
The Philippines Residential AirCon Standards & Labeling Profile #117

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Executive Summary

The Philippines Residential Air Conditioner ("AirCon") Standards and Labeling program represents an important avenue for energy efficiency in developing countries while providing insights well worthy of examination by utilities and energy ministries throughout the world. In the developing world, as national economies gain strength and residents seek higher standards of living, addressing the energy use of air conditioning will be essential to keep energy consumption in check. For more developed countries, given the transition to more competitive power industries, standards and labeling may become more important since many utilities are reducing their efficiency program expenditures. By creating standards, efficiency can be increased through advanced technologies; through labeling, incentives can be created that will cause manufacturers to continue to accelerate their efforts, both factors creating means to transform markets for efficient appliances.

The Philippines, not unlike many other developing countries located in hot and humid climates, has been experiencing a dramatic growth in the number and use of air conditioners. While the number of households with "aircon" units is now low, as the economy grows, more and more consumers will be able to afford air conditioning, underscoring the importance of aircon efficiency. This is also exacerbated by the dearth of insulation and advanced window glazings, thus greater aircon capacity is required to achieve desired comfort levels. Furthermore, the program serves as a platform for subsequent initiatives for other end-uses such as refrigerators, motors, and fans to minimize power plant construction and imported fuels, two situations which strain the country's financial resources and economic development.

For other countries in Southeast Asia, the Philippines AirCon model is encouraging and appropriate. Faced with rates of electric load growth of 5-10% annually and similar demands for greater comfort, standards and labeling initiatives can serve as relatively low-cost, government-sponsored programs. By working in cooperation with manufacturers both domestically and abroad, governments in Southeast Asia can seek to accomplish both increased living standards and the most efficient use of energy, two key factors in their overall development.

For countries around the world, standards and labeling may well become increasingly important. Utilities that need to keep their rates as low as possible to maintain market share are reluctant to provide efficiency incentives. Thus government-initiated programs may become that much more important, creating means of leveraging change and providing appropriate signals to manufacturers and consumers that foster efficiency in the short term and sustain it over time, a model for efficiency that may well be broadly applicable.

THE PHILIPPINES **Residential AirCon Standards and Labeling**

Sector: Residential (some commercial)

History: Concept first developed in 1983; process put on hold during 1986 revolution; testing continued from 1986-1991; standards developed through collaborative between manufacturers and government; both standards and labeling required in 1994 for window-type domestic and imported models

Mechanism: Standards establish baseline efficiencies for window-type aircon units of various sizes; labeling creates incentive for manufacturers to produce models with ever-greater efficiency; Fuels and Appliances Testing Laboratory certifies the efficiency of all aircon units including annual reassessments; labels feature Energy Efficiency Ratios for comparative consumer information

1993 PROGRAM DATA

Energy savings: 17,707 MWh

Capacity savings: 6,064 kW

Regulated aircon sales: 43,500

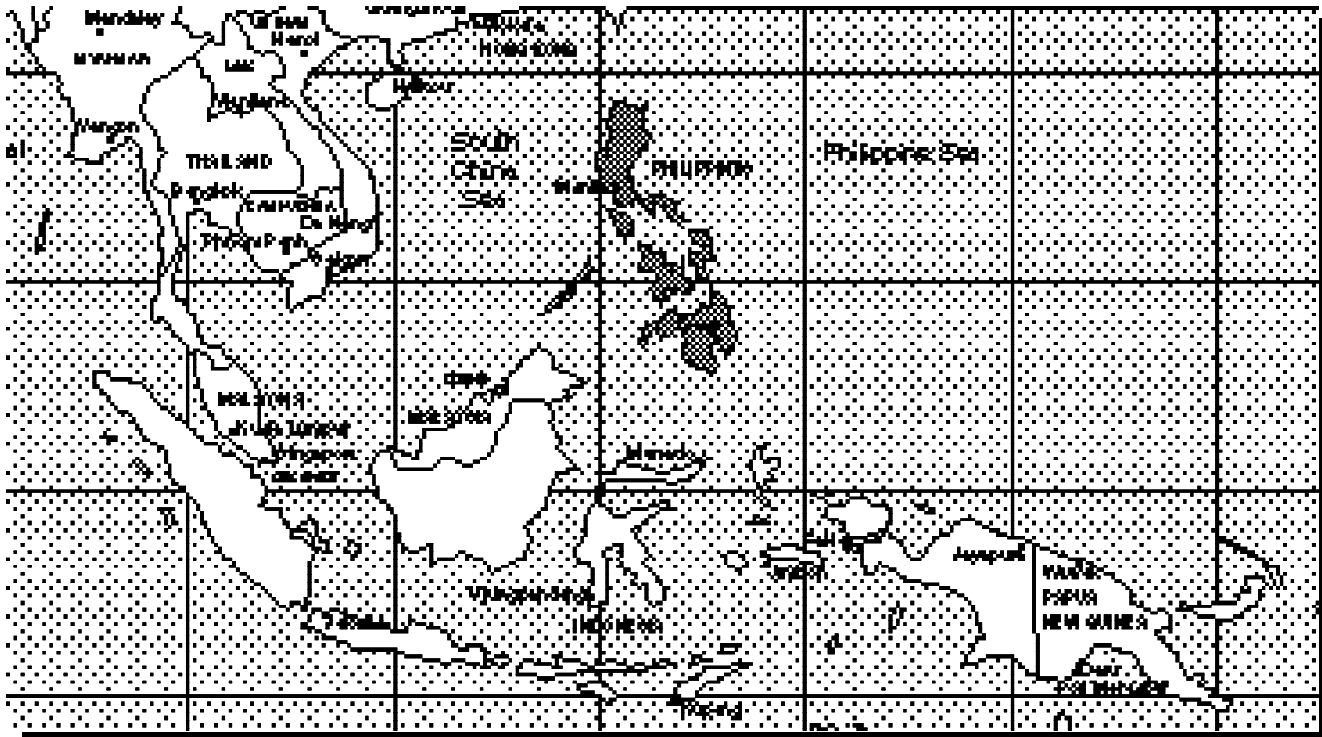
FATL cost: <\$200,000

CONVENTIONS

For the entire 1994 profile series all dollar values have been adjusted to 1990 U.S. dollar levels unless otherwise specified. Inflation and exchange rates were derived from the U.S. Department of Labor's Consumer Price Index and the U.S. Federal Reserve's foreign exchange rates.

The Results Center uses three conventions for presenting program savings. **ANNUALSAVINGS** refer to the annualized value of increments of energy and capacity installed in a given year, or what might be best described as the first full-year effect of the measures installed in a given year. **CUMULATIVE SAVINGS** represent the savings in a given year for all measures installed to date. **LIFECYCLE SAVINGS** are calculated by multiplying the annual savings by the assumed average measure lifetime. **CAUTION:** cumulative and lifecycle savings are theoretical values that usually represent only the technical measure lifetimes and are not adjusted for attrition unless specifically stated.

Country Overview



The Philippines was named after King Philip II of Spain in the 1500s after the region was claimed by Ferdinand Magellan in 1521. Although the Philippines are composed of 7,000 islands, eleven major islands make up 94% of the nation's land mass of 299,000 square kilometers. The Filipinos are a Malay people, closely related to the inhabitants of Malaysia and Indonesia. The population of the Philippines is approximately 65 million and growing quickly.

After more than three centuries of Spanish rule, the Filipinos, fighting side-by-side with American soldiers, ousted the Spaniards following the Spanish-American War of 1898. The Philippine Republic declared its independence at that time but the United States refused to relinquish its new-won territory and forcibly took control of the island nation. The U.S. governed the Philippines for the next half a century except for a brief period during World War II when the country was overrun by the Japanese. In 1946, shortly after the American defeat of the Japanese, the U.S. gave the Filipinos full independence. During the 1950s and 1960s, the Philippines had one of the more prosperous national economies in Southeast Asia. Ferdinand Marcos took control of the country in 1965. In 1972, he declared martial law and the Philippines entered an era marked by corruption and general public discontent.

In 1983, Marcos' political foe, Benigno Aquino, was assassinated and the country entered a period of sharp and pro-

nounced public opposition to Marcos. Seeing his power seriously threatened, Marcos called for a national election in 1986 that he hoped would legitimize his rule. Marcos' chief opposition in the election was Aquino's widow, Corazon Aquino. The election results were unclear. Both Marcos and Aquino claimed to have won but after dramatic shows of support for Aquino, Marcos fled the country. Aquino then became President for a six-year term, providing hope for the masses while barely surviving several coup attempts as the country experienced a dramatic economic downturn. At the end of her term, Fidel Ramos, a former general in the army, was elected President in 1992. By 1994, the Philippines' economy began to grow rapidly, with an annual growth rate of 5.5%, countering a negative growth rate from 1980-1991, providing economic opportunity for the country and making the Philippines once again a formidable trading partner in the region.

