CHAPTER I - INTRODUCTORY

STATE OF THE ART OF SOLAR COOKING
EARLY USES OF THE SUN TO SERVE HUMANITY

Human beings, as long as they have existed on this earth, have used both the sun and fire as means of survival. As backdrop for describing solar cooking programs around the world, the theme of this document, brief descriptions of the histories of the use of sun and fire (largely using wood from trees) are the topics of the introductory chapters. Both are inextricably connected to the history of humankind.

Visitors to the hallowed grounds of Stonehenge, now a major tourist attraction in England, are amazed at evidence that this handsome ring of upstanding stones, topped by huge horizontal pieces, is in fact an ancient calendar. Neolithic people who lived around 1500 B.C. learned, from years of observation and presumably some sort of record keeping, to understand the habits of the sun. They knew where and when it emerged from behind the earth (to human eyes) and what that portended for seasonally with its implications for harvesting or planting food crops, for preparations to survive in the months ahead, for appropriate shelter and food storage. The average contemporary person viewing Stonehenge probably first wonders how in the world they managed the physical problem of quarrying, transporting, standing the stones on end, and, most amazingly, balancing the top pieces far above the ground. But in many ways, the more astounding feat is illustrated by the very purpose of Stonehenge - a kind of annual calendar of natural events - and what it tells us about our "primitive" ancestors who knew so very much about how their world worked. Other similar edifices are found around the world, all testifying to detailed knowledge about the sun's regular and predictable patterns. Clearly, understanding and utilizing that knowledge was important in the story of human survival on earth.

Many cultures throughout history have considered the sun as a kind of deity, as the giver of light and life, the source of plenty, the enemy of darkness and evil. Around the world the sun is represented in art of many kinds, often associated with gods or

royalty who derived power from its mystique. Today we understand more fully that the sun is the source of all life on our planet. Its power creates photosynthesis, which makes plants grow which in turn feeds all life, including human beings. The earth's rotation around the sun initiates day and night; the varying tilt of the earth towards the sun is responsible for the seasons. The sun evaporates moisture from the seas, watering the land portions of the earth. Without the sun, all life would soon perish - small wonder that it has been worshipped, studied, and pondered on, and that humankind has tried through the ages to utilize its powers for many purposes.

In fact, the very power of the sun in ancient beliefs made the advance of scientific knowledge in Renaissance times difficult. How could anyone doubt, based on human observation, that the sun moved around the earth? Copernicus and his followers suffered mightily for scientific experimentation that established the basic framework of our current understanding of the solar system, the relationship of sun to earth, though counter-intuitive to human eyes. Copernicus and his followers, including Galileo, were all deemed heretics to question the heliocentric theory - but ultimately humankind was convinced by conclusive proof that, in fact, the earth does indeed revolve around the sun.

Whether fully understood or not, early humans clearly utilized the sun's power in many ways. The most complete examination of this usage is found in Ken Buti and John Perlin's 1980 book called Hie Golden Thread, 2500 Years of Solar Architecture and Technology (New York: Van Nostrand Reinholt). This work places solar energy in history in fascinating manner; sadly, the book is out of print and copies are very difficult to locate.

Early solar efforts include the success of early people in using the sun's energy to heat and cool living spaces. In ancient Greece, population growth was decimating forests; wood fuel was used heavily in small braziers to heat houses. Excavations of Classical Greek cities show that nearly all the houses, even entire cities, were oriented to the south, permitting maximum heat in cold weather, while large overhangs prevented heat from entering the houses in the summer months. Similarly the Romans considered the sun in planning human dwellings. Solar energy was used for greenhouses and cold frames, at least by the wealthy. Even "sun-right" laws were enacted to protect householders from other houses that might interfere with their sunlight. By the first century A.D., the

invention of glass made it possible to turn some rooms into veritable "solar furnaces", using the "heat trap" principle, the basis of solar box cookers. (The interested reader is urged to try to locate this fascinating book - or perhaps urge Van Nostrand to consider a re-issue.)

Before moving to solar cooking more explicitly, however, one major issue noted in the book must be highlighted. Little of the innovation cited above is well known as a part of human history. In nearly all the instances cited, a major motivating cause for the particular solar inventions described was scarcity or high cost of fuels, principally wood in those eras. When the shortage mitigated, or when other fuel sources emerged, the use of solar energy declined, a pattern that has been repeated over and over throughout time. Have we not seen the pattern in our own recent history? Recall, for example, the extensive promotion and sale of solar photovoltaic panels on household roofs in the 1970s (when fuel oil and gasoline shortages occurred and governmental policies were favorable to solar energy). Then think of the altered policy framework towards energy when the oil shock was temporarily over. Are we entering another time when solar innovation will once again become widely necessary?

The History of Solar Cooking

An odd antecedent of the current solar cooking movement is the story of what Buti and Perlin call "the burning mirror" (1980, Chapter 3). Greeks, Romans, and Chinese all explored the use of curved mirrors, which they found could concentrate the sun's rays in manner that would cause nearly any object to explode in flames. Interestingly, the use they perceived for this device was military - could they focus the burning mirror, as example, on an enemy warship? Burning mirrors were also used for less venal purposes, such as lighting altar fires and torches for sacrificial parades, but almost no other applied use was found. As will be seen later (See appendix section on Devices), the idea, now seen in concentrating solar cookers, is in use in many parts of the world today.

A more direct route to solar cooking came from extensive efforts to harness the sun for horticulture. Though found in Roman times in wealthy households, not until the sixteenth century (Buti and Perlin, p. 41) did glass become common and cheap enough to

be used for horticulture. Travel and trade on a global basis had seen the transport of tropical plants and fruits to northern countries, creating a desire for these products, which could not be raised in northern climates. First the Dutch and Flemish, then French and English built greenhouses for this purpose, heated only by the sun. Substantial horticultural activity focused on tropical flora and food crops, all raised under glass, in greenhouses huge in scale. Using southern exposure and insulation as needed, the greenhouse movement later inspired the use of "conservatories" or "sun rooms" in homes, as well.

The principle of the greenhouse, the so-called "solar heat trap", was further utilized in what is thought of as the very first attempt to use solar energy to cook. Many scientists of the era, and laypersons as well, knew about the use of glass to trap heat, but Horace de Saussure, a French-Swiss scientist, wondered why that commonly understood phenomenon had not led to additional applied use. In 1767, he built a miniature greenhouse with five glass boxes* one inside the other, set on a black tabletop. Fruit placed in the innermost box cooked nicely - and a new technology was born (Buti and Perlin, p. 55). De Saussure continued his experimentation, using other materials, adding insulation, cooking at different altitudes, etc. This European scientist, exploring solar energy nearly 250 years ago, is widely considered to be the father of today's solar cooking movement. Others followed his lead, including the Briton, Sir John Herschel, and American Samuel Pierpont Langley, later head of the Smithsonian, both of whom conducted experiments with the hot box, the forerunner of today's box cooker, probably still the most common design in use.

A French mathematician named Augustin Mouchot, working almost a century later, was eager to ensure that the learning of the past not be lost. He was more interested in practical application than in the number of interesting but not very useful solar devices which were appearing, using the newly discovered potential of the sun (whistles, water movers, talking statues, etc.). He began a search to use the sun's energy efficiently enough to boil water for steam engines, a venture that was not successful. His second project was more successful; he combined the heat trap idea with that of the burning mirror, creating an efficient solar oven from an insulated box, which when further modified by adding reflecting mirrors, even became a solar still. Eventually, he did create

an effective steam engine, but it was too large to be practical; he turned back then to the cooking challenge and developed a number of solar ovens, stills, pumps, and even electricity. His work was however short circuited by the advent of improved coal mining methods and hence lower cost fuels. His work, also, was caught in the situation of replacement by cheap fuels, rendering solar usage unnecessary and thus impractical for the time.

Late in the 19th century, other pioneers in the development of solar thermal (heat generating) technologies include Aubrey Eneas, an American who followed up on the work of Mouchot and formed the first solar power company, building a giant parabolic reflector in the southwest USA. Frank Shuman formed the Sun Power Company in Cairo to promote a solar driven water pumping system, and later a parabolic concentrator generating electricity. Other solar innovations have followed: motors and engines, hot water heaters, photovoltaic lighting, even crematoria. But throughout history, as in Greece and Rome and the Mouchot story, progress has repeatedly been interrupted by fluctuations in availability or cost of alternative fuels for all the above purposes.

More recently, Amory Lovins, writing in a Forward to the Buti and Perlin book, reminds us that today …" we speak of "producing" oil as if it were made in a factory; but only God produces oil, and all we know is how to mine it and burn it up. Neglecting the interests of future generations who are not here to bid on this oil, we have been squandering in the last few decades a patrimony of hundreds of millions of years. We must turn back to the sun and seek elegant ways to live within the renewable energy income that it bestows on us" (p. ix). He goes on to advise that countless earlier cultures have experienced dwindling fiiel resources and then were forced to rediscover earlier knowledge about practical solar energy, "bemoaning the absurdity of having to rediscover and reinvent what should have been practiced continuously" (p. ix). This document hopes, in some small way, to prevent that scenario from happening yet again.

More recent solar cooking history

In the early 1900s, a number of buildings designed to take advantage of solar energy were constructed, using heat trap principles, but were soon forgotten, then revived in the 30s when several largely solar heated office buildings were constructed. Double-

paned glass assisted with heat retention. World War II intervened, but after the war, the need for housing exploded, leading to new attempts, including solar collectors on roofs.

The contemporary solar cooking movement began in earnest in mid-century, with a few isolated attempts to create interest in the technology. In the late 1950s, the major personality, no longer well known to most, was the M.I.T. scientist, Maria Telkes, whose work on solar cooking occurred in the context of her professional activities in the housing field, particularly in using solar thermal energy to heat buildings. That interest led her to construct a classic box cooker, an insulated box of plywood with an inclined top of two layers of glass (with a small airspace between them) and four large flared reflectors. The design is used, in infinite variation, to the present day. (See appendix section on devices for diagrams of this and a number of current cooker models).

After that period, the years of the latter half of the 20th century show a number of individuals and groups experimenting with, demonstrating the potential, and conducting small and large projects using solar cooking devices. As early as 1955, a group of individuals in Phoenix organized themselves into an Association for Aapplied Solar Energy and held their first conference. Ultimately the group was the foundation of the American Solar Energy Society and its international counterpart, the International Solar Energy Society. Growing fuelwood and other energy shortages, coupled with expanding populations in China and India, encouraged governmental research on alternatives in the 1970s, with China holding its first seminar on solar cooking in 1973. China began distribution of subsidized cookers in 1981. Additional impetus for investigating the potential of solar energy came from the oil shocks of that era, with considerable experimentation in both Europe and the U.S. as well as in Asia. The ULOG group in Switzerland and EG Solar in Germany, as well as Solar Cookers International in the U.S., have origins in the 1980s. Also in the 80s, an Arizona woman, Barbara Kerr, with other colleagues, continued to develop solar cooker models, to test their efficiency, to experiment with various materials, and to promote the technology. In 1980, Barbara Kerr and a neighbor, Sherry Cole, designed a cardboard box cooker "kit" that could be largely built by a customer, and was highly valued by those who purchased one. This work of these two women inspired the formation of Solar Cookers International. A few years later, the organization, again with the technical assistance of Barbara Kerr, pioneered the

introduction of a different type of cooking device, the panel cooker, a hybrid between box and parabolic. This invention was a breakthrough, as it was less expensive and thus able to serve the needs of the world's poorest inhabitants.

One might say that the founding of Solar Cookers International on July 11 *, 1987, was the beginning of an effort to link solar cooking promoters everywhere in the networking sense, since its intent was largely educational and networking. Coincidentally, on that day the United Nations declared that the world population had reached five billion people (just 13 years after it had reached four billion). The new organization declared then that at least one billion persons could benefit from knowing how to cook with the sun. Obviously, the organization has been required to up its goals routinely, as the world's population has continued to burgeon, to well over six billion in 2004, meaning that today the target group is over two billion.

Of some historical interest is the fact that before the founding of SCI in 1987, a major demonstration of solar cooking was supported in the Bolivian highlands, an area where wood was already scarce. Two organizations, the then Pillsbury Corporation and a non-governmental organization called Meals for Millions, jointly sponsored demonstrations of cooking and later taught villagers how to build ovens with local materials. In 1988, Pillsbury, in cooperation with Foster Parents (now Save the Children) sponsored a similar project in Guatemala. These projects were among the early nation-to-nation projects, starting a long stream of such projects around the world that continues to flow today.

Since that time, numerous other organizations have been formed to sponsor projects and promote solar cooking activity. Their work, as known from written documentation, is detailed in the chapters, which follow. This thumbnail sketch is only a small part of the history, much unknown even to solar cooking supporters, of the many men and women who have caught a glimpse of the potential of the sun to cook food and have attempted over the centuries to spread that knowledge to others who can benefit.

The bulk of the contents of this report document contemporary activity in the solar cooking arena, beginning roughly in the late 1980s and continuing into the new 21st century. While many sources have been investigated, it is of course not correct to say that everything that has been done is reported here. New promoters and projects appear often

and are only reported after some period of activity. The development of the "wired world" has made dissemination of knowledge faster and easier, but all are aware that the entire world is not wired, and that a digital gap still exists. That may well have prevented much information from being known. Obviously, updates of the information found here will be necessary and important. Additional information about projects reported here, and, even more importantly, projects not reflected here, is welcome and should be sent on to the address provided on the title page.

In the next chapter, the report turns to issues that comprise the rationale for solar cooking: deforestation, health related topics, and benefits to households and their members.

CHAPTER II

RATIONALE FOR PROMOTION OF SOLAR COOKING

This chapter attempts to explain, briefly, major elements of the rationale behind the solar cooking movement, that is, just why the spread of solar cooking is important for people and for the environment. The reasons can be grouped into the following: alleviation of environmental degradation, prevention of air pollution related illness and death, and economic and social benefits to people and households.

The relationship of wood used as cooking fuel to deforestation and environmental degradation

The major cause of deforestation is most commonly thought to be the conversion of forests to agricultural plots, principally by small farmers in poor countries. (A similar conversion, of course, occurred some time ago in the now developed countries such as the US and much of Europe.) In both contexts, historical and current, the basic cause behind the phenomena is population growth, made possible largely by improved health knowledge that has lowered infant and child mortality and increased the life span. Over time, that new knowledge is triggering a demographic transition from high birth rates to lower, but in the short term, very substantial population growth continues in much of the developing world. In the new millenium, although growth is slowing; demographers estimate that the world will reach a population of between 9 and 11 billion people before a "steady state" population is achieved.

Until roughly a hundred years ago, nearly all people on earth used fuel from trees as their major source for cooking. In the 20th century, modern sources of energy (natural gas, electricity, LPG or gas under pressure, and so on) for cooking became widely available in most of the world's cities and throughout developed nations. However, in rural areas throughout the world, the more modern sources are not always, or even widely, available. The common estimate is that in the 21st century, about one-third of all humankind still eat food prepared largely on wood fires. Some sources even suggest close

to half (Washington Consultation on Household Energy and Health, 2001). One might surely believe one-third (or even half) to be an improvement from the past in terms of forest preservation - but it is critical to remember that the world population has in that period of time quadrupled. The world population in 1900 was under 1.5 billion people, while today the world population is over 6 billion, meaning that two billion *(pins)* people are still using wood as fuel.

A hotly debated question over some decades concerns the relationship between deforestation and use of wood for cooking. Unfortunately, no global system is in place to provide statistical evidence that might shed light on that relationship (FAO, 1955, cited in Woodwell, 2001). However some facts are tracked by the United Nations Food and Agricultural Organization (FAO). With small variations, several of the most recent State of the World's Forests series published by FAO provide recurring information on what foresters call "roundwood", that is, trees cut down for some type of human use. The most recent document providing this information is the 1997 version (annual reports of some years focus on thematic issues, rather than statistics), which states that 45% of the "roundwood" cut in a year is used for industrial purposes, such as housing, furniture, paper, etc. The other 55% is used for "domestic purposes". (FAO, 1997.)

The 45%, further analyzed, permits breakdown into sub-categories of use (housing, paper manufacturer, etc.), but no break down of the 55% is provided. Almost by definition, the 55% used domestically is not, in fact, easily tracked, since the bulk of it has only "use value". The cut wood does not enter the formal economic marketplace since much is used by the wood gatherer for domestic needs (75-90% of which is cooking the family's food). Hence, the 55% has no "economic value" as it is not bought and sold in the marketplace[5] and is therefore not tracked at either micro or macro level. These data alone, suggesting that the majority of wood cut down is used domestically, make pertinent the question about the causal relationship between cooking and deforestation. Without attempting to argue that cooking is the cause of deforestation, can domestic use mainly cooking, really be insignificant in the alarming deforestation scenario?

A historical picture of the way in which the issue has been considered over the last 30 years is provided by a recent study done by European scholars. The document, called Fuelwood Revisited: What Has Changed in the Last Decade? was written by four

European scientists, two Swedish and two British. The study,examines the perceived impact of woodfuel collection on forests, and related policy attention, over the last three decades of the 20th century.

The oil shocks of the 1970s, and resultant focus on energy issues aroused considerable concern about the world's forests, with considerable research and publication, policy attention, and limited action. The actions suggested included the search for alternative fuels, design of more efficient stoves, and improved wood production, including promotion of household woodlots. A reappraisal in the 1980s indicated that the expected shortfalls of fuel had not occurred with only a few location-specify problem areas. The result was an overall lowered focus on fuelwood shortages as related to domestic usage, and far less attention to the topic. Another turnabout came in the 1990s as the deforestation problem continued unabated, but with slightly different foci. The emphasis came to be more on the burden fuelwood gathering placed on women and children, on ecological damage from over harvesting of trees and/or using dung for fuel rather than fertilizer. In all the periods, the study concluded that insufficient policy attention has been paid to the issue.

