NATUR VÅRDS VERKET

The Top Runner Program in Japan

– its effectiveness and implications for the EU

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Preface

A shift towards a sustainable society requires policymaking that achieves overall environmental improvement while continuously promoting innovation and enhancing the competitiveness of industry. Setting non-prescriptive, goal-oriented targets has been recognized as a crucial means to move in this direction. A so-called “top runner” approach, as implemented in Japan for the improvement of energy efficiency for product groups, has gained interest in the EU, especially in the discussion of performance targets in the Environmental Technologies Action Plan (ETAP).

The purpose of this research is to critically examine the environmental effectiveness and the policy implications of the top runner approach in Japan, in order to better understand the potential for applying the top runner approach in Europe. The research addresses questions such as:

- how has the Top Runner Program been implemented
- what results has it generated and what is the effectiveness of the program
- what are the implications of the program for EU initiatives such as ETAP, integrated product policy and the directive on establishing a framework for the setting of Eco-design requirements for Energy-Using Products.

The report is written by assistant professor Naoko Tojo at the International Institute for Industrial Environmental Economics (IIIEE) at Lund University, Sweden, on behalf of the Swedish Environmental Protection Agency. The research was conducted in close collaboration with Ms Izumi Tanaka of the Swedish Institute of Growth Policy in Tokyo. The author has sole responsibility for the content of the report and it can therefore not be taken as the view of the Swedish Environmental Protection Agency.

Stockholm, November 2005
Swedish Environmental Protection Agency

Content

Summary

Background and purpose
Promoting the application of environmental technologies has been regarded as a means for achieving the dual purposes of improving environmental protection while enhancing the competitiveness of industry in the global market. In Europe, the idea is clearly reflected in the development of the EU Environmental Technologies Action Plan (ETAP). One potential concrete measure highlighted in ETAP as well as in selected EU environmental policies is a so-called top runner approach, implemented in Japan for the improvement of use-phase energy efficiency of selected product groups. Despite a growing interest in applying the approach in Europe, the actual implementation mechanisms and results of the Top Runner Program have not been well studied.

In light of this background, a 3-month research project was conducted for the following purpose: to *critically examine the environmental effectiveness and the policy implications of the top runner approach in Japan, in order to better understand the potential for applying the top runner approach in Europe.* In order to achieve the purpose, the research addresses the following questions:

1. What is the Top Runner Program, and how has it actually been implemented?
2. What have the results been?
3. What are the views of stakeholders on the effectiveness of the Top Runner Program?
4. What are the implications of the Top Runner Program for environmental product policy?

The research was funded by Naturvårdsverket (Swedish Environmental Protection Agency). It was conducted in close collaboration with Ms. Izumi Tanaka of the Swedish Institute of Growth Policy and the author of the report. In-depth, open-ended interviews with representatives of manufacturers, government, industry associations and experts conducted between March and April 2005, as well as a review of various written materials, constitute the primary sources of the study.

The content and implementation of the Top Runner Program
The Top Runner Program was introduced in 1999 as a part of the revision of the Law concerning the Rational Use of Energy (Energy Conservation Law). It also served as a means to tackle climate change. The aim is to address energy use in the transport, commercial and private sectors, which have shown significant increases in the past 30 years. Eighteen product groups – selected electrical and electronic equipment, cars and gas-using equipment – are currently included in the Program, and its scope is being expanded.

In principle, among the targeted products available on the market, the use-phase energy efficiency of the “top runner” (the one that achieves the highest energy

efficiency) becomes the basis of the standard. The standard setting takes into account the potential for technological innovation and diffusion. This means on one hand that in some cases an outstandingly energy-efficient product does not become a standard setter, especially when achievement of the standard would require the usage of a unique technology applied to the product. On the other hand, when potential technological development is perceived to be great, the level of standards becomes higher than what the top runner product achieves. Within the same product group, differentiated standards are set reflecting one or more parameters that affect energy efficiency in the respective product groups. These parameters include function, size, weight, type of technologies used, type of fuel used and the like.

Differentiated timeframes, ranging from 3 to 12 years, are set for the respective product groups. Producers (manufacturers and importers) that place more than a certain number of products on the market must make sure that weighted average of energy efficiency of the products placed on the market meets the standard. The standards, as well as timeframes, are reviewed when the target year arrives, or when a substantial portion of the products meet the standards prior to the target year.

Both mandatory and voluntary information tools are employed to disseminate information on the achieved energy efficiency of the products under the Program. The standards set in the Top Runner Program are utilized in a couple of policy instruments, such as the Green Purchasing Law and the green automobile tax scheme. There has also been an annual award provision for energy efficient products and systems since 1990.

The Top Runner Program takes a name and shame approach for enforcement. Regarding monitoring, although there is an information provision requirement on the energy efficiency of individual models, the aggregate results are officially collected only when the target year arrives.

Results achieved

The results achieved in terms of fulfilment of Top Runner standards have been very positive. Producers of product groups for which the target year for achieving the standards has already arrived – such as air conditioners, TV sets with cathode ray tubes and videotape recorders – meet standards not only on a weighted average basis but also on an individual model basis. The levels of efficiency achieved by some models are substantially higher than the Top Runner standards. The average energy efficiency improvement of these product groups therefore exceeded what was expected to be achieved by fulfilment of the Top Runner standards. Product groups such as cars and computers will manage to attain the standards prior to the target year.

A straightforward comparison of the standards set in the Top Runner Program with foreign standards is difficult due to the difference in products and measurement

methods. However, according to an existing study, the Top Runner standards for some product groups – such as air conditioners and refrigerators equipped with special technologies – are higher than other standards. In other product groups such as cars, the relative stringencies differ depending on the parameters (in the case of cars, size). The Japanese manufacturers that have been interviewed seemed to be rather confident in the competitiveness of their technological improvements. It can be sid that manufacturers must be at least as well equipped with improved technologies as their counterparts abroad in order for them to achieve the results they have managed to achieve so far. The manufacturers interviewed had all implemented a handful of measures to improve energy efficiency.

Views of the stakeholders

Interviews with manufacturers indicate that among various factors that encourage them to undertake measures to improve energy efficiency, the role of the Top Runner Program has been crucial. The most notable effect of the Top Runner Program has been to accelerate the commercial application of technologies that have not been used and/or the wider application of such technologies (diffusion). A number of interviewees commented on the effect of the fact that the Program is based on legislation.

There is general agreement among the interviewees that the standards have been set at a realistic level, enabling all the manufacturers, if they work hard, to meet the standards. Some interviewees were critical of the level and doubtful of the magnitude of the contribution that the achievement of such standards can make in light of the needed change.

An issue raised in this context is the differentiation of standards within the respective product groups – for instance, different standards are set between heavy cars and light cars, and between TV sets with wide screens and those with ordinary screens. On the one hand, such differentiation is fair to producers that produce products that consume more energy in general (i.e. heavy cars, widescreen TV sets) and allows the existence of a variety of products. On the other hand, when considered from the viewpoint of reducing energy consumption in absolute terms, one can question how much the existence of the relatively energy-intensive products should be justified. The current exclusion of outstandingly energy-efficient products from being standard setters can be also questioned from this viewpoint.

A main challenge facing the Top Runner Program is to increase consumer uptake. Despite the availability of products that are significantly more energy-efficient, their relative high initial cost makes them less competitive than their inexpensive, less efficient counterparts. The level of appreciation of the cost savings achieved during the use phase differs between different types of consumers. The fact that the Program addresses only one aspect of the products was also pointed out as a shortcoming by a number of interviewees.

Implication for environmental policy

The analysis of the Top Runner Program indicates several issues that may be of relevance to the design and implementation of environmental product policy in general, as listed below.

- The manner in which the standards are set in the Top Runner Program can contribute to the *industry-wide environmental improvement*. The approach is that products with the *highest energy efficiency* on the market are used a starting point for standard setting, but that *the potential for other manufacturers to realistically meet the standards* is also taken into consideration.
- The approach used in the Top Runner Program can play an important role in *accelerating the application of environmental technologies* on market.
- The *mandatory nature* of the Program forced producers to meet the standards and to consider some issues – in the case of the Top Runner Program, energy efficiency – in their product development strategy that they may not otherwise consider.
- Setting standards at a "realistic" level, as in the Top Runner Program, *facilitates steady improvement*, but may *not to contribute to radical change*. The change achieved may not correspond to what is necessary for the creation of a sustainable society.
- Factors affecting the level of standards include *prioritisation between environmental protection and economic growth*, *the perceived graveness of the addressed issues* and *the decision making process*. When a policy aims to pursue the dual purposes of environmental protection and economic growth, there seems to be a tendency for the latter purpose to dominate. It also depends on how serious the problem is perceived to be by policy makers, manufacturers and the public. Having direct channels to individual producers instead of going through the industry associations may help in obtaining opinions that are not influenced by the interests of the whole industry.
- Differentiated standards within the respective product groups may facilitate the *availability of a wide range of products*, but questions remain as to whether the availability of all types of products is preferable from a sustainability perspective.
- The standards set in the Program can be used as *criteria for other policy instruments*, such as purchasing programmes, environmental tax schemes and the like. The review and upgrading of standards facilitates the adjustment of the standards in other programmes.
- The *Green Purchasing Law* utilised the Top Runner standards as one criterion. The *parallel introduction* of the Green Procurement Law prior to the arrival of the target years set for the respective product groups under the Top Runner Program contributed to the *speedy* fulfilment of the Top Runner standards on an *individual model basis*.

- The *green automobile tax scheme* also incorporates the Top Runner standards as one criterion for the selection of environmentally superior cars. The modest tax reduction for consumers is perceived to be the most effective driver for triggering changes in *consumers' purchasing behaviour*.
- While the effect of the Top Runner Program may be limited to the promotion of relatively incremental progress, *awards* – and the improved corporate image associated with them – can contribute to the development of products with *outstanding environmental performance*.
- Fulfilment of standards by *individual* companies – the approach taken in the Top Runner Program – provides more motivation for design change than an industry-wide mandate. The latter approach, taken in the so-called 140 g voluntary agreements in Europe, may discourage individual producers to reduce the environmental impact of their products.
- Changing purchasing behaviour by providing *information to consumers* faces challenges, even when consumers can directly benefit from cost savings during the use-phase. The situation may be worse when there are no direct health impacts or cost consequences for consumers.
- The majority of the producers addressed in the Top Runner Program are large, well-known domestic companies. This may be one reason why the *name and shame* approach has been working well. It most likely also facilitates information gathering regarding their progress for policy makers. Addressing other types of producers may necessitate more stringent enforcement and monitoring mechanisms.
- Application of the approach to other environmental aspects may face *boundary problems*. It can be difficult to decide which product parameters should be used to determine the Top Runner in the case of, for example, design for end-of-life.
- In light of the difficulties involved in *comparing standards* in different regions, harmonisation of measurement methods and standards on a global scale may face challenges.

Sammanfattning

Bakgrund och syfte
Att stödja utvecklingen och användningen av miljöteknologier har setts som ett sätt att uppnå de två målen att förbättra skyddet av miljön och samtidigt stärka industrins konkurrenskraft på den globala marknaden. I Europa har denna idé fått en framträdande roll vid utvecklingen av EUs handlingsplan för miljöteknik (ETAP). En potentiell konkret åtgärd som framhålls i ETAP, liksom i delar av EUs miljöpolitik, är den s.k. Top Runner-modellen som implementerats i Japan för att öka energieffektiviteten vid användning för utvalda produktgrupper. Trots det ökande intresset för att tillämpa metoden i Europa, har faktisk implementering och resultaten av Top Runner-programmet inte studerats ingående.

Mot denna bakgrund har ett tre månaders forskningsprojekt genomförts syfte att *kritiskt granska Top Runner-programmets miljömässiga effektivitet och dess policymässiga konsekvenser i Japan, samt utvärdera hur Top Runner-modellen skulle kunna tillämpas i Europa.*
För att nå detta syfte, inriktades studien på följande frågeställningar:

5. Vad är Top Runner-programmet och hur har det i praktiken implementerats?
6. Vad har resultatet blivit?
7. Hur ser intressenterna på Top Runner-programmets effektivitet och genomslagskraft?
8. Vilka konsekvenser har Top Runner-programmet fått när det gäller riktlinjer för miljöorienterad produktpolitik?

Studien har finansierats av Naturvårdsverket. Den har utförts i nära samarbete med rapportens författare och Izumi Tanaka vid Institutet för Tillväxtpolitiska Studier ITPS). Studien baseras på djupgående, öppna intervjuer med representanter för producenter, regering, branschorganisationer och experter, utförda mellan mars och april 2005, samt en genomgång av diverse skriftligt material.

Innehåll och implementering av Top Runner-programmet
Top Runner-programmet introducerades år 1999 som en del av revideringen av lagen om rationellt utnyttjande av energi (Energy Conservation Law). Programmet har också utgjort som en metod för att hantera klimatförändringar. Syftet är att påverka energiförbrukningen i transportsektorn och i de kommersiella och privata sektorerna, vilken ökat markant under de senaste 30 åren. Arton produktgrupper, bestående av viss elektrisk och elektronisk utrustning, bilar och utrustning för användning av gas, omfattas för närvarande av programmet och en utökning av antalet produktgrupper är på väg.

Bland de produkter som är tillgängliga på marknaden inom en utvald produktgrupp, kommer den produkt som är mest energieffektiv i användningsfasen (dvs. ”the Top Runner”) att i princip sätta utgångspunkten för standarden. Vid fastställande av

standarden beaktas potentialen för teknisk innovation och spridning. Det betyder å ena sidan, att en extremt energieffektiv produkt i vissa fall inte kommer att sätta standarden, i synnerhet när en unik teknologi måste användas för att en produkt skall uppfylla standarden. Å andra sidan kommer nivån på standarden att bli högre än vad Top Runner-produkten uppnår när potentialen för teknologisk utveckling anses vara stor. Inom respektive produktgrupp sätts differentierade standarder för att beakta en eller flera parametrar som påverkar energieffektiviteten inom produktgruppen. Dessa parametrar innefattar produktens funktion, storlek, vikt, typ av teknologi samt typ av bränsle, etc.

Tidsramarna för att nå målen har satts upp för respektive produktgrupp och varierar mellan 3 och 12 år. Producenter (tillverkare och importörer) som ger ut mer än ett visst antal produkter på marknaden måste se till att det viktade genomsnittet av energieffektiviteten hos de produkter som de marknadsför uppfyller standarden. Både standarder och tidsramar revideras när målåret nåtts, eller tidigare i de fall en väsentlig mängd av produkten uppfyller standarden innan målåret nåtts.

Såväl obligatoriska som frivilliga informationsverktyg används för att sprida information om uppnådd energieffektivitet för de produkter som ingår i programmet. De standarder som sätts i Top Runner-programmet används i ett antal policyskapande styrmedel som Lagen om grön offentlig upphandling (Green Purchasing Law) och systemet för grön bilskatt. Sedan 1990 har dessutom ett årligt pris för energieffektiva produkter och system delats ut.

Top Runner-programmet använder ”name and shame”-modellen för genomförandet. Det aggregerade officiella resultatet från uppföljningen av hur efterlevnaden av programmet varit sammanställs först sedan målåret nåtts, även om det finns ett informationskrav om energieffektiviteten för individuella produktmodeller.

Uppnådda resultat

Resultaten har varit mycket positiva vid utvärdering av hur Top Runner-standarder har uppfyllts. Producenter från olika produktgrupper för vilka målåret för standarden har nåtts, t. ex. luftkonditionering, TV med katodstrålerör och videobandspelare, uppfyller standarden inte enbart på viktad genomsnittsbasis utan också på individuell modellbasis. Nivån på energieffektivitet som uppnåtts av vissa produkter är betydligt högre än nivån i standarderna. Den genomsnittliga förbättringen av energieffektiviteten som gjorts inom dessa produktgrupper översteg förväntade nivåer. Produktgrupper som bilar och datorer kommer att uppnå standarden före sina målår.

En direkt jämförelse av de standarder som är satta i Top Runner-programmet med utländska standarder är svårt att göra på grund av skillnader i produkter och mätmetoder. Enligt en befintlig studie är emellertid Top Runner-standarderna för vissa produktgrupper högre än de som finns på andra marknader, som luftkonditionering och kylskåp försedda med viss specialteknologi. För andra produktgrupper som t ex bilar, varierar de relativa kraven beroende på olika parametrar (för bilar, storlek).

De japanska tillverkare som intervjuats i denna studie föreföll vara övertygade om konkurrenskraften i deras teknologiska förbättringar. De framhöll att tillverkare måste ha tillgång till minst lika välutvecklade teknologier som sina utländska konkurrenter för att åstadkomma de resultat de uppnått hittills. Av de intervjuade tillverkarna hade alla vidtagit ett antal åtgärder för att förbättra energieffektiviteten.

Intressenternas uppfattningar
De intervjuer som gjorts med tillverkare visar att Top Runner-programmet har spelat en avgörande roll bland de olika faktorer som uppmuntrat dem till att vidta energieffektiviserande åtgärder. Den mest påtagliga effekten av Top Runner-programmet är påskyndandet av den kommersiella tillämpningen av hittills ej använda teknologier och/eller den vidare tillämpningen av sådana teknologier. Ett antal av de intervjuade kommenterade betydelsen av att programmet bygger på lagstiftning.

De intervjuade var helt överens om att standarderna inom Top Runner-programmet har satts på en realistisk nivå, vilket gett alla tillverkare möjlighet att uppnå standarden om de arbetar hårt. Vissa intervjuade var tveksamma till hur stort bidraget är från sådana här standarder i relation till den förändring som behövs.