The National Power Corporation (NPC), a nationally-owned power generation utility established in 1935, generates and transmits power throughout the country. While NPC's power plant nameplate capacity was 6,949 MW in 1992, actual power output was a fraction of this. NPC's energy sales in 1992 totaled 22,981 GWh, representing a national load factor of approximately 38%. In 1992 one-half of the power generation was oil-fired with other main sources being hydroelectricity and geothermal energy. While still highly dependent on oil, the Philippines possess abundant geothermal resources. In

Country Overview (continued)

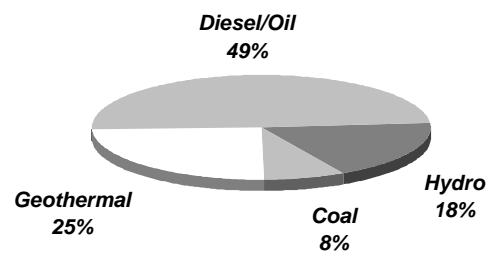
addition to geothermal resources, the Philippines has also recently discovered significant natural gas reserves.

As it attempts to reduce the nation's oil dependency, the government is also seeking to bring electricity to more Filipinos, a program seen as a precursor to sustained economic growth and development. Marcos established the National Electrification Administration in 1969 and by 1992 49% of Filipino households were electrified. Under Ramos' presidency, that level that is projected to reach 74% by the year 2000. One of the key challenges to electrification in the Philippines is the dispersed population on the many islands and the discontinuous electricity grid.[R#9]

From 1935 until 1987, NPC was the sole supplier of power in the nation. In 1987 Aquino revoked the decree that had given NPC monopoly status, opening up the market to competition and independent power production. Not only was this a significant structural change, but the cancellation of the 620 MW Morong nuclear power plant coupled with delayed construction of other baseload plants, threw the country into a serious capacity shortage. Other factors that culminated in serious blackouts in 1992 and 1993 were prolonged droughts that limited hydroelectric output, breakdowns at poorly maintained power plants, and the inability of NPC to raise rates to enable it to maintain plants and finance new investments. In Metro Manila, the nation's largest population center, blackouts often

Electricity is distributed to end-users by the large, investor-owned Meralco (Manila Electric Company, formerly known as the Manila Electric Railroad and Light Company), smaller investor-owned utilities such as Cepalco, and 120 rural electric cooperatives. Given the high level of dependence on imported oil, industrial and residential electricity rates in the Philippines are among the highest in Asia. Meralco's average rate in 1991,

1992 PHILIPPINES ELECTRICITY GENERATION



for example, was 9.43 ¢/kWh. Residential rates were well over ten cents per kilowatt-hour. (While the exchange rate between Philippine pesos and U.S. dollars has varied over the years, for the past three years the rate has remained relatively constant at approximately 25 pesos/dollar, the exchange rate used throughout this profile.)[R#34]

THE PHILIPPINES 1992 ELECTRICITY DATA	INSTALLED CAPACITY (MW)	PERCENT OF TOTAL CAPACITY	ENERGY (GWh)	PERCENT OF TOTAL OUTPUT
Hydro	2,257	32%	4,252	18%
Coal	405	6%	1,791	8%
Geothermal	888	13%	5,700	25%
Oil/Diesel	3,399	49%	11,238	49%
Total	6,949	100%	22,981	100%

lasted 6-8 hours and sometimes for as long as 12 hours. The unreliability of the power system threatened businesses and blocked significant foreign investments in the Philippines, curtailing economic development and stifling the rise of an effective democracy in the country. By 1994, however, and thanks to the highly competent leadership of the President of NPC, now the Secretary of Energy, the blackouts were virtually eliminated.[R#9]

The climate of the Philippines is characterized by hot and humid weather that reaches the pinnacle of its intensity in April and May of each year. Hot summers in the Philippines amplify the need for air conditioning, especially in Metro Manila, a city with a population greater than ten million and which is marked by heavy traffic jams and relentless air pollution. Air conditioning remains a luxury in the Philippines and thus far has penetrated less than one percent of the country's population.

The Residential AirCon Standards and Labeling program has been a joint initiative between several government entities and the private sector. Additionally, electric utilities in the Philippines have been supportive of the program, though they have played only a small direct role in the program to date. Within the government, two key agencies have been involved: the Department of Energy (DOE) and the Department of Trade and Industry (DTI), in particular its Bureau of Product Standards (BPS). At DOE, the program has been managed by the Fuels and Appliance Testing Laboratory (FATL).

While formally sponsored by the government, the AirCon program is the product of a great deal of industry participation and cooperation, largely conducted under the auspices of the Philippine Association of Home Appliance Manufacturers (AHAM), the national trade association of home appliance manufacturing and assembly companies. Supplementing the involvement of AHAM's secretariat, the organization's members have participated in the Technical Committee that envisioned, developed, and refined the program. This committee has also benefited from the participation of academic and non-governmental organizations.

DEPARTMENT OF ENERGY

In 1977, the Philippine Ministry of Energy was established, primarily in response to concerns about dependence on imported fuels. After the change in political leadership in 1986, as part of the government reorganization, the Ministry of Energy was replaced by the Office of Energy Affairs (OEA). The office was headed by an Executive Director and was placed in the Office of the President of the Philippines. In December 1992, the Office of Energy was transformed into the current Department of Energy.

DOE and its predecessor agencies have implemented a number of energy efficiency initiatives including the standards and labeling program that is the focus on this Profile. DOE has provided information and technical assistance for a variety of energy users in the Philippines. The Department's programs range from the general to targeted awareness-building campaigns – including a rather exciting Energy Bus that took its energy efficiency message on the road – to a sophisticated technical assistance/financing program. DOE's programs have served all sectors of the economy in both the retrofit and new construction markets, have been fuel-neutral (fostering thermodynamic efficiency rather than favoring electricity over oil or gas), and have promoted changes in industrial processes to maximize productivity while minimizing energy inputs per unit of the gross domestic product.

SELECT DOE ENERGY EFFICIENCY PROGRAMS

Energy Bus
Power Patrol
Residential AirCon Standards & Labeling
Commercial Building Energy Code
Industrial Audits & Training Program
Energy Efficient LPG-fired Model Kiln
Technology Transfer for Energy Management

Power Patrol: One of the most recent programs that DOE has initiated is Power Patrol. The program was launched in December of 1993 in Manila and is an information and educational campaign for residential, commercial, and industrial users though its focus has been primarily on the residential sector. There the program has generated a good deal of attention by working with students and increasing their awareness of energy use as well as means to conserve energy. The program has been training grade-school students how to read electric meters. A "report card" has been developed that provides a means for students to monitor their home electricity consumption, tips on how to conserve, and a feedback mechanism to track the program. Already a million and a half cards have been distributed to school children and a half a million students show average household savings of 5.6%. [R#2,28]

Commercial building energy code: Like many of their Association of Southeast Asian Nation (ASEAN) partners, the Philippines has been very keen on establishing a commercial building energy efficiency code. The Philippines adopted a code which was supposed to take effect in January of 1994 but so far has not been enforced. In fact, of the ASEAN nations only Singapore has engaged an enforceable code for both new and existing buildings.

In the Philippines, the Department of Energy developed the mandatory code for new construction. In turn, the Department of Public Works and Highways was given the responsibility and authority for its implementation and enforcement. Provided the Public Works Department does move the code forward, DOE will have an ongoing responsibility to conduct and facilitate workshops for architects and building owners and to assist Public Works with the technical aspects of monitoring the program.

Agency Overview (continued)

Industrial audits and training programs: Since 1979 the DOE has offered technical assistance to industries in the form of auditing and training for energy-efficient practices. Industrial auditing has been supported by the German government and has resulted in technical audits of over 700 industrial companies. While DOE has not been able to fully assess or evaluate the result of these audits, one encouraging follow-up survey of ten customers found that they had implemented 60% of the measures recommended. Another DOE analysis found that DOE's auditing activities have played a key role in creating approximately \$8 million of energy-efficient retrofit activity annually. [R#2]

The industrial audits have been important in identifying opportunities for efficiency; training sessions supported by the DOE have been instrumental in bolstering the capabilities of industries, equipment vendors, engineering firms, and other trade allies regarding the implementation of energy efficiency and assuring that efficiency measures put in place actually achieve durable savings. To carry out its mission with training, DOE works closely with trade allies such as the Energy Managers Association of the Philippines, the National Engineering Center, universities, and non-governmental organizations (NGOs).

Energy Efficient LPG-Fired Model Kiln: An interesting program supported by the German GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) involved developing an energy-efficient kiln for firing ceramics. Typically such kilns utilize electric resistance heaters that draw 50-150 kW or which use liquid petroleum gas (LPG). The Office of Energy Affairs with German consultants recognized the potential to improve the efficiency of the kilns to save energy, lower manufacturing costs, and potentially improve firing processes. In cooperation with the Philippine-German Rational Use of the Energy Project of the OEA and the European Communities Project for the Department of Trade and Industry, an energy-efficient kiln was developed as a demonstration. The result of the project was a gas-fired kiln that could be built using locally available materials at zero marginal cost when compared to electric models in use, 60% less cost than available gas models, and which cost 40-80% less to fire than models that were available at the time. In addition, the kiln developed was capable of firing fine porcelain and other ceramics that had not been possible through conventional models. Other features of the design included lower maintenance costs, since resistance heating wires would not have to be replaced. Furthermore, the gas-fired units allowed for more reliable operations since the country was experiencing frequent

power failures. As a result of the project the public was invited to examine and replicate the design. [R#14]

Technology Transfer for Energy Management: While industrial energy audits and training sessions form the core of current DOE industrial initiatives, there is no question that a pinnacle of DOE's industrial energy assistance came towards the end of the past decade when the DOE administered the highly successful Technology Transfer for Energy Management (TTEM) pilot program. TTEM not only provided audits and other forms of technical assistance to industrial customers, but also backed these services with financing made possible through a grant from the United States Agency for International Development (USAID). Through the demonstration program \$1.8 million was lent out; when collected with interest some \$2.6 million was returned to the Bureau of the Treasury earmarked for subsequent projects through a revolving fund mechanism.

