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060

Evaluation of Improved Stove Programs in Guatemala:
Final Report of Project Case Studies

December 2004

JOINT UNDP / WORLD BANK

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

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Abbreviations and Acronyms

CATIE	Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agricultural Research and Higher Education Center)
CCM	Central Mennonite Committee
CEMAT	Centro Mesoamericano de Estudios sobre Tecnología Apropiada (Mesoamerican Center for the Study of Appropriate Technology)
CETA	Centro de Experimentación en Tecnología Apropriada (Center for Appropriate Technology Studies)
CHOQUI	Cantón de la Aldea de Chiquilajá, Quetzaltenango
CII	Centro de Investigaciones de Ingeniería (Center for Engineering Research)
DIDECO	Directorate for Communities Development (Dirección de Desarrollo de las Comunidades)
ENCOVI	Encuesta Nacional sobre Condiciones de Vida (Living Standards Measurement Study)
FIS	Fondo de Inversión Social (Social Investment Fund)
FODIGUA	Fondo de Desarrollo Indígena de Guatemala (Indigenous Development Fund of Guatemala)
FONAPAZ	Fondo Nacional para la Paz (National Fund for Peace)
FUNDACEN	Fundación del Centavo (The Penny Foundation)
FUNDEMABV	Fundación de Defensa del Medio Ambiente Baja Verapaz (Environmental Defense Foundation of Baja Verapaz)
FWD	Foundation for Woodstove Dissemination (Fundación para la Diseminación de Estufas a Leña)
FYDEP	Fomento y Desarrollo del Petén (Promotion and Development of the Petén)
ICADA	Instituto Centroamericano de Desarrollo Agropecuario (Central American Institute for Agricultural Development)
ICAITI	Instituto Centroamericano de Investigación y Tecnología Industrial Central American Institute for Research and Industrial Technology
IDRC	International Development Research Centre (Centro Internacional para la Investigación)
INACOP	Instituto Nacional de Cooperativas (National Institute of Cooperatives)
INAFOR	Instituto Nacional Forestal (National Forestry Institute)
INCAP	Instituto de Nutrición de Centro América y Panamá (Nutrition Institute of Central America and Panama)
INE	Instituto Nacional de Estadísticas (National Statistics Institute)
LPG	Liquefied Petroleum Gas (Gas Liquado)
M&E	Monitoring and Evaluation (Evaluación y Monitoreo)

MEM	Ministerio de Energía y Minas (Ministry of Energy and Mines)
PEMF	Proyecto de Estufa Mejorada del FIS (Improved Stove Project of the Social Investment Fund)
POCC	Programa de Organización y Capacitación Comunitaria (Community Organization and Training Program)
PROLEÑA	Association for Wood Energy Development (Asociación para el Dessarollo de la Energía de Leña)
SEGEPLAN	Secretaría de Planificación y Programmación de la Presidencia (Secretariat for Planning and Budgeting of the Presidency)
UCOSE	Unidad de Control, Seguimiento y Evaluación Ex – Post (Unit for Control, Supervision, and Ex-post Evaluation)
UNDP	Programa de las Naciones Unidas para el Desarrollo. (United Nations Development Programme)
VITA	Volunteers in Technical Assistance (Voluntarios en Asistencia Técnica)

Currency Equivalents, 2002

US$ (dollar) = Q7.80 (Guatemalan Quetzal)

Glossary of Terms

Carga Unit of measure, equivalent to 100 pounds.

Chicharrón Small pieces of fried pig skin cooked in their own fat. Chicharrones are sold in markets as a main course or side dish.

Comal Preheated surface on which tortillas are placed to cook. A comal is commonly made from clay or sometimes small metal planchas. Round-shaped comals are preferred in Guatemala because they provide uniform heating. They are also used to heat other foods.

Hornilla Stove burner.

Nixtamal Used to make dough for tamales, nixtamal is prepared by cooking corn in a lime milk to treat carbohydrates in the corn kernels and eliminate the hulls.

Pache A tamal flavored with salsa, salt, spices, and a piece of chicken or pork. The dough can be made from corn, rice, or potato.

Panela Sweet juice squeezed from sugarcane.

Plancha Flat plate that serves as the cooling surface on top of the stove.

Poyetón Stove base.

Tamal Generic name for a portion of ground and mixed corn wrapped in corn leaves and steamed. In some regions, the flavor is enhanced by adding fat, salt, and spices.

Tarea Unit of measure, equivalent to 400 pounds.

Tayuyo Compressed bricks without holes through the middle.

Tortilla A portion of cooked and mixed corn that is flattened into a circle between the palms of the hands and then cooked on a hot comal.

Tortilleria Place where corn tortillas are sold.

Trebe Iron ring with three feet, used to hold pots and pans over a fire; also referred to as "Trébede."

Executive Summary

1. This report presents the results of a study conducted by Fundación Solar—a Guatemalan nongovernmental organization (NGO) that works in the field of renewable energy—on experiences from improved-stove programs in Guatemala. The goal of the study was to systematically evaluate selected projects to determine success factors, sound practices that could be replicated elsewhere, and weaknesses to avoid.

2. Fundación Solar's research team studied three projects, implemented by three respective organizations, on improved, wood-conserving stoves in Guatemala. To acquire needed information, the team conducted interviews and focus groups with stakeholders in the respective geographic regions—Baja Verapaz, Jalapa, and San Marcos—in which the three projects were implemented. This report includes the findings, conclusions, and recommendations that resulted from the three cases studied.

Project Organizations

- **Tezulutlán**: An NGO supported by the European Union (EU) and the Government of the Republic of Guatemala, Tezulutlán carried out a stove project in the northern department of Baja Verapaz. By the time it ended, the project had constructed more than 4,129 improved, metal-plancha stoves.[1] Among the project's key features was that stove users contributed to costs by paying 100 quetzals (Q) (about US$13) for the stoves,[2] providing local materials, and building their own stoves; thereby covering about 45% of total costs.

  Fundación Solar conducted field research in two villages—Quiaté and Pahoj—where the project had installed 74 and 28 stoves, respectively.

- **Social Investment Fund (SIF):** A Government agency that mainly implements infrastructure projects (and has local offices in every department of Guatemala), SIF carries out Guatemala's largest, most extensive stove project. To date, SIF has installed more than 90,000 improved, metal-plancha stoves throughout the country. The Fund subsidizes about 90% of the cost of each improved stove.

  Fundación Solar's fieldwork focused on two villages—Los Achiotes and Los Gonzáles—where the project had installed 28 and 65 improved stoves, respectively.

[1] The term *plancha* refers to the flat plate that serves as the cooking surface on top of the stove. Improved stoves used metal planchas.
[2] Based on an exchange rate of Q7.80 equivalent to US$1.

- **INTERVIDA:** An international NGO established in Spain, INTERVIDA is active in six departments of western Guatemala. The organization has constructed about 9,000 improved metal-plancha stoves, with users contributing an estimated 30% of total stove costs.

Fundación Solar's field research was conducted in two villages—San Antonio Las Barrancas and Cantel—where the project had installed 41 and 50 stoves, respectively.

Main Findings of the Study

- *User-perceived benefits:* According to users, the main benefit of improved stoves is the savings in firewood, which they estimated at 50-67% of what they used with open-fire cooking.

  Users also cited the savings in time, in terms of both cooking meals and collecting firewood. To a lesser degree, they indicated the health and home-cleanliness benefits that the improved stoves provided.

- *Level of subsidy*: The subsidy provided by the three organizations toward total stove cost has been estimated at 55-90%.[3] The level of subsidy continues to be high, despite efforts by the three organizations to increase the share of costs borne by users.

- *Functioning of the stoves*: Although various components of certain stoves have been modified, nearly 100% of the stoves examined were in working condition. However, 28% of all users interviewed said they still used open fires, but only for special occasions, such as holidays, when they needed to cook large quantities of food. Moreover, only 10% of those interviewed said they used propane stoves, mainly for preparing drinks, food that can be cooked quickly, or reheating previously cooked food.

- *Sustainability*: None of the three projects has a method that guarantees financial sustainability. They have depended largely on international support. Efforts to increase the projects' sustainability in other ways, such as building local capacity, have been made.

- *Marketing*: The high percentage of subsidies provided by the three organizations has created market distortions that make it impossible for stove manufacturing companies to compete freely. However some metalworking shops in the main municipal and departmental centers sell various types of metal planchas. This activity is just beginning, with greatest demand for planchas and finished stoves still coming from the development projects.

[3] The total cost of a stove includes the costs of materials and their transport, as well as labor.

Conclusion

3. Guatemala lacks a defined program for improving wood-conserving stoves through supporting research and technological development, with a strategy for technology dissemination. To date, efforts have focused more on providing stoves to the poorest families, paying little attention to marketing strategies.

4. The three projects studied have implemented activities using what are considered sound practices for achieving success. However, they still face serious limitations in terms of sustainability. The Fundación Solar research team identified best practices found in one or more of the projects studied, some of which are listed below:

- Early community participation in the design and cost of stoves,
- Gender focus,
- Local capacity building,
- Focus on specific geographic areas,
- Participation of local staff,
- Use of a wood-conserving design,
- Use of local materials for stove construction, and
- Application of ergonomic and safety criteria.

1

Introduction

1.1 Located in the Central American subtropics, Guatemala extends 108,889 square kilometers (sq km) and has a population of about 12 million. The country has a wide variety of climatic regions and life zones; its broad racial and cultural diversity includes 22 Mayan ethnic groups, as well as mestizos, Garífunas of Afro-Caribbean origin, and people of direct European descent. Although the country's official language is Spanish, each Mayan group, as well as the Garífunas, also has its own language.

1.2 Amidst this diversity of climates, races, cultures, and customs, 67% of Guatemala's estimated 1,591,593 families rely on wood energy—wood and charcoal—to prepare their daily meals.[4] Moreover, it is calculated that Guatemala loses an estimated 2,460 hectares of tree cover annually to fuelwood consumption.[5] This data demonstrates how important firewood is for the country, as well as the relevance and potential effects of any action undertaken to conserve this resource.

1.3 For nearly three decades, developments in the design and manufacture of improved stoves have aimed to reduce indoor smoke and improve efficiency of fuel wood use by the majority of the population. Stoves are the centerpiece of the typical Guatemalan kitchen and a fundamental component of many projects carried out by both the Government and national-level NGOs.

1.4 Because of the important health and environmental implications that fuelwood and improved stoves have for Guatemala, and to address one of the country's key energy-policy issues, Fundación Solar took on the task of developing case studies on improved-stove projects of three organizations, to identify factors for success, as well as weaknesses. It is envisaged that the case-study findings will provide a useful input for the design of strategies for conserving Guatemala's firewood and improving the air quality inside its homes.

Structure of the Report

1.5 Chapter 2 describes the evolution of improved stove programs and models in Guatemala during the period 1976-2002. Chapters 3 through 5 examine three case studies of improved stoves programs in Guatemala; and describe salient program

[4] Source: *Report on Human Development: Guatemala, The Rural Face of Human Development*, 1999 ed.
[5] Source: CONAMA/GEF-UNDP (1999). Estrategía Nacional para la Conservación y Uso Sostenible de la Biodiversidad y Plan de Acción Guatemala.

elements including organization, geographic focus, project features, and profiles of stove users and non users. Chapter 6 summarizes lessons learned from the case studies and identifies best practices, strengths and weaknesses of the programs. Finally, Chapter 7 presents the main conclusions and recommendations of the study. The appendices include various pieces of information referenced in the main chapters including among others, a description of the research methodology used to prepare the case studies (Appendix A), and the findings of a study of the costs of improved stoves promoted in Guatemala (Appendix M).

2

Review of Guatemala Stove Programs, 1976–2002

2.1 Guatemala is internationally recognized for development of its improved stove program and related technologies. For example, the Lorena stove is strongly associated with Guatemala. Furthermore, the process of technology transfer and research on new designs has been sustained over time. Evolution of the country's improved-stove programs is interwoven with the history, limitations, and conflicts of Guatemalan society and its aspiration to attain a more humane way of sharing the benefits that technology offers for meeting basic needs.

2.2 Since ancient times, stove models have been directly related to methods for cooking the two grains that have formed the foundation of the Guatemalan diet: corn and beans. These foods require specific methods of preparation; for example, the "comal" is indispensable for cooking corn tortillas.[6]

2.3 When studying topics related to wood-burning stoves, one immediately thinks of poor, rural families, which is strictly the case. Historically, however, improved wood-burning stoves were used initially to cook wealthy people's food, showcase their homes, and reflect their traditions and refinement. However, as wood alternatives—kerosene, liquefied petroleum gas (LPG), or electricity—became available, those who continued to use fuelwood were, in effect, the population groups that lacked sufficient resources to switch to other fuels.

2.4 Improved wood stoves are the result of research and development carried out by various Guatemalan technicians over a 26-year period. In most cases, stove designs arose in response to needs of the poor for improved equipment, knowledge about stove use and maintenance, and to foster a more open attitude among users toward introducing changes into their way of life and approaches to handling everyday problems.

2.5 Historically, the benefits associated with improved stoves have been based on the priorities established at the time they were introduced. Initially, these priorities were:

- Saving wood and economic benefits for households,
- Making cooking more convenient by lifting the fire off the ground,

[6] See Glossary.

- Making cooking cleaner by eliminating smoke from the kitchen, and
- Benefiting the environment by reducing deforestation.

2.6 It is not possible to recount an "official history" of the improved-stove movement in Guatemala because it is a model of technological innovation generated and enriched by popular participation and a mechanism for technology transfer and appropriation by a broad segment of society, which gives rise to more than one interpretation. Moreover, no documentation center in Guatemala has collected comprehensive information covering the 26-year period of dynamic activities.

2.7 The improved-stove programs had diverse objectives. For some people, groups, and institutions, they provided an opportunity to implement projects that would have immediate effects—improving the well-being of rural families and raising awareness about ways to deal with limitations and find solutions. For others, the objectives and products developed were dictated along political or religious lines or with the intent of organizing groups for other special purposes or interests.

2.8 This review is based on ongoing participation throughout the period covered, combined with information taken from various event-related documents, accounts, and user opinions. This data, in turn, has been used to reconstruct a general overview of each activity, objectives of programs and projects, and a list of institutions. The review structure is based on documented events. (It is possible that this interpretation overlooked an acknowledgment that should have been made; however, this should not detract from its objectivity.)

2.9 The review leads to the general conclusion that development of technology for improved wood stoves in Guatemala occurred in two similar stages that coincided with the introduction of technologically innovative models—the Lorena and metal-plancha stoves—which were widely accepted and constructed in relatively large quantities. Many similar models were introduced, most of which were advanced by enthusiastic designers but lacked the formal backing of a basic technical study that could have fostered confidence in the design changes (Westhoff and Germann 1995).

2.10 The representative programs and projects lack a formal relationship between users and designers because of the presence of an agent or intermediary who chose the models, decided how to use them, and managed program or project financing. As a result, women, the primary users, did not buy the stoves directly from manufacturers or distributors because, through their husbands—who historically made nearly all decisions—they sought the help of intermediary institutions to negotiate the direct terms of sale.

2.11 It has not been possible to develop a commercial market for the various models offered because of the models themselves and the subsidized nature of the programs. (The tendency has been to provide the stoves free of charge.) Institutions that constructed large numbers of improved stoves attempted to produce the largest number of units at the lowest possible cost. This attitude often led to a decline in product quality, with the expected results. It was difficult to demand commitment to quality in the absence of current market information on a product being given away.

2.12 This review includes valuable contributions derived from discussions and experience sharing at gatherings of stove experts, which have been held since 1977. Unfortunately, these inputs were not taken into account by the authorities responsible for making decisions. Nevertheless, Guatemalans continue to generate ideas and solutions for improved stoves, which only await the opportunity to be applied. Finally, women's participation in the decision-making process is beginning to be valued.

Prototype Characteristics

2.13 Improved stoves are characterized by a variety of features. They are used to cook food, use wood as their primary fuel, consist of various parts arranged to enclose the fire in a way that allows it to be tended as needed, and can be set at different heights. After making the greatest possible use of the hot air and gases generated by the fire, the improved stove carries the smoke and gases out of the kitchen. Another fundamental feature is the stove's visual appeal. In addition, it is preferable that the stove cost as little as possible. These features comprise the definition used in the review for evaluating stoves.

2.14 Stoves have been made from a range of materials: clay, bricks, sheet or plate metal of varying thicknesses, and conventional construction materials. The materials used have depended on the model; size; and desired function of the stove; and, in some cases, local availability of materials.

2.15 Other features can be added, such as a door for inserting wood or a flue valve to control the outflow of combustion gases. Aesthetic embellishments, such as a mosaic set in cement, can be added to the upper part of the stove or, in some cases, to all visible surfaces. Evaluation of Guatemala's improved wood-burning stoves has been based on how well they incorporate the basic required characteristics. The degree to which they incorporate these characteristics differentiates one model from another (VITA 1980).

2.16 The improved functions are as follows:

- The fire is enclosed and is not directly visible; that is, combustion occurs within a confined space or firebox;
- The firebox is positioned at a higher level than the kitchen floor;
- Hot air and gases are retained within the stove as long as possible to maximize use of heat; and
- A chimney conveys the gases from the fire to the outside and regulates the inflow of air for combustion.

2.17 The stove's main advantages are:

- Conservation of firewood. For most purposes, improved stoves are more efficient than open fires in terms of using the heat generated by burning wood.
- Increased comfort and safety, by elevating the fire above the floor.

- Improved air quality, by removing smoke from the cooking area.
- Cleaner environment, by avoiding excessive use of firewood and educating the public about responsible use of this resource.

2.18 In some cases, modifications of these characteristics to known stove models have compromised performance and led to abandoning the stoves.

Evolution of Stove Technology

2.19 The evolution of stove technology in Guatemala can been divided into stages distinguished by specific technological changes in the models disseminated at public events throughout the country. Each stage can be identified by a general program composed of various projects. Figure 2.1 provides a timeline of these stages, including key events, in the development of the country's improved stoves.

Figure 2.1: Timeline of Stove Technology Development

Models predating improved stoves	Technology innovation	Technology diversification	Studies conducted and results disseminated	Commercial models promoted	Commercial market begins
• Imported cast-iron stoves • Domestically produced, cast-iron stoves • Brick stoves, with cast-iron planchas	• Lorena stove introduced	• Large-scale production based on the Lorena model • CETA stove introduced* • Diversification of prefabricated models, based on the CETA stove	• National Survey on Improved Stoves • Baseline Study on Tortilla Stoves in Guatemala City • International Workshop of FWD • Market Study on Stoves in metropolitan Guatemala City • Study of Indoor Air Pollution from Smoke in Rural Households	• Acceptance of the plancha-armada model • Training programs in planchas manufacturing • Development of a plancha-armada prototype • Large-scale distribution of plancha-armada stoves • Development of commercial models	• Studies conducted on effects of stoves on users' health • Introduction of portable commercial models, based on the plancha-armada stove • Emphasis on women's participation in stove programs

*See Appendix I for a description of stove models.
Source: Original diagram based on interpretation of the historical review.

Wood-burning Stoves before 1976

2.20 Before the improved-stove programs began in 1976, the most common way to cook in Guatemala was over an open fire on a dirt floor, with cookware balanced over the fire on three rocks—a method still used today. An improvement on the method was the introduction of an iron ring with three feet used to hold pots and pans over a fire, known as a "trebe" or "trébede." The basic innovation was the construction of an elevated stone or masonry platform built near the doors of a house or in hallways, known as a "poyo" (Editorial Sopena 1990).

2.21 It is commonly known that innovations in using firewood for cooking have been brought to Guatemala since the 19th century, largely as an outgrowth of the European Industrial Revolution. In European countries, with their harsh winters, the stove's primary purpose had been to provide indoor heating through thermal radiation.

2.22 Adapted for cooking, imported wood-burning stoves had metal bottoms, sides, and tops. The heating area on top of the stove was made from a metal plate with holes, whose diameter could be modified with rings and moveable covers. The casting was of high quality, with an attractive appearance and high durability. Some of the stoves sold are still in use today, requiring only minor repairs. At the same time, models with similar features and dimensions were being manufactured locally in Guatemala. While not as attractive or durable as the imported European models, their pricing was competitive.

2.23 Both imported and local models were affordable only to wealthy people. The stoves were bought as a way to avoid emitting irritating smoke into the kitchen, as well as to add a decorative touch. An open fire located outside the kitchen usually supplemented the stove. Most of the stoves included a reservoir heated by a system of metal coils incorporated into the combustion chamber in which water circulated in convection currents. Other metal models were specially modified to cook food for commercial sale. Metal planchas of varying origin and form, often reinforced by long metal pieces, were used for this purpose.

2.24 Use of an enclosed, controlled wood fire and controlled emissions came to represent the basic cooking format of a highly developed, commercial stove model. Purchasers bought the stoves, installed them in their houses, and hired bricklayers or plumbers to prepare them for use; shortly thereafter, the stoves were integrated into the functioning of the homes. A fundamental feature of these commercial models was their portability.

Technology Innovation: 1976–1980

2.25 Guatemala's improved stove program began at the Choquí Experimental Station,[7] operating in the western altiplano of the country, with only one office in the department of Quetzaltenango. In the early 1970s, the Station began its research in renewable energy applications and promoted the use of solar energy for heating water and drying agricultural products, organic fertilizers, soil conservation practices, and testing wind energy for use in motive power.

2.26 The Station's approach to undertaking work in its rural area of operations included methods similar to those of the Appropriate Technology movement begun in Asia and Africa that discovered successful techniques for solving certain poverty-related problems. (The methods are variously referred to as appropriate, intermediate, alternative, or village technologies.). Mexico, El Salvador, and Costa Rica began similar programs in the Latin America and Caribbean (LAC) region, with which close contact was maintained. The core theme of appropriate technology is centered around technological practices aimed at meeting the basic needs of housing, food, education, clothing, and various other commodities, among which energy is one of the most important. Outcomes were greatest in China, India, and certain African countries, where efforts were being directed to address the threats of hunger and desertification.

2.27 As part of its basic philosophy, Appropriate Technology promoted key concepts that influenced improved-stove design. The most significant included:

- Intensive use of local labor for stove manufacturing;
- Preference for using local resources and materials instead of imported ones;
- Direct participation by users or beneficiaries in the manufacturing process, known as self-construction;
- Development of activities with small financial investments;
- Building of social organization around technical activities and outcomes, and manufacturing of many specialized units;
- Simple procedures to allow easy and extensive transfer and application of knowledge and experience;
- Basic mechanisms created by the technology to foster self-sufficiency among the regions and groups involved;
- Use of local or traditional technology, which, when revalidated, can yield benefits to the users who understand and value it (for example, activities are developed around using and molding clay); and
- Imparting knowledge to users, which they can use, exchange, and modify to suit their needs and preferences.

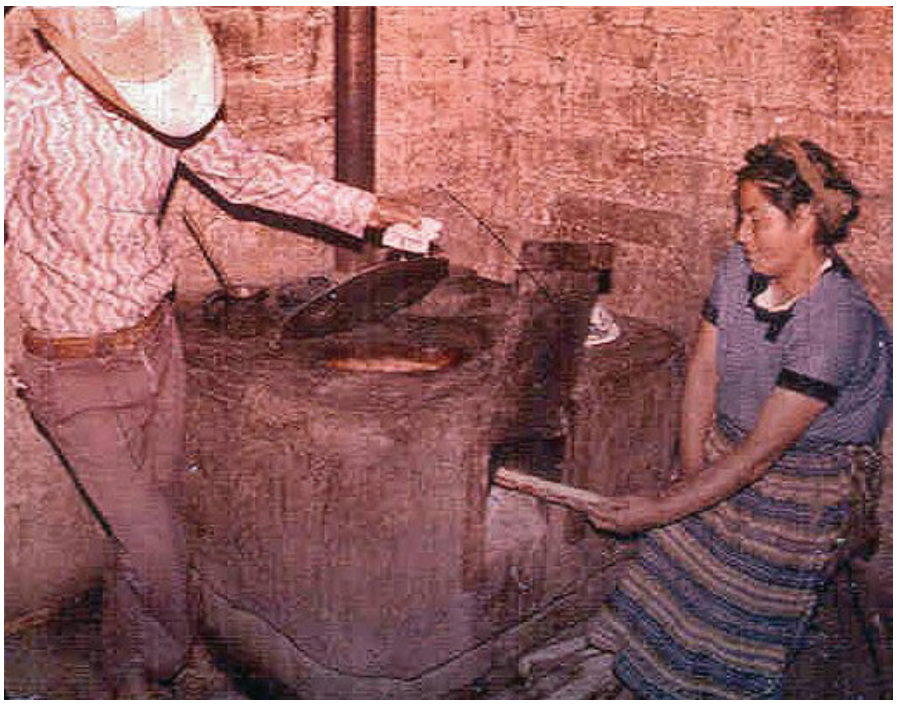
[7] The Choquí Experimental Station began Appropriate Technology work in 1970. Named initially for its location, the Station later changed its name to ICADA CHOQUÍ to better define its work and obtain the legal status of an agricultural cooperative.

2.28 In February 1976, an earthquake interrupted the Station's work. Over the course of reconstruction, the Station decided to organize available funds in a more reliable way. Therefore, it decided to use resources to develop and consolidate various small projects into the improved stove program.

2.29 Under financing agreements, technical experts from Canada and the United States became part of the team. One technical expert from Africa brought additional experience to the project, which led to development of the first Lorena prototype. The printing of informational pamphlets followed, and, in May 1976, technology dissemination began.

Lorena Stove: Product of the Period

2.30 The Lorena improved stove was named for the materials from which it was manufactured: *lodo* (clay) and *arena* (sand). As a single piece made of large amounts of a uniform material, the Lorena stove was categorized as an oversized product. Appropriate Technology criteria were applied in the stove's conceptualization, design, and means of distribution.



Lorena Stove
Photo credit: Manuel Tay

2.31 The Lorena stove's specific dimensions depended on each user's preferences and resources. As a result, stoves were round, square, rectangular, or even triangular in shape to fit into corners. Stove size and shape depended on space and available materials. The firebox, diameter of internal passages, opening for adding firewood, and chimney height were not standardized; no special tools were needed for construction; and measurements were made using hands and fingers.

Dissemination and Technology Transfer

2.32 A training methodology was developed to disseminate knowledge through practical construction courses associated with technical assistance programs. A research program to develop new styles and alternative materials, as well as quality-control mechanisms, was developed in parallel with the training courses.

2.33 An evaluation and support system for the stoves that were built was structured through the creation of information and communication networks of users and the ICADA Choquí Station. Integration of women stove builders into the construction process led to improvements in distribution and quality control.

First Regional Conference of Stove Experts

2.34 Relationships established through training programs with organized groups, individuals, NGOs, and other related groups led to the planning of the First Regional Conference of Stove Experts, held at the Catholic Training Institute in the city of Quetzaltenango in late 1977. Conference participants recognized that the Lorena stove demonstrated the ability of individuals and social groups to adopt and develop knowledge, when given favorable conditions within which to work.

2.35 It was recommended that the dissemination strategy should not include subsidies beyond resources used for training, which included a fee for paying the instructor. User groups should be charged for any supervision they requested, as well as the cost of manual production.

2.36 It was concluded that the Lorena stove had started the improved-stove movement in the region and that its successes should be followed up with similar innovative models that had begun to emerge, while adhering to the fundamental principles of the original design. It was determined that sponsoring institutions should be responsible for the methods of construction, dissemination, and quality control.

2.37 The agenda included group discussions on the technical difficulties of self-construction; the quantity, quality, and availability of materials; ways to identify types of clay; and initiatives by manufacturers and institutions not qualified for the task. (The list of Conference participants and the proceedings of the event could not be located).

Financing Methods for Improved-stove Installation

2.38 Dissemination of the stoves provided an opportunity for the participation of a variety of governmental, private, nongovernmental, and research institutions; as well as qualified local groups that aimed specifically to implement the programs and projects of other institutions.

2.39 For all the participants, priorities of the methodology were not motivated by commercial interests.. Rather than selling stoves, participants tried to build them in the new homes destroyed by the earthquake.

2.40 International donations financed basic assistance for support of training, construction, and supervisory programs for the stoves that were built, as well as design

and publication of informational pamphlets and construction manuals. Users' share of the total cost of the Lorena stove was relatively high because of the characteristics of the procedure used. Users bought the materials with which to build the stoves, transported them, and actively participated in construction.

2.41 As the number of institutions participating in the program grew, they began to provide larger subsidies, so much so that, during the information sharing session at the Second National Conference of Stove Experts (described below), it became clear that the attitude of providing stoves for free and competing for both potential stove users and international funding was jeopardizing program success (ICADA, CHOQUÍ, CEMAT, and XELAC 1980).

Second National Conference of Stove Experts

2.42 The innovation program concluded with the Second National Conference of Stove Experts, held February 25-29, 1980, in the municipality of San Cristóbal Totonicapán, at the then-named Quiché Bible Institute. Stove experts from various departments, municipalities, and four other countries attended the conference, representing a range of governmental and religious institutions and NGOs.

2.43 The agenda, invitees, and seminars, as well as the approval of learning materials for publication, all centered on the Lorena stove, the only model available at the time. Nevertheless, strong differences began to emerge with regard to construction methods and selection of materials. The groups concluded by expressing their concern about competition between them and the absence of an institution or entity that could serve as a technical reference unit to support the initiatives. A detailed Conference proceeding was compiled to provide a concrete record of the event (see Appendix H for a list of institutions that participated).

Technology Diversification: 1980–1986

2.44 The construction of the Lorena stove and all its variants grew through different types of organizations, leading to large-scale dissemination of the technology. Financing for most projects carried out during this period relied on resources donated by national and international organizations. The activities they carried out were widely known and well regarded.

2.45 The Ministry of Energy and Mines (MEM) involved the National Group for Improved Stoves, a renewable-energy working group organized by the Office of Alternative and Renewable Energy, in coordinating and promoting efforts of the some 30 institutions active in this field in 1982. Shaping of the groups took into account various interests, including recommendations of the Seventh National Congress of Engineering and the Third Latin American Conference on Bioenergy. Other institutions and individuals not involved in these groups worked independently, using their own resources.

2.46 The groups were 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—social, economic, and technological—that directly affect overlooked rural and suburban sectors. The ultimate objective is integral human development, while protecting and conserving the environment." (MEM 1985a).

2.47 At its most fully developed stage, the group comprised 27 formally registered, public- and private-sector institutions. They exchanged ideas, logistics, information, and technical resources, while trying not to interfere with the work of individual institutions. The central idea was to optimize resource use for the benefit of the institutions and work of each member group.

2.48 Their scope of activity was summarized as follows:

"Integration of institutional programs into a national plan for the diffusion and dissemination of the ecologically friendly technology of improved stoves [and] Interinstitutional training to expand the program's coverage, guaranteeing a good transfer and adoption of the technology and promoting the group's activities through workshops, seminars, means of mass communication, and national and departmental trade fairs." (MEM 1985a).

2.49 The achievements that the documents refer to involve developing a national improved-stove program; integrating the institutions working in this field; organizing an interinstitutional information system; and preparing a workshop seminar on the construction, use, maintenance, and dissemination of improved stoves.

2.50 Concrete results were attained in a 12-stove program conducted in San Pedro Ayampuc, which included interinstitutional participation by technical experts and an exhibition on improved stoves that used materials from various institutions. In addition, a directory of the national group was compiled, and the National Survey on Improved Stoves was conducted. However, with the change in government administration and officials, the national group per se began to disappear by 1986.

Proposed Models of Improved Stoves

2.51 Using the Lorena design as a starting point, new models were created that used new shapes, mixtures, and construction methods. The initiatives of the designers and innovators grew out of direct work with communities and stove users who made new demands and proposed solutions. Most of the models identified were the result of the dissemination work of these programs.

2.52 It is worth highlighting the initiative of the Appropriate Technology Experimental Center, known as CETA (Centro de Experimentación de Tecnología Apropiada), which proposed the construction and distribution of a model whose design was conceptualized differently (Ma and Sánchez 1983). This model was followed by those proposed by the Mennonite Central Committee, which were called "fish," "shark," and "whale" because of their respective shapes. The MEM used the technical

characteristics of the dissemination program for this model as the prototype for a potential mass assembly system with simple standards or patterns for making the stoves. However, the program was not self-sustaining (see Appendix I for a list of identified stove models).

Dissemination and Technology Transfer

2.53 The designers, both individually and institutionally, developed dissemination, manufacturing, and consolidation programs for their stove models. The models were made available to various programs, and the technology was developed in the field under independent control and supervision. The National Group for Improved Stoves, mentioned above, coordinated the work.

Financing Arrangements for Installation

2.54 All of the models presented varied in the way users acquired the stoves. However, one common feature was that the stoves were essentially considered a gift. This was the preferred option for most of the funding that flowed into the country during the period following the earthquake. Differences between programs consisted only of the varying degrees to which the families who received the stoves contributed unskilled labor for construction, transport of materials, and food for participants.

2.55 This funding arrangement was criticized sharply by institutions during follow-up and knowledge-sharing events, and was an issue on the work agenda of the National Group; however, no way was found to avoid it. Competition between institutions made it impossible to introduce any commercial components during this period. Except for private initiatives, the stoves in this program were not bought from a manufacturer.

Third National Conference of Stove Experts

2.56 This stage of the improved-stove programs ended with the Third National Conference of Stove Experts, held March 17–22, 1985 in Panajachel Sololá. The Conference was attended by many representatives of various institutions, and included demonstrations of a variety of models (MEM 1985b). In addition, working groups issued recommendations and warnings on the potential failure of the programs from a technical and distribution standpoint (see Appendix J for a list of Conference participants).

Conducting and Disseminating Studies: 1986–1993

2.57 During this relatively long period, institutions implemented projects that distributed various numbers of distinctive stove models independently, without coordination among institutions. Well-known groups disappeared, and new ones emerged. Disappearance of the National Group for Improved Stoves, for example, resulted in institutional isolation. The Ministry of Energy and Environment still sponsored a manufacturing workshop for CETA stoves, which was used to support the energy forest program. Numerous formal reports on improved stoves were produced;

however, they had limited relevance to dissemination. In addition, significant technical events were held.

National Survey on Improved Stoves

2.58 The accomplishments of improved-stove programs implemented in Guatemala before 1985 caught the attention of various national and international institutions, prompting the National Group for Improved Stoves to seek funding for a nationwide survey and evaluation of technology. With financing from the International Development Research Centre (IDRC) of Canada, the National Survey on Improved Stoves was implemented in 1985.

2.59 The Survey identified programs and institutions whose work on improved stoves had been recognized before and during the field survey (Appendix K). The main purpose of their work was determined, which, in most cases, was not limited strictly to the implementation of stove projects.

2.60 The Survey report underscored that 91.5% of the improved stoves being used were Lorena stoves, although the term *Lorena* was used generically. The report pointed out the technical errors in construction and users' rejection of the various stoves, particularly for failing to fulfill their promise of quality construction. It also showed that the method of disseminating stoves could not be commercialized because of widely available subsidies and donations, which limited users' willingness to pay. The report further stated that stove construction was deficient; the number of technical mistakes and errors was significant, revealing that builders were unqualified and institutional supervision was deficient. The Survey advised curtailing the way in which stoves had been disseminated in the past, calling for a reassessment of institutional objectives; review of the interests of individuals, institutions, and potential users; and study of other diverse factors related to promoting improved stoves (MEM 1985c).

2.61 Survey workers examined and evaluated the models they found in the communities visited. The Survey report stated that the stove characteristics were not defined well enough to allow for classification. However, using reasonable criteria, it was possible to produce general data on stove types (Table 2.1).

Table 2.1: Most Common Stoves in Use

Stove type	No. found	% of total	No. of departments
Lorena	728	91.50	21
Chulah	13	1.58	3
Singer	13	1.58	3
Metal plancha	16	1.98	5
Brick	11	1.38	2
Clay plancha	4	0.60	1
Other models	11	1.38	5
Total	**796**	**100**	**40**

Source: *National Stove Survey*, MEM, 1985c

2.62 National coordination of the Survey was carried out by a commission of appointed representatives from institutions participating in the National Group. The aim was to create interinstitutional working relationships based on the Survey outcome; however, this was not achieved.

Baseline Study for Design of Improved Tortilla Stoves

2.63 The baseline study for the design of improved tortilla stoves in Guatemala City was presented by the Firewood and Charcoal Unit of the MEM in May 1988. The study's goals were to facilitate the dissemination of wood-conserving, tortilla stoves and to gather data for improving stove design, incorporating the minimum features that would make the stoves readily acceptable and distributable. It was required that the model be able to cook corn, the basic ingredient of tortillas (MEM 1988).

