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The Evolution of Improved Stoves in Guatemala: Lessons from Three Programs

4.1 The modern, efficient biomass stove can be considered an important socioeconomic bridge for the people in developing countries who have access to low-cost, readily available biomass and cannot afford expensive modern fuels. The many potential benefits of improved stoves have been evident since the first discussion of the “fuelwood crisis.” Historically, the benefits associated with improved stoves were perceived as conserving wood, convenience for the cook by moving the fire from the ground to a higher level, making the task of cooking cleaner by reducing smoke inside the kitchen, and an environmental benefit of avoiding deforestation. There has been significant effort to promote better stoves worldwide. Many of the improved stoves promoted in Guatemala since the early 1980s have chimneys to remove smoke from the household and to reduce the exposure of family members to indoor air pollution. This chapter investigates a potential of improved stove programs in Guatemala for alleviating indoor air pollution problems.

4.2 Guatemala is known internationally for its role in developing stoves and other related technologies. For example, to say “Lorena Stove” is to refer to Guatemala. Furthermore, the research on new stove designs in Guatemala has evolved over time and is very much based on the style of cooking of ordinary people. For instance, the two main grains that are the foundation of the Guatemalan diet, both today and in ancient times, are corn and beans. Corn is used to prepare tortillas, which is a staple food in Guatemala. The later improved stoves have had a metal “*plancha*,” which is synonymous with flat metal plate, and is designed specifically for cooking tortillas.

4.3 Generally poor, rural families come most immediately to mind when discussions turn to wood burning stoves. This is an accurate reflection that it is mostly poor people in Guatemala who are reliant on wood energy for cooking. However, the first improved wood-burning stoves developed over 20 years ago were used to cook the food of wealthy people as a way to showcase their homes and reflect the traditions and refinement of their owners. But over time as alternatives to wood became available (kerosene, propane, or electricity) those who continued to use firewood were, in effect, the populations that did

not have enough financial resources to change to other fuels. Thus, today it is more important than ever to assist in the development of improved stoves, as they directly affect mainly the poorest people in Guatemala. These people still endure the drudgery of having to collect large volumes of wood for cooking and the health effects of breathing smoke from open fires.

4.4 The purpose of this chapter is to examine and learn from one of the most active stove programs in Central America. This review first examines the historical, technical development of improved wood stoves in Guatemala, especially the movement from the Lorena Stove to the *Plancha* Stove. This section is followed by a review of the performance of three existing programs.

Development of Improved Stoves in Guatemala

4.5 Since as early as the 19th Century, stove innovations involving the use of firewood for cooking were disseminated into Guatemala mainly from Europe as an outgrowth of the industrial revolution. In the European countries with their harsh winters, the primary purpose of the stove had always been to provide indoor heat through thermal radiation. Adapted for cooking, imported wood-burning stoves were sold that had metal bottoms, sides, and tops. They had a heating area on the top made from a plate of metal with holes whose diameter could be modified with rings and moveable covers for the purpose of cooking. The casting was high quality, with good appearance and high durability. Some are still in use today with only minor repairs. In addition, models with similar features and dimensions were being manufactured in Guatemala, and while they were not as attractive or durable as the imported ones previously described, they were able to compete on the basis of price.

4.6 Both models were only affordable to wealthy people. The stoves were bought as a way to avoid emitting dirty, irritating smoke into the kitchen as well as to add a decorative touch to a home. There was usually an open fire outside the kitchen to supplement the stove. Most of the stoves included a reservoir for water that was heated by a system of metal coils incorporated into the combustion chamber in which the water circulated in convection currents. Other metal models were specially modified to cook food for sale in markets. Metal *planchas* of varying origin and form first began to be used for cooking during this period.

4.7 This way of cooking, with an enclosed, controlled wood fire and controlled emissions, represented the basic format of a highly developed commercial stove model. The purchaser bought the stove and installed it in his house. He hired a bricklayer or plumber to prepare it for use, and in short order the stove was integrated into the functioning of the home. A fundamental feature of these first commercial models was that they were produced as a whole metal stove in an enterprise and then custom installed in the home.

Period of Technological Innovation, 1976–80

4.8 The early versions of the today's improved stove program in Guatemala had their foundation at the ICADA Choquí Experimental Station, operating in the western altiplano of Guatemala, with a sole office in the department of Quetzaltenango. The Station first began its research on alternative technologies for renewable energy applications in the early 1970s. The program has multiple purposes, including the promotion the use of solar energy for heating water and drying agricultural products, the use of organic fertilizers, soil conservation practices, and the evaluation of wind power for motive power. The ICADA Choquí Experimental Station's approach to undertaking work in its rural area of operations included methodologies similar to those developed in Asia and Africa for promoting alternative energy as a way to alleviate the problems of poverty in remote areas.

4.9 During this period the basic philosophy of promoting appropriate technology influenced the development and the design of improved stoves. This included the intensive use of local labor for manufacturing the stoves out of local materials, often self-constructed by local users. These development activities usually required only small financial investments and were based on simple procedures that would allow easy and extensive transfer and application of knowledge and experience. Also, there was an emphasis on the use of local or traditional technology that can yield benefits to the users who know and respect it. Therefore, the activities were being developed around the use of clay.

4.10 Ironically, it was the result of a natural disaster in 1976 that give birth to the first prototype of the improved Lorena Stove. Due to an earthquake, the Choqui Station decided consolidate their various small projects into the program for improved stoves. Under the financing agreements, technical experts from Canada and the United States were invited to participate in a team effort to develop an improved stove. This led to development of the first prototype of the Lorena Stove, followed by printing of informational pamphlets, and this was followed by the dissemination of the stove.

Table 4-1. Stages in the Development of Stove Technology

19th Century	1976-80	1980-86	1986-93	1993-2001	2001-Present
Models that predate improved stoves	Period of technological innovation	Period of technological diversification	Period of producing and disseminating studies	Period of promoting commercial models of stoves	Beginning of the commercial market period
<ul style="list-style-type: none"> • Imported cast-iron stoves • Domestically produced cast-iron stoves • Stoves made from brick, with planchas made of cast-iron 	<ul style="list-style-type: none"> • The innovative Lorena Stove 	<ul style="list-style-type: none"> • Large-scale models based on the Lorena Stove • The innovative technology of the CETA stove • Diversification of prefabricated models based on the CTEA stove 	<ul style="list-style-type: none"> • National Survey on Improved Stoves • Baseline Study on Tortilla Stoves in Guatemala City • The International Workshop of FWD • Market Study on Stoves in the Guatemala City Metropolitan Area • Study of Indoor Air Pollution from Smoke in Rural Households 	<ul style="list-style-type: none"> • Ubicación del Modelo de Plancha Armada • Training programs in planchas manufacturing • Development of a prototype plancha armada stove • Large-scale distribution of plancha armada stoves • Development of commercial models 	<ul style="list-style-type: none"> • Studies conducted on stoves' health impact on users • Introduction of portable commercial models based on the plancha armada stove • Emphasis on participation by women in stove programs

Source: Original diagram based on interpretation of the historical review.

