

# HOW ENERGY LABELLING AFFECTED PRODUCTION DECISIONS OF APPLIANCE MANUFACTURERS IN THAILAND

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## ABSTRACT

Recent experience in Thailand has shown the potential for appliance energy labelling programs to affect manufacturer production decisions. Thailand is one of the few Asian countries to have implemented a successful nation-wide energy labelling program for household appliances. The Electricity Generating Authority of Thailand (EGAT), the state-owned generating utility, implemented labelling programs as part of its national demand-side management (DSM) plan. The voluntary labelling of refrigerators and air conditioners started in 1995 and 1996, respectively.

After six years of DSM implementation, EGAT commissioned a Canadian consortium to evaluate the impact of its DSM programs in 1999. This paper describes the methods and strategies used in the process of interviewing the manufacturers. The results and our hands-on experience allowed us to draw important findings about the impact of energy labelling on production decision-making of Thai manufacturers. The Thai labelling programs are a successful example of a voluntary energy labelling effort in a developing country. The lessons learned from Thailand can provide useful guidance to policymakers in both developing and industrialised countries that are pursuing or revamping energy labelling programs.

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## INTRODUCTION

Thailand became the first country in Asia to implement a national demand-side management (DSM) program when the DSM Master Plan was developed and put into effect in 1992. By resolution of the Cabinet of the Royal Thai Government, the DSM Office (DSMO) was created within the Electricity Generating Authority of Thailand (EGAT) and given the authority to manage and implement DSM programs. The purpose of the initiative was to reduce peak energy demand while maintaining system quality and to instil an energy efficiency-oriented attitude within Thai consumers. Five DSM programs have been fully implemented and evaluated:

- Energy-Efficient Fluorescent Lamp (Thin-Tube) Program
- Compact Fluorescent Lamp (CFL) Program
- Street Lighting Pilot Project
- High Efficiency Air Conditioner Program
- High Efficiency Refrigerator Program

## EGAT'S ENERGY LABELLING PROGRAMS

The High Efficiency Refrigerator and High Efficiency Air Conditioner programs are two effective labelling programs implemented under the framework of the DSM Master Plan. EGAT started implementation of energy efficiency labelling for refrigerators and air conditioners in November 1994 and February 1996, respectively. Both programs aim to promote the use of energy efficient appliances and increase their average energy efficiency.

EGAT's energy labels for refrigerators and air conditioners rank the products on a scale of #1 to #5, where a rating of #5 is the highest efficiency level and #3 is average. The label also shows consumers the average energy consumption per year (kWh/year) and the average electricity price per year (Baht/year). Since these programs are voluntary, manufacturers/distributors choose not to label their products if tests reveal that their products are less efficient than average (#3). Thus, no product in the market show #1 or #2 label.

To obtain an energy label, one sample unit must be randomly selected from a pool of at least 30 units of the same model (same size and features) and sent to the Thailand Industrial Standards Institute (TISI) laboratory for energy performance testing. Once the model has been tested, it is issued a label with a ranking between #1 to #5 according to its efficiency value compared to the average efficiency value within its size category (see Table 1). Then, the manufacturer/distributor may choose whether or not to use the assigned label on their product.



Figure 1: Energy Label

Table 1: Rating Criteria for Energy Labels

Ranking	The model will receive...
#1	...if its efficiency value is <i>at least 30% less than</i> the average efficiency value.
#2	...if its efficiency value is <i>15 to 30% less than</i> the average efficiency value.
#3	...if its efficiency value is <i>between -15% and +10%</i> of the average efficiency value.
#4	...if its efficiency value is <i>10 to 25% greater than</i> the average efficiency value.
#5	...if its efficiency value is <i>at least 25% greater than</i> the average efficiency value.

## **METHODOLOGY**

In 1999, after six years of DSM implementation, the DSMO commissioned the AGRA Monenco consortium of consultants to perform process, market, and impact evaluation of its five DSM programs mentioned above. The evaluation focussed on assessing the actual reductions in electricity demand, energy use, and greenhouse gas (GHG) emissions realised by each of the programs. The evaluated savings were used to verify whether the savings reported by EGAT from rough market estimates were accurate.