2.64 This study is historically important because its findings were considered in the design, manufacture, and marketing of a stove that used LPG instead of fuelwood, thus beginning a process of fuel substitution.

International Workshop on Dissemination of Woodstoves

2.65 The International Workshop on Dissemination of Woodstoves was held in Guatemala October 4–10, 1987. It was supported by the IDRC of Canada and the Foundation for Woodstove Dissemination (FWD), and was organized by the Mesoamerican Center for the Study of Appropriate Technology (CEMAT). A main focus of the Workshop was review of the Guatemalan program on wood-burning stoves. Portable models from Africa and Asia were presented.

Woodstove Market Study in Guatemala City

In December 1990, CEMAT published the document *Market Study of Woodstoves in the Metropolitan Area of Guatemala*, which analyzed the movement to commercialize stoves, particularly models that manufacturers thought would be most attractive to buyers (CEMAT 1990). Table 2.2 shows the types of stoves commercialized, the location of businesses, and their prices.

Table 2.2: Commercialization of Improved Stoves

No.	Stove type	Location	Buyer	1990 price (Q)*
1	Ceramic	San Raymundo, Guatemala	Institutions	20.00
2	ROCKY	Zone 8 Guatemala, Guatemala	Projects	19.00
3	Improved Chefina	Antigua Guatemala, Sacatepéquez	Individuals	150.00
4	CETA	Santa María Cauque, Sacatepéquez	All types	50.00-120.00
5	CETA	Zone 7 Guatemala, Guatemala	Housewives	49.00
6	Lorena	Zone 4 Guatemala, Guatemala	All types	930.00-1,700.00
7	Lorena	Santa María Cauque, Sacatepéquez	Individuals	50.00-120.00
8	Clarita	San Juan Sacatepéquez, Guatemala	Projects	15.00
9	Ceramic	San Juan Sacatepéquez, Guatemala	Projects	20.00
10	Estrella and Estrellita	Zone 3 Guatemala, Guatemala	Projects	26.50 and 24.00

* The exchange rate in the parallel market during this period varied between 2.5 and 3.5 quetzals (Q) to 1 US dollar ($).
Source: CEMAT, 1990

2.66 Although manufacturers and distributors wanted to market goods and services related to improved stoves, lack of demand and problems associated with the technologies did not allow the stoves to be commercialized. Thus, after only a short time, the stoves disappeared from the marketplace.

Study on Indoor Carbon-monoxide Pollution in Rural Households

2.67 In 1993, researchers from the Division of Nutrition and Health of the Nutrition Institute of Central America and Panama (INCAP) began a study on indoor carbon-monoxide pollution from wood smoke in rural households of Guatemala. This study was the first phase of a larger study that examined arrested fetal development caused by chronic lack of oxygen resulting from rural housewives' daily exposure to carbon monoxide through wood-stove cooking.

2.68 The researchers concluded that, in the rural households studied, women were exposed to high levels of carbon-monoxide pollution for prolonged periods. The report recommended the need to continue research to clarify the physiopathology mechanisms in subjects with chronic exposure to high levels of carbon monoxide.

Decline of Large-scale Stove Models

2.69 While technological implementation continued, tangible impacts and results were in decline. The favorable outcomes of the diversification program began to show serious deficiencies, and once successful models began to experience problems and

largely disappeared. In their field visits, experts found that, with few exceptions, the stoves that had been constructed were subsequently abandoned, and others could not be found where the stoves had been built.

2.70 Program critics and analysts considered these results a technological disaster; nonetheless, manufacturers and institutions continued their work, confident in their knowledge of the stoves they had learned to make. Through various documents and research meetings, it was determined that it would be possible to coordinate these efforts and standardize the technology only when all of the models entered a formal commercialization phase. This position gave rise to the period that followed, described in the next section.

Promoting Commercial Models: 1993–2001

2.71 Experiences from 1976 to 2001 indicated that the models available in Guatemala could not be mass-produced or compete in a conventional stove market. The efforts and initiatives then under way were not sustainable. Furthermore, it was clear that a large-scale model's ability to remain commercially competitive depended on many qualitative factors. Since 1995, the global economic trend toward privatization of state services and market liberalization had become increasingly important. Guatemala began to take actions along these lines.

Development of a Commercial Stove Model

2.72 As a result of the information and knowledge sharing between various countries on the evolution of stove programs, it was concluded that, in order to achieve widespread dissemination of stove models, Guatemala would have to subject itself to the forces of supply and demand; users, through their market decisions, would define which features the stoves should have. Compared to the commercialization plans offered by certain Asian and African programs, Guatemalan models were not attractive because they could not be transported easily, once purchased. In addition, manufacturers could not maintain a reliable supply or consistent quality at reasonable prices to meet the larger demands of users and intermediary institutions. Moreover, the quality of self-constructed models could not be controlled, and they could not be mass-produced.

2.73 Using metal parts opened up as a potential way to address problems of quality control and durability of clay materials. The metal components of LPG stoves constructed for commercial tortilla producers had been used successfully and were accepted in the marketplace. Use of metal parts also raised the possibility of incorporating a tortilla pan or "comal" into the stove unit by using the already commercialized cast-iron planchas (and occasionally the plancha armada) and allowing trials to satisfy markets that could afford to pay more (e.g., food vendors in markets or on the street, artisan pork industry, and tamale and "pache"[8] plants).

[8] See Glossary.

Evolution of Plancha-armada prototype

2.74 No documentation could be found on the artisan origins of the plancha-armada stove as a heating surface separate from the direct flame, as it is known today. Let it suffice to say that the stove's form, shape, and function were derived from the planchas first imported from Europe. However, the innovative idea of the plancha armada arose from a long process of trial and error that emerged through collective creativity.

2.75 Today's plancha-armada stove evolved through changes in technical features users sought to meet their specific needs. Specific phases in the stove's evolution were as follows:

Phase 1. Flat plancha, usually cut from metal containers. It was used in the artisan production of "comals," improvised from metal, to prepare "chicharrones."[9]

Phase 2. Flat plancha supported by metal braces. It usually used leaf springs of automobiles to better support heavy pots with which to look large volumes of food.

Phase 3. Plancha with a cooking hole reinforced by the same pieces, supported by rocks on a "trebe" or "trébede." It was used by street vendors to make tortillas and other foods.

Phase 4. Flat plancha made of original metal, reinforced by angular metal sides soldered to the bottom. This model attempted to imitate the cast-iron planchas of the imported stoves and was the first plancha prototype used in homes.

Phase 5. Plancha with cooking holes, reinforced metal sides, and a removable lid supported by the reinforcements. Improved models were used in the homes of those who had prior experience with cast-iron stoves.

Phase 6. Flat plancha with more than one cooking hole, rings, and lids with independent supports. This present-day, commercial model has three or four holes and metal accessories used as controls, a door for inserting wood, a regulator for the outflow of gases from the fire, and a chimney made of galvanized sheet metal modeled on the downspouts of roofs. The hood covering the chimney is similar to conventional ones. A basic feature of this stove is that only its metal parts, particularly the metal plancha (the core feature of the model), are portable.

2.76 The metal-plancha stove has simplified the features and functions of the old, cast-iron models imported from Europe. Simplified construction, in turn, has significantly reduced the stove's price. The cast-iron plancha is manufactured in Guatemala by shops that specialize in the production of small, cast-iron objects, generally using recycled materials; during the period of peak production, an assembly line was opened to meet demand. The plancha-armada stove has the same height and usable

[9] See Glossary.

surface area as the Lorena stove; likewise, it uses the same base of concrete blocks to support the stove.

2.77 Training of manufacturers, builders, transporters, and project administrators has permitted more stoves to be produced in a shorter period of time than was previously possible. Currently, the country's production capacity can meet virtually any demand. However, the quality standards of most manufacturers and intermediaries are not clearly defined.

Commercial Distribution: 2001–present

2.78 The current stage of commercial distribution is similar to the first stage in the history of stove development in that new models are being produced, based on the original concept and design, but with changes aimed at improving stove performance or reducing costs. Widespread dissemination and use of the metal-plancha stove by various institutions and cooperative organizations during the previous 1993–2001 stage helped to foster subsequent development of new models. In 1994–1995, the MEM developed a training program for making plancha-armada models, which included building the entire stove in a place known as the "workshop school." These training events have been attended by artisans who want to learn how to construct the stoves and start their own businesses. The idea is to standardize the various procedures and maintain fundamental quality control of the products (MEM 2001).

2.79 In August 2001, Fundación Solar organized the Mesoamerican Exchange on Efficient Cooking Techniques and Improved Stoves, held in Antigua, Guatemala. A range of new models and techniques for preparing food were demonstrated (see Appendix L for a list of the models). Common features of the innovations were portability and use of metal planchas in their construction. However, the models differed in many respects. For example, the flat plancha consisted of several sections, with holes that could be used in various combinations; the model also had curved edges and structural modifications. The Rocky stove incorporated a natural flue system that consisted of fewer parts and required less firewood than the original model. Prefabricated models were made of lightweight concrete and were small in size. Finally, while portable, prefabricated models maintained the original size of the plancha armada, they were less expensive, as a result of using cheaper transport of bricklaying materials and not requiring specialized labor.

2.80 Large-scale dissemination of new models has led to the development of new types of programs and projects, especially those financed by Government social funds. Moreover, the process of negotiating and signing peace agreements has helped to attract international financial assistance to the country, which has resulted in this activity being considered a form of household improvement and support for gender-related projects. Major funding sources include the Government's Social Funds, SIF, National Fund for Peace (FONAPAZ), Indigenous Development Fund of Guatemala (FODIGUA), and others that work independently, with little coordination between programs.

3

Case Study 1: Tezulutlán Project

Organization

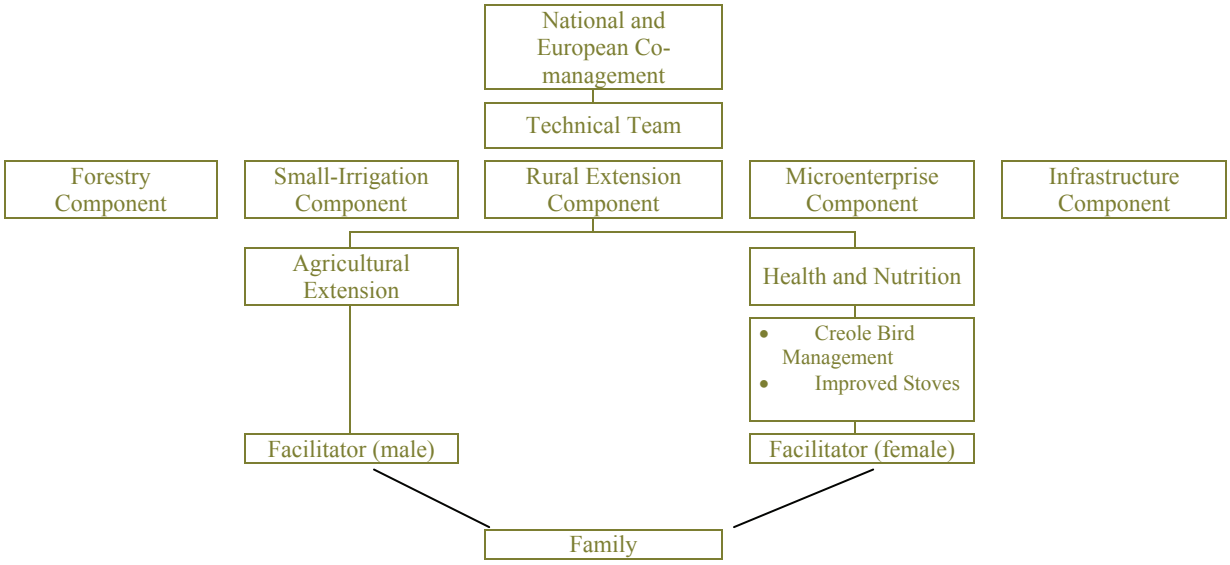
3.1 The Tezulutlán Integrated Rural Development Project was initiated in the northern department of Baja Verapaz, based on a 1988 agreement between the Government of Guatemala and the European Union (EU). The Government of Guatemala, through its Secretariat for Executive Coordination of the Presidency, contracts personnel to implement the Project, while the EU provides financial support, particularly for the Project's physical investments.

3.2 Formally begun in 1996, the Tezulutlán Project did not start work until January 1997. Over a five-year period, it implemented various projects throughout Baja Verapaz, including forestry, small irrigation, microenterprise, infrastructure, and rural extension.[10] As Figure 3.1 illustrates, the rural extension component was divided into two main categories: 1) agricultural extension and 2) health and nutrition (under which the improved stoves-component was implemented).

3.3 Active in five municipalities of Baja Verapaz—San Miguel Chicaj, Rabinal, Cubulco, El Chol, and Granados—the Project benefited 37 communities and built a total of 4,129 stoves.

[10] The rural extension component was responsible for coordinating community activities, especially those related to organization and training.

Figure 3.1: Tezulutlán Project Structure



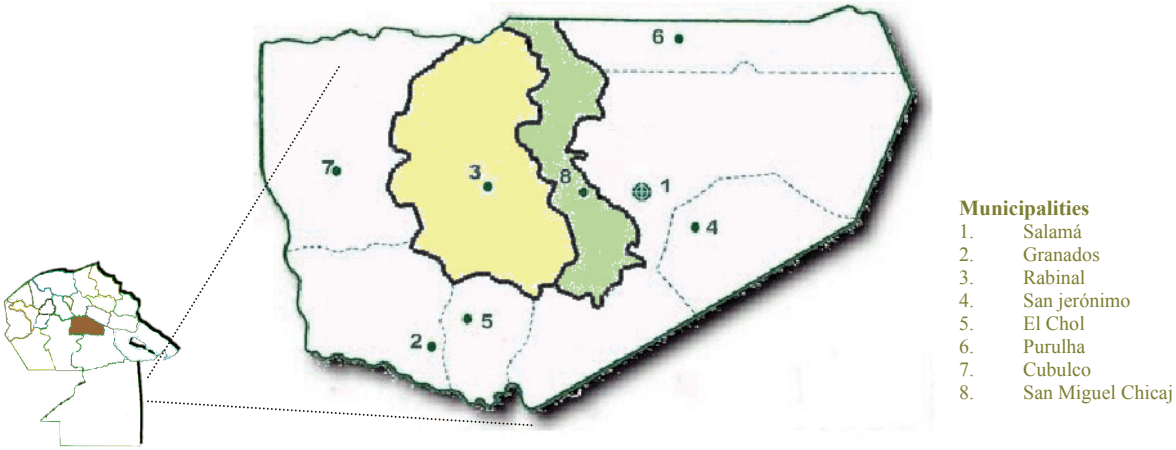
Source: Interviews with project technical staff.

Geographic Focus

3.4 The department of Baja Verapaz, located north of Guatemala City, is 3,124 square kilometers (sq km) in size, with a population density of only 67.93 people per sq km (the national average is 102). The department's eight municipalities have a high proportion of rural residents (78.1%) and a low literacy rate (55.9%). The department's poverty rate is 71.56%, with 31.01% living in extreme poverty.[11] Its economy is based on agriculture, and its main products are sugarcane, vegetables, basic grains, and cereals. The climate across most of Baja Verapaz is dry, with marked deforestation and firewood shortage in many communities (Figure 3.2).[12]

[11] According to SEGEPLAN, 2002.
[12] Based on the Tenth Population and Fifth Housing Censuses, INE, Guatemala, 1994.

Figure 3.2: Map of Baja Verapaz



3.5 Two communities, one in each of two municipalities, were chosen for the case study: Quiaté in the municipality of San Miguel Chicaj and Pahoj in the municipality of Rabinal. These two communities were chosen because they represented distinct methods of implementation. For example, in Quiaté, some stoves were donated to families, while the rest were paid for. Conversely, in Pahoj, all families had to pay for their stoves. Both communities are accessible by road and are located relatively close to municipal seats of government.

Quiaté Overview

3.6 Quiaté is located 11 km from the municipal seat of San Miguel Chicaj and 6 km from the closest paved road (the community is accessible by dirt road throughout the year). Quiaté's population of about 1,050 resides in 150 homes. Since Quiaté is not an indigenous community, the only language spoken is Spanish, and Catholicism is the predominant religion. Most of the community's residents work in agriculture, and the main crops are tomato, beans, corn, and peanut.

3.7 During its field visit, the Fundación Solar research team determined that Quiaté had such public services as a primary school, electricity, and indoor toilets. However, it did not have piped water or any means of telecommunication. All families owned their land. Families bought their fuelwood, and the principal fuelwood species were oak (*Quercus* sp.) and flor amarilla (*Tecoma* sp.).

3.8 The Quiaté stove project is unique in that a percentage of the 54 stoves that were built were provided free of charge.[13] The reason is that, when the Tezulutlán Project began, it tried to involve the SIF—which had planned to carry out an improved-stove project in the community on a donation basis—so that it would adopt the Tezulutlán stove model and include training in how to build the stove, which would be

[13] Interested families had to provide only labor and local materials.

the Project's responsibility. This led Quiaté community members to consider the stove project as much the responsibility of SIF as that of Tezulutlán. However, for administrative reasons, SIF could not make the project take shape, leaving responsibility in the hands of Tezulutlán. It decided to continue the initiative on a donation basis since SIF had already offered to give the stoves away. However, months after the 54 stoves were constructed, a group of women who had not received stoves under the project asked Tezulutlán to help them build their own stoves. Tezulutlán agreed, under the condition that the families comply with the original methodology and provide 100 quetzals and local materials and labor with which to build the stoves. The women agreed, and another 20 stoves were built on these terms.[14]

Pahoj Overview

3.9 Pahoj is located 8 km from the municipal seat of Rabinal and 6 km from the closest paved road (like Quiaté, Pahoj is accessible by dirt road throughout the year). Pahoj's population, estimated at 455, resides in 65 households. Because Pahoj is an indigenous community, its residents speak the Mayan dialect, Achí; most people also speak Spanish. About half the population is Catholic and the other half Protestant. The main income source is agriculture, and major crops are beans and corn (coffee, once a major crop, was abandoned due to the decline in coffee prices).

3.10 The community has a primary school, local health center, electricity, indoor plumbing and bathrooms, but no telephone service. All families live on their own land. Fuelwood is still abundant and therefore does not have to be bought. Principal fuelwood species are oak (*Quercus* sp.) and, to a lesser extent, flor amarilla (*Tecoma* sp.).

3.11 Unlike Quiaté, Pahoj has had support from Plan International, an NGO that works in various countries across the LAC region and has implemented projects in health, rural development, and support for children through international sponsorship programs.

3.12 Pahoj stove users provided 100 quetzals, as well as labor and materials; 28 improved stoves were built.[15]

Project Features

3.13 From the outset, the principal goal of the Tezulutlán Project was to improve rural living conditions, giving special attention to women, hygiene, health, and household improvement.[16] This goal implied using community services to gain access to technologies to address basic needs. This, in turn, gave birth to the idea of working on a project to build improved, wood-conserving stoves to improve the indoor environment of homes in the area.

3.14 Implementation of the three-year, Tezulutlán improved-stove project, initiated in 1999, occurred in phases, from analysis of existing stove models in the

[14] Based on interviews with project technical staff.
[15] Based on interviews with project technical staff.
[16] *Source*: Technical report on the Tezulutlán n stove, Baja Verapaz, May 2002.

various municipalities of Salamá to visits by Tezulutlán monitors to verify the quality and appropriate use of the installed stoves. The organization evaluated various types of commonly used stoves, including the Lorena, Ecotec, Chefina, CIF, and program stove of the Tropical Agricultural Research and Higher Education Center (CATIE) (*Centro Agronómico Tropical de Investigación y Enseñanza*).[17] The ultimate goal was to develop a new model of improved stove that would combine the best features of those promoted and would be installed by diverse development organizations in the department of Baja Verapaz.[18]

3.15 Once a new model of improved stove was designed, promotion work began. With the help of field staff, the project delivered a total of 4,129 improved, wood-conserving stoves and involved other NGOs that operated in the area, providing them with financial support and technical assistance for installing the stoves.

3.16 Like the other components in the larger Tezulutlán Project, the stove component covered five municipalities in the department of Baja Verapaz. Although the EU method focused on often overlooked rural areas, it attempted to include urban areas through the forestry component in order to reduce fuelwood consumption, especially by "tortillerias."[19]

3.17 A total of 40 people worked on all components of the Tezulutlán Project, including the stove project. Of these, 36 were Guatemalan, mostly natives of the project area, and 4 were European.

3.18 The extension component, and therefore the construction of improved stoves, ended in December 2001, leaving only a small staff until the end of April 2002; from then until the end of December 2002, only seven people remained to supervise unfinished activities, especially within the credit and small-irrigation components.

Stove Model Development[20]

3.19 In 1998, extension component staff (supported by the Tezulutlán technical team) and 20 women chosen from various communities (based on their experience in community work) made a one-day visit to households in various communities of the department. They familiarized themselves with the advantages and disadvantages of the stove models then in use so that they could jointly design a new wood-conserving model. In this effort, they considered only the functioning of the stove, its relative adequacy, and the amount of firewood consumed. They observed that many stoves had been abandoned or their parts had deteriorated, and others had been sold. In many cases, open-fire cooking had again become the principal means of preparing food.

3.20 The participants then defined the criteria for the new model, including an oven, clay chimney,[21] and a metal plancha with three burners or "hornillas" that could be

[17] *Source*: Historical Review of Improved-Stove Programs in Guatemala.
[18] *Source*: Technical report on the Tezulutlán stove, Baja Verapaz, May 2002.
[19] A place where corn tortillas are sold.
[20] Based on Interviews with technical staff and extensionists from the Tezulutlán Project and technical report on the Tezulutlán stove, Baja Verapaz, May 2002.

adjusted to suit the needs and preferences of rural families in the region. This meeting produced a plasticine model constructed by the women participants. This model served as the basis for the final design of the Tezulutlán improved, wood-conserving stove.

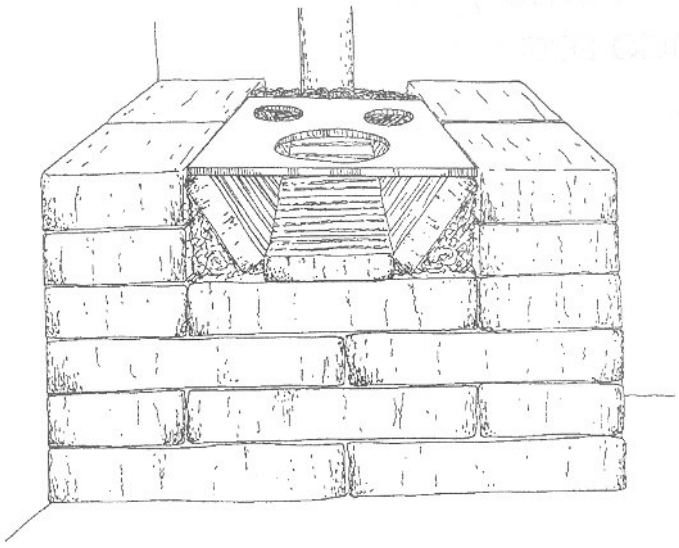
3.21 It was determined that the women participants focused more on the utility of the stove's components and its ease of use and maintenance, rather than its capacity to conserve fuelwood. Thus, the participation of technicians was also important since they were responsible for design factors related to efficiency. The technical team subsequently modified the design (the firebox was made of bricks and the oven in other models was removed, since it was not useful to the women).

3.22 The next step was to contract a local bricklayer to build the stove with the women; they learned how to use the tools to build and maintain it and, in the process, developed the first improved Tezulutlán stove.

Design Features

3.23 While the Tezulutlán stove retains the basic features of the metal-plancha model that the SIF disseminated throughout Guatemala (consisting of a base, firebox, metal plancha, and chimney), it has several distinctive features. First, the interior design of the firebox differs from that of the SIF model, although the concept of reducing internal volume is the same (Figure 3.3).

Figure 3.3: Firebox of the Tezulutlán Stove



[21] The women identified the clay chimney as having the advantage of being easy to clean and reducing the risk of being burned, thus increasing their children's and their own safety.

3.24 The opening for inserting firewood is 20 x 20 centimeters (cm); however, a ramp progressively reduces the size of the interior so that the back of the chamber is only 10 cm high. A smaller internal volume means that the heat generated by the fire travels more directly to the metal plancha and thus is used more efficiently. Second, the base is constructed from local materials (such as adobe,[22] cow manure [important for conserving heat, according to Tezulutlán], sand, and rocks). Third, this model uses a clay chimney produced by local artisans (although only on demand and in limited quantities since there are few artisans).

3.25 After development of the new proposed design, construction was begun in the community of Guachipilín, in the municipality of Rabinal, to monitor the stove's performance and wood consumption. The households chosen to construct these prototypes agreed to let other interested people from their own or neighboring communities visit their homes to view a demonstration, which began the promotion phase.

Use of Tezulutlán improved stove.
Photo credit: Tezulutlán Project

Institutional Structure for Project Implementation

3.26 As mentioned above, the improved-stove project was carried out as part of the larger Project's rural extension component, under the Health and Nutrition program. To conduct rural extension work, Tezulutlán coordinated with two national NGOs: Flor del Naranjo (from the Rabinal municipality) and the Environmental Defense Foundation of Baja Verapaz (FUNDEMABV) (*La Fundación de Defensa del Medio Ambiente de Baja Verapaz*). The goal of Tezulutlán was for these two NGOs to assume the entire process of transferring the stove. Therefore, Tezulutlán took care to design the model with the help of local women, and then delegated responsibility for training the two NGOs' extension workers. The Project provided funds to contract the extension workers, although they were still part of the team of NGOs; that is, Tezulutlán became a source of

[22] A block made from clay and various types of plant matter.

technical and financial support for the NGOs, which were already operating in the area, so that they could encourage use of the improved stoves and make the intervention more sustainable.

3.27 In addition, Tezulutlán provided technical assistance to Plan International and Caritas, two international NGOs active in the region that wanted to provide other communities improved stoves. Tezulutlán suggested that these organizations use Tezulutlán stoves, and provided them technical assistance on construction. Subsequently, the stoves were installed in various municipalities of Baja Verapaz.

3.28 While the national and international NGOs promoted and installed the same type of stove, their methods of working with beneficiary communities differed. Through the two national NGOs, Flor del Naranjo and FUNDEMABV, Tezulutlán asked beneficiary families to provide local materials, labor, and 100 quetzals. By contrast, PLAN International, which works through child sponsorship, generally involved only families of the communities sponsored. Beneficiary communities and families did not contribute to the costs, although Plan International paid the Tezulutlán Project 100 quetzals for each stove. Some community families were not included in the project because they did not have children and chose to acquire their stoves directly from the Tezulutlán Project and pay the 100 quetzals. Caritas, on the other hand, accepted Tezulutlán proposal to charge users 100 quetzals as part of the family's contribution to building the stove.

3.29 Of the total number of Tezulutlán stoves installed, 1,703 (42%) were installed by Plan International; 1,081 (26%) by Flor del Naranjo and FUNDEMABV (in 30 communities), with help from the Project's extension component; 583 (14%) by Caritas; 586 (14%) through the Project's forestry component; and 176 (4%) by other institutions.

Dissemination and Installation

3.30 The Tezulutlán stoves were disseminated and installed in five phases: community selection, promotion, stove construction, training, and monitoring and evaluation (M&E).[23]

Community selection

3.31 To select the communities, cooperating NGOs formed two-person (one woman and one man) extension groups composed of individuals from the region who were bilingual in Spanish and Achí. They first obtained information about the communities considered a high priority for the municipality, geographic data, and other types of information, such as the presence of other institutions, to determine their needs. The Tezulutlán stove was then demonstrated to organizations working in the area, including NGOs, in the municipalities. Communities were chosen for the follow-on promotion phase, based on their expressed interest in the stove technology offered.

3.32 The two most important points in the analysis of communities were: 1) potential for building the stoves based on the availability of materials, and 2) people's

[23] Based on interviews with project technical staff.

attitude toward the project. According to Tezulutlán extension workers, certain communities were rejected from the outset because of their negative attitude toward the organization's work.

Stove promotion

3.33 Promotion started with familiarization visits in which extension teams contacted local leaders interested in promoting the improved stoves. These visits included 30 communities, each of which had three stoves installed ahead of time, for a total of 90 stoves. In this way, the teams confirmed the quality of the stoves and the materials used. The stoves were evaluated for four months, and a comparative study of fuelwood consumption was conducted for the SIF and Tezulutlán models;[24] 21 communities in 5 of the department's 8 municipalities were visited: 8 in Rabinal, 5 in San Miguel Chicaj, 4 in Granados, 3 in El Chol, and 1 in Cubulco. All of the communities used SIF stoves. Study results proved that the Tezulutlán model was more efficient and therefore saved more fuelwood.[25]

3.34 Afterwards, local leaders were asked to invite friends and family members to view the stove and familiarize themselves with its advantages. For this step to succeed, the families involved initially had to be convinced of the stove's benefits in order to promote it to friends and family.

3.35 Although the goal was to have the greatest number of people possible benefit from the stoves, there was no initial interest in pursuing mass distribution through commercialization. Rather, technology transfer was achieved through a family-focused strategy, and therefore families were involved in building the stoves. To ensure that stoves were demonstrated clearly, the technical team accompanied the extension workers. According to information provided by the project team, the four technicians established a permanent presence in the field, which allowed them to guarantee the quality of both the stoves built and the field training that extension workers and the participating families received (80% of training was practical and 20% theoretical).

3.36 After choosing the initial group of local leaders (a one-year process), a smaller group of leaders within that group was selected to ensure that only the most motivated and committed leaders would be responsible for promoting the stove. According to members of the technical team, some initial leaders could not go ahead with the project because their focus was individualistic (that is, they wanted the stove exclusively for themselves, which did not conform to the concept of extension work).

3.37 Both written and mass communication were critical to stove promotion. To supplement their experience in using the stove, families were provided pamphlets that helped to explain stove construction, use, and maintenance.[26] Radio was also critical in

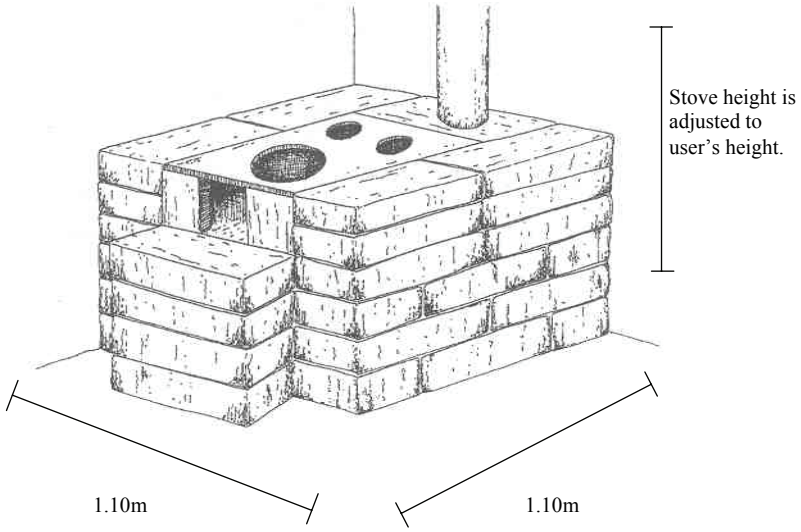
[24] Based on the technical report on the Tezulutlán stove, Baja Verapaz, May 2002.
[25] The study found that SIF stoves used 25-40 pieces of fuelwood per day for a family of 6-8, while the Tezulutlán stove used only 8-12 pieces for a family of 5 and 5-8 pieces for a family of 2. Tezulutlán issued a report on this study.
[26] Field pamphlets were also created on a range of other subjects, including native plants, basic nutrition, and techniques for appropriate soil use.

promoting qualities of the improved stove—especially after the participating families had had a positive experience—to families that might want to participate in the project. This form of mass communication involved the community leaders describing their stove experiences on the air. The technical team believes that promotional radio had much to do with increased demand for the stoves.

Stove construction

3.38 The stove base was the first part built. The design and types of materials used to construct it made it possible to vary the stove height to suit the needs of individual users (Figure 3.4). Next, the firebox was built using local materials, including "caulote"[27] and bricks. The firebox's design took into account the size of the plancha requested by users, as well as the number of hornillas that women considered acceptable for efficient cooking. According to Tezulutlán, this type of firebox had been used previously in a stove model promoted by CATIE.

Figure 3.4: Tezulutlán Stove Construction



3.39 The chimney was then made from ceramic cylinders manufactured in the municipality of Rabinal. Its size depended on the height of the home; however, each family was usually given four ceramic cylinders that could be combined to reach the required height (in some cases, five cylinders were needed). The only element that had to be obtained outside the local area was the metal plancha, which was brought from Guatemala City.

3.40 The Tezulutlán model included a support to keep wood from falling on the floor, which made the stove easier to use. The technical team found that the door for closing the firebox was not included because previous users had either removed it or

[27] Caulote is a common name for the tree species, *Guazuma ulmifolia*; caulote exudes a resin used in rural areas as a natural adhesive.

never closed it (this was also the case for the airflow regulator, which many people found difficult to use). According to Tezulutlán staff, technology transfer is easier when a model is simple and has few parts. Each family decided whether to use plaster to coat the base (most chose to do so for aesthetic reasons). Builders had to wait one week for the base to dry completely, after which they constructed the firebox and installed the metal plancha.

3.41 The first metal planchas were made of cast iron, which sometimes cracked. To prevent cracking, planchas were subsequently made of reinforced iron sheets available from a single supplier in Guatemala City. The plancha had three holes, each with removable rings that allowed their diameter to be modified.

3.42 When stove construction was completed, an informational sheet was posted near the stove that listed major maintenance items the family should keep in mind.

Training

3.43 Training in stove-building was conducted as the stoves were constructed in the users' homes. The goal was to have all families gain the ability to build their stoves so that, if necessary, they could build new ones in the future. Once trained in how to build the demonstration stoves, extension workers and participating innovator families were responsible for teaching other families how to build their own stoves. In addition, training was provided in stove use and maintenance, and extension workers visited the families weekly to ensure they were using the stove correctly.

3.44 Since the stove was made of adobe, part of the training focused on exterior maintenance. As mentioned above, some families covered the outside of the stove with plaster, which helped to protect it and make it more attractive. This was confirmed during field visits by the Fundación Solar research team.

3.45 According to the project's technical experts, learning was one of the project's most important goals. Tezulutlán paid special attention to creating local capacity to build the stoves; the idea was that knowledge could be replicated, thereby eliminating dependence on specialized builders and reducing costs.

Monitoring and evaluation

3.46 According to information provided by project extension workers, M&E (as well as training) was conducted by the six extension teams, which carried out activities in 30 communities. Each team was responsible for one community per day so that they could cover five communities per week, using a pre-established schedule for visits. During each visit, they verified that the stoves were being built correctly and that the families were maintaining them, re-emphasizing the correct way to use them.

3.47 To determine whether the established goals were being met, project co-managers conducted M&E activities at two levels:

1. Evaluation of the technical field team, divided into: a) written evaluation of technical knowledge related to various topics, including improved stoves. The information evaluated was provided to team members in advance by giving them

technical index cards to study that were handed out at a one- or two-day event and b) quarterly evaluation of job performance in the field, which measured the quality of their work with the communities and their attitude toward various activities.

2. To follow up on activities carried out with families, co-managers (Guatemalan and European) planned a schedule of visits to the communities. In this way, they evaluated project extension work, as well as work being done by the national NGOs (FUNDEMABV and Flor del Naranjo), keeping in mind that the ultimate goal was for the NGOs to assume responsibility for the work that the project was carrying out, as well as its technology and methodology, to ensure continuity and follow-up activities once the Tezulutlán project ended.

Quality Control

3.48 The project's technical team—along with the help of extension workers and enterprising families in the community—was responsible for guaranteeing quality of the stoves installed. Users of the first stoves built were interviewed to determine whether certain components, such as the metal plancha or chimney, had any quality problems.

3.49 At the beginning of the project, certain stove components had problems. For example, the metal planchas cracked because they used cast-iron acquired from various sources; in response, the team decided to use reinforced iron planchas from a single source, which solved the problem. Similarly, the first chimneys experienced problems; poor quality construction resulted in cracking after a short period of use. The project focused on helping local artisans; however, only one could achieve the desired quality (from then on, that artisan was the project's major chimney supplier).

3.50 According to Tezulutlán technicians, they also paid attention to the quality of the stoves built by users. However, visits by the Fundación Solar research team found that, in many cases, there were differences between these stoves, mainly in terms of the size of the opening for inserting wood into the firebox.