In the early 21st century, according to the researchers, two aspects of the situation are receiving attention: 1) the average magnitude of fuelwood and charcoal usage and direction of changes in each, and 2) patterns of fuel supply and their impact on forest resources. All available studies indicate that patterns of fuel usage will continue to go upward. Interesting in this respect is data that suggest fuelwood use is declining slightly, but the use of charcoal is increasing rapidly. That fact is important because charcoal, while desired by urban populations, is a less efficient manner of utilizing the energy of wood, since a substantial amount of the energy is consumed in making the charcoal (particularly true under less than high efficient production modes).

The authors are throughout careful to declare the tentativeness of their conclusions, given the inadequacy of data and uncertainty about its accuracy. The overall picture is complex and policy implications are not clear. One policy issue does emerge clearly - it is that "woodfuels have not received attention commensurate with the fact that they are amongst the main forest related inputs to poor household systems almost everywhere (Section 5.1 - Fuelwood Revisited, unpaginated).

For purposes of this review, the document is only one more example of the lack of attention to the nexus between the fuelwood/deforestation issue and the domestic use of wood. Solar cooking promoters have been routinely told that there is no connection between the two - but how can one doubt that there is at least some relationship?

One other related way to look at the issue comes from average estimates of household usage of wood. These data are not plentiful and of course there is substantial variation in various parts of the globe. Refugee camp studies however provide sites where usage is frequently monitored, sometimes for environmental reasons, sometimes because fuel must be supplied and the supplier must therefore know an amount

In 1996, the German development aid agency, GTZ, published a small monograph on Meeting Energy Requirements in Refugee Situations. The agency had worked in a number of camps in Africa and attempted in this publication to draw together their experiences and conclusions. Buried in the appendices of the document, one finds that GTZ used the figure of .7 kilograms per day per person as fuelwood requirement in a warm dry climate and up to 2-3 kilograms in cooler climates. Variation is attributed not only to climate, but also to types of food, some of which take longer to cook than others.

A report from CARE is found in the same document. That agency estimated fuel consumption in Tanzania at around 2.7-2.9 kilograms per day per person, and distributed the amount of .75 kilos. Variations in need between large and small families were noted, and as is obvious, all had to obtain additional fuel beyond what was issued, usually trading food for fuel (GTZ, 1996).

SCI projects in Ethiopia and Kenya (in warm and dry places) estimate that refugees use roughly just under one kilo per day per person. In the Kenya camp, fuel was provided, but as in Tanzania, an insufficient amount which means that food is used to buy fuel - unfortunate as the food ration is carefully calculated at "survival" level.

Based on the above, and for simplicity, a rather bare (refugee camp food type) minimum could be calculated as around one kilogram per day per person. Multiplying that by the number of person around the world whose food is cooking with wood and the quite astounding daily figure is 2 billion kilograms or 4.4 billion pounds consumed every day. The annual total is an amount beyond comprehension for most. Given the other

consequences of cooking with wood, it is difficult to conceptualize cooking as an insignificant use of wood and the world's forests.

Beyond those global issues, in specific instances, large migrations of people caused by civil and political strife have created not only human tragedies but also ecological damage almost beyond repair. One such instance, as example, was the massive movement of refugees out of Rwanda into neighboring Zaire (now the Democratic People's of the Congo) in 1994. More than a million people exited their homeland and settled in camps in then-Zaire, located near the Virunga National Park, a World Heritage site and home of the famed mountain gorilla. In short order, 7,000-10,000 cubic meters of wood were being collected daily for fuel and shelter. In addition, the gorilla population was seriously threatened.

In Kenya, near the giant Dadaab Camp near the Somali border, laws were enacted to prevent harvesting wood, as degradation became evident for a larger and larger circle around the camp sites. Laws did not however prevent refugees from continuing, at the cost of considerable personal danger, to collect wood to cook food for their families.

While not detailed here, the reader must also be reminded of the long term consequences of deforestation with its accompanying potential for erosion, desertification, long term soil degradation, loss of the "carbon sink" function of growing trees, and the like. Presumably most citizens of the world are in agreement that deforestation is not desirable for these and other reasons Buti and Perlin, whose book on humankind's use of the sun's power, also write of forests. They argue, in an elegant and more complex explanation than is possible here, that those nations, throughout history, which allowed degradation of their forests, inevitably suffered serious economic and social decline. Currently, the phenomenon is occurring worldwide - according to Buti and Perlin, we almost certainly should be worrying about the future of our world.

Health Consequences

Over the years, many health professionals have noted the consequences of inhalation of smoke and particulates of various kinds from open fires, and indeed, most people have experienced the phenomenon themselves, the cough, choking, stinging eyes, etc. from being too close to the campfire. But only recently has the scientific information

come fully together to disclose the full consequences of what is tiow known in the public health world as Indoor Air Pollution or IAP.

Many probably tend to think of pollution as an outdoor air issue, which of course it is. But the indoor environment in poor countries where various biomass materials are burned as fuel is now known to be a serious health hazard. In 2002, the Shell Foundation sponsored an online forum on household energy and health, led by an expert on the topic, Kirk Smith, an American academic and consultant to Shell. He estimates that about half the world's households use some form of unprocessed solid fuel, including biomass and coal, with substantial variation around the globe. Almost no one in the developed world uses wood routinely, but very high percentages, over 80%, of households do so in parts of Asia and Africa. Fuels for cooking, particularly wood, charcoal, or dung, produce a range of emissions, which contain carbon monoxide, hydrocarbons, sulfur, nitrogen, and respirable particulates. In unknown proportions, fuels are used inside houses, and, by definition, are used regularly and with people, particularly women and their small children, present.

A four-year study on the topic was carried out by Daniel Kammen, University of California-Berkeley and Majid Ezzati of Resources for the Future, and published in 2001 in the Environmental Health Perspectives, Vol. 109, 5, May 2001. The study utilized a sample living in rural Kenya, and explored the link between the degree of exposure and health outcomes, such as acute respiratory infections. Findings include the following: women have exposure levels two to four times higher than men; small children have the next highest exposure. Both groups also have the highest rates of other health complications. Both groups were found to have exposure levels far above the minimum suggested by WHO standards. Exposure rates are highest when an individual is close to the emission source. Non-cooks systematically are less exposed to the emissions and less prone to the related diseases.

Studies around the world furnish additional similar information. A number of those studies are summarized in a recent Washington Consultation on Indoor Air Pollution, Household Energy, and Health, held in November 2001. As in the Kammen-Ezzati study, the paper identifies both the level of pollution in the household environment and the degree of exposure. A number of important variables are identified, such as

presence or lack of a chimney when cooking is done indoors, characteristics of the cooking device, exposure patterns, and gender roles.

Conclusions based on multiple studies show strong evidence for a causal relationship between IAP and acute respiratory disease, chronic lung disease, and lung cancer. Evidence connecting IAP to the following is suggested but more tentative: upper respiratory infections, middle ear infections, asthma, tuberculosis, stillbirth and early infant death, eye irritation and cataracts. Research is ongoing on many aspects of the problem, from improving measuring equipment to standardizing disease outcome definitions for common use. The burden of disease in virtually all developing countries is large, with IAP gradually being recognized as the fourth leading cause of mortality.

The bulk of literature routinely, in almost all cases, suggests improving the efficiency of existing woodfuel stoves, to reduce emissions. No mention of solar cooking was found in the literature. That fact is interesting in view of the clear evidence that solar cooking is virtually the only technology, which has zero emissions, in fact, zero environmental impact of any sort.

From the health perspective then, given what is now known about the seriousness of both forest loss and the health consequences of continuing wood fuel usage, the rationale for solar cooking becomes strong and clear. There are zero emissions, zero consequences for the natural world, zero diseases from this energy source.

Other relevant concepts

Women who are solar cooks have many reasons for liking the device, in addition to those offered in the paragraphs above. As with all commodities which are becoming scarcer, the cost of wood fuel is rising rapidly. Many women recount their difficulty in being forced to use a majority of their food budget for fuel, with only a shrinking minority of funds left to purchase food. Solar cookers come in many forms and varieties (see the Appendix for a short discussion of various devices), some expensive, some cheap. But all function satisfactorily as a cooking instrument, which means that, after initial purchase or loan, no additional expense will be incurred for the fuel itself, which is now, and will always be, free to the user.

Another part of the rationale for solar cooking has to do with ease. The cook puts food in and can then leave it unattended, more or less (depending on the device and the location of cooking) while the sun's power cooks the food. Working women can put food out when they leave for work in the morning, and on return, find dinner ready. Other aspects of easy use concern the cleanliness of the pot, which never has soot or burned food to be scraped and scrubbed off, making the housewife both grubby and worn tired from the effort required.

There are of course also downsides. The cook must change her long held habits, particularly around the timing of cooking. Food is still expected at the same regular mealtime, which may mean starting in mid morning, rather than waiting until 5:00 p.m. to think about dinner. That may be the largest single barrier to overcome. In this writer's experience, that can be, and in many places, has been, overcome with adequate training and follow-up done by competent persons who are themselves solar cooks.

One could cite other benefits: the pleasure of knowing one is not causing, but rather aiding the earth to recover from deforestation and pollution, hence the reward of making the world of your children and other loved ones safer. Women also have the pleasure of joining in a sorority of women everywhere the world that are, through their performance of daily tasks, making a difference in the world.

Against that brief backdrop of reasons why, the next chapter turns to what has actually been happening in the world of solar cookers, with descriptions of programs found on all continents and many, many nations of the world.

CHAPTER III

CURRENT SOLAR COOKING ACTIVITIES MULTI - NATION PROVIDERS

The current, and to a lesser degree past, status of solar cooking programs around the globe comprises the content of this chapter. As the reader will see, the programs are varied in scale and scope; few, if any of the most ardent of promoters will know the full global picture that emerges here. While considerable information is published in a range of media, the information is largely anecdotal in nature, over time giving the- solar cooking community good information about current new development, but with no overall world context in which to place the new data. This report is intended to provide that broader context for interested persons.

The information is presented by continent, and within those, alphabetically by nations and areas (the term "areas" connotes a recognized political entity, even if not a nation). At the end of each chapter, a "statistical" picture is provided, giving a quick snapshot of the situation on the continent, masking of course, the detail found in the narrative, but allowing for generalization by continent and for comparison between continents. Making this information more readily available will better serve any and all parts of the world where solar cooking could be beneficial to people or to their environs.

Before proceeding to the continental pictures, the first section of this accounting of solar cooking projects and promoters around the world explores those organizations that have multiple projects or presence in more than one nation. All of their sub-projects may not be fully reported here; projects change continuously, either increasing or decreasing; descriptive material at any given time is known principally to the sponsoring organization itself. However, the presence on the international scene of these multi-faceted organizations is an important part of the total picture, as well as a major component in national programs in many countries.

The programs are of varying origins and have differing motivations, as will be seen. Some are focused only on solar cooking; for others, solar cooking is but one of the multiple activities of the agency or organization. Like describing much of human activity

in general, attempts to explain these varied and complex organizations take a variety of forms and are seldom neat and tidy. Where feasible, information that would enable the reader to obtain additional information is provided.

Multi-Nation Promoters
Programs of the United Nations

First, a look at the work of the United Nations and its associated agencies is appropriate; relatively little activity with regard to solar cooking has been found. The UN component focused on environmental issues, the United Nations Environmental Program (UNEP), is a logical place for an interest in the topic. A conference on the topic of energy use in refugee camps was held in November of 1997, and representatives of a solar cooking program in a Kenyan refugee camp were invited to attend and discuss the program. On another occasion, the author of this document personally called on representatives of the United Nations High Commissioner for Refugees (UNHCR) at its Nairobi headquarters, and was politely received but little interest in solar cooking was evident. No programming on the agency's part was mentioned at that time, but programs had been established in several refugee camps in East Africa. A large project had also been underway for some time in Pakistan, housing refugees from Afghanistan. Both the African and Asian projects were supported largely by non-governmental agencies.

At the UNEP meeting described above, a representative of the World Food Program (WFP) was present when a report on a solar cooking project in a Kenyan refugee camp was presented. He indicated the organization's interest in utilizing food as an avenue for prevention of environmental degradation; the thought led him to propose the use of World Food Program supplies to assist in the training of women in solar cooking. The idea led to an arrangement that became regular practice in Kenya's Kakuma Refugee Camp. The WFP provided food to all refugee camps, consisting of surplus foods donated by member states of the United Nations. The basic idea of the arrangement regarding solar cooking was that refugees, for whom only a subsistence level of food was supplied by the camp, could hardly be asked to risk their scarce food to experiment with what was, to them, an untried cooking method. Therefore, the food used in training cooks had to be provided. Its provision was a major cost and a logistical nightmare to the project's sponsoring agency, in this case Solar Cooker International (SCI). With the help

provided by the World Food Program, more refugee families could be served. (The food used in training was also a nice incentive for refugees to undertake this new learning - to get an extra meal for the family was a considerable luxury.) To the best of our knowledge however, no systematic attempt was made by the program's sponsors to enlarge on that opening with the WFP, nor was any attempt made to evaluate the program's effectiveness. In the latter years of the camp program in Kakuma, the food subsidies of the WFP ended.

Apparently the United Nations Emergency Fund for Children (UNICEF) had some interest in solar cooking at one time; a study on the topic was commissioned by that agency and conducted in 1993 in Kenya. The document is essentially a market study, designed to gauge interest in solar cooking in rural areas of that nation where access to fuel wood was scarcer each year and alternative fuels more expensive. It is an excellent study, with an outstanding bibliography for the time, but no further mention of any UNICEF programming has been located.

The United Nations Development Program (UNDP) has been approached on a few occasions by solar cooking promoters. That agency has also shown little interest in incorporating solar cooking into its programs. Earlier, a separate UN program existed, called UNIFEM, focused exclusively on programs for and with women. A possible relationship with that agency was explored. However, before the idea came to fruition, UNIFEM was folded into UNDP, and the existing emphasis on women no longer was visible.

UNDP does, however, administer a small grant program (using funding from the Global Environmental Fund or GEF, with funds from UNEP) in which grant awards are made at the country level by national committees created for the purpose. In a number of countries, solar cooking programs have applied and been granted funding under this auspice. One solar cooking organization, Costa Rica's Sol de Vida program, garnered considerable attention via a picture in the program brochure. In a recounting of non-governmental activity at the Johannesburg meetings, special note is made of the solar cooking program of another Costa Rica program, Association ANAI, which won the Equator Prize for its work in a nature conservancy area. Association ANAI teaches women to use solar cookers for income generating purposes, thus improving the family's

economic status with a range of benefits while also preserving the environs. (See Costa Rica section below for information on both projects.)

Despite the limited interest shown in its headquarters, The United Nations High Commissioner for Refugees has had perhaps the most direct experience with solar cooking programs under its auspices of any UN agency. With programs literally around the globe, this agency is responsible for the physical well being of millions of refugees, all of whom must eat regularly. The topic of cooking food is obviously of interest to the agency. In some cases, the provision of fuel is necessary (and expensive), as no other alternatives exist. In many situations, as for example, Mozambique, the environs suffered from extensive environmental damage inflicted by decades of war and the massing of refugees in camp areas. The obligation to restore the area, and its huge expense, caused donor nations to raise the issue, and to warn UNHCR to devise means to prevent such situations in the future. Solar cooking was one avenue to consider in prevention of environmental damage around refugee camps, a major component of which was the cutting of trees for cooking fuel. UNHCR, with this in mind, took the initiative in asking Solar Cookers International to plan a solar cooking program in a refugee camp; the locale chosen after considerable debate was AISHA Camp, located near the Ethiopian-Somali border. While details of that project are too lengthy to be discussed here (see case study below), it is clear that support for the idea within the agency was not unanimous, and that to a considerable extent, UNHCR staff in the national office in Addis Ababa did not support the program. Despite numerous bureaucratic problems, the solar cooking program in AISHA camp can be considered a success on many grounds: considerable fuel saving, lessening of environmental damage, and strong solar usage patterns with increasing use over the years, long established as the pattern of successful uptake for any innovation. UNHCR appears however to remain unconvinced, even by evidence of the success of its own project.

The largest scale endeavor undertaken by a UN agency in the broad realm of solar energy is the World Solar Program, 1996-2005, undertaken by the United Nations Education, Scientific, and Cultural Organization (UNESCO). The process that established this initiative included the creation of a World Solar Commission (made up on Heads of UN Member States), which held a World Solar Summit in Zimbabwe in September of

1996 to launch the work of the decade. Another part of this effort was the creation of a World Solar Cooking Program, under the auspices of a World Solar Academy, the body driving all activities of this endeavor. The feature article of UNESCO's August 1996 magazine, UNESCO Sources, entitled "The Power that Will Be" focuses on the potential of solar energy in the world's fixture.

Prior to the Zimbabwe meeting, representative of Solar Cooking International (see description of this organization and its work below) were asked to submit a proposal to conduct a solar cooking demonstration project in Zimbabwe. The goal was to have a concrete program in place to show to the Heads of State at their decade launching meeting, held in Harare. A quickly planned project was put in place in two locations in Zimbabwe, in collaboration with the Development Training Center of the University of Zimbabwe. Local women were trained and equipped as solar cooks, and by the September meeting, the new solar cooks prepared a fine lunch, consumed with pleasure and amazement by the Heads of State present. The Solar Decade was well launched; on this occasion, solar cooking was included in the thinking about solar energy. The Solar Summit concluded with the Declaration of the World Social Summit Decade, which would include a large-scale grant program through which governments could apply for funding to assist in the development of renewable energy sources and equipment of many kinds.