At the core of TTEM was a rather sophisticated financing mechanism. USAID provided the initial seed money for the program to the Central Bank of The Philippines which in turn provided capital on an as-needed basis to regional banks that Central Bank had accredited for the program. From the customer perspective, projects approved by the DOE were eligible to TTEM funding at variable rates which ranged from 14-24% for loans with five-year terms. TTEM began in 1988 and by the end of 1990 had lent out all the demonstration program's resources. Unfortunately, at that point the program was prematurely aborted despite its success.

By 1995, all the TTEM outstanding loans have either been repaid or are reaching their loan durations. The program has experienced no defaults and all the money has been paid back with interest to the Bureau of Treasury. Clearly the loan mechanism, despite its relatively high rates, was successful. DOE officials suggest that providing technical assistance, coupled with financing, was the key to the program's success. Given the positive track record of the pilot program coupled with the fact that the money originally lent has been repaid and is dedicated to future initiatives, DOE is working to establish and institutionalize a similar program. [R#2]

It is within this context of DOE's array of energy efficiency initiatives and programs that the Residential AirCon Standards and Labeling program was developed and launched, a program that now is among DOE's best examples of energy efficiency in the Philippines.

Program Design and Delivery

AIRCON ANNUAL SALES VOLUME	WINDOW TYPE UNITS <12,000 kJ/hr	PERCENT OF TOTAL SALES VOLUME	WINDOW TYPE UNITS >12,000 kJ/hr	PERCENT OF TOTAL SALES VOLUME	TOTAL
1988	1,873	4%	40,683	96%	42,556
1989	17,409	36%	31,514	65%	48,923
1990	13,203	24%	42,679	77%	55,882
1991	17,668	40%	26,573	60%	44,241
1992	18,346	35%	34,311	65%	52,657
1993*	46,188	70%	19,590	30%	65,778
1994*	67,627	75%	23,024	25%	90,651
Total	182,314		218,374		400,688

*The threshold for 1993 and 1994 between small and large units is 13,000 kJ/hr

THE PHILIPPINES AIR CONDITIONER MARKET

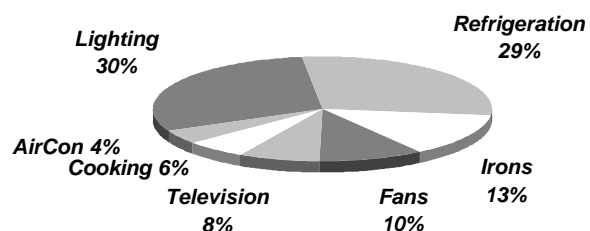
Given the Philippines' hot and humid climate, air conditioning is an extremely popular commodity. Since 1975, annual sales of residential air conditioners have increased by a factor of three, from 30,000 units to over 95,000 units. This figure is small compared to that of Thailand (with a population of 57 million), where 400,000 air conditioners are sold annually. The average Thai, however, earns more than twice as much as the average Filipino (\$1,570 per year compared to \$730 per year) making air conditioners affordable to a larger segment of society. In the Philippines, the cost of an aircon unit is roughly equivalent to an average annual income and thus are luxury items that few can afford. This is changing rapidly. Bolstered by a more robust economy than the country has enjoyed in many decades, aircon sales are projected to grow by over 20% per year for the foreseeable future.[R#23]

In 1991, a survey of household energy consumption (HECs) commissioned by the United Nations Development Program and The World Bank found that 65% of households have electricity, up from 54% in 1987. (Note that this is a much higher estimate than that reported by the Philippine Department of Energy in 1993.) Furthermore, the survey found that only 0.6% of the estimated 11.2 million households in the Philippines had air conditioners in 1989. HECs found that in rural areas there was a 0% saturation of air conditioning. This figure rose to 0.7% in "other urban" areas and to 2.5% in the National Capitol Region (NCR), the province encompassing metropolitan Manila. Compared with the penetration in the residential sector of

lighting (51%), refrigerators (19%), black and white televisions (25%), color TVs (12%), irons (34%), and fans (32%), the penetration of air conditioning units remains low.[R#24]

The study also found that air conditioning was not a large factor in energy consumption in the Philippine residential sector. Of the 6,845 GWh consumed in this sector in 1989, the biggest end-use was lighting (1,942 GWh), followed by refrigeration (1,846 GWh), irons (856 GWh), fans (649 GWh), television (487 GWh), cooking (374 GWh), and then air conditioning (265 GWh). The 265 GWh consumed by air conditioners represent 3.9% of total residential electricity use.[R#24]

1989 RESIDENTIAL ELECTRICITY CONSUMPTION

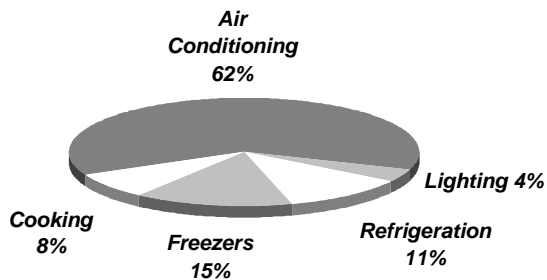


On the other hand, when analyzing those households that have air conditioning, average monthly electricity consumption for this end-use is much larger than for any other end-use. For those households with air conditioning, HECs found

Program Design and Delivery (continued)

that the average monthly energy consumption was 356 kWh, fully 62% of the total, compared to lighting (22 kWh), refrigeration (65 kWh), freezers (83 kWh), and cooking (44 kWh). Given the energy intensity of air conditioners – a situation exacerbated by a distinct lack of insulation in the Philippines – DOE sought to transform the market towards energy efficiency prior to the adoption of the technology by a greater percentage of the population. While air conditioners are relatively expensive in the Philippines, and the costs of operating air conditioners is also a barrier to their widespread adoption, they are one of the most desired appliances in the residential sector with refrigerators and televisions. Furthermore, DOE identified air conditioners because their use coincides with peak power demand. [R#6,23,24]

1989 RESIDENTIAL ELECTRICITY CONSUMPTION (homes with aircon units)



There are two kinds of residential air conditioners in use in the Philippines: window-type units similar to those commonly found in the United States, and “split systems.” Split systems are essentially bisected air conditioners in which the condenser unit that vents heat from the home is located outside and the evaporator that provides coolth to occupants is located inside. Split systems are almost universally used in Japan and Thailand but account for only 20% of the residential air conditioners in the Philippines.

While split systems are more expensive to purchase than window-type air conditioners, they can be installed in a broader range of applications and can provide coolth deeper into nar-

row homes and apartments. They can also be mounted on walls and ceilings and do not take up precious window space. Moreover, “splits” are quieter since their rather noisy condensers are far from inside evaporator units, nor are they relegated to positions along outside walls. Split systems are generally 10-15% more efficient than their window-type counterparts since their bigger condensers reject heat more efficiently. On the other hand, split systems are more expensive to purchase and can be 2-3 times as expensive to install because of the need to hook up both refrigerant and electrical lines. [R#5,10,17]

Small businesses also provide a market for residential-scale air conditioners. These businesses purchase as many as 25% of the annual sales volume of such units in the Philippines. While most medium- and large-sized buildings have central air conditioning, some small units are also used in supplemental applications, such as to cool a room or two at night or on weekends when it would be inefficient and expensive to operate the central system. [R#5,23]

In the Philippines, the Association of Home Appliance Manufacturers (AHAM) represents the manufacturers and installers of air conditioners. AHAM projects a 20% annual growth rate for air conditioners. Currently, AHAM does not foresee a time at which air conditioner unit sales will plateau. At some point, the growth of air conditioner sales will exceed the spending potential of the country’s residents, but currently this is not perceived as an issue by AHAM or its members. In fact, sales in 1993 and 1994 were even more robust than projected. In 1993, annual sales of window-type air conditioners were 25% higher than 1992 levels; while split system sales jumped by 43%. In 1994, sales of window-type units increased by 38% (with the greatest growth in the large sized window-type air conditioner market) and split systems sales rose by 23%. [R#5,23]

PROGRAM HISTORY

In 1980, shortly after the global oil shocks of the 1970s, the Philippine government passed the Energy Conservation Law. The law sought to reduce the country’s vulnerability to international fluctuations in oil prices and to lessen the burden of oil imports on the country’s limited finances. The resulting policy called for diversifying the country’s energy sources and

maximizing the use of indigenous energy resources. Concurrently, the government began to examine how to improve the energy efficiency of products, equipment, and processes. To lead this broad-based initiative the Office of Energy Affairs (OEA) was established. In addition, the law identified several specific programs to pursue including setting standards for energy consumption of oil-powered and electrically-driven machinery and equipment and energy labeling.