The evaluation consortium was comprised of consultants from Canada (AGRA Monenco, BC Hydro International, Bureau d'études Zariffa, and Ference Weicker & Company) and Thailand (EEC-Energetics, the International Institute for Energy Conservation, and BERA). During April-July 1999, EEC-Energetics and the International Institute for Energy Conservation (IIEC) worked closely together to collect the necessary data from residential, commercial, and industrial consumers as well as from the manufacturers and distributors of fluorescent tube lamps (FTLs), compact fluorescent lamps (CFLs), air conditioners (ACs), and refrigerators. The data was collected through the use of survey instruments (mail and in-person interviews) and on-site data logging of appliance use pattern.

### **SURVEY OF MANUFACTURERS & DISTRIBUTORS**

The manufacturer and distributor (M&D) survey required intensive in-person interviews where the questionnaires were designed to collect information on the manufacturer's production, market share, level of participation and satisfaction with the labelling programs. The questions were mostly open-ended; comments were encouraged after most questions to allow manufacturers to express their opinions and provide reasons for their responses. To cover the whole implementation period, manufacturers were requested to provide production and market data from 1993-1998.

In addition to the survey, label distribution information from EGAT was collected for the same period. We also gathered supplementary statistics and data from government agencies and public entities to fill in data gaps that could not be obtained from the survey.

### **Refrigerator Sample Size and Characteristics**

All 10 refrigerator manufacturers/distributors/importers (M&D) were surveyed by in-person interviews. Out of the 10 M&Ds, there were 7 manufacturers with local plants in Thailand, 2 distributors whose brands are produced by one or more of the 7 manufacturers, and 1 importer. This sample size represented 100% of the refrigerator market.

### **Air Conditioner Sample Size and Characteristics**

There are more than 200 AC manufacturers/distributors/importers/assemblers (M&D) in Thailand. Most of them are small assembling companies who use AC parts (compressors, heat exchanger, etc.) from the same parts distributors in

Thailand. We selected a total of 32 M&Ds that included all major producers, a good number of medium-size producers, and several small producers. The selection strategy aimed to attain the highest possible market coverage.

### **Data Processing**

Since the sample sizes for surveys are not large, the responses were compiled into simple Excel spreadsheets for data processing and analysis. For each interview, a separate data spreadsheet containing details of market and production data, as well as the summary of comments, was provided in addition to the main data sheet.

The data was formatted for simplicity in analysis and was given to the Canadian consultants to process. In this paper, we draw some results from the consortium's Final Report to EGAT (AGRA Monenco 2000), as well as key findings from further analysis of survey data by the authors.

## **IMPACT ON REFRIGERATOR INDUSTRY**

This section describes the impact of the High Efficiency Refrigerator or "Refrigerator" program on the refrigerator industry. First, we took a look at how much the energy labels have contributed to improving the average energy efficiency of refrigerators in the Thai market. If so, did it influence the manufacturing process and costs? From our interviews, we closely examined the manufacturers' views on the program and its impact on their refrigerator production decision-making.

### **IMPROVEMENT IN ENERGY EFFICIENCY**

Six out of 10 M&Ds agreed that the Refrigerator program contributed significantly to increasing the average energy efficiency level of refrigerators in the Thai market. Two M&Ds indicated that the program only contributed a little to the improvement. Another two M&Ds said the program was not a contributing factor due to lack of accurate validation and their contention that the decrease in energy consumption per unit also led to a decrease in unit cooling capacity.

To verify the improvement of energy efficiency, we examined the increase or decrease of #3, #4, and #5 rated units between 1995 to 1998<sup>1</sup>. The data from EGAT showed that the order of #5 labels increased from 11.6% to 96.8% of the total labels ordered by the M&Ds. The number of #4 and #3 labels ordered decreased from 74.6% to 2.8% and 13.8% to 0.4%, respectively. Further, the collected data indicated that the percentage of labelled units sold compared to the total units sold ranges from 85-92% in 1996-1998. (AGRA Monenco 2000) This infers a dramatic increase of energy efficient (#5 and #4) units and elimination of average efficiency (#3) units from the market.

From their experience with consumers, eight of the 10 M&Ds said that the program has positively changed the attitude and buying habits of consumers. They believe consumers were influenced by EGAT's highly visible advertising

campaign and recognise that the #5 product is energy efficient. However, one M&D who disagreed made the point that many consumers blindly look for a #5 label, but do not know what it really means.