Another major outcome of the Decade's work, with regard to solar cooking, was a global meeting on the topic. A World Solar Cooking Program, headquartered in Milan, was created as a part of Decade activities. Its staff organized and sponsored a conference, formally titled World Solar Cooking and Food Processing: Strategies and Financing, held in Varese, Italy, October 3-6,1999. Hosted in an elaborate historic mansion, now a conference center, the meeting was the fourth in a series of international gatherings on the topic of solar cooking. The outcome, in addition to the usual good networking among promoters, produced Proceedings with important information on new developments in the field (See bibliographical reference). However, not long after the conference, the entire World Solar Programme appears to have gone into decline, and ultimately, demise. Little remains of its goals and nothing is known of its achievements, other than the conference. In the work of the larger Decade, substantial financial resources were

dispersed to nations, based on national goals and proposals for programming in development of solar and other renewable technologies. To our knowledge, little or none of those resources was made available to solar cooking programs and attempts to obtain further information have not been successful.

The decade's time period is still running, and at least a small staff continues to work in the Paris offices of UNESCO. Unfortunately, the issue of solar cooking appears to have been lost. A remnant of the work can be found in the existence of the Women's World Summit Foundation of Switzerland, which held a workshop on solar cooking and water pasteurization, described in the Solar Cooking Review of March 2003.

The United Nations, at its various headquarters around the world, holds numerous meetings at which both UN staff and those of the many allied UN organizations, along with representatives of the non-governmental organization community (NGOs), come together to discuss and learn more about issues of common interest. The solar cooking community is represented in UN circles by Solar Cookers International (SCI), an NGO with UN consultative status and hence eligible to attend all relevant meetings. The organization has representatives in New York and Geneva, who attend meetings of many types, attempting to promote interest in solar cooking. They disseminate information to enhance awareness of solar potential, urging insertion of the topic where appropriate in UN documents, and generally attempt to educate policy makers and conferees about the issue. They work to ensure that relevant UN agencies are informed about the potential of solar cooking for amelioration of environmental and health problems and for the improvement of people's lives.

A recent addition to the list of UN related organizations with activities related to solar cooking is the World Bank unit known as the Energy Sector Management Assistance Programs or ESMAP. The unit's role is provision of policy advice and technical assistance to governments in the energy arena. It conducts a range of specific studies, offers advisory services, and conducts pilot projects. As new knowledge develops, the unit offers training workshops and seminars, and a range of publications. One of their regular conferences, held annually, is called Village Power, addressing themes such as the empowerment of people, gender concerns, and issues of rural energy

access. The topic of solar cooking has not apparently appeared as yet on their horizon, but could do so in the future, since the overall topic is particularly germane.

ESMAP also has a grant program, available to governments, private sector entities, research institutions, and non-governmental organizations. The listed criteria would appear to lend themselves well to proposals for promotion of solar cooking; the potential of this substantial financial opportunity could be explored by interested organizations.

In the summer of 2002, representatives of UN member nations met in Johannesburg, South Africa, to participate in the World Summit for Sustainable Development. While nothing like a focus on solar energy could be claimed, the topic of renewable energy in the larger context was an important consideration in both the official and the non-governmental meetings that accompany all major UN meetings. Representatives of Solar Cookers International, the Solar Oven Society, and the large German-South African project (see descriptions below) were present to explain the solar cooking process and their organizations' work. Solar cooking demonstrations were held at the Ubuntu Village, site of the NGO operations. The activities came to be known as the "unplugged kitchen" and garnered considerable media attention, with articles in papers of many nations.

Mention must also be made of the Kyoto Clean Development Mechanism (CDM), one of the provisions of the United Nations environmental initiatives authorized by the Convention on Climate Change signed at the Rio de Janeiro Earth Summit meeting in 1992. The CDM is a financing mechanism, which might be appropriate for solar cooking programs; it permits industrial world greenhouse gas polluters to continue polluting if they enable others to sequester carbon dioxide or to cease polluting in some other way. The mechanism requires cooperation between developing and developed nations. CDM projects, which produce "certified emission reductions", can trade those credits to countries which then use them to certify that they (usually developed nations with substantial industrial pollution) are meeting their reduction commitments under the Kyoto Protocol by virtue of activities they support elsewhere. The developing nations, in exchange, receive financial support to continue environmentally sound efforts. The mechanism surely could be explored for its potential usefulness by the solar cooking

movement. (A German solar cooking pioneer, Dr. Dieter Seifert, has written and spoken extensively on this topic. He is the founder of EG-Solar, a German organization that works internationally. More information on this topic is found in the next section on national entities that work around the world.)

In the same vein, the United Nations has created a Trust Fund for New and Renewable Sources of Energy (NRSE), under the auspices of the UN Department of Social and Economic Affairs (UNDESSA), the United Nations Development Program (UNDP), and the World Energy Council. A presentation on the Trust Fund was made at the Varese conference. The examples used however were all for the installation of photovaic applications. But clearly, the Trust Fund could also be investigated as a possible source of funding for solar cooking activities.

International Non-Governmental Organizations (Ingo's)
Rotary Clubs - Rotary International

The programs of the Rotary network are widespread and varied. For a number of years, dedicated solar cooking promoters, most notably Califomian Wilfred Pimentel and his wife Marie, have been traversing the world, teaching local Rotarians about the wonders of solar cooking. Wilfred and Marie have personally taught others in over a dozen countries, including Zambia, Zimbabwe, Tanzania, Ghana, Kenya, and Rwanda in Africa, Mexico and Bolivia in Latin America. This work was made possible by several aspects of the Rotary operation, principally its ability to link Rotarians around the world to other Rotarians with common interests and needs. Those linkages are used in connection with a program that designates individuals as approved Rotary Volunteers. Volunteers are provided with travel money and subsistence costs for projects for which expertise and experience are requested by another Rotary group. 'The Rotary Volunteers donate their time, but are provided travel costs and maintenance in distant locations, as they share specific skills and knowledge. The Rotary Volunteer Program has now been superceded by a slightly altered structure. Rather than maintaining a corps of skilled volunteers as a pool of resources, volunteers are located on an as-needed basis, and then offered financial assistance (which can be considerable in the case of travel to distant sites) to facilitate their participation in international projects.

Another important Rotary program, which has aided solar cooking promotion in many countries, is the program of Rotary International Grants. The program, run on a competitive basis between interested chapters from around the world, provides funds to carry out projects for 3-5 years, after a pilot program has demonstrated its feasibility. The dollars can provide equipment, travel costs, supplies and other project expenses, but not salaries - the assumption is that Rotarians are not paid for their labor in a good cause. Grants are made annually, in amounts up to $50,Q00 to a number of Rotary clubs. Solar cooking projects have been awarded grants in a number of cases, including Turkey (see below in the section on national programs.)

Another and quite different approach to solar cooking is found within the overall structure of Rotary. In this case, a number of clubs contribute to a larger cause called the Temple Solar Project. Named after a deceased Rotarian leader, Bill Temple, the project invests in community size solar cookers, the model known as the Villager, produced by the Sun Oven Organization. To date, the project has raised funds to purchase more than 50 Villagers, at a cost of around $10,000 each (plus shipping costs, which brings the total cost per unit to $13,500). The units are placed in institutional settings, or used as income generating ventures such as bakeries, in developing nations. To date, the Villager ovens have been shipped to 13 different countries. To support this work, the Temple Solar Project solicits financial assistance from Rotary clubs around the world, from individuals, and from other organizations with which they have ties.

While all of the projects above require evaluation procedures, relatively little is published about their outcomes. However this worldwide network of men and women, largely business and professional persons, represent an exceptionally promising avenue for the promotion of solar cooking all over the globe, wherever feasible and needed. In the past, continuing today, the Rotary organization has played a major part in the near-elimination of polio through many years of concerted effort in hard-to-reach areas where Rotarians lent a hand to the World Health Organization (WHO) and the larger public health community. This remarkable resource might be encouraged to undertake a yet larger role in the promotion of solar cooking technology with its potential for lessening deterioration of the environment and its positive effects on the lives and health of so many.

World Association of Girl Guides and Girl Scouts (WAGGS)

The global headquarters of the Girl Scout and Girl Guide movement is located in the United Kingdom, but the heart of its activities in solar cooking is in California, USA, where the foremost advocate for solar cooking activities within the WAGS network, Ms. Barby Pulliam, lives. This tireless worker has conducted workshops literally around the world, on several continents and to hundreds of guide/scout leaders and leaders of other non-governmental groups at the same time.

WAGGS is an organization that has 100,000 volunteers, and perhaps ten million girl guides/scouts in the 70 countries where it is active. The organization is divided into five regions, is managed by a 17-person board, and holds a world meeting every fourth year, moving from continent to continent. The organization's mission is clearly stated: service to girls and young women. Programs employ the following principles: a value base, peer education (learning from one another), experiential learning (learning from doing) and volunteer leadership.

Ms. Pulliam has created training guides, cookbooks, CDs, Power Point presentations, and other educational materials on solar cooking. In the early years of her work, she principally conducted workshops for new cooks; more recently she has concentrated on training others to be the trainers of new solar cooks. A detailed outline for a 5-day training course for trainers is available for leaders of scout groups and other organizations. More recently, Ms.Pulliam (sometimes in concert with Rotary activities) has been promoting what is known as the "integrated cooking method". The approach teaches households how to create a complete cooking system, using a fuel-efficient stove (for times of rain or darkness), a haybox or retained heat cooker, and a solar cooker. Ms. Pulliam is an energetic trainer whose training is always accompanied by songs and exercises, in good Scout tradition.

To date, she has conducted workshops in over 20 countries, with an estimated thousand attendees. The overwhelming bulk of her work has been personally supported, at a very considerable cost to her. The WAGGS organization, in turn, has cooperated in the preparation and promotion of a badge in solar cooking for scouts and guides, as well as commitment to the programs of Ms. Pulliam.

Ms. Pulliam has, because of limited finances, been unable to conduct full-scale evaluations of the consequences of her very considerable volunteer effort. Her energy and enthusiasm for the cause of solar cooking is noteworthy and it is unfortunate that more adequate documentation of the lasting consequences of her work is not available. Her work in this area, dating to the early 1990s has been continuous and well integrated with WAGGS activities. The impact on girls and young women may well be considerable and a careful evaluation is clearly called for.

Nationally Based Multi-Nation Promoters
All-European

Much innovation in the solar cooking field has stemmed from the European continent, beginning with the laboratories of deSaussure (see chapter 1). European agencies and organizations serving many nations, that is, sponsoring programs in a number of countries around the world, will be introduced next.

The European Commission

The European Commission operates a Joint Research Centre in Ispra, Italy, which focuses on renewable energies and their practical application. The Centre is particularly interested in the potential of solar energy as a substitute for the burning of wood fuels and the greenhouse gas emissions that practice creates. Center scientists estimate that solar cooking and food processing could be appropriate for up to 2 billion people worldwide, and urge its continued development. Attendees at the World Solar Cooking Program sponsored conference in Varese were privileged to visit the Centre to observe its activities, largely research oriented with policy implications to follow. Little is however known about their actual activities.

European Committee For Solar Cooking Research

A less formal non-governmental committee of Europeans has worked for the last several years in conducting research on a range of solar related topics. The group calls itself the European Committee for Solar Cooking Research (ECSCR); it was active in the evaluation of a number of devices as potential choices for the large German sponsored South African project (discussed below). Michael Grupp, a physicist and writer on solar

cooking, and Agnes Klingsheim of the German Technical Cooperation Organization (GTZ), have served as coordinators of the work. Recent activity included assistance in production of a film for promotion of solar cooking, called "Bon Appetit, Monsieur Soleil". The film showcases parabolic cookers, making essential points regarding the technology, such as acceptance by consumers, advantages in time and fuel saving, prevention of deforestation, etc. It was made specifically for use in Burkina Faso, using its three main languages of Moore, Diallo and French, and is available with subtitles in German and English also.

National Programs
France

France is the home of the Virtual Laboratory of Solar Domestic Applications. The organization has a number of associates located around the world; its principal function is the issuance of an electronic news bulletin for dissemination of information about new devices to be shown to potential consumers. The associates come from the following nations: Paraguay, France, United States, Poland, Bolivia, South Africa, Nicaragua, and England; all are well known names in the solar community. The news bulletin itself is useful, skillfully designed, with excellent photographs and good documentation, enabling the reader to obtain additional information or to purchase equipment. The organizer of this activity, Andre Kotowski and his wife Sophie, are themselves designers and promoters of solar cooking devices of many types. This is an excellent source of information on current developments in solar usage for household purposes.

Subscription to the information bulletin is free, and subscribers come from many parts of the world. Materials are published in English and French. Many articles are accompanied by stunning pictures of the new or improved devices. The bulletin serves as a valuable communication device on recent developments in solar cooking technology (Kotowski@wanadoo.fr).

Another organization has proven to be a supporter of solar cooking, although the topic is not its major focus. The French organization called INTI has been a key supporter of work described below in the section on South America, Bolivia. Bolivian INTI provided both technical and financial support to the work of Sobre la Roca, a Bolivian organization that is among the continent's most impressive promoters. In a different

context, INTI is providing assistance to a Moroccan civil servant who is attempting to initiate solar cooking activity in her country.

Germany
EG Solar

EG Solar, a prominent worldwide solar cooking program, has its headquarters in a small southern German town. Centered in a national industrial school, founders Dieter and Imma Seifert, with the assistance of other family members and friends, registered EG Solar as a charitable organization in 1993, though their activities date back to the early 1980s. The organization has been very active in promoting parabolic cookers, of varying size and characteristics, literally around the world. Their strategy is based on the underlying assumption that people can assist themselves by constructing the^cookers. The cookers' components are manufactured in Germany and shipped with instructions which are "word free" - entirely pictorial - and thus relatively easy (though time consuming) to assemble into the finished product. The Seiferts also make available, as needed, the equipment to produce most of the parabolic cooker's components, even in places without electricity. Because of difficulty of obtaining appropriate materials and the need for quality control, the shiny aluminum panels that constitute the parabolic reflector itself are made in Germany and shipped around the world. The Seiferts conduct workshops in Germany on the construction and use of the devices, as well as in many other countries of the world. This German based operation is among the larger, if not the largest, such program in the world. They report that 15,000 cookers have been sold in over 80 countries of the world. (Printed brochure, EG Solar.) Among the nations where they have substantial sales programs are: Afghanistan, Ghana, Haiti, Mauritania, Namibia, Nepal, Zanzibar, Zimbabwe, South Africa, and Uganda and many others.

Dieter Siefert has been active in promoting solar cooking as one way to reduce the emission of carbon dioxide and other greenhouse gases into the atmosphere, contributing to the greenhouse effect and global warming. He has urged the consideration of solar cooking programs as eligible for carbon credits as envisioned in the United Nations Joint Implementation/Clean Development Mechanism, that permits the exchange of "carbon credits" between developed and developing nations. One such exchange is in place between the area where Dr. Seifert lives and an organization in Nepal, where solar cooking promotion is supported in this manner. Almost alone in the solar community to

explore this potential, Dr. Seifert offers to provide assistance to others in calculating carbon emissions as a prelude to applying for assistance in this carbon credit scheme {www.eg-solar.de}.

Solar Brucke

Solar Brucke is the German arm of the ULOG group, headquartered in Switzerland. See below for further information on their activities over many years.

Solar Institute-Julich

Another German group, somewhat less well known in the solar cooking community, presented a summary of their work at the conference held in Varese, Italy, in 1999. The Engineering Office for Energy and Environmental Technologies (IBEU) has its headquarters at the Solar Institute-Julich, a physical location within a technical high school in Julich, Germany. They report on the introduction of solar cookers in many countries, including Argentina, Brazil, Chile, India, Mali, Nicaragua, and South Africa. The device they promoted is called the "Schwarzer"type. Named the Sunfire, it is a system with flat plate collector and reflectors, doubled walled pots, and a thermal storage unit (using oil) which permits cooking to be continued after the sun has gone down. A 2000 article states that 200 such units have been installed, ranging from small home-sized ones to large scale institutional sized units feeding up to 500 persons, as reported in the Proceedings of the 2000 Conference, held in Kimberly, South Africa.

South West Information (SWI)

Three German men of varied backgrounds (one physicist, one chef, and one medical doctor) have been working in the Sahelian area of Africa for a number of years. The organization they have created is also sometimes called called Solar Cooking in West Africa (BSW). They have published a book on the topic (in German) that describes ecological and economic circumstances in Africa from the Sahel to Sudan. Against that background, accompanied by dramatic photos of desertification in the region, they suggest solar cooking as an alternative for consideration. The principal device associated with their work is an adaptation of the parabolic, called The Butterfly. Further information is provided on their work in the African section.

The Netherlands

A Dutch organization, the KoZon Foundation, sponsors solar cooking programs in several nations of the African Sahel, Burkina Faso, Mali, and Niger. The work was initiated largely as a result of the work of a Dutch woman, Wietzke Jongbloed* who began her work in Burkina Faso on her own initiative, in collaboration with a Burkina group. Later her work was taken up enthusiastically by KoZon and has spread to other nations. The Foundation's executive, Ben van der Pouw, has become a dedicated and demanding supporter of solar cooking, directing the foundation in serving a geographical area of great need.