As part of this massive effort the air conditioner standards and labeling program was conceived in 1983. In that year, the government identified room air conditioners, refrigerators, and fluorescent lamp ballasts as priority equipment for such a program based on the magnitude of potential energy savings from these appliances and their contribution to peak load. The OEA gave high priority to air conditioners because the demand for air conditioners represented one of the most dramatic areas of increased demand for electricity in the residential sector.

Thanks to funding from the United Nations Development Program (UNDP) and the assistance of the United Nations Industrial Development Organization (UNIDO), the Philippines was able to support the development of standards and later labeling through the development of the Fuels and Appliance Testing Laboratory discussed in the next section.

At the time that the AirCon program was conceived there were five local manufacturers and assemblers of residential aircon units in the country. (Several manufacturers also served and continue to serve as equipment manufacturers for other name brand models.) OEA recognized that transforming the market would require working closely with these manufacturers. But the timing couldn't have been worse. Just as the program was conceived, the end of the Marcos regime took place and the government was subsequently reorganized. When President Aquino replaced President Marcos the entire Philippine economy slowed and the program was abruptly halted. All but one aircon manufacturer closed their factories by 1987 and Concepcion Industries, the loan manufacturer, requested that the program be stopped. Concepcion claimed that it would be difficult to meet any standards that would require it to invest in retooling, causing further hardship and potentially causing the firm to have to lay off more employees. To allay pressure on

Concepcion, and to support the company during this time of extreme duress, the program was effectively halted though research continued.

PRODUCT CERTIFICATION

While the development of standards and labeling were significantly delayed by the changes in the Philippine government, the OEA used this period to develop a solid foundation for the program. OEA recognized the importance of developing means to test the efficiency of air conditioners and to develop test standards that would be agreeable to manufacturers. In 1986, it began to test air conditioners in order to certify that they met the specifications on their nameplates in terms of power consumption and cooling capacity delivered. Several tests were conducted in 1986 and 1987 prior to Concepcion's request to terminate the program and testing continued in the absence of a standard or labeling component. OEA's goal was to validate the efficiency of every air conditioner sold in the country and to do so in an objective and rigorous manner. This would serve as the backbone to the subsequent efforts with standards and labeling.

By 1987 the Philippine economy was gaining strength. As several domestic aircon manufacturers revitalized their operations and imported air conditioning units entered the market, the AirCon program again began to take shape. To bolster the program and to get the important "buy-in" of the private sector, the Office of Energy Affairs invited manufacturers into an inquiry process. Consultation meetings lasted nearly five years as government and industry sought to establish consensus on standards. A Technical Committee charged with developing the program was formed with representatives from government and industry.

In 1991, OEA's Fuels and Appliance Testing Laboratory was formally inaugurated as the country's first independent testing laboratory dedicated to energy performance testing of household appliances. As the test facilities were refined for air conditioners, staff simultaneously began to determine the energy consumption, energy efficiency, and other test parameters for additional end-uses such as refrigerators and lamp ballasts. In fact, OEA planned to use the aircon standards and labeling program concept for a range of appliances. ☞

Program Design and Delivery (continued)

STANDARDS DEVELOPED

In 1992, after considerable negotiation between the public and private sector, the program was beginning to reach fruition. Consensus was reached not only on an agreeable test procedure but also on a two-tiered plan for minimum standards as well as a labeling program. The Technical Committee intended for the standards to go into effect in 1993. After a memorandum of understanding was signed and the implementation guidelines were approved by the Technical Committee, the standards were officially approved by the Department of Trade and Industry and its Bureau of Product Standards. The Philippine National Standard (PNS) 396 had been formally adopted.

For the purposes of the AirCon program, residential air conditioners are classified in two categories based on their output using a threshold capacity of 12,000 kilojoules per hour. Small and medium-sized air conditioners generally consume less than 12,000 level kJ per hour; large units consume 12,000 kJ per hour or more.

Fundamental to the program was the development of an energy efficiency ratio (EER) used to measure the energy efficiency of air conditioners. The Philippines chose a ratio similar to EERs used commonly in the United States. The EER is defined as the quotient of the cooling capacity in kilojoules per hour divided by the electrical power input in watts. It provides a simple to understand measure of the relative efficiency of various sized air conditioning units. Different EERs were established for the two-tiered standards and for the two class sizes being considered.[R#13]

After substantial debate a compromise on the first-tier standards was reached in July 1992. On July 15, 1992 the parties to the process signed the Memorandum of Understanding and the Implementation Guidelines. Shortly thereafter actual testing of room air conditioners was begun at the Fuels and Appliance Testing Laboratory. Labeling began in April 1993.

The first-tier standards required aircon units consuming less than 12,000 kJ per hour to achieve minimum EERs of 7.9; those consuming 12,000 kJ per hour or more needed to achieve a minimum EER of 7.4. FATL staff estimated that at the time that

the agreement was reached, half of the smaller-sized units sold met the standard while half did not. Staff also suggest that none of the larger units met the standard though their manufacturers were certain they could attain the level. Under the terms of the agreement, by January 1994, all units sold would have to meet the minimum standards. Thus manufacturers had nearly one and a half years to comply and to eliminate their inventory of non-complying air conditioners.[R#1,6,9]

AIRCON STANDARDS (EER)	1994	1996
<12,000 kJ/hr	7.9	8.3
>12,000 kJ/hr	7.4	7.8

Currently the standards and labelling program does not apply to split systems. Manufacturers can voluntarily use labels to market these systems, providing them with a competitive advantage in the absence of a formal requirement to do so, but to date have not been required to test and certify the split systems.

The program design also called for second tier standards to ratchet the minimum standards upwards. Originally, DOE intended for the standards efficiency component to rise by 5% across the board between 1995 and 2000. Manufacturers of small-sized AC units were prepared for this increase well before January 1995. In fact, all the units with cooling capacities less than 12,000 kJ per hour already met the proposed standard of EER 8.3. Concepcion Industries even urged the Technical Committee to increase the required average efficiencies by 10%. With respect to larger units, however, other manufacturers asked that the proposed minimum standards of 7.8 – representing a 5% efficiency gain – be deferred by one year until 1996, a provision that was granted by the Technical Committee.

ENERGY LABELING

The second feature of the AirCon program is labeling. Although the standards and labeling components of the programs are inextricably intertwined, standards set floors for energy efficiency while labeling provides the means for educat-

ing consumers about the relative efficiencies and operating costs of various units. By educating consumers, labeling serves to create competition between manufacturers. Air conditioners with the best energy efficiency ratings and the most competitive costs will likely sell the most units. Thus, labeling not only forces manufacturers to comply with a baseline of efficiency, it also encourages them to seek increased market share by improving their products while holding their costs down.

Key to the labeling component is a bright yellow label. The label is printed by the manufacturer but must be validated by the Department of Energy through its Fuels and Appliance Testing Laboratory. Manufacturers are required to send printed labels to the lab that, provided the test unit meets the EER rating claimed by the manufacturer, are then certified by FATL. After receiving certification, FATL sends the labels back to the manufacturer which then must prominently display them on the front of each of their products to provide information to consumers at the time of purchase.

The labeling component of the program was begun in October 1993. At that time, the program was just beginning and was essentially voluntary. In January 1994, the labeling provision became mandatory for window units consuming less than 12,000 kJ per hour. Window-type air conditioners larger than 12,000 kJ per hour were required to carry labels a few months later.

STAFFING REQUIREMENTS

The personnel required to carry out the Residential AirCon Standards and Labeling program come from variety of organizations, with principal participants from FATL, DOE, BPS, DTI, and AHAM. Manufacturers must also devote considerable staff time to redesigning their products to meet or exceed the standards. In addition, the Technical Committee guiding the program was made up of representatives from each of the organizations listed above, and from engineering societies, non-profit groups, and academic institutions.

The program startup involved nearly three dozen staff and is now implemented by about a dozen full-time equivalent staff. The project also benefited from the insights of Dr. Albrecht Kaupp. Dr. Kaupp, the Chief Technical Advisor to the Philip-

pine Department of Energy for three years and a resident specialist for eight years, was a Technical Adviser for the project. Furthermore, Mr. George Yamamoto, Vice President of Energy Technology Laboratories of New York, and Mr. Norval Jackson, a UNDP Technical Adviser, provided support to the establishment of FATL and consequently to the energy labeling program.

DUTY-FREE SHOPS CREATE AN UNUSUAL TWIST

One of the unusual challenges of the Philippines AirCon program is the existence of duty-free shops. Unlike duty-free shops around the world that are located in airports and generally sell commodities such as perfumes and liquor, duty-free shops in the Philippines are found in other locations such as Subic Bay, dating back to the days of a pronounced U.S. military presence in the Philippines. These duty-free shops sell a wide variety of goods, including appliances such as air conditioners. In fact, 5% of all residential air conditioners sold in the country are sold through duty-free shops.[R#1]

Until recently, air conditioners sold in these venues were not required to meet the standards and labeling program specifications. Filipino consumers, who can purchase up to \$1,000 per year in duty-free goods (foreigners are entitled to \$2,000 per year) and who desired to purchase the least expensive air conditioners available, purchased them at these shops. This created a serious loophole in the air conditioner standards and labeling program. It was also a source of unfair competition for domestic manufacturers who were forced to comply with the minimum efficiency standards. DOE, not surprisingly, wanted to close this loophole.