### **INFLUENCE ON PRODUCTION DECISIONS**

Table 2 summarises the reasons why the manufacturers participated in the Refrigerator program. Gaining customer trust through the program received the highest vote, receiving 32 out of 100 points. The reasons ranked 2<sup>nd</sup> to 4<sup>th</sup> are all market-oriented reasons, showing that M&Ds see the label as an influential factor on the market demand for their products. To further illustrate the importance of the label, all 10 M&Ds indicated that they used the label in their promotional campaigns and brochures to advertise their products.

**Table 2: Reasons for Participating in the Refrigerator Program<sup>2</sup>**

<b>Rank</b>	<b>Reasons</b>	<b>Points (out of 100)</b>
1	To gain customer trust through program	32
2	Expected an increase in sales	17
3	To remain competitive in the market	13
4	Free market support (advertisements) from EGAT	12
5	To support national energy conservation efforts	10
6	No cost for testing and labels	7 (6.5)
	Participation process is easy	7 (6.5)
7	Minor or no production line modification	2
8	Minor or no production cost increase	1

Half (5 out of 10) of the M&Ds indicated that they had to modify their production line to achieve higher label rating, while 4 M&Ds did not have to. One interviewee, a distributor, did not know the answer. All five manufacturers who modified their production line said that, as a result, their production costs increased. Three of the five indicated small increases (1-8%) in production costs, but the other two claimed a 20% increase.

This explains the low score for the last two reasons in Table 2. Even though five manufacturers had to modify their production lines to achieve higher efficiency rating, which also led to increases in production cost, they still chose to participate in the program. This move shows that production decisions are based more on market considerations rather than difficulties in production line modification – which is good news for the consumers.

### **OUTLOOK FOR THE PROGRAM**

Seven out of 10 M&Ds supported the future enforcement of mandatory labelling and minimum energy performance standards, while the remaining three supported mandatory labelling but not minimum efficiency standards. For energy labelling, eight M&Ds felt that the efficiency requirement for each rating level should be adjusted higher. The two M&Ds that did not agree felt that the action would lead to higher production costs, which would directly become a burden on consumers.

For most aspects of the program (design of label, management, and advertising campaign), the majority of the M&Ds indicated that they were either “satisfied” or “more or less satisfied”. The only one aspect of the program with which the majority (60%) of the M&Ds were dissatisfied was the testing process. They pointed out that the process takes too long and does not produce accurate and repeatable results.

Overall, six of the M&Ds are satisfied and four were “more or less satisfied” with the refrigerator labelling program. All M&Ds plan to keep labelling their refrigerators in the future (mostly due to market demand for #5 units). Six M&Ds confirmed that they would *increase* the use of labels for models that are not currently labelled and new models.

### **KEY COMMENTS AND SUGGESTIONS FROM M&Ds**

Below, we summarise the comments and suggestions concerning the refrigerator labelling program that appeared most frequently during the interviews.

- Increase energy efficiency testing capacity and accuracy;
- Continue the marketing support (advertisements, commercials, etc.) and education of consumers;
- Increase energy efficiency level of each label rating; the market has become saturated with refrigerators of the highest efficiency rating;
- Provide financial support to manufacturers for the development of more energy-efficient refrigerators at lower production costs.

### **IMPACT ON AIR CONDITIONER INDUSTRY**

This section summarises the impact of the High Efficiency Air Conditioner or “AC” program on the air conditioner industry, in the same format as the refrigerator section above.

#### **IMPROVEMENT IN ENERGY EFFICIENCY**

Although 31 out of 32 M&Ds (97%) said that the AC program contributed to increasing the average energy efficiency level of ACs, only 19 indicated that they thought the program had made a significant contribution. One M&D said the program was not a contributing factor due to the fact that there are relatively few #5 ACs on the market compared to the number of unlabelled units that are untested, and are likely to have low energy efficiency.

