reductions, energy savings and economic rewards related to lifestyle changes they make. For example, the Eco-Mileage scheme, one of the carbon point schemes run by the Seoul municipal authority, provides information to consumers through its website. By motivating consumers to follow greener lifestyles and creating new demand for eco-friendly products, the Green Credit Card scheme can help transform the entire supply chains for products and services towards greener practices, products, and services.

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3.4 U.S. ENERGY STAR Retail Products Platform – A Collaborative Midstream Retail Program of Scale

3.4.1 Motivation and Challenges Faced

As market share and per unit efficiency of efficient products increase, it becomes more challenging for consumer products program to achieve energy savings because the incremental savings available is lowered, which lowers the cost-effectiveness of traditional consumer rebates. This poses significant challenges for easy-to-implement efficiency programs, such as downstream consumer rebate programs, as lower per unit rebates may be insufficient to motivate consumers to purchase efficient products and retailers are less interested in participating due to cost and complexity, and reduced value and efficacy of incentives as driving sales with lowered consumer participation. For the program administrator, additional challenges include rising administrative costs as a share of overall program costs and difficult in obtaining high-quality and detailed retail sales data persist beyond low retail and consumer interest.

3.4.2 Program Overview and Status

In 2016, the U.S. Environmental Protection Agency (EPA), U.S. state-level energy efficiency program sponsors, and retailer partners collaboratively launched the pilot ENERGY STAR Retail Products Platform (ESRPP) in 2016 in 10 states with the participation of 700 stores. A broader national program followed in 2017 with greater than 1000 participating stores and representing more than 70% of the U.S. appliance market, covering clothes washers and dryers, room air conditioners, refrigerators, freezers, room air cleaners, and sound bars. The target of the ESRPP program is to serve over 30% of the U.S. population by the end of 2017, up from the 25% served in 2016.

The ENERGY STAR Retail Products Platform aims to transform markets by streamlining and harmonizing energy efficiency programs with retailers by providing national-level structure and coordination on designing and delivering a low-cost retail-based incentive program. Under this midstream model, program sponsors provide low per-unit incentives to a concentrated group of retailers to encourage participating retail stores to stock, promote, and sell a higher percentage of energy efficient products. More specifically, core product categories with exact specifications are selected by a joint Task Group through consensus and incentives are provided by program sponsors to retailers to increase sales of qualifying ENERGY STAR products. Depending on the product category, these tiered incentives may range from $5-$20/unit for ENERGY STAR certified products to $15-$25/unit for products 30-50% more efficient than minimum ENERGY STAR requirements or if applicable, designated ENERGY STAR Most Efficient products. Retailers provide a predefined set of detailed category-level sales data during each program cycle in order to receive their incentive payments, and this data is used by program sponsors to define the baseline, sales goals, and conduct programmatic evaluation, measurement and verification.

3.4.3 Success Factors

As a midstream retail program, the ESRPP effectively meets five key requirements for success by recognizing that retailers are profit-driven, do not want to introduce additional risk into their

business, make product-related stocking and marketing decisions at corporate and not store-level, develop their own merchandising plans, and are reluctant to share detailed sales data. The ESRPP model works because retailers and efficiency program sponsors both benefit from consistent program design in incentive product categories, uniform data requirements and management through a third-party system, that result in lower per-unit incentive and administrative costs. Program sponsors can extend the reach of their program to more consumers by aggregating influence at the retailer level, and also benefit from uniform program design guidelines and common program implementation processes. Retailers benefit from streamlined and consistent process, data and reporting requirements, targeted product categories, and marketing flexibility to align consumer outreach with their own goals of increasing sales.

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4. Multi-lateral Global Award

In addition to government-led standards, labeling, and financial incentive programs, multi-lateral global awards and competitions have also been launched to drive and recognize innovations in high efficiency product design and production by manufacturers.

4.1. Global Cooling Prize

The Global Cooling Prize is a competition initiated by Rocky Mountain Institute (RMI) with India's Department of Science and Technology and Mission Innovation, and administered by RMI, Conservation X Labs, CEPT University and the Alliance for an Energy Efficient Economy. The competition seeks to incentivize innovation in the development of a residential cooling solution that will have at least five times less climate impact than standard room air conditioners (AC) units in the market today by offering at least US$3 million in prize money.

The competition was launched in November 2018 and has been successful in garnering significant global interest, with over 2100 registrations received from 96 countries, 445 intent to apply submissions from 56 countries, and 139 detailed technical applications from 31 countries. An initial set of eight finalists were selected based on submitted design and performance specifications in November 2019 based on two primary criteria: climate impact 5X less than the baseline unit based on energy use and refrigerant GWP, and affordability defined as cost at scale of no more than 2X the cost of the baseline unit.