In 1994, the Bureau of Product Standards convinced the manager of Duty-Free Philippines to comply with the AirCon program. Importers are now required to submit their models to DOE's Fuels and Appliance Testing Laboratory. To date, eight importers have submitted their units for testing, boosting the effectiveness of the AirCon program.

Product Testing and Certification

Product testing and certification is the backbone of the Residential AirCon Standards and Labeling program. Without a rigorous protocol for testing air conditioners and an independent facility to objectively carry out this essential function, the program would not only lack credibility but would have no basis for enforcement. As such, the Office of Energy Affairs, with the support of the United Nations Development Program, created the Fuels and Appliance Testing Laboratory (FATL) which was given the responsibility to measure the actual power consumption of window-type air conditioners and to rank their efficiency.[R#1,28]

In 1983, UNDP approved the Philippine government's request for a grant for the Industrial Energy Management Consultancy and Training project. As part of this project, UNDP and the United Nations Industrial Development Organization assisted in the establishment of FATL. This not only included procurement of the latest laboratory testing equipment but also involved sending staff to recognized laboratories abroad for training in energy testing of fuel products and appliances and in calibration. In addition, competent local and international consultants were hired for the design of various test facilities. Approximately \$3 million of support was provided in two phases to build these capabilities in the Philippines.[R#10,30]

The Philippine government, for its part, provided the funds for the construction of the buildings to house FATL. The first building was completed in 1986 and now houses the test modules for room air conditioners, refrigerators, lamp ballasts, and fuel products. A second building was constructed in 1991 to provide space for instrumentation, a control study station, and meeting function rooms. In June of 1991 FATL was officially inaugurated.[R#30]

While FATL is at the heart of the AirCon program, the laboratory serves several other essential functions. A major aspect of FATL's work relates to testing fuel oils and water used for industrial boilers. The lab, for example, tests the sulfur content of bunker oil used by industry to assure proper quality fuel, minimal impurities, and environmental compliance. In addition, the lab offers calibration services for both the government and the private sector, including measuring the accuracy of thermometers and other sensitive instrumentation that provide references for temperature, pressure, and electrical voltages. FATL also conducts training sessions in instrumentation and quality controls both on-site and off-site.

FATL is currently staffed by 22 professionals and support persons. Seven employees are directly involved with appliance testing in addition to the lab's director, Mirna Campanano, whose time is split between all lab functions. Two full-time staff are devoted to aircon testing and certification. The lab is now placing greater emphasis on refrigerator testing, however, given the recent duty-free shop program compliance, the lab will have more aircon units to test.

FATL staff report that it takes about one day to test each air conditioner unit at the lab according to the Philippine National Standard 396. (The lab can only test a single unit at a time.) Using carefully controlled and calibrated equipment and the International Standards Organization test procedures, FATL staff place an aircon unit in a control module that is split to simulate indoor and outdoor conditions. After stabilizing conditions, a process that takes two to six hours, a steady state is maintained and the actual efficiency test is conducted.

In designing its standard, FATL was cognizant of the issue of international standard harmonization and especially of harmonization within ASEAN nations. Not only do the ASEAN countries have similar climates, they plan to become a free-trade zone by the year 2010. In such a setting, it made sense to develop consistent codes. Such codes, however, are often elusive.

The procedure that FATL chose is in accordance with the Philippine National Standard and was adopted from the International Organization for Standardization. Testing procedures are necessarily adapted for specific countries, so minor modifications appropriate to the Philippines tropical climate were made. FATL's refrigerator test procedure is based on the U.S. ANSI/AHAM standard. The International Electrotechnical Commission standards (that are in use with minor variations throughout Europe and Asia) are used for other electrical appliances.

While a time-consuming process – made clear by the usual backlog of aircon units waiting to be tested – FATL officials insist that it is essential that the lab maintains the highest degree of accuracy. It is also essential that the lab remains unbiased so as not to jeopardize the program's credibility. Challenged by concerned manufacturers, staff have spent a good deal of time proving the center's efficacy. They understand the lab's legal responsibility and that the lab can be sued by manufacturers if test results are questionable or procedures found negligent.

The importance of such rigorous testing was made clear when a manufacturer questioned FATL test results that found that a particular unit was not of sufficient efficiency to be sold in the

Philippines. At the request of the manufacturer, FATL extensively tested five of the units in question. Again, the models failed the Philippine standard. The manufacturers then sent several teams of testing experts to FATL to assess the facility, its operators, and the accuracy of the calorimeter in particular. Each team of outside investigators left satisfied with FATL and its ability to serve as an objective foundation for the program. Still disappointed with the results, the manufacturer sent the model to Japan for a comparative test. Again, the unit failed the requirements of the program although it did pass the less rigorous Japanese testing protocol. Moreover, the results of the Japanese lab differed from those of FATL by less than 1%, validating FATL's technical expertise, easing the manufacturers' concerns, and allowing the program to proceed with the requisite level of confidence.

While not a modern, lavishly equipped laboratory, FATL has been able to do remarkably good work, largely a tribute to its staff and management. The lab is a low-cost facility and appears outdated but has been able to carry out high quality testing. In addition to testing and certifying appliances for the AirCon program, FATL provides technical assistance to manufacturers who do not have their own facilities. By doing so, while maintaining strict confidentiality between manufacturers, FATL can also promote efficiency at the design level.[R#10,30]

FATL's funding base has effectively shifted from international organizations to the Philippine government, providing the lab with assurance of its continued viability. For the last two years, the government has provided FATL with sufficient funds to meet its operating and maintenance expenses. Nevertheless, as the laboratory looks to the future, it sees two key needs: the ability to recover costs from its activities and to expand its testing capabilities to other products.[R#28]

To date, FATL has been constrained by an early government provision that the lab cannot profit from its activities. While the law was drafted with good intentions, the provision stifled the lab by limiting FATL's ability to recover even those costs associated with equipment depreciation and staff time. Until recently, FATL was only allowed to charge air conditioner manufacturers \$208 for testing a single unit and certifying its efficacy. This amount was intended to pay for the upkeep of the equipment and the lab operating costs directly related to the facility. Since the equipment was originally donated, the government sought to keep costs as low as possible in order to eliminate manufacturers' concerns. Recently, however, FATL was allowed to increase this charge by a factor of two, moving the testing and certification fees closer to actual values, thereby

weaning the lab from government support and dependence.

Enhanced cost recovery has been supported in the past year by a Philippine Office of President memorandum encouraging FATL to "recover all fees." The memo applies not only to aircon testing, but also to the fees that the lab charges for trainings and other services. Now that this barrier has been partially stripped away, FATL may be able to entertain innovative proposals, potentially allowing it to expand its capabilities, increase its technical sophistication, modernize its equipment, and increase its staff.[R#1,10]

Even the ability to recover the full cost of testing would not be sufficient to make FATL financially independent since the government requires that all fees that FATL charges for tests be remitted to the national treasury. FATL is not allowed to use any of its income to pay for its operating expenses. Instead, FATL must rely upon annual government appropriations. Because of the delay between budget requests and actual appropriations, FATL has had limited ability to respond quickly to requests for unprogrammed testing. FATL has to submit its budget requests more than one year in advance and is not assured of approval of the full amount requested.

The recent program tie-in with duty-free shops has allowed FATL to expand its testing of aircon units to cover imported air conditioners such as Toshiba, Amana, Sansio, Whirlpool, Samsung, Frigidaire, and Goldstar. While many of their units may already exceed the Philippine standard, it will require additional FATL testing to prove they meet the standard. In addition, manufacturers of split systems are seeking testing and labeling. Although this is still voluntary, it is a testament to the success of the program.

In addition to aircon units, FATL is now testing refrigerators for a fee and plans on expanding this capability in the coming years for proposed standards. Fans are already being tested at the lab for the Bureau of Product Standards which plans to introduce standards for fans in the future. (Fans are very common appliances in the Philippines, ranking just behind televisions and lights.) Through a study funded by the World Bank, FATL is also testing compact fluorescent lamps at different voltages to ascertain both their light output and their relative reliability at 230 and 207 volts. Already FATL has found dramatic failure rates at 207 volts, a common voltage reduction in developing countries. Beyond these projects and responsibilities, FATL is a key instigator in proposed testing programs for a range of other appliances, including refrigerators, electric fans, rice cookers, and beverage coolers.[R#1,22]

Program Savings

1993 SAVINGS OVERVIEW	NUMBER OF UNITS	AVERAGE UNIT SAVINGS (watts)	ANNUAL CAPACITY SAVINGS (kW)	AVERAGE UNIT SAVINGS (kWh)	ANNUAL ENERGY SAVINGS (MWh)
<12,000 kJ/hr	9,200	28.7	264	83.7	770
>12,000 kJ/hr	34,300	169.1	5,800	493.0	16,937
Total	43,500	--	6,064	--	17,707

DATA ALERT: Calculating the effect of standards and labeling programs is complex and is heavily dependent on assumptions. This section is intended to review estimates made by Philippine officials and to present the issues involved with such analyses. The calculations of savings are not precise. FATL's primary analysis of savings is based on figures for 1993, the year the program was expected to be launched, and is a useful proxy of the program's savings. In reality, the standards became law in 1994.