En fråga som lyftes i samband med detta är differentieringen av standarder inom respektive produktgrupp. T.ex. har olika standarder satts för stora respektive för små bilar, för TV apparater med storbild respektive för de med normal skärm. Å ena sidan, är sådan differentiering rättvis för tillverkare av produkter som generellt konsumerar mer energi (t.ex. stora bilar, TV apparater med storbild) och tillåter ett varierat utbud av produkter. Å andra sidan kan man fråga sig från ett energibesparande perspektiv i absoluta termer, om tillverkning av relativt sett mer energikrävande produkter kan motiveras. Det nuvarande undantaget att extremt energisnåla produkter inte sätter nivån för en standard, kan också ifrågasättas mot denna bakgrund.

En stor utmaning för Top Runner-programmet är att öka konsumenternas intresse. Trots tillgången på produkter som är betydligt mer energieffektiva, innebär den relativt höga initialkostnaden att de blir mindre konkurrenskraftiga i jämförelse med deras billigare, mindre effektiva konkurrenter. De uppskattade kostnadsbesparingarna i användarledet varierar mellan olika konsumeter. Det faktum att programmet endast tar upp en aspekt hos produkterna sågs som en brist av flera av de intervjuade.

Konsekvenser för miljöpolitiken
Analysen av Top Runner-programmet indikerar flera viktiga frågor som kan vara relevanta vid utformning och implementering av miljöorienterad produktpolitik generellt, se följande lista.

- Det sätt på vilket standarden utformats i Top Runner-programmet kan bidra till *miljöförbättringar inom hela industrin.* De produkter på marknaden som har den *högsta energieffektiviteten* utgör utgångspunkt för standarden, samtidigt som *potentialen för att andra tillverkare också skall ha en realistisk chans att uppnå standarden beaktas*.
- Den metod som används i Top Runner-programmet kan spela en viktig roll genom att *påskynda användningen av miljövänlig teknologi* på marknaden.
- Programmets *obligatoriska karaktär* har tvingat tillverkare att uppfylla standarden och beakta vissa frågor, inom Top Runner-programmet energieffektivitet, i sina strategier för produktutveckling. Något som de annars kanske inte skulle gjort.
- Fastställande av standarder på en "realistisk" nivå, såsom inom Top Runner-programmet, *främjar en kontinuerlig förbättring* men *bidrar kanske inte till radikala förändringar*. Förändringarna överensstämmer kanske inte med vad som är nödvändigt för ett hållbart samhälle.
- Faktorer som påverkar standardnivåerna inkluderar *prioritering mellan miljöhänsyn och ekonomisk tillväxt, med vilket allvar frågorna hanteras* och *beslutsprocessen*. När en policy har ambitionen att de båda målen, dels miljöhänsyn och dels ekonomisk tillväxt, tenderar den senare att dominera. Det beror också på hur allvarligt politiska beslutsfattare, tillverkare och allmänheten ser på problemet. Direkta kanaler till individuella tillverkare i stället för att gå igenom branschorganisationer kan, vara ett sätt att erhålla synpunkter som inte påverkats av hela branschens intressen.
- Differentierade standarder inom respektive produktgrupp kan möjliggöra *större urval av produkter,* men frågan kvarstår huruvida tillgången på alla dessa produkter är önskvärd ur hållbarhetssynpunkt.
- De standarder som sätts i programmet kan användas som *kriterier i andra policy instrument,* såsom program för upphandling, miljöskatter och liknande. Genomgång och uppgradering av standarder i Top Runner-programmet möjliggör justering av standarder i andra instrument.
- *Lagen om grön upphandling* i Japan (Green Purchasing Law) använde standarderna inom Top Runner-programmet som ett kriterium. Det *parallella införandet* av lagen om grön upphandling innan målåret uppnåtts för respektive produktgrupp under Top Runner-programmet, bidrog till att *snabbare* uppfylla standarderna i Top Runner-programmet för respektive produkt.
- *Systemet för bilskatter* innefattar också standarder i Top Runner-programmet som ett kriterium för val av extra miljövänliga bilar. Den skattereduktion, om än liten, som konsumenterna erhåller, upplevs som den effektivaste drivkraften för att åstadkomma förändringar i *konsumenternas inköpsvanor*.
- Samtidigt som effekten av Top Runner-programmet kan vara begränsad till att främja förhållandevis stegvisa förbättringar, kan *belöningar* – och den

högre företagsimage som följer av detta – bidra till utvecklingen av produkter med *utomordentligt goda miljöprestanda*.

- Top Runner-programmets krav på att *individuella* företag ska uppfylla standarderna innebär större motivation till förändringar i produkterna utformning än ett krav som riktar sig till hela branschen. Det senare upplägget har använts i de s.k. frivilliga 140g avtalen i Europa och kan minska motivationen hos individuella tillverkare att reducera sina produkters miljöpåverkan.
- Att ändra konsumenters inköpsvanor genom *information till konsumenter* är en utmaning, även när konsumenterna kan dra fördelar genom kostnadsbesparingar under användarfasen. Situationen kan vara än svårare när det inte finns något direkta hälso- eller kostnadsincitament för konsumenten.
- Majoriteten av de tillverkare som omfattas av Top Runner-programmet är stora välkända inhemska företag. Detta kan vara en anledning till varför *”name and shame-metoden”* har fungerat så bra. Det underlättar troligen också vid insamlandet av information om gjorda framsteg. Om andra typer av tillverkare skulle omfattas skulle det troligen kräva mer strikta system för implementering och uppföljning.
- Tillämpning av metoden för andra miljöaspekter kan innebära *gränsdragningsproblem*. Det kan vara svårt att avgöra vilken av produktens parametrar som skall vara avgörande vid bedömning av vilken produkt som är den bästa, the Top Runner, vid t ex utformning av produkten med syfte på bra avfallshantering.
- Med tanke på svårigheten att *jämföra standarder* i olika regioner, kan en global harmonisering av mätmetoder och standarder innebära utmaningar.

List of abbreviations

CAFÉ	Corporate Average Fuel Efficiency
CPU	central processing unit
CRT	cathode ray tubes
DVD	digital versatile disc
EEE	electrical and electronic equipment
ETAP	Environmental Technologies Action Plan
EuP	Energy using Products
IPP	Integrated Product Policy
LCD	Liquid crystal display
METI	Ministry of Economy, Trade and Industry
OEM	original equipment manufacturers
RoHS	Restriction of Hazardous Substances

1 Introduction

This report summarises the results of a 3-month research project entitled “Evaluation of the Effectiveness of the Top Runner Program in Japan”, funded by Naturvårdsverket (Swedish Environmental Protection Agency). This introductory chapter aims to provide readers with a brief overview of the project: its background and purpose and the research questions addressed, the scope and limitations of the project, and how the research was conducted. The last section presents an outline of the report.

1.1 Background

Environmental protection constitutes an integral pillar of sustainable development. In the European context, the so-called Lisbon Strategy[1]argued that the enhancement of a competitive and dynamic knowledge economy is the key for Europe to survive, while the importance of the integration of environmental considerations in this process was stressed in, for example, the Göteborg European Council in 2001.[2] A means identified to achieve this integration is the promotion of environmental technologies. In the EU, the aim of the Environmental Technologies Action Plan (ETAP) has been developed with the aim “to exploit the potential of environmental technologies for meeting the environmental challenges faced by mankind while contributing to competitiveness and growth” (COM (2004) 38 final, p6).

One of the three actions proposed in the ETAP is improving market conditions, so as to enhance the commercialisation of many potentially significant environmental technologies that are currently unused. The importance of “positive incentives and appropriate regulatory framework” is highlighted (COM (2004) 38 final, p14). A concrete measure proposed in this context is setting performance targets. Indeed, there has been a growing recognition of the use of a non-prescriptive, goal-oriented approach in environmental policy making instead of so-called command-and-control approach. The approach has been used and/or discussed in various European environmental policy arenas, such as IPP (integrated product policy) (COM (2003) 302 final) and the so-called EuP Directive (Directive 2005/32/EC). The capacity of non-prescriptive, goal-oriented environmental policy in providing incentives to producers for innovation while reducing the overall environmental impacts from society has been discussed in literature and supported by some empirical studies.[3]

[1] Adopted in the President Conclusions of the Lisbon European Council.
[2] Article1of the President Conclusions of the Göteborg European Council reads: “The European Council met in Göteborg agreed on a strategy for sustainable development and added an environmental dimension to the Lisbon process for employment, economic reform and social cohesion;….”.
[3] See, for instance, Ashford, Heaton, Priest (1979), Porter & van der Linde (1995), Kemp (2000), Norberg-Bohm (2000), Rennings, Hemmelskamp, Leone (2000), Field & Field (2002), Ashford (2002) and Tojo (2004).

The understanding of performance targets varies, as observed in a meeting on ETAP in Göteborg.[4] Moreover, challenges exist in the manner in which the targets are set to achieving the dual purposes of promoting innovation while achieving overall environmental improvement. A so-called top runner approach, as implemented in Japan for reduction of energy consumption of selected product groups,[5] has been discussed as a policy approach that may achieve the aforementioned dual purposes. The Top Runner Program in Japan identifies the product that achieves the highest energy efficiency within the product groups belonging to the same product category. Standards are set based on the performance of the identified product as well as the prospects of future technological development. Producers of the same product group should improve the performance of their products so that the weighted average use-phase energy efficiency of their products meet the targets.

The approach used in the Program seems promising at first glance: a non-prescriptive and goal-oriented approach providing industry with possibility to determine their own innovation paths while motivating them to strive for environmental efficiency. The Program has contributed to the increased interest in the scheme in Europe, and application of the scheme in selected EU environmental policies has been advocated. However, the actual effectiveness of the program in achieving the goals envisioned in the EU (bringing various unused environmental technologies to the market while reducing the overall environmental impacts from society) has not been well studied. A closer look at the actual implementation of the approach as well as the results achieved has been considered to be of great value for the potential application of such an approach in Europe.

1.2 Purpose

The purpose of the research is to *critically examine the environmental effectiveness and the policy implications of the top runner approach in Japan, in order to better understand the potential for applying the top runner approach within the EU.*. In order to achieve the purpose, the research addresses the following questions:

1. What is the Top Runner Program, and how has it actually been implemented?
2. What have the results been?
3. What are the views of stakeholders on the effectiveness of the Top Runner Program?
4. What are the implications of the Top Runner Program for environmental product policy?

[4] "A think tank meeting about performance targets (PT)", held in Göteborg University and Chalmers University of Technology, Göteborg, 29-30 September 2004.
[5] As of June 2004, the approach has been applied to 18 product groups, and its application to more product groups has been discussed. For more discussion, see Section 2.2.

1.3 Scope and limitation

The study primarily focuses on the *Top Runner Program in Japan* within the revised Law concerning the Rational Use of Energy (Energy Conservation Law). However, other related policy instruments or those that have taken similar approaches were also explored as far as possible within the given time frame. Such approaches include the Law concerning the Promotion of Public Green Procurement, the green automobile tax, the exhaust gas emission limits set under the Law on Air Pollution Prevention and eco-labelling schemes in Japan, as well as those in other countries such as the Energy Star Program, the so-called CAFE Program in the United States[6] and voluntary agreements to reduce CO_2 emissions from cars in Europe.[7] These approaches are referred to wherever relevant.

Among the 18 product groups currently included in the Top Runner Program, the following products were selected for in-depth investigation.[8]

- Cars (passenger vehicles)
- Refrigerators and freezers
- Air conditioners
- Computers
- Copying machines
- TV sets

The primary principle underlying the selection of the product groups was that they were deemed to be rich in information and had a high potential for learning opportunities (purposeful sampling: Patton, 1987, pp. 51-60; Stake 1995, pp. 4-7). The selected products vary in their longevity, maturity, the timeframe set to achieve the standards and the like (variation sampling). The similarities and differences found in different product groups help extract issues that can be considered when applying the approach in general. Recommendations from experts, access to information, changes in standards and scopes and relevance to the European context were also considered when selecting the product groups. For instance, TV sets were selected as the inclusion of new types of TV sets (those with liquid crystal display and plasma display) has been discussed. Heated toilet seats were not looked at due to their rather exclusive usage in Japan. However, issues related to other product groups are also discussed in the report wherever appropriate.

The purpose of investigating some products groups in detail was to obtain understanding for the approach used in the Top Runner Program through concrete examples, and not to gain detailed knowledge concerning the application of the approaches to the specific product groups *per se*. Thus, instead of describing the

[6] CAFE stands for Corporate Average Fuel Economy. More information can be found at www.nhtsa.dot.gov/cars/rules/cafe/overview.htm
[7] Commission Recommendation 1999/125/EC, Commission Recommendation 2000/303/EC and Commission Recommendation 2000/304/EC.
[8] See Section 2.2 for the full list of products included in the programme.

application of the approach to each product group, issues related to the approach in general are discussed and illustrated by examples from different product groups.

In light of the purpose of this research, the evaluation criteria for environmental policy focused on in the study are *environmental effectiveness* and *effectiveness for the stimulation of innovation* (effectiveness evaluation).[9] In this study, innovation is understood to be technological development relating to products that are more energy-efficient than previous models.

Evaluation of the effectiveness of an intervention can be looked at from two viewpoints: 1) whether the outcomes correspond to the goals set out in the intervention (*goal-attainment* evaluation) and 2) whether the outcomes are produced by the intervention (*attributability* evaluation) (Vedung, 1997, pp. 37-39).

With regard to goal attainment evaluation, the study sought to explore the status of the *attainment of energy efficiency standards* set out in the Program (environmental effectiveness). However, gathering information on achievement faced considerable challenges in some sectors.[10] Due to the differences in products sold in different markets and in methods for measurement of energy efficiency, comparison of the energy efficiency of products sold in Europe with those sold in Japan was restricted to references to a previous study, supplemented by comments from the interviewees. Concerning the effects on *innovation*, the lack of access to information and limited time did not allow the author to conduct a quantitative analysis of the changes in the number and types of innovation. Instead, concrete examples of innovation and the perceptions of interviewees were explore to obtain an understanding of whether and how the Top Runner Program influenced innovation. The manner in which the attainment evaluation is conducted, along with its limitations, is discussed further in Chapter 3.

Various internal and external factors – from top management commitment to customer demands on quality and safety and regulatory measures – influence product design.[11] Data regarding the factors can be only obtained through the perceptions of the people involved in the interview process. Consequently, it would be difficult to identify an indisputable "causal link" between the Top Runner Program and the observed change in energy efficiency and innovation. Therefore the author did not seek to single out or measure the attributability of the Top Runner Program. Rather, the author discusses the role of the Program in inducing the observed changes in light of other influencing factors, as discussed further in Section 1.4 and Chapter 4.

[9] For further discussion of evaluation criteria, see for instance Tojo (2004, pp. 34-45)
[10] It was in general very difficult to obtain an agreement to conduct an interview with industry associations who, according to a number of interviewees, have the information.
[11] See, for instance, Hall (2001) and Tojo (2004).

1.4 Research approach and methodology

The research primarily took a *qualitative* approach in order to capture various phenomena relating to/surrounding the Top Runner Program. The two main parts of the study – *information collection* and *analysis* – took place interactively, especially when interviews were conducted. Information collection and part of the analysis were carried out in close collaboration with Ms. Izumi Tanaka of the Swedish Institute of Growth Policy.

Information was collected both by a *review of various written materials* and *in-depth, open-ended interviews* of various actors in Japan who were deemed to have knowledge and opinions concerning the Top Runner Program. Information of both a qualitative and a quantitative nature was collected.[12]

Written materials reviewed include both printed materials and web-based materials. Types of materials include legislation and other governmental and public programmes (e.g. eco-labelling schemes), reports, newsletters, articles in academic and trade journals, product catalogues and other materials provided by the interviewees (e.g. presentations).

Information gained through desktop research was complemented, substantiated and triangulated by *in-depth open-ended interviews* with actors conducted in Japan between 17 March and 8 April 2005. The interviewees included 32 representatives from 12 manufacturers of the studied products, 4 representatives from 2 industry associations, 9 experts and 3 government officials. The list of interviewees, their positions at the time of interviews and the timing of the interviews are summarized in Appendix 1. Due to the anonymity requested by some interviewees from manufacturers, reference to the industry representatives will not be made in the document.

The *manufacturers* interviewed in the study sell finished products to the market (original equipment manufacturers: OEMs), not components (criteria sampling). Among the OEMs that manufacture products selected for this study, interviewees were selected based on contactability and availability in the timeframe of the study.

In the case of manufacturers and industry associations, prior to conducting the interview, initial contact was made with personnel working in the environmental field. At the initial contact, the general purpose and focus area of the research was explained and a request was made for introduction to persons working in the areas that were relevant to the research. Many Japanese electrical and electronic equipment (EEE) manufacturers produce a variety of products, ranging from household appliances to entertainment equipment and industrial systems. Therefore, specific

[12] A study on the Top Runner Approach has also been conducted by German Ministry of the Environment. However, the content of the report did not become available within the timeframe of this study.

products were mentioned in order to obtain concrete information from the interviewees.

Once the contacted companies agreed to participate in an interview, a list of issues to be discussed was sent out. The list was sent to interviewees prior to the interview, in order to facilitate the smooth and efficient conduct of interviews. The list of issues also served as an *interview guide* during the actual interviews. In the author's own interview guide, concrete items were added as the interviews proceeded reflecting upon the information obtained. Except for one interview, a brief overview of the project was also sent out in advance. The content of the interview guides differed for the rest of the interviewees, depending on what information the author expected to obtain. The interview guides are found in Appendix 2.

All the interviews were conducted in person. Except for three interviews, all the interviews were conducted together with Ms. Izumi Tanaka. The duration of the interviews was between one hour and one hour and a half. Except for three, all the interviews with manufacturers were recorded. After each interview, the strategy for the remaining interviews was discussed.