The Lorena Stove As a Product of the Period

4.11 The Lorena Stove was named for the materials from which it was manufactured—mainly *lodo* and *arena*—the Spanish words for earth and sand. The appropriate technology criteria previously mentioned were applied in the conceptualization, design, and means of distribution of the Lorena Stove. Because the clay and sand were formed into a single stove within each house, it did not have specific dimensions because they would depend on the preferences and resources of each user. As a result, stoves were made round, square, rectangular, and even triangular to fit in corners of a room, and the size and shape would depend on the space and materials available to each user. Those installing Lorena stoves did try to standardize the firebox, the diameter of internal passages, the opening for adding firewood, and the height of the chimney. No special tools were needed for construction, and measurements were made using hands and fingers. This custom design and lack of standardization later turned out to be a problem for the reputation of the stoves, as each one performed differently.

4.12 From these modest beginnings, the further development of Lorena Stoves and all its variants spread through all different types of organizations. The consequence was a large-scale dissemination of the technology. Financing for most projects carried out in this period counted on resources donated by national and international organizations. The activities carried out by these institutions were widely known and highly regarded.

4.13 In response to this popular program, the Guatemala Ministry of Energy and Mines formed the National Group for Improved Stoves. Working groups were organized under the Office of Alternative and Renewable Energy organized to coordinate and promote the efforts.²³ The reason for this was that in 1982 roughly 30 institutions were active in this field. The groups were formed taking into account various interests, including the recommendations of the Seventh National Congress of Engineering held that same year, and those of the Third Latin American Conference on Bioenergy. This was a coordinating role and other institutions and individuals that were not involved in these groups worked independently with their own resources.

4.14 At its most fully developed, the National Group for Improved Stoves comprised of 27 formally registered institutions from the public and private sector. They exchanged ideas, logistics, information, and technical resources, while trying not to interfere with the individual work of each institution. The central idea was to make the most of the resources for the benefit of the institutions and the work of each member group. The achievements of the energy groups involved formulating a national program to develop improved stoves, integrating the institutions working in this field, organizing an inter-

²³ The groups are defined as follows: “National Energy Groups are composed of all state and nongovernmental (national and international) institutions that work directly on activities related to the development of renewable energy and also coordinate efforts to provide technical assistance on the most relevant problems that directly affect the rural and suburban sectors that are held back socially, economically, and technologically. The ultimate objective is integral human development while protecting and conserving the environment.” (MEM, 1985a)

institutional information system, and preparing a workshop seminar on the construction, use, maintenance, and diffusion of improved stoves. In addition, a directory of the national group was put together and the National Survey on Improved Stoves was carried out. However, with the normal progression of change in the administration and government officials, by 1986 the national group as such was disappearing.

Studies on and Decline of Improved Stoves, 1986–93

4.15 The isolation of the improved stove programs that we see today in Guatemala had its roots in the late 1980s. The energized period of dissemination of the Lorena stove in its various forms took a turn for the worse beginning in the mid 1980s. Although there were still a significant number of projects being carried out during this period, there also was a fairly high turnover in the number of participants. Some stove promotion groups disappeared, and depending on donor funding, new ones would appear. Part of the reason for this change was the disappearance of the National Group for Improved Stoves, which led to the isolation of the institutions promoting stoves.

4.16 Although the stove implementation period continued, the tangible impacts and results were declining. The previously favorable diversification in the program began to show serious deficiencies, and the models that were successful as new began to have technical problems as they aged. As a consequence consumers abandoned them. A key part of any program is whether or not consumers will purchase a new stove after the old one wears out. In this case new stoves could no longer be found at the place where they were built, and people reverted to their old ways of cooking.

4.17 Critics of the stove programs considered such results to be highly problematic, but manufacturers and institutions continued their work, confident in their knowledge of the stoves they had learned to make. In various documents and research meetings it was determined that the only way to coordinate these effort and standardize the technology would be when all the models entered a formal commercialization phase.

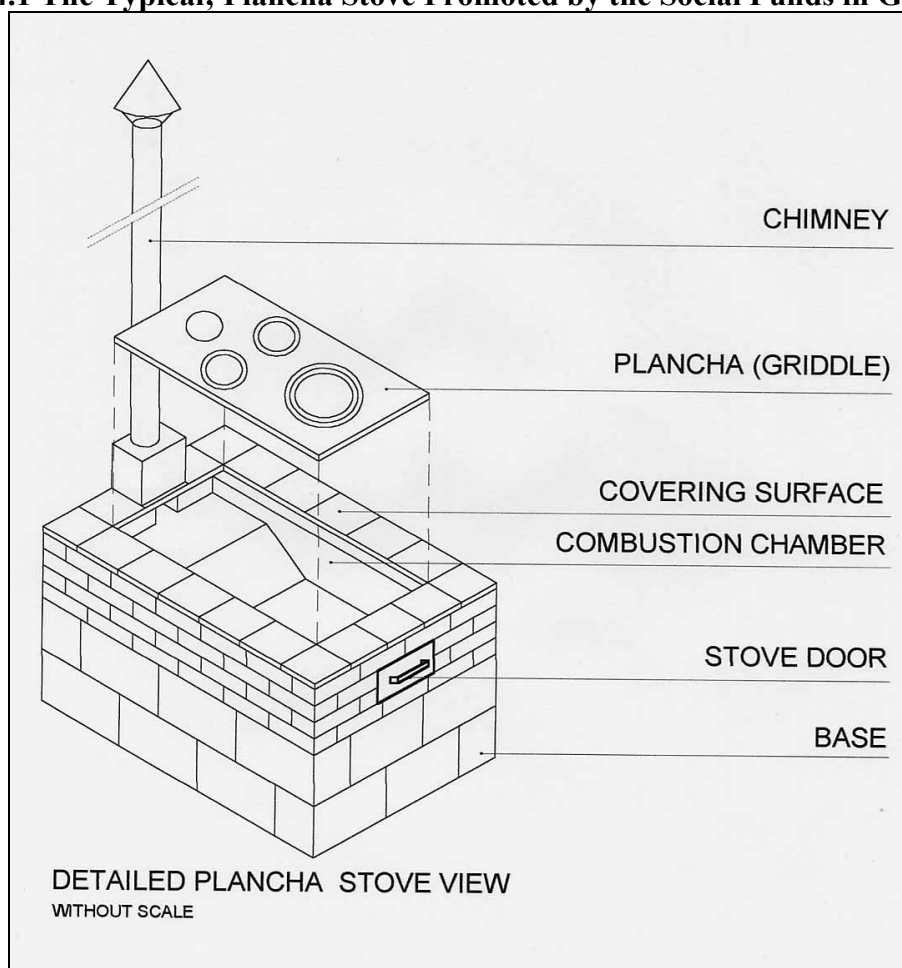
Promotion Commercial Models Of Improved Stoves, 1993-2001

4.18 Partly because of the failure of consumers to purchase new stoves once their old ones wore out, within Guatemala by the early 1990s it was decided that the stove program should be subject to the forces of supply and demand. The idea was that through their market decisions stove users would define their likes and dislikes of the various features and models of improved stoves. However, unlike the commercialization plans that were introduced by some programs developed in Asian and African countries, the models offered in Guatemalan could not be transported easily once they were purchased. In addition, the manufacturers could not maintain a reliable supply that could meet larger demands and maintain consistent quality at reasonable prices. Likewise, the quality of models built almost entirely on site, the main feature of the Lorena Stove, could not be controlled because each model was a different size and shape.