Community Benefits

3.51 Because the Tezulutlán method focused on the family, the project's technical team believed it was important to convince families of the advantages of using the stove; that is, not just giving them the technology, but also raising their awareness about the importance of conserving fuelwood and the stove's ability to improve users' health by reducing smoke, increase safety by preventing burns (especially for children), and increase cooking efficiency by users not having to crouch over an open fire. Little by little, the families came to regard the stove not just as another tool, but as a fundamental household enhancement that provided many benefits for all.

3.52 One important outcome was that the project connected the issues of health and conservation of natural resources. The extension component of the larger Project

combined health and nutrition inherently, and improved stoves played an important role within this component; that is, the stoves linked food security and conservation.[28]

3.53 It is not known how many families adopted the stoves; however, according to technical project appraisals, in some communities, 100% of families built improved stoves (although the average is estimated at about 50%). However, it is difficult to measure the true rate of stove use because the project never conducted a study to verify the data.

3.54 One measure of the degree of project success is that, in the year 2000, there was considerable interest in obtaining a stove; unfortunately, there were not enough resources to reach all interested families. The demonstration or display stoves installed in the communities, promotional meetings, and radio interviews all contributed to familiarizing families with the technology, and interest gradually increased in both rural and urban areas of the department.

3.55 Upon completing the project and recording the number of families that had participated, it was found that more had been served than originally envisioned.[29] For Tezulutlán, this is an indicator of the project's success, since payments by the beneficiaries increased the project's funds and, in the end, made it possible to build more stoves.

3.56 Moreover, the project supported ceramic artisans in Rabinal, which has a tradition of clay artisanship. The project contributed to improving quality control for the clay chimneys. In addition, the chimneys were promoted over the radio so that stove users could replace damaged ceramic cylinders, which, in theory, benefited local artisans. However, to date, this indirect benefit has not been confirmed; the principal chimney supplier stated that he has not sold any chimney cylinders since the project stopped buying them in bulk.[30]

Structure of Financing and Subsidies

3.57 The Tezulutlán project obtained funding for carrying out the various components from the EU and the Executive Secretariat for Coordination of the Presidency of Guatemala. The EU provided funds for infrastructure and the purchase of materials needed to build the stoves (such as metal planchas and clay chimneys). The Executive Secretariat for Coordination of the Presidency of Guatemala covered salaries and honoraria of technical and administrative staff (including Guatemalan and European co-managers, field staff, secretaries, and consultants).

3.58 Users paid a portion of the stove cost. Each family interested in acquiring an improved stove had to contribute 100 quetzals (about $US13, based on an exchange rate of Q7.80 equivalent to US$1), in addition to providing local materials (such as sand, adobe, cow manure, clay, and labor). Table 3.1 lists the contributions of both the project and stove users.

[28] In the opinion of project extension workers.
[29] The project originally planned to serve 2,400 families; by the end of the project, 4,129 had been served.
[30] Based on an interview with the project's largest chimney supplier.

Table 3.1: Financial Contributions of Tezulutlán and Stove Users

Tezulutlán	*Cost (Q)*	*Beneficiary*	*Cost (Q)*
Part of the cost of three-holed, metal plancha and ceramic chimney	250	Part of the cost of the three-holed, metal plancha and ceramic chimney	100
Transportation to the community	about 50	35 adobe blocks	Together valued at about 50
		26 bricks (12.5 x 5 x 2.5 inches each)	
		2 sacks of clay	
		3 containers of caulote resin (about 20 liters each)	
		.5 sack of lime	
		1 sack of sand	
		1 sack of cow manure	
		2 sacks of large rocks	
		8 sacks of dirt	
		Unskilled labor	50
Total cost	300 Q (US$38.46)		200 Q (US$25.64)

Source: Tezulutlán Project.

3.59 Therefore, when a family agreed to receive an improved stove, Tezulutlán provided the metal plancha and clay chimney, while the beneficiary family provided local materials, labor, and 100 quetzals. The net cost of the stoves for families was 200 quetzals, or 40% of the total cost. As mentioned previously, this was the case in Pahoj and part of Quiaté, where most of the stoves were donated.

3.60 It should be noted that the costs of the metal plancha and clay chimney were usually higher for individual buyers; however, in this case, the cost was only 350 quetzals due to the wholesale purchase made by the project. Moreover, this amount did not include the cost savings in transporting the metal planchas that the project bought in Guatemala City and the Rabinal chimneys or the cost of training (without which the beneficiaries would not have been able to build the stoves). Moreover, no company in Baja Verapaz built this type of stove (certain metalworkers sold the metal planchas and artisans in Rabinal sold the clay chimneys). Thus, that area had no standard of comparison for the cost and price of a finished stove.

3.61 According to the project's technical experts, the 100 quetzals requested from each family was used to buy more chimneys and metal planchas and to pay local artisans. The amount was set based on the economic status of most people in the department of Baja Verapaz. The project never planned to provide a full subsidy because the team believed that, if people paid something for the stove, they would value it more

and thus take better care of it and use it properly. In addition, it would help eliminate the paternalistic nature of NGO interventions.

Marketing

3.62 Before completing the project, Tezulutlán promoted improved stoves in various hardware stores in the seats of the five participating municipalities. The goal was to convince hardware stores to start selling the metal planchas and the chimneys because, according to Tezulutlán, of their higher quality and area families' familiarity with them.

3.63 At the time project technical staff were interviewed (over a 1.5-month period), five sets of metal planchas and chimneys were sold in Chol, and one set each was sold in Rabinal and Cubulco. However, when the project team monitored commercial trials, it realized that prospective buyers would ask the hardware-store sellers why they did not provide the stove components at the same price as the project did (that is, 100 instead of 400 quetzals).

3.64 Project extension workers and technicians attributed the greater number of commercial sales in El Chol to the fact that, in Rabinal and Cubulco, many more families knew about the 100-quetzal price available in the villages, and were still hoping they could buy the stoves at that lower price. Conversely, in El Chol, project activities had been less extensive; thus, fewer families knew about it the lower price and were willing to spend 400 quetzals for the plancha and chimney set.

3.65 Hardware stores sold the plancha and the chimney, along with a construction manual. Purchasers would bring the items home and build the stove, using materials they had obtained on their own. According to the project's extension workers, the people who did this built the stoves correctly.

3.66 Project staff assumed that, once the interested families realized that the project had ended and they no longer had the option of buying stove components at project prices, they would consider the possibility of buying stoves, even at local hardware stores. In this regard, the municipalities of El Chol and Granados were thought to have the greatest commercial potential because NGOs using the stove components had a lower profile in these municipalities, many families received remittances from family members living abroad and therefore had a greater ability to pay, and because residents in those municipalities were said to have an idiosyncratic tendency to maintain attractive and well-organized kitchens. Unfortunately, the project did not start promoting the stoves through hardware stores until the final months of the program; therefore, no data is available to support this idea.

3.67 In terms of local conditions conducive to marketing, no hardware stores currently distribute or sell complete stoves. Only component parts or sets—such as planchas and chimneys made from sheet metal—are sold.[31] Moreover, the quality of the

[31] According to experience of the Fundación Solar research team, various hardware stores in Baja Verapaz have sold metal planchas for some time, although their design has varied.

planchas varies. The predominant type of metal plancha, made of cast iron, sells for Q350-450, depending on its size and the manufacturer.[32]

User Profile

3.68 In both Quiaté and Pahoj, the research team created a profile of beneficiaries by gathering information through semi-structured interviews (Appendix D) and focus groups (Appendix G). A total of 24 stove users were interviewed (most were women), 17 in Quiaté and 7 in Pahoj. In Quiaté, the 17 stove users were interviewed in two groups: the first group of 12 people received the stove as a donation, while the second group of 5 paid Q100 for each stove and provided local materials. In Pahoj, 7 stove users were interviewed, all of whom paid Q100 for their stoves.

3.69 In addition to the interviews, focus groups were held in both communities; in each group, 8-12 women stove owners—some of whom had already been interviewed—participated. Because the majority of indigenous people in both communities were bilingual, communicating in Spanish did not present an obstacle.[33]

Socioeconomic Profile

3.70 The average household size in the communities studied was 4.5. Household members included mother, father, children, and often grandparents and other close family members. The families' main economic activity was agriculture since the communities had few private services or businesses. During field visits, the research team noted that farmers grew such crops as corn and beans mainly for their own consumption, while, during certain seasons, they grew commercial crops, including tomato and peanut. In Pahoj, however, most farmers grew only corn and beans.

3.71 The above-mentioned data, together with that gathered from poverty maps of Guatemala, indicate that the country's population is either poor or extremely poor.[34] Poverty makes it difficult to market many products, including the improved stove. This reality is what has prompted many NGOs to conduct programs that donate stoves or provide large stove subsidies.

3.72 In both communities, the most common diseases, according to the women interviewed, were respiratory (respiratory infections are considered the leading cause of mortality for women and men in Guatemala).[35] A direct causal relationship between open-fire cooking and the rate of respiratory illness could not be shown; however, the prevalence of respiratory illness reinforces the importance of having available a less polluting means of cooking, such as improved stoves (Table 3.2).

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[32] Based on interviews with hardware store managers in the region.
[33] In Quiaté, 20% of people are indigenous, while 95% of people in Pahoj are indigenous Achí, a Mayan ethnic group.
[34] In Baja Verapaz, 71.56% of inhabitants are poor, while 31.01% are extremely poor.
[35] Source: *Second Report on Human Development: Guatemala, The Face of Rural Human Development*, 1999 ed.

Table 3.2: General Socioeconomic Statistics for Quiaté and Pahoj

Community	*No. inter-viewed*	*Gender*		*House-hold size*	*Major illnesses*		*Economic activities*		
		M	*F*		*Respi-ratory*	*Gastro-intestinal*	*Agri-culture*	*Business/ services*	*Both*
Quiaté	17	1	16	5.3	14	3	16	0	1
Pahoj	7	0	7	4.4	7	0	7	0	0

Literacy

3.73 According to the most recent census by the National Statistics Institute (INE), in 1994, 114 (60%) of Quiaté residents were literate and 73 (40%) were illiterate. In Pahoj, the situation was reversed, with 30 (28%) literate and 76 (72%) illiterate. However, no relationship was found between literacy rate and acceptance and maintenance of improved stoves.

Ownership of land and durable goods

3.74 All stove users interviewed owned their land, but land ownership did not appear to have a direct relationship to stove ownership.[36] However, it did have a relationship to the type of stove used and the importance of being able to afford to build one's own stove. In terms of durable goods, most people bought a radio because it was affordable (Q100-150) and, in many cases, the sole means of outside communication. In both communities, only one person made purchases on credit. This is an important point in terms of designing a credit program for improved stoves, and a more detailed study should be conducted (Table 3.3).

Table 3.3: Ownership of Land and Durable Goods in the Two Communities

Community	No. interviewed	Ownership Status				
		Land	Bicycle	Motorcycle	Radio	Television
Quiaté	17	17	5	1	12	4
Pahoj	7	7	0	0	5	0

[36] In Guatemala, land ownership is related to income level, and property can be used as collateral to obtain credit.

Housing characteristics[37]

3.75 Residents in both communities lived in houses with adobe walls and clay tile roofs (Tables 3.4 and 3.5). They all had to adapt their improved-stove chimneys to the tile roofs, but apparently this posed no problem. Unlike other communities in Guatemala, where roofs are made from straw, these community members did not fear that the chimney would cause a fire by emitting heat or sparks.

Table 3.4: Housing Materials in Quiaté, Baja Verapaz

	Walls			Roof			
Area of house	Wood	Block or brick	Adobe	Stalk	Sheet metal	Thatch	Tile
Living area	0	0	12	0	0	0	12
Kitchen	0	0	12	0	0	0	12

Table 3.5: Housing Materials in Pahoj, Baja Verapaz

	Walls			Roof			
Area of house	Wood	Block or brick	Adobe	Stalk	Sheet metal	Thatch	Tile
Living area	1	0	6	0	0	0	7
Kitchen	1	0	6	0	0	0	7

Stove Performance, Maintenance, and Fuels[38]

3.76 In both communities all stoves were working. Interestingly, in Quiaté, numerous components failed, while, in Pahoj, only one problem occurred with the base of one stove. However, most problems were related to the plancha (including the openings for cooking) and the chimney that the project supplied. The stove base, built by the respective families, caused virtually no problems in either village. The team could not determine whether problems with the plancha were caused by poor-quality materials or improper use (Table 3.6).

3.77 The four individuals who experienced problems with their chimneys replaced the original ceramic chimneys with sheet-metal ones (sheet metal was more readily available from which to make chimneys). Changes to the base were made for aesthetic purposes. The one individual who completely rebuilt his stove did a good job and maintained the original design (Table 3.7).

[37] Based on interviews with stove users and focus group results.
[38] Based on interviews with stove users and focus group results.

Table 3.6: Stove Parts Failure in Quiaté and Pahoj

Community	No. interviewed	Base or poyetón	Firebox	Plancha	Holes for cooking	Chimney	Accessories
Quiaté	17	0	0	7	5	4	0
Pahoj	7	1	0	0	0	0	0

Table 3.7: Modifications to Stove Components in Quiaté and Pahoj

Community	No. interviewed	Base or poyetón	Firebox	Plancha	Openings for cooking	Chimney	Accessories
Quiaté	17	1	1	0	0	4	0
Pahoj	7	1	1	1	1	1	0

3.78 Community residents were divided regarding the amount of time per day they kept a fire burning. Of the 24 stove users interviewed, 14 (59%) said they used the stove throughout the day, while 10 (41%) said they used it at specific times. Only 4 said they used it to heat their houses.[39] While most families used the stove only to cook food, some used it as a table around which to eat.

3.79 One key factor in choosing a stove is the types of food cooked on it. Throughout Guatemala, corn is the most universal food, especially for making tortillas to accompany other dishes. In rural areas of the country, particularly more isolated communities, families commonly cook their own corn, which, once ground, is used to make tortilla dough. The corn is cooked in a relatively large pot, which the stove dimensions, especially the metal planchas, must accommodate. In addition to corn and tortillas, other foods frequently cooked on the stove include beans, tamales,[40] vegetables, coffee, and occasionally meat.

3.80 Maintenance of this improved stove involves cleaning the metal plancha and chimney. Women are accustomed to cleaning the plancha on a daily basis, taking special care not to use cold water when the plancha is still hot. The chimney is cleaned whenever it is thought necessary, which, in most cases, is about every 8-28 days.

3.81 Firewood is the main fuel type used in improved stoves. In addition, 35% of those interviewed in Quiaté said they used corncobs as an energy source, [41] and 23% used the hard seeds of a local tree species (Table 3.8). In terms of firewood size, residents tended to use either short, thin pieces or pieces of all sizes, but not thick piece (which had been commonly used to cook over an open fire) (Table 3.9).

[39] Both communities have temperate climates, unlike the Altiplano region of the country.
[40] A typical dish made from corn and rice, cooked in large pots of water.
[41] After removing the corn kernels, the cob can be dried and used as a fuel.

Table 3.8: Fuel Types Used in Quiaté and Pahoj

Community	No. interviewed	Fuel used				
		Firewood	Corn-cobs	Corn stalks	Cow dung	Seeds
Quiaté	17	17	6	0	0	4
Pahoj	7	7	0	0	2	0

Table 3.9: Firewood Characteristics of Stove Users in Quiaté and Pahoj

Community	Firewood Characteristics			
	Short and thin	Thick pieces	All sizes	No response
Quiaté	6	0	11	0
Pahoj	1	0	6	0

User Satisfaction

3.82 In rural Guatemala, various units are used to measure quantities of firewood, from individual pieces or logs ("unidades"), to the amount one person can carry ("cargas"), to what a beast of burden can carry ("bestiadas"), and even the number of days of labor spent gathering firewood in a specific place. It was difficult and, at times, impossible to convince those interviewed to agree on a standard unit for comparing firewood consumption between families. However, the project was able to compare a family's use of firewood before and after it obtained the improved stove; it found that consumption usually decreased 50-67% in Quiaté and about 55% in Pahoj (the greatest reduction reported was 67%). This is considered a significant savings in firewood.

3.83 Eighty-three percent of those interviewed said they had received training in stove use and maintenance (Table 3.10). This is vital for a project like Tezulutlán, which sought to build local capacity as a way of supporting the transfer of technology. In addition, most users said staff from the implementing organization visited them after they had built the stove, which is an important factor in controlling quality, building awareness, and reinforcing knowledge.

Table 3.10: Training in Stove Use and Maintenance and Follow-up Visits to Quiaté and Pahoj

Community	No. interviewed	Training in stove use and maintenance		No. of visits by institution after construction of improved stove					
		Yes	No	1	2	3	None	Many	Don't know
Quiaté	17	13	4	4	1	4	0	0	4
Pahoj	7	7	0	1	3	1	0	2	0

3.84 Few families continued to use open fires once they acquired a stove. The few who used open fires did so only when they needed to cook large quantities of food that did not fit on the stove. Stove users said they used open fires when they cooked tamales or had to prepare large quantities of food for special occasions. Propane stoves, used rarely, were mainly used for preparing food that could be cooked quickly, reheating food, or making coffee. Those who had gas stoves still considered their woodstoves indispensable (Table 3.11).

Table 3.11: Use of Open Fire and Propane Gas in Quiaté and Pahoj

Community	No. interviewed	Use of open fire	Use of propane gas
Quiaté	17	2	2
Pahoj	7	0	0

3.85 While the benefits of improved stoves are widely known, each rural user has his or her own perception and priorities. In the communities that the project studied, fuelwood conservation emerged as an especially important concern. The next most frequently mentioned priority was reducing indoor smoke, although this was not usually linked to health concerns. The third priority for women was savings in time (Table 3.12).

Table 3.12: Benefits of Improved Stoves in Quiaté and Pahoj

Benefit	Quiaté	Pahoj	Total
Less fuelwood used	14	4	18
Less indoor smoke	12	3	15
Less cooking time	11	2	13
Less time required to collect firewood	6	2	8
Cleaner kitchen	5	0	5
Improved respiratory health	4	0	4
No. interviewed	**17**	**7**	

3.86 While no community members—through interviews or focus groups—expressed any disadvantages in using the improved stoves, they did suggest how to improve the external appearance (Appendix G). The most common suggestions were to apply a layer of plaster, cement, or tile and use cinderblocks, instead of adobe, for the base.

3.87 The only factor evaluated in terms of the user's perspective was awareness of stove marketing and sale. More than half (54%) of the women said they knew of no place to buy stoves or major component parts. The other 46% did know, or had heard of,

planchas being sold, but few knew for certain where they were sold or at what price. The only places they mentioned were hardware stores in the respective municipal seats (Rabinal in the case of Pahoj and San Miguel Chicaj in the case of Quiaté).

Non-user profile

3.88 Apparently, the socioeconomic characteristics of non-stove users were similar to those of stove users. The main reason identified for their not participating in the project was not being able to afford the Q-100 contribution. This forced them to continue using an open fire and more firewood than their neighbors who owned stoves. Some non-stove users expressed interest in acquiring a Tezulutlán stove, and would have liked the project to consider making credit available to people without the economic means to pay.

Lessons Learned

Institutional Strengths

3.89 Tezulutlán's focus on the family allowed stove users to participate in stove design and construction, which made technology transfer faster and easier. Training in stove-building enabled community members to build their own stoves and raised awareness of their collective responsibility, strengthened ties within and between communities, and improved women's social status by applying an implicit gender focus to project activities.

3.90 While such a focus may appear to reduce the need for monitoring, it increased the need, in effect, because it was necessary to verify the quality of the stoves that the families built and ensure that they did not overlook any important technical details that could affect the stove's efficiency.

3.91 Furthermore, Tezulutlán's original goal of having other NGOs participate in or assume responsibility for the project was a factor that, at least in theory, improved the project's sustainability. (Information sharing and gaining consensus on goals can help improve projects and avoid failures, especially if the project can learn from past experiences and better understand the local situation.)

3.92 Finally, before starting stove dissemination, the project made an effort to learn about other stove projects, thereby gaining an understanding of factors related to user satisfaction, comparable efficiency of stove models already in use, and local situations.

Sound Technical Design

3.93 User participation in stove design was one of the Tezulutlán project's greatest strengths. In particular, it helped to guarantee that the stove was well suited to the needs and preferences of women in the region.

3.94 The stove design allowed greater flexibility of construction by using local materials, which also lowered costs. For example, adobe construction allowed the height

of the stove to be adjusted to suit each user. Moreover, the clay chimney prevented the external surface from overheating, thereby keeping users from burning themselves, especially when making tortillas (which are cooked several times daily).

3.95 Stoves built more than three years earlier were still in good working condition. Although parts have had to be replaced in some cases, this has been part of each family's responsibility and has fostered a greater sense of ownership and familiarity with the stove, thereby reducing dependence on project technical staff.

3.96 Interestingly, most technical problems have involved the project-provided components (chimney and plancha), not the parts built by the families. To a certain degree, this indicates success in transferring skills to stove users and increased likelihood that they can build new stoves for themselves when necessary.

Financing

3.97 With regard to financing, the Tezulutlán project seems to have struck a good balance between community contributions and subsidies, since most rural people lack the economic resources to cover the entire cost of the stoves. Such a model, which combines subsidies and community payments proportionate to families' ability to pay, is a practice worth considering with regard to future projects.

User Satisfaction

3.98 Aside from suggesting certain changes to the stove's exterior appearance, users have been pleased with this model. Using the stove has conserved fuelwood, which is the primary perceived benefit among users. Families' active participation in stove construction, combined with bearing a portion of the cost, has created a greater sense of ownership and responsibility for the stoves, which have become an integral part of households.

Institutional and Technical Challenges

3.99 The goal of having local NGOs assume responsibility for transferring technology and guaranteeing project sustainability did not progress as Tezulutlán had planned. This, in turn, created project follow-up and marketing limitations.

3.100 While 100% of the stoves are still working, the research team determined that, in many cases, variations in certain technical details could have affected the stove's efficiency. This may have been caused, in large part, by insufficient project monitoring, especially during construction.

3.101 The research team believes that, if the initial training provided to the community and the presence of local technicians reduce dependence on project technical staff, then close, continuous supervision of technology transfer, especially during the initial stages, could ensure standardization of procedures and quality of the final product, as long as high-quality materials and components are used.

Logistical Limitations

3.102 Technically, the stove has exhibited many more positive features (such as saving firewood and time, reducing smoke in the home, and reducing respiratory problems) than defects (such as external appearance). However, certain components pose logistical problems. For example, users cannot easily replace broken chimneys because major manufacturers are located in Rabinal (which communities, especially in other municipalities, cannot easily access). In addition, village roads are usually in poor condition, which makes it difficult to transport fragile items, such as the clay cylinders used to make stove chimneys. As the research team discovered, users respond to this problem by replacing the clay chimneys with sheet-metal ones because the latter are easier to buy, are less fragile, and can be made wherever sheet metal is available.

Commercialization Issues

3.103 Stove marketing through independent, local distributors was not an original goal of the Tezulutlán project. Marketing was limited to familiarizing hardware stores in the project area with the improved stove's advantages. No marketing structures were created, little consulting was done on the potential for marketing, and public promotion was limited primarily to radio interviews. Moreover, ties between producers, intermediaries, and vendors were not tightened. As a result, while the Tezulutlán stove is a good option for families in the region, it might not be introduced to more homes in Baja Verapaz.

4

Case Study 2: Social Investment Fund Project

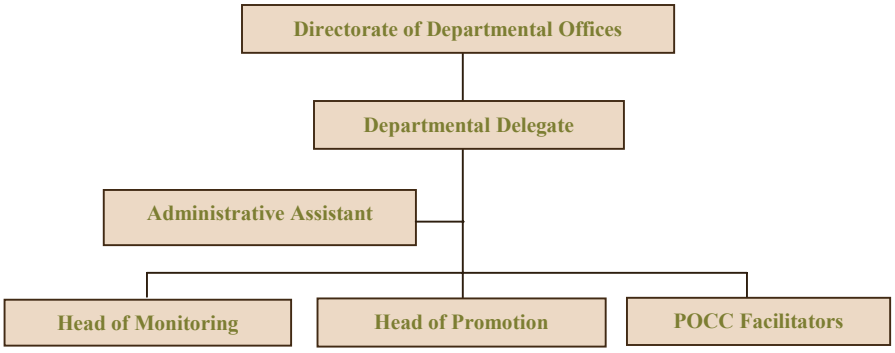
Organization

4.1 The Social Investment Fund (SIF) is a decentralized, governmental entity with administrative autonomy in using resources and carrying out its functions, with its own legal standing and heritage.[42] Established in 1993, the Fund originally had an eight-year mandate, which, in 2000, was extended for four years.

4.2 The SIF focuses on investment in activities that improve quality of life for the rural poor in Guatemala. Working groups include environment; productive projects; water and sanitation; and education, health, and nutrition. SIF work focuses on three areas: 1) guidance, training, and technical assistance; 2) financing of development projects; and 3) strengthening processes of community self-management.

4.3 Operational units are composed of management offices for water and sanitation, health and nutrition, education, economic infrastructure, environment,[43] and productive projects, which interact with departmental offices and the Community Organization and Training Program (POCC). Currently, the SIF has nationwide coverage through its 24 departmental offices (Figure 4.1).

Figure 4.1 SIF Departmental Structure



Source: Directorate of Departmental Offices, SIF.

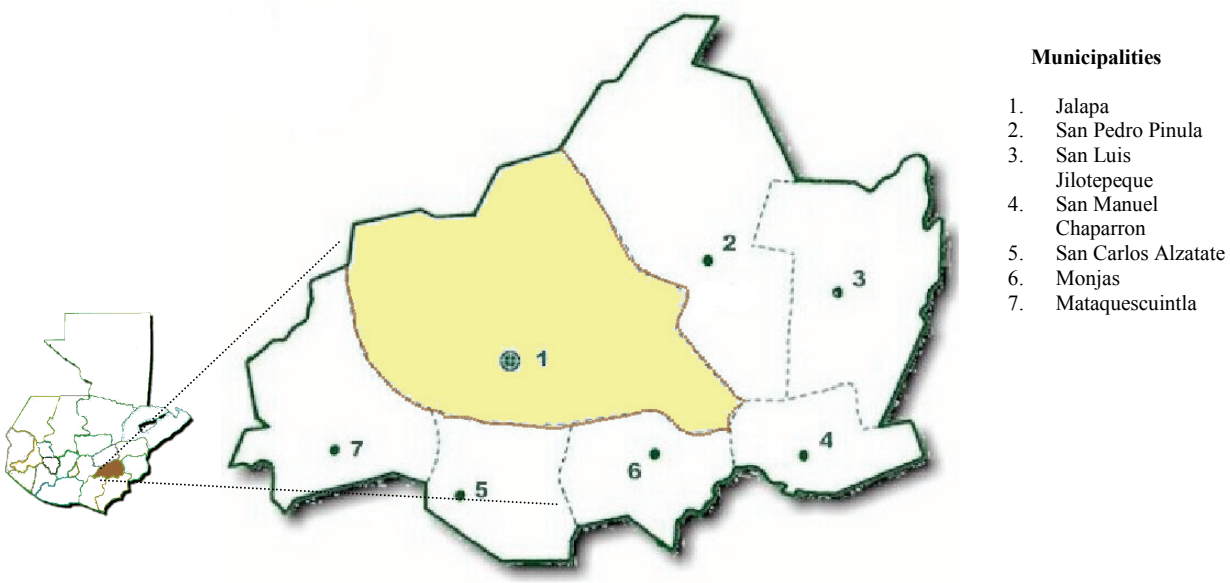
[42] According to the 2000 SIF annual report.
[43] Unit that operates the improved-stove project.

4.4 Together with the POCC, the SIF works to strengthen local development through creation of enterprises—composed of people from poor, rural communities—that carry out productive or social SIF program activities. This enterprise program, known as the EFIS, is implemented in microregions of 35 municipalities in 5 departments (Izabal, Zacapa, Chiquimula, Jalapa, and Jutiapa).

Geographic Focus

4.5 Jalapa, a department in western Guatemala, rises to 1,361 m above sea level, with an area of 2,063 sq km and a population of 285,118 (138 people per km^2). Most residents (71.8%) live in rural areas. Jalapa's literacy rate is 61.2%, and the poverty rate is high (72.59%), with extreme poverty at 29.23%. The department's economy consists of diverse agricultural, ranching, commercial, and industrial activities shaped by the distinct characteristics of the region's land and climate. Agricultural production is based on corn, beans, rice, potato, coffee, banana, and tobacco. The department has a general shortage of firewood because of deforestation and a relatively dry climate. It is divided into seven municipalities. Both communities selected for the SIF case study—Achiotes and Los González—are located in the municipality of Jalapa (Figure 4.2).

Figure 4.2: Map of Jalapa



Los Achiotes Overview

4.6 Los Achiotes, located on the slopes of Jumay Volcano, is only 7 km by dirt road from the municipal seat and departmental capital of Jalapa, making it easily accessible and close to an urban area. Its 325 residents live in 100 homes, with an average distance of 200 m between houses. Spanish is the only language spoken. About half the population is Catholic and half Evangelical.

4.7 The community's public services include a primary school, electricity, latrines, cellular telephone service, and grocery stores. Most people work in agriculture (major crops are coffee, beans, corn, and tomato); to a lesser extent, they work in livestock and chicken farming. The community's plant nursery reflects the economic role of many local women. The 1994 census indicated that the economically active population consisted of 67 women and 68 men; that is, women comprise 50% of Los Achiotes' economically active population, in contrast to 30% in most other communities of the municipality. All families in the community own their own land.

4.8 The SIF carried out an improved-stove project in Los Achiotes in 1999.[44] The project team found that fuelwood in the community and surrounding area—obtained mostly from oak (*Quercus* sp.) and pine (*Pinus* sp.)—was scarce. This observation was confirmed during project discussions with local women. Because it was not possible for them to walk long distances to gather firewood, most women bought it from vendors. According to the women, firewood was becoming increasingly scarce and more expensive. The situation was particularly difficult during the wet winter months; in extreme cases, people resorted to stealing firewood because of the difficulty in obtaining it. It was not possible to calculate a family's annual expenditure on fuelwood because consumption data was given in terms of number of pieces used, while cost data was given in terms of price per "carga."[45]

González Overview

4.9 The community of Los González, located on Santa María Xalapan Mountain, is 14 km from the municipal and departmental capital of Jalapa. As of May 2002, a paved road into the community was being completed. Los González has 540 residents who live in 90 households. According to the 1994 census, 96% of residents are indigenous, of the Poqomam ethnic group; however, they speak Spanish and Catholicism is the predominant religion. The community has a primary school, electricity, plumbing, and grocery stores. The major productive activity is agriculture (main crops are beans, corn, and fruit). All families own their land, most of which is inherited (Appendix B).

[44] Plan International also implements an improved stove project in the community.

[45] According to user focus groups, 1 carga of pine costs Q20 ($2.56), and 1 carga of oak costs Q25 ($3.21), based on an exchange rate of Q7.80 equivalent to US$1. According to the *Mathematical Manual for Agriculture, Livestock, and Forestry*, published by R. S. Lambous in Guatemala (1996), 1 carga equals 100 pounds.

Major fuelwood species are oak (*Quercus* sp.), pine (*Pinus* sp.), and alder (*Alnus acuminata*).

4.10 In terms of development projects, Los González has been supported by the SIF and Plan International. SIF implements the POCC and Plan International, in addition to sponsoring children, works on reforestation projects. The SIF improved-stove project was implemented in 2001.

4.11 At the time of the study, firewood scarcity in Los González was not as serious as in Los Achiotes; even so, according to women community members, it was no longer possible to gather wood from nearby. Most families purchased it or paid someone to gather it. Community members stated that firewood was becoming increasingly scarce because of deforestation and the ever-growing population. Women stated that, when they bought firewood, it was delivered to their homes; otherwise, men were responsible for collecting it.

4.12 One carga of pine cost Q15 ($1.92), oak cost Q25 ($3.21), and the price of alder was not determined. This study could not determine the numbers of cargas families bought each year because consumption was expressed in pieces of firewood per day.[46] Most families with improved stoves used 10-15 pieces of wood per day.

Project Features

4.13 According to the SIF Environment Unit, the Fund's Improved Stove Project, known as PEMF, began in 1996 and was extended, along with the Fund, until 2004. The PEMF represented the Unit's greatest responsibility because of rural communities' demand for improved stoves throughout the country.

PEMF Overview

4.14 The PEMF encompasses projects for plancha-type improved stoves, in accordance with the SIF prototype to replace similar stoves that are in poor condition for members of impoverished groups or communities in rural areas.[47] According to the SIF Environment Unit, since inception, the projects have promoted stoves with metal planchas, which have undergone modifications, including the plancha's thickness (at first, the plancha was made of 8 mm cast iron; now, it is made of 5 mm reinforced iron).

4.15 The expected benefits of the PEMF were socioeconomic (such as reducing the cost and quantity of wood consumed) and environmental (such as reducing indoor air pollution by increasing stove efficiency).[48] However, the project did not evaluate whether these outcomes were achieved. The findings of the present study indicate that community members perceived a savings in firewood consumption of 50-67%; however, no systematic quantification or monitoring of the stoves' impact on environment and human health has been conducted. According to the SIF Environment Unit, the PEMF

[46] The study could not determine the average weight of a piece of wood in order to calculate the number of pieces in 1 carga (equivalent to 100 pounds).
[47] According to the SIF descriptive guide.
[48] According to documentation provided by the SIF Directorate of Departmental Offices.

offers an opportunity to promote the participation of rural women; however, the study team found that the policy concerning women's participation was not clearly defined.

4.16 Today, SIF stoves can be found throughout Guatemala, and the technology is known in many rural communities. According to the Environment Unit, the demand for stove projects has been stable; it estimates that 15,000 are built each year. During the 1996–2001 period, this would have included 90,000 stoves and 540,000 beneficiaries, assuming 6 beneficiaries per household). [49]

4.17 According to the Environment Unit, the SIF stove model has been used since 1996, when the PEMF began. Initially, the model was not standardized; however, a 1998 document includes technical specifications, which implies that the model had become standardized by then. According to the Environment Unit, one notable design change was replacing an 8-mm, cast-iron plancha with a 5-mm one made of reinforced iron. According to various sources (including the Tezulutlán Project, SIF Environment Unit, and plancha producers and marketers), Guatemala's plancha-armada stoves are of higher quality and cost less than cast-iron planchas. No technical support has been available to certify the quality of stove components. Thus, SIF, Tezulutlán Project, and INTERVIDA have all evolved from using cast iron to reinforced iron through respective trial-and-error processes (indicating that the three groups do not interact with each other).

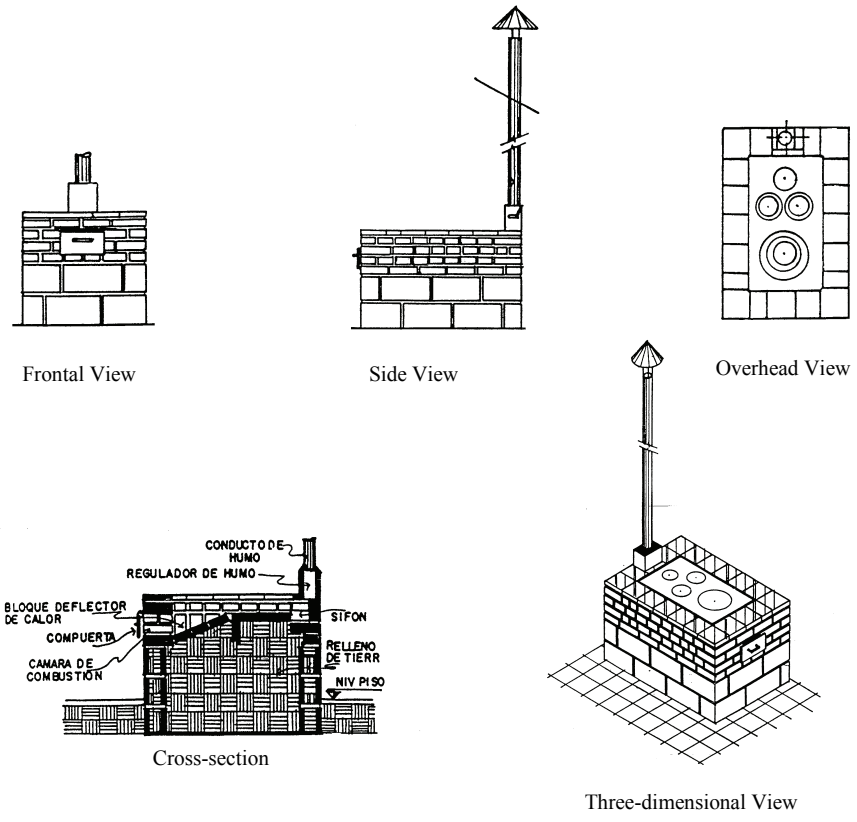
4.18 Now that the SIF project has documented technical specifications (with no further changes to the design), stove manufacturers are required to follow design specifications exactly. To date, PEMF procedures have not allowed flexibility for modifying the stove, and neither the communities nor the Departmental Offices have provided feedback requesting changes.