While it is difficult to assess the effect of the standards and labeling program, DOE and FATL analysts have made preliminary calculations of annual program savings based on the number of complying and non-complying units sold in 1992, the year immediately prior to the year that the standards were supposed to take effect.[R#23]

In 1992, FATL found that half of the residential aircon units sold met the standard, while half did not. Furthermore, the average efficiency of all residential air conditioners increased by 25% in a one-year period as the standards took effect. This dramatic increase can be attributed to the program, a program whose mechanism will allow for greater and greater improvements as 1) labeling creates a competition among manufacturers to sell the best and most efficient products, and 2) as the second tier of standards pushes the baseline of efficiency to even greater levels.

In 1992, FATL estimated that 9,200 units with a cooling capacity less than 12,000 kilojoules per hour met the standard EER while 9,200 did not. The units that did not meet the standard

in 1992 were required to do so in 1993. Therefore FATL assumed that the improved efficiency of the non-complying units represented the program's annual savings for 1993. On average, the 9,200 non-complying units drew 28.7 watts more than the standard allowed. Based on this figure, FATL estimated that the introduction of standards resulted in capacity savings of 264 kW (9,200 x 28.7 watts). Assuming that the units were operated for an average of six hours per day every day of the year, annual power savings per unit was 83.7 kWh (28.7 watts x 6 hours/day x 365 days/year). Annual savings for the 9,200 units totaled 770 MWh (9,200 x 83.7kWh).[R#1,6]

FATL conducted a similar analysis for air conditioners with a cooling capacity of 12,000 kJ per hour and above. In 1992, none of the 34,300 units sold met the standard, but all were required to do so in 1993. To meet the standard, per unit power requirements needed to fall 169.1 watts. Based on the same operating parameters as above, this reduction resulted in annual energy savings of 493 kWh per unit. Thus, by regulating large air conditioners, FATL estimated that the program created capacity savings of 5,800 kW (34,300 x 169.1 watts) and energy savings of 16,937 MWh (34,300 x 493 kWh). Combining the savings from both sizes of window-type air conditioners, in 1993, the program resulted in annual capacity savings of 6,064 kW and annual energy savings of 17,707 MWh.[R#1,6]

Note that the FATL analysis above does not take into account improvements at the upper end of the market, only those improvement where manufacturers were required to achieve baseline efficiencies. In fact, the program has improved the efficiency of all aircon units, those at the lower end of the scale and those at the upper end as well. Most of the manufacturers have developed products whose energy efficiency ratings are dramatically above the standards. Thus, the savings presented

in this section are only approximations of savings resulting from the minimum standards aspect of the program, while no estimates of the effect of the labeling program have been made.

Another FATL analysis suggests that, as a result of the implementation of standards, by 1993 the efficiency of all residential air conditioners sold in the Philippines increased by 25 percent. This figure translates to, on average, individual units drawing 92 watts less power and (based on the same operating patterns as above) consuming 268 kWh less energy. In 1993, according to AHAM there were 65,778 window-type air conditioning units sold in the Philippines. Thus, in sum, the program resulted in 6.05 MW (65,778 x 92 watts) of annual capacity savings and 17,629 MWh (65,778 x 268 kWh) of annual energy savings. Using the same analysis, the 90,651 units sold in 1994 resulted in annual capacity savings of 8.3 MW and annual energy savings of 24,294 MWh. Note further that these savings do not reflect any efficiency improvements from split systems, of which 4,616 were sold in 1993 and 5,714 in 1994. [R#1,6,31]

Although these savings are imprecise, they are also conservative. The program will stimulate further improvements in aircon efficiency as labeling creates competition among manufacturers to sell the best and most efficient products and as the second tier of standards pushes the baseline efficiency to even higher levels.

PARTICIPATION RATES

All manufacturers and assemblers of window-type residential air conditioners in the Philippines must meet the standards and labeling requirements of the program. Currently, there are two major manufacturers in the country: Concepcion Industries, which makes Carrier, Condura, and Kelvinator models; and Matsushita Electric Philippines Corporation, which makes National models. In addition, there are five firms in the Philippines which assemble residential air conditioners using parts imported from other countries: Philippines Appliance Corporation; Roltan Industries; Sansio; Maxim Industries; and Sanyo Philippines. All imported window-type residential air conditioners sold in the Philippines have to participate in the program, whether sold in ordinary retail establishments or duty-free shops. (Second-hand aircon units are exempt but represent a relatively small sales volume.) While labeling of split systems is voluntary, many manufacturers are interested in la-

beling these systems to take advantage of the marketing opportunities that it provides.

PROJECTED SAVINGS

Projecting savings from the Residential AirCon Standards and Labeling program is difficult for a number of reasons. In essence, the program has accelerated the adoption of energy-efficient aircon units in the Philippines. This “technology leap” arguably would have occurred eventually, raising questions about the level of savings that can be attributed to the program. In addition to this fundamental question, various projections of future savings use differing assumptions regarding the number of units sold, the weighted average of efficiency gains, hours of operation, and peak coincidence factors.

An analysis conducted by Marbek Resource Consultants for UNDP and the World Bank projects that in the year 2000, the program will have resulted in 130 GWh of cumulative energy savings (split evenly between peak and off-peak savings), 33 MW of cumulative peak capacity savings, and 11 MW of off-peak capacity. Marbek projects that in the year 2010 the program will have resulted in 322 GWh of cumulative energy savings (split evenly between peak and off-peak), 83 MW of on-peak capacity savings, and 28 MW of off-peak capacity savings. [R#31]

FATL projects that the program will provide cumulative energy savings of 262 GWh from 1993-2000 (split evenly between on- and off-peak savings) and cumulative capacity savings of 89 MW (67 MW of which are projected to be on-peak and 22 MW off-peak). In the year 2010, FATL projects cumulative energy savings of 1,120 GWh and 405 MW of capacity savings. Note that FATL’s analysis assumes a far greater sales volume than the earlier Marbek study and a faster growth in demand for air conditioners. [R#33]

A third analysis of projections, prepared by SRC International, suggests cumulative energy savings in the year 2000 of 61 GWh and capacity savings of 27 MW. This analysis, however, only considers savings above the standards that are currently in place. It assumes no savings until the year 1999 because the next tier will not be enforced until that time. In the year 2010, SRCI projects energy savings of 365 GWh and 169 MW of capacity savings. [R#32]

Cost of the Program

FATL COSTS OVERVIEW (US\$)	1994	1995
<i>Travel</i>	\$13,360	\$12,000
<i>Communication Services</i>	\$3,128	\$4,000
<i>Repair & Maintenance</i>	\$2,400	\$2,400
<i>Transportation Services</i>	\$320	\$400
<i>Supplies & Materials</i>	\$18,840	\$16,000
<i>Reproduction</i>	\$88	\$88
<i>Water and Power</i>	\$24,000	\$24,000
<i>Staff Training</i>	\$1,200	\$2,000
<i>Other Services</i>	\$24,020	\$20,400
<i>Building Costs</i>	-	\$24,000
<i>Personnel</i>	\$80,000	\$97,016
Total	\$167,356	\$202,304

Data alert: Given the relatively scant cost data available, the uncertainty of the estimates presented, the wide variations in currency exchange rates, and the uncertain time frames of expenditures, the data in this section are unlevelized.

In general, the costs of standards and labeling programs are borne by consumers who must pay more for more efficient products. These consumers, of course, also benefit from lower utility bills. For this reason, if such programs can be implemented (a function of public and political will), they are considered low-cost and highly effective. Unlike utility programs that carry rate impacts and high administrative costs, standards and labeling programs are relatively cheap to implement. Such programs represent a model that may become more and more

appropriate given the increasingly competitive utility industry that is developing in the Philippines and around the world.

Administering the AirCon program requires staff employed at DOE, BPS, and FATL. (Members of the Technical Committee, essential to the process but unpaid, are not considered here.) DOE reports 2.2 FTE assigned to the program; FATL has eight FTE staff devoted to the program; and BPS has three FTE responsible for the program including administrative support and program assessors and draws upon the services of staff at DTT's 14 regional and 90 provincial offices to monitor market-level compliance with the program. In addition, regional office staff are used to interface with the six manufacturers in the Philippines, three of which are located outside the Manila metropolitan area. In total, the program is administered by approximately a dozen professionals. [R#1,2,3,32]

While several agencies are involved with implementing the AirCon program, the bulk of its administrative costs lie with the Fuels and Appliance Testing Laboratory. Thus, this section focuses primarily on FATL's costs, examining both start-up costs and ongoing operating costs. Unfortunately, this is complicated because FATL is not only responsible for testing and certifying aircon units, but also manages several other programs, discussed earlier, whose costs are intertwined with aircon testing.

Funding for the construction of two FATL buildings was provided by the Philippine government. Grants from UNDP (totaling \$675,000 and administered through UNIDO) equipped the lab with the fuels and appliance testing equipment. Unfortunately, no breakdown of the equipment used for testing air conditioners versus that used for testing other appliances or fuels has been completed.