4.19 The success of using metal components in propane stoves that were made for commercial tortilla producers opened the possibility of using metal parts as a way of addressing problems of quality control and the durability of clay materials. The idea evolved into the use of a tortilla pan (*comal*) in the already commercialized cast-iron *planchas*. In the northern part of Guatemala, it was discovered that people already were using a *plancha armada*²⁴ for cooking. Some models were developed using the *plancha* and trials were conducted by providing them to food vendors in markets or on the street. After the trials, there was a widespread use of the metal *plancha* in the stove models during the 1993-2001 period. The various institutions and cooperative organizations fostered the development of new models based on the concept of incorporating a *plancha* in an energy efficient stove that also has a chimney for removing smoke from the house.

4.20 In 1994 and 1995 the Ministry of Energy and Mines put together a training program for making *planchas armada* and for building the entire stove, in a place designated for this task that was called the “workshop school.” These training events were attended by artisans who wanted to learn how to make the stoves and start their own business. The idea was to standardize the various procedures and maintain fundamental quality control for the products (MEM, 2001).

²⁴ The *plancha armada* consists of a sheet of metal that is cut in the appropriate dimension, and then is welded to a metal frame.

Figure 4.1 The Typical; Plancha Stove Promoted by the Social Funds in Guatemala***Beginning Of The Period Of Commercial Distribution, 2001 And Onward***

4.21 The large-scale diffusion achieved by the new model led to the development of new types of programs and projects, especially those financed by government social funds. The process of negotiating and signing the peace agreements helped bring a great deal of international financial assistance to the country, which had the result of making this activity a form of household improvement. New programs and projects arose, such as those of the Social Funds, the Social Investment Fund (FIS), the National Fund for Peace (FONAPAZ), the Fund for Indigenous Development (FODIGUA), and others that carried out work according to their own plans with little coordination between them. During the mid 1990s, most of the responsibility and financing for improved stoves was moved from the Ministry of Mines and Energy to these social funds.

4.22 Finally, the later part of this period is similar to the first phase in the history of stove development in that there was a development of many new models based on the original design that was intended to improve stove performance and reduce its costs. At the Mesoamerican Exchange on Efficient Cooking Techniques and Improved Stoves, organized by Fundación Solar and held in Antigua in August 2001, there were demonstrations of new stove models and techniques for preparing food. The innovations

presented have the common principal characteristic of being portable and using metal *planchas* in their construction. For example, there was a new flat *plancha* constructed in several sections and with different holes so that it could be used in various configurations. There was a stove based on natural convection that was made of fewer parts and required less firewood. Also, smaller, fixed, as well as portable prefabricated models, were demonstrated that were made of lightweight concrete pieces.

4.23 Despite all of these innovations, the dominant stove program in rural Guatemala involves the stove promoted by the Social Investment Fund. Without much alteration, the original design developed in the Ministry and Mines was utilized as the only model of improved stove that would be promoted as an option under the program. In this program, communities are able to receive mostly grant funds for special programs that are of their own choosing.

Description of Research and Main Issues

4.24 For the purpose of ascertaining the best future direction of the improved stove programs in Guatemala, it was decided to examine three relatively successful programs. The programs selected for the case studies were chosen based on a variety of characteristics, including the success of the program and, government and non-government involvement, and geographical diversity. The success of the programs was judged on their ability to achieve both a high and sustained adoption rate of improved stoves. The studies were carried out in selected communities chosen to reflect geographical coverage and relatively higher rates of stove penetration. Therefore the case studies were carried out for gaining insights into the merit of each program and they are not intended to be program evaluations or market studies.

Main Issues Examined in Stove Programs

4.25 The following key issues were identified for evaluation in the case studies.

4.26 *Stove pricing:* The studies examined the pricing of stoves compared to the costs to produce and market them. This included an examination of the benefits or problems of producing relatively inexpensive stoves made of local materials versus the use of higher quality components or parts that may be more expensive, and how this was related to the market for the stoves.

4.27 *Program financing:* The appropriate level of program financing can involve a delicate balance between the size and the delivery mechanism of a subsidy and the pricing of stoves to be affordable to poor households. In most internationally successful programs, the stove price does not contain a large subsidy component, but governments provide financial support (for development costs) and technical assistance to the programs.

4.28 *Market identification:* The use of surveys and other market assessment techniques has been an essential component of most successful programs.

4.29 *Identification and development of stove types to be promoted in the program:*

Many internationally successful programs have required an iterative process of development and test-marketing under real conditions.

4.30 *Customer service and satisfaction:* The case studies evaluated both the impact of stoves on rural communities and the degree of consumer satisfaction with the stoves, focusing on the techniques utilized to sell and service the stoves.

4.31 *Operational procedure:* These included the allocation of institutional responsibilities, the allocation of work, and training at the community level or for artisans.

4.32 *Communication and promotion:* Communication and promotion of stoves is often a key component in a successful program. This is especially the case for the executing agency, the stove manufacturers, and the rural beneficiaries.

4.33 *Local perception:* Taking into consideration the needs and views of consumers has been a hallmark of most successful programs. This includes whether consumers value the stoves valued because they save energy, are convenient, or eliminate indoor air pollution, and the types of adjustments they would like to see made to the stove.

Design of the Study

4.34 Three projects were chosen as case studies based on their location, differences in the availability of firewood (some with abundant supplies and others with scarce supplies), beneficiaries from various indigenous ethnic groups as well as the Ladinos (an indigenous group), and the use of different project implementation methodologies including different levels of subsidy. This makes all three projects fairly representative of projects carried out in other parts of Guatemala. The programs include the Fondo de Inversión Social (FIS) project which is national in scope, the INTERVIDA project located in various departments in western Guatemala, and the Tezulutla'n project that covers a number of municipalities in the northern department of Baja Verapaz (Table 4.2). Once the projects were selected, a preliminary list of communities was compiled, and then for each project two communities were chosen that best met the selection criteria.

Table 4.2: Communities Selected for the Study

Organization	Community 1	Stoves in Project	Community 2	Stoves in Project
TEZULUTLA'N	Quiaté, San Miguel Chicaj, Baja Verapaz	74	Pahoj, Rabinal, Baja Verapaz	28
FIS	Los Achiotés, Jalapa, Jalapa	28	Los Gonzáles, Jalapa, Jalapa	65
INTERVIDA	San Antonio Las Barrancas, Sibinal, San Marcos	41	Cantel, San Pedro Sacatepéquez, San Marcos	50

Source: Fundación Solar, 2003

4.35 Conducting the case studies involved collecting information from a variety of different sources. A range of documents was used to gather secondary information on population, economic status, housing, means of access and transport, and poverty maps in the study areas. First, field teams were formed to gather the data. Facilitators were required to conduct the interviews with stove users, especially in the case of the study carried out in the department San Marcos because it is an area with a predominantly indigenous population, which could make communication problematic. Next, visits were made to the regional offices of the various projects to interview technicians and extension workers and learn about their work methodologies. After that, selected communities and community leaders were contacted to ask for their help in gathering information and organizing focus group interviews. Leaders in all the selected communities offered their support, which facilitated the process of gathering information. In addition, the team interviewed the owners and employees of metalworking shops that sell components and manufacture improved stoves.

Three Case Studies of Improved Stove Programs

4.36 The three stove programs examined in this chapter offer some unique insights into the different types of programs in Guatemala. The stove programs include one financed by the European Union, another funded by the government of Spain, and the final one supported by the social development fund and implemented by the FIS. In this section, there is a brief background explanation of the programs and their method of implementation.