Women users with the SIF stove
Photo credit: Fundación Solar.

[49] According to the ENCOVI 2000 database, the average number of people per household in rural areas nationwide is 5.64, which, for practical purposes, was rounded to 6.

4.19 The SIF stove model consists of a base, comprising three rows of cinderblocks, the first of which is set below ground level; a firebox of "tayuyo" bricks,[50] with a block to reflect heat, which reduces internal volume in a way that makes better use of the heat generated; a plancha made of 5-mm reinforced metal with four cooking holes that can be modified using iron rings, depending on the size of the pot; a chimney of galvanized sheet metal used to remove smoke from the house and improve the fire; and accessories to make wood-burning more efficient, including a regulator to control airflow and a door for inserting firewood (Figure 4.3).

Figure 4.3 SIF Improved Stove



[50] Compressed bricks without holes through the middle.

Implementation Methods

4.20 According to the SIF Directorate for Departmental Offices, during implementation of the stove projects, two dissemination methods have been used: sectoral and POCC microregion. The latter method is currently used to implement improved-stove projects. The Directorate informed the study team that the reason PEMF requires projects to be implemented only in communities that belong to the POCC microregions is that, as it gained experience with stove projects, it began to realize that a considerable amount of community assistance work was required, which is expensive. Realizing the limitations of providing adequate supervision to the projects, it was decided to focus on POCC microregions, which are not only better defined geographically, but also focus more on community strengthening. Thus, the PEMF could ensure that both stove promoters and facilitators were from the department where the SIF Directorate Departmental Offices were located. It is clear that the PEMF has made efforts to encourage community members to adopt the SIF Stove, but has not attempted to adapt the stove to better meet users' needs.

Sectoral method

4.21 Using the sectoral method of implementation, stove project requests were presented before a committee organized by the community, and were acted upon, depending on availability of financial resources and fulfillment of conditions SIF had laid out for a viable project. According to this method, the promoter is the person responsible for following up on community requests. When a request arrives at the Departmental Office, the promoter visits the community to verify and complete the information.

4.22 The project implemented in Los Achiotes used the sectoral method. According to Environment Unit records, in 1998, the committee for improving Los Achiotes submitted a request to the Departmental Office in Jalapa that included a list of 28 people interested in the stoves; the project was subsequently executed in 1999.

POCC method

4.23 Using the POCC method, a stove project emerges from a community forum in which community members define their priority needs. According to this method, the facilitator is the link between the SIF and the community that does the work. Through the facilitator's presence and relationship with the communities, s/he becomes a leader that provides guidance to community members and strengthens the community organization to enable it to manage its own projects with SIF and other development organizations.

4.24 According to the facilitator in the Jalapa Departmental Office, this method works on a reward-for-effort basis, whereby the facilitator visits the communities, classifies them by sector, and calls a meeting of all community leaders (religious, legal, and traditional). An association, called the EFIS, is formed, composed of representatives of the various communities. The members are trained and a community forum is then held at which community members prioritize their needs and propose short-, medium-, and long-term solutions. Later, as a reward for their community organization work, the

SIF provides them financing and other support so that, through the community association formed, they can self-manage their first project. The idea is that these communities, through the associations formed, will retain the ability to self-manage other projects that interest them with other development organizations.

4.25 According to the facilitator of Jalapa's Santa María Xalapán Mountain microregion, the improved-stove project in Los González grew out of a community forum, was managed by a community association from the Santa María Xalapan Mountain microregion, and built 65 stoves in 2001. The facilitator told the study team that he works in 21 communities and has formed 4 legally recognized associations. In this microregion, each association is composed of 100 community leaders and household heads, representing 5-7 communities.

PEMF Planning and Implementation

Goal setting

4.26 According to the Environment Unit, PEMF activity planning and goal setting are done every year based on the funds allocated; however, the number of community requests for improved-stove projects exceeds the financial resources allotted for the program. The SIF Planning Unit allocates funds to the Departmental Offices on the basis of the poverty map; these funds are designated for various operational units (including health, education, and environment).[51] The poverty map is used to locate regions of the country categorized as "impoverished" and "extremely impoverished."[52] Updating of the map allows the demarcation of geographic pockets of poverty, not only at the municipal level, but also at the community level, which allows the SIF to focus its investments in the most economically depressed areas.[53]

Site and community selection

4.27 According to the Environment Unit, community-eligibility criteria for stove projects are: need for the technology, having every stove built inside the house, a willing community available to participate in the project through community contributions (unskilled labor and local materials), and community commitment to training others in stove use and maintenance.

4.28 In Los Achiotes, the Fundación Solar research team observed the case of a woman who, in 1998, requested an SIF stove even though she already had a Plan International stove that she said was in poor condition. Despite the criteria mentioned above, a stove was built for her outside the house because she planned to build another kitchen; however, as of May 2002, the SIF stove was not being used. While this case is not representative and cannot be used to generalize about the PEMF stove program, it does illustrate the need for control of selection criteria.

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[51] In 1994, at the outset of operations, the SIF created a poverty map that it used to allocate project investments.

[52] Of Guatemala's 22 departments, Jalapa has the seventh highest rate of poverty (72.59%) and the eighth highest rate of extreme poverty (29.23%).

[53] According to the 2000 SIF annual report.

4.29 In addition to the criteria previously mentioned, according to the Directorate of Departmental Offices, it started implementing stove-improvement projects several years ago using only the POCC method. The Los González community, an example of using this method only, received better institutional support than did Los Achiotes.

Stove promotion

4.30 According to the Environment Unit, at the outset of the PEMF, promoters in the Departmental Offices informed the communities about the various projects in the SIF portfolio and their benefits. This promotional work created the demand for improved stoves; once the technology was disseminated, the promotional work was no longer as important since, although not every family in Guatemala was aware of the technology, the program had more demand than it could meet. These same communities, on their own, formed a committee and submitted requests to the SIF for improved stoves. Now, however, the improved-stove projects are chosen through the POCC community forums, where presentations are made about the SIF portfolio of projects and their benefits.

4.31 Although he no longer actively promoted the improved-stove technology, the facilitator for the Santa María Xalapan Mountain microregion said that he saw a need to resume promotional work to raise community awareness about the environmental benefits of using improved stoves. That many communities were still not familiar with improved-stove technology and its benefits was confirmed in Los González, where the women said that, before the project began, they knew virtually nothing about improved stoves; it was only when they held a community forum that they began to think about the benefits of the stoves. According to the facilitator, they became more aware about issues of health and women's participation.

Contracts and payments

4.32 SIF stoves are built by private companies contracted through public bidding after projects are approved by the Technical Committee.[54] At the same time, an outside supervisor or company is contracted to conduct technical training in how to use and maintain the stoves and social monitoring.

4.33 The contract for the stove construction company is a "key-in-hand" arrangement. The builder is responsible for constructing the complete stove, including the purchase of non-local materials and the cost of supplying materials and skilled labor to the community. The company guarantees its work for one year.

4.34 The payment system for the construction company is directly related to progress in building the stoves; 40% is paid as an advance at the beginning of the job, followed by three equal payments of approximately 16.67% each—the first for building the base; the second for installing the firebox; and the third for installing the planchas, chimneys, and accessories. The remaining 10% is paid when the completed stove is delivered to the owner.

[54] Composed of directors agreed on by the Executive Board for approving projects and authorizing investments.

Costs and raw materials

4.35 According to the Environment Unit (current as of May 2002), the stove price was Q900-1,300 (US$115.38-166.67),[55] or an average price of Q1,100 (US$141.03). This did not include the community's contribution of local materials and unskilled labor. The price variation was caused by distance and community accessibility.

4.36 To quantify the value of the community contribution and calculate a total value for the stove, INTERVIDA Project figures were used to simulate the cost of local materials (Table 4.1). Based on these assumptions, the value of local materials provided by families participating in the SIF project was Q62.50 ($US8.01). Added to the average price of the stoves, the amount was Q1,162.50 ($US149.04), not including unskilled labor.

Table 4.1: Assumed Cost of Community Contribution to the PEMF

Beneficiary contribution	Cost (Q)
1.5 sacks of river sand	22.50
1 sack of powdered clay	30.00
2 cupfuls of "panela"*	10.00
Unskilled labor	---
Total	**62.50**

* "Panela" is the sweet juice squeezed from sugarcane.
Source: INTERVIDA Project data.

4.37 Assuming that unskilled labor cost Q50.00 ($US6.41), the total value of the stove rose to Q1,212.50 ($US155.45). It should be noted that, in some cases, local materials and unskilled labor may not represent monetary expenditures by the families, but rather work.

Stove construction

4.38 Construction company bricklayers built the improved stoves based on SIF technical specifications and the above-mentioned payment arrangements. Stove users transported the materials from the community warehouse to their respective homes, and family members helped bricklayers build the stoves. No flexibility was allowed in terms of making design changes, except for the number of cylinders used to make the chimney, which varied according to the height of the roof.

4.39 Both local and non-local materials were used to build the stove. Each family was responsible for supplying the local materials, while the contractor supplied non-local ones. According to the technical monitor for Jalapa, it was sometimes difficult to obtain the appropriate clay for making the bonding mixture for bricks in the firebox. There was no difficulty in supplying other materials.

[55] The exchange rate in September 2002 was Q7.80 equivalent to US$1.

Monitoring and evaluation

4.40 According to the head of the Unit for Control, Supervision, and Ex-post Evaluation (UCOSE), project M&E involves a system of payment controls, whereby the monitor verifies progress in stove construction in order to authorize payments and certifies and accepts the finished work. Currently, 25 UCOSE monitors are responsible for 22 departments (that is, one monitor supervises all projects implemented through the Departmental Office, including infrastructure, education, and water and sanitation projects). Because of the many types of projects being implemented in numerous communities of the department, it is difficult for the monitor to visit all of them each month. The Jalapa monitor commented on stove users' demands and suggestions, such as adding space to store firewood; the monitor has considered passing along the suggestions to the PEMF, but thinks it would be difficult to make any changes because of the rigid, centralized structure of the project's decision-making process.

4.41 Quality control is the responsibility of the supervisor, who is contracted as a requirement for receiving financial assistance. The supervisor visits the projects twice a month during the implementation phase and writes reports. The monitor reviews the reports and makes sporadic visits to the communities to verify that everything is going along as reported. Contractors who fail to fulfill their obligations lose their deposit and another company is hired. However, according to the Jalapa Office monitor, UCOSE requests that the contractors make needed repairs and avoids seizing deposits because this causes delays and creates uncertainty in the community about the projects. According to the head of UCOSE, ex-post evaluations of improved-stove projects are only conducted when a financing agency requires it.

Training

4.42 Private companies contracted by the SIF provide training in stove use and maintenance, usually to groups of women during the implementation phase of projects. An external monitor is contracted to supervise the training. According to the facilitator for the Santa María Xalapán Mountain microregion of Jalapa, this training has been easy because the women are confident and have a history of organization.

Financing Structure

4.43 According to the Directorate of Departmental Offices, the Government's contribution to sustaining the improved-stove projects is substantial,[56] and support provided by such international organizations as the World Bank is also important, although they appear more receptive to funding other types of projects, particularly health and education. According to the Directorate, grant and credit organizations often hesitate to fund the PEMF because they are not convinced of its benefits and because these projects require considerable institutional supervision. This was confirmed during a visit to the Departmental Office in Jalapa, where work team members noted that financial institutions were not open to collaborating on implementation of improved-stove projects.

[56] Exact figures were not available.

They also expressed that one way to change the perception of these entities would be for such institutions to undertake field visits to the communities so that they could witness the considerable benefits that improved-stove technology can offer rural families.

4.44 SIF project subsidies focus on project administration and strengthening of community organization. They cover about 91% of the price of the stove, according to above-mentioned data.

4.45 According to the facilitator for the Santa María Xalapán Mountain microregion, in Los González, where the POCC method is followed, the project is strict about the community contribution (9% of total value) and insists that participants sign an agreement promising to provide the contribution and participate in training on how to use and maintain the stoves. By contrast, according to information gathered during the focus group in Los Achiotes (which applies the sectoral method), the women said that the SIF did not request any community contribution, although construction companies required them to provide unskilled labor and occasional meals for the bricklayers.

Marketing

4.46 According to the Environment Unit, during project implementation, no attempts were made to foster a commercial market for either the stoves or the planchas because the projects' goal was to serve families with scarce resources.

Regional structures that support marketing

4.47 Since the SIF did not carry out marketing work, brief research was conducted in the departmental seat of Jalapa to check for any signs of a commercial market for stoves or metal planchas. A survey of the availability of metal planchas in hardware stores was carried out (Table 4.2).

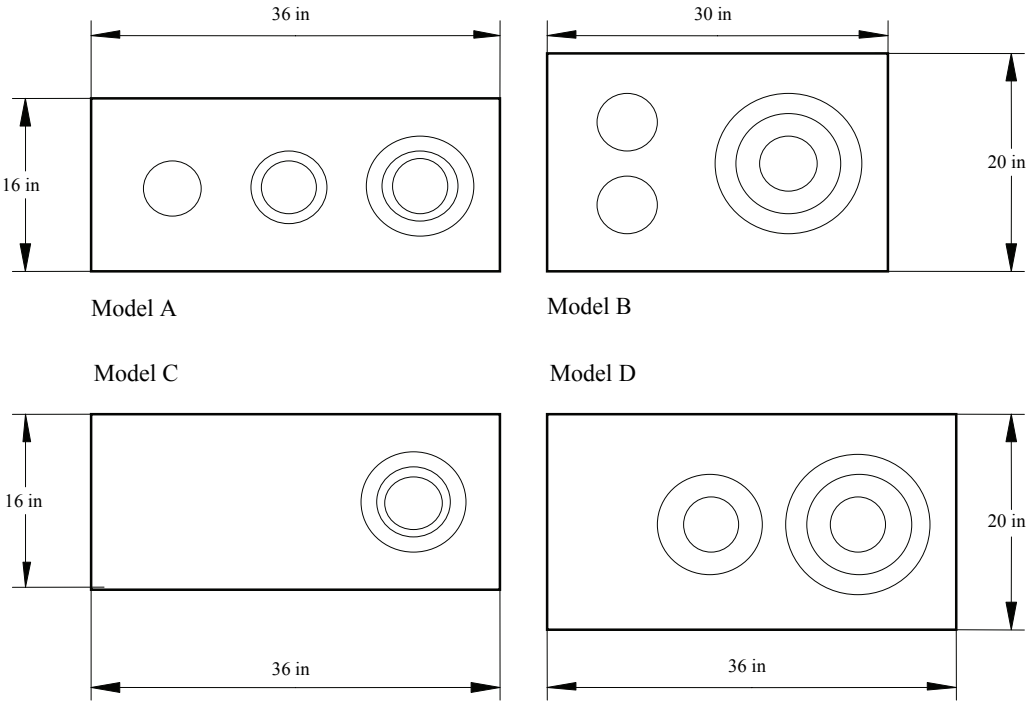
Table 4.2: Plancha Availability in Hardware Stores, Municipal Seat of Jalapa

Description	Store 1	Store 2	Store 3	Store 4	Store 5
Plancha model	1	2	3	2	1
Size types and dimensions (in inches)	A, 31 x 19	A, 36 x 16 B, 30 x 20	A, 36 x 16 B, 30 x 20 C, 36 x 16	Not available	D, 35.5 x 25
Material Used	Reinforced iron	Reinforced iron	Reinforced iron	Cast iron	Reinforced iron
Price (Q)	A, 250	A, 240 B, 275	A,B,C, 240-275	A, 280 D, 225	250-275
Vendor's rough estimate of demand	Low	Normal	Normal	Normal	Normal
Supplier	Jalapa	Guatemala City	Jalapa	Guatemala City	Guatemala City, Jalapa

4.48 Visits were made to seven hardware stores; five of them sold planchas, one manufactured them (mainly for wholesale to hardware stores, but also to retail markets and projects), and one expressed interest in selling them. In short, 86% of the hardware stores visited sold metal planchas. They carried five models, the most common

of which was Model A (Figure 4.4). Only one hardware store sold cast-iron planchas, while the rest sold plancha armadas. Half of the stores visited bought their planchas from a local workshop, while the other half bought them in Guatemala City stores, including the one that carried cast-iron planchas. Most planchas had three holes for cooking, although some had one or two holes. Some had an open space for cooking tortillas. The price of plancha armada was Q240-275 (US$30.77-35.26), and the price for cast-iron planchas was Q225-280 (US$28.85-35.90). Curiously, none of the hardware stores visited sold the SIF plancha, which has four openings.

Figure 4.4 Plancha Models for Sale in Hardware Stores, Municipal Seat of Jalapa



Local manufacture of planchas

4.49 The survey on stove availability in Jalapa revealed that a workshop in the departmental capital manufactures eight models of metal planchas from reinforced iron (the models measure either 18 x 28 or 17 x 36 inches, with 1, 2, or 3 holes, and with or without an area for cooking tortillas). The workshop also makes portable plancha stoves that use gas as fuel. The stoves are made using 3/16–inch reinforced metal and 3/16–steel angles. The wholesale price to hardware stores is Q200 (US$25.64), while the price for projects is Q175 (US$22.44). Despite recent variability in the price of raw materials, the workshop owner keeps the price constant to avoid having an unstable price affect demand. The workshop owner sells and distributes planchas (he does not market planchas) mainly to hardware stores in several western departments of Guatemala; and

also sells them in his hardware store. (He indicated that he previously applied to work on the SIF project, but his competitors offered a lower price.)

4.50 To manufacture the planchas, he buys reinforced iron ("hierro armado") from a factory in Guatemala City. He employs three artisans, who make stoves on a daily basis. An expert artisan makes three planchas per day and is paid Q25 (US$3.20) per plancha. The workshop's average daily production is seven planchas.

4.51 The owner added that he uses reinforced metal, instead of cast iron, because the former, when properly reinforced with steel angles, does not buckle under excessive heat, as does the latter. To ensure quality, he solders 6-7, 1-inch beads onto the burner discs (other manufacturers use only 4-5, 1/2-inch beads, the minimum requirements in SIF stove specifications). He is so confident of the quality of his planchas that he offers a one-year guarantee.

User Profile

4.52 In both Los Achiotes and Los González, the research team profiled users by collecting information through semi-structured interviews (Appendix D) and focus groups (Appendix G). In Los Achiotes, interviews were conducted with 10 (36%) of the 28 people who had received SIF improved stoves; in Los González, interviews were conducted with 21 (32%) of the 65 people who had received stoves. In addition, two focus groups were held, one in each community (Los Achiotes had 14 participants and Los González had 12). No differentiation was made between those previously interviewed and those who had not been. In both communities, project activities were carried out in Spanish without an interpreter (since 100% of Los Achiotes and 96% of Los González residents are Spanish-speaking).

Socioeconomic Profile

4.53 In both Los Achiotes and Los González, most of the stove users interviewed were women. In Los Achiotes, the average household size was six, while that of Los González was seven. In Los Achiotes, the most common type of illness according to the women was respiratory reported by 90% of the interviewees. During the field visit to Los González, the study team observed that diarrhea was prevalent; indeed, 81% of those interviewed cited the prevalence of diarrhea or gastrointestinal illness, and 62% cited respiratory illness. Although a cause-and-effect relationship could not be shown between use of improved wood stoves and prevalence of respiratory or gastrointestinal illness, results of the interviews underscored the importance of providing women with a less polluting, more hygienic method of cooking (Table 4.3).

Table 4.3: Socioeconomic Characteristics, Los Achiotes and Los Gonzáles

	Gender				Main illnesses		Economic activities	
Community	No. inter-viewed	M	F	No. persons per household	Respir-atory	Gastro-intestinal	Agri-culture	Business/ services
Los Achiotes	10	1	9	5.5	9	1	8	2
Los Gonzáles	21	1	20	7.3	13	17	18	2

Literacy

4.54 According to the 1994 INE census, 81 people (58%) in Los Achiotes were literate and 59 (42%) illiterate. In Los González, 70 people (70%) were literate and 30 (30%) illiterate. Although Los González has a higher literacy rate, no relationship was found between different literacy rates in the two communities and their adoption and maintenance of improved stoves.

Ownership of land and durable goods

4.55 All of the people interviewed in both communities owned their land (Table 4.4). This fact may have increased the level of project participation because, once a stove is built, it is not easily moved as a unit. If families lacked confidence in their being able to stay in their homes, they might have been less interested in contributing toward the value of the stoves. While this issue suggests the need for a greater variety of stove designs (including portable ones), no direct relationship was determined between land ownership and stove acceptance.

4.56 Regarding ownership of durable goods, 70-80% of the families interviewed in Los Achiotes had a bicycle, television, and radio. In Los González, about 50% of those interviewed had a radio and television, and about 30% had a bicycle. (It should be noted that many residents bought used goods.) In Los Achiotes, 80% of those interviewed said they bought goods with cash, while 20% said they bought on credit. Similarly, in Los González, 81% said they purchased goods with cash and 19% on credit. These results indicate that most community residents are not yet accustomed to buying on credit (this fact should be considered when exploring the marketing potential of an improved-stove program.

Table 4.4: Ownership of Land and Durable Goods in Los Achiotes and Los Gonzáles

		Own land						
Community	No. interviewed	Yes	No	Bicycle	Motorcycle	Radio	Television	Other
Los Achiotes	10	10	0	8	1	7	8	0
Los González	21	21	0	6	1	11	13	1

Housing types

4.57 In both Los González and Los Achiotes, most houses have adobe walls and tile or sheet-metal roofs (Tables 4.5 and 4.6). Field visits revealed that residents did not have problems with rainwater seeping through the roof around the chimney. These roofing materials also prevent fires caused by sparks or overheating of the chimney.

Table 4.5: House Characteristics, Los Achiotes, Jalapa

Area	Walls				Roof			
	Wood	Block or brick	Adobe	Stalk	Sheet metal	Tile	Palm	Other
House	0	3	7	0	5	5	0	0
Kitchen	3	1	6	0	6	4	0	0

Table 4.6: House Characteristics, Los González, Jalapa

Area	Walls				Roof			
	Wood	Block or brick	Adobe	Stalk	Sheet metal	Tile	Palm	Other
House	0	4	17	0	10	11	0	0
Kitchen	0	5	16	0	6	15	0	0

Stove Performance, Maintenance, and Fuels

4.58 About three years after the stoves were installed in Los Achiotes, 50% of the chimneys had to be replaced. In Los González, about two years after stove installation, there was only one chimney problem, which was related to deterioration of the base. It was known in advance that the chimney had to be replaced occasionally. According to Table 4.7, the base or "poyetón" of the stove had problems with cracking, presumably caused by poor construction. However, it did not significantly affect the functioning of the stove. In Los González, 33% of the problems reported involved accessories; for example, doors for inserting firewood fell off due to poor-quality installation. Each community experienced one case of a cracked plancha, attributable to sudden temperature changes, such as when cold water is spilt on the hot surface.

4.59 Residents in both communities modified stove components (Table 4.8). In Los Achiotes, one woman user (10% of those interviewed) modified the firebox. In Los González, however, 6 of the 21 people interviewed (30%) modified the firebox, taking out the heat-deflecting block that reduces the internal volume of the chamber to permit the insertion of more firewood. Other modifications, which were related to exterior appearance, included replacing the chimney and repairing cracked planchas.

Table 4.7: Component Failures Reported by Stove Users, Los Achiotes and Los Gonzáles

Community	No. interviewed	Base or poyetón	Firebox	Plancha	Burner or hornilla	Chimney	Accessories
Los Achiotes	10	4	1	1	1	5	0
Los González	21	2	1	1	1	1	7

Table 4.8: Component Modifications Reported by Stove Users, Los Achiotes and Los Gonzáles

Community	No. interviewed	Base or poyetón	Firebox	Plancha	Burner or hornilla	Chimney	Accessories
Los Achiotes	10	0	1	1	0	1	0
Los González	21	1	6	1	0	0	0

4.60 During a field visit to Los González, where 30% of those interviewed had modified the inside of the firebox, the research team found that a community leader developed this practice because his stove did not become sufficiently hot. The solution, however, did not have technical merit since enlarging the firebox reduced efficiency and required more firewood to heat it. Such findings show that many families had difficulty adapting to using less wood. It is also important to note that the modifications users made were not always related to problems (Table 4.8).

4.61 Problems in adapting to the established model show that more research and technical development are needed to design stoves that better meet users' needs. However, it is also important to raise people's awareness about the improved stove's economic, health, and environmental benefits and provide them adequate technical training in stove use and maintenance.

Use and maintenance

4.62 At first, women stove users in both communities had trouble adapting to using less firewood and splitting the wood so that it would fit into the firebox. Later on, they said they had become accustomed to the stoves and found them easy to use.

4.63 Switching from an open fire to an improved stove could, understandably, create apprehension and difficulties for users. For example, they had to learn to manage the flow of air, feeding of wood, and use of the stove valves (firebox door and chimney regulator).[57] The height of the chimney also affected performance.

4.64 Women primarily used the improved stoves to prepare food (corn, beans, tortillas, coffee, and, to a lesser extent, meat and other vegetables). When asked about

[57] According to Manuel Tay, engineer and expert on improved stoves.

uses other than cooking, only two women from Los González said they used the stoves for baking and as a dining table. In addition, 4 of the 10 people interviewed in Los Achiotes (40%) and 6 of the 15 interviewed in Los González (40%) said they used the stove to keep warm. The communities visited commonly kept the fire burning all day. This was true for 7 of the 10 respondents in Los Achiotes (70%) and 13 of the 21 respondents in Los González (62%). The remainder said they used the stove for about two hours per day at mealtime.

4.65 Users cared for their stoves by cleaning out the ashes from the firebox, cleaning the plancha once a day, and cleaning the chimney once every week, two weeks, or month.

Fuel use

4.66 In the two communities studied, the main cooking fuels were firewood, followed by corncobs.[58] In Los González, cornstalks were also frequently used. In both Los Achiotes and Los González, 40-45% of the women interviewed said they used short, thin pieces of wood, and the rest used wood of varying sizes. No one said they used only large pieces of firewood (Table 4.9).

Table 4.9: Main Cooking Fuels, Los Achiotes and Los Gonzáles

Community	No. interviewed	Fuel used			Firewood size			
		Wood	Corncob	Cornstalk	Short and thin	Thick pieces	All sizes	NR
Los Achiotes	10	10	9	0	4	0	6	0
Los González	21	21	9	12	9	0	9	3

User satisfaction

Firewood savings

4.67 According to data reported on the survey forms, most families with improved stoves in Los Achiotes used 50-67% less firewood. Significant reductions in wood use were also found in Los González, where families that could quantify their consumption indicated savings of 50-63%. Conserving firewood also benefited the communities economically since 5 out of 10 people interviewed in Los Achiotes and 9 out of 10 interviewed in Los González purchased their firewood. However, some women users, out of habit, preferred to use as much wood as they wanted or could afford.

Training and follow-up visits

4.68 As Tables 4.10 and 4.11 illustrate, institutional support was better in Los González, where the POCC method was used, than in Los Achiotes, which implemented the sectoral method. In Los Achiotes, only 60% of those interviewed were trained in

[58] After removing the corn kernels, the cob is dried and then used as a fuel.

stove use and maintenance (they received no training materials); by contrast, in Los González, 95% of those interviewed said they received training (they were also given a pamphlet and training diploma). In both communities, the women interviewed said that the training was useful and sufficient.

Table 4.10: Training on Stove Use and Maintenance, Los Achiotes and Los Gonzáles

Community	No. interviewed	Training received	
		Yes	No
Los Achiotes	10	6	4
Los González	21	20	1

4.69 In Los Achiotes, only 50% of those interviewed were visited after their stoves had been built. However, in Los González, 86% said they had received follow-up visits (Table 4.11). In both communities, most of the people visited said they received either one or two visits. In Los González, the women said they liked the additional assistance and follow-up visits.

Table 4.11: Follow-up Visits, Los Achiotes and Los Gonzáles

Community	No. interviewed	No. of follow-up visits by institution			
		1	2	3	None
Los Achiotes	10	3	2	0	5
Los González	21	9	8	1	3

Use of open fires and propane stoves

4.70 Some community households used propane stoves, largely because of their close proximity to urban centers. In Los Achiotes, the propane supplier is located nearby; thus, women who worked in the nursery used propane stoves, while continuing to use wood-burning stoves for such foods as beans, corn, and other foods that take longer to cook. In both communities, women said they used gas for fast-cooking foods, such as morning coffee and eggs.

4.71 In Los Achiotes, 40% of those interviewed still used an open fire, but only for cooking large quantities of food for holidays and other special occasions. Similarly, in Los González, 38% of the women said they used open fires, mainly for celebrations. However, unlike the women in Los Achiotes, they also used an open fire to keep warm since Los González is located at a high altitude.

Advantages of improved stoves

4.72 As Table 4.12 demonstrates, the main benefits that women stove users (10 interviewed in Los Achiotes and 21 in Los González) identified were savings in firewood, less time needed for cooking, and less indoor smoke; to a lesser degree, they indicated overall savings in time, improved respiratory health, less eye irritation, and a cleaner kitchen.

4.73 In both communities, women focus-group participants indicated that the improved stoves were useful in cooking tortillas. The stoves represented a household savings of Q20-60 (US$2.56-7.69), by not having to buy separate comals,[59] which the women said required replacing every three months. Moreover, the women indicated that, if they had to move from their homes, they would take the planchas with them and build another stove in the new home.

Table 4.12: Perceived Benefits of Improved Stoves, Los Achiotes and Los Gonzáles

Benefit	Los Achiotes	Los González	Total
Less firewood consumed	8	18	26
Less time to cook	6	19	25
Reduced indoor smoke	7	15	22
Time saved	4	8	12
Improved respiratory and eye health	4	6	10
Cleaner kitchen	3	6	9

Disadvantages of improved stove

4.74 While women in both communities cited disadvantages in using the improved stoves, most experienced no problems. In Los Achiotes, women cited the following disadvantages: limitations in the weight that can be supported by the plancha,[60] difficulty in controlling intensity of the fire, and a chimney diameter that is too small. However, 60% cited no disadvantages. In Los González, women cited smoke trapped in the house (14%) (apparently caused by inadequate cleaning) and difficulty cooking tortillas on the plancha (5%) (possibly caused by difficulty in controlling intensity of the fire) as the two major disadvantages. However, 52% cited no disadvantages. This data, which reflects a lack of technological research and development work, points to the need for future projects to include technical consulting on improved stoves and training in stove use and maintenance.

[59] Clay plates used for cooking tortillas. A clay comal costs Q5-12 (US$0.64-1.54).

[60] According to Manuel Tay, an engineer and expert on improved stoves, high-quality planchas are not damaged by excessive weight.

Suggested design changes

4.75 Results of the focus groups conducted by Fundación Solar show that, in Los Achiotes, 6 out of 10 women wanted to modify the stove's chimney. In Los González, 5 women suggested enlarging the stove, 2 wanted to plaster the exterior, another 2 wished to add an oven, and 1 wanted to add a clay comal for cooking tortillas. However, 11 out of 21 women in Los González said they would change nothing (Appendix G).

Marketing perceptions

4.76 The marketing potential of the SIF improved stove focuses on the plancha since other stove parts can be bought separately and are made from common construction materials. When asked if they knew of anyone who sold complete stoves, the women said they did not since, generally speaking, this type of stove is not used locally. However, when asked if they knew of any place where metal planchas were sold, 9 out of 10 (90%) women in Los Achiotes answered "yes;" their response makes sense since this community is located only 7 km from town. In Los González, which is twice as far (14 km) from town and situated on a mountainside, only 7 out of 21 (33%) knew of any place that sold planchas.

4.77 In both communities, women did not know how much the planchas cost, but had the impression they were expensive. In the focus groups, prices were mentioned that were higher than those of hardware stores in the departmental capital of Jalapa.

Non-user profile

4.78 In Los González, two non-users were interviewed; they differed little demographically or economically from the stove users interviewed. They spoke Spanish; practiced the same religion; were landowners; had houses made of adobe and tile; and owned radios, televisions, and motorcycles that they bought with cash. They worked in agriculture and business. However, one did not have access to the project, and the other was not interested.

4.79 These non-users used an open fire for cooking and household heating. Like improved-stove users, they used wood, cornstalks, and corncobs for fuel. One interviewee said her family of two used 10 pieces of wood per day. The other said her household of five used 25-30 pieces a day. These figures are in line with the advantages perceived by improved-stove users. Both families collected, rather than bought, firewood, but this could not be determined as the reason they did not participate in the project.

4.80 Both non-users said they knew of the PEMF and considered the advantages of the stoves to be savings in time and firewood. However, they had heard that the stoves also had problems. One of the non-user families was not interested in acquiring a stove; the other non-user family, while interested, was unable to participate in the project. Neither knew where stoves were sold.

Lessons Learned

Institutional Capacity and Flexibility

4.81 The SIF is distinguished by its implementation capacity, having installed some 15,000 stoves per year since 1996. Participation of implementing units (Departmental Offices) and the private sector—including small construction firms, component manufacturers, and external consultants—has allowed the SIF to achieve an implementation capacity that no other project has matched. This institutional capacity has created jobs for small stove-construction firms (many of which were established in response to demand generated by the SIF stove projects), shops that manufacture metal planchas, bricklayers, and external consultants.

4.82 One selection criterion for hiring staff in the SIF Departmental Offices is that they be natives of the department where they are hired. This allows them to better understand the needs of communities, including their customs and language, geographic situation, and accessibility factors.

4.83 SIF has modified its project methodology to focus more on community participation. Through the POCC, SIF has required that the community formally commit to project collaboration. Using this method, SIF forms a local association responsible for managing the project, and beneficiaries commit to attending training sessions and providing community support (10% of the cost of the stove).

Institutional Limitations

4.84 Despite its institutional capacity, SIF lacks an adequate communications structure, both internally and externally, which makes project evaluation more difficult. Project decision-making is concentrated in the Central Offices of Guatemala City, and lacks a feedback system to permit adequate communication between workers in Departmental Offices and designers of strategies for improved stove projects. Procedures for project approval are time-consuming because a single committee is responsible for approving all projects in the SIF national portfolio.

4.85 No M&E system has been established for assessing the project's impact on communities; obtaining feedback on the methods used or key issues involved, such as cost sharing by users; or evaluating proposed strategies to enhance project sustainability. Moreover, the SIF has not conducted technology research and development, which has prevented stove-model improvements that reduce costs (SIF stove model is about 40% more expensive than the INTERVIDA model).

4.86 Because technicians designed the stove without considering women users' opinions and preferences regarding ergonomic and safety aspects, the stove lacks built-in flexibility; for example, women users cannot select the height of the stove base. Although the task group that implemented the project recognizes the need for SIF to focus on women, there is no evidence that actions were taken to increase women's participation in community development, decision-making, and access to resources. In the two communities studied, women's role was limited to that of beneficiary.

Technical Challenges

4.87 In Los González, 35% of firebox doors fell off as a result of poor-quality installation. These unusable doors reflect inadequate technology transfer, as well as a cost to the project. Therefore, the quality-control and assurance system during stove construction needs strengthening.

Sustainability Issues

4.88 The SIF stove project faces both funding and marketing challenges. Because the project depends on financing from international aid agencies, it is vulnerable to the availability of international funding. The situation is made worse when, according to SIF staff, international aid agencies are skeptical about this type of project. In addition, SIF has not promoted a commercial stoves market; thus, project beneficiaries remain strongly dependent on project contributions.

5

Case Study 3: INTERVIDA

Organization

5.1 INTERVIDA, a Spanish nonprofit organization established in 1993, seeks to improve the living conditions of children and their families in the areas of greatest poverty. Its work and financing methods are based on the concept of sponsorship. Currently, the organization works in seven countries around the world.

5.2 Headquartered in Barcelona, INTERVIDA has worked in western Guatemala since 1996, carrying out various projects in the departments of Sololá, Quiché, Quetzaltenango, San Marcos, Totonicapan, and Huehuetenango. Central departmental offices are located in Quetzaltenango, along with departmental branches called TERRAs (*Territorio de Acción Solidaria*). The headquarters office in Spain defines the global operational strategy, while TERRAs work relatively independently within the INTERVIDA structure (each TERRA-proposed project depends on the needs identified in specific areas).