More detailed reports on the work can be found in the country reports, as available. The methods used include the use of local women as trainers of others, extensive demonstrations of the technology in marketplaces and other community meeting spots, initiatives to encourage local manufacture of cooking devices, and support for evaluation of project work. The hallmark of KoZon activities is its careful attention to the training and follow up needs of new solar cooks, sensitivity to cultural factors associated with changing traditional ways, and the systematic evaluation of results {b.vanderpouw@worldonlinel.nl}

Switzerland
ULOG

One of the older, continuously operating organizations in the solar cooking field is the ULOG group. Ulrich and Lisel Oehler founded the organization in 1984, after they learned about solar cooking in Burkina Faso. (The Oehlers have now retired and the leadership of the group has passed to Michael Goetz.) The organization began with the development of box cookers, usually with slant fronts, known as the ULOG type. Some years later, an Austrian physician named Wolfgang Sheffler joined the Oehlers in their work. His contribution was promotion of larger parabolic cookers, used in schools, hospitals, or other community kitchens, many with heat retention features. Because members of the group believe that solar cooking is more than a tool for people in poor countries, they have promoted the use of solar cooking in central Europe as well as in other parts of the world. In all nations, they develop partnerships with local organizations

and firmly believe that free gifts are not valued, hence at least partial payment for cookers purchased is provided by the consumer.

The German partner agency of the ULOG group, Solar Brucke, has worked for some years in India, and is credited with helping to build a very large solar kitchen in Mount Abu, a community of the Brama Kumaris World Spiritual Organization. A number of other European solar promoters cooperate with ULOG in its programs in Europe and around the world.

A hallmark of ULOG work is its heavy emphasis on, in addition to the technology itself, use and follow up. They believe that involving women is critical, and that follow up must continue for several years. Their experience leads them to believe strongly that "development tourism, one person who knows little about solar cooking taking a cooker to a developing country and expecting it will be adopted" is doomed to fail.

The ULOG website is a useful source of information on their work and is linked to other related sites (www.cuisinesolaire.com). The site describes efforts of the ULOG group to spread knowledge about solar cooking by creation of a mobile "solar creperie" which is taken to outdoor festivals in Europe (see below for more detail).

United Kingdom
Wonderbox Products

Wonderbox Products are the brainchildren of an unusual British woman named Anna Pearce. A Quaker, Anna was born in South Africa but now lives in the United Kingdom. The Wonderbox is what most technologies designate as a "hay box", an insulated, tightly closed, box which will, once food is boiling, enable it to continue cooking or to keep cooked food warm for later serving.. She has also developed a patented solar cooker, based on the Wonderbox (which can be used as a backup if the sun fades) called "No Fuel Cooking for the Space Age". Ms. Pearce is an inventive, charismatic woman who has no desire to work with marketers. Rather, the devices are made in a workshop for disabled people, thus creating needed jobs, then distributed by charities to the needy around the world. A pamphlet she has written even provides guidance to any ordinary householder in an emergency, with advice on using the haybox, solar cooker, and an emergency wood stove, made of leftover cans, in order to manage

without utilities. (BOX AID, 11 Hill Top Lane, Saffron Walden, CB11 4AS, United Kingdom).

United States

Solar Household Energy, Incorporated (SHE, Inc.)

She, Inc. was created in 1997 by individuals who had ties with SCI (see below). The specific goal of this organization is the promotion of solar cooking by means of market initiatives. The rationale is that the non-governmental organizations of the world, primarily with charitable goals, were not sufficiently considering the potential of the market to assist in meeting the goal of widespread availability of solar devices, particularly for the poor. With non-profit status obtained in 2001, SHE, Inc. Jias provided consultative services to solar cooking promoters in a number of countries, forging loose alliances in Burkina Faso, Bolicia, Morocco, Senegal, and others. Most recently, SHE Inc. was a winner in the World Bank's Development Marketplace. The funds will support promotion of solar cooking, using an improved and more durable version of the CooKit in Mexico, principally in nature conservancy areas where the use of biomass is prohibited.

Solar Cookers International

Solar Cookers International is a non-governmental organization, headquartered in Sacramento, California. The group was inspired by the research and development of one of its founders, Barbara Kerr, who wrote on the topic, developed a range of cooker types, rigorously evaluated types against one another, and is widely thought of as the U.S. founder of the current solar cooking movement. Barbara is the denizen of the Kerr-Cole Sustainable Living Center, located in Taylor, Arizona, a home that serves as a living laboratory and experiment station for many sustainable technologies. She is also the author of The Expanding World of Solar Box Cookers (Mimeo, 1991, revised version, 2000) and a forthcoming book on The Kerr-Cole Solar Wall Oven.

A group of Sacramento professionals, having learned about solar cooking from Barbara Kerr, incorporated the organization in 1987, initially as Solar Box Cookers International, Incorporated (SBCI), later changed to Solar Cookers International (SCI) to indicate the organization's commitment to promoting all solar cooking devices. In its

early years, the group worked principally in California, giving workshops on how to make and use solar cookers, conducting demonstrations at public events, and developing educational materials on the topic. Over the years, however, the organization took on the role of focal point for solar cooking activities around the world. In that capacity, SCI provided assistance for meetings and conferences to burgeoning groups of users in Central and Latin America, assisting them to come together and learn from one another. SCI also sponsored three world conferences, bringing together interested persons from all continents. In Stockton, California in 1992,150 people representing 18 nations were present; in 1994, meeting in San Jose, Costa Rica, 249 from 44 countries attended; and in Coimbatore, India, 1997, over 200 persons from 20 countries came, including representatives from all Indian states and over 50 research institutions in that nation.

In the middle nineties, SCI initiated a major field program. A new cooker type, called the CooKit, had recently become available (see Appendix section on devices). The CooKit is a hybrid, somewhere between a box and a parabolic, made of cardboard with reflective material such as aluminum foil, glued or laminated on the surface and folded in manner that focuses the sun's rays on a single pot,. The pot is enclosed in a plastic bag as as heat retainer. Since the device is inexpensive to make, it filled a clear need - solar cookers for the very poor - and thus made it possible for the first time to think about large-scale programs serving that population. Board members and staff agreed on the need to demonstrate in a large scale manner that ordinary people would find solar cooking useful, would adopt the technology routinely, would adapt it to their own circumstances, and would find solar cooking useful in saving fuel costs or time spent gathering wood. After considerable thought about a site, a refugee camp in Kenya was chosen as the first demonstration project of the organization. From its beginnings in 1996, the project is drawing to a conclusion in 2004, after distribution of over 20,000 CooKits. SCI is assisting its refugee training staff to create a solar cooking cooperative in order that the demonstration, sales, training and follow-up of solar cooking in the camp will continue.

In the same time period, two other projects in refugee camps were undertaken and completed, one after the entire population had been equipped with and trained in the use of solar cookers, the other aborted when problems in the camp made continuation

impossible (see sections on, respectively, Ethiopia and Kenya). One other small demonstration project was started in Zimbabwe in 1996, in collaboration with the Development Technology Centre of the University of Zimbabwe.

The project in Kakuma is one of the largest such projects of its kind. As this document is in press, a "final" evaluation of the results of the work has been conducted. One of the case studies found in the appendices of the study discusses the history and outcomes of this large project.

SCI has for some years hosted a website knows as the Solar Archives, the major source of electronic information in the field. Recently, they have established a second website, focused specifically on the work of the organization itself. SCI remains a small organization in terms of budget and staff, but is recognized as the core of global solar cooking activity and thus plays an important part in promotion of the technology. The two relevant websites are Solar Archive [www.solarcooking.org} and for SCI activities {www.solarcookers.org}.

Solar Oven Society

Another organization in the United States is the Solar Oven Society. The work of a Minneapolis couple, Mike and Martha Port, supported by an army of volunteers, has made possible the creation of a relatively low cost solar oven for use both in the US and in poor nations. The Ports have been active in solar cooking for many years, having worked in Jamaica, Haiti, and Central America. Originally they worked with wooden or cardboard box cookers, but have spent the last five years in development of a slant front cooker made out of recycled soda bottles. The result is both light in weight and less expensive than those made of other materials. The ovens can be assembled in their Minnesota headquarters (which also serves as incubator for a number of small non-governmental organizations) and can also be shipped unassembled along with all equipment needed for assembly in other sites.

The Ports sell cookers on the US market, earning a profit, which is then used to subsidize shipments to poorer countries. Four hundred cookers have been sent to and assembled in Afghanistan, creating jobs for workers there, and are now in the process of being sold along with the appropriate training in solar use.

The new cooker, called The Sport, holds two pots. An optional reflector that will increase its cooking power in colder weather is in production. This oven was intended to help fill the gap between the low priced cardboard cooker sold by SCI (the CooKit) and the considerably more expensive wood or metal box cookers, thus meeting a clear market need {www.solarovens.org}

Manufacturers of Solar Ovens

For solar cooking to be used more widely in all appropriate nations of the world, obviously solar devices must be available for purchase. While some devices can be made, others would be difficult or impossible to "do it yourself while meeting standards of durability and efficiency. Therefore a brief look at the world of manufacturers of solar cooking devices seemed appropriate; to that end, a listing of manufacturers found around the world can be found in the appendices, largely taken from the Solar Archives {www.solarcooking.org}. Clearly not all manufacturers are represented here, but the reader will see the range and variety of devices available currently.

Promoters have long been concerned about the fact that solar cookers are not very visible in the commercial marketplace. One or two environmentally oriented catalogs in the United States carry solar cookers, and a range of devices can be purchased through SCFs order form in the Solar Cooker Review. For example, the Real Goods catalogue offered both the inexpensive CooKit and the high-end Sun Oven for some years. But, for the most part, an individual who had come to know about solar cookers would not have an easy time locating a product to purchase. Currently, the major information route would probably be "word of mouth" (since all would not know about the solar cooking website).

Manufacturers of solar cooking devices are found in many countries of the world. Initially, except for China and India, the devices were designed, tested, and produced by non-profit organizations whose overall goal was assistance to poor people, and reduction of environmental damage caused by the use of wood fuels. Later, entrepreneurs also entered the market place, when it became obvious that customers would buy products of this type. (The situations in India and China are a little different; in both countries governmental support permitted a degree of subsidy that lowered the cost to consumers. See country reports for more information.) Most of the manufacturers of solar cooking

equipment, wherever located, would, of course, be pleased to sell their products around the world. Usually however the cost of shipping and the complexities of customs requirements mean that most manufacturers sell principally to domestic markets. Perusing the list found in the appendices will show that the country with the largest number of manufacturers appears to be India, probably related to the fact that the Indian government provided a substantial subsidy to entrepreneurs to establish solar cooking products. Others are however found in Canada and the USA.

Two manufacturers are particularly prominent in the world market; one is a business, the other a non-profit organization. Both have origins in the United States. Both focus principally on selling their cookers to markets outside the US and both have developed manufacturing operations in other parts of the world. Both are major promoters of the technology as well as sellers of devices.

The Sun Stove Organization

Richard Wareham is an American who has been involved in the production and sale of solar cookers for many years. He believes, and has demonstrated, that for a business or a non-profit organization the manufacture and sale of cookers must be either profitable (for a business) or self-sustaining (for a non-profit organization). He argues that a major problem with many programs in the past has been that most projects either subsidized or "gave away" cookers. Those projects eventually cease when funding dries up. The Sun Stove Organization therefore, while organized as a non-profit, operates in many ways in entrepreneurial manner. The website sponsored by the Sun Stove Organization is {www.sungravity.com}. It both serves as a selling mechanism, and as an excellent source of general information (including a fine solar cookbook).

Sun Stoves were initially manufactured in the US but now are made in South Africa, where registration as a non-profit has been obtained. Hundreds of Sun Stoves have been manufactured in Mexico. A Rotary organization in Calcutta, India, is also sponsoring a program for Sun Stove production and distribution. Unlike most solar cooker designers, Mr. Wareham has sought and obtained a patent on his product. He states, however, that other organizations can produce the product when feasible and with his permission. The product is a modified box model of plastic, light in weight, weather

resistant and relatively inexpensive. It was one of the designs chosen for use in the large German-South African project (see below in section on national programs). He has in addition designed another model for specific use of refugee populations, said to be relatively easy to make, discussed on the website. The focus of the Sun Stove group appears to be placed on sales in the US, but currently ently the market served by this organization appears to be largely international.
{www.simgravity.com/solar/solarcookmgjitirri.}

Sun Ovens International

Paul Munson is another American whose work with solar cookers began in the United States, when he purchased an existing solar cooking manufacturing plant from another American, Tom Burns. The device itself was developed by Mr. Burns, a retired restaurateur, with technical help from the Sandia National Laboratory in New Mexico. The work continues to be headquartered in Elburn, Illinois, U.S.A., but manufacturing and/or assembly is now underway in Ethiopia, Germany, Haiti, Ghana, Uganda, and South Africa. Mr. Munson has recently received substantial loan funding from the Overseas Private Investment Fund (OPIC) as well as a grant from U.S. AID for his work.

Sun Oven International is incorporated as a business. They produce two cooker models, one for household use, the other a large community sized device used in institutions, in bakeries or other food producing businesses. The web site reports that thousands of cookers have been shipped to 126 countries around the globe. In addition to the sale of assembled solar cookers, small and large, Sun Ovens can also make available a complete assembly system, which would enable local groups to establish the manufacturing process locally and then sell Sun Ovens themselves.

The Sun Oven organization utilizes a variety of tactics for promotion and sale of its products. The European operation involves partnership with European aid organizations, in order to facilitate the movement of Sun Ovens into a range of programming for developing nations. A different and interesting strategy is in use in Haiti. One community was selected as a test market. Women are provided with CooKits (the inexpensive cardboard cooker) with the proviso that they regularly use and record that use for a three-month time period. At the end of the period, those who have become

experienced and constant solar cooks will have earned for themselves a Sun Oven, with the amount of fuel saved by the CooKit used as a " payment". Given the background of considerable solar cooking activity in Haiti, it will be particularly interesting to see how this approach works.

Another ingenious plan is underway to fund establishment of a manufacturing unit in Ethiopia. Members of the expatriate Ethiopian community in the US are invited to donate a solar cooker to a family member or friend living in Ethiopia. The cooker, plus a training opportunity, will be provided in country to the recipient. Profits generated will be used to establish manufacturing within Ethiopia in the future, where an assembly plant is already in place, prepared to become a full-scale manufacturing site when possible. In addition, the expatriate donor will be gifted with a tree planted in his name in an Ethiopian reforestation area.

Sun Ovens has also partnered with a group within the Rotary International Association for the purchase and distribution of the large Villager Oven to many places around the world. The principal project supporting this effort is Temple Solar, described above under the Rotary heading. Over 50 such Villagers have been purchased and set up around the world with the cooperation of Rotary clubs from around the world, as well as donations from schools, churches and other organizations. The Villagers are placed in institutional settings such as schools or hospitals, and are also used in income generating activities such as bakeries.

In Uganda, a similar mechanism is in used to encourage sales of the Sun Oven in that nation. Initially, the component parts are being shipped to Uganda, where an assembly plant has been built. When demand is sufficient, a full scale manufacturing unit will be created to serve Uganda and neighboring countries.

The Sun Oven International firm, a for-profit company, is one of the larger distributors of high-end solar cookers in the world. The company has successfully teamed with a wide variety of non-governmental organizations to achieve its basic aim of providing assistance to persons living in sun-rich, but fuel poor nations, a market which increases every day {www.sunoven.com).

In the next section, programs by continent, and alphabetically by individual nations, will be described. The devices made or promoted by the above organizations will

be discussed, as appropriate and where known, in the specific nations where they are in use. At the end of the descriptions for each continent, a summary of efforts will be provided.

CHAPTER III A

SOLAR COOKING AFRICA

The gigantic African continent hosts the world's largest number of countries, some of which are large, others very small. The continent stretches from around 36 degrees north of the equator for over 5,000 miles to, at its southern tip, almost 35 degrees south. The continent is historically critical in human history, as on this continent, records of our earliest ancestors are found, dating back millions of years. Between one and two million years ago, those ancestors, early humans, began to disperse to all other areas of the world.

Africa is second only to Asia in size, and has historically high rates of population growth. Its population of nearly 800 million makes it the second continent in terms of population, though considerably less densely occupied than Asia. Africa is roughly two-thirds rural, although steady movement from countryside to city changes that figure regularly. Large areas in the interior are less populated than coastal areas; the Sahara alone covers almost one fourth of the continent. Other smaller desert zones exist also, along with dense forests, savannah plains of grass, enormous riverine systems, and mountains. Geographical variety is matched by an amazing diversity of ethnic, linguistic, and religious groups. The continent has considerable wealth in natural resources of gold, diamonds, precious minerals, but has been hampered in its economic development by problems of governance, fragmentation by language and nationality, many catastrophes, some natural (droughts, floods) and others man-made (poverty, disease, wars, famine).

Size and diversity mean that the continent also has rich and colorful histories. Those of northern countries are tied intimately to the Mediterranean Sea and the history of Roman and Greek conquests. Africa had great indigenous kingdoms as well, in Great Zimbabwe, Uganda, the Niger Delta, and Benin. From around the seventh century, substantial contact with the Arab world began through trade. In the colonial era, various European states established colonies and came to rule much of the continent, searching for riches to extract. One tragic outcome was establishment of the inhuman trade in

slaves that flourished for two centuries. At roughly the same time, others were introducing European religions to Africans - few seem to have noted the incongruity of those two "exports" to the African continent from Europe.

With European encroaching from virtually all sides, the continent was mapped and ultimately cut into colonies from afar by the close of the 19th century. Limited consideration was given to cultural or ethnic traditional boundaries in the dividing process. Haifa century later, in mid-century, the process of gaining independence from the colonial powers began in a rush, following the Second World War, with its dawning recognition of the inherent human rights of all human beings. The second half of the last century has been largely the history ofnewly independent nations, struggling to establish themselves and to survive in the fast changing global society. Africa continues to face that challenge in the young 21st century.