The Tezulutla'n project: Integrating Stoves with Rural Development

4.37 The Tezulutla'n project is an integrated rural development project that lasted over 5 years. The funding for the project was provided jointly by the government of Guatemala covering personnel expenses and by the European Union that covered most of the physical investments. The project involved mainly agricultural extension and health and nutrition. The stoves component was implemented under the health and nutrition component, and the specific work with stoves started in 1999 and lasted about three years. From the beginning, the principal goal of the stove component was to improve living conditions for rural populations, with special attention to women, hygiene, health, and household improvement.²⁵ This gave birth to the idea of working on a project specifically for building improved, wood-conserving stoves that would produce improvements in the indoor environment of homes in the area.

4.38 The Tezulutla'n project was implemented in the department of Baja Verapaz in the Northern Region, north of Guatemala City. The department is 3,124 square kilometers in size, with a low population density of 68 people per square kilometer compared to the national average 103 people per square kilometer. The share of the population that lives in rural areas is relatively high at 78%, while the literacy rate is very

²⁵ Technical report on the Tezulutla'n stove. Baja Verapaz, May 2002.

low at 56%. The department's poverty rate is 72%, with 31% living in extreme poverty.²⁶ The economy is based on agriculture and the main products are sugar cane, vegetables, basic grains, and cereals. The climate in most of the department is dry, with marked deforestation and shortage of firewood in many communities.²⁷

4.39 There were several phases in implementation of the project--from the analysis of existing stove models in the various municipalities of Salamá to visits by monitors from the organization to verify the quality and proper use of the installed stoves. Initially Tezulutlán conducted research on improved stoves, showing that some of the models still used a considerable amount of firewood. The organization evaluated various types of stoves that were commonly used in the field²⁸ with the ultimate goal of developing a new model of improved stove that would combine the best features of the stoves that were promoted and installed by diverse development organizations in the department of Baja Verapaz.²⁹

Figure 4.2: The Tezulutla'n improved stove.



Source: Photo from Tezulutla'n Project. Note the clay chimney, lack of a stove door, and the shelf for holding up the fuelwood so that it can be fed into the stove once the wood inside is burned up.

²⁶ SEGEPLAN 2002.

²⁷ 10th Population Census and 5th Housing Census of the National Statistics Institute. Guatemala. 1994.

²⁸ See section on historical review of Improved-Stove Programs in Guatemala.

²⁹ Technical report on the Tezulutla'n stove. Baja Verapaz, May 2002.

4.40 Once a new model of improved stove was designed, the work of promoting the stove began. With the help of field staff the project delivered 4,129 improved, wood-conserving stoves during the 3 years of implementation, and involved other NGOs that operated in the area, providing them with financial support and technical assistance for installing the stoves. Therefore, Tezulutla'n took care of designing the model with the help of the local women, and then gave responsibility for training to the extension workers from the two NGOs. The project provided the funds to contract the extension workers, though they still were part of the team of the NGOs. That is, Tezulutla'n became a source of technical and financial support for the NGOs, which were already operating in the area, so that they could foster the use of the improved stoves and make the intervention sustainable.

The INTERVIDA Program: Focus on Children, Families and Poverty

4.41 INTERVIDA is a Spanish NGO that supports community development in Guatemala and also in other six countries, through sponsored child program with donations from European citizens. The goal of the program is to improve the lives of women and children through projects in areas such as training and community organization, cultural events, education, community infrastructure, income generating initiatives, health and food security. Established in 1996 in Guatemala, INTERVIDA is focusing its activities on the western highlands.

4.42 There are three main components of INTERVIDA's work in Guatemala. First, the "Community Support, Organization, and Training" program is considered the foundation because it strengthens community organization and forms community committees that manage the projects. Second, the "Basic Support" program is focused on health and education, and through which medical visits and school construction are carried out. Lastly, the "Production and Marketing" program tries to stimulate the economy and generate income through work in livestock, agriculture, forestry, and community organization.

4.43 According to the coordinator of the San Marcos TERRA, the project to disseminate wood-saving stoves began in 1998 in response to demand for the stoves. From 1998 to 2000 the project grew steadily; in the department of San Marcos 142 stoves were installed in 1998, 1,200 in 1999, and 2,000 in 2000, but declined to only a couple hundred in 2001. The project was carried out under the Production Component because INTERVIDA wanted people in the communities to make a stronger commitment to the project and share some of the cost of the stoves. The production component is very flexible in terms of its work strategy. Its principal objective is to promote the economic development of the communities, and to achieve this the team designs workplans and strategies that are constantly changing and receiving feedback, as we will see in this case study. According to the production component, the objectives or impacts being sought through the dissemination of wood-saving stoves are the following: save firewood to benefit both the environment and family budgets; improve the home by reducing indoor air pollution; and use and manage natural resources sustainably. The stoves often served

as an incentive for people to participate in the productive projects run through the production component.

4.44 As of the end of 2000 projects implemented in the western part of the country had installed 8,500 stoves, though after that year stove production at the household level declined significantly, with only 500–600 stoves installed in 2001. One of the main lessons learned, according to the production component, is that projects for wood-saving stoves require strong community assistance efforts. Meanwhile the Basic Support Project had implemented stove projects for schools.

Figure 4.3: Variations of Intervida-Type Stove



Source: left, photo from Intervida and right, photo by Rogério Carneiro de Miranda. Typical *plancha* stove built in the year 2000 by INTERVIDA in Quetzaltenango region. Note that the stove door is open and the chimney has already been replaced by a cement pipe.

4.45 More recently, the stove project is being refocused on an integrated watershed management project that will last 10 years, from 2001 to 2010. Within this watershed project the communities are to carry out wood-saving stove projects as well as integrated projects in the fields of forestry, agriculture, and livestock. The stove project would be implemented under the condition that each beneficiary pays for the approximately 100 dollar value of the stove over a one-year period, with these funds being utilized as seed money for investment in other productive projects in the fields mentioned above.

Currently this implementation model is being considered for approval by the program directors.

The FIS Program: Successful Government Program with Limited Flexibility

4.46 The Fondo de Inversión Social (FIS) is a decentralized, government entity with administrative autonomy and with its own legal standing and heritage. As an aftermath of the war in Guatemala, the FIS was created to provide grants and investments in activities that improve quality of life for the rural poor in Guatemala. The main working groups within the FIS include environment, productive projects, water and sanitation, and education, health, and nutrition. The three fundamental goals of its work are to provide technical assistance, to finance of development projects, and to strengthen community self-management. Currently the FIS has nationwide coverage through its 24 departmental offices.

4.47 The FIS Environment Unit implements the stoves program. Due to the large demand for improved stoves on the part of rural communities throughout the country, stoves are their largest responsibility. The stove program encompasses projects for *plancha*-type improved stoves based on the FIS prototype. For members of impoverished groups or communities in rural areas, this stove was developed to replace ones that are worn out or as an alternative simple open fires. Since the beginning of the projects they have been promoting stoves with metal *planchas*, which have undergone some changes.

4.48 The FIS stove program has been exceedingly popular among rural communities in Guatemala. Today the FIS stoves can be found throughout the country, and the technology is well known in many rural communities. The demand for stove projects by communities has been very robust, and it is estimated that approximately 15,000 stoves are built each year. Since the program started in 1996, this would mean that by the year of 2001 a total of 90,000 stoves have been build in rural homes in Guatemala.³⁰

4.49 The main FIS stove has a metal *plancha* with four holes for cooking (see Figure 4.4). This model has been used since the beginning of the program in 1996. The only significant change over the years has been changing from an 8 mm cast-iron *plancha* to one made of 5 mm armado iron.³¹ It is generally accepted that today's armada *planchas* in Guatemala are better quality and cost less than older cast-iron *planchas*. However, there is no technical support for certifying the quality of the stove components. All programs (the FIS, the Tezulutla'n Project, and Intervida) encountered the same problems with the old *planchas* that eventually resulted in changing from cast iron to armada iron. Each program made this change independently and even today the various groups working on improved stoves do not interact with one another to any great degree. This lack of interaction is a significant weakness in the stoves programs in Guatemala.