Organizational Structure

5.3 INTERVIDA's organization structure includes administrative units for quality, communications (marketing and graphic design) projects, international partners, human resources, management, information, administration and finance, and sponsorship (Figure 5.1).

5.4 Each TERRA is composed of a branch coordinator and operational units, which have sectoral managers. At the operational level, each sector (training, production, education, and health) has assistants and promoters. Assistants are responsible for managing various fields (such as livestock or agriculture), while promoter specialize in only one field (Figure 5.2).

Figure 5.1 INTERVIDA Organizational Structure

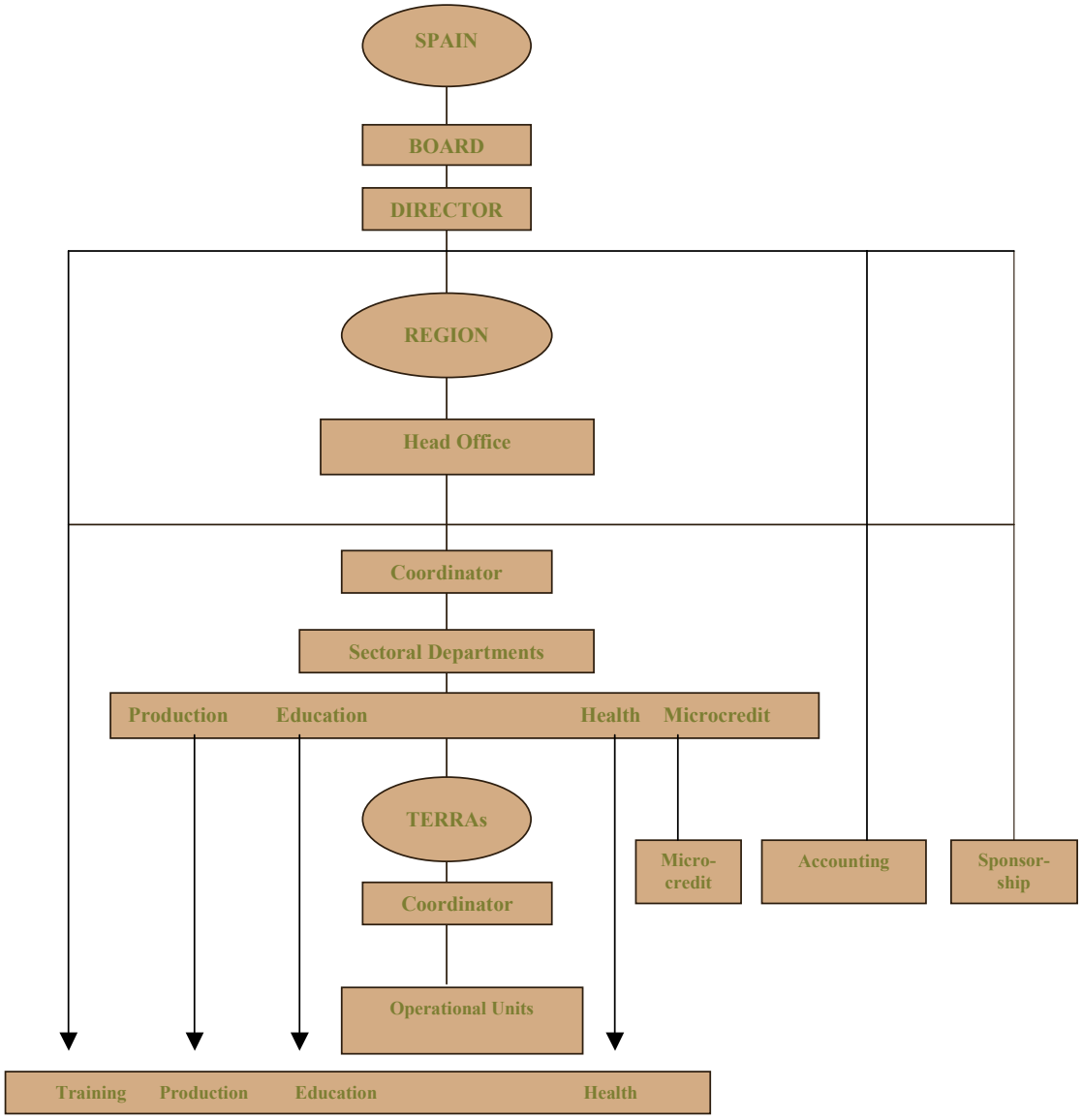
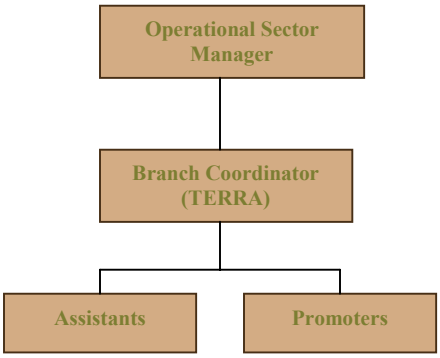


Figure 5.2 Operational Sector Structure



Program Components

5.5 INTERVIDA's work in Guatemala has three program components:

1. *Community Support, Organization, and Training*. Considered the foundation of project work, this program strengthens community organization and creates community committees to manage projects.

2. *Basic Support*. This health-and-education centered program is the component through which medical visits and school construction are carried out.

3. *Production and Marketing*. This program aims to stimulate the economy and generate income through project work in livestock, agriculture, forestry, and community organization.

5.6 Specialists working in the three program components visit the communities where the sponsored children live to determine their priority needs. Basic Support services are free of charge for affiliated communities, while Production and Marketing projects require community commitment and cost sharing.

Geographic Focus

5.7 From its work in six western departments of Guatemala, INTERVIDA chose to focus on San Marcos for this case study because, according to the Production and Marketing Unit, San Marcos has one of the largest improved-stove programs and information is available. In 2000, INTERVIDA installed 5,500 stoves in all the areas where the program was active. Over the previous two-year period, it installed 3,500 stoves in 89 communities of the department (Table 5.1).

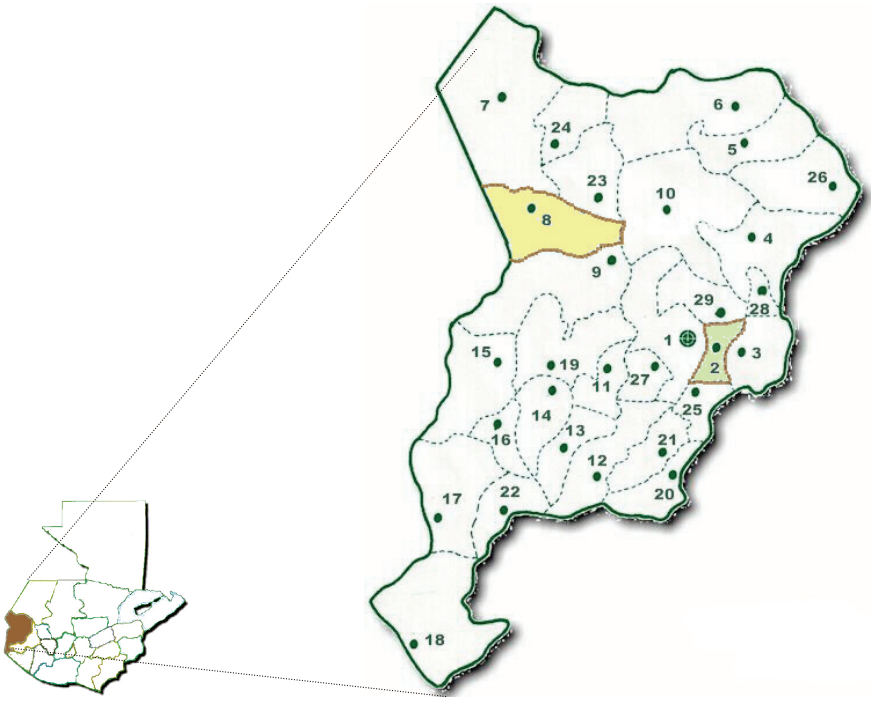
Table 5.1: Stove Dissemination in San Marcos

Program year	No. stoves installed	No. of communities
1998	142	6
1999	1,200	30
2000	2,000	53

Source: INTERVIDA

5.8 San Marcos—Guatemala's poorest department, with a general poverty rate of 86.66% and an extreme poverty rate of 61.07%—covers an area of 3,791 sq km (Figure 5.3). It has one of the highest population densities in the country (232.71 per sq km), and 85% of people live in rural areas. The department's literacy rate is 65.6%, close to the national average of 67.3%. Its economy is based on agriculture, divided into two zones: cold (north) and warm (south). This case study was conducted in the cold zone, where farmers grow corn, wheat, potato, other vegetables, and fruits.

Figure 5.3: Map of San Marcos



Municipalities

1. San Marcos
2. San Pedro Sacatepéquez
3. San Antonio Sacatepéquez
4. Comitancillo
5. San Miguel Ixtahuacán
6. Concepción Tutuapa
7. Tacaná
8. Sibinal
9. Tajumulco
10. Tejutla
11. San Rafaél Pie de la Cuesta
12. Nuevo progreso
13. El Tumbador
14. El Rodeo
15. Malacatán
16. Catarina
17. Ayutla
18. Ocós
19. San Pablo
20. El Quetzal
21. La Reforma
22. Pajapita
23. Ixchiguán
24. San José Ojetenam
25. San Cristóbal Cucho
26. Sipacapa
27. Esquipulas Palo gordo
28. Río Blanco
29. San Lorenzo

San Antonio Overview

5.9 San Antonio las Barrancas is a village located in the municipality of Sibinal, near the Mexican border (Figure 5.3). It is 4 km from the municipal seat of Sibinal and is accessible during summer months. Indigenous people comprise 57% of the population, and 43% is ladino. Older people are more likely to speak the indigenous language of Mam, while younger people speak Spanish. The literacy rate is 63%. The principal economic activity is agriculture, and major crops include potato, corn, and wheat. Residents own their land. The community's 97 households are spaced an average of 200 m apart. The community has a health center, primary school, electricity service, and three telephone lines. It has a pro-improvement committee and five other organized committees for projects in health, agroforestry, education, small-scale irrigation, and safe drinking water. In 1998, an improved-stove project installed 41 stoves.[61]

5.10 According to information compiled during Fundación Solar field visits, fuelwood is still abundant in San Antonio; however, the women interviewed perceive that the supply is declining. The main fuelwood species are alder (*Alnus acuminata*) and oak (*Quercus* sp.). Men are responsible for collecting the wood. Because of its perceived abundance, all wood is collected; thus, there is no known price. According to members of the pro-improvement committee, an agroforestry garden is currently being managed, with INTERVIDA support.

Cantel Overview

5.11 Cantel, a village in the municipality of San Pedro Sacatepéquez, is located only 2 km from the municipal seat and is accessible by road year-round. Some 85% of residents speak Spanish, and the literacy rate is 61%. Agriculture is the principal economic activity (major crops are corn and beans), and people own their land. The community has 213 houses, spaced an average of 200 m apart. The community has a health center, primary school, piped drinking water, electricity service, and stores for buying basic goods. It has a pro-improvement committee and four other organized committees, including a women's group called Nueva Esperanza (New Hope).[62] Cantel's high level of commerce makes it an interesting case for studying the marketing potential of improved stoves and metal planchas.[63]

5.12 The INTERVIDA improved-stove project, implemented in 2000, installed 50 stoves. According to INTERVIDA stove users who participated in the Fundación Solar focus group, fuelwood is scarce. Those interviewed have primarily responsibility for collecting wood. The main tree species used are alder (*Alnus acuminata*) and oak (*Quercus* sp.). Because of the scarcity, most people purchase fuelwood from vendors who transport it from the southern part of San Marcos. Users said the price is continually rising. One "tarea"[64] of wood costs Q125-150 (US$16.03-19.23). By using improved

[61] Based on data from the 1994 census and information sheets filled out by community members who participated in the Fundación Solar case study.
[62] Based on focus-group observations, Nueva Esperanza consists of a highly active, participatory group of women.
[63] Based on 1994 census data and primary data from the community information sheet of Fundación Solar.
[64] 1 tarea equals 400 pounds, according to the *Manual de Matemáticas para Uso Agrícola, Pecuario, y Forestal,* R.S. Lambous. M., Guatemala, 1996.

stoves, those interviewed said they now use only about one tarea of firewood per month, which represents an annual savings of Q1,500-1,800 (US$192.31-230.77).[65]

Project Features

5.13 According to the coordinator of the San Marcos TERRA, the project to disseminate wood-conserving stoves began in 1998 in response to demand for the stoves and studies of improved 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; in 2001, however, installations declined to only about 200. The project was carried out under the Production and Marketing component to encourage people in the communities to make a stronger commitment to the project and share a portion of the cost. Stoves often served as an incentive for people to participate in productive projects implemented under the Production and Marketing component.

5.14 The Production and Marketing component is flexible in terms of its work strategy. Its main objective is to promote economic development of the communities; to this end, the team designs work plans and strategies, which are constantly evolving through the feedback received, as this case study illustrates.

Historical Overview

5.15 According to the Production and Marketing component, the aims of disseminating wood-conserving stoves are to:

- Save firewood to benefit both the environment and family economy,
- Improve the home by reducing indoor air pollution, and
- Use and manage natural resources sustainably.

5.16 As of the end of 2000, the projects implemented in the western part of the country had installed 8,500 stoves; after that year, however, stove production at the household level declined significantly, with only 500-600 stoves installed in 2001. Concurrently, INTERVIDA's Basic Support program component implemented stoves projects for schools. One of the main lessons learned from the Production and Marketing component, was that projects for wood-conserving stoves require strong community assistance.

5.17 Currently, the stoves project focuses on a 10-year, integrated watershed management project (2001–2010). Within this watershed project, the communities carry out wood-conserving stoves projects, as well as forestry, agriculture, and integrated livestock projects. The stoves projects are implemented under the condition that each beneficiary pays for the value of the stove, Q800-1,000 (US$102.6-128.2)[66] over a one-year period; these funds serve as seed money for investment in other productive projects in the above-mentioned fields. Currently, this implementation model is being considered for approval by the INTERVIDA board of directors.

[65] The exchange rate, as of September 2002, was Q7.80 equivalent to US$1.
[66] Based on the September 2002 exchange rate of Q7.80 equivalent to US$1.

5.18 To select its staff, INTERVIDA considers such aspects as prior experience working on development projects and academic background in each area of specialization.

5.19 Performance evaluations are conducted quarterly at all levels so that the manager for each sector evaluates the performance of his or her project team. The facets evaluated are initiative, performance in their respective area, and interpersonal relationships. Employees who need strengthening in a certain area of the evaluation are sent for training either within or outside the organization. Those who receive a rating of "outstanding" are rewarded with the opportunity to pursue training in other fields through courses at the national or international level (with exchanges between the TERRAs in various countries).

Stove Model Development

5.20 According to the Production and Marketing Unit, INTERVIDA's strategy for choosing a stove model was to seek guidance from local people and institutions experienced in improved stoves; in the absence of a technical support unit, it contracted the services of a stove builder and manufacturer of reinforced metal planchas.

5.21 The model INTERVIDA adopted is based on the same concepts as the SIF model. Its base is made of adobe or cinderblocks; a firebox made from tayuyo bricks,[67] with a trapezoidal interior of diminishing size, held together with a mixture of clay, sand, and panela;[68] a reinforced metal plancha, with 3/4 x 1/8-inch steel angles; and a 4-inch diameter, zinc sheet-metal chimney, with a rain cover on top. The INTERVIDA and SIF models differ in that the INTERVIDA plancha has three cooking holes, while the SIF model has four. Other differences between the two models arise in the method of building the stoves. Initially, the INTERVIDA project used 8-mm, cast-iron planchas, and later used 5-mm, reinforced metal planchas because the cast-iron planchas were more expensive and of poorer quality. Lack of interaction between organizations implementing the stoves projects and lack of a coordination and technical assistance entity became apparent in the course of conducting the three case studies (the Tezulutlán, SIF, and INTERVIDA projects all underwent the same trial-and-error process with the metal planchas).

[67] Compressed brick without holes through the middle.
[68] Sweet juice squeezed from sugarcane.

INTERVIDA-type stove
Photo credit: INTERVIDA.

Implementation Methods

5.22 According to the Production and Marketing Unit, stove projects have come about through 1) requests from the communities to the TERRAs and 2) participatory rural assessments. Using the first method, the TERRA sends a technical expert to verify and evaluate whether it is possible and advisable to implement a project. The second method grows out of a community effort through a participatory rural assessment, which indicates that the institution has given more assistance to the community.

5.23 In developing its stove projects, INTERVIDA does not network with other projects, except to ensure that it is not working in the same community as another stove project, such as the SIF. However, it has coordinated activities with other projects, such as the Post Harvest of MAGA,[69] with which it has helped to build community organizational structures.

Dissemination Methods[70]

1998–1999

5.24 When the project started in 1998, stove-building firms were contracted to provide training and technical assistance to INTERVIDA staff, as well as to male leaders in the communities where the projects were being implemented. Two-to-four demonstration stoves were built in each community in the homes of community members chosen for their enthusiasm, cooperativeness, and leadership. Next, the leaders who received training took responsibility for building the rest of the project stoves in their communities and for transferring knowledge to women stove users. The project's technical staff provided guidance and technical assistance. During 1998, a total of 142 stoves were installed in San Marcos (including those installed in the village of San Antonio). In 1999, the project installed 1,200 stoves. According to the Production and

[69] Ministerio de Agricultura, Ganadería y Alimentación (Ministry of Agriculture, Livestock, and Nutrition).
[70] Based on information and documentation provided by the Production and Marketing Unit of INTERVIDA.

Marketing Unit, this method did not produce the expected results because of multiple problems caused by poor construction quality. It was later observed that some stoves built in San Antonio had deteriorated significantly.

2000

5.25 According to the Production and Marketing Unit, after observing the problems caused by poor construction quality, a new method was adopted in 2000 for implementing the project. That year, the project distributed 2,000 stoves in San Marcos (including those in the village of Cantel).

5.26 Organized groups, often temporary committees known as "comités pro-planchas," were formed; 98% of cases included both men and women. A stove construction firm was contracted that also made metal planchas. Trained bricklayers from the firm built the stoves in the communities. The stove base ("poyetón"), which, under the first method, had been made of adobe, was now made out of cinderblocks according to more rigorous, technical specifications under the supervision of the professional bricklayer. The goal of this method was to build better-quality stoves. The staff of INTERVIDA was responsible for making a follow-up visit after the stove was built. The process was guided by community leaders trained by the project in stove construction in order for them to help other households build their stoves.

5.27 The beneficiaries promised to clean the chimney continuously, change the chimney's cylinders when they became damaged, maintain the stove, and use it properly. They backed up their promise by signing a letter of understanding. In addition, each community promised to establish a forestry nursery, with technical assistance from the agriculture sector of INTERVIDA's Production and Marketing component.

2001–2002 (Seed Fund)

5.28 According to the coordination node for San Marcos, in 2001 the Production and Marketing component realized that it was too expensive to provide adequate supervision for such a large number of stoves, and thus decided to change the method, leaving about 5,000 households in need of a stove.

5.29 During 2001–2002, the new method was designed and was at the time of this study being considered for approval by the board. According to the Production and Marketing Unit, several communities have already been chosen for a pilot project, including one community in San Marcos, with about 20 participating families. The idea of this model is to work in the communities that are willing to buy the stoves. The project would work with organized groups, and each participant would pay about Q800 (roughly US$100) over a one-year period. To help the participants afford their stove, they would work in productive projects (livestock, agriculture, or forestry) that would allow them to increase their incomes. Money from sale of the improved stoves would serve as a seed fund that the community could reinvest in productive projects with an environmental focus. According to INTERVIDA's Production and Marketing component, the productive projects would allow community members to increase their incomes and prepare for the time when the INTERVIDA projects ended.

Other strategies

5.30 To promote stove use, INTERVIDA implemented a training project for a group of local artisans on how to make metal planchas. The one-week course was taught by a plancha manufacturing company from western Guatemala. According to the plancha maker that provided the training, this strategy did not work because of the short duration of the course and because making planchas requires special equipment that the trainees did not have.

Project Planning and Implementation

Setting goals

5.31 According to the Production and Marketing Unit, INTERVIDA projects focus on providing benefits to the families of children sponsored by the institution. Goals were set based on requests, identification of community needs, and the annual budget.

Selection of areas and communities

5.32 Project areas were selected by visiting communities in the watersheds or departments (concentrated in western Guatemala), based on their level of poverty. People's willingness to participate was a determining selection factor. INTERVIDA technicians visited the communities and conducted awareness-raising and promotional activities. Then, the communities organized themselves, made a list of those interested in participating, and made a request to the offices of INTERVIDA, after which a verification visit to the community was made.

Promotion

5.33 When INTERVIDA began working in a new area, staff of the Community Organization and Training component implemented promotion and awareness-raising activities on forest resource management (a portion of which promoted wood-conserving stoves). Currently, INTERVIDA promotes improved stoves only in communities where it plans to implement the integrated watershed management concept.

Contracts and payments

5.34 According to the Production and Marketing Unit, contracting a firm to build the stoves was done through a bidding process conducted by INTERVIDA's procurement unit. Contracts were made for a specific number of stoves, and for pre-selected people or communities. Builders had to guarantee not only the stove construction, but also its use for a six-month period.

Costs and primary materials

5.35 In 2000, each of the participants made a commitment, through a signed letter of intent, to collaborate with the project. The cost of materials and skilled labor covered by INTERVIDA and the beneficiaries was Q634 (US$81.28) (Table 5.2). Assuming an additional cost of Q50 (US$6.41) for unskilled labor, the total cost would be Q684 (US$87.69).

Table 5.2: Cost Sharing of Stove Materials and Labor

INTERVIDA	Cost (Q)	Beneficiary	Cost (Q)
Metal plancha with 3 burners	140.00	20 concrete blocks	36.00
Accessories (door for feeding firewood and smoke regulator)	26.00	150 lbs. of cement	52.50
120 tayuyo bricks	72.00	1.5 bags of river sand	22.50
Skilled labor	125.00	1 bag of powdered clay	30.00
Three 26-caliber, galvanized, sheet-metal tubes, with a cover	40.00	2 capfuls of panela	10.00
100 lbs. of cement (4,000 psi)	35.00	Unskilled labor	--
Transportation to the community	45.00		
Total (Q)	483.00		151.00
Total (US$)	61.92		19.36

Source: Intervida Production and Marketing component.

5.36 In 1998 and 1999, the project supplied only tayuyo bricks; an 8-mm, cast-iron plancha; and three 4-inch cylinders for the chimney, including a cover for the top. The stove did not have a door on the firebox.

Stove construction

5.37 In 1998 and 1999, community members built the stove base using their own means, (usually with adobe). A group of men from the community was trained by building demonstration stoves; once they learned how, they built the rest of the community stoves. The project provided technical advice. This method failed because of multiple mistakes caused by poor construction.[71] In the village of San Antonio, the Fundación Solar team found numerous problems, mainly with the firebox and stove base. The opening for feeding firewood was designed in the shape of a triangle, which limited wood insertion; in their eagerness to insert more firewood, some women broke the fireboxes.

5.38 To improve quality, bricklayers from a private firm built the stoves in 2000 with the help of each beneficiary. The firm was contracted on the basis of its reputation and experience in building stoves.

5.39 In no case were there indications of problems in supplying materials. Each family was responsible for collecting the local materials and verifying that the materials supplied to them by outside sources were free from defects. If defects were found, INTERVIDA technicians would report them to the construction firm so they could be replaced.

[71] According to INTERVIDA Production Marketing Unit.

Quality control

5.40 Control of the quality of purchased materials was handled through INTERVIDA's quality-control department. During stove construction, quality control was the shared responsibility of project technicians, who supervised the work; local people, with the help of community leaders trained in stove construction; and the construction firm, primarily responsible for the quality of construction and performance, at least for the duration of the guarantee.

Monitoring and evaluation

5.41 According to the Production and Marketing Unit, its technicians are responsible for making at least two visits to each home that has a stove. The visits were made without warning to observe the problems women users were having and to verify that the stove was made with the materials provided. During these visits, the technicians would reinforce the concepts introduced during training on the use and maintenance of the stove. In addition, when other production activities were being implemented, the community enjoyed the relatively constant presence of the institution. There is no knowledge of any ex-post evaluation of the stoves' impact on the community.

Training

5.42 According to documentation provided by the Production and Marketing Unit, in 1998 and 1999, training was given only to male community leaders; they were responsible for building the stoves and transferring their knowledge to the rest of the community. In 2000, one or two community leaders with prior construction experience were trained in stove construction; they then supervised the construction of stoves in each community household. Training in stove use and maintenance, provided by the technical staff of the INTERVIDA Production and Marketing component, was given first to the entire group of project beneficiaries and then individually, through follow-up visits to each home after installation.

Financing structure

5.43 According to management of the San Marcos TERRA (the departmental node), financing for the INTERVIDA stove project came from payments made by sponsors of the children they were helping. This budget, managed by INTERVIDA's headquarters office in Spain, was allocated to each TERRA based on the area's needs and project requests and proposals implemented. The subsidy strategy evolved over time, taking care to have beneficiaries contribute whatever they could afford. Currently, the aim is to have beneficiaries cover the entire cost of the stove, while the organization provides technical and financial assistance. After this change in method, the Production and Marketing Unit indicated that it observed an inverse relationship: the more the project requested the community's commitment or contributions, the less demand there was for the stoves. Table 5.3 shows three scenarios that evolved over time for beneficiary contributions to the project.

Table 5.3: Scenarios for Beneficiary Contributions to the INTERVIDA Wood-conserving Stoves Project, 1998–2001

1998-1999 Scenario	2000 Scenario	2001 Scenario
• Local materials • Entire construction of the stove • Transportation of materials within the community	• Local materials • Construction materials (concrete blocks and cement) • Unskilled labor • Forestry nursery project • Transportation of materials within the community	• Local materials • Q800 (US$100) over a 1-year period (seed money) • Participation in productive projects (livestock, forestry, and agroforestry)

Source: INTERVIDA Production and Marketing Unit.

5.44 In 2000, the value of unskilled labor was Q50.00 (US$6.41); thus, the user's contribution was equivalent to 29.4% of the stove's value. It is worth mentioning that some of the materials supplied by the users were not bought; rather, they were gathered or made by the users. In 1998 and 1999, the beneficiaries covered an even higher proportion of the value of the stove because, in addition to providing the same materials as in 2000, they were also responsible for the stove's entire construction.

Marketing Trials and Support Structures

5.45 INTERVIDA incorporated certain features into its operational strategy that, to an extent, transitioned the communities from a paternalistic situation to a cost-sharing arrangement between the NGO and stove users, with the goal of making the project more sustainable. The Production and Marketing component observed that the poverty in which many rural families lived was a significant obstacle to creating a commercial market for the stoves. In 2001, a group of men from the communities was trained in making planchas for the stoves. The aim was to create local capacity in stove-making, but the project was discontinued.

5.46 A survey on the availability of metal planchas found that San Marcos, which neighbors the municipal seat, had an established market with an active commercial sector. According to the survey, San Pedro had 32 hardware stores, of which 20 (about 63%) sold metal planchas. (Employees of the hardware stores said the planchas were bought from a supplier in Quetzaltenango.) In the four stores visited, the survey found that the price of reinforced metal planchas with 3-4 burners ranged from Q160 to Q175 (US$20.60-22.52). Small ones cost Q120 (US$15.44). Two of the hardware stores visited sold reinforced metal planchas for Q425 (US$54.70). Various designs and sizes were available.

User Profile

5.47 The research team gathered information in both San Antonio and Cantel to develop a profile of stove users through semi-structured interviews (Appendix D) and focus groups (Appendix G). In San Antonio, 14 out of 41 users (34%) were interviewed; while, in Cantel, 18 out of 50 (36%) were interviewed. In addition, two focus groups

were held—one in each community—with 6 participants in San Antonio[72] and 8 in Cantel. In San Antonio, about 58% of the population is indigenous (of the Mam ethnic group); however, most residents speak Spanish, with the exception of some elderly people. In Cantel, 87% of the population is ladino and 13% is Mam, although Spanish is the language commonly spoken.

Socioeconomic Profile

5.48 In San Antonio, 43% of those interviewed were male (men usually took the lead in answering survey questions, although women were also present). In Cantel, all of the stoves users interviewed were women. The average household size of those interviewed was 10 in San Antonio and 6 in Cantel. The main economic activity was agriculture. In both communities, the most common illnesses were respiratory, followed by gastrointestinal disease. The stoves contributed to a certain extent in improving community members' health by eliminating indoor smoke and thus maintaining a cleaner kitchen (Table 5.4).

Table 5.4: General Socioeconomic Data, San Antonio and Cantel

		Gender			Main illnesses		Economic activities	
Community	No. inter-viewed	M	F	No. persons per household	Respir-atory	Gastro-intestinal	Agri-culture	Business/ services
San Antonio	14	6	8	10.07	13	11	14	0
Cantel	18	0	18	6.11	12	10	15	3

Literacy

5.49 National census data from 1994 indicated a literacy rate of 63% in San Antonio and 61% in Cantel. The percentage difference is insufficient for comparing the communities in terms of conditions for project success.

Ownership of land and durable goods

5.50 In both communities, all of those interviewed owned their land (which in no case exceeded 7,000 sq m); however, no relationship could be drawn between land ownership and acceptance of the stoves. In terms of durable goods, 78% of the families interviewed in San had a radio and 35.7% had a television. Despite Cantel's accessibility and proximity to a municipal seat with an active business sector, only 39% of those interviewed had radios and televisions. In both San Antonio and Cantel, nearly 100% of those interviewed said they purchased durable goods with cash. This reflects the purchasing power of a portion of the population, as well as their being unaccustomed to buying on credit. These factors should be taken into account when designing projects that include cost sharing by the users and in fostering a commercial stoves market (Table 5.5).

[72] Not all of the women invited came because of an unexpected medical visit by the INTERVIDA Basic Support component.

Table 5.5: Ownership of Land and Durable Goods, San Antonio and Cantel

Community	No. interviewed	Land ownership		Durable goods owned				
		Yes	No	Bicycle	Motorcycle	Radio	Television	Other
San Antonio	14	14	0	1	0	11	5	0
Cantel	18	18	0	0	0	7	7	0

Housing types

5.51 In both San Antonio and Cantel, most houses had adobe walls and sheet-metal roofs. Houses with cinderblock walls were more common in Cantel, and kitchens in San Antonio still had thatched roofs (see Tables 5.6 and 5.7). With a thatched or straw roof, the top of the chimney had to be at least .5 m higher than the surface of the roof (according to SIF stove specifications) because, according to an INTERVIDA focus group held in San Antonio, fires broke out in several cases due to overheated chimneys and sparks flying out of the chimney. The women interviewed said that most community members had converted their thatched roofs into sheet-metal ones; however, this change negatively affected the families in other ways. For example, women field technicians indicated that community members were accustomed to hanging food from the rafters for storage. With a thatched roof, the food maintained its freshness; however, with a sheet-metal roof, which absorbs more heat, the food spoiled more easily.

Table 5.6: Housing Materials, San Antonio

Area	Walls				Roof			
	Wood	Block or brick	Adobe	Cane	Sheet metal	Tile	Thatch	Other
House	0	2	12	0	13	0		1
Kitchen	0	0	14	0	9	0	6	0

Table 5.7: Housing Materials, Cantel

Area	Walls				Roof			
	Wood	Block or brick	Adobe	Cane	Sheet metal	Tile	Thatch	Other
House	2	3	12	0	15	2	0	0
Kitchen	5	2	6	3	14	2	0	0

Stove Performance, Modification, and Maintenance

5.52 In both communities, all of those interviewed said their stoves still worked. However, some women in the San Antonio focus group said their stoves were in poor condition; they requested that the project either repair or replace them.

5.53 The INTERVIDA stove project was implemented in San Antonio in 1998 and in Cantel in 2000, using different methods.[73] In San Antonio, the survey sample showed that 36% of stoves had failures in the base, firebox, and chimney. Problems with the stove base and firebox indicated poor construction quality on the part of the local builder. Flaws in the chimney were probably caused by the chimneys having exceeded their useful life expectancy. About 30% of those interviewed said they had problems with the metal plancha, although it was difficult to tell whether this was due to poor quality or misuse. The plaster of the bases had deteriorated, which did not directly affect stove performance. The front of the fireboxes had loose or broken bricks, likely indicating that the bonding mixture was inadequate. During a field visit to San Antonio, it was discovered that some women users had broken the bricks in the front of the firebox by attempting to insert more firewood than the opening would allow. Women who participated in the focus group said that burner supports often became detached, apparently because of inadequate soldering, indicating poorly-manufactured solder beads. In Cantel, common problems were cracked fireboxes, stove bases, and planchas (Table 5.8).

Table 5.8: Failure of Stove Components Reported in San Antonio and Cantel

Community	No. interviewed	Base	Firebox	Plancha	Burner	Chimney	Accessories
San Antonio	14	5	5	4	1	5	1
Cantel	18	4	9	2	0	1	0
Total	32	9	14	6	1	6	1

5.54 In both communities, users modified components of the improved stoves (Table 5.9). In San Antonio, the main change was replacing the original chimney with a larger-diameter one. They also modified the exterior plaster. In addition, they made other stove-related changes. For example, they eliminated a fire hazard by converting the thatched roof to sheet metal and increased cooking efficiency by switching from clay pots to aluminum ones. Neither change received project assistance. In Cantel, women who participated in the focus group said the stoves worked well, despite data on stove problems collected from the information sheets. These women users said that they had made no changes to the stoves, except to improve their appearance.

Table 5.9: Modifications to Stove Components Reported by Users

Community	No. interviewed	Base	Firebox	Plancha	Burner	Chimney	Accessories
San Antonio	14	6	0	0	0	7	0
Cantel	18	0	0	0	0	0	0
Total	32	6	0	0	0	7	0

[73] When comparing the physical condition of the stoves in the two communities, one should recall that those installed in Cantel are older than those in San Antonio.

5.55 Initially, women in both communities experience difficulty getting used to the stoves. They were required to wait 30-40 days before they could use them for the first time; some did not wait, which damaged the stoves. Others had trouble giving up the habit of inserting as much fuelwood as they could into the firebox. More recently, the women said that they had become accustomed to the stoves, that they were easy to use, and that it would be difficult not having them.

5.56 Most women use their stoves at specific times of day (two hours at each of three mealtimes). Usually, they only cook on the stovetop; however, in Cantel, one woman used it for baking, and three women used it to heat water for bathing (this is understandable, given the area's cold climate; moreover, during the colder months, the family gathers around the stove for warmth).

5.57 The main foods cooked using the improved stoves were corn, beans, tortillas, and coffee. Some women also prepared tamales, atol, and bread, as well as other vegetables and meat.

5.58 In San Antonio, some 60 of those interviewed said they cleaned their chimneys every week or two, while the rest said they cleaned theirs every one or two months. In Cantel, 72% of those interviewed said they cleaned their chimneys every week or two, and the rest did so once a month. The field team estimated that 30% of those interviewed should clean their chimneys more often. Some women in the San Antonio focus group said they replaced their 4-inch diameter chimneys with a 5-inch one because the smaller one required cleaning too often.

Fuel Consumption and Savings

5.59 In San Antonio, wood is the principal cooking fuel; however, in Cantel, where there is a fuelwood scarcity, supplemental fuels are also used; in order of importance, they are: cornstalks, corncobs, and cardboard. Some women in San Antonio said they still use open fires when they need to cook large quantities of food. None of the women used propane. In Cantel, some of those interviewed used open fires for heating the home and a few used gas. However, most used wood for cooking.

5.60 In San Antonio, 79% of those interviewed said they used short, thin pieces of firewood, even though they said it took longer to split the wood. The rest used thick ones (they perceived that thicker pieces made the fire last longer). In Cantel, only 28% said they used short, thin pieces, while the rest used firewood of all sizes (Table 5.10).