The eight finalists' submittals include optimized designs pairing efficient vapor-compression technologies with PV, evaporative cooling, dessicants, and novel materials. The finalists prototypes will be subjected to three tests:

1. laboratory test using Indian Seasonal Energy Efficiency Ratio (ISEER) protocols,
2. lab simulated year-round performance test, and
3. field test in an existing apartment building in India.

The prize winner is expected to be announced in March 2021.

Lesson Learned and Success Factors

The Global Cooling Prize has been effective in attracting global interest and active participation through multiple success factors, including:

- a strong coalition of government, civil society and industry partners
- experienced prize competition management and technical capacity through its technical review committee
- strong and experienced governance and communications, including marketing and outreach support by outreach partners
- a large USD$3 million prize amount to attract interest

Through the applications received and the selection process for narrowing down to 8 finalists, the

competition has identified multiple promising technologies that could achieve 5x less climate impact with potential to be produced affordably at scale. It also demonstrated that challenge competitions can help spur innovation and bring technologies to market at scale faster.

References:

The Global Cooling Prize, https://globalcoolingprize.org

5. Key Findings and Global Best Practices

As highlighted by the global case studies in this report, there are various ways to encourage the development and adoption of top-of-the market efficiency and best-available technologies through design changes in traditional standards and labeling programs and innovative incentive policies and multilateral award programs.

Through the Top Runner program and revised Ecodesign requirements for electric motors, Japan and the EU demonstrated the target-setting approach for setting future efficiency requirements in based on pre-commercial ambitious efficiency levels of technologies not yet widely available on the market. The EU also demonstrated the target-setting principle in re-scaling its Energy Label back to its original A-G efficiency grades, with the top 1 or 2 efficiency grades reserved for best available technologies not yet on the market in label revisions. Specific criteria to trigger Energy Label reviews prior to the mandated 10-year review are also set to address market saturation of efficient appliances that occurs faster than anticipated. By anticipating the near-term market penetration of pre-commercial, top-of-the market efficiency technologies and explicitly recognizing their role on the market ambitious future mandatory efficiency requirements, target-setting sends a clear signal to manufacturers to invest in super-efficient technology development. Combined with the setting of specific criteria to trigger reviews for program revisions, target-setting helps avoid common challenge of market transformation outpacing the speed of standards and labeling program revisions.

Incentive programs have been adopted in multiple countries to primarily stimulate new appliance purchase, and the inclusion of traditional or innovative design elements can help meet specific programmatic goals and achieve additional socio-economic and environmental benefits. China's three recent subsidy programs have demonstrated the effectiveness of both consumer and manufacturer rebates in stimulating economic demand and expenditure through large-scale new appliance purchases. Its "Old for New" subsidy programs have also reaped additional benefits in increased product recycling and disassembly, material recovery. Its Energy Efficient "Benefits for the People" subsidy program transformed the domestic air conditioner market by effectively phasing out the production of the least efficient products while dramatically increasing the market shares of high efficiency products.

Similarly, Japan's novel EcoPoints program was designed to promote broader green consumerism by providing consumers with more flexibility in redeeming EcoPoints earned on efficient product purchases, while simultaneously incentivizing the replacement of old appliances with new, higher efficiency appliances. This program effectively raised the market share of high efficiency appliances, and contributed to CO_2 emission reductions and creation of new jobs.

South Korea's Green Credit Scheme follows a similar concept as Japan's EcoPoints program but provides an integrated platform building on public-private partnership to help transform both consumer behavior and supply chain towards more green practices. By using a single credit card that tracks carbon points across multiple sectors, the scheme creates new demand for green

products and services while supporting long-term, sustainable lifestyle and behavior changes for consumers.

Different from downstream incentive programs, the U.S. ENERGY STAR developed a new mid-stream, tiered incentive program targeting large national retailers. Retailers and efficiency program sponsors benefit from streamlined program design that results in lower per-unit incentives and administrative costs, with greater marketing flexibility for retailers to tailor consumer outreach strategies. The use of tiered incentives in the ENERGY STAR program also helps motivate retailers to sell more units of higher efficiency products.

Lastly, the Global Cooling Prize helped spur technological innovation by specifically targeting manufacturers with a large award prize and global recognition, and illustrates that technologies capable of significantly reducing climate impacts exist and have potential to be produced affordably and at scale.

Together, these nine case studies of international programs aimed at different types of market transformation that ranges from targeting narrow but very ambitious efficiency improvements to enabling broader societal change towards more environmentally-friendly supply and consumption. By making specific design changes to differentiate from traditional standards, labeling and incentive policies and programs, these nine examples effectively helped accelerate the market adoption of high efficiency and greener products and services and achieved additional socio-economic benefits.