Against that brief background, a look at the history of solar cooking on this huge continent is provided, country-by-country. For the reader's convenience, the information is presented by nation, in alphabetical order. Considering the continent from a regional perspective may ultimately prove to be more useful for purposes of future planning, however. A later section of this study will look at groupings of nations, considering existing political and cultural ties, as a possible means of moving forward in the promotion of solar cooking on this and other continents.

All Africa

Based on information currently located, there is nothing like an all-African effort to promote solar cooking. The closest indication of interest in the topic is found in the existence, within the former Organization of African Unity (now renamed the African Union) of a Scientific, Technical and Research Commission, with a sub-committee on New, Renewable, and Solar Technologies. Discussion on the possibility of a plan for Promoting the Role of Renewable Energy Amongst Governments in Africa has been reported. A plan was to be developed to accomplish this promotion, but inquiries made failed to reveal the current status of this initiative.

Similarly, the European Community has created a "framework programme" on the topics of energy, environment and sustainable development. The activity focuses on

research, technological development and demonstration. It i§ the main instrument of European nations for cooperation with the world of science, economics, and politics. Driving forces for this activity include climate change, the need to address potential, strong demand for clean and affordable energy, and the liberalization of energy markets associated with globalization of the economy. The organization's targets include: meeting the goals specified in the Kyoto objectives, doubling the share of energy produced by renewable energy, improving energy efficiency, and maintaining the security of energy supplies. Within those goals, some specific actions include: integration of new and renewable energy sources into current systems, cost-efficient abatement technologies to reduce energy usage, development and demonstration of new energy sources such as biomass, wind, and solar and fuel cell technologies. The amoitious goals are noteworthy, and global in their implications.

More directly relevant to Africa (as well as to Asia and the Caribbean) the European Commission (EC) has also created a unique framework of co-operation, known as the Lome Convention, between its members and the 71 ACP (African, Caribbean, and Pacific) countries,. The EC created a special instrument, the European Development Fund, to finance programs in the energy area. It was clear that enormous investments in infrastructure were required to meet the needs of the ACP countries. Speaking at the world meetings in Varese, Italy, a representative of the EC demonstrated good understanding of the problems faced by householders, and collectively by nations, and called for efforts of many sorts, including solar cooking, to facilitate a shift to renewable energy sources (Varese, p. 39).

One non-governmental organization, Trans-World Radio (TWR), serves an all-Africa audience by means of short-and medium-wave radio transmission. The content of the radio programs has multiple purposes; some is straight news, some is evangelism, some is educational for varying age groups and audiences. The organization might best be called a missionary one, conducted largely electronically across the continent and in fact, world, but one with strong social programming. Its programs are delivered in over 100 languages, 27 of them African. It has 30 offices around the world, 7 in Africa.

In addition to the broadcasts, the Kenya office of Trans-World Radio has had a program to promote solar cookers in East Africa for over a decade. Supported by grant

funding from various sources, the organization has had an active'program of making wooden box cookers and training household cooks in their use. In the first 3 years, over 360 cookers were made and sold. TWR principally worked, in their on-site program, in the areas around Nairobi, but also had reached out to persons from other countries who were living in Kenyan refugee camps. In addition, TWR promoted solar cookjng on its radio programs, in the division on social development, and reached in this manner persons from across the continent, although the only specific help provided was written instructions on how to make and use a solar cooker.

Through a series of staff changes, the TWR program continues. Boxes are constructed in a course at a Nairobi Village Polytechnic, and sold at cost to potential customers, or in some cases, to a group of customers who pool resources to "buy a cooker to share. (TWR has been particularly active in Kakuma Refugee Camp - see case study on that project).

Other projects known are more or less limited to one nation. One exception, noted below, is the creation of an East African Resource Center on Solar Cooking in Nairobi, Kenya, intended to provide consultant services and technical assistance on solar cooking to the entire East African Region. (See Rwanda, Somalia, and Tanzania below).

Algeria

Nothing is known of programs in this country, which would however appear to be well suited for solar cooking.

Angola

Nothing is known about any programs in this country.

Benin

Relatively little information has been found about solar cooking activity in Benin. One individual, a man named Vincent Nnanna, writes of having aided in the building and distribution of around 200 cookers.n Information about his work and a Solar club in Benin with 20 members wis found in the SCI Review of November, 2002. (Vinnfish@hotmail.co.uk).

Botswana

At the world meeting held under UNESCO auspices in Varese, Italy, a representative of the Botswana Ministry of Minerals, Energy and Water Affairs was present to make a presentation, describing that government's plans for a National Solar Cooking Programme. In this country, fuelwood is the dominant household energy source in rural areas. While originally it was considered as a "free"commodity, increasingly people need to purchase wood that is ever more scare and expensive. According to R. Fagbenle, Director of Energy Affairs in the Ministry, woody biomass supplies 70% of the country's energy, almost entirely fuelwood for cooking. Less fuelwood is used in the urban area. The nation is increasingly aware of the problem of deforestation, which requires people to travel farther and farther to locate fuel sources.

The solar cooking program planned to begin with a pilot program involving two communities, one urban, one rural. The overall objectives of the program were ambitious, including the distribution of 550,000 cookers over four years. To date, no information has been located on the success, or indeed the implementation, of the program.

Burkina Faso

A thriving solar cooking promotion has been underway for several years, initially through the efforts of a young Burkinabe, William Ilboudo, who founded ISOMET, a business enterprise in the late 1990s. Other organizations also work in this Sahelian nation, which is ideally suited for solar cooking.

William Ilboundo had studied in Germany where he came to know about solar ovens. When he returned to his country, he started a small business, basically in his own backyard and with the assistance of family members, making and selling wooden box cookers. Because of the cost of the boxes, the audience was primarily a middle class one, at least initially. Even then, the ovens were usually sold on a pay-over-time business, and collecting the money proved problematic. Efforts to assist in the development of a micro-credit scheme, to be managed by a banking firm, were not successful.

In 2000, William, who is loosely allied with SHE, Inc. as one of that organization's roster of solar entrepreneurs, returned to Germany for another course of

study. On his return, a larger scale business plan was developed - one that would create a proper workshop and permit a number of employees to be used in expanding cooker production. Technical assistance in management of this effort was provided to Mr. Ilboudo by a Dutch representative of an association of retired business executives. A number of visitors and observers have evaluated the work done by ISOMET. All who have visited the project were impressed with the dedication of the workers and the quality of the solar products. Throughout the early years, Mr. Ilboudo continued to receive support from a number of German solar cooking experts, including Rolf Baeringer, a well-known solar cooker promoter. In 2000, a Swiss expert visited this Burkina Faso business and reported that over 150 excellent ovens had been built, and demand appeared to be steady if not spectacular

In 2003, M. Bonello, a European solar cooking promoter, visited programs in three West African nations, one of which was Burkina Faso. He reported that ISOMET now has four employees and is manufacturing a range of types of cookers. After several years of only working with box cookers, they now are also manufacturing the CooKit, the cardboard reflector that is the least expensive, but efficient, cooker available. 300 of these had been sold, following a major promotion on television. Currently, they sell around 50 of those per year.

In addition, William is importing kits for the assembly of small-scale parabolic cooking devices, far more expensive, but able to cook for up to 10 people. One negative aspect of this part of ISOMET's work is the necessity to pay a heavy custom duty of around 33% on the imported goods. (Paradoxically, the government subsidizes gas products, such as kerosene, at around 40%). Yet another part of the work of this organization is equipping school cafeterias with large-scale Scheffler parabolic devices, some equipped with tracking devices made from bicycle parts in the ISOMET workshop. Maintenance problems have been severe however with these more complex devices.

Topping off the work of ISOMET, Mr. Ilboudo and his workers have recently installed a solar bakery capable of producing 1500 loaves of bread a day. The bakery is equipped with 16 large parabolas, and has a heat retention system using a container filled with stones. This effort has been led by the Solar Institut Julish, using ISOMET staff.

The organization is currently building more spacious quarters and has additional large projects in mind.

Other promoters work in this nation, as well. The Albert Schweitzer Center for Ecology is located in Ougadougou; a part of its work is a Workshop for Solar Energy and Appropriate Technologies. The latter is a research and training center for farmers, artisans, and small business owners. An affiliate of the center is the German non-governmental organization, APEES, the Association for the Promotion of the Use of Solar Energy. That group has, in turn, affiliated itself with local artisans and with women's organizations to distribute solar cookers and dryers. In 2003, as reported by M. Bonello (see above), they had sold around 500 such units in the past decade.

Another company, SED, has been created by Boudacar Zongo, who was already in the business of provided various cooking devices, through his business, Household Energies. The focus of SED is on fuel conserving stoves, but they actively promote solar cooking as well. One promotional scheme included a small store located in a low income area of Ougadougou, where cakes, chicken, or other food cooked in solar ovens are sold. To increase traffic, they even installed a pay phone. SED receives technical assistance from the Albert Schweitzer Center for Ecology and its unit on renewable energy. Ougadougou would appear to be an excellent site for initiatives established by local entrepreneurs, perhaps a model for other cities and nations.

On the other end of the solar cooking range from the large scale parabolics is a project developed in a rural area of Burkina Faso. The pioneering site was the village of Goram-Goram, in the northern part of the country. Wietzke Jongbloed is a volunteer associated with the Dutch NGO, the KoZon Foundation. Wietzke started with 20 CooKits to introduce to village women. She is a very experienced solar trainer who first went to Goram-Goram in 1999. Already well acquainted with and supportive of the activities of ISOMET, where experimentation with the CooKit was underway, she decided to see what success might be had with the far less expensive CooKit in the rural areas.

The first 20 CooKits were given to two groups of women to try with their own cooking practices. Reaction was very positive and many asked that more CooKits be made available. After this "pilot", the KoZon Foundation was willing to support a larger

project. In 1999, 300 Cookits were made available for sale, though subsidized to make the price low enough to be feasible for the potential customers, who are very poor. The cooking kit comprised a thin aluminum pot, two plastic bags (used to retain heat in the pot) and the cardboard CooKit; the price was about $2.50 (actually, about the cost of the pot alone). Experienced solar cooks from the initial project later served as trainers for new buyers of CooKits. All the solar cookers sold very quickly and many more people inquired about availability of more such devices.

Sixty percent of the kits were purchased by women, 25% by men for their families (sometimes several, as multiple wives are common), and 15% to young single men, the latter becoming very enthusiastic users of the CooKit. Many families would like to have more than one CooKit, as their families are large. This very positive reception appears to be related to a number of factors: the use of village women as trainers, familiar foods for demonstrations, cooking that is normally done out of doors, the excellent insolation, and the high cost of alternative fuels, plus, no doubt, Wietzke Jongbloede's skill and persistence. The generosity of KoZon in subsidizing the poor of the nation is also a major factor.

The Kozon group has since promoted solar usage in other nations (see Mali and Chad) and other areas of Burkina Faso. CooKits are being made in Burkina Faso, rather than imported, which both provides jobs for Burkinabes and is less expensive, making support dollars go further.

One of the very interesting parts of the KoZon support for solar cooking in West Africa is their support of an evaluation of the project. A masters level student from at a Dutch university (and from Benin) was assisted to conduct the evaluation which carefully studied and observed solar cooker purchasers, their motives and the consequences of solar usage. Those findings were summarized, and the staff and board of KoZon very systematically examined each and made appropriate changes in their approaches as the data indicated. This outside evaluation and the uses made of it are fairly rare in the solar cooking world, and hence to be noted and commended.

A more recent report from Burkina Faso tells of the work sponsored by other European groups in West Africa. BSW Alternative Energy, a German company, makes a somewhat different type of parabolic cooker known as the Butterfly or Papillion. Instead

of an inverted dome like most parabolics, the Butterfly has two wings, with room for the cook to stand between for ease of cooking. In addition, the device folds to go through a doorway. The device can cook for up to 15 people, since it holds several pots, and is very powerful.

The BSW Solar Energy group is promoting the Butterfly for West Africa (SEWA) where they have been working since 1994. They recently have introduced 70 Butterfly cookers in Gaoua, Burkina Faso. The devices were manufactured in country with technical assistance from BSW. The Butterfly can also be purchased as a kit for home assembly, and a scheme is in place for payment over time with savings from previous reductions in fuel purchasing. The costis repaid in around 18 months; once repaid, the funds are available for another family to use for a cooker and pay back in the same manner.

The promoters of this scheme include Willi Heinzen, Bernd Hafiier, and Paul Kramer, chef, scientist, and medical doctor, respectively. Their recent book, Solar Kocher, (Munich, Germany, 2002: Sud West Information) unfortunately for many of us, is published only in German. It provides an excellent discussion of solar cooking technology and practice, with detailed diagrammatic drawings of various types of cookers and marvelous pictures of fuel scarce West Africa.

Burundi

Nothing is known of solar cooking activity in Burundi.

Cameroon

Paul Lebga Fonyonga, a teacher in Cameroon, has taught two workshops on solar cooking in the past year (2002). No other organized activity is known to exist.

Cape Verde

No activity is known about in this nation.

Central African Republic

No information on solar cooking programs is known to exist in the Central African Republic.

Chad

In 2001, the Kozon Foundation (see above for an account of it work in Burkina Faso) was considering an alliance with an NGO in Chad for a solar cooking program on an extension model. No further information is available on the status of that possibility.

An individual, an American woman, now in medical school, was a Peace Corps volunteer in Chad some years ago. She plans a return visit and hopes to establish a solar cooking program there at that time. Solar Cookers International has provided her with materials and instructions, but thus far no reports have been received about this potential project.

Recently, the South West Africa group (see section on organizations that work in a number of countries) has begun a program in Chad. Starting only in 2004, no other information on this activity is available.

Comoros

No knowledge of solar cooking in the Comoros was located.

Congo

Nothing is known of solar cooking in this nation.

Cote d'lvoire

An ambitious project has been conceived and developed rather fully by an Ivoirian named Maurice Djan, who had been in the United States several years ago as a Hubert Humphrey Fellow. He came to know about solar cooking during that time period and has done extensive preparatory research on the topic. Maurice is a government employee with a strong commitment to sustainable development in his country; the project he designed is a multi-dimensional project with a focus on housing including built-in solar cooking and solar energy components. He secured a number of cooperators

in his project, including SHE, Inc., and Habitat for Humanity. When the project planning was complete, he submitted the document to a World Bank competition for funding under the Global Environmental Fund (GEF). The proposal was a finalist, but unfortunately, not a winner. Mr. Djan will continue to seek funding from other sources for the project, which had been promised substantial governmental support, both national and city, if and when additional outside dollars became available. It would be an important project with its built in opportunity to introduce solar cooking in a model housing development.

Democratic Republic of the Congo

This huge nation, with its long history of tyranny and instability, is hardly the place one would have in the last years attempted to start projects of any kind. However, the need is undoubtedly great. To the best of our knowledge, no organized project has been attempted in this country.

A group currently active in Uganda, the DRC's northern neighbor, is currently seeking funds to expand its work into Burundi and part of the Democratic Republic of the Congo.

Djibouti

Nothing is known of projects in this small city-state. Solar cooking in most places is usually found in rural areas, where more space is available, with urban areas more difficult for promotion. Surely the climate is suitable and Djibouti is surrounded by countries with solar cooking projects underway, but currently, nothing is known of activity on this front there.

Egypt

Several interesting projects have been established in Egypt, a place where solar cooking works very well. Some activity there was driven by the work of Swiss volunteer, Annamarie Wenger-Marti, an elementary school teacher who has also worked in Turkey. Ms. Marti began working in Egypt in the early 1990s. The "students" were from households living in "new communities" created for workers in an agricultural area near

Alexandria. Local carpenters made wooden box cookers, which were then purchased by women who were trained by Ms. Marti. Her work was the inspiration for yet another project in Egypt, involving a Swiss mechanical engineer, who came to know of solar cooking through her activities.

Alex Gagneux, the Swiss engineer, designed and oversaw the building of Egypt's first "community kitchen" located on El Sherouk Farm, some 72 kilometers north of Cairo. The kitchen, completed in 2000, is used to cook meals for workers on the farm, which is on land reclaimed from the desert, and now supports the cultivation of mangos, papayas, peaches, oranges, bananas, lemons, oranges, grapes, and a variety of exotic plants. The climate here is cloudless most of the year, with cool evenings and pleasantly warm days.

The devices used in the kitchen are huge parabolas, made of individual squares of mirrored glass attached to a concentric circular framework, equipped with automatic tracking systems to follow the sun's path. The concentrated solar radiation generated is sent to the nearby kitchens through portholes in the wall. Food is cooked daily for 300 young workers. When food is cooked, the parabolas' radiation is shifted to water tanks to wash dishes, make tea, and provide water for personal hygiene. Heat storage covers keep food warm for workers who return later. Photovoltaic lighting is also used in the kitchen, as needed.

Much of the agricultural land is owned by individuals, in this case, Dr. Adel El Ghandour, a dedicated environmentalist, who is committed to creating an integrated and renewable energy strategy for the farm. His activities have attracted considerable attention in Egypt, with visitors from national ministries and universities. Much of the country would be suitable for solar cooking.

Equatorial Guinea

No information on solar programs in this nation has been found.

Eritrea

In this nation, not long ago formed as an independent state following a long war with Ethiopia, an organization known as A.K. Lilu Alternative Energy Research has been

in touch with Solar Cookers International. The founders are inventors and manufacturers of solar cookers in that new nation. Little else is however known about their sales or programs.