As the adjacent table shows, FATL's annual operating costs are between four and five million pesos (\$160,000-200,000) which includes the cost of non-aircon programs. Expenses for 1994 included \$80,000 (48 percent) for staff costs, with other large expenditures for water and power (14 percent), and other

services (14 percent) such as subscriptions, repairs of equipment, and promotional activities. The lab currently recoups nearly five percent of these expenses (200,000 pesos) through the testing of approximately 40 aircon units annually, for which it charges 5,000 pesos per unit. For 1995, the number of units tested is expected to increase to 60 due to an influx of imported units. Income will rise when the lab is allowed to increase its fee for aircon testing. FATL also charges fees for refrigerator testing, the various seminars that it conducts both on-site and off-site, fuel testing, and equipment calibration services. [R#1,10]

COST TO CONSUMERS

Compared to the developed world, the Philippines is a relatively poor country and thus only a small percentage of households can afford to purchase an aircon unit. While more common in metropolitan Manila, in some rural areas the saturation of air conditioners has been estimated to be as low as 0.6 percent. Not only are air conditioners expensive to purchase, but they are expensive to operate. [R#18,24]

The average window-type air conditioner in the Philippines costs 15,000 to 20,000 pesos (\$600-800). The least expensive units – also those with the least cooling capacity – cost roughly 11,000 pesos (\$440). One manufacturer suggests that the marginal cost to the manufacturer for more efficient units is five to ten percent. Thus if we assume an average retail cost of \$600 and assume that the manufacturer passes all of the marginal cost on to consumers, the average cost of an aircon unit will rise to \$630-660, an increase to consumers of \$30-60. Marbek assumed a \$48 average marginal cost per unit. [R#18,19,31]

COST EFFECTIVENESS

Calculating the cost effectiveness of the Aircon program is somewhat problematic. Essentially the program has accelerated the adoption of energy-efficient window air conditioners in the Philippines. How much this process has been acceler-

ated and will be accelerated above normal market forces, however, is uncertain. As such, any analysis of the program's cost effectiveness is based on a series of questionable assumptions that certainly cannot be transferred to other countries or jurisdictions without a similar overlay of region-specific assumptions.

The program's benefit/cost ratio can be viewed from a number of perspectives and was analyzed in November of 1994 by SRCI International Pty Ltd along with International Institute for Energy Conservation (IIEC) and others as part of an analysis for the Philippines Department of Energy and the Asian Development Bank. What the analysis found was that if utilities were to get financially involved in the promotion of the program (internalizing relatively small expenditures when assessing their benefits) their B/C ratio would be 94.6, indicating very low cost and major system benefits. From a rate impact perspective, the B/C ratio has been calculated to be 0.77 indicating that the program would cause rates to rise slightly (projected to be 0.259 ¢/kWh) over the life of the program because of rather significant revenue losses. From the participant's perspective, the program's B/C ratio is 9.71 while both the total resource cost and societal cost tests resulted in benefit/cost ratios of 6.47. [R#32]

Environmental Benefit Statement

AVOIDED EMISSIONS: Based on 17,707,000 kWh saved in 1993

<i>Marginal Power Plant</i>	<i>Heat Rate BTU/kWh</i>	<i>% Sulfur in Fuel</i>	<i>CO2 (lbs)</i>	<i>SO2 (lbs)</i>	<i>NOx (lbs)</i>	<i>TSP* (lbs)</i>
Coal						
Uncontrolled Emissions						
A	9,400	2.50%	38,176,000	906,000	183,000	18,000
B	10,000	1.20%	40,708,000	351,000	118,000	88,000
Controlled Emissions						
A	9,400	2.50%	38,176,000	91,000	183,000	1,000
B	10,000	1.20%	40,708,000	35,000	118,000	6,000
C	10,000		40,708,000	234,000	117,000	6,000
Atmospheric Fluidized Bed Combustion						
A	10,000	1.10%	40,708,000	107,000	58,000	29,000
B	9,400	2.50%	38,176,000	91,000	73,000	5,000
Integrated Gasification Combined Cycle						
A	10,000	0.45%	40,708,000	72,000	12,000	29,000
B	9,010		36,618,000	26,000	9,000	2,000
Gas						
Steam						
A	10,400		22,205,000	0	51,000	0
B	9,224		19,283,000	0	121,000	6,000
Combined Cycle						
1. Existing	9,000		19,283,000	0	74,000	0
2. NSPS*	9,000		19,283,000	0	35,000	0
3. BACT*	9,000		19,283,000	0	5,000	0
Oil						
Steam--#6 Oil						
A	9,840	2.00%	32,138,000	487,000	57,000	55,000
B	10,400	2.20%	34,086,000	483,000	72,000	35,000
C	10,400	1.00%	34,086,000	69,000	58,000	18,000
D	10,400	0.50%	34,086,000	203,000	72,000	11,000
Combustion Turbine						
#2 Diesel	13,600	0.30%	42,656,000	85,000	132,000	7,000
Refuse Derived Fuel						
Conventional	15,000	0.20%	50,642,000	131,000	172,000	38,000

In addition to the traditional costs and benefits there are several hidden environmental costs of electricity use that are incurred when one considers the whole system of electrical generation from the mine-mouth to the wall outlet. These costs, which to date have been considered externalities, are real and have profound long term effects and are borne by society as a whole. Some environmental costs are beginning to be factored into utility resource planning. Because energy efficiency programs present the opportunity for utilities to avoid environmental damages, environmental considerations can be considered a benefit in addition to the direct dollar savings to customers from reduced electricity use.

The environmental benefits of energy efficiency programs can include avoided pollution of the air, the land, and the water. Because of immediate concerns about urban air quality, acid deposition, and global warming, the first step in calculating the environmental benefit of a particular DSM program focuses on avoided air pollution. Within this domain we have limited our presentation to the emission of carbon dioxide, sulfur dioxide, nitrous oxides, and particulates. (Dollar values for environmental benefits are not presented given the variety of values currently being used in various states.)

HOW TO USE THE TABLE

1. The purpose of the accompanying page is to allow any user of this profile to apply the Philippine's level of avoided emissions saved through its Residential AirCon Standards and Labeling program to a particular situation. Simply move down the left-hand column to your marginal power plant type, and then read across the page to determine the values for avoided emissions that you will accrue should you implement this DSM program. Note that several generic power plants (labelled A, B, C,...) are presented which reflect differences in heat rate and fuel sulfur content.

2. All of the values for avoided emissions presented in both tables include a 10% credit for DSM savings to reflect the avoided transmission and distribution losses associated with supply-side resources.

* Acronyms used in the table

TSP = Total Suspended Particulates

NSPS = New Source Performance Standards

BACT = Best Available Control Technology

3. Various forms of power generation create specific pollutants. Coal-fired generation, for example, creates bottom ash (a solid waste issue) and methane, while garbage-burning plants release toxic airborne emissions including dioxin and furans and solid wastes which contain an array of heavy metals. We recommend that when calculating the environmental benefit for a particular program that credit is taken for the air pollutants listed below, plus air pollutants unique to a form of marginal generation, plus key land and water pollutants for a particular form of marginal power generation.

4. All the values presented represent approximations and were drawn largely from "The Environmental Costs of Electricity" (Ottinger et al, Oceana Publications, 1990). The coefficients used in the formulas that determine the values in the tables presented are drawn from a variety of government and independent sources.

Lessons Learned / Transferability

LESSONS LEARNED

Standards and labeling programs serve a key role in establishing minimum levels of efficiency while also providing direct incentives for manufacturers to work on creating ever more efficient products: Standards and labeling programs represent a model for the capture of energy-efficient opportunities that makes sense and that can be introduced relatively inexpensively. While standards set base values, pushing the market toward higher levels of efficiency, labeling creates a market-pull mechanism. These two elements have been fundamental in transforming the market for air conditioners in the Philippines and now can serve as a platform for subsequent initiatives.

An essential element to the program design is the ability to ratchet upwards. In the Philippines, manufacturers are already trying to beat the standard and to use the program to their advantage. One manufacturer actually wanted to accelerate the second tier of standards. While this proposal was not adopted, it underscored the success of the program in shifting manufacturers from a position of feeling threatened, to confidence and a welcome exploitation of the program design.

The program, and specifically the use of EERs, has and will continue to create an awareness of lifecycle economics in the Philippines: Key to a standards and labeling program is its educational component. The bright yellow energy efficiency labels on air conditioners educate consumers about the advantages of efficiency, raising consumers' awareness of both the first and lifecycle costs of their purchases. This fundamental understanding of the cost savings through efficiency could affect consumers' future purchases of other appliances and even decisions about cars, homes, and business activities.

Standards and labeling programs must be rooted in effective testing and product certification: One of the potential liabilities of such a program is the concern that testing is neither correct nor fair. FATL has gone to great lengths to develop a system that makes sense and which is indeed defensible. The program was really challenged in 1994 when a manufacturer directly contested FATL's procedures. Fortunately FATL's testing had been accurate and the program's credibility was enhanced, nor deteriorated. FATL's rigor, despite a small operating budget, has provided a solid foundation for the program.