We examined the data from EGAT to estimate the increase or decrease of #3, #4, and #5 rated units between 1996 to 1998<sup>3</sup>. Results showed that the percentage of #5 labels increased from 82.8% to 91.5% of the total labels ordered by the M&Ds. The percentage #4 labels decreased from 17.2% to 8.5%. There were no #3 labels ordered. Even though more #5 labels were ordered, percentage-wise, one can not fully conclude that average energy efficiency of ACs in the total market has

improved. Statistically, the percentage of labelled units sold compared to the number of total units sold only increased from 19% to 38% from 1996-1998. Therefore, more than 60% of the units sold are unlabelled and most probably are of lower efficiency. There is also another important market characteristic that we need to consider.

The Thai government requires that every AC unit sold in Thailand must be subjected to excise tax. In our survey of M&Ds, nearly every interviewee noted that there is a large “illegal” AC market, which may account for 30% of the total AC market. This “illegal” market is made up of small AC assemblers who avoid payment of excise tax and are able to sell their units at very low prices, relative to those subjected to excise tax. These units usually offer high cooling ability, but low energy efficiency and reliability. The existence of these “illegal” ACs and the lack of government enforcement causes unfair competition and discourages the “good” manufacturers from investing in production of high efficiency products.

Nevertheless, 94% of the M&Ds agreed that the program has positively changed the attitude and buying habits of consumers toward energy efficient air conditioners. However, two M&Ds who disagreed indicated that consumers still buy products based on price because the sale of unlabelled and “illegal” ACs did not seem to decline.

### **INFLUENCE ON PRODUCTION DECISIONS**

Similar to the refrigerator industry, air conditioner M&Ds also indicated market-oriented reasons as the most important reasons for participating in the AC program (see Table 3). Most M&Ds anticipated an increase in sales and expected to gain customer trust by joining the program. Remaining competitive in the market is also one of their main priorities. This reasoning and the fact that 28 out of 32 M&Ds (88%) use the label in their advertisements confirm that M&Ds recognised the energy label’s strong influence on market demand.

**Table 3: Reasons for Participating in the AC Program<sup>4</sup>**

<b>Rank</b>	<b>Reasons</b>	<b>Points (out of 100)</b>
1	Expected an increase in sales	24
2	To gain customer trust through program	23
3	To remain competitive in the market	18
4	Free market support (advertisements) from EGAT	11
5	Participation process is easy	6
6	No cost for testing and labels	5
	Minor or no production cost increase	5
7	Minor or no production line modification	4
8	To support national energy conservation efforts	4

Twenty-eight out of 32 M&Ds (88%) said they modified their AC units (design of parts, higher efficiency parts, etc.) to improve the energy efficiency ratio (EER) and rating of the units. Modification of their units caused an increase in production costs for 86% of M&Ds. The average increase in costs was estimated

to be about 15%. In monetary value, to improve from #3 to #4 rating, the production cost would be about 3,800 Baht/unit (US\$100), and from #4 to #5 would cost about 5,000 Baht/unit (US\$132). These substantial increases in production cost are the main reasons why M&Ds still chose to produce and market unlabelled (low- and medium-efficiency) units.

All but one M&D produce at least some AC units that are unlabelled. When asked why they do not label some AC models, the most significant reason was that there was not enough demand for labelled units. Other main reasons were because the models would not achieve a #5 rating, to offer low-priced options for consumers, and to avoid testing delays. Unlabelled, low-priced units were offered to consumers to take away market share from the “illegal” AC units on the market.

### **OUTLOOK FOR THE PROGRAM**

Fifty-three percent of M&Ds supported the future enforcement of mandatory labelling and minimum energy performance standards, while 25% were in favour of having only mandatory labelling and 13% were for MEPS only. Three M&Ds did not want any mandatory regulations by the government; one did not think EGAT enforces the regulations properly and one said that local manufacturers would not be able to compete with multi-national manufacturers if standards and labels become mandatory.

In contrast to the Refrigerator program, only 6 out of 32 of M&Ds (19%) agreed that the efficiency requirement for each rating level should be adjusted higher. Most M&Ds (75%) disagreed because the current efficiency requirements for #4 and #5 ratings are already high enough and in-line with international standards. They contend that it would be too difficult for manufacturers to keep the costs down while providing the same cooling capacity. Furthermore, there is only a single set of requirements covering all sizes of ACs at present; this needs revision. Efficiency requirements should be specified for each product size category. It is relatively easy for small capacity (9,000-13,000 BTU) units to achieve high ratings; however, it is very difficult for high capacity (>13,000 BTU) units to achieve #5 ratings due to technical limitations.