The interviews addressed a list of issues outlined in the interview guide. The interview did not necessarily follow any particular order, but rather, following the approach of Patton (1987, p. 111), the list was utilised to make sure that all relevant issues were covered. Some follow-up questions not necessarily in the guide were also asked. When the interviewees were asked about the factors driving or hindering design improvements for energy efficiency, particular care was taken to mention various competing factors together with the Top Runner Program. This illustrative examples format was taken from Patton (1987, p. 128), in order to establish neutrality. It was suspected that allowing the interviewees to freely discuss various influencing factors, rather than asking about the influence of Top Runner Program explicitly, would help grasp the relative importance of the Program among other influential factors in inducing changes. Learning the various factors was also intended to help the author understand the interrelatedness and complexity of such factors and provide a broader understanding of the role of the Top Runner Program.

After the interview, the recorded interviews were transcribed and the interview notes for the rest were reviewed and summarised. The transcripts and the summary of the meeting notes were sent to interviewees for review and comments. They were summarised in accordance with the corresponding research questions. With regard to *attributability* evaluation, as suggested by authors such as Yin (1994, pp. 44-51) and Stake (1995, pp. 74-79), the summaries of the respective interviews were then aggregated in order to aid the search for both general patterns and differences. With regard to *goal-attainment* evaluation, analysis of various written materials constitutes the main source, as explained further in Chapter 3.

Based on the analysis of the results and the perceptions of the interviewees regarding the Top Runner Program, the author seeks to extract and discuss elements of the Program that may provide some insights when designing and implementing an environmental product policy in general. References are made to European environmental policy making wherever appropriate. Conclusions are drawn reflecting upon the findings and presented in the different chapters.

All the interviews were conducted in Japanese, and a number of publications referred to in this report are available only in Japanese. Information used in this document is taken from sources in Japanese is translated by the author.

1.5 Structure of the report

The report consists of six chapters. The next chapter describes the content of the Top Runner Program and the manner of its implementation to date. It also briefly introduces other related policy measures in Japan. Chapter 3 presents the achievement of Top Runner standards for selected product groups, as well as concrete measures taken by manufacturers to meet the standards. In Chapter 4, the perceptions of the interviewees regarding various factors influencing the undertaking of measures to improve the energy efficiency of products, as well as regarding the Top Runner Program per se, are summarised. Based on an understanding of how the Top Runner Program has been implemented and perceived, issues that may influence the outcome of the approach taken in the Top Runner Program, as well as issues that may be useful to consider when designing and implementing environmental product policies in Europe as well as in general, are extracted and analysed (Chapter 5). The report ends with a short concluding chapter.

2 The Top Runner Program in Japan

This chapter outlines the content of the Top Runner Program, as well as how the Program has actually been implemented. In addition to the outline of the Program, a brief introduction is given to other related policy instruments referred to by interviewees.

2.1 Background and aim

The top runner approach was introduced in 1999 as part of the revised Law concerning the Rational Use of Energy (hereafter referred to as Energy Conservation Law) in Japan.

Originally introduced in 1979 to deal with the oil crisis, the Energy Conservation Law aims to contribute to ensure an efficient use of fuel resources reflecting the domestic and international socio-economic circumstances surrounding energy. In doing so, it suggests various measures to promote a rational use of energy. The three concrete areas addressed by the law are energy use in factories (Chapter 2), buildings (Chapter 3) and equipment (Chapter 4). The goal of the legislation is to contribute to the sound development of the national economy (Article 1).

In addition to energy security, climate change started to become an important issue for energy conservation in the 1990s.[13] Its importance in the political agenda has increased particularly since the ratification and entry into effect of the Kyoto Protocol to the UN Framework Convention for Climate Change.[14]

The Energy Conservation Law has been rather effective in stabilising energy use from industrial sources since the oil crises. However, energy consumption in the transport, household and commercial sectors has steadily increased.[15] Approximately 80% of the increase of energy use in the transport sector in the 1990s was attributed to private cars (Energy Efficiency Committee, Advisory Committee for Natural Resources and Energy, 2001, p. 7). This is in spite of the fact that

[13] It is said that approximately 90% of greenhouse gas emission in Japan are related to energy use (Kyoto Giteisho Mokuhyou Tassei Keikaku [Plan to Achieve the Targets in the Kyoto Protocol], 2005. p9).
[14] The magnitude of political commitment was manifested in, for example, the creation of a special committee within the Cabinet to develop a national plan to tackle climate change. It resulted in the publication of the “Plan to Achieve the Targets in the Kyoto Protocol” by the Prime Minister’s office.
[15] In 2001 the transport sector (transport of people and goods) used 2.15 times more energy than in 1973, and in the commercial and private sectors 2.25 times. This led to an increase in total energy use of nearly 1.5 times during the same period: from the equivalent of 287 million m^3 of crude oil in 1973 to 408 million m^3 in 2001 (Agency for Natural Resources and Energy, n.d., pp. 1-2)

use-phase energy efficiency of energy-using equipment per product has been greatly improved.[16]

Thus, it has been considered crucial that measures be taken to reduce energy consumption related to the transport, household and commercial sectors, whose energy consumption has continued to increase significantly.[17]

The Top Runner Program has been introduced as one of the primary approaches to reduce energy use from these non-industrial sectors. The aim is to reduce energy consumption in the household and private transport sectors by improving the use-phase energy efficiency of selected products.[18]

2.2 Scope of the Program

The Energy Conservation Law sets three criteria for products, which determine when policy makers should consider the application of the Top Runner Program (Article 18). These criteria are:

- products that are used in large quantities in Japan;
- products that consume a considerable amount of energy in the use phase; and
- products for which there is considered to be a special need for energy efficiency improvement.

After starting with 10 product groups in 1999 (ECCJ, 1999b), 18 product groups are currently included in the Top Runner Program. These product groups include: gasoline and diesel passenger vehicles, gasoline and diesel light trucks, refrigerators, freezers, copying machines, computers, magnetic disc units, TV sets, videotape recorders, washing machines, air conditioners, fluorescent lights, heated toilet seats, oil and gas heaters, oil water heaters, gas water heaters, vending machines and transformers.

Within the respective product groups, further differentiation has taken place in light of the aforementioned three criteria. For instance, among passenger vehicles, only gasoline and diesel cars have been included in the Program in the initial phase,

[16] For instance, the average energy consumption of refrigerators was reduced by 66% in 1984 as compared to 1973, and by 42% in the case of air conditioners. However, it is interesting to note that after a significant drop of energy consumption in the 1970s, the energy efficiency of electrical home appliances (TV sets, air conditioners, air conditioners and refrigerators and freezers) stabilised between the early 1980s and mid-1990s (AEHA, 2005, p201-204).

[17] As of 2002, energy consumption related to the transport sector causes 21% of total national greenhouse gas emissions, while energy consumption related to the household sector causes 13% and the commercial sector 16% (Prime Minister's Office, 2005, p. 10). While energy consumption in the industrial sector decreased by 1.7% in 2002 compared to 1990, consumption in the transport sector increased by 20.4% during the same period, and by 33% in the household and commercial sectors (Prime Minister's Office, 2005, p. 14).

[18] Prior to the introduction of the Top Runner Program, energy efficiency standards had been set for selected product groups in the Energy Conservation Law. However, the way in which standards were set was different from that used in the current Top Runner Program. The scope has been significantly extended since 1999 as well.

while electrical vehicles and hybrid cars have been excluded. Likewise, the Program for TV sets in the initial phase addressed TV sets with CRT (cathode ray tube) displays, but not those with LCD (liquid crystal displays). Among the copying machines, 1) those with extremely rapid copying speed, 2) those for large paper size 3) coloured copies and 4) those with multiple functions (e.g. facsimile, printer) are exempted due to their relatively small market share, their specific usage and lack of established energy-efficiency measurement method. In the case of refrigerators and freezers, those manufactured for industrial use are excluded due to the large variety of the product types and the small production quantities of each type.[19] Moreover, producers whose market share is below the threshold level are exempted.

Meanwhile, the scope of the Program has been extended, concomitant the increasing numbers of products put on the market in recent years. For instance, the inclusion of TV sets with LCD and plasma displays and DVD players has been discussed. Cars powered by liquefied petroleum (LP) gas were added in 2003. Other product groups proposed for inclusion in the Program are looters /looters?/ for computers, microwave ovens and electric rice cookers (Energy Efficiency Committee, Advisory Committee for Natural Resources and Energy, 2004, p. 4).

2.3 Standard setting and goal achievement

The Top Runner Program can be characterised by its *standard setting* and *goal achievement requirement,* as well as *continuous revisions*.

2.3.1 Standard setting

The top runners set the standards: In principle, among the targeted products available on the market the year before the standard is discussed, the use-phase energy efficiency of the one that achieves the highest efficiency (top runner) becomes the basis of the standard.

Standard setting takes into account technological innovation and diffusion: Standard setting takes into account the potential for technological innovation and diffusion. This means that the “top runner” product may not necessarily become a standard setter. For instance, even when a product achieves outstandingly superior energy efficiency, it may not become a standard setter if achieving the same efficiency requires competitors to purchase the unique technology used in the product. This happened in the case of, for instance, copying machines and cars.[20]

[19] Refrigerators that use specific technologies such as electronic cooling technologies and absorption technologies are also exempted.

[20] The latest brochure explaining the implementation of Top Runner standards suggests that the level achieved by the outstanding technologies, though not a standard setter *per se*, should be considered when deciding upon the standards. Other criteria for products to be excluded from becoming a standard setter include 1) those that are produced for specific purposes and customers and are not manufactured in large quantity, 2) those that have a high probability to be sold with price less than production cost with the intention to promote the image of the company and 3) those whose technological development is immature due to uncertainty on safety and reliability (ECCJ, 2005b).

Taking into consideration the potential for technological innovation also means that the standard can be set even higher than the highest energy efficiency currently achieved. This was found in, for instance, the standards set for TV sets with LCD and plasma displays and DVD players. As these products are relatively new and the technologies used are still growing, it was assumed that there is a good potential for energy efficiency improvement in these products. Thus the standards set for these products were 5% higher than what was achieved by the top runner when the standards were set. Meanwhile, even after the arrival of their first target years, no new targets are set for TV sets with CRT displays and videotape recorders due to their declined production and sales (Evaluation Standard Subcommittee for TV sets and Videotape Recorders, 2005).

Differentiated standards are set based on various parameters: Within the same product groups, differentiated standards are set based on one or more parameters that affect the energy efficiency of the respective product groups. Examples of such parameters include function (for example copying machines: number of copies made per minute; TV sets: whether a videotape recorder is included or not, and a number of other additional functions), size (for instance refrigerators: internal volume; TV sets: size of screen), weight (for instance passenger vehicles), types of technologies used (for instance refrigerators: refrigeration method), fuel used (for instance passenger vehicles) and the like. Examples from copying machines and passenger vehicles are found in Table 2-1 and Table 2-2.

One of the issues considered is the effect on the availability of the products to consumers – whether meeting the standard would oblige manufacturers to abolish the production of widely-used products. For instance, in the case of TV sets, in addition to the differentiation made based on the size of the displays and additional functions, differentiated functions are used between TV sets with wide screens and normal ones (see Figure 2-1). The use of the same functions would have forced the producers to stop producing TV sets with wide screens due to the difficulties of meeting the standards (ECCJ, 2005b).

Table 2-1: Energy Efficiency Standards for Copying Machines under the Top Runner Program (unit = Wh)*

Parameters	Type of machines			
Copying speed	A4 machines	B4 machines	A3 machines	A3Y machines
Up to 10 copies per minute	11	17	19	27
11-20 copies per minute	17	20	55	77
21-30 copies per minute	69	85	99	139
31-40 copies per minute	88	108	125	175
41-50 copies per minute	123	151	176	246
51-60 copies per minute	144	176	205	287
61-70 copies per minute	180	221	257	383
71-80 copies per minute	200	246	286	433
81-85 copies per minute	258	317	369	483

* Energy efficiency E = (A + 7B)/8. A stands for the amount of energy consumed in one hour after turning the switch on. B stands for the amount of energy consumed in the next hour.

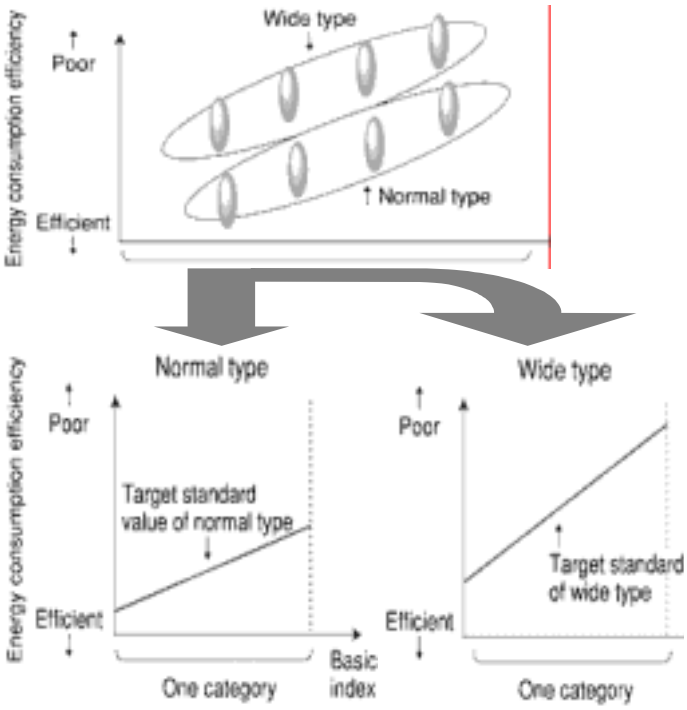
Source: ECCJ (2004e, p. 8)

Table 2-2: Energy Efficiency Standards for Passenger vehicles under the Top Runner Program (unit = km/l run in 10/15 mode*)

Parameters	Type of fuels used		
Weight (kg)	Gasoline	Diesel	Liquefied petroleum gas
Less than 703	21.2	18.9	15.9
703-828	18.8	18.9	14.1
828-1016	17.9	18.9	13.5
1016-1266	16.0	16.2	12.0
1266-1516	13.0	13.2	9.8
1516-1766	10.5	11.9	7.9
1766-2016	8.9	10.8	6.7
2016-2266	7.8	9.8	5.9
2266 and above	6.4	8.7	4.8

* The 10/15 mode refers to a mode in which a car is assumed to be driven both in cities and on highways and to reflect a typical driving pattern in Japan. It has been used to measure exhaust gas emissions as well as fuel efficiency.

Source: ECCJ (2004e, p. 4)



Source: adapted from ECCJ (2005b)

Figure 2-1: Differentiated Target Setting: Examples of TV sets

Although the detailed parameters differ, the governmental programmes for use-phase energy efficiency improvement in Europe and the United States also incorporate similar differentiation for EEE for which standards exist (ECCJ, 2003).[21] However, in the case of cars, such differentiation has not been incorporated in European voluntary agreements or US legislation. The implication of the difference will be discussed further in Chapter 4.

2.3.2 Goal achievement requirement

Producers (manufacturers and importers) must make sure that the *weighted average of energy efficiency of the products placed on the market* in the target year meets the standard. This means that a producer can still sell products with lower energy efficiency than the standard so long as a sufficient number of products with higher energy efficiency are placed on the market so that the average equals or exceeds the standard.

[21] In Europe, energy efficiency requirements are imposed on three product groups: hot-water boilers (Directive 92/42/EEC), refrigerators and freezers (Directive 96/57/EC) and ballasts for fluorescent lighting (Directive 2000/55/EC). In addition, a labelling scheme exists for refrigerators, freezers, washing machines, dryers, dishwashers, ovens, water heaters and hot-water storage appliances, air conditioners and lighting sources (Article 1, Council Directive 92/75/EEC).

Different timeframes, ranging from 3 to 12 years, are set for the respective product groups. Issues taken into consideration when determining the timeframe include the necessity to meet requirements set out in the Kyoto Protocol, the frequency of new product development, the prospects for future technological development, the longevity of products, and the like. (Fuel Efficiency Standard Committee for LP gas vehicles, 2003, p. 5; Evaluation Standard Subcommittee for Computers and Magnetic Disc Units, 2003, p. 15; Evaluation Standard Subcommittee for TV sets and Videotape Recorders, 2005, p. 14).

2.3.3 Revision

When the target year for a product group arrives, revision and a new target year are discussed with a view to further enhancing energy efficiency. For instance, the target timeframe for the type of air conditioner which has been used most in Japan was September 2004. According to one interviewee, the discussion regarding new targets for air conditioners had just begun at the time of the interview. As discussed earlier, target revision takes into account the potential for further improvement, prevalence in the market, and the like. When standards are achieved by the vast majority of the producers prior to the arrival of the target year, discussion of the new targets starts before the end of the initial timeframe. This has been the case for computers, magnetic disc units and passenger vehicles. In the case of computers, new standards with a new target year were decided in 2003, while the target year for the initial phase was 2005 (Evaluation Standard Subcommittee for Computers and Magnetic Disc Units, 2003).

The revisions in general made the timeframe given to achieve the next target shorter. For example, the timeframe given for computers and magnetic disc units for the second period is 5 years compared to 7 years in the beginning (Evaluation Standard Subcommittee for Computers and Magnetic Disc Units, 2003, pp. 15-30). Likewise, the new product groups that were not included in the Top Runner Program in the initial phase (for instance, cars run on Liquefied Petroleum Gas, DVDs, TV sets with plasma and LCD screens) have a shorter timeframe than similar products included in the initial phase (i.e. gasoline and diesel cars, TV sets with CRT, videotape recorders). (Fuel Efficiency Standard Committee for LP gas vehicles, 2003, p. 5; Evaluation Standard Subcommittee for TV sets and Videotape Recorders, 2005, pp. 16, 65).