Table 5.10: Cooking Fuels in San Antonio and Cantel

Community	No. interviewed	Fuel used				
		Wood	Corncob	Cornstalk	Root	Cardboard
San Antonio	14	14	0	0	1	0
Cantel	18	18	10	12	0	4

5.61 In San Antonio, the information sheets indicate that one group reduced fuelwood consumption by about 27%, while the other group reduced it by about 59%. The reasons involve such variables as the physical condition of the stove, the way it is used, the type of firewood used, and use of alternative fuels. In Cantel, the data sheets indicated that most people who could quantify their firewood consumption before and after obtaining the stoves (about 57% of the sample) reported savings of up to 50%. However, some families reported saving up to 67%. For a family that previously bought 24 tareas per year (at an average cost of Q137.50 per tarea) and now buys only 12, the annual savings is about Q1,650 (US$211.54).

5.62 In both communities, the women did not know how many pieces of firewood they used for cooking. The person who gathers the firewood is usually more aware of the amount used because of the labor that is saved by using less. In San Antonio, most families gather their own firewood because it is still abundant. By contrast, in Cantel, where firewood is scarce, most people purchase it. This means that the men in San Antonio perceive a benefit in terms of labor saved, while, in Cantel, the family benefits by saving money.

Training and Follow-up Visits

5.63 Interviews showed that more than 70% of stove owners in San Antonio received training in stove use and maintenance (Table 5.11). However, the women in the focus group said they were not included in the training; only one group of men was trained in stove construction, use, and maintenance, and they then transferred that knowledge to the rest of the community. In Cantel, 89% of the women interviewed said they had received training as a group and that they had to sign a document confirming their participation. In both communities, only the community leaders were given pamphlets to reinforce their training.

Table 5.11: Training in Stove Use and Maintenance in San Antonio and Cantel

Community	No. interviewed	Received training in use and maintenance	
		Yes	No
San Antonio	14	10	4
Cantel	18	16	2

5.64 In San Antonio about 96% of those interviewed were visited subsequent to stove construction. In most cases, they were visited once or twice (Table 5.12).

Table 5.12: Follow-up Visits in San Antonio and Cantel

Community	No. interviewed	No. of follow-up visits by institution				
		1	2	3	None	Unsure
San Antonio	14	3	9	0	2	0
Cantel	18	6	2	3	5	2

Perceived Benefits, Suggested Design Changes, and Marketing

5.65 Women in both communities were generally satisfied with the improved stoves. They perceived the main benefits as fuelwood conservation, improved health, increased safety, and savings in time. In addition, they said they did not have to buy clay comals since they could cook tortillas on the plancha. Moreover, they said their kitchens were cleaner. In terms of perceived disadvantages, about 60% of those interviewed in San Antonio complained that the stove did not heat the house. In Cantel, only one person cited a disadvantage—that the stove was placed too low.

5.66 Women in San Antonio suggested design changes, while those in Cantel liked the stove as it was. The main suggestions were to enlarge the chimney and add space for storing firewood. Some suggested constructing the chimney out of cement or bricks instead of sheet metal, adding an oven and a water heater, and building the platform out of cinderblock or brick instead of adobe. Still others suggested placing the stove lower and enlarging the opening for feeding firewood.

5.67 The commercially marketed part of the stove is the metal plancha since other stove parts can be bought separately and made from common construction or local materials. When asked if they knew of anyone who sold entire stoves, the women said they did not. However, when asked if they knew where to buy metal planchas for stoves, about 70% of those interviewed in both communities said they could be found in hardware or appliance stores in the municipal seat or in San Pedro Sacatepéquez. In general, the women perceived that the metal planchas were more expensive than they were (based on a survey conducted on availability of planchas in San Pedro Sacatepéquez).

Non-user Profile

5.68 In San Antonio, five people were interviewed who did not participate in the project; they did not own their homes when the project was implemented (one requirement for making a stove was that it be built inside a home). However, these people were interested in owning a stove. Another woman did not obtain a stove because her husband was not in the village when the project was implemented, which illustrates some women's dependence on their spouses. Non-users perceived the main advantages of the stoves as conserving fuelwood, health benefits, saving cooking time, and cleanliness. Because of the poor structure of the commercial market for stoves and planchas, non-users were unsure about how they could obtain a stove and were waiting for a development program.

5.69 In Cantel, eight non-users were interviewed; the main reason they gave for not obtaining a stove was lack of money. Another reason could have been religious in nature since most stove owners belonged to a different religious group. Non-users still used open fires, and all were interested in obtaining a stove after having witnessed its advantages. All of the women interviewed bought their firewood. Thus, it would have been advantageous for them to invest in a stove since the savings from consuming less firewood would soon have offset its cost.

Lessons Learned

Institutional Strengths

5.70 Every departmental unit of INTERVIDA hires people from the project area, which allows the team to better understand those they serve—their needs, culture, and language—as well as their area's accessibility, geographic features, and climate.

5.71 INTERVIDA's Production and Marketing Unit is responsible for project implementation and outcomes, while operational units for Production and Marketing in each of the TERRAs (departmental nodes) implement the project in their respective areas. Such decentralization facilitates direct communication and grassroots feedback, making it easier for those responsible to introduce new work strategies.

5.72 The INTERVIDA stove project has integrated its efforts with those of the community. For example, in 1998 and 1999, local artisans were trained in building improved stoves. In 2000, local leaders were trained to assist the community by supervising stove construction undertaken by a private firm. In addition, stove projects have been integrated with productive projects, such as forestry nursery projects, that the community has committed to participating in, with the help of the Production and Marketing Unit.

Institutional Challenges

5.73 Because the INTERVIDA stove project does not conduct research or technology development, the organization lacks a complete understanding of the technological and related factors that could improve quality, technical assistance to the communities, stove design (efficiency, materials, and cost), and integration of stove users' opinions.

5.74 The metal-plancha stove design was created by technical designers, external to the project, who did not consider women's opinions during its development, even though women were the primary users. INTERVIDA made no effort to understand women's needs and preferences before introducing the technology to the community. Subsequently, women in the San Antonio focus group stated that the stoves were built too high. The project made no effort to promote women's participation in community decision-making or to give them greater access to resources.

5.75 Although the project included monitoring activities during and after construction (two post-construction visits) that allowed for feedback, no systematic evaluation on project impact or ex-post evaluations were conducted.

Technical Problems

5.76 During follow-up visits to the communities, the stoves were found to have flaws, which brings into question the quality of construction and the materials used. In San Antonio, where local people built their own stoves, components critical to the functioning of the stove—the firebox and metal plancha—suffered cracks (in about 36% of stoves). In Cantel, where a private firm constructed the stoves, 28% had problems with cracked fireboxes.

Financing Issues

5.77 International donors have supported the project. The dependence solely on international donor funds does not guarantee the sustainability of the work. A portion of the subsidy that INTERVIDA has provided still focuses on the cost of stove components and materials. Excluding training, assistance, and community visits by INTERVIDA, the project subsidizes about 70% of the stove's costs (selected materials, construction, and transportation). This shows that project participants still depend heavily on the project for acquiring the technology. At the time of this study, a method was in the process of being approved, whereby users would cover the total cost of the stove, using project-financing services. This money would become a seed fund that participants could use to invest in productive projects.

Commercialization Gap

5.78 Although INTERVIDA has helped stove users to assume greater responsibility—they covered about 30% of stove costs in 2000—no marketing activities have been undertaken directly. The Production and Marketing component of INTERVIDA believes it will be difficult to create a commercial stoves market because of the region's 86.66% poverty rate.

6

Key Findings

Lessons Learned

6.1 All three projects implemented practices that can be considered successful and also faced significant challenges. Best practices, summarized in Table 6.1, and project weaknesses, summarized in Table 6.2, are discussed below.

Institutional

6.2 ***Community participation*:** It is important that interest in having an improved, wood-saving stove come from the family users, especially in projects that donate the stoves. In this respect, use of such tools as participatory analysis facilitated the projects' understanding of the communities and their needs.

6.3 Knowing the opinions and perspectives of potential users helped the technical teams incorporate new stove design features. In some cases, observations about convenience and safety were considered, which made it easier for users to accept the stoves. Users suggested making chimneys out of materials that do not conduct heat so they would be less dangerous for the cooks and their children; they also suggested building shelves to keep firewood from falling on the ground. Moreover, community participation often translated into shared responsibility in project implementation.

6.4 ***Creation of local capacity***: Participation in building the stove as a way of creating local capacity was also a positive factor in promoting adoption of the technology. Knowing how the stove was built improves, but does not guarantee, users' ability to construct a new stove when necessary. However, having the users help build the stoves requires more monitoring to ensure product quality, and limits the commercial potential for selling complete stoves. However, it can still be considered a possibility for the poorest families. Building stove-owner capacity to use and maintain their stoves properly was important to all three projects.

6.5 ***Gender focus***: Women's participation in decision-making about the inclusion of certain stove components and construction—especially considering how important a tool the stove is in fulfilling their reproductive role—to some extent strengthened and improved women's social position in the community. In interviews with women users and their spouses (whose work was also lightened by the improved

stoves), the field teams observed the extent to which women felt connected with their stoves, their benefits, and the building process in their homes.

6.6 ***Geographic focus***: Two of the three projects studied had specifically defined geographic areas so that they could work more intensively with groups that had similar ethnic and cultural characteristics. This is important in a country like Guatemala, with its great diversity of customs and traditions, languages, and worldviews. Moreover, it permits optimal use of the implementing agency's resources, as well as allowing better and more efficient monitoring and feedback.

6.7 ***Participation of local staff*:** All three projects included people from the implementation area on their project teams. Facilitators, field technicians, trainers, and administrative personnel knew the project setting—that is, the language (in the case of Mayan ethnic people), local geography, customs and traditions, means of access, and availability of firewood in the communities. This familiarity greatly benefited the process of implementation, conveying the appropriate messages, training, and gaining of local trust by the implementing organization.

6.8 ***Ineffective monitoring and evaluation***: Although all three projects had M&E systems, they were not effective enough to ensure that all the stoves were well made and that all users were trained in proper use and maintenance. None of the three projects systematically compiled information to confirm or support the impact of the intervention. As a result, it is difficult to analyze the beneficiaries and products of this type of project, and the feedback process is limited.

6.9 ***Scarce research and technology development***: No entity in Guatemala conducts research and technology development related to improved stoves. None of the three projects studied has a unit or department created for that purpose, which means the interventions are limited to replicating existing stove models. It is virtually impossible for the projects to make substantial technical innovations.

Technical

6.10 ***Wood-saving designs***: Users' main perception regarding the utility of the improved stove, independent of its availability and cost, was that it reduced fuelwood consumption; data provided by the users reflects a 50-67% reduction. At the same time, the wood-conserving stove saved time and effort in cooking and money for households that must purchase firewood. In addition, the families saved by not having to buy clay comals because they could now cook tortillas on the metal plancha.

6.11 ***Use of locally available materials***: Taking advantage of local resources reduced the cost of the improved stove and increased user participation in cost sharing. Local access to materials reduced transport costs and gave more responsibility to users by making them active participants in the stove-building process. The models studied allowed for use of local resources (clay, sand, panela, and even cow dung), which are readily available in most Guatemalan communities.

6.12 ***Application of ergonomic and safety criteria*:** Application of ergonomic and safety criteria in stove design allowed users to embrace the technology more easily. It was important for both technicians and stove users to decide on those criteria.

6.13 ***Model replicability***: Metal-plancha stoves have demonstrated their replicability, having served as the foundation of the three projects studied and having been disseminated throughout the country since 1996. They continue to gain an ever-greater presence in Guatemalan homes.

6.14 ***Poor construction quality***: Although most of the stoves are still working, the components that affect the stoves' efficiency, such as the firebox or regulator to control the airflow, are sometimes not standardized. In most cases, quality control is limited to stove users' observations or complaints once the stove is functioning.

6.15 ***Difficulty replacing parts***. Although stoves with metal planchas are the most widely used type of stove in Guatemala, certain components are sometimes hard to replace because the marketing structure to supply them is inadequate.

Financing

6.16 ***User contribution to stove cost***: The three projects studied provided a high level of subsidy for the stoves (55-90% of total cost). This does not support project sustainability and continues the users' dependence on the implementing agencies. However, considering the social and economic situation of the beneficiaries (a 71-86% poverty rate in the regions studied), it is considered sound practice for the users to pay at least part of the stove's cost. The research team considered cost sharing by the community a step toward consolidating a commercial market and reducing the community's dependence on aid organizations..

6.17 ***Financing is not self-sustaining***: None of the projects studied is financially self-sustaining. The high subsidy of the direct cost of the stoves (55-90%) fosters dependence on donations, making it difficult to achieve sustainability over time.

6.18 ***Subsidies focused on stove cost***: Because the subsidies are focused directly on the cost of stoves, little effort has been made to explore the potential for marketing of components or technical assistance to manufacturers. While this level of subsidy helped install stoves in many homes, it does not ensure sustainability. The findings of a detailed study of the cost structure of improved stoves promoted by different programs in Guatemala are presented in Appendix M.

Commercialization

6.19 ***The only commercial relationship is between the project and builders***: The projects buy the stoves from private firms, which compete against each other for work already planned by the projects. In short, the implementing organizations, not the users, establish the market position of the product. Generally, the user does not create direct demand for the stove, but is merely an "interested party" in its acquisition.

6.20 ***Lack of marketing structures***: Little effort has been made to create market structures for commercializing improved stoves. The high subsidy provided by the implementing organizations creates market distortions. Dependence of stove-building firms and parts manufacturers on the projects makes them less interested in marketing their products and services since they know in advance that they cannot compete freely in the marketplace.

Table 6.1: Summary of Best Practices, by Project

ASPECT	PROJECT		
	TEZULUTLÁN	SIF	INTERVIDA
INSTITUTIONAL	• Family focus • Participation of women and the family in stove design and construction • Collective responsibility for the stove • Gender focus • Reduced dependence on the NGO (45% contribution toward cost of stove) • Local capacity to support project sustainability • Basic research • Participation of local population	• Implementation capacity • Job creation (private Guatemalan firms) • National scope (Departmental Offices) • Participation of local population • Identifying community priorities through participatory practices • Evolution toward greater community participation	• Participation of local population • Decentralized implementation units • Joint NGO-community effort (contributing 30% of the stove's value)
TECHNICAL	• Use of locally available materials • Ergonomic design criteria • Safety criteria used in design • Wood-saving design	• Wood-saving design • Durable materials • Replicability	• Wood-saving design • Durable materials
FINANCING	• Users' contribution (45%) toward the cost of stove	• Users' contribution (10%) toward the cost of stove	• Users' contribution (30%) toward the cost of stove
COMMERCIALIZATION	• Marketing of the stove in local hardware stores • Support to local artisans		

Table 6.2: Summary of Weaknesses, by Project

ASPECT	PROJECT		
	TEZULUTLÁN	SIF	INTERVIDA
INSTITUTIONAL	• Lack of monitoring during construction • Lack of project evaluation • Lack of project self-sustainability	• Lack of integration of project team • Centralized decision-making • Lack of feedback • No research on technological development • No participation by users in stove design • No gender focus • Lack of project self-sustainability	• No research on technological development • No participation by users in stove design • No gender focus • Lack of project evaluation • Lack of project self-sustainability
TECHNICAL	• Users' lack of access to certain stove components • Difficulty in transporting fragile components (e.g., clay chimneys) • Lack of standardization of components, which affects efficiency	• Poor construction quality	• Poor construction quality
FINANCING	• Dependence on international donations • Subsidization of certain components (plancha, chimney, bricks) and transport (55%)	• Dependence on international aid • Complete subsidization, except for local materials and unskilled labor (90%)	• Dependence on international aid from sponsors • Subsidization of materials (bricks), components (plancha and chimney), and transport (70%)
COMMERCIALIZATION	• No marketing structures (currently, only certain stove parts are sold in municipal seats)	• Program dependence (commercialization limited to project builder level) • No marketing structures (currently, only certain stove parts are sold in municipal seats)	• Program dependence (commercialization limited to project builder • No marketing structures (currently, only certain stove parts are sold in municipal seats)

Firewood Availability and Complementary Fuels

Availability of Firewood

6.21 In the communities studied, a correlation was found between degree of urbanization and the purchase of firewood; that is, the closer a community is to an urban center (in this case, the municipal seat), the more likely its members will have to purchase firewood because of the resource's scarcity (Table 6.3).

Table 6.3: Relationship between Urbanization and Purchase of Firewood

Community	Municipality	Department	Distance to Departmental Seat (km)	How wood is obtained
Cantel	San Pedro Sac.	San Marcos	3	Buy
Los Achiotes	Jalapa	Jalapa	7	Buy
Los González	Jalapa	Jalapa	14	Buy and gather
Quiaté	San Miguel Chicaj	Baja Verapaz	21	Gather
Pahoj	Rabinal	Baja Verapaz	42	Gather
San Antonio	Sibinal	San Marcos	74	Gather

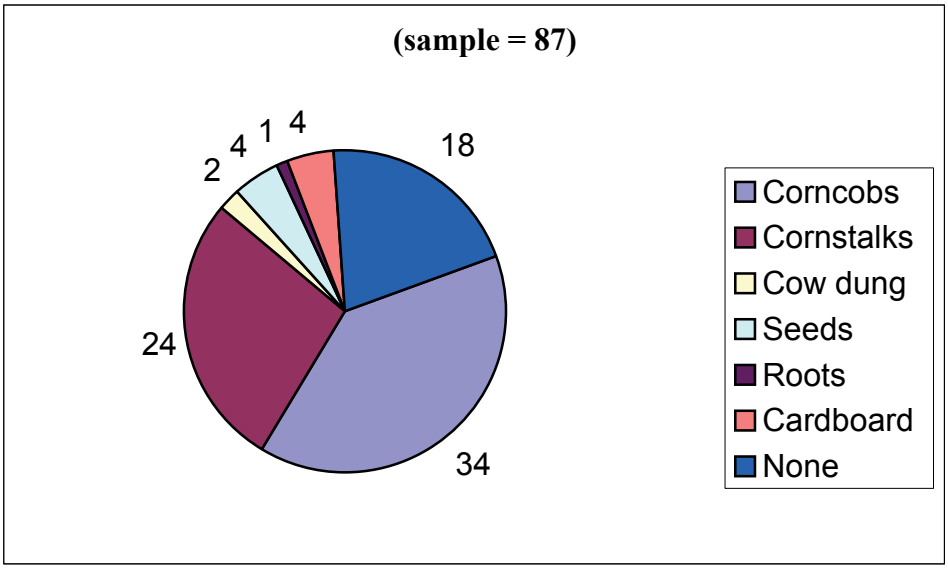
Source: Evaluation of Improved Stove Programs in Guatemala, Fundación Solar, 2002

6.22 The communities are grouped into three categories, based on their distance from the departmental seat: 0-10 km, 11-20 km, and 21 km or more. In the 0-10 km range, community members must buy their firewood. In the 11-20 km range, some can gather firewood themselves while others must buy it. Finally, in the range of 21 km or more, rural people can gather enough firewood to meet their needs (Table 6.3).

Use of Complementary Fuels

6.23 In the communities studied, wood is the main household cooking fuel. The two main fuels used to supplement firewood are derived from corn: corncobs and cornstalks. The next most common, supplementary fuels are various forms of biomass—cow dung, seeds, roots, and cardboard—whose use depends on the particular community (Figure 6.1). The studies show that communities with less opportunity to gather their own firewood (Cantel, Los Achiotes, and Los Gonzáles) use greater amounts of complementary fuels. Stated differently, families that must purchase their firewood are also more likely to use other types of fuel (Tables 6.4 and 6.5).

Figure 6.1: Fuels Used To Supplement Firewood in Improved Stoves



Source: Evaluation of Improved-Stove Programs in Guatemala, Fundación Solar, 2002.

Table 6.4: Firewood Availability and Cost in the Communities Studied

Community	Municipality	Department	Distance from municipal to departmental seat (km)	Distance from community to municipal seat (km)	Type of firewood[1]	Method of obtaining wood, and price Exchange rate: US$1.00 = Q7.80 (September 2002)	Approximate annual expenditure on firewood when using a wood-saving stove[2]
Cantel	San Pedro Sacatepéquez	San Marcos	1	2	oak, alder	buy at Q125-150 ($US16.03-19.23) per tarea	Most people spend Q1,500-1,800 (US$192.31-230.77)
Los Achiotes	Jalapa	Jalapa	0	7	oak, pine, alder	buy at Q25 (US$3.21) per carga (oak); buy at Q20 (US$2.56) per carga (pine); not available (alder)	Expenditure not determined (oak); labor (pine)
Los González	Jalapa	Jalapa	0	14	oak, pine	gather and buy at Q25.00 ($3.21) per carga (oak); Q15.00 ($1.92) per carga (pine)	Expenditure not determined (oak); labor (pine)
Quiaté	San Miguel Chicaj	Baja Verapaz	10	11	oak, flor amarilla	gather	labor
Pahoj	Rabinal	Baja Verapaz	34	8	oak, pine	gather	labor
San Antonio	Sibinal	San Marcos	approx. 70	4	oak, alder	gather	labor

[1] Scientific names for fuelwood tree species are: *Quercus* sp. (oak), *Pinus* sp. (pine), *Alnus acuminata* (alder), and *Tecoma* sp. (Flor amarilla).
[2] Data on annual expenditure for firewood as reported by users of wood-saving stoves, based on the price of a tarea or carga of firewood and their annual wood consumption. Cantel was the only community where annual expenditures could be calculated because information was provided in tareas for both consumption and price; in the other communities, the annual cost could not be determined because consumption was given in pieces of wood and price was given per carga.
Source: Assessment Study of Improved Stove Programs in Guatemala, September 2002.

Table 6.5: Fuels for Wood-burning Stoves and Additional Use of Open Fires and Gas Stoves

						Fuels used in wood-burning stove							Additional use of open fire and gas stove	
Community	Municipality	Department	Project	Total no. of stoves	Sample size	Wood	Corncobs	Cornstalks	Cow dung	Seeds	Roots	Other	Use open fire (29% of the sample)	Use gas stove (10% of the sample)
Quiaté	Sn. Miguel Chicaj	Baja Verapaz	Tezulutlán	74	17	17	6			4			2	2
Pahoj	Rabinal	Baja Verapaz	Tezulutlán	28	7	7			2					
Los Achiotes	Jalapa	Jalapa	SIF	28	10	10	9						4	2
Los González	Jalapa	Jalapa	SIF	65	21	21	9	12					8	2
San Antonio	Sibinal	San Marcos	INTERVIDA	41	14	14					1		6	
Cantel	Sn. Pedro Sac.	San Marcos	INTERVIDA	50	18	18	10	12				4	5	3
TOTAL				**286**	**87**	**87**	**34**	**24**	**2**	**4**	**1**	**4**	**25**	**9**

Source: Assessment Study of Improved Stove Programs in Guatemala, September 2002.

Use of open fire

6.24 For the participant families, use of improved stoves did not necessarily replace completely the use of an open fire. As Table 6.6 shows, about 29% of the families interviewed said they still used open fires, but mainly for cooking large quantities of food on special occasions and for heating homes. The lowest open-fire user rates in the communities studied were Quiaté (12%) and Pahoj (0%), both of the Tezulutlán Project, which focused strongly on user participation in the design and construction process. By contrast, the open-fire user rate for both the SIF and INTERVIDA project communities was about 40%.

Table 6.6: Open-fire User Rates (%) in the Communities Studied

Community	Municipality	Department	Project	Sample size	No. that used open fire	% that used open fire
Quiaté	San Miguel C.	Baja V.	Tezulutlán	17	2	12
Pahoj	Rabinal	Baja V.	Tezulutlán	7	0	0
Los Achiotes	Jalapa	Jalapa	SIF	10	4	40
Los González	Jalapa	Jalapa	SIF	21	8	38
San Antonio	Sibinal	San Marcos	INTERVIDA	14	6	43
Cantel	San Pedro Sac.	San Marcos	INTERVIDA	18	5	28
Total				**87**	**25**	**29**

Source: Evaluation of Improved Stove Programs in Guatemala, Fundación Solar, 2002

6.25 Although this study could not determine conclusively whether a causal relationship exists between participation in the stove design process and abandoning cooking over an open fire, it is an interesting correlation to consider for later analysis.

Use of liquefied petroleum gas[74]

6.26 Of the more than 250,000 gallons of LPG sold in Guatemala each day, 72% is sold in cylinders for residential use. Less than 1% is used in cars as a gasoline additive. The remainder is used by glass, flooring, and tile industries; and service industries, including restaurants and laundries.

6.27 Seven firms import LPG and one company produces it (refines imported crude oil into derivative products). Fifteen companies are involved in LPG marketing (storage, bottling, and distribution). Forty storage and filling plants are distributed strategically around Guatemala. More than 4,000 retailers sell LPG in cylinders and use services to transport the cylinders; 96% of all LPG used in Guatemala is imported by sea and land, and only 4% is produced domestically.

6.28 LPG consumption varies considerably by region. Guatemala's central region accounts for 71% of the country's LPG consumption, followed by the western

[74] Data obtained from: L. Ayala, *El Mercado del Gas Licuado del Petróleo en Guatemala*. Ministry of Energy and Mines, General Administration of Hydrocarbons, Department of Transformation and Distribution, Guatemala, 2001.

(15%), south (7%), north (4%), and east (3%). The retail price of LPG is Q10.76 (US$1.38)[75] per gallon bottled in cylinders and Q11.38 (US$1.46) per gallon for industrial and auto use.

6.29 LPG for residential use is sold in cylinders of varying capacities. The most common sizes are 25 pounds (77% of residential sales), 35 pounds (17%), and 100 pounds (2.5%), with cylinders of 10, 20, 40 and 60 pounds accounting for the remaining 3.5% of the residential market.

6.30 About 10% of the 87 households in the sample group used gas stoves (Table 6.7). For these families, the gas stove did not replace the wood-burning stove; rather, it was used for foods that could be cooked quickly (such as eggs, coffee, vegetables) or for reheating previously prepared food. Wood-burning stoves were used to prepare slow-cooking foods, such as corn and beans, because the families said it was too expensive to cook them with gas stoves.

6.31 There was a correlation between communities' proximity to urban centers and their use of gas stoves. As Table 6.7 shows, the percentage of households that used gas stoves was 15-20% in communities located 0-10 km from the departmental capital and about 10% in communities 11-21 km away; in communities located more than 40 km away, no households used gas stoves.

Table 6.7: Percentage of Households with Gas Stoves, by Distance from Departmental Seat

Community	Distance to departmental seat (km)	Sample size	No. with gas stoves	% with gas stoves
Cantel	3	18	3	17
Los Achiotes	7	10	2	20
Los González	14	21	2	9
Quiaté	21	17	2	12
Pahoj	42	7	0	0
San Antonio	74	14	0	0
Total		**87**	**9**	**10**

Source: *Evaluación de Programas de Estufas Mejoradas en Guatemala*, Fundación Solar, 2002.

[75] Based on the September 2002 exchange rate of Q7.80 equivalent to US$1.

Technical and Design Aspects

6.32 When mass production of metal-plancha stoves began, most improved-stove projects relied solely on technical experts for design, without seeking users' input. This made users' adoption of the technology more difficult and prevented feedback and design improvements based on user participation. The SIF and INTERVIDA case studies confirmed this weakness (in the Tezulutlán Project, users participated to an extent in designing the stoves).

Problems and Modifications

6.33 The chimney, plancha, and firebox are the most critical components for making the improved stoves function properly. The number of stoves with problems (by component) expressed as a percentage of the sample size of 87 improved stoves was chimney (18%), firebox (18%), plancha (17%), and accessories (16%).

6.34 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 (Tables 6.8 and 6.9), mainly in the chimneys and bases (18% of the stoves sampled in the three projects had some type of problem with the chimney). Regarding the planchas, fireboxes, and accessories, it is likely that the problems reported were caused by the poor quality of the materials used or deficiencies in their construction.

6.35 The communities studied in the SIF and INTERVIDA projects received no project assistance in modifying the stoves or replacing parts. Tezulutlán Project communities received more support from technical staff and extension workers during the execution and monitoring phase during the first year of stove use.

Table 6.8: Chimney Problems in the Communities Studied

Community	Project	Chimney construction	Year chimney built	Total no. of stoves	Sample size	No. of chimneys with problems	Chimneys with problems (%)
Pahoj	Tezulutlán	Clay	2001	28	7	-	0
Los González	SIF	Zinc sheet metal	2001	65	21	1	5
Cantel	INTERVIDA	Zinc sheet metal	2000	50	18	1	6
Quiaté	Tezulutlán	Clay	2000	74	17	4	24
Los Achiotes	SIF	Zinc sheet metal	1999	28	10	5	50
San Antonio	INTERVIDA	Zinc sheet metal	1998	41	14	5	36
Total				**286**	**87**	**16**	

Source: *Evaluación de Programas de Estufas Mejoradas en Guatemala*, Fundación Solar, 2002.

Table 6.9: Design and Technical Aspects of the Stoves*

					Problems					Replacements or modifications[2]					Changes suggested by users				
Community	Project	Year stove was built	Total no. of stoves	Sample size[1]	Chimney	Plancha	Firebox	Accessories	Base (poyetón	Chimney	Plancha	Firebox	Accessories	Base (poyetón)	Change chimney	Size or height	Appearance	Added features[3]	Change base (poyetón)
San Antonio	INTERVIDA	1998	41	14	5	4	5	1	5	7				6	•	•		•	•
Los Achiotes	SIF	1999	28	10	5	1	1		4	1	1	1			•				
Quiaté	Tezulutlán	2000	74	17	4	7				4		1		1			•		
Cantel	INTERVIDA	2000	50	18	1	2	9		4										
Pahoj	Tezulutlán	2001	28	7					1	1	1	1		1			•		
Los González	SIF	2001	65	21	1	1	1	7	2		1	6		1		•	•	•	
	TOTAL		**286**	**87**	**16**	**15**	**16**	**8**	**16**	**13**	**3**	**9**		**9**					

* Note: Problems, modifications, replacement of parts, and suggested changes were reported by stove users during field research conducted by the Fundación Solar team.
[1] Of all the stoves sampled only one, in Los Achiotes, was not working.
[2] Replacements or modifications made did not always result from failed components.
[3] Additional features suggested by users were an oven, a space in which to store firewood, a clay comal, and a water heater.
Source: Estudio de Evaluación de Programas de Estufas Mejoradas en Guatemala, September 2002.

6.36 Since the chimney is a critical component of the stove, but is not durable, it should be replaced from time to time, depending on the amount of stove use and frequency of maintenance. In Los Achiotes, where the chimneys were made of zinc sheet metal, only one of the five broken chimneys was replaced (Table 6.9), and the families that did not replace their chimneys once again endured the affects of having smoke inside their houses.

6.37 All three projects studied repeated the trial-and-error process regarding the metal planchas. At first, they used 8-mm, cast-iron planchas, which had problems due to poor quality. This led them to change to 5-mm, reinforced metal planchas. This underscores the lack of a certifying entity to assess the quality of the planchas and the lack of interaction between the project organizations.

6.38 Two problems that arose with the metal planchas were cracking and warping. Of the 15 women in the sample of 87 that had problems with the planchas, only 3 said they had improvised their own modification to solve the problem. This indicates that community members could not find an easy way to repair the planchas; thus, whenever a plancha cracked or warped, the likely result was a smoke-filled house. It is essential that the planchas are of good quality and that stove users understand the exact limitations of their use and how to care for them properly.

6.39 With regard to the firebox, San Antonio had the most problems of the six communities studied. In this community, local men, trained by bricklayers, built the stoves. For this reason, it is likely that the problems were caused by lack of quality control during construction. The main problems were breaks where the bricks were joined, which, in extreme cases, led to bricks coming loose entirely, leaving a gap in the firebox.

Problems in Technology Use

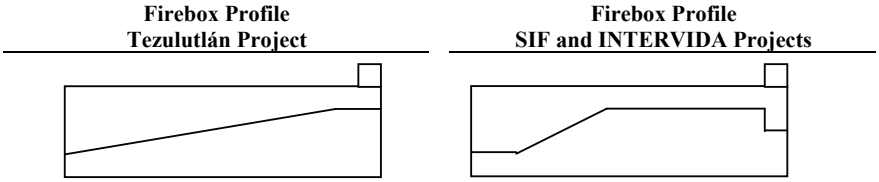
6.40 According to the three case studies, the chimney, firebox, and accessories (the door for feeding firewood and the regulator to control airflow) caused most of users' difficulties in operating the stoves.

6.41 In two of the four communities that used chimneys made of zinc sheet metal, some users replaced their 4-inch diameter chimneys with ones that had a larger diameter. Women participants in the focus groups said they preferred larger chimneys because they required less cleaning. On the other hand, clay chimneys were fragile and difficult to transport; moreover, only one artisan in Baja Verapaz produced this type of chimney. This limitation required users to order replacement parts from outside; this, in turn, created a logistics problem since the communities were remote, accessible only by poor roads.

6.42 Some users, mainly in Los González, enlarged the inside of their fireboxes because they said it was difficult to insert the firewood. They thought that the small volume of the firebox meant they had to split their firewood into smaller pieces, which mean more work for their families. Even in San Antonio, some women, in their eagerness to insert more wood or larger pieces, broke the fireboxes and dislodged the bricks that framed the opening for inserting wood. In Quiaté and Pahoj, where community users built the stoves, they tended to make a larger firebox

than specified in the design, and also enlarged the opening for feeding firewood. The Tezulutlán firebox design, which differed from the SIF and INTERVIDA model, allowed for easier insertion of larger pieces of wood (Figure 6.2). The Tezulutlán project did not attach doors to the fireboxes because the team considered them too sophisticated and difficult for users to operate.[76]

Figure 6.2: Comparison of Project Firebox Designs



User Benefits

6.43 Although conserving firewood was the main benefit that family users of the improved stoves identified, they also cited less time spent cooking (since several dishes could be prepare at once on the metal-plancha burners), less work for those responsible for collecting firewood (usually men), and less money spent on firewood for families that purchased their wood. In the community of Cantel, for example, firewood consumption was reduced by as much as 50%. To illustrate, if a family's annual spending on firewood was Q3,000-3,600 (US$385-462) before using the improved stove, it could be lowered to Q1,500-1,800 (US$192.31-230.77) after receiving a stove. In addition, not having to buy a new clay comal every few months saved another Q20-60 (US$2.56-7.69) per year.[77] Another benefit cited by stove users was eliminating indoor smoke, which is directly related to health benefits (though not necessarily so in the minds of the stove users).

[76] The Incó Xanacón Project, implemented by a civil association in the Department of Chiquimula in eastern Guatemala, also did not attach doors to the firebox.
[77] Based on an exchange rate of Q7.80 equivalent to US$1.

7

Conclusions and Recommendations

7.1 In 1976, when it introduced the Lorena stove, Guatemala became a pioneer in the field of wood-burning stoves. Until the late 1980s, evolution of stove development in the country involved the active participation of a diverse range of institutions, technological diversification of improved stove models, extensive networking through Conferences of Stove Experts, and coordination and technical assistance provided by the National Group for Improved Stoves.

7.2 Unfortunately, the successes of this period were limited because:

- Actions and efforts were not unified under an integrated program; rather, they consisted of isolated project activities that operated independently.
- Projects tended to donate stoves, which involved market-distorting subsidies.
- Innovative stove models had technical deficiencies resulting largely from a lack of technical support to ensure proper performance.
- Poor feedback between designers and stove users rendered the stoves less effective.
- Lack of training for men and women stove builders reduced community interest.
- Projects tended to view stove users as beneficiaries, rather than clients who should be given a high-quality product.
- Stakeholders lacked commitment to incorporating recommendations of the Conferences of Stove Experts.

7.3 Between 1996 and 2002, more than 100,000 stoves with metal planchas were built in Guatemala, mostly through the SIF. This large-scale effort generated both national and international interest in conducting case studies on three of the most representative improved-stove projects in Guatemala: Tezulutlán (with more than 4,000 units), SIF (with more than 90,000 units), and INTERVIDA (with more than 9,000 units). These three cases show that, even without a national stove program in place, these organizations continue to implement projects, albeit isolated, sometimes lacking in continuity (as in the case of Tezulutlán), or lacking sufficient technical support and user feedback (as in the cases of SIF and INTERVIDA).

7.4 Nevertheless, these projects have included sound practices that should be considered when implementing a national improved-stove program. In addition, they include challenges that should be faced and weaknesses to be avoided.

Summary of Best Practices

7.5 Sound project practices include the use of methods that promote community participation and local capacity-building. They focus on women, user participation in stove design, and community members' commitment to helping build the stoves.

7.6 Because of Guatemala's multiethnic, multicultural, and multilingual nature, improved-stove projects tend to focus on defined geographic areas, which permits more intensive work with groups of similar ethnic and cultural backgrounds. In addition, hiring staff from the project area facilitates the management of local resources for implementing the project, improves communication between the project and communities, and strengthens support and training activities.