³⁰ According to the ENCOVI 2000 database, the average number of people per household in rural areas nationwide is 5.64, which for practical purposes we are rounding to 6.

³¹Footnote 24 describes the *plancha armada*. In comparison, the cast iron *plancha* is a casted metal sheet made in one piece. This is usually heavier than the *plancha armada*.

Figure 4.4 Stoves in Rural Households

Source: Pictures by Fundacion Solar and Rogério Carneiro de Miranda. Typical *plancha* stove and FIS stove built in the year 2001 by FIS in Quetzaltenango region. Note the missing stove door in the picture on the right and that the stove edge is used as a table.

4.50 Under the FIS program, communities groups are organized and given the responsibility to select development options. The process works as follows. A facilitator goes to a community, and calls a meeting of all the community leaders (religious, legal, and traditional). An association is formed that is composed of representatives of the various communities. The members are trained in the method of operation of the FIS. After this, a community forum is held and members of the community prioritize their short-, medium-, and long-term needs. As a reward for participating in the community association and organizing the community, the FIS provides financing for highest priority project on the communities list, provided the association can manage the project. The idea is that these communities, through the associations that are formed, will retain the ability to manage other future projects that interest them, perhaps with other development organizations. In the case of a stove project, requests from the committee organized by the community would be financed by the FIS, subject to availability of financial resources and fulfillment of the conditions for a viable project.³²

³² See the subsection on *Selection of Sites and Communities* in this document.

4.51 After a technical committee approves the project,³³ private companies contracted through public bidding make the FIS stoves. The contract for the stove construction company is a “key in hand” arrangement. The builder is responsible for constructing the complete stove, including purchase of materials, the cost of getting the materials to the community, and skilled labor. The company has to give a one-year guarantee on its work. The payment system for the construction company is directly related to progress in building the stoves. Forty percent is paid as an advance at the beginning of the job, followed by three equal payments of approximately 17 percent, the first for building the base, the second for the firebox, and the third for installing the *planchas*, chimneys, and accessories. The remaining 10 percent is paid when the completed stove is handed over.

Comparative Assessment of the Case Studies

4.52 The improved stove program in Guatemala is quite advanced compared to other regions in Latin America. Although there are both good and poor aspects evident in the program, it is obvious that there has been and continues to be significant support for the program both among local people and donors willing to support them. In this section, we review the three case studies in a comparative context.

Subsidies and Commercialization of the Stove Program

4.53 The stove program of Guatemala is rather unique in that it involves the distribution of fairly substantial and expensive stoves. As opposed to other parts of the developing world, the stoves in Guatemala are prohibitively expensive for poor people, and they cost over 50 US dollars for even the most inexpensive one, compared to 5 to 10 US dollar price for stoves in most other countries. The establishment of a purely commercial market for such an expensive stove in rural areas is most likely out of the question. In spite of this, due in part to government and donor assistance, rural people place a high priority on getting such stoves, for the purpose of reducing indoor air pollution and conserving energy. The stoves component is among the most popular programs offered by the FIS.

4.54 Because the financing for the stoves does not come from consumers, but rather comes from other sources, the development of a dynamic market for improved stoves has been relatively limited. The programs have consisted of isolated activities by projects that operated independently. Although most projects are fairly well designed and rural people generally seem to be satisfied with them, such independence and isolation inevitably generate some problems. For instance, the tendency to produce and sell particular models of stoves for about 20 percent of their total cost (see Table 4.3) by each program has created a situation in which the different types of stoves do not compete with each other. This results in market distortions and some technical deficiencies in some stoves models. For instance, the use of an open fire rather than the improved stove in the

³³ Composed of directors agreed by the Executive Board for approving projects and authorizing investments.

household is quite common in the FIS and the Intervida program. The stove developed for Tezulutia'n appears to be utilized more than the others.

Table 4.3: Typical Subsidies in Three Programs, Rural Guatemala, 2002

Community	Total number of stoves	Firewood Procurement	% Using Open fire	Improve Stove Cost to User	Approximate Total Stove Costs (incl. User Cost)
Tezulutlán					
Quiate	74	Gather	12%	Qs. 100 & Materials	Qs. 500
Pahoj	28	Gather	0%	Qs. 100 & Materials	Qs. 500
FIS					
Los Achiotes	28	Buy	40%	Qs 65.5 incl. Mat.	Qs. 800-1000
Los González	65	Buy & Gather	38%	Qs 65.5 incl. Mat.	Qs. 800-1000
Intervida					
San Antonio	41	Gather	42%	Qs 151 incl. Mat.	Qs. 684
Cantel	50	Buy	28%	Qs 151 incl. Mat.	Qs. 684

4.55 The adverse effect of the subsidies is that because each program has its own approved model, there is no competition among the models. Although most successful programs limit the actual subsidies for stoves themselves, in Guatemala the preference for more expensive stoves may limit such an approach. However, the development of and competition for customers is limited in the programs, and there could be new mechanisms to share experience between the programs.

Stove Design Issues and After Sales Maintenance

4.56 The three projects studied all repeated the same process of trial and error in developing the metal *planchas*. The lack of communication between the programs led to a process in which they were all discovering and responding to the same problems independently. For example, at first all three used 8 mm, cast-iron *planchas*, which had problems due to poor quality. This led the projects to change to 5 mm, armada *planchas*. This underscores the lack of coordination among programs to assess the quality of the *planchas*.

4.57 The two kinds of problems that arose with the metal *planchas* were cracking and warping. For the fifteen women in the sample that had troubles with the *planchas*, only 3 made some type of homemade modification to solve the problem. This indicates that the people in these communities could not find an easy way to repair the *planchas*, and if a *plancha* cracks or warps the likely result is that the house will become smoky again. It is essential that the *planchas* are of good quality and that the stove users know exactly what the limitations are on their use and how to care for them properly.

4.58 According to the three case studies, the chimney, firebox, and accessories (the door for feeding firewood and the regulator to control airflow) caused most of the

difficulties that users had in operating the stoves. In two of the four communities that use chimneys made of zinc sheet metal, some people replaced their 4-inch diameter chimneys with ones that had a larger diameter. Women in the focus groups also said they prefer larger chimneys because they require less cleaning. On the other hand, the problem with the clay chimneys is that they are very fragile to transport, in addition to which in Baja Verapaz there is only one artisan who produces that type of chimney. This makes it hard for people to get a replacement and requires them to order new chimney parts from outside, which is problematic because the communities are often remote and only accessible by poor roads.