2.4 Decision making process

Three layers of committees consisting of experts, academia, consumer groups, local government representatives, industry representatives, etc. are involved in determining what products should be included in the Program, the content of the standards, target years, and the like. (ECCJ, 2005a). The top layer, the Advisory Committee for Natural Resources and Energy, is in charge of overall policy making to promote proper use of energy (ECCJ, 2005a). The middle layer, the Energy Efficiency Standards Subcommittee, taking into consideration the suggestions by the Natural Resources and Energy Agency under the Ministry of Economy, Trade and

Industry (METI), determines the product groups to be included in the Top Runner Program.

Once the product groups to be included in the Program have been determined, an evaluation standard subcommittee is established for the respective product groups. This subcommittee makes proposals on concrete issues such as scope of the product group, evaluation methods, differentiation parameters, standards, target years, and the like. The work is conducted in close collaboration with METI and industry representatives, academia, experts and the like. The typical decision-making process is as follows (Tsuruda, 2005, March 30; ECCJ, 2005a):

1. Analysis of the current situation and determination of the scope of the product group
2. Determination of measurement method
3. Measurement of the energy efficiency of products available on the market by producers, determination of the top runner standard
4. Development of an Interim Proposal, which is to be open to public comments
5. Reporting back to the Energy Efficiency Standards Subcommittee for their approval.

Both industry representatives, experts and government officials interviewed agreed on the strong involvement of industry associations in the standard-setting process. An industry representative mentioned that approximately 50 meetings are held in one year while discussions takes place at the evaluation standard subcommittee level.

The whole process usually takes about a year to two and a half years (ECCJ, 2005a).

2.5 Information to consumers

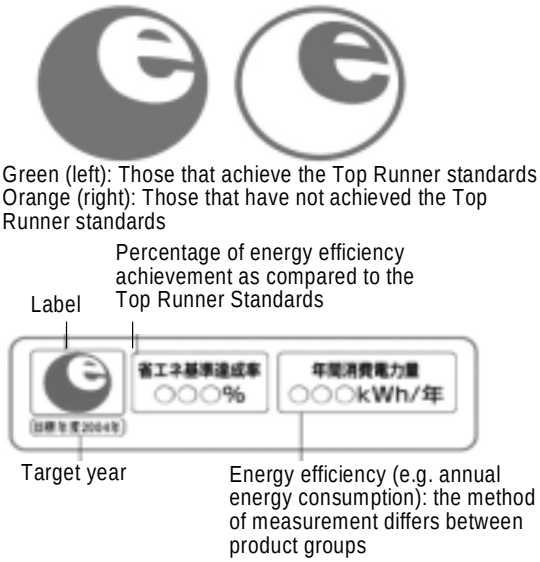
Producers are requested to *provide information* on the level of energy efficiency to consumers both on a *mandatory* and a *voluntary* basis. Moreover, *energy efficiency performance catalogues* have been published twice a year to enable consumers to easily *compare* the energy efficiency of products they intend to purchase. An *award system* also exists for *retailers* to encourage them to actively promote energy-efficient equipment.

Mandatory information provision by producers: All the producers of the targeted products, including the small and medium-sized producers that are exempted from meeting the standards, must provide information on the energy efficiency of their products (Article 20, Energy Conservation Law).

Voluntary labelling scheme with achievement percentage: In addition, a special label has been developed that indicates the level of conformity to the Top Runner standards. Namely, when a product meets the standard, it is given a green label

indicating energy efficiency in percent of the standard. An orange label with the same numerical indication is put on products that do not meet the standard (See Figure 2-2). The labelling scheme started with five EEE products in August 2000, followed by an additional five products in 2003 and three in 2004.[22] Although use of the label is voluntary, the vast majority of manufacturers have come to use the labels.[23]

Cars that meet the Top Runner standards, as well as those that are 5% more energy efficient than the standards, are furnished with stickers with the information. The stickers are attached to their body.



Source: ECCJ (2004b).

Figure 2-2: Labels indicating the conformity with the Top Runner standards (top) and examples of information with level of achievement (bottom)

The Energy Conservation Center, Japan (ECCJ), which is an organisation under METI and is in charge of the collection and provision of information relating to energy conservation to the public, provides various types of information on the Program itself as well as the energy efficiency of EEE. Since 1997 it has produced energy efficiency performance catalogues that sum up information relating to the

[22] The first five products were air conditioners, refrigerators, freezers, TV sets and fluorescent lights. Added in 2003 were stoves, gas cookers, gas water heaters, oil water heaters and heated toilet seats, followed by transformers, computers and magnetic disc units in 2004 (ECCJ, 2005e).

[23] Uptake in the beginning was different for different products. In the Energy Efficiency Catalogue from the winter of 2000, in which the labels first started to appear, it varied from 0% uptake (fluorescent lights), to approximately 50% (TV sets) to 100% (refrigerators). In 2004, except for 5 models from one company, all products in the catalogue had labels.

energy efficiency of selected EEE covered by the Program.[24] The information in the catalogue is based on the information presented in the product catalogues published by manufacturers. The energy efficiency performance catalogues, published twice a year, rank the energy efficiency of all the products with product catalogues. It also gives the estimated annual running cost of the product.

The Ministry of Land, Infrastructure and Transport evaluates the fuel efficiency of cars covered by the Top Runner Program and publishes the results on its Internet homepage.[25] The Ministry distinguishes between those that meet the standards and those that achieve an efficiency 5% or more higher than the standards. The Ministry also publishes a catalogue reporting the energy efficiency of all cars once a year (Ministry of Land, Infrastructure and Transport, 2005b).

Further, ECCJ has since 2003 awarded retailers that proactively sell energy-efficient products and provide adequate information relating to energy conservation.

2.6 Monitoring

When the target year arrives, the Agency of Natural Resources and Energy collects figures from manufacturers on their level of achievement (ECCJ, 2005c). Prior to the arrival of the target year, the author did not identify any formal requirement on progress reporting. However, the Ministerial Ordinances require the publication of statistics on the energy efficiency of individual products. As for cars, the Ministerial Notification stipulates annual evaluation of the energy efficiency of the models against the Top Runner standards and provision of information based on the evaluation.[26]

A number of interviewees mentioned that the industry associations of the product groups included in the Program somehow keep track of the industry-wide interim progress on a weighted average basis. The information on interim progress is not publicly available, however.

2.7 Enforcement

In case of non-compliance, the Top Runner Program takes a “name and shame” approach. The Energy Conservation Law stipulates a four-step process: recommendation, public announcement, order and payment of a fine of up to one million JPY (68 000SEK)[27] (Article 19, Article 21, Article 28.2). This applies to both when producers fail to fulfil the requirements mentioned in Section 2.3.2 and when they fail to provide information as required (Section 2.5).

[24] Copying machines for business use and computers are not included in the catalogue. Producers provide information on products they wish to recommend. The information is published on the website of the Energy Conservation Center.
[25] The result from 2004 is found at www.mlit.go.jp/jidosha/nenpi/nenpikouhyou/index.html.
[26] Notification No. 61 of the Ministry of Landscape, Infrastructure and Transport.
[27] With the exchange rate of JPY 100 = SEK 6.80, as of 21 July 2005 (Forex, 2005).

2.8 Related policy instruments

The standards set in the Top Runner Program have been utilised in several other policy instruments. One of them is the Law concerning the Promotion of Public Green Procurement (Green Procurement Law) that came into force in 2001. As far as energy efficiency criteria are concerned, the Green Procurement Law incorporates the standards developed in the Top Runner Program.[28]

In the case of passenger vehicles, the Top Runner standards have been included as a criterion for tax reduction. In combination with the level of achievement regarding exhaust gas emissions, two levels of reduction are indicated, depending on whether the cars sold in 2004 and 2005 achieve the Top Runner standards, or are 5% more efficient than the standards.[29] The tax reduction scheme has been in use for two years (1 April 2004 to 31 March 2005) (Ministry of Land, Infrastructure and Transport, 2005a).

In order to raise consumer awareness and promote the uptake of energy-efficient products and environmental technologies, the Tokyo Metropolitan Government has established a mandatory labelling program for refrigerators, air conditioners and TV sets with CRTs (Tokyo Metropolitan Government, 2005).[30] The products will be labelled in five different ways depending on the level of achievement in comparison to the Top Runner standards (Tokyo Metropolitan Government, 2005). In the case of the cars, according to one interviewee, the Tokyo Metropolitan Government requires that information on the energy efficiency of cars be provided at the point of sale and that the purchasers must attest that they have received such information.

ECCJ has also been running the annual Energy Efficiency Award scheme since 1990. The scheme selects and awards products that are remarkably superior in their energy efficiency. Candidate products should be designed not only for energy efficiency but also for resource efficiency, innovativeness, possible commercialisation, safety, etc. (ECCJ, 2005f).

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[28] There are currently 12 product groups included in both the Top Runner Programme and the Green Procurement Law. Until 2004, computers were also included in the Green Procurement Law. However, as all the computers in the market have met the criteria, they were taken off the list of green procurement items. With the introduction of new Top Runner standards, computers will be reintroduced in the Green Procurement Law again.

[29] There are 9 types of tax related to cars. Those related to Top Runner standards are the acquisition tax and the automobile tax. The size of the acquisition tax, paid at the time of obtaining a vehicle, is 5% of the purchase price. The automobile tax is paid annually by the car owner and is differentiated based on the size of vehicles (JAMA, 2005b).
Depending on the level of achievement of exhaust gas emissions reduction and fuel efficiency, the acquisition tax is reduced by JPY 10,000 to JPY 15,000 (SEK 680 to 1020). The automobile tax is reduced by 25 to 50%, which means, depending on the size of the cars and the achievement level, that it varies from JPY 7,375 to JPY 55,500 (SEK 501-3,774) the year after the car is purchased ((Ministry of Land, Infrastructure and Transport, 2005a). For the exchange rate, see Footnote 27.

[30] Notification No. 767 of the Tokyo Metropolitan Government concerning the Items that Indicate the Standards for Relative Evaluation Method of Specified Home Appliances, Energy Efficiency and the like and of Paper that Describe these Items.

3 Achievement so far

As discussed in the previous chapter, it is now more than 5 years since the Top Runner Approach was introduced. What are the results? This chapter seeks to evaluate the effects of the Top Runner Program achieved so far from two angles. In Section 3.1, the attainment of standards set forth in the Program is presented in several ways, followed by a short discussion of the relative stringency of the standards. Section 3.2 provides some examples of measures taken by producers that contribute to the attainment of the results presented in 3.1.

3.1 Status of goal attainment

As mentioned in Section 1.3, information related to the progress of the Program so far was surprisingly difficult to obtain. Based on the available information, the level of goal attainment is presented in different ways (Section 3.1.1 and 3.1.2). When presenting the results, the author discusses what they represent and their limitations.

It should be noted that the data presented only covers the manufacturers and importers who are members of the respective industry associations, the majority of whom are Japanese. On the other hand, a large portion of the product types discussed in this document are produced by domestic producers.[31] So it can be safely said that their level of achievement substantially reflects the reduction of domestic energy consumption achieved in this sector so far. It should be noted, however, that the volume of imported products has been increasing rapidly in some product areas, and that the situation may be different in the future.[32]

3.1.1 Results reflectied in the number of models on the market

The Top Runner Program incorporate the actual market situation in its evaluation of standard achievement by requiring a sufficient number of products with superior energy efficiency to be placed on the market in order for the standard to be met. With this in mind, it would be useful to examine changes that somehow reflect the relative number of different models placed on the market.[33] This can be done by determining, for instance, the weighted average energy efficiency improvement of products put on the market every year. Another way can be to follow the changes in the percentage of the absolute number of products on the market that meet the Top Runner standards.

[31] For instance, as of 2003, out of 5,853,000 cars sold in Japan, 240,000 were manufactured by foreign producers (JAMA, 2005c; JAIA, 2005). In 1999, 98.7% of all refrigerators sold in Japan were produced by 6 Japanese manufacturers (Hosoda, 2004, p. 178).

[32] For example, out of 10.15 million air conditioners sold in Japan in 2003, approximately 4 million were manufactured abroad (ECCJ, 2004a, p. 7). According to a few interviewees, all TV sets with CRTs are now manufactured abroad. As most of them are still produced by Japanese companies, there may still be a higher likelihood of exerting direct influence on these products. However, some interviewees commented on the increase in imports of products without brand names.

[33] This is especially the case when considering comments from manufacturers that despite their efforts, energy-efficient products may not sell well compared to inexpensive models with lower efficiency.

Figures 3-1 and 3-2 indicate the changes in the percentage of absolute number of personal computers and cars that meet Top Runner standards respectively (including projections after 2004).

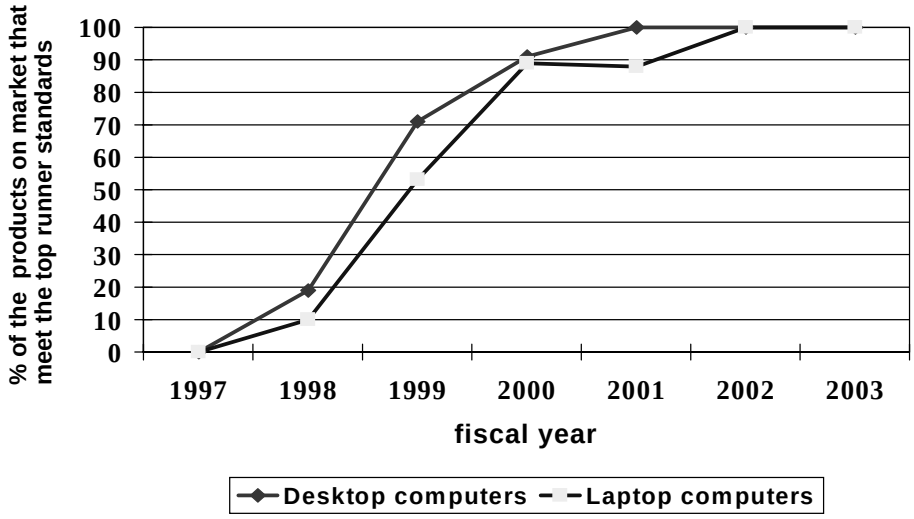

Figure 3.1: Change in the number of personal computers put on market that meet the Top Runner Standards. Source: JEITA(2005)

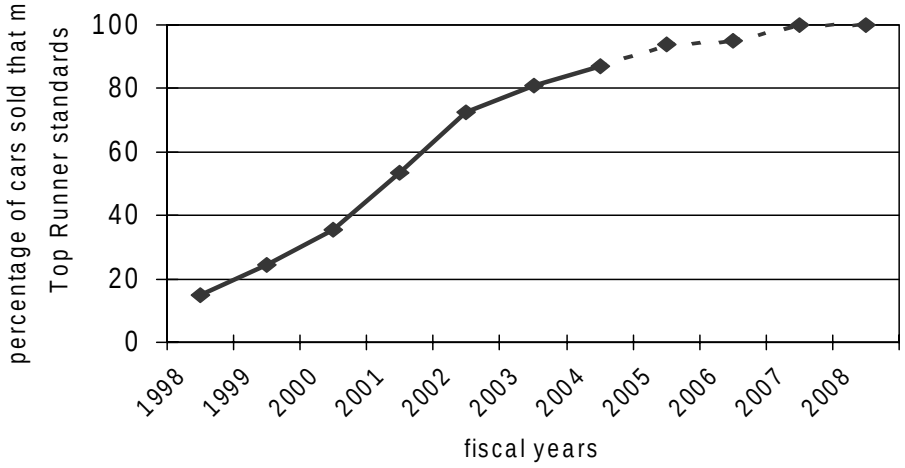

Figure 3.2: Change in the number of cars sold that meet the Top Runner standards. Source: adapted from JAMA (2005a), Nikkei Ecology (2005, p36)

The target year is 2005 for computers and 2010 for cars. Personal computers achieved their target well before the target year of 2002, as did other types of computers. According to interviewees, this is largely due to improvements in some of the commonly used parts, such as CPUs. One interviewee mentioned that this could also explain the great improvement between 1998 and 99. A number of models achieved an efficiency 500% or more higher than the Top Runner standards.

In the case of cars, the projection suggests that all the domestic cars will be able to achieve the standards by the year 2007. However, according to some interviewees, none of the foreign producers have achieved the targets so far.

As mentioned in Section 2.3.3, concomitant to the rapid achievement of the standards, new standards have been set for computers for 2007, and discussions have been initiated regarding new standards for cars.

3.1.2 Results on the improved efficiency of various models

Except for computers and cars, information regarding the number of products placed on the market could not be obtained.[34] Thus, the author seeks to indicate the results by showing the increases in the percentage of models placed on the market that meet the Top Runner standards. Figures 3-3 and 3-4 show how the percentage of models whose energy efficiency conforms to the Top Runner standards has changed in the case of air conditioners and refrigerators. The target timeframes for the type of air conditioners most prevalent in Japan and refrigerators are September 2004 and March 2005, respectively.[35]

[34] As mentioned in Section 2.5, the Energy Conservation Center, Japan (ECCJ) publishes energy efficiency performance catalogues of selected EEE twice a year. The catalogue contains information on, for example, the energy efficiency achievement rate compared to the Top Runner standard for all products whose product catalogues are published by their manufacturers. However, it does not contain information as to how many of these products have been placed on the market. According to Ms. Mito of ECCJ, sales data are available for the respective models, but are prohibitively expensive.