The cooperative effort between government and industry has been essential to the success of the AirCon program: The key barrier to implementation of the standards and labeling program was resistance from large and influential

manufacturers. To overcome this barrier, government officials met with manufacturers and representatives of their trade association to reach consensus. Initially, the manufacturers were not pleased with the program, perceiving it as unnecessary government intervention. They believed the government was controlling design, limiting their abilities, and increasing their operating expenses. DOE exercised patience, met the industry's demands, and gradually made manufacturers comfortable with the program. At the same time, DOE stood firm in its position that aircon efficiencies must increase in time. [R#1,3,5,20,28]

Compromise weakened the potential of the program but was necessary to get it off the ground, accelerating aircon efficiency in the Philippines: There were two fundamental compromises made by DOE to launch the program. First, DOE had to set a low minimum standard. Staff believed that manufacturers were technically more than capable of meeting the program's standards and that the technological advances in air conditioners necessary to reach the agreed upon standards were already happening. The switch from piston compressors to rotary compressors, for example, had already begun and would have occurred in the Philippines in the absence of the program. The program served to accelerate this change but did not force manufacturers to develop truly innovative means of retooling for even greater efficiency levels. [R#28]

The second major compromise involved the label design. DOE pushed for an American-style label that would show the range of efficiency options for a unit in a given size, with an arrow pointing to the relative efficiency of the unit compared to the least and most efficient units on the Philippine market. Manufacturers would not accept such comparisons. As a compromise, the program's label features the boldly displayed EER without providing an explicit comparison. Naturally, the more comparative the label design, the greater push manufacturers will have to beat their competitors, and thus the greater the program's impact. [R#28]

Turning domestic manufacturers' fears and suspicions into interest was in part a function of the competitive threat from cheap and inefficient imports: While it took some time to get the duty-free shops to require importers of air conditioners to meet the programs standards and labeling requirements, once this happened manufacturers gained interest when they saw that the program could level the playing field with imports from China, Korea, and other nations. Through increased concerns about international competition for air conditioning market share, manufacturers have shifted

from perceiving the program as a threat to a means of developing a competitive advantage.

Given recent trade agreements (e.g., GATT and the Asian Free Trade Agreement), manufacturers realized the necessity of aligning their products with international standards to succeed in international markets. Whether or not Philippine manufacturers export to other ASEAN countries, they will face foreign competitors seeking to sell products in the Philippines. By helping to improve product quality, the program has assisted domestic manufacturers in protecting their markets from growing international competition.

Manufacturers are concerned with delays in product certification: While supporting standards and labeling, manufacturers are concerned with delays in the process, especially as FATL has experienced backlogs and some equipment downtime. FATL, however, is not the only source of delay. The process is complicated as well by the multiple government agencies involved. In order to get a new aircon unit certified, a manufacturer must first notify the Bureau of Products and Standards that it has a product in “pre-production” and that 10-20 prototype units are ready for certification. BPS contacts the Department of Trade and Industry which in turn notifies its regional office. The regional office then goes to the factory and selects a prototype unit for measurement and certification. After the unit has been officially sealed, the manufacturer sends it to FATL. When it arrives at FATL, the boxed unit is placed in the queue for testing. The lab then tests the unit, evaluates the nameplates on the unit for accuracy, certifies the unit, and notarizes the EER labels provided by the manufacturer. Manufacturers claim that as long as there are no interruptions in the process, the program is acceptable. When FATL contests a manufacturer’s claim, the process can slow the time from product prototype to delivery in the market, a situation manufacturers are keen to avoid. [R#18,19]

As manufacturers change their inventory more quickly and additional aircon units require testing, FATL may become overloaded and thus less, rather than more, responsive: Typically, aircon manufacturers upgrade their entire product line every 2-3 years. In 1994, one manufacturer introduced eight new units and in each case the units had to be tested and certified by FATL. Furthermore, all manufacturers must have each of their products annually re-certified by FATL, in what are called annual assessments. To date, the lab has met most of its commitments in a timely fashion. As FATL assumes responsibility for certifying imports and as manufacturers request FATL to test their split units, delays could become a greater problem, harming its reputation in the eyes of manufacturers.

Manufacturers claim to welcome the opportunity to work with government to provide superior products to consumers: In general, manufactures do not want to spend money complying with government regulations. Those involved in the Residential AirCon program, however, believe that the program will benefit them in the long-term. Matsushita, for example, has a corporate commitment to excellence and environmental responsibility, and the AirCon program conforms with these goals. Furthermore, Matsushita staff believes that the more efficient an air conditioner, the lower its operating costs, and thus the greater opportunity for increased sales over time.

As standards push manufacturers to increased efficiency, prices go up, forcing sales eventually to diminish: The economic law of supply and demand has a bearing on aircon standards. While not yet an issue in the Philippines, manufacturers are likely to resist government regulation if it causes a noticeable or perceived threat to sales. The ideal program would motivate manufacturers to increase the efficiency of their units without increasing their prices. This could be achieved either through better manufacturing practices or through cutting costs in other aspects of a manufacturer’s operations. Manufacturers could also maintain their profitability through smaller profit margins per unit if these increased sales volume. Nevertheless, if the AirCon standards begin to adversely impact sales, manufacturers will be less supportive of the program in the future.

U.S. experiences have shown that aircon standards and labeling programs have pushed prices of high-end units down, more in line with their actual marginal costs. Standards have been key to improving efficiency of units, while getting the prices of premium products in line with the marginal costs of the product to the manufacturer. Prior to the implementation of standards, many efficient units were sold at an unnecessarily high premium cost, with the marginal cost to consumers ten to twenty times above the actual costs of the improved design and materials required in their production. [R#17]

TRANSFERABILITY

Appliance standards and labeling programs can support market transformations to higher levels of energy efficiency. If utilities are forced to reduce financial incentives for efficiency programs, governments desiring to increase energy efficiency may have to compensate by turning towards programs featuring codes and standards. These programs can also be used in conjunction with incentive programs that stimulate manufacturers to exceed the code and even accelerate the standard.

Lessons Learned / Transferability (continued)

Standards and labeling have been used successfully with other devices. In the United States, automobile standards for fuel efficiency have been tested and proven. Many American consumers now turn to these labels as a guide in their purchasing decisions. Appliance programs in the U.S., while not as well known, have also enjoyed success. Home energy rating systems continue to improve and are likely to become more common in the coming years. In South Korea, labeling of many different energy end-uses, from cars to appliances, also appears to have been successful.

Perhaps key to the success of standards and labeling programs is their ability to gradually move the market. They accomplish this by stimulating manufacturers to innovate in the search of ever higher efficiency levels. Often unobtrusive and uncontested these programs transform markets by eliminating poor products and using competition to accelerate efficiency.

For new programs, several key issues and options remain. First, it must be determined who will conduct the tests to certify efficiency levels: a government lab; an independent test lab; an accredited university lab; or accredited manufacturers. A program needs to have checks and balances and must be solidly rooted in objectivity and fairness, but programs may be able to take advantage of the technical sophistication of regional manufacturers. If the choice is made to allow manufacturers to certify their own products, serious penalties for improper certification must be established (e.g., fines or loss of accreditation). On the other hand, government facilities could be allowed to charge manufacturers market rates for their services. This would potentially allow labs to operate without requiring on going government appropriations and could permit them to expand their services to other countries and/or other end-uses, further promoting efficiency through market transformations.

The second issue concerns label design. Labels can be designed so that products are easy to compare (for example, by showing how the unit compares to the least and most efficient units in its size). Another simple design is exemplified by Thailand's voluntary refrigerator labeling program, which uses a five-star approach, as does the Australian labeling program. Similar to some energy-efficient home rating programs in the U.S., medium-efficiency refrigerators are adorned with three stars; refrigerators with efficiencies 10% above this level receive

four stars, while five stars are awarded to units with efficiencies 20% above the medium. (In voluntary programs, manufacturers generally do not label appliances which receive three stars or fewer, while the four and five-star units prominently display their efficiency rating in order to stimulate sales.) While the EER provides a better indicator of performance than the five-star approach, it requires a greater effort to educate consumers. In fact, at the time of this writing, an advertising campaign is underway in the Philippines to educate the public about energy efficiency labels, offering prizes (aircon units, what else?) to those correctly defining EERs and the formulas used in their calculation.

Another option that countries may want to consider when attempting to transform the market for efficient air conditioners relates to the use of refrigerants. Many air conditioning units currently use R-22 as a refrigerant. R-22 is a chlorofluorocarbon (CFC) and will eventually be eliminated due to provisions in the Montreal Protocol on ozone-depleting chemicals. Alternatives to R-22 exist, including natural gas, propane, butane, and ammonia. One alternative refrigerant, cyclopentane, is already replacing the use of CFCs in another application: the blowing of the foam insulation used in refrigerators. By linking aircon standards to national policies to phase out CFCs and related compounds, the goals of the Montreal Protocol could be achieved at an earlier date, and domestic manufacturers could be provided a jump on global competitors who will eventually be forced to make the shift away from these ozone-depleting chemicals.

Finally, another program design consideration for other countries and utilities considering appliance standards and testing programs, relates not to the air conditioners at all, but to the spaces that the AC units condition! In the Philippines there is a noticeable dearth of insulation, a situation that causes the capacity of air conditioners to be much larger than necessary if the spaces were properly insulated, if windows were efficient, homes sealed, etc. Fundamentally the need to air condition is one that can be addressed by tightening the building shell, even addressing the architectural design of a building. While too difficult to address in many situations, effective solar design, tight building shells, plus shading that can be supported through tree planting programs, are more basic and ought to be promoted and occurring concurrently with air conditioner standards and labeling programs.

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