Participants in the 2001 Shell Oil sponsored electronic dialogue on household energy and health were informed that the Department of Energy of Eritrea had* however, engaged in a project promoting the use of fuel efficient stoves in that year. Studies had shown the inefficiencies of traditional bread baking methods and the loss of energy in charcoal making, as well. Therefore, what appears to have been a successful program to change long held habits had been instituted in a pilot area, then expanded to a larger number of villages, auguring well for promotion of additional renewable technologies.

Ethiopia

Ethiopia has much to show in terms of work with solar cookers. Two activities stand out, and will be discussed initially. The first is a long lasting, though now ended, program in a refugee camp located near the border with Somalia and Dhibouti, in a place known as Aisha. A more detailed description of Aisha will be found in a case study (below), which will hopefully give the reader a somewhat better feeling for the working of a solar project.

The solar cooking work in Aisha was initiated at the request of the United Nations High Commissioner for Refugees, through a staff member named Christopher Talbot who had seen the project in Kakuma Refugee Camp in Kenya (below). At that particular time, the UNHCR was being severely criticized for the massive destruction of forests caused by refugees from the southern Africa civil wars in Mozambique and Angola. A UN "pledging" meeting had been held for the purpose of raising millions of dollars to restore terrain ravaged by refugees in camps run by UNHCR in that part of Africa. Funds were in fact given for additional refugee work, of course, but with the strong admonition to UNHCR and its allied organizations and governments to take great care to see that damage to the environs of camps from uncontrolled collecting of firewood by refugees be strictly curtailed. UNHCR was thus urgently seeking solutions. Seeing the solar cooking project in Kakuma led them to undertake an experimental program in a small camp in an isolated corner of Ethiopia.

The camp's inhabitants are almost entirely refugees from nearby Somalia; the camp is located near enough to the border that it was even possible for refugees to make visits to their former homes from time to time. The area was one with limited forest cover even at the time the camp was established, and soon the landscape was nearly desolate. Refugees who at first could make a fuel gathering trip and back in a/day soon had to change to a pattern of using draft animals to go longer distances requiring two or three day trips. Fuel gathering thus ceased to be one in which women and children gathered wood nearby to one in which commercial arrangements were made by entrepreneurs who hired woodcutters and draft animals, then sold the wood to refugees. The difference was immaterial to the environment, of course, which suffered substantially from both practices.

Aisha was not large, as refugee camps go. It housed around 2,000 households and between 14,000-15,000 individuals. The site itself was far from Addis Ababa, both difficult and time consuming to reach. But the site also offered a place where need was great, where sunshine was abundant, where the population was relatively stable (for a refugee camp), and where careful and detailed evaluation would be possible. A baseline study of fuelwood use was done for later comparison, and the project began in 1998.

The project in Aisha continued until 2002, by which time all refugees who were interested had been supplied with cookers and trained in cooker usage. Refugee women and men were trained to be the trainers of others and an Ethiopian coordinator oversaw the project for SCI. Before formally closing the work as an SCI sponsored project, a final evaluation of the project was undertaken by an Ethiopian social scientist, with noteworthy results. About 95% of all householders in the camp used solar cookers, at least part of the time. Spending for fuel declined by 42% from pre-project days. Refugees spend substantially less time gathering wood, allowing children to attend school and women to engage in community and income generating activity. Additional details of the project's operation, management, and outcomes are provided for the reader in the case study on this project. (AISHA Solar Cooking Project: Evaluation Report to Solar Cookers' International, info@solarcookers.org.)

Another major solar stove operation is underway in Ethiopia, under the auspices of SUN OVEN, International, a unit of an American business (See details in the section

on Multi-Nation Promoters). The scheme in use for the introduction of solar ovens in Ethiopia is a unique one, designed to bring the community of expatriates from the country into collaborative solar cooking promotion. The campaign, described on the SunOven website, invites expatriate Ethiopians living in the United States or elsewhere to buy a Sun Oven for a relative still living in Ethiopia. Information is provided about the desperate fuelwood situation as incentive. Each Sun Oven purchased in that manner will be delivered to the individual or family specified as the recipient, and the donor is honored by the planting of a tree in a reforestation project. Sun Ovens are currently assembled in Ethiopia from parts made in the U.S. and by an Ethiopian staff, thus providing job opportunities in country. When demand justifies expansion, a full-fledged manufacturing operation will be established in Ethiopia.

To date, a number of Ethiopians now living in the U.S. as new citizens or green card holders have purchased Sun Ovens. Ethopia, with its abundant sunshine, severe deforestation (0.4% of the land is forested, and decline is continuing), and extensive poverty, coupled with the substantial emigration of the last decades, would seem to be an ideal place to put a plan of this sort into action. The scheme is too new to have substantial evaluation data, but promoters may wish to carefully watch the situation (sunoven.com).

Gabon

No information about solar cooking programs in this country is available.

Gambia

An organization in the United Kingdom, the Gambia Fellowship Association, has been promoting solar cooking in the Gambia for a number of years. Four units to produce cookers have been developed by the group with assistance from the British High Commission, the Gambia Energy Department and the British Foreign Office in London. The organization has also made a film about solar cooking which is shown from time to time on Gambian television.

Another group, the Boka Loho Organization, in the Gambia itself, has built and demonstrated solar cookers at agricultural shows and other gatherings. They produce

cookers, train users, and also work with schools in the promotion' of solar energy usage. An individual, Mr. Saikou Jarra, has also promoted solar cooking for years in his area of the Gambia. Other organizations, both governmental and non-governmental, seems to be active as well, including the Ministry of Trade and Industry which has trained women's groups as users and carpenters in the making of box cookers. One of the early/promoters was an organization called Rescue Mission, which disseminated 200 cookers in the early 1990s through demonstrations and classes.

For some years, a British woman, Rosalyn Rappaport, has been spreading solar cooking in Western Gambia, working through the Methodist Agricultural Mission, the Gambia Renewable Energy Centre and the Women's Solar Cooking Club of Marakissa. Initially, they only had a small number of box cookers, which women shared, taking turns using the devices. Many women worked in the fields, and the larger box cookers were difficult to transport, requiring a cart at minimum. Ms. Rappaport decided to try the panel cooker which is much lighter in weight. Women there invented a variation that used string to hold the folded sides of the cooker together. After systematic testing to see if the panel performed well enough (it did!) the panel came to be more widely used. The panel is made locally, and a substitute for the plastic bag was found in a product used to package sugar (SCI Rev. Aug, 02).

In a more recent report, Ms. Rappaport, described the ongoing development of solar cooking projects in the Gambia, particularly the Marakissa Solar Cooks Club. The group has been in existence for a number of years, and members use both box cookers and the panel cooker (CooKit). They have engaged in demonstrations in a number of villages and towns. Originally (see above) they had difficulty locating plastic bags for use with the CooKit, but have recently found a local manufacturer of inexpensive bags. Local women use an existing Methodist church network, and have attempted systematically to follow up with newly trained cooks to assess progress made. Reports thus far have been favorable, and most food used in the country lends itself well to solar cooking. (SCI Rev., Mar 02).

Other Gambians have indicated their interest in solar cooking by corresponding with Solar Cookers International; that number includes persons affiliated with government and non-governmental organizations.

Ghana

A number of Ghanaians have similarly indicated interest in solar cooking, with requests for information from universities and non-governmental organizations. As far back as the early 1990s, a faculty member at the University of Kumasi, Department of Agricultural Engineering, Dr. A.K.Dzizi, was providing cooking demonstrations and instructions. A leading women's group, the 31st December Women's Movement, has taken a specific interest in the technology, as reported at the Varese conference. The movement was encouraging women to take up farming ventures, and in addition to add value to their products for the export market. Hence, both solar cooking and solar drying were considered as important possibilities. Much of Ghana's electricity generation is hydroelectric, and has proven to be problematic in times of drought. Wood and charcoal are in increasingly short supply, and gas is too expensive for most people. Hence solar cooking and drying would appear to be an important potential. In 1999, the group was actively seeking funding for this promotion. No further information is available.

Recently, in 2002, a Ghanian effort was the highlight of the solar cooking year when a project headed by Dr. Mercy Bannerman was one of the top winners at the World Bank's Development Marketplace, an opportunity held annually to showcase exemplary activities in less developed nations. Dr. Bannerman, a medical doctor, won the award for her project entitled " Simple Solar for Health + Wealth". The program used the panel cooker, the CooKit, and a WAPI (water pasteurization indicator) to ward off the dangers of guinea worm, e-coli, and other waterbome hazards in drinking water. She had been initially taught about the use of the sun for these purposes at a Girl Guides program in Ireland, and later through Rotary connections, learned more about solar cooking and water pasteurization. The award, $100,000 was to be used for training of additional persons to spread the technology more widely in Ghana. The project has now moved beyond household use to the creation of small scale enterprises for making CooKits and selling them. Dr. Bannerman has also been awarded funds for similar purposes through Rotary International's programs. Her award was a milestone for solar cooking promoters everywhere, with its recognition of the potential of the technology as an important component in development.[v]

Guinea

A long lasting effort in Guinea is found in the work of a solar pioneer in that country, Abdoulaye Sadid Diallo, who has spearheaded an effort which has produced hundreds of solar cookers, both box type and panels. The organization, called Guinean Volunteers for the Environment, has made and sold cookers on a plan that permits the free distribution of one cooker, to a family in a rural village, for each one they are able to sell. Occasionally they have trouble locating materials, but have a staff well trained in the training of others, and in the producing of cookers (SCI Rev Aug 03).

Guinea-Bissau

No information on solar cooking has been located for this nation.

Kenya

Kenya is the center of solar cooking activity in East Africa. A number of organizations are endeavoring to promote the technology in this country, which has been the commercial hub of the area for several decades.

Its capital, Nairobi, is also well served by air, making access to the nation and region readily available, using Nairobi as entry point.

The promotion of solar energy is decades old in Kenya. As far back as 1977, GTZ (the Germany's official technical aid agency) initiated and later abandoned a project in Nairobi. The reason given had to do with the fact that products used were made in Germany and not available in East Africa. Two different Catholic missions in rural Kenya seem to have tried solar cooking, but no information is available on outcomes. As early as 1991, some ovens were exported to Tanzania (through Trans World Radio, perhaps), indicating that the product presented a business opportunity. In 1992, an Earthwatch grant permitted an academic, Dr. D.M. Kammen, to initiate a multi-year study of renewable energy technologies, including solar cookers, using volunteers in short-term Earthwatch projects.

Other early efforts included the work of Trans World Radio to promote solar use, promotion within the Girl Guide organization, a large project under the auspices of the

Institute for Cultural Affairs, and the activities of a remarkable Peace Corp Volunteer. In the mid-1990s, with assistance of Solar Cookers International a national coordinating body for the purpose of sharing information and strengthening progress by collective action around the topic of solar cooking was formed in Nairobi.

Among those early efforts was the activity of Trans World Radio (see above for information on the organization, listed among those entities which serve multiple nations). TWR work began in the early 1990s. A conference proceedings on Renewable Energy Policies in East Africa, held in 1993, includes a paper by TWR coordinator Clive Wafukho on their work in solar cooking. This organization promoted solar cooking on its radio programs, made and sold box cookers in the Nairobi environs, and worked also in a distant refugee camp. They pioneered solar cooking in Kakuma Refugee Camp, where SCI later established another project. TRW estimates that in the period between 1992 and 2001, they distributed a total of 2,350 cookers in the camp and other localities in Kenya. Logistics and staff support were always problems in the remote areas. In 2000, an attempt to solve that problem was the training of refugees as carpenters to build the cookers in the camp itself. TRW reports the production of 400 cookers in that manner. The cookers are large and well suited to the needs of the Sudanese population that lives in extended family compounds, requiring cooking for 10-20 people daily. Trans-World Radio has demonstrated remarkable staying power in this difficult to serve area, with a population that could not afford to buy the expensive box cookers. Therefore most were given away free, with funds raised for the most part outside of Africa. TWR estimate that two-thirds of the cookers are used regularly.

In roughly the same time period, a U.S. Peace Corps Volunteer named Barbara Ross was assigned to an area in western Kenya. Her responsibilities were varied, but, outside of her assigned tasks, more or less on her own initiative, she began the promotion of solar cooking. Ms. Ross recruited and trained a number of women in the locality to which she was assigned, who then formed themselves into a Housewives' Club, and proceeded in turn to teach others. They made box cookers of cardboard, which worked very well in a propitious climate, and solar cooking was on its way in this part of Kenya.

The interest of Girl Guides in solar cooking also goes back to roughly the same time period. An early training program had been initiated in Kenya by Barby Pulliam,

chief promoter of the World Association of Girl Guides and Girl Scouts. Little remains of that one-shot demonstration, but it did serve as a foundation for later work that developed more fully in the latter 1990s. An interesting offshoot of that program is a unique program, a Girl Guide troop in Kakuma Refugee Camp, run by individuals originally inspired by the work of Ms. Pulliam. In few places can Girl Scout/Guide activities be more welcome!

The other major early actor on the Nairobi scene was the Institute for Cultural Affairs, which had a long term presence in the development community, focused on empowering local communities to define their own needs and plan their own development strategies. Solar cooking was a kind of side interest for ICA, though obviously related to its larger issues. To carry out the solar cooking mission, a Swiss volunteer, long interested and skilled in the technology and in training others, joined the Nairobi staff of ICA, for the specific purpose of promoting solar cooking. ICA created a solar box cooker construction course at a local technical school, which ultimately produced all the cookers used by ICA in the communities where they worked. ICA used a rather classical community development approach in their work. In community meetings, workers facilitated community members in defining their needs and existing barriers, which prevent meeting those needs. Fuel shortage was a major problem, and hence solar cooking promotion became an ongoing part of the program in many areas of Kenya. However, the solar activity more or less ceased after the very effective volunteer returned to her home.

The agencies described above formed the corps of the solar cooking consortium formed in 1994, with some financial help from SCI. The purpose of the consortium formed around solar cooking was to share information with one another, and to enlist additional person power for promotional efforts. SCI provided financial and moral support to the effort for some years. One conference was held in Nairobi, and one in out-state Kenya, in the hope of involving additional people in the effort. Ultimately, the logic of solar power dictated that purveyors and promoters of photovoltaic technologies would be included in the group. Over time, and after finally achieving NGO status in Kenya (not an easy task), the organization came to be dominated by the larger and considerably

more powerful community of business and industrial photovoltaic personnel in Kenya and thus of less value to solar cooking promoters.

Shortly after the creation of the consortia arrangement described above, in 1994, Solar Cookers International made the decision to embark on a demonstration project in a refugee camp. The story of the project in Kakuma Refugee Camp is recounted as one of the case studies provided in this document; therefore recounting here will be brief. The program was carefully planned (in so far as that was possible for an organization which had not previously worked in an overseas setting) and carefully monitored throughout the project. Kakuma is located in the semi-arid Rift Valley in the far northeast corner of the nation, reachable only by air (or 20 hours on a rickety bus). The camp grew from what seemed a very large 28,000 initially to almost 100,000 at one point, with major changes in the ethnic makeup. Logistical problems were always difficult, as the camp, being so remote, was not easily accessible. Eventually, a Kenyan staff was formed, and the camp work is, in 2004 (8 long years later), phasing into a refugee-run cooperative with similar purposes to the original SCI project, i.e., a demonstration that persons in need can and will adopt solar cooking, save fuel and scarce financial resources, while inflicting less harm on the already fragile environment. (See the case study of Kakuma for more detail.) The November 2003 SCI Review carries a small article about a woman refugee, Mumina Baraka, who now operates a small scale bakery in Kakuma, selling in small quantities to make a living, and to provide baked goods for other refugees to purchase. She plans to take her CooKit back to Ethiopia with her when that becomes feasible.

A number of other projects, mentioned above, were established in roughly the same time frame, as described above, in the activities of TWR, the Girl Guides and ICA. (Somewhat later, a Rotary project in Nairobi was started, but turned out to be less than wholly successful, perhaps showing the difficulty of working in urban areas. Need is considerable, but space, security of food and cooker, etc. are difficult issues in congested poorer urban areas.)

During the early years of the Kakuma Camp program, the solar cooking program generated considerable interest in refugee circles. All visitors were taken to the training sites and, when advance notice made it possible, given a meal cooked by the sun. SCI's refugee coordinator, a Zairean woman who spoke excellent English, became almost a

camp staff person, and was frequently called on to accompany visitors, to translate for them, and to provide demonstrations. One of the visitors in the early years was a UNHCR staff person from the head offices of the UN agency in Geneva. He was integral to beginning the program in Ethiopia. In addition, he discussed the possibility with SCI of working in Dadaab camp in Kenya, located on the Somali border, to the east and north of Nairobi. That camp, almost entirely Somali in population, was far bigger than Kakuma (with about 100,000 residents) and differently structured, with three separate sub-camps, each located at a distance from the central offices of the organizations serving the camp.

The camp administrator in Dadaab was enthusiastic about starting a solar cooking program. Activities concerned with energy conservation were well underway in the camp, under the direction of the German technical assistance agency, Deutsche Gemeinshaft fur Technische Zusammenarbeit (GTZ) which had been implementing an improved stove program for some years. That program used an interesting model of "work for a stove" in which individuals were given 25 tree seedlings to plant and cultivate at their own homestead. At the end of three months, if they had successfully nurtured the seedlings, the "gardener" was given a voucher to obtain a stove. The devices used were a somewhat larger version of a charcoal stove in use in Kenya for some years, one in which the fire bed was made of ceramic, then encased in a metal shell. The stoves were "manufactured" in a workshop run by GTZ and were considerably more efficient than traditional three-stone fires. Trained "animatrices" were assigned to various parts of the camp where they did extensive workshops showing people how to use the new equipment.