[35] The target year for the rest of air conditioners is 2007.

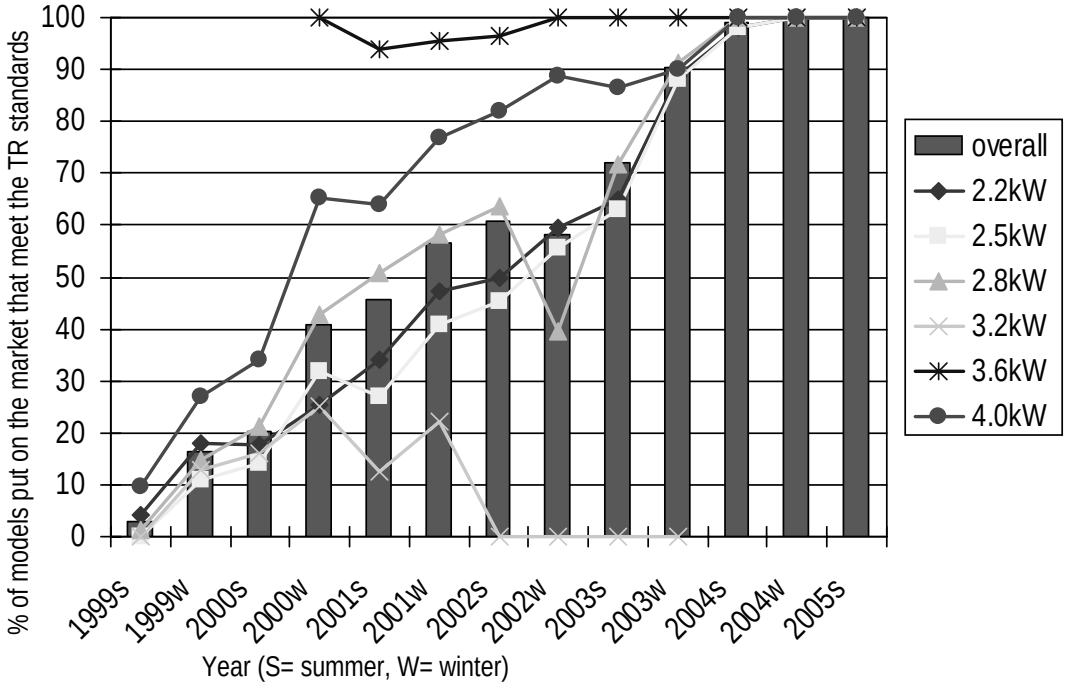

Figure 3.3: changes in the percentage of models put on the market that meet the TR standards: Air Conditioners. Source： ECCJ (1999a), ECCJ (1999b), ECCJ (2000a), ECCJ (2000b), ECCJ (2001a), ECCJ (2001b), ECCJ (2002a), ECCJ (2002b), ECCJ (2003a), ECCJ (2003b), ECCJ (2004c), ECCJ (2004d), ECCJ (2005d) (Calculation and illustration by the author)

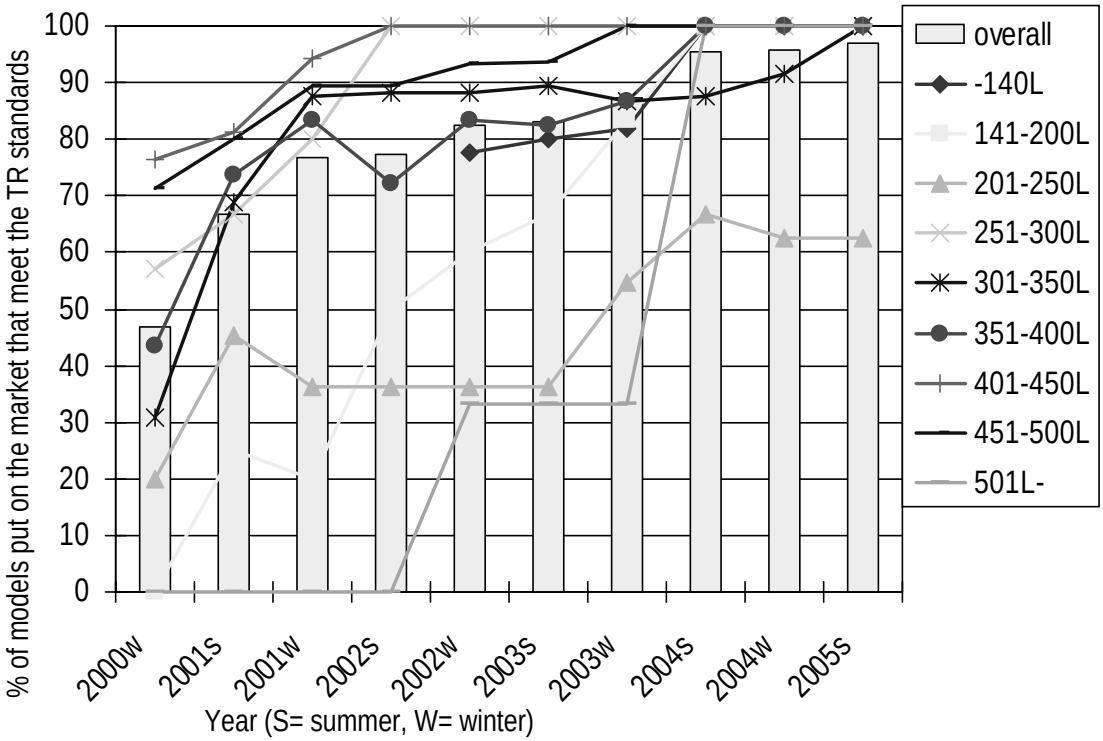

Figure 3.4: changes in the percentage of models put on the market that meet the Top Runner standards: Refrigerators. Source： ECCJ (2000a), ECCJ (2001a), ECCJ (2001b), ECCJ (2002a), ECCJ (2002b), ECCJ (2003a), ECCJ (2003b), ECCJ (2004c), ECCJ (2004d), ECCJ (2005d) (Calculation and illustration by the author)

Table 3-1indicates the highest, lowest and average energy efficiency achieved by air conditioners of different capacities in the winter of 2004.

Table 3-1: Energy efficiency of Air Conditioners in 2004

Cooling capacity	2.2kW	2.5kW	2.8kW	3.6kW	4.0kW
Number of models	51	41	58	31	45
Top Runner standards*	5.27	5.27	4.90	3.65	3.65
Highest energy efficiency (% compared to the standard)	6.49 (123%)	6.22 (118%)	6.30 (128%)	5.31 (145%)	4.78 (130%)
Lowest energy efficiency (% compared to the standard)	5.27 (100%)	5.27 (100%)	4.90 (100%)	3.67 (100%)	3.65 (100%)
Average energy efficiency (% compared to the standard) **	5.53 (104%)	5.45 (103%)	5.26 (107%)	4.43 (121%)	4.10 (112%)

* The average of cooling capacity (calculation method stipulated in Japanese Industrial Standards B8615-1 and B8615-2) divided by cooling power consumption and heating capacity divided by the heating power consumption.

** Simple average of the models.

(Source: ECCJ, 2004c. ECCJ, 2004e)

The increase in the number of models that conform to the standards does not necessarily correlate with an increase in the sales of these energy-efficient models. However, it does indicate that the availability of the energy-efficient models has increased.

Figure 3-1 shows that by the time the target year arrived, all the air conditioners placed on the market met the Top Runner standards. Moreover, as found in Table 3-1, the levels of efficiency achieved by some models are substantially higher than the Top Runner standards. This means that conformity to the Top Runner approach is achieved not only on a weighted average basis, but also on an individual product basis. Indeed, a number of interviewees mentioned that when Japanese producers said they conformed to the Top Runner standards, they meant that all the models meet the standards. Some interviewees were not even aware that it is only on a weighted average basis that producers have to fulfil the targets.

This has not only been the case for refrigerators and air conditioners. Results for the target year have been published for the product groups whose target years have already arrived. The weighted average energy efficiency of TV sets with CRTs in 2003 was 104 kWh per year as compared to 140 kWh per year in 1997, an improvement by 25.7%. This exceeded fulfilment of the Top Runner standards, which would have been an improvement by 16.4%.[36] Similarly, the improvement for videotape recorders was 73.6%, exceeding the expected achievement for fulfilment of the Top Runner standards (58.7%) (Evaluation Standard Subcommittee for TV sets and Videotape Recorders, 2005).

[36] All the TV sets listed in the Energy Efficiency Catalogue for the Summer of 2004 that are subject to the Top Runner Approach have achieved the Top Runner standards (ECCJ, 2004c).

The lines in the graphs in Figures 3-3 and 3-4 show that the rate of achievement differs between the types of products sold. For instance, in the case of refrigerators sized 401-450 litres, all achieved the standards as early as summer 2002, while the rate of improvement of those with the size of 141-250 litres has been rather slow. One refrigerator manufacturer mentioned that this is partly due to the fact that more resources can be invested in a product with a relatively high price (i.e. larger refrigerators) to enhance its energy efficiency than those with a lower price (i.e. small ones). Similarly, even when a technology that permits the achievement of high energy efficiency is developed, if it is expensive, its application may be limited to high-priced products.

The interviewee also noted the differences in priorities between different categories of customers. For instance, typical customers who buy large refrigerators have families and intend to use the refrigerator for a long time, so it makes sense for them to buy a refrigerator that has a high initial cost but a low running cost. Similar decisions tend to be made by people with relatively high incomes. Meanwhile, typical customers for smaller refrigerators could be university students with relatively low incomes who are not likely to continue to use the same refrigerator for a long time. Their prioritisation of energy efficiency when purchasing electrical appliances is perceived to be rather low.[37] The interviewee mentioned that among buyers of small refrigerators, business customers such as hotels tend to purchase products with a high initial cost but a low running cost.

3.1.3 Relative stringency of the Top Runner Standards

As shown in the previous sections, the manufacturers have been very successful in attaining the Top Runner standards. Meanwhile, the fact that manufacturers in some groups manage to meet the standards even prior to the target year suggest that the standards may be have been set too low. This can be analysed by comparing the standards with other standards addressing a similar issue.

ECCJ (2003c) conducted a study to compare the standards for products for which counterparts exist in Europe and the USA.[38] In reviewing the study, it became apparent that due to differences in products and measurement methods, a straightforward comparison is difficult. This has been echoed by a number of interviewees. For instance, a refrigerator manufacturer mentioned that due to the difference in the number of doors between Japan (typically 5 to 6) and Europe (1-2), the

[37] A survey conducted by the Tokyo Metropolitan Government in 2002 asked people how much they prioritise energy efficiency when purchasing an electrical appliance. The alternatives are: 1) prioritise energy efficiency, 2) consider energy efficiency but depending on price, 3) do not consider energy efficiency. Assuming the performance provided by the appliance is the same, the categories of people who prioritise energy efficiency more than others include 1) women (in terms of gender), 2) above 60 years old (in terms of age), 3) housewives or those with no occupation (in terms of occupation) and 4) people with family (as compared to living alone). Among people who said that they consider energy efficiency but depending on the price, the survey also asked how long the pay-back period should be, the alternatives being one, three, five or seven years and longer. 41.5% of people living alone said one year, while 50% of those with family said 3 years (Tokyo Metropolitan Government, 2003).

[38] The products compared in the study include cars, air conditioners, videotape recorders, refrigerators and freezers, gas water boilers and converters.

refrigeration method used is very different. Refrigerators made by Japanese manufacturers are hardly exported to these two regions, and vice versa. Car manufacturers also mentioned differences in testing methods, perception of diesel cars, transmission preferences etc. between Europe and Japan. Due to these differences, one car manufacturer mentioned that they adopt different design strategies for the three regions.

The aforementioned study from 2003 nonetheless sought to convert the standards available in the two regions for comparison.[39] It indicates that the Top Runner standards for air conditioners are higher than those existing elsewhere. In the case of refrigerators, the Top Runner standards for those with the specified technologies[40] are the most stringent of the three. As regards standards set for those without the specified technologies, relative stringencies vary depending on the size of the refrigerators. As regards cars, Top Runner standards are more stringent for smaller-sized vehicles, while the standards in US and Europe are currently higher for medium-sized and large vehicles. All in all, the interviewees were rather confident about the competitiveness of their technological improvements. The perceptions of producers, together with comparisons of standards, seem to suggest that manufacturers must be at least as well equipped with technologies as their counterparts abroad when it comes to meeting and exceeding the Top Runner standards.

3.2 Measures adopted by industry

The following list presents examples of measures taken by manufacturers to reduce energy consumption of products during their use. These examples have been provided by the interviewees with some reference to the Top Runner standards.

- Application of vacuum insulation panels (in combination with urethane foam insulation), change of direction of the glass wools used for vacuum insulation panels, use of inverter control technologies such as pulse width modulation and pulse amplitude modulation (refrigerators)
- Application of pulse amplitude modulation technology (air conditioners)
- Incorporation of mechanisms that simultaneously control temperature and humidity, which enables the user to feel comfortable without having to set the temperature too low (air conditioners)
- Incorporation of a sensor that measures not only the temperature around the machines but also in the entire room, to avoid the reduction of the room temperature unnecessarily low (air conditioners)
- Provision of information to users regarding the level of energy efficiency (cars)

[39] Except for cars, differences in measurement methods were not considered when making comparisons.

[40] As mentioned in Section 2.3.1, one of the parameters used for differentiating the standards for refrigerators is refrigeration method. More stringent standards are set for those with specified technologies, which are vacuum insulation and inverter control (ECCJ, 2004d, p. 11).

- Shortening of the recovery time from a sleep mode/zero energy standby mode to the mode in which the machine can be used (copying machines). The improvement was perceived necessary as many users do not want to use sleep mode despite its superiority in energy efficiency due to the perceived inconvenience of the long recovery time.
- Continuous improvement of engines and their commercial application, from lean burn engines in 1994, to direct injection engines in 1997, to engines that incorporate electronic control mechanisms for variable valve timing in 2001, and their application to wider range of products (cars)
- Development and wider application of belt-type continuously variable transmissions (cars)
- Change from plugs to AC adaptors (desk top computers)
- Replacement of chip sets with more energy-efficient ones (computers)
- Reduction of energy consumption during the standby mode (EEE in general: voluntary initiative by a manufacturer in 1996, resulted in a reduction from 15W in 1996 to 0.065W in 2003, voluntary commitment by the home appliance industry to reduce standby energy consumption to less than 1W by 2004[41])

A couple of manufacturers mentioned that the Top Runner standards have been incorporated as one of the criteria for their product development.

A number of manufacturers argued that despite some scepticism regarding standards, meeting the standards required considerable efforts. For instance, one car manufacturer mentioned that when product models were changed every four years or so, they used to continue to use the engine from the old model for several new models. Complying with the Top Runner standards forced them to use new engines in all new cars, which necessitates investment. Similarly, according to another interviewee, application of new technologies to refrigerators of all sizes requires substantial investment.

[41] JEITA, JAMA and JRAIA (2001).

4 Perceptions of the interviewees

The results presented in Chapter 3 indicate that the use-phase energy efficiency of products included in the Top Runner Program has improved significantly since the introduction of the program.[42] This chapter seeks to first examine the reasons for this trend. What motivates the manufacturers to improve energy efficiency? What are the obstacles they face in doing so? After summaries of these promoting and hindering factors (Sections 4.1 and 4.2), Section 4.3 presents the views of the stakeholders regarding the Top Runner Program.

The views of manufacturers, industry associations, experts and government officials obtained through the interviews constitute the primary source of information presented in this chapter.[43]

4.1 Factors promoting use-phase energy efficiency improvement

The interviewees mentioned a number of factors that promote design changes aimed at improving use-phase energy efficiency. Figure 4-1 summarises these factors, ranked with those mentioned by the greatest number of manufacturers first.

Top Runner Program: Ten interviewed manufacturers mentioned the influence of the Top Runner Program on their product development. The majority of them referred to the technological improvements the Program has helped induce or accelerate. The Program contributed to application of technology that had been developed but had yet to be commercialised. The program forced the manufacturers – or gave them a reason – to apply these technologies "in the drawers" to their products. As one interviewee put it, "Without the program, improvements in energy efficiency would never have come this far."

A number of interviewees stressed the fact that the Top Runner Program is part of the Energy Conservation Law and that compliance with legislation is a "must".

Some manufacturers mentioned that the top runner standards had been incorporated in their internal design assessment criteria.

One manufacturer mentioned that compliance with the standards gave them an opportunity to re-examine the improvement potential of their products.

[42] The improvement is significant especially when considering that following the rather significant improvement in the 1970s, the energy efficiency of electrical home appliances has not improved much. See Footnote 16.

[43] The interviewees and the interview guides used for the different categories of interviewees are listed in Appendices 1 and 2.