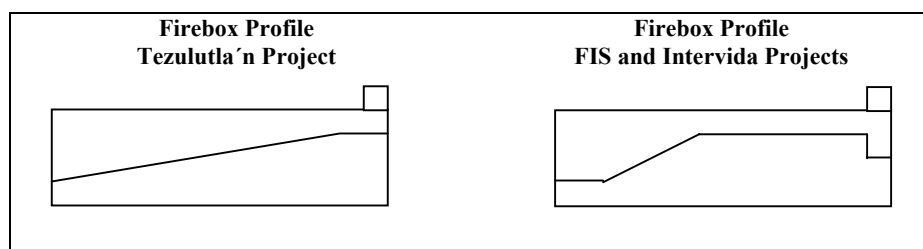
Table 4.4: Problems with improve Stove Chimneys in Guatemala, 2002

Community	Chimney construction	Year chimney built	Total number of stoves	Sample size	Number of chimneys with problems	Percent of chimneys with problems
Tezulutla'n						
Quiaté	Clay	2000	74	17	4	24%
Pahoj	Clay	2001	28	7	-	0%
FIS						
Los Achiotes	Zinc sheet metal	1999	28	10	5	50%
Los González	Zinc sheet metal	2001	65	21	1	5%
Intervida						
San Antonio	Zinc sheet metal	1998	41	14	5	36%
Cantel	Zinc sheet metal	2000	50	18	1	6%
Total						

Source: Fundacion Solar, 2003

4.59 Some people in Los González, have enlarged the inside of the firebox because they say it is hard to put in firewood. They indicated that the small volume of the firebox meant they have to split their firewood into smaller pieces, which represented more work for the families. Even in San Antonio las Barrancas some women, in their eagerness to put in more wood or larger pieces, have broken the fireboxes and dislodged the bricks that frame the opening for putting in wood. In Quiaté and Pahoj, where people from the community built the stoves, they tended to make a larger firebox than specified in the design, and also enlarge the opening for feeding firewood. The design of the firebox in the Tezulutla'n project is different from the model used by FIS and Intervida (see Figure 4-5), and makes it easier to put in larger pieces of wood. The Tezulutla'n project did not put doors on the fireboxes because they considered it too sophisticated and difficult for the users to operate.³⁴

³⁴ There is another case, the Incó Xanacón Project carried out by a civil association in the Department of Chiquimula in eastern Guatemala, that also did not use doors on the firebox.

Figure 4.5: Firebox Differences Between Stoves

4.60 Concerning the fireboxes, the community that had the most problems was San Antonio las Barrancas. In this community, where the project was implemented in 1998, it was the local men with training from bricklayers who built the stoves. For this reason it is likely that the problems were due to lack of quality control during construction. The main problem with the firebox was breakage where the bricks were joined, which in extreme cases led to a brick coming loose entirely, leaving a gap in the firebox. The chimney, *plancha*, and firebox are the critical components for making the improved stoves function properly. The rate of problems for each component in the sample of 87 improved stoves is 18% for the chimney, 18% for the firebox, 17% for the *plancha*, and 16% for the accessories (See Table 4.5).

4.61 The age of the stoves studied ranged from 1 to 4 years, and there was a relationship between the age of the stove and the number of problems reported (see Table 4.4), mainly in the chimneys and poyetóns or bases. The communities studied in the FIS and Intervida projects received no assistance from the projects for making modifications to the stoves or replacing parts that failed. The communities from the Tezulutla'n Project received more support from the project's technical staff or extension workers during the execution and monitoring phase in their first year using the stove. Thus, the program with more emphasis on stove design in conjunction with the needs of the users appear to have been more successful in avoiding problems in actual use.

4.62 Thus, the process of stove design can have a significant impact on the acceptance of the stove by users and whether or not they use it as their main cooking device. The experimentation of the Tezulutla'n project, including designing a stove without a door, proved to be important for the use of the stove. At the very least, there needs to be greater communication among programs about the practice of stove design.

The Users Perception of Improved Stoves

4.63 The general impression of people participating in all three programs is that improved stoves have a significant impact on their lives. The families reported the most valued benefits to be the use of less fuelwood, a reduction in cooking time, and removing smoke from the households (Table 4.5). Given the drudgery involved in collecting firewood and cooking, in and of themselves, these are significant benefits for rural women. For instance, the reason given for the reduced time in Cantel and San Antonio

was that with the multiple stove pot openings they can cook several dishes simultaneously. They also agree that the kitchen is now cleaner than it was before. In addition, to the time saved, another benefit of improved stoves reported by users is the removal of smoke from the house. Although households perceive that improved stoves remove smoke from the household, they are less likely to understand the long term health consequences of breathing smoke. The benefit of reducing eye irritation and improving respiratory health were perceived as the lowest benefit under the program. Another benefit valued by the women is that they do not have to buy clay comals since they can cook tortillas on the *plancha* of the stove. But overall, the women interviewed in the study were very happy and satisfied with the stoves.

Table 4.5: The Benefits of Improved Stoves in Two Programs, Guatemala, 2002

Benefits	Tezulutla'n						FIS					
	Quiaté		Pahoj		Total		Los Achiotes		Los González		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Uses less firewood	14	82	4	57	18	75	8	80	18	86	26	84
Less smoke in the house	12	71	3	43	15	63	7	70	15	71	22	71
Requires less time to cook	11	65	2	29	13	54	6	60	19	90	25	81
Saves time collecting firewood	6	35	2	29	8	33	4	40	8	38	12	39
Kitchen is cleaner	5	29	0	0	5	21	3	30	6	29	9	29
Effect on eyes & respir. health	4	24	0	0	4	17	4	40	6	29	10	32
Number interviewed	17	100	7	100	24	100	10	100	21	100	31	100

Source: Fundacion Solar, 2003

4.64 Although in general the stoves were appreciated by those interviewed for the study, they also had some suggestion for improving the stoves. In San Antonio almost 60 percent of those interviewed said that one problem is that the stove does not heat the house. In this community other suggestions are to enlarge the chimney and to add space to the stove for storing firewood.³⁵ The people interviewed also indicated that the chimney might be made out of cement or bricks instead of sheet metal. The stove could have an oven and a water heater. The platform could be made out of cinder blocks or brick instead of adobe. The women in San Antonio said they would have liked the stove to be lower and the opening for feeding firewood larger. On the other hand, in Cantel those interviewed liked the stove the way it was and made no suggestions for changing it. In Cantel one person said that the stove was too low, but the rest found no disadvantages with the stove.

4.65 The women in Los Achiotes made several observations about the disadvantages of improved stoves. They did not like the limited weight that the *plancha* could support.³⁶ They also felt that there were problems controlling the intensity of the fire, and the diameter of the chimney was too small. The disadvantages cited by the women in

³⁵ These suggestions came out of the focus groups conducted by Fundación Solar.

³⁶ According to Ing. Manuel Tay, an expert on improved stoves, high-quality planchas are not damaged by excessive weight.

Los González are that the smoke does not go out of the house (14%), which was thought to be caused by inadequate cleaning. A small number of people indicated there was difficulty cooking tortillas on the *plancha*, which may be due to problems in controlling the intensity of the fire. On the other hand, 52% said they found no disadvantages to using the improved stoves.

4.66 The people who did not participate in the stove program had a variety of very practical reasons for not adopting the stoves. In San Antonio the main reason they did not participate in the project is because they did not have their own house when the project was implemented (one of the requirements for making a stove is that it be built inside a home). In Cantel eight people without stoves were interviewed and the main reason they did not get a stove was lack of money. The people without stoves still use open fires. All of them are interested in getting a stove now that they have seen the advantages of having one. According to them these advantages include saving firewood, better cooking performance, removing smoke from the house, and improving the home. Although the reason cited for not having a stove is mainly their cost, all the women interviewed buy their firewood, so in fact it would have been advantageous for them to invest in a stove because the money saved by consuming less firewood would quickly offset it.