By the time GTZ heard about the solar program, Dadaab staff had already provided stoves for over 90% of the camp's residents, using the distribution method described above. Both GTZ and SCI agreed that adding solar cookers to the mix would be one more way to cut down on the use of wood fuel, which by that time had been declared unlawful by the Kenya government, but was still occurring routinely. The team of GTZ extension workers, already trained in promotion of wood stoves were given additional training in solar technologies, thus adding another tool to their fuel saving repertoire. Eventually, SCI trained additional Dadaab women as trainers, in order to proceed at a faster rate in this huge camp.

An unfortunate event occurred next in Dadaab, one that effectively put an end to the solar cooking project and considerably dampened the improved stove project as well. A delegation of American congresspersons visited the camp. They were told stories of the dangers women were exposed to in the collection of wood (unlike Kakuma, refugees were allowed to collect wood in the area, even though it was unlawful by order of the government). Dadaab is located only about 15 miles from the border with Somalia; the lawlessness of that country spilled over into the nearby camp. Cars were routinely hijacked, necessitating convoy travel to the campsites. Security was certainly a high concern. Some refugees had been robbed, a few killed, and some women raped and murdered while searching for wood. Naturally, this gained the sympathy of the congresspersons. On return to the US, they managed to add a rider to legislation already in process that provided several million dollars for the purchase of fuelwood for Dadaab. Both GTZ and SCI were horrified at this well meaning, but ultimately destructive, act, which harmed the fuel-efficient stove program and effectively ended the solar cooking project. Obviously, free fuelwood was a far more attractive option. Two years later, the money for fuel was finished, and the programs promoting alternatives to fuelwood were no longer present in the camp. In the US, SCI attempted to protest, but was unsuccessful in obtaining a hearing on this emotional issue, taken up in good faith by ill informed U.S. representatives. The solar cooking program in Dadaab program of SCI was closed and has not been restarted.

A Swiss woman named Allison Curtis, working for an NGO called the Solar Health and Education Project (SHEP), has provided a number of workshops in the coastal and other regions of Kenya. The first workshop was held in the Kenya Marine National Reserve locality, a protected part of the spectacular coast of that nation. The initial group trained was made up of teachers and public health workers, in order to encourage the introduction of simple solar technologies into school curricula and thus into everyday life. Both cooking and water pasteurization techniques were demonstrated and the required skills taught to participants. A second group of new solar cooks was simply introduced to the concept and practice of solar cooking in a basic training workshop, while a third group of experienced cooks reviewed progress in their respective villages (based on earlier training and promotion).

A second cluster of workshops was held in an area with a'pastoral population that had not been exposed at all to solar cooking previously. The group made their own CooKits from recycled Tetra pack cartons (small boxes used to hold milk, lined with foil, which becomes the CooKit's shiny surface). After construction of the CooKits, smaller groups cooked their meals, with the assistance of the trainers. As is common, amazement was the hallmark of the day! They loved the food and could hardly believe it had been cooked with the sun. In good pastoral style, one of the participants told Ms. Curtis 'this initiative is like a cow given to us. We, the Masai, consider the cow the greatest gift one can offer. Let's utilize it". After the praise a promotion committee was appointed to create an action plan to spread the technology in their area.

An exercise not common in the solar cooking world was executed in Kenya in 2002. Working on behalf of the NGO, SHE, Inc. (see Multi-Nation Promoter section) a team of graduate students from the University of Michigan, as a part of an assignment for a class in their MBA program, conducted an extensive market survey re solar cookers in Kenya. The students, supported by a generous donor to the school, conducted both phone and in-person interviews with knowledgeable sources in the U.S., Mexico, and in Kenya itself. The result is a comprehensive review of past and present solar cooking projects in Kenya, their market strategies, successful or failing, along with the views of a large number of opinion leaders from government, the non-governmental community, entrepreneurs and manufacturers on the topics. In conclusion, the students brought their knowledge from Business School courses to bear on the problem, resulting in a useful document for promotion of solar cooking in the country. The document can also serve as a model for other related market research endeavors. Sponsored by SHE, Inc., this unusual effort concerning solar cooking turned out to be not only an excellent learning experience for students but also a document useful for multiple purposes. Further information is available on the SHE, Inc. website, [ww.she-inc.org].

And, lastly, and perhaps of most interest, though new enough that little can be reported, is a different program of SCI. The project, called Sunny Solutions, has been established in an area of west Kenya near Lake Kisumu. The project is located in a district called Nyakach, a sub-division of Nyanza province, in West Kenya, not far from Lake Victoria. Local organizations were recruited as partners and an intense campaign

involving a range of stakeholders from government, women's groups, churches, and so on, was initiated. Initially, thirty women were chosen to be pilot trainees; they were provided with CooKits, the cardboard cooker used in areas where families have limited resources, and were given intensive training and an extended follow-up. During this phase of the program, a team of research consultants conducted an evaluation exercise to serve as a baseline for later program assessment of accomplishments in terms of fuel savings and health benefits.

In July of 2003, the formal kickoff of the program began, with a proper Kenya-style community celebration, including solar cooked food, singing and dancing, visits from government officials and community leaders, with banners strung over the site touting the wonders of the sun. The project was well organized and the community, chosen for its willingness to cooperate, is looking forward to considerable accomplishment in the years ahead. Continuous careful evaluation is planned, to assure that the project remains on course as it moves towards its goals.

Reports of other small scale programs exist in Kenya; the ones desribed above are te longest lasting and largest known currently.

Lesotho

Around two decades ago, as reported by A. A. Eberhard in the 1994 Proceedings of the Eighth Biennial Congress of the International Solar Energy Society, a group of South Africans attempted to introduce solar cooking in the mountains of Lesotho. The project was not a success from Eberhard's perspective, confirmed by two others on return from a Peace Corps assignment and academic work in the country. Their analysis of reasons, cast in terms of Rogers' 1983 theory on the diffusion of innovation, concludes that an innovation basically cannot be introduced by foreigners. They then proceed to discuss successful introduction of devices by others with foreign sounding names like Yaholnitsky and Scott, that have in fact, been more successful. (Scott, though not a Basotho, was born there.) Their approaches to introducing solar cooking were very practical, such as teaching women how to cook the basic staple of the country, and using local people as aides and trainers. Perhaps all of this is a precursor to the current situation in Lesotho.

The current center for solar cooking in this small nation is located in a multi-purpose educational facility, the Bethel Business and Community Development Center, located in Moorosi, Lethotha. The Centre, which began in 1998, provides adult education of many applied types, attempting to inculcate practical skills and teamwork in its young adult student body. The center demonstrates by its own use topics such as water resource development and utilization, improvement of rural infrastructure, enhancement of village design, solar energy utilization, and environmental regeneration. Some of the courses of study are extended, giving students professional training and skills; others are short courses for refreshing already learned skills and exposure to new ideas in the various fields. The campus included residential quarters for both the full time and the short-term students.

The unit that focuses on solar technology is called Solar Soft. Representatives of the group were present at the world meeting in Kimberley, South Africa. The design they were using was a box cooker mounted on a heavy pipe set into a ground base which allowed it to turned to follow the sun. (SCI personnel made certain they had a CooKit to take home and experiment with.) A small but steady demand for cookers, which are made by craftsmen at the Center, has been generated. Their strategy has been to target a better-educated, middle class audience, touting environmental arguments rather than fuel savings. They have demonstrated that cookers can be sold to this audience. Students at the college prepare lunches every day of the school week using solar cookers. A strength of the program is the situating of solar cooking firmly in the range of other solar and renewable modes of operating, thereby providing students with multiple and integrated lessons for their later life.

Liberia

Nothing is known of solar cooking in Liberia.

Libyan Arab Jamahiriya

No reports on solar cooking have been found for the Libyan Arab Jamahiriya.

Madagascar

Madagascar, with its unique biological diversity, has attracted the attention of environmentalists from around the world to its rescue. It is somewhat surprising then to learn that little has been done to curtail the use of fuelwood as the major cooking energy for the population. Around one-fifth of the island's land has forest cover, which is diminishing at nearly 1% annually (FAO, 2003). A representative of the country, speaking at the Varese meeting in 1999, spoke of solar experimentation in the 1970s, revived in the 90s as deforestation worsened, but with little progress in mass implementation. The initial introduction was principally of parabolics, but later the 'breadbox" model was introduced and enthusiastically endorsed. The report called on governments, non-governmental organizations, and businesses to attempt to establish a strong national program, urging that international research and development be done cooperatively and shared widely with smaller nations.

The only program known to be actually operating in Madagascar is one run by the medical arm (SALFA) of the Malagasy Lutheran Church. SALFA runs 25 hospitals throughout the country. Dr. Stanley Quanback and his wife, medical missionaries in the country, initiated the project and helped to develop collaboration with another medical organization, Pathologists Overseas. Teaching materials and consultation were provided to the volunteers by California volunteer, Alice Hoenecke, sociologist Andriamanantsoa Agnes, and nutritionist Sosanna Suzanne, the latter two employees of SALFA and citizens of the country.

The group began by training women in one village in a semiarid region of the country. The trainees were hospital staff members and members of a churchwomen's organization. As stated above, fuelwood was become very scarce and expensive. Miss Sosanna directs the project, supervising 15 trainers who are working now in 11 villages. Primary health centers are usually the site for training in the use of solar cookers. They estimated, as of 2003, that there were 1,000 users and others begging to have solar cookers made available to them. (SCI Review, November 01 and personal information.)

Malawi

An unusual sponsor of solar cooking in Malawi is the non-profit organization, Peace Child International. One of its programs called Be the Change (BTC) challenges young people to make a difference in their communities. In Malawi the youth? action work focuses on solar cooking. One young man proposed to his colleagues that they make and sell solar cookers as a BTC project. With a very small budget, they did all planning and implementation of the project. By 2001,the group has been able to provide 50 village families with solar cookers in 9 different villages. The group has reached out for support from organizations in Germany and Austria, and has also been aided in locating reflective materials by a Malawian business, Universal Industries. (SCI Review, November 01.)

A quite different type program in Malawi was reported on at the Kimberly meetings in South Africa in 2000. The country has excellent solar insolation and severe deforestation in some areas. The Department of Energy Affairs has established a Renewable Energy Program, which intends to promote a range of renewable devices, including solar cookers. Using box cookers sold through a micro-financing scheme, the project intends to establish distribution centers across the country. A private business, the Zako Solar Cookers Industry is the principle manufacturer of ovens, and non-governmental organizations are assisting in the distribution.

To begin, a national planning workshop was held. Various stakeholders came together to divide up the tasks involved in presenting a series of demonstrations on energy saving measures. Participatory principles were stressed and a choice of optional renewable energy modes offered to people. The foci of the project included both arresting environmental degradation and the reduction of poverty.

Information presented at Kimberly described the program at a very early stage. Follow up to ascertain results of the project had not yet been accomplished. This project, started by governmental initiative, is an important development in Africa where the bulk of solar cooking work has been done through non-governmental organizations, many from outside the continent (Kimberly, p. 67).

Mali

The Sahelian nation of Mali is the site of several solar cooking projects. Desertification is of course an immense problem in this part of Africa. Only 10% of the land has any forest cover, and deforestation continues to occur. As in other areas, clearing land for agriculture and grazing is assumed to be the principal reason for the forests' decline, but there is also recognition that over 70% of wood production is used for cooking. Solar cooking offers one way to stem this unwanted development in Mali.

Researchers at the University of Torino, studying the problem, have experimented with a wide range of fuel-saving devices, dryers, water heaters, solar lighting panels, and solar cookers. (As one researcher said-, "Every day when I get up (and look at the sun), I see all that energy going to waste.) Considerable study done under the auspices of the University, with joint efforts of the Faculty of Agricultural Science and the Interdepartmental Centre of Women's Studies, has included surveys, interviews, and field analyses of both problems and some suggested solutions. Local associations promote various fuel saving devices, such as metal stoves or parabolic cookers; other promote solar cooking (see below for an example). But in a nation without adequate communication channels (television or daily newspapers) and a population with only a 35% literacy rate, spreading new technology is difficult. Radio broadcasting is thought to be the most promising dissemination media. Most important in this situation is the awareness of the problem and the willingness to seek solutions.

One single person, Gnibouwa Diassana, long committed to solar cooking, has managed in these circumstances to make and sell around 50 cookers of the wooden box type. He does this on his own, without assistance even from the NGO for which he works on other kinds of projects. This sole person, working only with a son, has a promotion plan for an energy week and even a business plan that would permit expanded production of solar box cookers. He hopes to find partners among women's organizations but knows that resistance to change, and rigid gender based roles, make it difficult for women to pursue the purchase of cookers. He is however a determined man and perseveres in his work. (Pictures and story, SCI Review, March 2003).

Another project created by an individual is the work of Lanseri Niare, who has been introducing box cookers, both by teaching people how to build their own cooker

and how to use the box when built. Major problems encountered in this project have been glass breakage, termites if the box is used on the ground, and the Harmattan period (a severe windy season) which brings much dust, so that even when sunny, cooking is difficult) (SCI Review, Dec. 98).

One other project, which has proven successful in Mali, operates under the auspices of the KoZon Foundation, a Dutch organization that works through the western African Sahelian nations. From a beginning in Burkina Faso (see above), the efforts of KoZon and its dedicated volunteer Wietzke Jongbloede, have introduced CooKits in Mali since 2001. Wietzke operates at a very grassroots level, taking cookers (mostly using CooKits made in the Sahel to keep cost low) to marketplaces for demonstrations. The CooKits themselves were initially imported from abroad, and then purchased from Burkina Faso. This operation, relatively new, has not yet been evaluated by KoZon, but is gradually moving forward, in cooperation with the Association of Women Engineers of Mali.

Mauritania

No record of solar cooking activity in this country has been found, other than one Peace Corps individual who, many years ago, attempted to make solar cookers with local materials.

Mauritius

This island nation has no record of a solar cooking project. One individual has communicated with SCI and stated his involvement in solar cooking advocacy. However, no additional information is available on his activities.

Morocco

The Ministry of Energy and Mines of Morocco became interested in solar cooking through involvement of an employee, Touria Dafrallah, the recipient of an award for one year of study in the United States under the auspices of the Hubert Humphrey Fellowship Program. She studied at Cornell during that year, and came to know of solar cooking. During a practicum period spent in Washington, D.C., Touria spent a share of her time

working with Solar Household Energy, Inc., becoming a proficient cook and conferring with SHE personnel on establishing a project in Morocco.

Upon her return to Morocco, Touria began to lay the groundwork for a project. Experienced project staffs associated with the French NGO INTI (see above in section on agencies that work in Multi-Nation Promotion) were made available to work with her in planning and piloting the project. The device chosen was the ULOG type box cooker, used in INTI projects in other countries. It could be made in Morocco. Morocco was also interested in learning more about, and perhaps acquiring a large solar cooker called the Villager, a product of Sun Oven International and Rotary International (see section on organizations that do Multi-Nation Promotion)..

The latest reports of progress in Morocco indicate that work continues on the project but with slow progress.

Mozambique

Little is known of solar cooking activities in Mozambique, other than the efforts of a faculty member at Eduardo Mondlane University, who had taught an American volunteer about the technology. The volunteer, Miho Kobashi then spent six months in a remote village, working as a teacher, and while there taught a number of villagers to make and use solar cookers. This small experiment used the CooKit that people made for themselves. As is usual, villagers were unwilling to believe that food could be cooked with a piece of cardboard, and were amazed to see the results of their experiment. (SCI Review, July 03)

Namibia

A workshop was presented at the Varese, Italy, meeting in 1999 by a solar promoter, Harold Schutt. He described the construction and dissemination of solar stoves in Namibia over a period of 8 years in the 1990s. His initial exposure was provided in a workshop in Germany presented by representatives of the ULOG group (see description in the section on Multi-National Promoters). Following that, Mr. Schutt worked in Namibia, initially in a refugee camp and later in settled communities, teaching Namibians how to build a wooden box cooker and how to use the device. Female

carpentry-trainers were taught the techniques of making the ovet, and considerable experimentation was done to keep costs low while still producing quality devices.

This solar promoter has distilled lessons he has learned in many years. His view include the following: use a solar stove yourself, use schools as teaching sites, create social clubs around solar cooking, train builders of stoves of high quality; launch publicity campaigns to raise awareness, including demonstrations at sports events, supermarkets, clinics, and schools (Varese, p. 215).

Nothing is known however about the outcome of this work in Namibia.

Niger

A representative of the Department of Social Development, Population, Promotion of Women and Welfare of Children, Government of Niger, made a presentation at the conference in Varese in 1999. Outlining the situation in Niger, the Minister, Mme Foumakoye Nana Aicha, discussed the energy situation, highlighting the use of wood in 90% of all households and the serious consumption of forest resources that use represented, as well as the amount of carbon emissions released to the atmosphere. The nation is seeking both to preserve its already fragile environment (around 1% forested land) and to reduce its dependence on imported fuels. A variety of renewable technologies are under consideration, including solar cooking. A National Solar Energy Center has been created and is conducting experiments with parabolic cookers and boxes, for large-scale dissemination, planning for up to 40,000 cookers. The minister's speech illustrated a good understanding of the importance of the topic, in terms of global environmental circumstances (Varese, p. 57). However, no further information is available on the status of the plan at this time.

Against that large vision for Niger, a smaller scale endeavor has been launched by the KoZon foundation, whose work in Burkina Faso and Mali is discussed in those national sections. The inexpensive solar cooking device, the CooKit, was introduced in the Niger town of Kirkissoy, in connection with other local agencies in 2002. No further information is available on the progress of that work, which is only beginning.