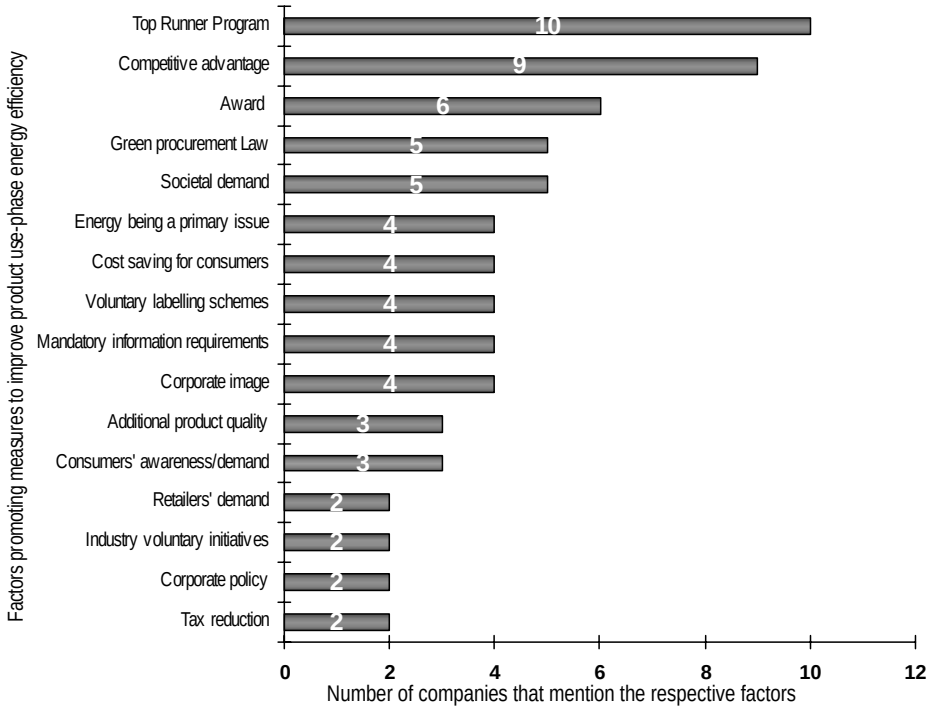

Figure 4.1: Factors promoting the undertaking of measures to improve product use-phase energy efficiency

Competitive advantage: A total of nine manufacturers mentioned that improving energy efficiency would lead to an increase of their competitive advantage. One manufacturer suggested that in the face of the influx of relatively inexpensive products from neighbouring countries, environmental technologies will enable Japanese manufacturers to compete.

Award: Five manufacturers commented on the effects of obtaining awards**.** One interviewee illustrated how the award can be used as an internal incentive to encourage designers to strive for energy efficiency. One manufacturer mentioned that they considered the award to be an effective marketing tool. One copying machine manufacturer referred to the "Copier of the Future" award, where various characteristics desirable in a copying machine are stipulated.[44] Another interviewee commented on the importance of a similar award that stipulates the characteristics of an ideal future product , instead of setting the target based on what is available on market.

Green Procurement Law: As mentioned in Section 2.8, many of the products included in the Top Runner Program are also included in the Green Procurement Law that came into force in 2001. The Green Procurement Law incorporates the criteria of Top Runner standards. This means that only those models that meet the Top Runner standards are candidates for the tendering process of public

[44] The detailed product specification for candidates for the award is found at www.energystar.gov/ia/products/ofc_equip/copiers/Copier_Procurement.pdf

organisations, which seemed to have had a substantial influence on the producers' design strategy. According to one manufacturer, the Green Procurement Law accelerated compliance with the standards due to its introduction prior to the target year, and to the fact that individual models, rather than the weighted average, have to meet the standards.

Societal demand: Five interviewed manufacturers commented on society's growing recognition of the challenges related to climate change, and that improving energy efficiency is a societal demand.

Energy a primary issue: Four of the manufacturers emphasised that energy efficiency has been a long-standing and primary design priority for them. One manufacturer ,mentioned their voluntary commitment to reducting energy consumption in the standby mode of products. A manufacturer of home appliances commented on the difference between products such as refrigerators or air conditioners on one hand and TV sets, DVDs and computers on the other. Refrigerators and air conditioners are mature products, and energy efficiency may be one of the primary parameters that consumers look at when purchasing such a product. Energy efficiency may not be a priority for consumers purchasing TV sets, DVDs and computers, however. For these products, other parameters are of higher interest to consumers, such as visual clarity, sound dynamics and special features.

Cost savings for consumers: Some manufacturers commented on the relative easiness of linking improvements in energy efficiency to cost savings for consumers. Relating to relative importance of energy issues, energy efficiency is readily understood to lead to reduced running costs in products such as cars, refrigerators and air conditioners. In contrast, computer manufacturers noted that the cost savings of improved energy efficiency in their products for private consumers are so small that it has not been a selling point at all, although it may have some impact on business consumers who buy a large number of products. A few manufacturers pointed out the difference between consumers' perception of energy efficiency and their perception of hazardous chemicals or design for end-of-life. They mentioned that it is relatively easy to "sell" energy-efficient products due to the direct link to cost savings for the consumer, whereas it is difficult to convince consumers to purchase products with initial high costs due to improvements relating to reduction of hazardous substances or improved recyclability.

Voluntary labelling schemes: Some manufacturers commented on their commitment to voluntary labelling schemes such as Energy Star Programme, German Blue Angel and Japanese Eco Mark. The criteria used in these schemes have been incorporated in their product assessment programmes. One interviewee mentioned that compliances with these labels is often included as a condition in tendering processes. Another interviewee provided the author with a list of products that had been awarded by various labelling schemes.

Mandatory information requirements: As mentioned in Section 2.8, the Tokyo Metropolitan Government mandates provision of information in the form of labels for selected EEE and at the point of sale for cars. A few manufacturers referred to this mandate.

Corporate image: In line with societal demand, a few interviewees suggested that efforts to improve energy efficiency also helped improve the image of their companies. One interviewee described how manufacturers strive to develop a "star" model and try to gain competitive advantage by establishing a positive corporate image through the model.

Enhanced product quality: A couple of manufacturers pointed out that efforts to improve energy efficiency also lead to the enhancement of other product qualities. For instance, energy efficiency improvement of computers means noise reduction and/or longer battery life. Reduced energy use in TVs with plasma displays resulted in the elimination of one glass layer, leading to weight reduction and clearer visual effects.

Consumer awareness/demand: A few manufacturers mentioned that consumers have begun to appreciate the energy efficiency of the products they purchase more than before. A TV manufacturer provided the author with a survey indicating that energy efficiency was ranked third among features that consumers consider most when they compare alternative products, and fourth when they actually purchase the products.

Retailer demand: Presumably due to the award programme for retailers, some retailers have started to provide more information on the energy efficiency of products. The indication that the energy-related information would be displayed urged some producers to put efforts into reducing energy consumption.

Voluntary industry initiatives: A couple of manufacturers commented on the industry-wide voluntary initiatives to reduce the energy consumption of standby mode to less than 1W by 31 March 2004 (Section 3.2).

Corporate policy: Two interviewees mentioned that the top management commitment to energy reduction and the corporate policy to position global warming as an important issue accelerated their efforts to improve the energy efficiency of their products.

Tax reduction: As discussed in Section 2.8, there is a periodical tax reduction scheme for cars. Both of the car manufacturers interviewed stressed the importance of this incentive mechanism, which is implemented in parallel to the Top Runner Program. The "carrot" rewards those that achieve the standards earlier, encouraging those producers that are able to place more energy-efficient cars on the market earlier. One manufacturer commented on the superiority of a tax reduction of this

kind, which is somewhat limited in terms of both time and size. They found that giving a small reward is a good trigger for change, and is more cost efficient than, for instance, awarding large subsidies to one company to develop new technologies.

4.2 Factors hindering use-phase energy efficiency improvement

The interviewees also indicated several challenges facing use-phase energy efficiency improvement of their products. Figure 4-2 presents these factors, ranked with those mentioned by the greatest number of manufacturers first.

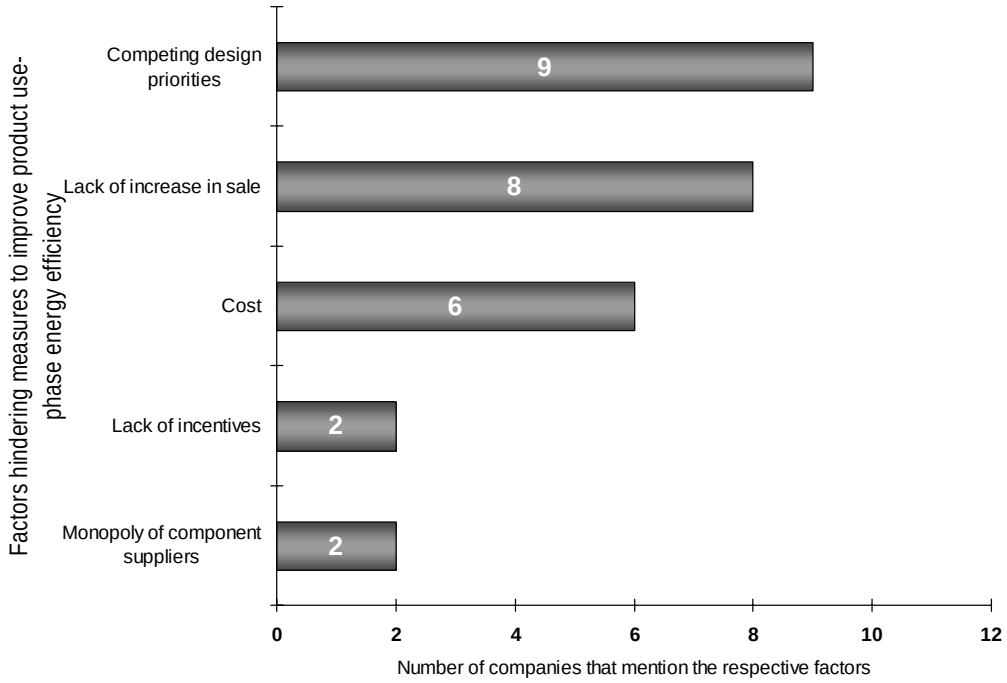

Figure 4.2: Factors hindering the undertaking of measures to improve product use-phase energy efficiency

Competing design priorities: A total of nine producers described their struggles to balance improvements in energy efficiency with various other design priorities. For instance, car manufacturers stressed the necessity of balancing criteria such as safety, reduced exhaust gas emissions and energy efficiency. Both of the manufacturers commented on the pros and cons of gasoline and diesel. Diesel cars can achieve higher energy efficiency than gasoline cars, but the cleaner exhaust gas can be achieved in gasoline cars than in diesel cars. Increasing the size of heat exchangers and compressors would be the most effective way to improve the energy efficiency of air conditioners, but it would go against miniaturisation, an important characteristic in relatively small Japanese homes. Some manufacturers argued that

the energy efficiency improvement of rice cookers would compromise the quality of the cooked rice.

As mentioned earlier, the importance of energy efficiency may not be ranked so high compared to other features in some products. Both of the computer manufacturers mentioned that energy efficiency, compared to such features as the size of memory and the like, is not ranked high. Among environmental criteria, more attention is being given to hazardous substances such as lead, due to the influence of the upcoming EU Directive on the Restriction of Hazardous Substances.[45]

A few interviewees were rather critical to the energy efficiency performance catalogues, in which the products are ranked according to energy efficiency. They argued that it is misleading as it concerns only one parameter.

Lack of increase in sales: The majority of manufacturers interviewed were concerned that despite the availability of many energy-efficient products, consumer uptake has been rather slow. A few of them mentioned competition with low-priced products with low energy efficiency that are imported from abroad and are sold without brand names. Technological improvements would be in vain unless these products are included.

Cost: A number of interviewees commented on the barrier to applying new technologies due to their high costs. They often need to be selective in introducing products whose expected purchasers most likely rank energy efficiency higher than other features. Examples include refrigerators and air conditioners, as discussed in Section 3.1.2.

Lack of incentives: As of July 2005, the tax reduction scheme applies only to cars. Some manufacturers mentioned that they need some carrots together with sticks, especially in light of the difficulty of attracting consumers to energy-efficient products with relatively high initial costs. One producer also mentioned that it would be very helpful to receive subsidies for the development of new technologies.

Monopoly of component suppliers: Both of the computer manufacturers mentioned that the energy efficiency of their products is largely dependent on components such as CPUs. As the global market for CPUs has been dominated by one company, they have no choice but to purchase CPUs from this company. Their efforts to reduce energy use are rather limited, especially as standby energy use has been reduced significantly already.

[45] Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. OJ L 37 13/02/2003 pp.19–23.

4.3 Perceptions of the Top Runner Program

The analysis presented in the previous two sections is aimed at understanding the relative importance of Top Runner Program in promoting manufacturers' measures to improve the use-phase energy efficiency of the products they manufacture. This section discusses perceptions of the Top Runner Program *per se*, by reference to the findings presented so far (Chapter 2, 3 and Section 4.1 and 4.2) and the views of all the interviewees.

Contribution to technological development: The analysis of the perceptions of manufacturers presented in the previous two sections suggests that the Top Runner Program plays a crucial role in promoting technological development. It has clearly accelerated the commercial application of previously unused technologies, or the wider application of technologies (diffusion). This role of the Top Runner Approach has been widely recognised by experts (Yokoyama, 2005, 17 March: Yamamoto, 2005, 29 March; Yasui, 2005, 31 March; Morishita, 2005, 7 April).

Standards can be achieved by all the manufacturers: The interviewees who commented on the standard setting generally agreed that the standards are set so that more or less all the manufacturers can, if they work hard, meet the standards. As one interviewee put it, the standard are "not too sweet and not too bitter, meaning that can all comply." Most of the manufacturers are positive to the way the standards are set. One interviewee mentioned that the fact that the standard is set at the level achieved by one of their competitors makes them think that it should be achievable. A prevailing view was that the standards should not create unemployment or bankruptcy, and that the standard of all the manufacturers will increase. It is more like a Top Group standard than the Top Runner standard (Yokoyama, 2005, 17 March).

The idea behind the standard setting is reflected, for instance, in the exclusion of specific technologies that did not become standard setters despite their superior energy efficiency. Some interviewees, including those who had these technologies, mentioned that having such technologies as standard setters would entail great uncertainty as to whether the rest of the industry could attain the standards, and may end up putting some companies out of business. However, another manufacturer mentioned that at least in the case of electrical home appliances that are based on relatively simple technologies, "*Simply because a new technology with patent comes into market, it does not necessarily mean that we should purchase it. The more we look into it, the more likely it is that we will find ways to get around it [and achieve the same goal]*" ([] added by the author). A few interviewees pointed out the differences between products such as cars and copying machines and electrical home appliances as far as the availability of superior technologies is concerned.

Quick decision making process: Tsuruda (2005, 30 March) mentioned that one advantage of the Top Runner Program is a quick decision-making process. As it is

relatively clear what the standards entail, it is easy to set the standards and also revise them. In theory, there is a risk that manufacturers may become reluctant to continue developing technologies, as the higher the efficiency they achieve, the tougher the standards become. None of the interviewees had so far observed a deliberate stagnation of technological development because of the standards.

Appropriateness of goal settings: However, the standard setting meets rather strong criticisms as well. Kurasaka (2005, 5 April) compared the Top Runner Program with the methods that have been used to mitigate exhaust gas emissions from cars since the 1970s. The standards for exhaust gas emissions were set based on what was required to reduce air pollution to mitigate health hazards.[46] From its introduction until now, the standard under the Law on Air Pollution Prevention has been revised a number of times and gradually been toughened (Environmental Agency, 1991, p201-209; Kubota, 2005, 8 April). This approach contrasts with the way Top Runner standards are set in that the latter sets the standards based on the best available technology instead of what is required to bring about a desirable change for society. Yamamoto (2005, 29 March) as well as one manufacturer shared a similar view.

Another difference observed was the manner in which the producers were involved in the decision making process. In the case of the Top Runner Program, manufacturers have sought to reach a consensus through discussions. The process has been facilitated by the industry associations. In contrast, setting standards for exhaust gas emissions involves interviews with individual producers by government officials and experts (Kubota, 2005, 8 April).[47]

Kurasaka (2005, 5 April) and Yokoyama (2005, 17 March) suggested that the rationale behind the approach taken in the standards setting could be explained by the mission of the Ministry of Economy, Trade and Industry. The mission of METI, the agency in charge of the Energy Conservation Law is, is essentially to advance the interests of Japanese industry and the Japanese economy. However, Yokoyama (2005, 17 March) and a manufacturer mentioned that the attitude of the government may change when the targets are revised.

Differentiated standards or one standard: As discussed in 2.3.1, car manufacturers stressed the importance of having differentiated standards on a weighted

[46] Hongou (1978) provides a very interesting and detailed description of the process of the development of the law, reactions of industry, etc. The law incorporated the standard set forth in the Clean Air Act of 1970 in the United States, which had the most stringent emission standards at that time. Despite the strong resistance of industry, the stringency of requirements and the continuous postponing and relaxation of the standards of the Clean Air Act in the US itself, it retained most of its content in Japan. In the end it led to the development of technologies that achieve rather low emission standards by some Japanese car manufacturers, and gave them a strong competitive advantage (Hongou, 1978; Kurasaka, 2005, 5 April).

[47] In the beginning, the discussions of the exhaust gas emission standards also involved industry associations. However, after the public exposure of a memo written by a representative of the industry association raised strong criticism towards the association. This triggered the change in the manner of holding consultation with industry changed (Hongou, 1978).

basis. The main reasons given include 1) fairness to car manufacturers who make cars of different sizes, and 2) the diversity of products, giving consumers a choice of what to buy. The CAFE (Corporate Average Fuel Efficiency) standards in the United States, as well as the so-called 140 g voluntary agreements in the EU, have a single standard for all cars. This makes it easy for manufacturers of small cars to meet the standards, while making it next to impossible for manufacturers of big cars. It may even force the big-car manufacturers out of business. In contrast, if the standards were differentiated according to the weight of products, it would provide all producers with similar challenges to meet the standards. The differentiation of standards between TVs with wide screens and those with normal ones is based on similar reasoning (Section 2.3.1).