7.7 Moreover, using stove models that incorporate ergonomic and safety considerations; that are functional for cooking local foods; and that provide economic, health, and safety benefits contributes to users' willingness to embrace the new technology.

7.8 Finally, having users share in the cost of the stove (about 40% in the Tezulutlán Project, 10% in the SIF Project, and 30% in the INTERVIDA Project) contributes to reducing community dependence on social assistance projects (Appendix M).

Summary of Project Weaknesses

7.9 The projects' lack of systematic community feedback, M&E, and research and technological development; as well as the poor quality of some of the stoves; created obstacles to improving the stove models and prevented users from have more and better options.

7.10 In addition, large project subsidies and lack of a direct relationship between vendors and users caused market distortions, elevated prices, and prevented development of commercial structures necessary for sustainability.

7.11 Furthermore, technical assistance was lacking to support model modifications and innovations that would have reduced costs and increased effectiveness and efficiency. This could have been achieved by conducting trials, certifying quality, consulting with stove users, and training stove builders.

Lessons from India and China

7.12 Useful lessons can be learned from India and China, which have the world's largest improved-stove programs, with about 18 million and 150 million units, respectively. The practices and structures that contributed to their program successes are described below.

Technical Assistance Unit

7.13 Stove programs in India and China have technical assistance units for stove producers to certify the quality and efficiency of stove-model modifications and new models. These technical units conduct market studies to obtain user feedback about their preferences. They also conduct training programs aimed at artisans and stove-manufacturing companies.

Well-directed Subsidies

7.14 In China, the stove subsidy is directed to designers and producers through the training and technical and marketing assistance that the technical assistance units offer. The goal is to promote commercialization of the stoves and ensure that stove users have access to a quality product at an affordable price. The subsidy is provided by the Government.

Market-user Relationship

7.15 Stove companies and artisanal stovemakers offer their products directly to stove users. In China, the stoves are fully commercialized; user demand and competition between producers have generated technological diversification backed by the technical assistance program. In successful cases in India, artisans sell their stoves directly to users, but at prices subsidized by the program. The program pays the subsidy, which covers 50% of the stove's cost, directly to the stovemaker.

Government Supporting Role

7.16 In both India and China, the Government is responsible for implementing the National Program for Improved Stoves—through the Ministry for Alternative Energy in India and the Ministry of Agriculture in China. These programs are managed by the respective ministries at the national level and by implementing agencies at the state and district levels.

7.17 In India, the Ministry for Alternative Energy supports the technical assistance units and the implementing agencies, which are responsible for promoting the program. In China the technical assistance unit also functions as a support entity for the program, with backing from the Ministry of Agriculture.

NGO and Civil-society Participation

7.18 NGOs and other civil-society groups have participated within the technical assistance units in designing and evaluating stove technology, as well as helping train users and promote the stove programs.

Recommendations

7.19 When one considers that 67% of Guatemalan households use wood as their principal cooking fuel and about 90% of families still cook over an open fire, one can clearly see Guatemala's need for a National Improved Stoves Program. The

three case studies conducted by Fundación Solar found that communities perceived considerable benefits from using the improved stoves, particularly in terms of saving money and improving indoor living conditions, which, in turn, improved their health and safety. A well-structured, integrated implementation effort would encourage and strengthen existing projects' sound practices and address their weaknesses, thereby achieving more successful programs.

7.20 Implementation strategies for a National Improved Stoves Program for Guatemala must consider the unique and complementary roles of a range of stakeholders, as well as organizational, subsidy, technological, and marketing issues. Based on the historical overview, case studies, and lessons from India and China, the following strategies are suggested.

7.21 ***Encourage commercial markets, whereby project beneficiaries become valued clients***. The National Program should encourage actions and create structures that allow for a direct relationship between commercial interests (private firms that manufacture stoves) and stove users so that construction firms view the user as their client (not just a project beneficiary) to whom they must deliver a high-quality product and provide good service. Having a commercial market will allow users to express their needs and preferences through market demand, and give them more than one model from which to choose. Market studies should be conducted to help define strategies for stove suppliers in terms of the four market/technology elements: the stove itself, price, means of retail distribution, and marketing.

7.22 ***Direct subsidies toward innovation that incorporates user feedback and promotion of marketing structures***. The Government should provide a subsidy aimed at: 1) providing technical assistance for stove designers and builders, especially with regard to issues of efficiency, quality, materials, costs, testing of new products, and technological innovation; 2) protecting users through project M&E, gathering feedback from users about their experiences with the stoves, and considering the opinions of users to make model modifications that offer even greater benefits; and 3) supporting structures that foster commercialization of the stoves.

7.23 ***Encourage designers and users to interact to increase stove efficiency and innovation***. Stove designers and users should interact so that modifications and innovations result in more energy-efficient stoves that more effectively meet users' needs and allow for technological diversification.

7.24 ***Develop efficiency criteria for resource conservation and consumer protection***. Implemented stove designs should have efficiency criteria for conserving firewood and ensuring efficient combustion to make the best use of this increasingly scarce resource. Moreover, consumers should be protected by certifying the stove quality, components, materials, and performance.

7.25 ***Encourage stakeholders to play mutually supportive roles***. The **Government** should take a lead role in implementing the National Program for Improved Stoves through the MEM, which, in the past, participated as the leader of the National Group on Improved Stoves. The Government should take advantage of existing structures for promoting stoves, including the SIF, which has, through its Departmental Offices, representation in every department. Regarding **private firms**,

The National Program should optimize use of existing infrastructure built around already implemented projects involving stove-building firms, manufacturers of metal planchas and accessories, firms that provide training in stove use and maintenance, and interested individuals who have participated in the stove projects. It is important that these groups participate in the National Program, education and training events for builders and manufacturers, and dissemination of stove technology. With regard to **civil society**, NGOs, universities, and other groups should participate in the Program through technology promotion and dissemination; technical assistance activities involving design, technology diversification, market studies, performance monitoring and fuel consumption, design of marketing strategies; and training and education programs.

7.26 ***Link stove program to meeting the energy needs of rural families***. The National Program should include actions directed at meeting the energy needs of rural families, who, because of poverty and inadequate commercial infrastructure, remain a long way from substituting fuelwood with such alternatives as propane. The Program should be linked to specific practices, such as energy forests, which will require the involvement of the National Forestry Institute, Ministry of Environment and Natural Resources, NGOs, and related civil-society groups.

7.27 ***Create a technical unit to facilitate national program development***. To facilitate Program development and address the weaknesses encountered in the historical review and the three case studies, a Technical Unit should be created. This Unit would be coordinated by the MEM and would include the participation of various civil-society actors, NGOs, academic institutions, stove users, and international aid agencies. The Unit would need Government support to give it legitimacy in the eyes of the stakeholders involved.

7.28 The Technical Unit would be responsible for:

- Conducting research to help develop new stove models,
- Training producers of improved stoves,
- Verifying the efficiency and quality of the models developed by stove manufacturers, and
- Conducting market studies for the various models.

7.29 The Unit's main objectives should be:

- **Diversification of stove models** so that users can choose the type that best suits their needs, based such factors as family size, location, physical characteristics of the users, comfort, customs, and types of food cooked.
- **Reduction of stove price**, an important factor in commercial distribution and accessibility to poor families. The Technical Unit would need to research diverse materials, sizes, and designs that can help lower the cost of making a stove.
- **National-level coordination** between various improved-stove projects and programs. Sharing information would help create feedback for both the

Technical Unit and the projects. In addition, these projects would be provided technical support and help with quality control and in determining the efficiency of the models being used.

- **Meeting the needs of stove users**. The Unit would evaluate and certify the quality of the stoves developed by producers and help ensure that the models satisfy users' needs.

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Appendices

Tables

Figures

Appendix A

RESEARCH Methodology

A.A.1 The following research methodology was used to prepare the case studies:

Review of the History of Guatemala's Stove Improvement Programs

A.A.2 Documents containing information about the history of developing improved stoves in Guatemala were compiled. The participation of Manuel Tay, an engineer and expert on improved stoves, was essential to this effort. His contributions, along with the documents reviewed, made it possible to compile a historical account of the country's improved-stove projects.

Definition of Selection Criteria

A.A.3 Sets of criteria that considered diverse conditions were developed for selecting appropriate stove programs or projects. The criteria taken into account were related to:

- Institutions: These included the project's time frame, the implementing agency's indicators for success, openness to doing the case study, and strategies for sharing costs with stove users.
- Stove users: These included income level, housing density, degree of community organization, and participation in project development.
- Technical design: The model had to be one already distributed in the country or region.
- Geographical areas of influence: These included climate variability and fuelwood availability.
- Resource optimization: This referred to the research team's ability to carry out and complete the studies successfully, making the best use of available resources.

Identification of Programs and Projects To Include in the Study

A.A.4 The first step in the research process was obtaining basic information on stove improvement programs and projects at the national or regional level. Following brief research, five projects were identified:

- **Social Investment Fund (SIF)** (*Fondo de Inversión Social*), which is national in scope;

- **Inko Xanacón Association**, which covers various municipalities in the eastern department of Chiquimula;
- **Tezulutlán**, which covers a number of municipalities in the northern department of Baja Verapaz;
- **Plan International**, which operates in various departments, mainly in the northern and eastern parts of the country; and
- **INTERVIDA**, which covers various western departments.

Project Selection

A.A.5 Ultimately, three projects—**Tezulutlán, SIF, and INTERVIDA**—were chosen, because they are located in different regions of the country and present unique and distinct characteristics such as fuelwood availability (abundant or scarce supplies); beneficiaries from various indigenous ethnic, as well as mixed-race, groups; and project implementation methods (and levels of subsidy). Thus, the three projects selected for the study could be representative of other projects carried out across Guatemala, making it possible to yield a wealth of information.

Selection of Communities

A.A.6 Once the projects were selected, individuals involved in their implementation were contacted in order to obtain information on the characteristics of the beneficiary communities. Based on the data acquired, a preliminary list of communities was compiled. Then, for each project, two communities that best met the selection criteria were chosen (Table A1).

Table A.1: Selected Project Communities, Including Number of Installed Stoves

Organization	*Community 1*	*No. of project-installed stoves*	*Community 2*	*No. of project-installed stoves*
Tezulutlán	Quiaté, San Miguel Chicaj (Baja Verapaz)	74	Pahoj, Rabinal (Baja Verapaz)	28
SIF	Los Achiotes, Jalapa (Jalapa)	28	Los Gonzáles, Jalapa (Jalapa)	65
INTERVIDA	San Antonio Las Barrancas, Sibinal (San Marcos)	41	Cantel, San Pedro Sacatepéquez (San Marcos)	50

Development of Data-collection Tools

A.A.7 Parallel with the selection of communities, the tools needed for collecting data were developed. These included:

- Form for gathering basic information on the community (Appendix B),
- Interview forms for non-users (Appendix C) and users (Appendix D) of the improved stoves,
- Interview guidelines for producers of stoves or stove components (Appendix E) and selected organizations (Appendix F), and
- Guidelines and sample topics for focus groups of improved-stove users (Appendix G).

Secondary Information Gathering

A.A.8 A range of documents was compiled to obtain secondary information on population, economic status, housing, means of access and transport, and poverty maps in the study areas.

Primary Information Gathering

A.A.9 First, field teams were formed to collect data. Facilitators were required to conduct interviews with stove users, especially in the INTERVIDA study area (since the department of San Marcos has a predominantly indigenous population, which could make communication problematic). Next, regional offices of the various projects were visited to interview technicians and extension workers about their working methods. Then, the selected communities were visited and community leaders were contacted at the first opportunity to request their help in gathering information and organizing focus groups, particularly since a number of families would be visited. Fortunately, leaders in all of the selected communities offered their support, which facilitated the information-gathering process. In addition, visits were made to metalworking shops that sold improved-stove components and shops that manufactured stoves.

Report Compilation

A.A.10 Data from the various forms were tabulated and organized, along with the information gathered from interviews, focus groups, and secondary sources. Observations and results were documented and compared across the three projects. Finally, discussions were held on the final results, and the study conclusions were written. The draft of the three studies was based on activities carried out during February-August 2002.

A.A.11 This report offers a general description of each project studied, including technical features of the stoves used; marketing or marketing-related activities; allocation of subsidies; best practices that can be replicated in future projects; and identified weaknesses that should be overcome.

Appendix B

Community Data Sheet for Improved Stove Projects

a) Name of Community: _____

b) Municipality: _____

c) Department: _____

d) Location (GPS): _____

e) Distance to municipal seat: _____

f) Distance to the closest community with electricity: _____

g) Distance to the closest paved road: _____

h) Access roads:

Summer

Good □ Drivable □ Poor □

Winter

Good □ Drivable □ Poor □

i) Distance or time to walk on foot (from where to where) _____

j) Total number of inhabitants: _____

k) Literacy rate: _____

l) Number of households: _____

m) Degree of dispersion. On average, houses are:

- Less than 200 meters apart
- About 200 meters apart
- More than 200 meters apart

n) What is the availability of firewood?

Abundant □ Medium □ Scarce □

o) What kind of wood is most commonly used? _____

p) Type of employment? (main productive activities) _____

ACTIVITY
POINT OF SALE
TIME OF YEAR

q) Services found in the community:

SERVICE	YES	NUMBER	TYPE	NO
Electricity				
Health				
Education				
Telecommunications				
Piped water				
Latrines				
Stores				
Other				

r) General land ownership situation in the community:

Own □ In protected area □ Rent □ Free use or legal right to use □

s) If land is owned by users, how did they obtain it? (find out from the municipality)

_____

t) Religions practiced: _____

u) Languages spoken: _____

v) Organized groups in the community:

NAME
ACTIVITY

w) Name of the male community leader: _____

x) Name of the female community leader: _____

y) NGOs and governmental organizations that operate projects in the community:

NAME
PROJECT SUPPORTED
SINCE WHEN

Appendix C

Interview with Non-Users of Improved Stoves

Sheet No. _____

Community: _____ Date: _____ Sex: M F

Municipality/Department:_____

Interviewer:_____

I. Demographic Information

a) Number living in household: _____ Number who can read and write _____

Mother
Father
Children

b) Languages spoken? Mam Spanish Other _____

c) What illnesses affect the family?_____

d) What religion do you practice?_____

e) What kind of work does the family do? Agriculture Services Business Other

II. Use of Open Fire/Gas Stove

a) What do you use for cooking? _____

b) Besides cooking, how else do you use:

Open fire	Gas stove

c) What foods do you prepare with an open fire/gas stove? (specify which)

_____

III. Fuel Use (firewood, gas, etc.)

List fuels used for cooking	How often do you use it?		
	Very frequently	Rarely	Some of the time

If you use firewood:

a) What kind of firewood do you use for cooking?

Short, thin pieces Thick pieces All sizes

How many pieces of firewood do you use per day? How long does a carga of firewood last?

Determine the best way to ask the question. If asking in terms of cargas, make sure to determine how many pieces of wood are in a carga.

b) How do you get your firewood?

1) Buy 2) Gather

c) Who carries the wood to the house? _____

IV. Perception of the Improved Stove

Do you know of the Improved Stoves/Plancha Project being implemented in your community or in another community?

YES NO

If the answer is yes:

b) Fill in the table, indicating what you consider as the advantages and disadvantages of the improved plancha stove that you have seen.

Positive things about the improved stove	**What things do you not like about the improved stove?**

c) Why haven't you gotten an improved stove? _____

d) Are you interested in getting a stove? YES NO

If the answer is yes:

Do you know of any place that sells improved stoves or planchas? YES Where? _____
NO

V. Willingness To Pay

a) Do you know how much an improved stove costs? YES How much? _____
NO

If the answer is yes:

How much would you be willing to pay? _____

VI. Property Ownership

a) Land ownership status: Own land Rent Tenant farmer Usufruct
Other _____

b) What rooms are in the house, and where is the stove located? _____

c) Note the characteristics of the house:

Area	**Walls**				**Roof**			
	WOOD	BLOCK OR BRICK	ADOBE	CANE	SHEET METAL	THATCH	TILE	OTHER
House								
Kitchen								
Other								

d) Have you bought any durable goods?

Bicycle Motorcycle Radio TV Other

How did you pay for these goods?

Cash Installments Loan Other
Specify: _____

Appendix D

Interview with Users of Improved Stoves

Sheet No. _____

Community: _____ Date: _____ Sex: M F

Municipality/Department: _____

Interviewer: _____

I. DEMOGRAPHIC INFORMATION

a) Number living in household: _____ Number that can read and write _____

Mother
Father
Children

b) Languages spoken? Mam Spanish Other

c) What illnesses affect your family?_____

d) What religion do you practice?_____

e) What kind of work does your family do? Agriculture Services Business Other

II. INSTITUTIONAL ASPECTS

a) How long have you had your improved stove? _____

b) What is the name of the program/organization that conducted the project? _____

c) Who built the stove?

Bricklayer Yourself Local artisan Promoter of the Project Other
Specify _____

d) Did you receive training in how to use and care for the improved stove? YES NO

Individual Group

Comments (pamphlets provided, etc.) _____

e) After the stove was installed, did anyone from the Program come to see how it was working?

YES How many times? _____ NO

f) How much did you contribute toward the cost of your stove?

Transportation of materials	YES	NO		
Materials	YES	NO	What materials?	_____
Construction	YES	NO	Explain	_____
Cash	YES	NO	How much?	_____
Nothing				

III. USE AND MAINTENANCE

USE OF THE IMPROVED STOVE

a) Besides cooking, what else do you use the stove for?_____

b) Ask the person being interviewed what times they use the stove:

When do you first light the fire in the morning? _____ When do you put it out? _____
When do you relight it in the morning? _____ When do you put it out? _____
What time to you light it in the afternoon? _____ When do you put it out? _____

c) Do you use the stove for warmth? YES NO

d) What foods do you prepare with the stove? _____

FUEL USE (FIREWOOD, CORNCOBS, ETC.)

List Fuels used for cooking	**How often do you use them?**		
	Most of the time	**Rarely**	**Some of the time**

e) What kind of wood do you use for cooking food?

Short, thin pieces Thick pieces All sizes

f) How many pieces of firewood do you use per day? How long does a carga of firewood last?

This question is about consumption of firewood before and after getting the stove. Determine the best way to ask the question. If asking in terms of cargas, make sure to determine how many pieces of wood are in a carga.

Before getting the improved stove _____
With the improved stove _____

g) How do you get your firewood? 1. Buy 2. Gather

h) Who carries the wood to the house? _____

CARE OF THE IMPROVED STOVE

i) How often do you clean the chimney? _____

j) How else do you care for the stove to keep it working well? How often? _____
_____

USE OF OPEN FIRE/GAS STOVE

k) Do you still use an open fire or propane stove?

Open fire YES NO Propane stove YES NO

If the answer is no, go to Section IV
If the answer is yes:

Open fire		Propane	
Activity	**How much time per day?**	**Activity**	**How much time per day?**

IV. DESIGN AND PERFORMANCE OF THE STOVE

NOTE: To fill out this section, you should be in the same room as the stove because you will be able to answer some questions just by examining the stove and the room it is in.

a) Is the stove working?: YES NO
If the answer is no:

b) How long has it been since the stove was working?_____

c) Examine the stove and the parts listed in the following table, and ask the woman if any of the parts have problems or are broken, and what the cause of the problem is.

Stove Component	Problems or Broken Parts				Cause/Observations
Base or poyetón	Cracked	Unstable	Other	None	
Firebox	Cracked	Other		None	
Plancha	Cracked	Warped	Other	None	
Burners or hornillas	Cracked	Warped	Other	None	
Chimney	Explain				Explain
In this space, write down any other problem not previously mentioned					

d) Have you modified or repaired the improved stove? YES NO

If the answer is yes:

e) What modifications were made? _____
_____

f) Did you get any help making the modifications? _____

V. PERCEPTION OF THE IMPROVED STOVE

a) What do you think of your improved stove? _____
_____

b) What benefits have you found with the improved stove?

- Less smoke in the house
- Takes less time to cook
- The kitchen is cleaner
- Uses less firewood
- Saves time
- Does not cause respiratory problems or eye irritation
- Other comments:
  _____
  _____

c) What disadvantages have you found with the improved stove? _____
_____

d) If you could change something about the stove, what would it be? _____
_____

VI. COMMERCIALIZATION ASPECTS

a) Do you know of any place that sells stoves/planchas? YES NO

Where? _____

VII. PROPERTY OWNERSHIP

a) Land ownership status: Own land Rent Tenant Usufruct
Size of property: _____

b) What living areas are in the house and where is the stove located? _____
_____

c) Note the characteristics of the house:

Area	**Walls**				**Roof**			
	WOOD	BLOCK OR BRICK	ADOBE	CANE	SHEET METAL	PALM	TILE	OTHER
House								
Kitchen								
Other								

d) Have you bought any durable goods?

Bicycle Motorcycle Radio TV Other: _____

e) How did you pay?

Cash Installments Loan Other
Specify: _____

THANK YOU FOR YOUR COOPERATION!

Appendix E

Interviews with Commercial Enterprises

(including stove-building firms and individuals and component manufacturers)

Experience with Stove Commercialization

(Marketers, plancha manufacturers, stove builders, stove vendors, hardware stores, etc.)

1. Cost of stove
2. Price of stove
3. Fluctuations in price
4. Pricing strategy (need for micro-financing); is there any possibility of lowering the price of the stoves?
5. How do you feel about the profit margin on stoves?
6. What model of stove have you tried to commercialize or do you think would be good for commercialization? (a portable model, sale of individual parts, construction in the home, etc.)
7. Infrastructure created (service network, skilled labor, etc.)
8. Marketing activities used (type and strategy), institutional support, incentives for employees.
9. Sales strategy
10. Goal-based marketing
11. Strategy for repeat business
12. What role does user training play in stove use and maintenance for commercial enterprises?

Production Method

Costs

- Who produces or builds the stoves? (local or outside artisans, stove providers, program staff, etc.)
- Where are the stoves manufactured or built? (in a factory or workshop, user's home, both, etc.)
- How are the stoves built or manufactured? (assembly line, mass produced, to order, in parts, etc.)
- Do you use quality control in building the stoves?
- Do you use quality control in obtaining the raw materials?
- When do you build or manufacture the stoves? (to order?)

Quality Control Methods

- Quality control (performance of the stove), stove construction, fulfillment of project objectives, etc.)
- M&E project instruments
- What is your exit strategy? What mechanisms are you leaving in place that will promote sustainability of the Project?
- What problems have you faced in implementing the Project?
- What are the achievements of the Project?
- What are the main challenges in this type of Project?
- What improvements would you recommend, based on your experience with this type of Project?

Appendix F

Guidelines for Gathering Information from Project Implementing Organizations

Regarding the Implementing Agency

- Social mission of the institution
- Institutional structure: formal, informal, vertical, horizontal, organigram, etc.
- Institutional logistics
- Length of time working in this field
- Types of programs and relationship with the communities

Regarding the Project

General

- Start of project and its origins
- Duration
- Goals and objectives
- Project focus (reducing smoke in the home, saving wood, economic benefits, etc.)
- What organizations are carrying out the Project and what are their responsibilities or roles
- Relationship of the Project to other organizations (Actors), and their responsibilities or roles
- External or internal technical support for implementing the Project
- Financing strategy and sources (subsidy, donation basis, etc.)
- Methodology for conducting the Project
- Status of the Project and outcomes achieved

Operational Aspects

Within the project team of the implementing agency

- Project autonomy in decision-making and design
- Leadership style within the organization/Project (level of autonomy of team members and ways of motivating staff)
- Structure and responsibilities within the Project
- Integration of the project team
- Methods for evaluating staff performance

Regarding the communities (market)

- Size of Project (number of stoves, families, and communities) and variation over time
- Criteria for selecting sites or communities
- Geographic area of the Project
- Interaction between the Project and members of the communities
- Methodology for promoting and disseminating the stoves (women's participation)
- Methodology for transferring the stove technology (training)
- Cost sharing by the stove user

- Has any analysis been done of the sensitivity of demand to variations in the share of costs covered by the users?

Design of the stove

- Origin of the stove design
- Key criteria for the stove (efficiency, safety, cost, availability of materials, etc.)
- Participation by the institution in design of the stove and the criteria considered
- Interaction between users and the organization in designing the stove (consideration of cooking habits, needs of the users, etc.)
- Considerations concerning cost of the improved stove—actions aimed at making optimal uses of resources (productivity and cost/benefit relationship, quality vs. cost)
- Methods and cost of obtaining materials (local materials, outside materials, etc.)
- Process of buying the stove (bidding and procurement process, strategy and cost of transporting materials, construction, etc.)

Information about Stove Users

- Demographic characteristics
- Economic characteristics (occupation)
- Housing characteristics (walls, roof, floor, etc.)
- Income (ability to buy a stove)
- Experience with and access to credit (ability to obtain credit to buy a stove)
- Land ownership
- Cooking habits
  - Foods prepared
  - Quantity cooked
  - Hours used for cooking
- Fuel use
  - Amount or firewood used (before and after getting a stove)
  - Obtaining firewood (is firewood bought, difficulty and time required to gather wood?)
  - Access to alternative cooking fuels (kerosene, propane, electricity, etc.)
  - Use of open fire
- Implementing agency's perception of the benefits and economic impact that the stove Project has had in the communities

Information about the Communities or Geographic Areas

- Climate, access, languages, housing density, availability of firewood, basic services (health center, schools, piped water, drinking water, telecommunications, electricity, etc.)
- Is the market for firewood an open one or is it a system set up by the community or the NGOs that manage the forests?

Experiences Commercializing the Stoves

- Barriers to commercialization
- What model of stove have people tried to commercialize or do you think would be a good candidate for commercialization? (a portable model, sale of individual components, construction in the home, etc.)
- If the stoves have been commercialized, who did it?
- Pricing strategy (need for microfinancing); could the price of the stoves be reduced?
- Method of commercialization/distribution (distribution chain). Have actions been taken to create a basic infrastructure (service network, skilled labor, etc.) for commercializing the stoves?
- Marketing and information
- Sales strategy

- Goal-based marketing
- Strategy for repeat business
- What role does user training play in stove use and maintenance for commercial enterprises?

Production Methods

- Who produces or builds the stoves? (local or outside artisans, stove providers, Project staff, etc.)
- Where are the stoves manufactured or built? (in a factory or workshop, user's home, both, etc.)
- How are the stoves built or manufactured? (assembly line, mass produced, to order, in parts, etc.)
- When do you build or manufacture the stoves? (to order?)
- Quality control methods
- Quality control (stove performance, construction, fulfillment of project objectives, etc.)
- Project M&E
- What is the exit strategy? What mechanisms are being left in place that will promote sustainability of the Project?
- What problems have you faced in implementing the Project?
- What are the achievements of the Project?
- What are the main challenges in this type of Project?
- What improvements would you recommend, based on your experience with this type of Project?

Issues Related to Pollution in the Home, Health, and Related Benefits

Contacts in the Communities: Stove committees, pro-improvement committee, deputy mayor, marketers of the technology, hardware stores, stove suppliers, other important actors.

Appendix G

Guide to Focus-Group Topics

REMINDER

GENERAL GOALS OF THE IMPROVED-STOVE STUDY:

Propose specific ways to strengthen the improved-stove program in Guatemala, and thereby help develop strategies to mitigate indoor air pollution in Guatemala.

Improved-Stove Users

Characteristics of the Focus Groups:

- ✓ ***Number of groups per community***: 2
- ✓ ***Number of people per group***: 8-10
- ✓ ***Characteristics of the groups:*** Female improved-stove users between 16 and 50 years old. Socioculturally homogenous (same ethnicity and similar economic level). Participation by community leaders who could influence the discussion was avoided. Members of previous groups were never included.
- ✓ ***Location*****:** Isolated, peaceful, comfortable room that is easily accessible for the participants. The chairs must be arranged in a way that does not create a hierarchy among the participants. The facilitator should treat each person equally.
- ✓ ***Time and duration:*** A time should be chosen that is convenient for each group, and the session should last no more that 1.5 hours.
- ✓ ***Materials*****:** Cassettes, recorder, paper and pen, enlarged photo of the improved stove.

I. Preparation and Explanation

a) Introduction

- Participants are thanked for coming, and the importance of their opinions about the improved stove is emphasized.
- The composition of a focus group is explained: It is a group from the community whose members are selected because they are willing to express their opinions about the improved stove.
- It is not a test or exam, nor it is an offering from the project. Rather, it is a study intended to strengthen future improved-stove projects.

b) Purpose

- The idea is to have a dialogue about the stove. It is not an evaluation. Hearing your opinions is very helpful for us. You can express freely your agreement or disagreement regarding any of the topics addressed.

c) Procedure

1. As the women arrive, they are asked their names and given an identification tag. This allows the facilitator to address each participant by name during the focus group and creates a more personal and intimate conversation.
2. Participants are thanked for coming, and the importance of their opinions about the improved stove is emphasized.
3. Explanation of the objectives of the focus group.
4. After explaining the objectives, the women should be given an opportunity to ask questions about the focus group.
5. The rules of the focus group are explained: The information provided during the focus group will only be used for the study (it is confidential); each person's opinion is important; the facilitator will manage the group and ask questions; the participants can answer without being afraid that they are wrong; participation should be orderly (speaking one at a time), etc. "We are all going to talk about the stoves together."
6. Explain that the tape recorder is being used a way to make sure important information is not forgotten.
7. Conduct the focus group.
8. The activity is concluded by giving a brief summary of what the women themselves said about the topics addressed, and thanking them for their valuable participation.
9. The group is offered refreshments.

d) Presentation

All the participants are introduced, beginning with the facilitators.

REMEMBER TO USE THE FOLLOWING QUESTIONS:

- ✓ **Can you expand on that issue?**
- ✓ **Could you explain that?**
- ✓ **Give me an example**
- ✓ **What do you think of this?**
- ✓ **Why? and Why not?**
- ✓ **Etc.**

II. Firewood

1. What do you think about the amount of firewood the stove uses? (Is it what you expected? Is it a lot? A little? Is it acceptable?)
2. How do you get your firewood?
3. Do you think it is difficult to get firewood? Why?
4. In the past, do you think the availability of firewood in your community was different? Why?
5. How much do you pay for firewood? Do you think that is expensive? *Why?*
6. Who in your household is responsible for getting firewood? *Why?*

III. General Issues, Operation, and Maintenance of the Stove

Sample questions

1. Do you think it is easy or complicated to cook with the stove? Why?
2. What maintenance have you done on the stove?
3. Has it been difficult to take care of? Why?
4. How often do you perform maintenance on it? Why?
5. Who maintains the stove? Why?
6. Would you like to make any changes to improve the stove? What are they?
7. Has the stove given you any problems? How? What have you done to fix the problem?
8. What did you contribute to obtaining the stove? Was it hard to make that contribution? Why?
9. Have you made any changes to the stove? What were they? Why?

IV. Prices and Commercialization

Sample questions

1. Do you know of any place where you can buy an improved stove or a plancha?
2. If you had to, could you and your family build an improved stove by yourselves?
3. Now that you are familiar with the improved stove, if you moved to a new house, would you buy another improved stove? Why?
4. Do you know how much it costs to but a stove like the one you have? Do you think that is expensive? Why?
5. Have you seen another model of stove that you like or would want to buy? What is it like?
6. Has anyone offered to sell you an improved stove?

V. Promotion, Client Service, and Feedback

Sample questions

1. Before you had your stove, did you want to have one? Why?
2. Why did you decide to get a stove?
3. What was the process for getting the stove? (steps you followed up to actually getting the stove)
4. Do you think the training you received on how to use and take care of the stove was sufficient? Why? Was it group training or individual training?
5. Was any stove poorly constructed? What did you do in that case?
6. What have you done when a stove component broke or was no longer working? If nothing has broken, what do you think you would do if something did break?
7. Has anyone come to your house to see whether the stove is working well? Who? How many times? Do you think that is enough?
8. Have you had any language problems during the training sessions or inspections of the stove? Why?

VI. General Perceptions of the Users

Sample questions

1. What do you think of the improved stove? Why?
2. What kind of problems did you have before you owned an improved stove?
3. What advantages do you see in the improved stove?
4. Have you saved money by using the stove? How much?
5. How has your health situation changed? And cooking safety?
6. How would you suggest improving the stove project?

VII. FAREWELL

- At the end of the discussion, each participant should give a short summary about the improved stove.
- The facilitator should summarize the most important points expressed by the participants concerning the topics addressed.
- Resolve any conflict that came up during the focus group. Serve refreshments.
- Thank the focus-group members again for their attendance and participation.
- Invite the participants for refreshments.
- At the end of the focus group write down notes about the discussions to ensure that the facilitator does not forget anything.

Appendix H

Participating Institutions and Number of Representatives, Second National Conference of Stove Experts

Volunteers in Technical Assistance (VITA), United States
2 specialists (women) in preparation of teaching materials

Center for Appropriate Technology Studies (CETA), Nicaragua
1 volunteer

1 representative each, Haiti and Peru

Mesoamerican Center for the Study of Appropriate Technology (CEMAT)
3 representatives, Santa Catarina Palopó
2 representatives, San Andrés Semetabaj
2 representatives, Santiago Atitlán
2 representatives, San Pedro La Laguna
3 representatives, San Lucas Tolimán
1 representative, Sumpango

XELAC Cooperative
1 representative, San Andrés Xecul
6 representatives, San Cristóbal Totonicapán
1 representative, Quetzaltenango departmental seat

National Forestry Institute (INAFOR)
2 representatives, San Francisco el Alto
1 representative, Cantel

Choquí Experiment Station
5 representatives, La Esperanza
2 representatives, Quetzaltenango departmental seat
1 representative, San Juan Ostuncalco

World Vision
1 representative, San Juan Ostuncalco
1 representative, Cantel
4 representatives, San Cristóbal Totonicapán

Cooperative for Assistance and Relief Everywhere (CARE)
1 representative, Quetzaltenango departmental seat

Central American Institute for Industrial Research and Technology (ICAITI)
1 representative, Guatemala City

Central Mennonite Committee (CCM)
1 representative, Patzún Chimaltenango

Secretaría de Coordinación de la Junta Nacional de Educación Extraescolar
4 representatives from the departmental seat of Quetzaltenango

Rafael Landívar University
1 representative, Quetzaltenango departmental seat
1 representative, Tejutla San Marcos
1 representative, Ixchiguan

General Directorate for Agricultural Services (DIGESA)
1 representative, San Juan Ostuncalco

Appendix I

Improved Stove Models and Supporting Institutions Identified During Technological Diversification

1. Rossi Stove ("Poyo Campesino"). Iron grill, cast-iron plancha in the cooking area. Commercial model built under manufacturing standards of the Rossi Workshop. It is associated with the models known as "plancha" stoves found in urban areas.
2. Lorena Stove. Large-scale stove made of clay and sand. Designed to be built by the stove users themselves. Choquí Experiment Station.
3. Modified Lorena Stove. Similar to the Lorena Stove but with improvements in the quality control of materials. Central American Institute for Industrial Research and Technology (ICAITI).
4. Chulah Stove. Similar to the Lorena Stove, but with modifications in the construction and proportion of materials. Uses straw from wheat as the binding material. ICAITI.
5. CETA Stove. Uses lightweight cinderblocks and a concrete plancha with metal reinforcements. Standardized system of construction. Center for Appropriate Technology Studies (CETA), Center for Engineering Research (CII), and University of San Carlos of Guatemala (USAC).
6. Pescado, Tiburón, and Ballena Stove. Similar to the CETA system, with a different size and shape that resembles a fish. It is built in place out of prefabricated parts. Central Mennonite Committee (CCM).
7. LOB Stove. Similar to the Lorena Stove. Modifies the system of construction by integrating a wooden frame into the manufacture of the basic block of clay and sand. General Directorate for Agricultural Services (DIGESA).
8. Clarita Stove. Portable stove made of clay. Uses kiln-fired, ceramic components. Developed by ECOTEC.
9. Rocky Stove. Made of heat-treated ceramic. Introduced the concept of fire-induced draft. No chimney and portable. Peace Corps through ICAITI.
10. Prefabricated Ceramic Stove. Introduced prefabricated kiln-fired, ceramic parts to the Lorena Stove's hornillas and flues, establishing standards for materials and dimensions. Proposed by ICAITI and supported by ceramicists from Rabinal, Baja Verapaz, and Pachalí San Juan Sacatepequez, Guatemala.
11. Josefina, Chefina, and Improved Chefina Stove. Built with the same dimensions and characteristics as the Lorena Stove. Uses prefabricated and kiln-fired clay bricks to form the flues and hornillas. Proposed by ICAITI.
12. Wood base. A wooden base with an open fire on top. Promoted by elements within the army. Other details not known.