4.67 These results indicate that people have very definite opinions on how to make improvements in the usability of the stoves. This brings up the topic of the next sections, which reviews how it is possible to improve the design of the stoves through greater interaction among the key people involved in the projects.

Interaction Between Stove Users, Builders, and Designers

4.68 Probably one of the most interesting aspects of case studies is program differences involving the interaction between the users, builders, and designers in the stove programs. Under the FIS program, the stove design basically has been unchanged for the last 10 years. The stove design being used under the FIS was originally the result of such interaction, but there has been not evolution in the design to meet changing needs of users. Under the Intervida program, there was fairly intensive interaction at the beginning of the program. It is mainly in the Tezulutla'n program that even after the beginning of the program there has been significant consultation with local people regarding the benefits of the stove for them and what they would like to see changed in the stove design. Thus, in this section we will examine more in depth the development of the Tezulutla'n stove.

4.69 Participation of the users in designing the stove model is one of the greatest strengths of the Tezulutla'n project. This helps guarantee that the stove is well suited to the needs and preferences of women in the region. Among other things, the design itself allows greater flexibility in construction since it includes local materials, which also brings down the cost. For example, making the stove out of adobe allows the height of the stove to be adjusted to suit each user. The Tezulutla'n stove also has the virtue of having a clay chimney, which prevents overheating of its external surface and in turn

helps the users avoid getting burns, especially when making tortillas. This is very important in terms of comfort because tortillas are cooked several times each day.

4.70 A good indicator is the fact that stoves built more than three years ago are still working well, and although in some cases parts had to be replaced, this has been part of each family's responsibility and fosters a greater sense of ownership and familiarity with the stove, thereby reducing their dependence on the project's technical staff.

4.71 Most of the differences in the Tezulutla'n compared to other stoves were the result of an interactive process between the designers, builders and users of the stove. The design of the Tezulutla'n stove retains the basic elements of the common metal-*plancha* stove disseminated around the country by the FIS project. This includes a stove base, a firebox, a metal *plancha*, and a chimney. However, as indicated the interior design of the Tezulutla'n stove's firebox is different from the FIS model (see Figure 4-5) though the concept of reducing the internal volume is the same. The opening for putting in firewood is 20 by 20 centimeters, but a ramp progressively reduces the size of the inside so that the back of the chamber is only 10 centimeters high. By having a smaller internal volume there will be more efficient use of the heat generated by the fire, which goes more directly to the metal *plancha*. The larger opening makes it easier to put various sizes of wood into the stove. This model uses a clay chimney, which are produced by local artisans.

4.72 One thing that made it easier to use firewood in the Tezulutla'n model is a support for the wood so that it would not fall on the floor. Since the stove had no door, the wood sticks out beyond the opening of the stove. The technical team had determined that the door to close the firebox was not included because as far as they could tell from previous experience the people usually took it off or never closed it, which was also the case for the airflow regulator because many people found it difficult to use. As indicated, the absence of a door or its lack of use is a common feature in the other programs (see Figure 4-4). In addition, according to the staff of Tezulutla'n, transferring the technology is easier when the model is simple and has few parts. When construction was finished an informational sheet was posted near the stove to remind the family of the principal things to keep in mind in terms of maintenance. The interaction also resulted in a change in the design of the *plancha*. The first *planchas* were made of cast iron which sometimes cracked. The design team developed a *plancha* made of reinforced sheets of iron that was only available from a single supplier in Guatemala City but which did not have problems with cracking. The *plancha* also has three holes, each with removable rings that allow their diameter to be modified so that different sizes of pots can be used on the stove without difficulty. Thus, the design of the stove was quite responsive to the needs of the consumer.

4.73 In contrast to the Tezulutla'n project, the FIS and the Intervida projects were not as proactive in the design of the stoves in their project. The FIS stove is not flexible in terms of allowing the women to choose the height of the base, according to the comments of some women in the communities visited. The opinions and preferences of the women regarding ergonomic and safety aspects were not considered. Although there is

awareness within the task group that carries out the stove projects on the need for the FIS program to be focused on women, there was no evidence that actions were being taken to increase the participation of women in community development, decision-making, and greater access to resources. As opposed to the Tezulutla'n project which decided not to have a door for the stove, it was found in the FIS project in Los González, that 35 percent of the doors fell off the firebox, and therefore are not used. In the Intervida project, despite the fact that the stove is a technology used by women, the project made no effort to reaffirm the importance of women's participation. Neither did the project carry out actions to promote the participation of women in community decision-making or to help give them greater access to resources.

4.74 Thus, for at least two of the project one the initial stove was designed, there was very little use of feedback from stove users to adjust the designs of the stoves. In addition, very little communication between programs takes place. The other two programs could have evaluated some of the innovations developed under the Tezulutla'n project. Finally, unfortunately, there is very little cross-fertilization of ideas among these programs.

Recommendations and Lessons

4.75 One-third of rural families still use wood exclusively as cooking fuel and only about 5 percent do not use it at all in their homes. Over 90% of these families still cook over an open fire, which causes serious indoor air pollution and accidental burns. Furthermore, the three case studies reviewed in this chapter reveal that people in the communities with improved stove programs identified a considerable number of benefits from using them, particularly in terms of saving money and making conditions in the home better, which in turn can result in enhanced health conditions. A more structured and coordinated effort for improved stoves would help foster and strengthen the practices employed by the existing effective projects, and thereby provide access to a variety of quality, improved stoves by people in rural Guatemala.

4.76 One of the major problems in Guatemala involves the lack of coordination among the very dynamic stove programs in the country. There is definitely an important role for the government to play in both facilitating dialogue among the various parties interested in promoting improved stoves, and in ensuring that the public has access to stoves that are durable and of good quality. In this section strategies to make the overall efforts on improved stoves in the country more effective are discussed. Based on the historical overview, the case studies, and international experience, we present suggested strategies that could help the further development of stoves in Guatemala, by improving the effectiveness of existing programs, and linking these better with broader rural development programs.

Role of subsidies

4.77 Today in Guatemala, the stoves being promoted by the government and various donor agencies involve about an 80 percent subsidy for the purchase of the stove. A high percentage of the remaining 20 percent that the consumer must bear is in the form of materials and labor. This is in part necessitated by the very high costs of the type of stove being promoted in Guatemala. At present, subsidies are tied to particular models of stoves—mainly those involved with the program or donor providing the subsidy.

4.78 Given that subsidies are an integral part of the improved stove program in Guatemala, the immediate removal of all subsidies would probably do harm to existing programs and consequently could have adverse consequences for the health of rural people. This is especially the case since many of the models developed are quite costly and are not affordable without a subsidy provided to rural people.

4.79 Thus, the recommendation is to create a more open process for subsidizing improved stoves. For instance, the subsidies provided by the FIS might possibly be useful for implementing programs sponsored by non-governmental or even programs affiliated with other donors. This would mean that before participation in the FIS subsidy program, the models being promoted by the non-governmental organizations or donors would have to be tested and certified to reduce energy and remove smoke from the households. This would make it possible for the donor investments to be utilized for developing new and different kinds of stoves, serving a more diverse set of rural populations. For instance, in some areas, families appreciate the heat from the stoves in addition to the improvements in cooking. Because groups promoting stoves could utilize the subsidy from the FIS program, they could concentrate their efforts on stove development, project supervision, and other features necessary for a successful program. This process could be facilitated by the development of a technical assistance unit discussed later in this section.