Goal of the Program: environmental or industrial, or both: The issue of standard setting is closely related to what the Program ultimately wants to achieve. If the goal is to make the necessary changes – including radical ones – for creating a sustainable society, the standards can be set so that they restrict the use of products with relatively great environmental impacts (e.g. large cars, large TVs). This was the case with exhaust gas emissions. The comments of one car manufacturer suggest that there is a difference in attitudes towards exhaust gas emissions and climate change. The pressure for society to tackle the problem is much greater in the former case, while in the latter the attitude is more “let us do it together”. This perception is in contrast with Yamamoto (2005, 29 March), who asserts that climate change requires immediate action.

Legislation, but lack of severe penalties: A number of manufacturers referred to the fact that the Top Runner Program comes under the Energy Conservation Law, and that it is something they are obliged to follow. A few others commented on the shame attached to being exposed for non-compliance. Kurasaka (2004, p. 205) as well as Morishita (2001, June 26) are sceptical of the effectiveness of the name and shame approach (Section 2.7).

Synergy with other policy instruments: The Top Runner Program so far seems to have managed to produce synergy with other related policy instruments. Incorporation of the standards in the Green Procurement Law accelerated the process of complying with the standards. Car manufacturers have been very positive to the fact that the Top Runner Approach is accompanied by incentives for consumers in the form of tax reduction. The tax reduction directly affects the amount of money the consumers have to pay at the time of purchase and during the first two years of using the car (footnote 29). A home appliance manufacturer expressed the wish that tax reduction schemes should be offered for their products as well. Provisions of awards appear to have had a positive influence on both the internal design process and external communications.

Categories of producers: The majority of producers addressed in the Top Runner Program are big, well-known domestic manufacturers. A few interviewees

commented on the relatively easiness for the authorities to oversee the behaviour of these manufacturers compared with medium- and small-sized producers.

Only one aspect is compared: As mentioned above, the only aspect covered by the Top Runner Program is the use-phase energy efficiency of selected products. Evaluation of merely one aspect of product performance raised concern among manufacturers, especially when products have competing priorities or energy efficiency is not what consumers primarily look for in the products. In this respect, an interviewee pointed out that ranking of products in energy efficiency performance catalogues can be misleading for consumers. On the other hand, some interviewees, who admitted that they had not been aware of the energy efficiency performance catalogue until they started to work on environmental issues, doubted whether consumers know about the catalogues at all.

Individual or collective mandate: The Top Runner Program mandates individual producers to fulfil the standards, while under the 140 g Voluntary Agreement in Europe, the mandates should be collectively fulfilled by three automobile industry associations: European, Japanese and Korean. [48] In the latter, the members of the association should collectively meet the mandate. This has been criticised by the Japanese manufacturers due to the difficulty of meeting the standards without negotiating with competitors, which would violate antitrust law.

Competitive advantage abroad: The degree to which the energy efficiency technologies give the manufacturer a competitive advantage seems to differ from product to product depending on, for instance, the transferability of the technologies. For example, a manufacturer of refrigerators argues that due to differences in product features (e.g. number of doors), the technology developed in Japan would most likely not be of interest to European producers. Meanwhile, the same manufacturer mentioned that a broader application of some of the basic technologies, which would reduce the application costs, would enhance diffusion. On the other hand, a manufacturer of air conditioners was concerned about the pirating of technology: air conditioners can be put together anywhere as long as basic parts are available and their production does not require large investments. When energy efficiency is of relatively little perceived importance – as in the case of personal computers – energy efficiency improvements are not likely to enhance competitive advantage.

Measurement method: A few producers as well as experts pointed out the discrepancy between the current measurement method and how consumers use products in reality. For example, a copying machine manufacturer mentioned that the sleep mode that is used for calculation of energy efficiency is not utilised by consumers due to the time it takes for the machine to be reactivated. They argued that

[48] Commission Recommendation 1999/125/EC, Commission Recommendation 2000/303/EC and Commission Recommendation 2000/304/EC. Article 1 of the voluntary agreements reads: “The members of the European Automobile Manufacturers Association (ACEA) should…. Collectively achieve a C02 emission target of 140 g/km CO2…” (the word “European” is replaced by “Korea” and “Japan”, and “ACEA” by “KAMA” and “JAMA” in the respective agreements).

the time required for the machine to be reactivated should be included in the criteria to permit fair comparison. A similar discrepancy has been observed in the case of air conditioners, TV sets and computers. In all these cases, the method has been revised, or discussion is under way.

The consumers need further motivation: One important point that needs further improvement in the Program is to make sure that energy-efficient products are actually used. The Top Runner Program incorporates both mandatory and voluntary information provision requirements. Local governments also utilise the standards to influence the decisions of consumers when purchasing products. However, according to the survey conducted by the Tokyo Metropolitan Government in 2003, 48% of the respondents answered that they did not know about the energy efficiency label (Tokyo Metropolitan Government, 2003). This has become one of the essential concerns of manufacturers, and also determines the success of the label in the long run.

A car manufacturer also noted the improvements made in how the truck drivers drive their trucks. It was argued that educating consumers on how to drive a car for maximum energy efficiency can be one rather effective measure in reducing use-phase energy consumption. Some manufacturers suggested that the Top Runner Program has worked so far because it relates to cost savings for consumers. In their view, it would be difficult to expect the same in the case of chemicals.

5 Implications for environmental product policy

The achievement of the program to date presented in Chapter 3 indicates that the use-phase energy efficiency of products improved more than expected due to the implementation of the Top Runner Program. The perception of interviewees presented in Chapter 4 suggests that the Top Runner Program played a crucial role in driving the observed change.

In this chapter, reflecting upon the findings and analyses presented in the previous chapters, the author seeks to discuss elements that seem to contribute to this achievement, as well as elements that need further improvement. In doing so the author tries to extract elements that may provide some insights into the design and implementation of environmental product policy in general.

As mentioned in the introduction, the approach employed in the Top Runner Program has been discussed in connection with the development of several EU environmental policies, such as the Environmental Technologies Action Plan (ETAP), the Directive on Energy using Products (EuP Directive) and the Integrated Product Policy (IPP). Implications for these policies are discussed where appropriate.

The Top Runner Program has contributed to industry-wide progress: Considering the results achieved and the views of the interviewees, it can be safely said that the Top Runner Program has contributed to the enhancement of environmental performance – in this case, energy efficiency – in the product groups included in the Program. There has been clear progress in the average energy efficiency of the product groups falling within the scope of the Program.

The Program has accelerated the application of environmental technologies: The environmental improvements have been achieved at least in part through the accelerated and extended application of environmentally superior technologies. The necessity of meeting the Top Runner standards provided the companies with an incentive to utilise the technologies, which they may otherwise have waited to commercialise.

The mandatory nature of the Program forced producers to meet the standards and to consider energy efficiency issues in their product development strategy: Comments from the interviewees indicate the weight the Program has put behind the attainment of standards due to its mandatory nature. The fact that the Program is based on legislation also seemed to help ensure the incorporation of an energy efficiency parameter in the manufacturers' design strategy, especially when the parameter is relatively of low importance in consumers' purchasing decisions (for instance, energy use for personal computers).

The observed influence of the mandatory nature of the Program can be a warning signal against the rather strong advocacy of voluntary approaches found in recent European environmental policy meetings, such as IPP. The Commission's Communication paper on IPP, in discussing the IPP Approach, says for example, "Within IPP, the tendency is clearly to work with voluntary approaches, although mandatory measures might also be required" (COM (2003) 302 final, p. 5). It is worthwhile considering regulations that would drive environmental innovation as a policy option on at least the same level (not as a secondary option) as the use of voluntary approaches, as recognised in ETAP.[49]

Setting standards at a "realistic" level facilitates improvement, but tends not to contribute to radical change: As discussed, the standard setting practice currently used in the Top Runner Program aims at ensuring that the standards can be realistically fulfilled by all the producers in the "Top Group". As confirmed by practice, it has the advantage of achieving solid progress. On the other hand, as pointed out by a number of interviewees, this method of standard setting has the pitfall does not fully exploit the potential of environmental technologies. Whether the resultant change corresponds to the desirable and necessary changeover to a sustainable society remains to be seen.

Given the great cultural and social differences, as well as the differences in environmental and technological development, it might be difficult to agree on a "Top Group", not to mention "Top Runner" standards, in a European context. Considering the advantage of the straightforward and prompt decision-making process employed in the Top Runner standards, the feasibility of employing the "Top Runner" approach is higher than that of the "Top Group" approach. However, considering the heterogeneity of European industry, rewarding only the Top Runners may have the serious drawback of further accentuating economic and social discrepancies among the European countries. It can work better in a policy arena where national governments decide on their own standards instead of Europe-wide standards.

Factors affecting the level of standards include the relative priorities of environmental protection and economic growth, the perceived graveness of the addressed issues and the decision-making process: One factor that influences the decision of what constitutes an appropriate level of standards is the goals of environmental policy and the relative priorities among the goals. The Top Runner Program, by pursuing the dual goals of environmental protection and economic growth, has so far aimed at improving the environmental performance of the whole industry, with the hope of increasing its competitiveness at the same time. An alternative approach would be to make a radical shift to achieve higher goals with the risk of some socially undesirable consequences such as a (temporary) increase in unemployment.

[49] The Communication on ETAP reads, "Bold policy measures are required to further environmental technologies. Positive incentives and an appropriate regulatory framework are important, as are public procurement and voluntary instruments" (COM (2004) 38 final, p14).

The current trend to emphasise technological development and the economy in Europe tends to suppress the environmental agenda, as manifested in the Lisbon Strategy. The importance of including environmental agenda was recalled by several delegates of the EU member states at the Meeting of the High Level Working Group on the implementation of ETAP that took place on 17 June 2005 in Brussels. As found in the Top Runner Program, aiming to achieve the dual goals of environmental protection and technological development may compromise the achievement of a radical shift towards a society based on sustainable production and consumption.

The level set would also be affected by the graveness with which the problem is perceived by policymakers, manufacturers and the public, as evidenced by the difference between how things developed with exhaust gas emissions and energy. The level of acceptance in society for the possibility of socially undesirable consequences depends partly on the people's perception of the necessity of making changes.

The findings from interviews indicate that there is much discussion at the industry associations. On one hand, the industry associations can play an important role in, for example, gathering information from their members. However, as the mission of the industry association is to serve all of their members, their opinions tend to reflect the lowest common denominator. Having direct channels to individual producers as in the setting of exhaust gas emission standards may help bring out opinions not influenced by the interests of the whole industry. Such an approach is also recommended in Europe, especially considering the potentially large gap in technologies among the companies and the observed strong lobbying power of industry associations.

Differentiated standards within the respective product groups may promote the availability of diverse products, but questions remain whether the availability of so many products is preferable from a sustainability point of view: Related to the level of standards are the pros and cons of differentiated standards within the respective product groups. On the one hand, the differentiated standards would be fair for manufacturers who make products that have higher environmental impacts in general – for instance, as regards energy efficiency, heavy cars and TV sets with wide screens – and would allow the availability of a variety of products in society. On the other hand, it is questionable whether the availability of these relatively environmentally burdensome products is preferable to the achievement of a sustainable society.

The Program makes an updated environmental criterion available for other policy instruments: The availability of the standards developed for the Top Runner Program would most likely facilitate the introduction of other policy instruments such as the Green Procurement Law and the green automobile tax scheme by reducing the laborious work of developing a criterion. The fact that the Program

also incorporates mechanisms for periodical review of the standards facilitates the adjustment of standards used in other policy instruments to the appropriate level as well.[50]

The use of the Top Runner standards in the Green Purchasing Law and the green automobile tax scheme seems to serve as a good example for a coordinated use of policy instruments, a key concept in current European environmental policymaking.[51] As discussed further below, the combined use of these instruments has created synergies and accelerated the application of environmental technologies as well as their uptake by consumers.

The Green Procurement Law promoted earlier application of environmental technologies to individual models: Incorporation of the Top Runner standards as a criterion within the Green Procurement Law seems to have contributed to the further application of environmentally superior technologies in two ways. Firstly, due to the introduction of the Law prior to the target years set for the Top Runner Program, the industry started to apply technologies that enabled them to meet the standards earlier than the target years. Secondly, as the Green Procurement Law requires fulfilment of the standards on an individual model basis – as opposed to a weighted average basis – it tends to encourage producers to incorporate the Top Runner standards in a larger number of models. It may have contributed to the fact that virtually all the producers in the industry association meet the standards not only on a weighted average basis but also on an individual product basis.

The Tax Reduction facilitates uptake by consumers: The most effective driver for changes in consumer purchasing behaviour, as perceived by manufacturers so far, has been the tax reduction. At the same time, the introduction of a tax reduction must be considered with regard to various features of products, such as price and the manner in which they are sold. The level of the tax reduction also requires careful consideration.

Awards can contribute to the development of products with outstanding environmental performance: The high level of energy efficiency attained by some models suggests that manufacturers, while ensuring that all their products meet the Top Runner standards, also develop products whose environmental performance is well beyond the standards. Comments from manufacturers seem to suggest that awards – and the improved corporate image attached to them – contribute to the development of these products. They seem to serve as a driver for manufacturers to

[50] The utilisation of standards in this manner has been observed in the case of criteria developed for Eco-labelling schemes (Thidell & Leire, 2005).

[51] A key role of IPP is to "strengthen the coordination and coherence between existing and future environment-related product policy instruments" (COM(2003)302 final, p. 7). The Communication on ETAP also discusses the "need to optimise the use of different policy instruments", suggesting the importance of the selection of "the most effective measure – or combination of measures – to create an environment that encourages those who develop, purchase and use environmental technologies" (COM(2004)38 final, p. 8).

continuously develop and apply superior technology instead of leaving these technologies on the shelf in order to prevent the level of standards from rising. Just like the Green Procurement Law, the award can also incorporate various environmental as well as other features of products. It can set the criteria for "ideal" products in the future, as done in the "Copier of the Future" award (see footnote 44).

Combined use of criteria may facilitate the incorporation of other (environmental) qualities: Both the Green Purchasing Law and the green automobile tax scheme utilise the Top Runner standards along with other environmental and quality criteria. They may also serve to remedy a shortcoming of the Top Runner Program pointed out by a number of interviewees – that it addresses only one aspect of the qualities of a product.

Fulfilment of standards by individual companies provides added motivation for design changes: Requiring individual producers to fulfil the standards instead of the entire industry, as in the Top Runner Program, would provide greater incentives for the producers to improve the environmental profile of their own products than collective requirements. Collective goal-attainment – an approach taken in the voluntary agreement relating to CO_2 reduction for cars in Europe – would mean that companies who make less of an effort would be offset by those who try harder. This issue has been hotly debated in Europe and elsewhere when it comes to implementing programmes that incorporate the concept of extended producer responsibility.[52] Individual fulfilment would also most likely stimulate innovation by individual companies more than the system based on collective fulfilment, while collective fulfilment might enhance industry-wide diffusion of new technologies.

Changing purchasing behaviour by provision of information faces challenges: One limitation identified in the current implementation of the Top Runner Program is its influence on consumers' purchasing behaviour. Despite various efforts to raise consumer awareness, not much success has been observed by the provision of information.

If energy efficiency, which is more directly related to cost savings for consumers than other environmental impacts, fails to have much effect on purchasing behaviour, it would most likely be even more difficult to influence purchasing behaviour with issues such as design for end-of-life. In this case, there is no direct health impact or cost implications for consumers.[53] Similar challenges can be foreseen in the implementation of the European policies that aim to address various types of environmental impacts arising from all stages of the product life cycle.

[52] For further discussion of individual versus collective responsibility relating to the implementation of extended producer responsibility programmes, see, for example, Tojo (2004).
[53] Further discussion of the lack of demand for design for end-of-life as perceived by manufacturers is found in Tojo (2004, pp.114-148).

Category of producers may affect implementation: The majority of the producers addressed in the Top Runner Program are large, well-known domestic companies. Considering the characteristics of these manufacturers, how they are perceived and the magnitude of corporate social responsibility currently occupying them, the name and shame approach may work fine for them. Information on standard achievement is relatively easy to obtain when producers are identifiable. The situation becomes more complicated when a large number of small and medium-sized manufacturers and importers are involved, as in Europe. When dealing with other categories of producers, a stricter enforcement approach may be called for.[54]

Application of the approach to other environmental aspects may face boundary problems: The Top Runner Program addresses the use-phase energy efficiency of selected product groups. Although various challenges exist in determining the measurement methods, there is still a rather well-defined system boundary.

Greater challenges may be posed when setting standards for other environmental aspects, as well as other parts of the life cycle, as is the basis of the European environmental product policies. For instance, upstream changes to reduce environmental impacts from end-of-life can vary from changing materials to enhance recyclability, reducing the number of components to changing the entire product system. In order to determine the Top Runner, a system boundary as well as parameters to be compared should be agreed on. Setting the boundary and agreeing on parameters would not be straightforward in the case of, for instance, upstream changes to reduce environmental impacts at the end-of-life.[55] The challenge will be even greater when the entire life cycle is addressed, as has been evident in the dispute regarding life cycle assessment. The changing boundaries between different products (for instance, combinations between mobile phones and computers) and additional features attached to them may also make it difficult to determine the appropriate unit for comparison.

International harmonisation of measurement methods and standards may face challenges: Considering the difficulty of straightforward comparison of standards among three regions (Section 3.1.3), harmonisation of the measurement method and/or standards would face challenges. Reasons observed in this study include differences in the characteristics of products, differences in environmental priorities where products are sold, differences in user preferences, differences in use patterns, etc. Similar difficulties would most likely be encountered in Europe. The challenges increase when the environmental impacts of the whole life cycle of a product are addressed. Similar problems have been experienced in efforts to harmonise the criteria for eco-labelling schemes between different regions.

[54] As mentioned, the number of imported products in some of the product groups included in the Top Runner Program is rapidly increasing (see footnote 32). Different enforcement mechanisms may become necessary in the future.
[55] Further discussion of this issue is found in among others Tojo (2004, pp. 19-21).