13. Kelly Stove. Developed by groups of independent builders in western Guatemala. Made modifications to the flues in the Lorena Stove.
14. Singer Stove. Mentioned in some of the documents consulted, but no details were given.
15. Estrella Tortillera Stove. Portable stove made of number 26, galvanized sheet metal. Has no chimney. Adapted from African models. Proposed as a commercial model in urban areas.
16. Estrellita Stove. A smaller version of the Estrella Tortillera Stove. Aim was the same.
17. Finlandia Stove. Uses a metal plancha, without holes, placed atop bricks. Developed by Trifinio Project in Guatemala, Salvador, and Honduras.

Appendix J

Participating Institutions, Third National Conference of Stove Experts

1. Private stove builders. Samajelá Microenterprise Group.
2. General Directorate for Alternative and Renewable Energy. Ministry of Energy and Mines.
3. Central American Institute for Industrial Research and Technology (ICAITI).
4. Center for Engineering Research (CII). Engineering Faculty, University of San Carlos of Guatemala (USAC).
5. School of Chemistry and Pharmacology, USAC.
6. World Vision.
7. Coordinadora Cakchickel de Desarrollo Integral (COCADI).
8. General Directorate for Agricultural Services (DIGESA).
9. Community Alliance for Youth Development.
10. Peace Corps.
11. Mesoamerican Center for the Study of Appropriate Technology (CEMAT).
12. Tropical Agricultural Research and Higher Education Centre (CATIE).
13. Grupo Unión y Perseverancia, la Unión Zacapa.
14. French Embassy.
15. Secretaría de Coordinación de la Junta Nacional de Educación Extraescolar.
16. National Forestry Institute (INAFOR).
17. Municipality of Guatemala City.
18. United Nations Development Programme (UNDP).
19. General Secretariat for Economic Planning (SEGEPLAN).
20. Association of Community Health Services (ASECSA).
21. ICADA (Scientific Research Related to the Altiplano) Experiment Station, Choquí.
22. Taller Rossi.
23. GATE/GTZ of Germany.
24. Central Mennonite Committee (CCM).
25. Technical Institute for Training and Productivity (INTECAP).
26. Ministry of Agriculture.
27. International Development Research Centre (IDRC), Canada.
28. Latin American Energy Organization (OLADE).
29. Guatemala-Germany Food for Work Commission (COGAAT).

30. Secretariat for Central American Economic Integration (SIECA).
31. Community Promoters of Huehuetenango.

Appendix K

Participating Institutions in Improved Stove Programs

These institutions include those that participated in various conferences of stove experts, the National Improved Stove Group, were mentioned in the national survey on improved stoves, or were cited by other institutions in publications related to the subject of improved stoves.

1. Choquí Experiment Station. Headquartered in the department of Quetzaltenango. Develops appropriate technology programs. Not currently active.
2. Center for Appropriate Technology Studies (CETA). Based at the University of San Carlos, Guatemala.
3. Central American Institute for Industrial Research and Technology (ICAITI). Was based in Guatemala City, but is now closed.
4. Technical Institute for Training and Productivity (INTECAP). National in scope. The renewable energy program has been suspended.
5. Central Mennonite Committee (CCM). Was based in Santa María Cauqué. Its Manuel Guaram experiment center has ceased activities.
6. Mesoamerican Center for the Study of Appropriate Technology (CEMAT). Based in Guatemala City. Develops appropriate technology programs.
7. Peace Corps. Its programs in Guatemala do not directly include stoves.
8. Community Development. Ceased operation.
9. Community Alliance for Youth Development. Concluded its activities.
10. National Institute of Cooperatives (INACOP). Does not participate in stove programs.
11. General Directorate of Agricultural Services (DIGESA). Does not participate in stove programs.
12. National Forestry Institute (INAFOR). Activities suspended.
13. Cooperative for Assistance and Relief Everywhere (CARE). Is not known to be active in the area of improved stoves.
14. Caroll Berhorst Foundation. Does not participate in stove programs.
15. National Reconstruction Committee. Activities were suspended.
16. Centavo Foundation. Suspended activities in stove programs.
17. World Neighbors. Current status not known.
18. Foster Parents Plan. Current status not known.
19. Secretaría de Coordinación de la Junta Nacional de Educación Extraescolar. Current status not known.
20. World Vision. Is not known to be active in the area of improved stoves.
21. General Directorate for Alternative and Renewable Energy. Ministry of Energy and Mines. This office was closed as part of administrative reorganization.
22. Nutrition Institute of Central America and Panama (INCAP). Supports studies on indoor air pollution resulting from burning fuelwood in rural Guatemala.

23. Association of Community Health Services (ASECSA).
24. Guatemala-Germany Food for Work Commission (COGAAT). Current status not known.
25. General Directorate for Fisheries Services (DIGESEPE). Closed its operations.
26. Empresa Nacional de Fomento y Desarrollo Económico del Petén. Current status not known.
27. Fuelwood Project implemented by CATIE/ROCAP. Suspended stove work in Guatemala.
28. National Council of Development Institutions (COINDE). Current status not known.
29. Médicos del Mundo. Does not do work with stoves.
30. National Electrification Institute is mentioned, although central authorities were unaware of it. Does not currently have a stove program.
31. Talleres Rossi and Talleres Turbo Mac (private shops). Talleres Rossi makes cast-iron plancha models in various sizes, while Talleres Turbo Mac makes models that use propane.
32. Fundación Solar. Conducts research, development, and implementation of projects related to renewable energy.
33. Conservation Project for the Alta del Río Chixoy Watershed. Does not have an improved-stove program.
34. Aprovecho Research Institute. Supports research on improved stoves to help develop new models.
35. Proleña. Located in Nicaragua, has a strong research, development, and dissemination program for commercial stoves in peri-urban areas of Guatemala, Honduras, and Nicaragua.
36. INTERVIDA.
37. Tezulutlán Project.
38. Helps International Project. Implements research programs on indoor air pollution from firewood.

Appendix L

Improved Stove Models and Supporting Institutions Identified During Commercialization

1. **Plancha Armada Stove**. Uses a firebox with a plancha on top made of plate metal with cooking holes, rings, and covers. The plancha has metal reinforcements to prevent warping. It is considered a popular creation by commercial users of cooking equipment. It was studied and incorporated into development projects by various institutions and individuals.
2. **Rocket Stove** and its variants. A modified version of a design from the United States that is known in Guatemala. Proposed by the Aprovecho Research Center.
3. **Justa Stove** or **Aprovecho Stove**. Uses a metal plancha and the Rocket system, known as "Rocky" in Guatemala. Proposed by the Aprovecho Research Center.
4. **Ecofogón**. Uses a metal plancha and its cover components are made of metal. Proposed by the Proleña Project of Nicaragua.
5. **Molded Stove**. System using a plancha with a firebox made from prefabricated pieces of lightweight concrete. Proposed by the Helps International Project of Guatemala.
6. **China Stove**. Guatemala Model. A system made of metal, which burns coal imported from China mixed and pressed with discarded organic material. Introduced by a private researcher.

Appendix M

Cost Study on Improved Stoves in Guatemala

Contributed by Rogério Carneiro de Miranda

Introduction

A.M.1 Guatemala is one of the Latin American countries that has made significant progress in design and dissemination of improved, wood-conserving stoves.

A.M.2 It is impossible to consider improved stoves as a solution for reducing indoor air pollution without taking into account the ability of users—most of whom have scarce resources—to pay. According to the findings of the case studies of improved stove programs examined in this report, there exist great price differences between improved stoves, despite similarities in their designs. The reason for this price variation is unclear and requires more detailed research. This study considers it essential to gain a clearer understanding of the costs of each stove's structure and design by investigating the factors that contribute to price variation. Results of this research will significantly impact stove promotion and supply from the 1) demand side (users' attitude toward acquiring improved stoves) and 2) supply side (helping to improve the factors needed for effective and efficient production of improved stoves).

Objective

A.M.3 The main objective of this study was to review the costs of improved stoves promoted by various stove programs in Guatemala—mainly those analyzed in this study—with the goal of gaining an understanding about production costs and factors that determine market prices. It is expected that the results will be used to 1) conduct a price comparison between different improved stoves; 2) identify existing cost similarities and differences based on stove structures, as well as factors responsible for them; and 3) identify how cost implications for users can be appropriately modified to better reflect production cost.

Method

A.M.4 To develop this study, the following activities were carried out:

1. Review a preliminary report developed by Fundación Solar on improved stove programs in Guatemala.

2. Interview stove-program coordinators and staff from SIF, INTERVIDA, and Plan International.[78]

3. Visit communities served by the above-mentioned organizations to observe them in action; interview 22 users/owners of improved stoves in the communities.

4. Interview manufacturers of metal-plancha, improved stoves.

5. Interview builders of metal-plancha, improved stoves.

6. Collect general information on the cost of transport and materials in hardware stores, providers of services and materials, and local markets. (This information was collected in Guatemala City, Chimaltenango, Quetzaltenango, and San Marcos.)

Wood-conserving Plancha, Improved-stove Model

A.M.5 The Lorena stove was created in Guatemala in the mid-1970s to reduce fuelwood consumption in the preparation of food.[79] The design was simple: a mix of local clay and sand, shaped into tunnels with a low-cost chimney. However, it was not as efficient as had been initially thought. Because it was a large-scale stove, it could not absorb the energy needed to initiate the saving process. As a result of efficiency measurement, some families were found to have saved approximately 30% of wood, while others did not try to save or even used more wood than what had been used in a traditional open fire. It was determined that more maintenance activities were needed because of the low-cost materials and local construction used.

A.M.6 Today, a commonly accepted design in Guatemala is the plancha stove. Recently, newer models have been introduced, such as the portable plancha stove developed by a Guatemalan researcher and the U.S. NGO, Helps International.

A.M.7 Although the stoves used by the various social assistance programs have small differences, the design concept is the same (Figure AM1).

[78] Plan International was selected since it uses the method developed by Tezulutlán, a rural development project analyzed in this report but no longer operative in Guatemala.

[79] Lorena: clay and sand. Developed in ICADA-CHOQUI, Quetzaltenango, Guatemala.

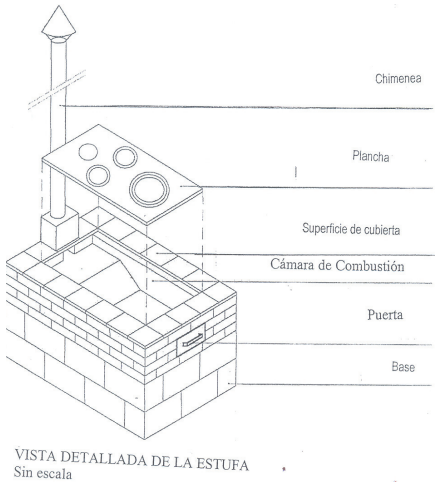

Figure AM1. Detailed View of the Plancha Stove

Promoters of Improved Stoves in Guatemala[80]

A.M.8 **Social Investment Fund (SIF)**: In 1996, the SIF began to promote the use of plancha stoves at the national level, as a way to improve rural Guatemalans' environmental and socioeconomic conditions. This is because the stove reduces costs and time spent collecting wood as an energy source, pressure on forests for fuelwood, and indoor air pollution. The SIF coordinator for environmental projects states that approximately 15,000 plancha stoves are built each year, representing about 100,000 units built to date.

A.M.9 Since 1997, the SIF has promoted the use of plancha stoves only in communities that belong to the POCC (Community Organization and Training Program) work area. This program focuses on communities with scarce resources that need an appropriation strategy, accompanied by training as key tools for long-term sustainability of SIF-implemented projects.

A.M.10 In 1998, the SIF adopted a standard plancha-stove design for its programs. This decision was made because of the variable quality of materials and construction process.

A.M.11 The method and steps followed by the SIF to develop plancha-stove projects in a given community are:

1. The community makes a formal, written request to the SIF to develop an improved-stove project.
2. A SIF technician visits the community to evaluate improved-stove needs.

[80] The main body of this report provides a more detailed description by promoters on program strengths and weaknesses.

3. The community, led by the coordinator for the SIF environment unit, evaluates the request and makes a decision based on the geographical area and funds.

4. The SIF environment unit, based on its database, makes a tender for contractors to bid on stove projects. To make an offer, each contractor must have made a prior visit to the community.[81]

5. The SIF environment coordinator nominates a three-person committee to evaluate the offers and make a selection based on the lowest price.

6. The contracts and training-program supervisors are selected and evaluated.

7. The contract is awarded to the lowest bid presented by the contractors, supervisors, and trainers. The SIF provides an internal evaluator to make a joint project assessment.

A.M.12 **Plan International**: This is a private, child-sponsorship development organization. It receives technical assistance on stove construction from Tezulutlán, a rural development project funded by the European Union, which terminated operations in 2002. Tezulutlán developed a specific, plancha-stove model called the Tezulutlán model.

A.M.13 The difference between the SIF plancha-style, stove model and this one is that the stove base is constructed from local materials, such as adobe or clay mixed with cow dung. The blocks or bricks of the combustion chamber are arranged diagonally instead of vertically; they lean approximately 30 degrees toward the outside. The justification for this difference is that reducing the size and intensifying the heat increase the efficiency of the combustion chamber. Other differences include the support base for firewood in the stove door and a chimney constructed out of cement or ceramic tubes.

A.M.14 Generally, the method of constructing plancha stoves is to contract a local NGO, which is responsible for constructing stoves in the homes determined by Plan International. For each stove constructed, Plan pays Q500.00 to cover the costs of the chimney, plancha, stove door, combustion chamber, construction quality, and transport.[82] Each beneficiary must contribute blocks/bricks for the stove base, cement, lime, sand, labor to support construction, and clay/mud to fix the blocks/bricks.

A.M.15 Plan International constructed approximately 1,703 stoves between 1999 and 2002 in the communities served.

A.M.16 **INTERVIDA**: This is a Spanish NGO that supports community development in Guatemala through a program that supports children with European donations.

A.M.17 From 1998 to 2002, INTERVIDA implemented plancha-stove projects, with more than 9,000 units constructed. The goal of stove-building was to

[81] Contractors that have more than five SIF contracts are not considered.
[82] The exchange rate used in this report is Q7.80 equivalent to US$1.00.

contribute to basin management, reduce fuelwood demand, and improve users' living conditions. The plancha model is similar to that of the SIF, with the difference that it has space only for three pots.

A.M.18 The method used in stove projects is to contract a person, for an amount of about Q604.50, to build stoves in selected communities. This amount includes all materials, wages, transport, and benefits; each beneficiary community makes arrangements for the person's accommodation, and each beneficiary provides labor. This investment is a loan, not a donation. In one year, beneficiaries must pay Q800.00, and allocate the difference to the available fund to facilitate income-generating initiatives for the community.

Cost Components of the Improved Stove

A.M.19 Listed below are the components that determine the cost of a plancha stove.

- The stove base can be made from less expensive materials, such as adobe mixed with cow dung, adobe, or from more expensive materials, such as cement blocks.
- The combustion chamber can be built less expensively by using clay or adobe or more expensively by using ceramic bricks or even special hard bricks. Lime mixed with clay is also used as a cement substitute to hold bricks together.
- The plancha that defines the cooking surface or active area can use less costly materials, such as concrete, or more expensive materials, such as a steel sheet or even cast iron.
- The chimney that expels gases from the combustion chamber can be made of less expensive materials, such as ceramic or concrete tubes, or more expensive ones, such as galvanized iron, or even more costly ones, such as stainless steel.
- The quality of accessory materials, such as hooks to manipulate the rings and the stove door.
- Unskilled, local labor is generally voluntary, but could be an opportunity cost if contracted locally.
- Transport is usually by truck, and even could be by individuals from the community or by animal. The contractor could be a less expensive NGO or a more expensive engineering company.
- Beneficiary training in stove operation, basic care, and maintenance could be less costly with institutional promoters or, conversely, more costly using specialized consultants.

A.M.20 Through a combination of these components, stove cost and quality could vary significantly. Some institutions must pay a supervisor to maintain the quality of the contractor and training services.

Author's Costs

A.M.21 As a point of reference, this author proposed building a stove with the aim of comparing project costs, as illustrated in Table M1. The cost of the stove proposed should be interpreted as: final expected cost for a plancha stove, taking into account the average costs of materials of available market quality, including cost of delivery to the home and contracting a builder experienced in stove construction. In addition, the cost was estimated for a family member's voluntary labor in helping to construct the stove. To estimate the author's cost, the costs for a model SIF stove were used as a reference.

A.M.22 As Table M1 shows, the author's cost estimate for a plancha stove installed by the SIF project is Q719.25. If this were not a SIF project stove, the cost could be reduced to Q709.25 by eliminating Q10.00 for warranty coverage.

Table M1. Author's Cost Estimates for Plancha-stove Installation (in Q)

Item	*Unit*	*Quantity*	*Lowest price Q/unit*	*Highest price Q/unit*	*Average price*	*Total cost Q/item*
Blocks	Block	30	1.8	2.0	1.9	57
Cement	Bag	1	35	38	36.5	36.5
Sand	m^3	0.5	45	48	46.5	23.25
Adobe	m^3	0.5			30	0
Bricks	Brick	120	0.425	0.475	0.45	54
Lime	Bag	1	15	16	15.5	15.5
Moldavia	Block	4	4	7	5.5	22
China for surface	m^2	0.76	25	25	25	19
Accessories	Set	1	20	38	29	29
Plancha	Plancha	1	120	200	160	160
Chimney	Chimney	1	41	75	58	58
Worker	Days of work	1	115	155	135	135
Local labor	Days of work	1			50	0
Transport	km	150	0.66	0.66	100	100
Subtotal						**709.25**
Warranty	Warranty	1	10	10	10	10
Total						**719.25**

Costs of Improved Stoves Promoted by Various Programs in Guatemala

A.M.23 Table M2 compares the author's cost estimates with the costs reported by different SIF organizations and contractors. One can observe that Q500.00, presented by Tezulutlán, represents the lowest cost; it uses materials available locally in the communities for the stove base and does not contract a professional builder. This cost can be representative for a low-quallity stove using local materials and unskilled beneficiary labor.

A.M.24 Amounts of Q686.00, Q604.50, and Q623.00, presented respectively by the Inko Xanacón Association, INTERVIDA, and Plan International, represent the lowest costs for a good-quality stove, with a maximum hauling distance of 150 km. These costs can be considered compatible with the author's costs of Q709.25 for an SIF-recommended stove (without the warranty). These amounts do not include the costs for NGO contractors.

A.M.25 The amounts of Q782.00 and Q860.00, presented respectively by DICONSI and Cornelio Díaz, represent the costs of a good-quality stove made by SIF private contractors. These costs are also comparable to the other costs of contractors (Rony Ralac, Q800.00 and Cesar Spell, Q750.00). They represent the lowest known contractor costs and include a profit and a 12% consumer tax (IVA), with a maximum hauling distance of 150 km. These costs are significantly higher than the author's estimated costs for an SIF project (Q719.25).

Transport Costs

A.M.26 Estimated transport costs will depend on the number of stoves hauled and the community situation, as well as distance of the community from places where materials will be bought. In order to obtain a more exact estimate of the transport cost, Table M3 takes into account the location of actual SIF projects included in the evaluation.

A.M.27 For each project, the distance from the closest distributor of ceramic bricks (considering Chimaltenango and Salamá) was calculated, as well as the closest distributor of cement blocks/bricks (considering the department of Guatemala as the closest). Finally, the number of stoves built was used as a variable. It was assumed that the rest of materials, such as the plancha, chimneys, cement, ceramic floor, etc., would be provided by the same place as the ceramic bricks. Potentially additional, transport costs were included;[83] a conservative assumption was made that this cost was equivalent to 50% of the distance from the community to the closest departmental seat.

[83] Additional transport is required because of highway and road restrictions. Transport trucks cannot access the community; thus, additional transport of materials is needed, which could be by dual-transmission vehicles, animal, and/or individuals from the community.

Table M2: Plancha-stove Cost Comparison; by Institution, Contractor, and Author's Estimates*

	Inko Xanacón[1]			*DICONSI*[2]			*INTERVIDA*[3]			*Tezulutlán*[4]			*Cornelio Diaz*[5]	*Plan International*[6]			*Author's Costs*[7]		
Item (unit)	*Amt.*	*Q/ unit*	*Q*	*Amt.*	*Q/ unit*	*Q*	*Amt.*	*Q/ unit*	*Q*	*Amt.*	*Q/ unit*	*Q*	*Q*	*Amt.*	*Q/ unit*	*Q*	*Amt.*	*Q/ unit*	***Q***
Blocks (block)	22	2	44	30	2.5	75	20	1.8	36	no	0	0	60	30	2	60	30	1.9	57.00
Cement (bag)	1	35	35	0.5	39	19.5	2.5	35	87.5	no	0	0	90	1	35	35	1	36.5	36.50
Sand (m^3)	0.25	48	12	0.5	45	22.5	0.5	46	23	0	0	0		0.25	48	12	0.5	46.5	23.25
Clay (m^3)[8]	0.5	30	0	0.5	30	0	1	30	0	0.5	30	0		0.5	30	0	0.5	30	0.00
Bricks (brick)	100	0.55	55	120	1.3	156	120	0.6	72	0	0	50	180	120	0.5	60	120	0.45	54.00
Lime (bag)	0	0	0	1	16	16	no	0	0	0	0	0		1	16	16	1	15.5	15.50
Moldavia (block)	3	5	15	4	6	24	2	5	10	0	0	0		4	6	24	4	5.5	22.00
China for the surface (m^2)	no	0	0	0.76	25	19	no	0	0	no	0	0		no	0	0	0.76	25	19.00
Accessories (set)[9]	0	0	0	0	0	0	1	26	26	0	0	0		1	25	25	1	29	29.00
Plancha (plancha)	1	300	300	1	250	250	1	140	140	1	250	250	350	1	150	150	1	160	160.00
Chimney (chimney)	1	50	50	0	0	0	1	40	40	1	100	100		1	41	41	1	58	58.00
Worker (work days)[10]	1	75	75	1	190	190	1	125	125	1	50	50	170	1	100	100	1	135	135.00
Local labor (work days)	1	50	0	1	50	0	1	50	0	1	50	0	0	1	50	0	1	50	0.00
Transport (km)	200	0.5	100	0	0	0	90	0.5	45	100	0.5	50		200	0.5	100	200	0.5	100.00
Subtotal			**686**			**772**			**604.5**			**500**	**850**			**623**			**709.25**
Warranty	no	0	0	1	10	10	no	0	0	no	0	0	10	no	0	0	1	10	10.00
Total			**686**			**782**			**604.5**			**500**	**860**			**623**			**719.25**

Note: In quetzales (based on an exchange rate of Q7.80 equivalent to US$1.00.

[1] NGO. The beneficiary provides lime, while accessories are included in the cost of the plancha.

[2] Private contractor. Accessories and chimney are included in the cost of the plancha, while transport is included in the cost of materials.

[3] NGO. Data based on the Fundación Solar stoves evaluation report; INTERVIDA currently contributes 100$ of the cost. In one year, beneficiaries must pay INTERVIDA Q800.

[4] NGO. Data based on the Fundación Solar stoves evaluation report. Worker is the same as training beneficiary; the base is constructed of local clay and adobe.

[5] Private contractor. All costs are included in the data reported. No other details were found.

[6] NGO. Plan contributes Q500, while beneficiaries cover the remaining costs of materials.

[7] Estimated costs are based on the SIF stoves-contracts manual.

[8] The price is recorded but is not included in the total cost of the stove.

[9] Includes the stove door and hooks to handle the plancha rings.

[10] Includes travel expenses and transport.

[11] Applies only to SIF-constructed stoves, such as DICONSI and Cornelio Diaz.

Table M3: Estimated Stove Transport Costs for SIF Projects (both Hypothetical and Actual)*

Project references	*No. of stoves*	*Project location*			*Transport costs (Q)*		
		Department	*Municipality*	*Community*	*Ceramic bricks*	*Cement*	*By stove*
A	100	Guatemala	Guatemala	Guatemala	1,320.00	300.00	16.20
B	100	Chimaltenango	Chimaltenango	Chimaltenango	240.00	300.00	5.40
C	100	Santa Rosa	Cuilapa	Cuilapa	2,808.00	3,510.00	63.18
D	100	Quetzaltenango	Quetzaltenango	Quetzaltenango	240.00	300.00	5.40
E	100	San Marcos	San Marcos	San Marcos	1,152.00	1,440.00	25.92
F	100	Izabal	Puerto Barrios	Puerto Barrios	8,400.00	5,760.00	141.60
G	100	Petén	Flores	Flores	13,032.00	11,550.00	245.82
21,702	33	Quetzaltenango	Sibilia	Nuevo Belen	600.00	600.00	36.36
19,128	100	Quetzaltenango	San Carlos Sija	Aldea Pachute	960.00	1,200.00	21.60
23,298	46	Chimaltenango	San Andres Itzapa	Caserio Panimauin	168.00	252.00	9.13
19,669	123	Chimaltenango	San Andres Itzapa	Caserio Panimauin	420.00	588.00	8.20
23,214	84	Alta Verapaz	Tucurú	San Juan las Flores	4,416.00	5,520.00	118.29
23,179	54	Alta Verapaz	Senahú	Syuc Selocbilchoch	4,338.00	4,338.00	160.67
23,217	88	Alta Verapaz	Tucurú	Nuevo Chintún	4,416.00	5,520.00	112.91
20,773	136	Chimaltenango	Parramos	San Jose Parrojas	576.00	672.00	9.18
79,420	198	San Marcos	San Pablo	Bello Horizonte	4,944.00	6,180.00	56.18
133,560	126	San Marcos	Ocós	Palmar II, Carrizales	6,120.00	8,568.00	116.57
209,260	73	San Marcos	Ocós	La Union	3,672.00	4,896.00	117.37
229,000	107	San Marcos	Malacatán	San Eduardo	3,540.00	4,248.00	72.79
231,290	192	San Marcos	Catarina	La Gloria	6,048.00	7,560.00	70.88
198,740	92	San Marcos	San Jose Ojeteman	Las Barrancas, San Fernando	3,216.00	4,020.00	78.65

*Assumptions: 3,500 ceramic bricks hauled by truck (per carga); 600 cement blocks hauled by truck (per carga); 11 tons hauled per loaded truck (per carga); 6 Q per km traveled by loaded truck; 10% per additional weight in trucks loaded with bricks, per transport of other materials.

SIF Costs

A.M.28 According to Table M4, SIF's estimated stove costs average 22.33% higher than those of the author. SIF probably anticipated this difference to accommodate the contractors' profit margin. There is a cost difference in materials and transport since SIF uses the data of different regions of the country, which is not always the lowest available cost.

A.M.29 Similarly, Table M5 compares the author's cost estimates with those of actual SIF projects. The assumed actual costs by SIF average 36.44% higher than the author's estimated costs. Again, the reasons are probably to accommodate the contractors' profit margin, which in reality are even higher than the SIF estimate (20-30%). Moreover, one of the goals of this organization is to stimulate market mechanisms. This statement justifies why one prefers to use contractor services to implement stove projects.

A.M.30 The SIF has had projects in the range of Q1,200.00-1,300.00, owing to transport conditions. The contractors maintain stove prices in the range of Q1,000.00-1,200.00. However, some mentioned that they could make project offers in the Q800.00-850.00 range and still make a 10-15% profit.

Table M4: Comparison of Author's and SIF Estimated Costs

Project reference	***Project location***		*SIF estimated costs (Q/stove)*	*Author's estimated costs*[1]			*% difference, SIF/Author*
	Department	*Municipality*		*Basic stoves*[2]	*Transport*	*Q / stove*	
A	Guatemala	Guatemala	792.56	619.25	16.20	735.81	7.71
B	Chimaltenango	Chimaltenango	895.55	619.25	5.40	723.50	23.78
C	Santa Rosa	Cuilapa	934.01	619.25	63.18	789.37	18.32
D	Quetzaltenango	Quetzaltenango	956.65	619.25	5.40	723.50	32.23
E	San Marcos	San Marcos	942.95	619.25	25.92	746.89	26.25
F	Izabal	Puerto Barrios	1,153.50	619.25	141.60	878.77	31.26
G	Petén	Flores	1,164.88	619.25	245.82	997.58	16.77
							22.33 % difference

[1] Includes (Q1,000/100 stoves) to cover SIF signed projects, a 2% increase to cover the warranty, and a 12% consumer tax (IVA).
[2] The author estimates the SIF costs per stove at Q719.25, minus Q100 transport since the specific cost of transport is calculated in this table.

Table M5: Comparison of Author's Estimated Costs and SIF Actual Costs

Completion date	*Project reference*	*Project location*			*No. of stoves*	*SIF costs (Q/stove)*	*Author's estimated costs*[1]			*% difference SIF/author*
		Department	*Municipality*	*Community*			*Basic stove*[2]	*Transport*	*Q/ stove*	
8-25-01	21,702	Quetzaltenango	Sibilia	Nuevo Belen	33	810.93	619.25	36.36	777.70	4.27
9-25-01	19,128	Quetzaltenango	San Carlos Sija	Aldea Pachute	100	863.00	619.25	21.60	740.57	16.53
11-25-02	23,298	Chimaltenango	San Andres Itzapa	Caserio Panimauin	46	1,000.00	619.25	9.13	738.09	35.48
5-03-02	19,669	Chimaltenango	San Andres Itzapa	Caserio Panimauin	123	1,009.59	619.25	8.20	723.42	39.56
11-22-02	23,214	Alta Verapaz	Tucurú	San Juan las Flores	84	1,107.14	619.25	118.29	852.70	29.84
11-22-02	23,179	Alta Verapaz	Senahú	Syuc Selochilchoch	54	1,092.59	619.25	160.67	907.63	20.38
11-22-02	23,217	Alta Verapaz	Tucurú	Nuevo Chintun	88	1,090.91	619.25	112.91	846.03	28.95
12-25-02	20,773	Chimaltenango	Parramos	San Jose Parrojas	136	1,029.41	619.25	9.18	723.76	42.23
1-14-03	79,420	San Marcos	San Pablo	Bello Horizonte	198	1,085.86	619.25	56.18	775.04	40.10
11-14-02	133,560	San Marcos	Ocós	Palmar II, Carrizales	126	1,134.92	619.25	116.57	846.77	34.03
10-14-02	209,260	San Marcos	Ocós	La Union	73	1,068.49	619.25	117.37	853.45	25.20
11-14-02	229,000	San Marcos	Malacatan	San Eduardo	107	1,084.11	619.25	72.79	798.27	35.81
12-14-02	231,290	San Marcos	Catarina	La Gloria	192	1,093.75	619.25	70.88	791.96	38.11
1-10-03	198,740	San Marcos	San Jose Ojeteman	Las Barrancas	92	978.26	619.25	78.65	806.48	21.30
					1,452					36.44% difference, avg. gain[3]

[1] Includes (Q1,000/no. of stoves) to cover SIF approved project, a 2% increase to cover the warranty, and a 12% consumer tax (IVA).

[2] The author estimates the SIF stove cost at Q719.25, minus Q100 for transport since the specific transport cost is calculated in this table.

[3] The percentage difference gain takes into account the effect of the number of stoves of each project on the total percentage of the cost difference between SIF and the author; that is, it is the sum of the column "no. of stoves," multiplied by the column "% difference SIF/author," divided by the total number of stoves (1,452).

Supervisory and Training Costs

A.M.31 SIF projects have supervisory and training costs aimed at beneficiaries. These costs are in the Q6,000.00-15,000.00 range for project supervision, minus the stove cost and Q8,000.00-13,000.00 for training.

A.M.32 The SIF training program covers three modules, and each module consists of two four-hour sessions each week. The module themes are:

1. Strengthening: self-esteem, human relations, organization, women's participation, functions of the community board of directors, community responsibility for the project, administration, and community monitoring and evaluation of stoves.
2. Environmental education.
3. Stove use and maintenance.

A.M.33 A key observation is to include in the modules the importance of the stoves in reducing health risks by reducing smoke.

A.M.34 In the cases of Plan International and INTERVIDA, the training program is carried out through their staff, focusing mainly on stove operation and maintenance. The actual cost will vary according to the number of family beneficiaries.

A.M.35 A cost estimate for a two-day training session (five hours per session) with 60 stove beneficiaries (30 beneficiaries per session) would be in the range of Q59.00 per beneficiary for an institution that uses its own staff for training to Q86.00 per beneficiary for an institution that uses training contractors.

Cost-reduction Alternatives

A.M.36 Improved-stove construction costs and methods implemented in Guatemala are still rather high to allow for market commercialization. Thus, dissemination depends heavily on donations, subsidies, and loans so that rural residents with scarce resources can obtain a plancha stove.

A.M.37 The plancha-stove dissemination phase is reaching a point where market commercialization is nearly ready. It is possible that the reason is because of SIF's strong dissemination of the plancha stove—more than 100,000 units—in the country.

A.M.38 Plancha-stove costs in Guatemala could be reduced potentially through mass production of portable stoves. Some plancha manufacturers are already producing a portable plancha stove that functions like a fixed plancha stove and can be installed in less than one hour. Helps International, a U.S. NGO, has developed a new portable, plancha stove that uses a more effective combustion chamber (rocket stove) and can also be installed in less than one hour.

A.M.39 The cost of producing a portable plancha stove through plancha manufacturers ranges from Q500.00 to Q600.00 for a small stoves and from Q900.00 to Q1,200.00 for a larger stove. The size of a small-model plancha is 18 x 24 inches, with space for two, three, or four pots. The interior of both models has a metal frame

construction that accommodates approximately 38 ceramic bricks for the combustion chamber, plancha, and chimney.

A.M.40 The large, plancha-stove model has an extra border of approximately 12 cm surrounding the plancha that protects against overheating and risk of burns. The small plancha-stove model could respond well to rural families' needs; however, it is important to learn whether there would be some risk of burns since there is no extra border around the plancha to protect the user.

A.M.41 The second option of the portable plancha stove is the model promoted by Helps International. The interior of this model has a cement-frame construction. The frame is supported by a base made of cement blocks, similar to those of the SIF stoves. The plancha size is 28 x 14 inches, with space for two pots. The combustion chamber is made of a rocket stove, which is probably more effective than the combustion chamber of a traditional plancha stove. The stove frame is filled with pumice to enhance insulation and efficiency. In addition, a chimney is connected to the stove.

A.M.42 The cost of the stove is Q520.00, which includes user training. About an hour is needed to install the stove, and an 11-ton truck can carry approximately 80 units. More than 400 stove units have been installed and are operative in Guatemala. Helps International expects to promote 3,000 more units over the next 36 months, with funding from the Shell Foundation.

A.M.43 According to Helps International, this stove saves 50-70% in fuelwood, and emits fewer particulates and less carbon monoxide than the traditional plancha stove because of the stove's rocket combustion chamber.

A.M.44 Helps International is promoting a stove without a chimney that is used outside the kitchen to prepare corn. It has a larger hole for pots and is made of a metal barrel with a rocket-stove burner. According to Helps International, this stove is important to complement a family's needs (it can be used to cook large quantities of corn or for celebration days), and also achieves an 80% savings in fuelwood. The cost of this stove is Q120.00.

A.M.45 Both types of portable stoves (the plancha and Helps International stoves), even with smaller planchas than the SIF stoves, should respond well to rural families' needs. Their price is lower, the cost of transport should be lower, and they require less supervision and time for installation. In addition, the stoves occupy less space within the kitchen area, their use is immediate (the SIF stove requires at least 20 days to dry before using), maintenance is easier, and they can be moved around.

A.M.46 However, this research did not evaluate the two stoves in detail, as was done with the fixed plancha stove. It would be worthwhile to evaluate their durability, use, and user acceptability. Only in this way can one reach a conclusion about the quality and convenience of promoting these stoves.

A.M.47 Given the advances that Guatemala has made with respect to improved wood stoves, it is recommended to create an agency or unit to coordinate and guide future projects; create a quality-control and technology-assurance agency; encourage more technology development, training, assessments, and studies; and promote

commercialization through cost reduction and loans. Ideally, this agency or unit should be part of the Ministry of Energy and Mines (MEM), but with a strong board that involves NGOs, the private sector, and user representatives.

Joint UNDP/World Bank

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

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	Lead Elimination from Gasoline in Sub-Saharan Africa. Sub-regional Conference of the West-Africa group. Dakar, Senegal March 26-27, 2002 (French only)	12/03	046/03
	1998-2002 Progress Report. The World Bank Clean Air Initiative in Sub-Saharan African Cities. Working Paper #10 (Clean Air Initiative/ESMAP)	02/02	048/04
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Last report added to this list: ESMAP Technical Paper 060/04.