Role of the market

4.80 In Guatemala, there is a need to facilitate market structures that allow for more direct relationships between private firms that manufacture stoves and stove users. The goal is for retailers selling the stoves to view the user rather than the donor or government as their customers. This would mean that the firms would have to develop high quality stoves and provide good service to consumers. Having a commercial market will allow the users to express their needs and preferences through market demand. The stove user also will be able to choose from more than one model of stove. However, at least in the short term given the expense of these stoves it does not seem possible to have a market for these stoves without some kind of subsidy involved in their promotion. Also, it should be realized that stove manufacturers are often very small businesses, with no capability to conduct market research into consumers' desires and needs.

4.81 Therefore, technical assistance for market studies involving improved stoves are necessary to clarify the relationship between the market for stoves and whether subsidies are necessary to promote them. They also would be important in helping define strategies for retail distribution and marketing of stoves.

Greater Interaction Between Programs: Stove Users, Designers, and Manufacturers

4.82 The benefit of having greater interaction between stove users, designers, and manufacturers is evident from the case study conducted in Tezulutlán project. Among the innovations in the project coming from an interaction between users and designers was the deletion of the stove door to the firebox. After examining the stoves in actual use, the team noticed that the doors to the stoves, which are very important in regulating the air and consequently improving stove efficiency, were often missing. Thus the efficiency gains were being negated by the consumer problems in using the stove with the door closed. Thus, the team designed a stove without a door, which compromises efficiency. Unless convenient for the user, the door would not be used even further reducing the efficiency of the stove. The experience of programs with lessons like this could be invaluable for other groups promoting improved stoves. One of the problems in the stove program in Guatemala today is that each program must in a sense reinvent the stove anew for each program.

4.83 Thus, it is recommended that technical assistance be given to a nongovernmental organization or a national agency to assist in facilitating greater interaction among all parties involved in the design and marketing of improved stoves. The lessons learned from the various programs could be shared among those groups involved in improved stoves resulting in less duplication of efforts and improvement in stove programs.

Institutional Roles and Participants for Promoting Improved Stoves

4.84 In order to implement the recommendation to improve the effectiveness of current programs, it is recommended that the government should play a leadership role in implementing an Intersectorial Coordination Group on Rural Household Energy through the Ministry of Energy and Mines. The Ministry of Energy and Mines in the past had participated as the leader of the National Group on Improved Stoves. Such a Coordination Group, in which there should be representation of all key stakeholders including the Health Ministry and the FIS, could have as a mandate the championing and implementation of policies related to meeting the energy needs of rural families. It is particularly important that this mandate be closely linked with broader rural development and poverty reduction programs.

4.85 The Intersectorial Coordination Group on Rural Household Energy should make the most of the existing infrastructure built around the projects that are already being implemented. For instance, the government should take advantage of existing structures for promoting stoves, such as the Social Investment Fund (FIS), which has distributed

more improved stoves than any other entity in Guatemala and has experience and representation in every department through its Departmental Offices. Also, there can be involvement in various ways of stove building firms, manufacturers of metal *planchas* and accessories, firms that provide training in the use and maintenance of the stove, and in general the people who have worked in the stove projects. It is important that they participate in a Coordination Group and in education and training events for builders and manufacturers, and also that they are part of the structure for disseminating the stove technology.

4.86 The NGOs, universities, and other civil society groups should be participants in the Intersectorial Coordination Group on Rural Household Energy as well, be it in the promotion and dissemination of the technology, or in technical assistance activities having to do with design, technological diversification, market studies, monitoring the performance and fuel consumption of the stoves, designing strategies for commercialization, and implementation of training and education programs. To conclude, a Intersectorial Coordination Group on Rural Household Energy should coordinate and implement necessary policy actions directed at meeting the energy needs of rural families.

Technical Unit to Certify Stoves for Subsidy Approval

4.87 In Guatemala today, there is no one agency that can evaluate for the government the quality and efficacy of improved stoves. Most successful programs around the world have a government financed technical unit that evaluates the quality, reliability, and durability of improved stoves. They often are involved in testing of prototypes to ensure design changes do not come at the expense of the stove performance. More recently some have begun to assess the health impacts of improved stoves, and have started to measure the indoor air pollution consequences of various models of stoves. The stove designs that are implemented should have efficiency criteria that conserve firewood and have efficient combustion to make the best use of this increasingly scarce resource. Also, the certification of the quality of the stove, its components, materials, and performance would do a great deal to protect consumers from stoves that have problems. As indicated, the design of stoves involve significant tradeoffs between price, reliability, and technical efficiency.

4.88 Thus, it is recommended that the government establish a Technical Stoves Unit that is involved in testing and approving improved stoves to be included in various programs sponsored by the government and donors. Such a Unit could facilitate the work of the Coordination Group and help to address the weaknesses encountered in the historical review of stoves in Guatemala and in the three case studies. The Technical Unit would be coordinated by the Ministry of Energy and Mines, but could be run by a third party NGO or private sector entity, and would include the participation of various civil society actors, NGOs, academic institutions, stove users, and international aid agencies. The Unit must have the support of the government to give it legitimacy in the eyes of the different stakeholders involved.

4.89 The Technical Stoves Unit would be responsible for the following specific tasks. They would conduct research to help develop new stove models, and train producers of improved stoves. In addition, they would be responsible for verifying the efficiency and quality of the models developed by the stove manufacturers. Finally, they would conduct or contract out market studies for the various models and assess the consumer satisfaction with the products on the market. This feedback would be very useful for those designing the stoves.

4.90 The principal objectives of the Technical Unit should be directed toward diversification of stove models so that users can choose the type of stove that best suits their needs based on factors such as family size, location, physical characteristics of the users, comfort, customs, and type of food. To accomplish this, as indicated the Unit also would be responsible for coordination at the national level between the various improved-stove projects and programs.

4.91 The Technical Stoves Unit would be a focal point for sharing information and experiences between the various projects or programs implemented by different organizations around the country. Also, it could provide technical support for projects, helping them with quality control and measurement of both the efficiency and levels of indoor air pollution associated with various models of stoves. Last but not least, they would protect consumers by evaluating and certifying the general quality of the stoves developed by the producers.

Conclusion

4.92 This review of relatively successful projects points the way to important work involving the future development of stoves in Guatemala. Specifically, the subsidy process for improved stoves needs to be more open in order to promote innovations in both technical and institutional ways for promoting improved stoves. Second, it is important to have a Technical Stoves Unit to ensure that the stoves offered to the public are of good technical design and quality. This is not only important from the standpoint of improving energy efficiency and reducing drudgery of women, but also as a way to improve health and productivity in rural areas.

4.93 The record of the improved stove program in Guatemala is more impressive than in any country in Central America. Between 1996 and 2002 more than 100,000 stoves with metal *planchas* were built in Guatemala, mostly through FIS. The scale of this effort generated national and international interest in conducting case studies on three of the most representative improved-stove projects in Guatemala. The case studies show that even without a coordinating effort, these organizations are continuing to implement isolated projects, though sometimes without a great deal of continuity. However, Guatemala is now at a stage in which the efforts of many of these isolated programs can be enhanced through placing these efforts in the context of broader rural development and poverty reduction programs, improved policy coordination between key stakeholders,

provision of broad technical support, and evaluation of the stoves being produced under the various programs.