Market demand and characteristics are important to consider when making revisions and changes to program requirements. If efficient AC unit prices increase due to higher requirements, several M&Ds warned that the market demand might split towards the low-end and “illegal” units and the high-end units, leaving the medium and medium-high efficiency units out of the market share. This will negatively affect the average Thai AC manufacturers, who can not compete with multi-national companies due to lack of funds for technology improvement and mass-production capability, nor compete with the “illegal” manufacturers. A majority of the M&Ds suggested that the program should focus more on enforcing the excise tax for all units sold in Thailand to provide a fair level of competition, instead of increasing efficiency requirements.

## **KEY COMMENTS AND SUGGESTIONS FROM M&Ds**

For the AC program, M&Ds provided more input on how to improve the program than did M&Ds of the Refrigerator program. This is because the AC market in Thailand is more complicated, with a large number of manufacturers and a large “illegal” market. Below are the comments and suggestions for the air conditioner labelling program:

- Manufacturers’ decisions to participate in a voluntary labelling program are driven by consumer demand for labelled air conditioners. Since a major purchase criteria is price, consumers tend to purchase unlabelled models rather than labelled ones and this causes manufacturers to produce less of the high efficiency, labelled models;
- Encourage the government towards stricter enforcement of excise tax collection in order to decrease the market share of illegal, inefficient air conditioners.
- A mandatory labelling program will help eliminate the market distortion caused by illegal air conditioners, but will require strict monitoring and enforcement if the program is to be successful;
- Increase energy efficiency testing capacity and accuracy;
- Continue the marketing support (advertisements, commercials, etc.) and education of consumers so that they know why high-efficiency air conditioners cost more initially but can save them significant amounts of money over the air conditioners’ life-cycle;
- Provide technical and financial support to manufacturers for the development of more energy-efficient air conditioners at lower production costs.

## **CONCLUSIONS**

The Thai energy labelling programs are a successful example of a voluntary energy labelling effort in a developing country. The lessons learned from Thailand can provide useful guidance to policymakers in both developing and industrialised countries that are pursuing or revamping energy labelling programs. Important lessons learned from the Thai experience are presented below.

- A similar labelling strategy for the Refrigerator and AC programs yielded much different results. Programs must be designed, customised, revised, and improved specifically for each particular product market. Program design should differ not only on technical requirements, but also market transformation strategy. Each product market has different characteristics that will determine the success or failure of a labelling program.
- Voluntary labelling was effective in transforming the refrigerator market because there was not a significant spread in efficiency level and small number of manufacturers. However, for the AC market, there is a bimodal distribution of efficiency and high number of manufacturers. Stricter enforcement and stronger market intervention strategies were needed.
- Enforcement of regulations is critical for avoiding market distortion and unfair competition. The lack of excise tax enforcement allowed the

“illegal” AC market to diminish the positive impact of the AC labelling program. Loopholes in mandatory regulations cause unfair competition, which will become an unyielding barrier to convincing M&Ds to participate in a labelling program.

- M&Ds weigh market demand and trends more heavily than production and testing difficulties encountered in improving energy efficiency. Therefore, the labelling programs must focus on influencing consumers to control market demand. However, the market must ensure fair competition as mentioned above.
- Each country and each product market is different. The success of labelling programs depends on both consumers and M&Ds. A survey of M&Ds and consumers should be conducted during the design stage of the program in order to obtain their views and suggestions.

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## ENDNOTES

<sup>1</sup> Source data from EGAT – showing the number of #3, #4, and #5 labels ordered by manufacturers for refrigerator units during 1995 to 1998.

<sup>2</sup> Point system: Manufacturers were asked to rank 4 most important reasons. The most important reason receives 4 points, while linearly, the 4<sup>th</sup> most important reason received 1 point. The points were totalled up for each reason and normalised to 100.

<sup>3</sup> Source data from EGAT – showing the number of #3, #4, and #5 labels ordered by manufacturers for AC units during 1996 to 1998.

<sup>4</sup> Point system: same as described in Endnote #2

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