6 Conclusions

In this concluding chapter, the author first wishes to highlight some of the main findings relating to the Top Runner Program. The following section enlists issues taken from the analysis of the Program that may be of relevance when developing and implementing an environmental product policy. The chapter concludes with brief recommendations for future research.

6.1 Implementation of the Top Runner Program to date

The Top Runner Program under the Energy Conservation Law in Japan has been implemented since 1999 and addresses use-phase energy efficiency of selected product groups. The program aims to achieve in essence two goals: to reduce environmental impacts – that is, in the case of the Top Runner Program, to reduce CO_2 emissions by reducing energy consumption – and to enhance the national economy via technological progress in industry. Eighteen product groups – selected electrical and electronic equipment, cars and gas-using equipment – are currently included in the Program, and an expansion of the scope is under way.

Under the Top Runner Program, the energy efficiency of the product with the highest efficiency currently available on the market sets the standards. However, interviews with various stakeholders revealed that in setting the standards, not only the level of energy efficiency achieved by the Top Runner but also the potential for the rest of the industry to meet the targets have been considered. This consideration is manifested in the potential exclusion of products with outstanding energy efficiency – especially when it requires the use of specific technologies – from becoming standard setters. Moreover, standards are differentiated based on various parameters that influence energy efficiency.

The standards set in the Top Runner Program are utilised in a couple of policy instruments, such as the Green Purchasing Law and the green automobile tax scheme. Both mandatory and voluntary information tools are employed to disseminate information concerning the energy efficiency performance of the products included in the Program.

The results so far have been positive. The Top Runner Program requires producers to meet the standards on a weighted average basis. In reality, among those products for which the target year for meeting the standards has already arrived, all the producers who are members of the industry associations have managed to achieve the targets not only on a weighted average basis, but also on an individual model basis. The levels of efficiency achieved by some models are substantially higher than the Top Runner standards. The average energy efficiency improvement in these product groups therefore exceeded what was expected to be achieved by fulfilment of the Top Runner standards. Interviews with manufacturers revealed that the Top

Runner Program has been one of the crucial driving forces behind this achievement. The role of the Top Runner Program in accelerating the development of environmental technologies and their commercial application was commonly recognised. A number of interviewees commented on the effect of the fact that the Program is based on legislation.

The main criticisms of the Program relate to the level of the standards. Critics argued that while the Program leads to some improvement in the energy efficiency of products, it may not be sufficient to make the necessary shift to create a sustainable society. They questioned the approach in which considerations are made so as to enable, in principle, all the manufacturers in the "top group" to meet the targets. An alternative approach suggested was the one that has been used to reduce exhaust gas emissions in cars. It has been effective in reducing air pollution, and despite its strictness and the difficulties manufacturers faced to achieve compliance, it enabled some Japanese car manufacturers to gain considerable competitive advantage in the end. The fact that the Program addresses only one aspect of products was also pointed out as a shortcoming by a number of interviewees.

A main challenge facing the Top Runner Program is to influence consumers' purchasing behaviour. Despite the availability of products that are significantly more energy-efficient, the relatively high initial cost of these products make them less competitive than their less expensive, less efficient counterparts. Consumer appreciation of the cost savings achieved during the use phase appears to vary between different types of consumers.

6.2 Implications of the Top Runner Program for Environmental Product Policy

The analysis of the Top Runner Program indicates several issues that may be of relevance to the design and implementation of Environmental Product Policy in general.

- The manner in which the standards are set in Top Runner Program can contribute to *industry-wide environmental improvement*. The approach is that products with the *highest energy efficiency* on the market are used as a starting point for standard setting, but that *the potential for other manufacturers to realistically meet the standards* is also taken into consideration.
- The approach used in the Top Runner Program can play an important role in *accelerating the application of environmental technologies* on market.
- The *mandatory nature* of the Program forced producers to meet the standards and to consider some issues – in the case of the Top Runner Program, energy efficiency – in their product development strategy that they may not otherwise consider.

- Setting standards at a "realistic" level, as in the Top Runner Program, *facilitates steady improvement*, but may *not to contribute to radical change*. The change achieved may not be sufficient for the creation of a sustainable society.
- Factors affecting the level of standards include *prioritisation between environmental protection and economic growth, the perceived graveness of the addressed issues* and *the decision-making process*. When a policy aims to achieve the dual purposes of environmental protection and economic growth, there seems to be a tendency for the latter purpose to dominate. It also depends on how serious the problem is perceived to be by policy makers, manufacturers and the public. Having direct channels to individual producers instead of going through the industry associations may help in obtaining opinions that are not influenced by the interests of the whole industry.
- Differentiated standards within the respective product groups may promote the *availability of a wide range of products*, but questions remain as to whether the availability of a variety products is preferable from a sustainability perspective.
- The standards set in the Top Runner Program can be used as *criteria for other policy instruments*, such as purchasing programmes, environmental tax schemes and the like. The review and upgrading of standards facilitates the adjustment of the standards in other programmes.
- The *Green Purchasing Law* utilised the Top Runner standards as one criterion. The *parallel introduction* of the Green Procurement Law prior to the arrival of the target years set for the various product groups under the Top Runner Program contributed to the *speedy* fulfilment of the Top Runner standards on an *individual model basis*.
- The *green automobile tax scheme* also incorporates the Top Runner standards as one criterion for the selection of environmentally superior cars. The modest tax reduction for consumers is perceived to be the most effective driver for changes in *consumers' purchasing behaviour*.
- While the effect of the Top Runner Program may be limited to the promotion of relatively incremental progress, *awards* – and the improved corporate image associated with them – can contribute to the development of products with *outstanding environmental performance*.
- Fulfilment of standards by *individual* companies – the approach taken in the Top Runner Program – provides more motivation for design change than an industry-wide mandate. The latter approach, taken in the so-called 140 g voluntary agreements in Europe, may discourage individual producers to reduce the environmental impact of their products.
- Changing purchasing behaviour by providing *information to consumers* faces challenges, even when consumers can directly benefit from cost savings during the use-phase. The situation may be worse when there are no direct health impacts or cost consequences for consumers.

- The majority of the producers addressed in the Top Runner Program are large, well-known domestic companies. This may be one reason why the *name and shame* approach has been working well. It most likely also facilitates information gathering regarding their progress for policy makers. Addressing other types of producers may necessitate more stringent enforcement and monitoring mechanisms.
- Application of the approach to other environmental aspects may face *boundary problems*. It can be difficult to decide which product parameters should be used to determine the Top Runner in the case of, for example, design for end-of-life.
- In light of the difficulties involved in *comparing standards* in different regions, harmonisation of measurement methods and standards on a global scale may face challenges.

6.3 Recommendations for future research

It will be very interesting to continue to see how the Top Runner Approach develops in the future. Specific areas to be examined include the practices and perceptions of importers and small and medium-sized manufacturers, measures to monitor their progress and changes in timeframes and how standards are set. A comparison of the technological progress that has taken place in Japan and elsewhere would provide further insights into the role of the Program in bringing about technological changes. It would be also interesting to study other policy instruments mentioned in the study, such as the CAFE programme in the United States and voluntary agreements for cars in Europe.

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Appendix 1: List of interviewees

Listed in the order of the time of the interviews within the different categories. Positions are translated by the author when not available in English.

Manufacturers

Name of the company	Name and position of the interviewee	Time & date
Toshiba HA Products Co., Ltd.	Temmyo, Minoru. Chief Specialist, Refrigerator Design Group, Refrigerator Products Dept.	09:30-10:30, 24 March 2005
Toyota Motor Corporation	Ohno, Eishi. Project General Manager, Environmental Affairs Div. Nishizutsumi, Tohru. Project General Manager, Planning Group, Environmental Affairs Div.	16:00-17:15, 29 March 2005
Matsushita Electric Industrial Co., Ltd.	Yoshida, Keiichi. Councilor, Environmental Planning Group, External Relation Team, Corporate Environmental Affairs Division.	13:30-15:00, 30 March 2005
Hitachi, Ltd.	Namikawa, Osamu. Manager, Environment Promotion Center, Corporate Environmental Policy Division.	15:30-16:45, 31 March 2005
Cannon Inc.	Sato, Bunryo. General Manager, Product Environment Promotion Div., Environment Management and Engineering Center, Global Environment Promotion Headquarters. Iwanaga, Ryuichi. Manager, Environmentally Conscious Products Dept., Environment Management and Engineering Center, Global Environment Promotion Headquarters. Fujisawa, Kyoko. Environmentally Conscious Products Dept. Product Environment Promotion Div. , Environment Management and Engineering Center, Global Environment Promotion Headquarters.	10:00-11:30, 1 April 2005
Ricoh Company, Ltd.	Nakamaru, Susumu. Corporate Councilor, Products & Environmental Safety, Corporate Environmental Division, Quality of Management Division and CSR Division. Noritake, Yuji. General Manager, Environmental Sustainability Development Office, Corporate Environmental Division. Tanigawa, Tetsuro. Assistant Manager, Technology Strategy Department, Office Business Planning Center.	14:00-15:30, 1 April 2005
Fujitsu Limited	Takaki, Jun. General Manager, Management Planning Division, Sustainable Development Planning Office, Environmental Headquarters. Matsumura, Tadanobu. General Manager, System Solution Technology Division, Center for Common Technology Supervision. Kurihara, Seiichi. General Manager, Eco-design Promotion Division, Center for Promoting Environmental Technology, Environmental Headquarters. Takayama, Haruo. Eco-design Promotion Division, Center for Promoting Environmental Technology, Environmental Headquarters.	10:00-11:00, 4 April 2005

Name of the company	Name and position of the interviewee	Time & date
Nissan Motor Co., Ltd.	Uno, Soichiro. Manager, Technical Affairs Group, Environmental and Safety Engineering Department Kumataka, Hiroyuki. Assistant Manager, Technical Affairs Group, Environmental and Safety Engineering Department Tsuzuki, Mikio. Assistant Manager, Technical Affairs Group, Environmental and Safety Engineering Department Ban, Yuuichi. Environmental Management Group, Environmental and Safety Engineering Department	13:30-15:30, 4 April 2005
Pioneer Corporation	Yokota, Takeshi. Coordinator, Division of Environme<ntal Preservation Takayanagi, Rikizo. Assistant Manager, Division of Environmental Preservation Ohmachi, Akio. General Manager, Product Planning Section, Product Planning Division, Plasma Display Business Company Yamagishi, Kesanobu. Staff Coordinator, Public Relations Department, Corporate Communications Division	16:15-17:45, 4 April 2005
Sharp Corporation	Morishita, Masaaki. Manager, Environmental Planning Department, Environmental Protection Group. Mizuno, Maki. Junior Manager, Environmental Planning Department, Environmental Protection Group.	09:30-11:00, 5 April 2005
Mitsubishi Electric Corporation	Sugawara, Sakuo. Director General, Technological Issues, External Relation Division, Business Headquarters for Living and Digital Media. Ueno, Kiyoshi. Director General, Technological Issues, External Relation Division, Business Headquarters for Living and Digital Media. Takahashi, Tetsuya. Expert, Planning Group, Headquarters for Environmental Management.	16:00-17:30, 5 April 2005
NEC Corporation	Satou Yasuharu. Expert, Environmental Group, Environmental CS Promotion Division, NEC Personal Products Co., Ltd. Saita, Masayuki. Environmental Products Manager, Environmental Management Division. Takata, Nokiko. Assistant Manager, Environmental Management Division.	09:30-10:45, 6 April 2005
Hewlett-Packard Japan Ltd.	Tabata, Toshio. Manager, HP Japan Environmental Stewardship.	14:00-16:00, 6 April 2005

Experts

Name and position of the interviewees	Organisation (type of organisation)	Time & date
Yokoyama, Hiroshi. Director. Center of Eco-Design and Information, Department of Environmental Business and Technology. Nakaniwa, Chie. Planning and Development Office, Center of Eco-Design and Information, Department of Environmental Business and Technology,	Japan Environmental Management Association for Industry (JEMAI)	17:00-18:15, 17 March 2005
Mito, Chiho. Chief, Research First Department. Hayai, Kayo. Chief, Research Division, Research Second Department.	Energy Conversation Center, Japan (ECCJ)	14:00-15:00, 23 March 2005
Yamamoto, Ryoichi, Ph.D. Professor. International Research Center for Sustainable Materials, Institute for Industrial Science,	University of Tokyo.	11:00-12:00, 29 March 2005
Januki, Nobuo. Associate Director	Protiviti Japan (consultancy)	17:00-18:00, 30 March 2005
Yasui, Itaru, Ph.D. Vice-Rector	United Nations University	12:00-13:00, 31 March 2005
Kurasaka, Hidefumi, Prof.	Chiba University	12:30-14:30, 5 April 2005
Morishita, Ken. Director	Eco Management Institute (consultancy)	11:00-12:00, 7 April 2005

Government Officials

Organisation	Name and position of the interviewees	Time & date
Ministry of Economy, Trade and Industry	Tsuruda, Masanori. Deputy Director, Energy Efficiency and Conservation Division, Agency for Natural Resources and Energy.	10:00-11:00, 30 March 2005
Ministry of the Environment	Okunushi, Yoshimi. Director General, Environmental Measures for Automobiles Kubota, Hidenobu. Assistant Director, Environmental Management Technology Division, Environmental Management Department	16:00-17:00, 8 April 2005

Industry Associations

Organisation	Name and position of the interviewees	Time & date
Japan Electronics & Information Technology Industries Association (JEITA)	Suzuki, Toshimasa. Manager, Environment and Engineering Group, Digital Home Appliances Department.	16:30-17:30, 1 April 2005
Japan Electrical Manufacturers' Association (JEMA)	Eto, Fukuo. Director & General Manager, Environmental Department. Tajima, Hiroshi. Director, Technology Second Division, Department of Home Appliances. Saito, Kiyoshi. Chief. Technology First Division, Environmental Department	16:30-17:00, 6 April 2005

Appendix 2: Interview guides

Manufacturers[56]

1. Focus areas for reduction of environmental impacts from company-related activities
   - In terms of life cycle phase? (i.e. extraction of raw material, design, production, sales, use, end-of-life, transportation)
   - In terms of environmental aspects? (quantity of material used, types of material/substances used, energy use, noise, odour, others)
   - Tools used to come up with/identify these areas

2. Measures taken to reduce the energy consumption of the products
   Concrete example of measures, status of energy efficiency improvement, communication to consumers, etc.

3. Factors that promote measures to reduce the energy consumption of products
   Market competition, improvement of corporate image, customer demand (consumers or business customers, or both, in what manner?), internal driving forces (concrete examples?), legislation (concrete examples?), etc.

4. Factors that hinder such measures
   Cost, lack of demand, balance with the improvement of product qualities other than energy efficiency (concrete examples?), internal factors (concrete examples?), (lack of) legislation (concrete examples?), etc.

6. Views on the Top Runner Program
   Influence on domestic and international market competition, influence on technological development, etc.

Experts

- Appropriateness of the level of the Top Runner standards (e.g. easiness/difficulty of achieving the standards, comparison with foreign standards, the method and manner of differentiation between the different product groups)
- Appropriateness of the manner in which the Top Runner standards are determined (e.g. consulted parties, potential negotiation among manufacturers to slow down technological improvement to prevent the standards from being raised)
- Power relationship between manufacturers, industry associations and government

[56] The interview guide presented on this document is the one that was sent to manufacturers prior to the actual occurrence of the interviews. In the author's own interview guide, more concrete question items were added as the interviews proceeded reflecting upon the information obtained.

- Effectiveness of the approach taken in the Top Runner Program (advantages and disadvantages for domestic and foreign companies, potential for applying the approach to environmental aspects other than energy efficiency)
- Other views on the Top Runner Program

Government Officials

1. Ministry of Economy, Trade and Industry
   - The level of target attainment
   - Actual process of setting the Top Runner Standards
   - Advantages of the Top Runner Standards
   - Challenges facing the Top Runner Standards
   - Appropriateness of the level of the Top Runner standards (e.g. easiness/difficulty of achieving the standards, comparison with foreign standards, the method and manner of differentiation between the different product groups)
   - Difference in administrative feasibility between various types of industry (e.g. size, domestic or foreign)
   - Differences in standard setting and manners of implementation due to differences in product characteristics
   - Appropriateness of the manner in which the Top Runner standards are determined (e.g. potential negotiation among manufacturers to slow down technological improvement to prevent the standards from being raised)
   - Effectiveness of the approach taken in the Top Runner Program (advantages and disadvantages for domestic and foreign companies, potential for applying the approach to environmental aspects other than energy efficiency)

2. Ministry of the Environment
   - Historical development of the Exhaust Gas Emission Law and standards
   - Status of the Exhaust Gas Emission Law, its background
   - Actual process of setting the standards
   - Relative stringency of the standards compared to standards abroad

Industry Associations

- Recent and current developments relating to the Top Runner Program and the position of the industry association
- Level of target attainment
- The manner in which the industry association and its member participate in the standard setting process, discussion within the industry association
- Status of membership: participation of foreign manufacturers and importers

The Top Runner Program in Japan

– its effectiveness and implications for the EU

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A shift towards a sustainable society requires policy-making that achieves overall environmental improvement while continuously promoting innovation and enhancing the competitiveness of industry. A so-called "top runner" approach, as implemented in Japan for the improvement of energy efficiency for product groups, has gained interest in the EU, e.g. in the discussion of the Environmental Technologies Action Plan (ETAP).

This study critically examines the environmental effectiveness and the policy implications of the top runner approach in Japan, in order to better understand the potential for applying the top runner approach in Europe.

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