Nigeria

This giant African country has a wide range of individual and group supporters of solar cooking. The country was a 1992 stop on a solar promotion tour conducted by Dr. Robert Metcalf, an SCI founder, in which he provided demonstrations in a number of African nations. One organization with which he worked is, as example, the Nigerian Society for the Improvement of Rural People. Its leader, Chris Ugwa, reports that around 50 families are regularly using solar cookers to pasteurize water and to cook food. They continue to train household cooks and are aiming to reach 100 new families per year.

Another Nigerian, Lydia Gordon Nkan of the Environmental Education Institution reports that her group has^ taught hundreds of students to make and use solar cookers. Her work was principally in primary and secondary schools, with an ambitious goal of seeing that every household in the country would in coming years be using solar cooking methods. The problem in much of Africa, and true in this case, is the lack of financing for costs like publicity on radio and television, which would create broad awareness and demand. For the poorest part of the population, the cost of even the least expensive cooker is a major hurdle, also true in many other developing nations.

A number of universities in Nigeria have promoted the technology, as has the Solar Energy Association of Nigeria. Rotary Clubs in the country also have plans to work through the partnering activities of Rotary International to start a large project that could eventually cover a substantial proportion of the country. This project which requires resources of time and money from the local clubs has not yet come to be a reality, but remains on the drawing boards for the future.

In the mid 1990s, a foreign oil company working in Nigeria made an attempt to introduce solar cookers in the communities they were working in. After several years of effort, they conducted an evaluation that did not yield positive results. For the most part, cookers had not been used nor found useful by villagers. It appeared from the evaluation document that relatively little attention had been paid to appropriate training and follow up assistance to new users, a common pattern which is almost certain to lead to less than hoped for results.

In many ways, however, Nigeria - in at least major parts of its territory - is well suited for solar cooking. An excellent array of supporters exists in the country, many

with small scale but persistent programs under way across the cbuntry. Nigeria appears to be an excellent candidate for more concentrated promotion.

Reunion

No solar cooking history has been found for this small island nation. /

Rwanda

This small landlocked, very populous nation occupies a significant role in solar cooking history. In 1994 when a civil war broke out in the nation, millions of people fled to neighboring then-Zaire (now the^Democratic Republic of the Congo) as refugees. This exodus, one of the largest in a short period, overwhelmed available services initially and over a substantial period of time. The event occurred just as representatives of the solar cooking community from around the world were meeting in Costa Rica at the Second World Conference on Solar Cooking, sponsored by SCI. Between sessions, the assembled solar promoters watched hotel televisions and listened to radios as the news turned ever worse, with reports of cholera deaths from unclean water, lack of food, housing, and other services. The event was the impetus for Solar Cookers International to shift from what had been largely an educational and networking role to one of demonstrating in practice that solar cooking had a role to play in keeping people in need alive and well. Shortly before the meeting, the new inexpensive cooking device, the CooKit had been devised by Roger Bernard, French promoter for many years, and then adapted further by Barbara Kerr, the US sage of the movement. Concern for the people of Rwanda was the impetus for planning a new phase in SCFs history, made possible for the first time by the emergence of an inexpensive but efficient cooker.

More recently, a project began in Rwanda in 2003, initiated by local Rotary groups, in concert with Rotary groups from other parts of the world. A team traveled to Rwanda in the summer of 2003, after a long period of planning and consultation, to initiate the project. This project is somewhat unusual in its emphasis on combining the use of solar cooking with the use of hay box and fuel-efficient stoves. This provides the cook with an integrated method - the most efficient "cooking system" feasible at low cost. Wilfred and Marie Pimentel, long time solar cooking promoters, Margaret Owino

and Faustine Odaba of the Solar Cookers Resource Center in, Nairobi, and, for the first time, a representative of the fuel efficient stove community, Larry Winiarski, aided in the training. While too early to comment on outcomes, the project appears to be off to a good start, and will be periodically evaluated as required by good practice, as well as by the sponsoring Rotary organizations.

Saint Helena

No information was found about solar cooking on the island of St. Helena.

Senegal

Considerable activity is present in Senegal on the solar cooking front. Much of that can be credited to the work of Abdoulaye Toure, a former teacher in the nation and now a government official, responsible for work in the renewable energy field. He serves as the executive of a national commission, and has direct contact with the President of the country who is so enthusiastic about the potential of solar cooking that he seconded Mr. Toure to the Ministry of Education to pursue this work. Prior to taking this position, Mr. Toure worked on solar cooking when he could, outside of his work hours as an elementary principal, in the construction and promotion of solar ovens. In his present position, he has created a substantial amount of publicity and activities, including television shows, visits to neighboring countries to extend the technology beyond Senegal's border, and numerous demonstrations and training courses all over the country. He is well known as the most ardent developer of solar energy, and is sometime dubbed in Senegal as "Mr. Sun."

One example of this work can be seen in the village of Diaganiao, a rural community with 6,000 inhabitants. It hosts several solar cooking projects, including a workshop that produces solar ovens for sale. As always, the problem with box cookers is the high cost to ordinary citizens, which has meant a slow uptake of the technology. Experimentation is ongoing with larger devices, to meet the needs of larger families, and less expensive devices as well.

In his most recent report to the President of the Republic, Mr. Toure elaborates on his work. He clearly is a dedicated person and a dreamer, now in a position of more

influence, making him optimistic for the future of his cause, In his words " When one dreams alone, it is only a dream. When one dreams with many, it is the beginning of reality". To that end, an organization called Friends of the Sun was instituted in 2002. Senegal also was the first African nation to join the Global Ecovillage Network (GEN), a feat recognized in the Johannesburg Social Development meetings. They are (partnering with counterparts in a Chinese Network to transfer reforestation technology. Similarly, they partner with an American network on technical issues.

The activities of the association revolve around two major projects: the African Solar Cooker Project (PCSA) in partnership with French groups, and the GEN network, mentioned above. A large number of individual projects have been established in the country, as well, in many parts of the country, in over 35 communities.

One major operation is called the Palette Project, with an educational focus. An American group that has been generous in providing resources to schools finances this activity. Mr. Toure sees this as critical for developing a creative spirit in the communities where they work. One problem badly needing a creative solution concerns the mangrove swamps that line the Senegalese coast. Mangroves are being cut and burned to smoke fish for commercial sale, thus leading to serious erosion, as well as destruction offish habitat (a problem not unique to Senegal). He believes that solar energy can play a role in solving this problem, by providing alternative energy for the fish-smoking process.

The work of Senegal's Mr. Sun has been known in the solar cooking world for some time, despite communication issues for monolingual English speakers. All who know him are delighted that he is currently in a position where his vast knowledge and long lasting dedication to solar cooking can be placed efficiently in the service of that cause in his country and the region. Most noteworthy is the strong and continuing commitment of the government of Senegal to this work.

Remains of other projects are also found, some no longer in use. One example was seen in a dispensary in the town of Niaming which had a solar photovoltaic panel, used for sterilization of medical equipment. It was however not in use, with local medical personnel preferring to use an electrical sterilizer, even though the costs were very high. The solar version was slow to heat up and less convenient than the electric version,

which had been locally built and government subsidized at a cost' of around 380 Euros (Trip Report, M. Bonello, 2003).

Seychelles

No information has been found about solar cooking programs in this island nation.

Sierra Leone

A number of Sierra Leonians have written to SCI, asking for further information on solar cooking, but to date, no information about individual or collective activity to promote the technology is known to exist.

Somalia

Since little or no information comes from this beleaguered place, which continues to have no recognized government, there is also no information on any solar cooking programs. The one exception is found with regard to programs in the autonomous region in the north of the country, now calling itself Somaliland. In 2001, a Somaliland organization was awarded one of the prizes in the World Bank's Development Marketplace competition for community activities that included solar cooking. No information is available as yet on the outcomes of the funds received. Additional requests for assistance in renewable energy projects have been developed, but the logistical complications are substantial and no project had been successfully planned.

The situation in this part of the world is promising, climatically speaking, for solar cooking, and the need is great. However, continuing unrest and civil disorder have effectively prevented projects from happening. Several years ago, a photvoltaic installation was installed in Somaliland, but only at enormous cost, since all materials had to be flown in from Nairobi. It is hoped that at some point in the future, normal national activities can resume, and will include solar cooking projects.

In 2002, a team of staff from SCFs East African Resource Center, on request, visited the Somaliland area to provide consultant services on solar cooking. Their

conclusion was that solar cooking was feasible and would be useful. Interest appeared to be strong. No further developments in this area have been noted.

South Africa

The unique situation of South Africa has obviously played a major role in its development scenario. In the apartheid era, relatively little development assistance from outside agencies was received. With the birth of an African-led government and the remarkable leadership of Nelson Mandela, considerable effort has been made by donors to assist the nation which, related to its history, has a relatively high GDP per capita (for Africa) and solid growth. Enormous problems remain, of course, included housing and infrastructure shortages, huge inequalities, health issues - most prominently[v] AIDS - and the continuing struggle to achieve political stability and equity. In the latter years, a number of efforts to introduce solar cooking have occurred in the country, including a large and well-funded collaboration with the Government of Germany, described below.

The work of Anna Pearce, described above in "multi-country promoters" is prominent in South Africa, since she herself had lived in that country for many years. An organization called Women for Peace/Wonder Box seems to have multiple goals. Its members have taught many others to cook and to use the WonderBox, a commercially made hay box, as well as solar cookers.

A University of Natal community resources worker, Ms. Marianne Green, has been teaching women to use solar cookers for a number of years in the southeastern section of the country. She and her colleagues first conducted a survey on local perceptions of need, finding that collection of fuelwood was the biggest problem for women, resulting in exhaustion and lost time. To assist with that problem, a solar cooking program was devised, training women in solar cooking use, and teaching them how to build inexpensive ovens themselves. A description with considerable detail on this work was presented at the Kimberly world conference in 2000. Their study, a very well planned evaluation (a fine model for others to follow) allowed them to arrive at a number of conclusions. Solar cooking is clearly feasible in this part of South Africa, and could ease the burden of fuel collection for women. However, attention must be paid to gender issues, aimed at reducing the substantial inequities. The report ends with a

description of their plan to proceed, including local hosting committees, micro finance or revolving credit schemes, and development of income generating activities utilizing solar ovens (Varese, p. 207.)

The SunStove Organizion, allied to the international organization of that name (see 'Multi-National Promoters) has a strong presence in South Africa, complete with manufacturing capability and local staff. The stove was one of those selected for the GTC project (see below) and has been widely promoted in the South Africa context.

In the community of Vryburg, a school hosts a Training Center that has focused on teaching students and members of the community about solar cooking. Known as Tiger Kloof, the operation began in 2000, initially working with the school's students, then adding work in the local community. They have developed collaborative relationships with the Palmer Group, a South African consulting firm which has been vitally concerned with solar cooking, serving as local staff backup on the GTZ project (below). Tiger Kloof had a larger goal, that of establishing a formal instructional system for food caterers, a project which earns income for the school and meet a need for training for employment. Along with formal teaching, the operation's commitment is demonstrated by the fact that all of the buildings in the school and the catering training center are solar powered (.Kimberly, pp. 157).

An individual living in KwaZula, Natal, Richard Pocock, has also been a promoter in his area of South Africa. He has invented a variant on the panel cooker, made of a cardboard box folded to a pentagon shape. Like other panel cookers, the black pot in enclosed in a heat shield of plastic.

It is apparent that South Africa is serious about the use of solar energy. The Government has established policies ensuring that renewable energy technologies and applications are implemented and is making strong efforts to address constraints against such adoption. Resources are invested in further development of renewable technologies, comparable to other governmental investments.

Illustrating that commitment, far and away the largest program in South Africa is one which involves collaboration between the nation's Ministry of Minerals and Energy and the German technical cooperation agency (GTZ), the latter described above in the

section on "Multi-National Promoters. This project was the mosf thoroughly planned project ever, enjoying substantial financial support to "do it right".

Initially, a panel of European solar cooking experts was convened to examine a wide range of available cooking devices. After careful testing, six devices were chosen on the basis of cooking performance, durability, potential cost, and so on. Witfi the devices chosen, the next step in the project, Phase One, was a yearlong market study, evaluating the preferences of selected households in three sites in the project area of northwest South Africa. Devices were rotated at two-month intervals, and the sample population was surveyed repeatedly on each, evaluating convenience, durability, fuel saved, time spent, and other uses of saved time. A team of three social scientists conducted this carefully conceptualized and meticulously carried out study over a period of one year.

In a published article [http://solarcooking.org/social-acceptance=rsa.htm], the project describes that evaluation process and results. One hundred families were in the sample with 30 others serving as a control group. The topics evaluated included end-user acceptance, impacts on household fuel consumption and expenditure, planned purchase of stoves, and affordability issues. The study provided important lessons, including the promise of solar energy demonstrated by high usage, the importance of options in solar devices (no one size fits all), and the link between high use and payback time.

With the information gathered in Phase One, the project was prepared to go into full swing. Phase Two involved a large scale venture with manufacturing firms that would produce the cookers selected by consumer panels. Next came the commercial campaign to sell cookers (Phase Three), initially in the study area, but with a plan to cover more of South Africa over time. Arrangements were in process for households to be able to finance cooking devices. Extensive advertising campaigns were to be mounted in multiple media, newspapers, radio, TV, etc. Commercial outlets were secured in existing appliance and department stores to make purchasing a cooker convenient. Documents on the project's website, as of the writing of this study, report that the campaign is progressing. Another report from a correspondent indicated that there must have been a delay in obtaining government approval for the commercial aspect of Phase Two, intended to bring production to mass manufacturing (personal correspondence).

Phase Three however now appears to be underway: The activity and will be watched with interest by solar cooking promoters everywhere.

The original planner and implementer of the joint GTZ-South African Ministry plan, A.Bierman, retired from the agency. His intent at the initiation of the project was to do everything right: a carefully planned scheme, based on technical assessment of appropriate devices and by field assessment of actual users of the devices, followed by a commercial marketing plan to reach mass audiences. Time will tell how successful this impressively planned and carried out project proves to be.

Sudan

No formal activity involving solar cooking is known to be happening in Sudan.

Swaziland

No information was found on solar cooking activities in Swaziland.

Togo

No record has been found of solar activity in Togo.

Tunisia

No information is available on solar cooking work in Tunisia.

Uganda

A number of small and medium scale projects have been initiated in Uganda, a country frequently touted as making good development progress, economically and politically. Interestingly, several of the small projects have been undertaken by organizations serving disabled persons. One, led by Amos Byakagaba, coordinator of the organization, demonstrates a range of solar cooker types in many public venues. They have targeted 23,000 families in Uganda as appropriate for training in the use of solar cookers (SCI Review, Nov. '01). A similar organization, Disabled Technicians Uganda Limited, also demonstrates and promotes solar cooking (SCI Review, Sept. '97).

Another project includes Ultra-Tec, Inc., which is a company selling global Sun Ovens, with plans to collaborate in manufacturing when demand is sufficient. An active organization, The Creative Center of Mbale, has taught many people to make and use solar cookers in the Mbale Solar Cooking project (SCI website -solar cookers.org).

Substantial momentum appears to have occurred in this country, with the creation of a national promotional group, the Solar Connect Association (SCA), headquartered in the Kampala area. This group has been in existence for nine years, and reports that they have taught 20,000 persons to solar cook, and have produced 10,000 solar cookers in that time. They even have recruited and trained employees of the Virunga National Park Environment Project, located in the Democratic Republic of the Congo, home of the famous mountain gorillas.

SCA has utilized solar box cookers and also has assisted in the distribution of the parabolic cookers of EG Solar in Germany. The most commonly used, the real "workhorse", is the inexpensive cardboard CooKit that can be made by individuals for an expenditure of 60 cents. In 2004,1,161 new trainees were reported, with 1,354 various types of cookers made.

The solar devices are not only used to feed households, they are also employed in income generating activities, including baking cakes and bread, canning fruits, and pasteurizing water. The group's leader, Mr. Mukasa, credits the work to his meeting Ulrich Oehler, a legendary figure in solar cooking and the founder of the ULOG group, in Switzerland, then researching many sources for additional information. One person can truly make a huge difference (http://www.solarconnect.4t.com).

A rather unusual project has also been reported in Uganda. The Health Technology Development Centre of the Ministry of Health of that nation reports successful use of solar cookers as sterilizers, as well as preparers of food in hospital and health centres. They have also developed a pasteurizer for use in purifying water for hospital use. Attempts to disseminate solar technologies have been slower than desired, and therefore they have also attempted to analyze barriers and consider methods to eliminate those barriers. Those methods have included collaboration with various international/national institutions, use of local materials that fosters job development, and the development of local standards for construction and installation of the technology.

This group believes in the technology and suggests that creative means to disseminate solar cooking more broadly will be needed, including demonstrations and multiple training opportunities.

United Republic of Tanzania

Wide ranges of projects are found in Tanzania, many located in schools, missions, or local training centers. Solarafrica, a Zanzibar organization, has promoted both basketry and solar ovens on the island of Zanzibar for many years, sponsored by the Esperanto Club of Lund, Sweden. Early in the development of connections between the two areas, the shortages of fuel for cooking were noted. Swedish participants have developed a number of simple technologies that can be locally made, such as parabolics of cardboard lined with foil, and another formed from a large flat basket. (SCI Review, Sept '02).

Yet another project on Zanibar, sponsored by a German group, Mama Earth, uses both parabolic cookers and boxes, preferring to cook some food in the slower box and the parabolic for "speed cooking" rice, and also for dying plaited palm leaves for craft use. In addition, the group is experimenting with the use of flattened beer cans as reflectors in a frame of wood or metal for homemade cookers.

Another German group, Solar Cooking Zanzibar, is also located on the large island offshore from the mainland of Tanzania. The focus of this group is craft and artisan development; they have used solar cookers to dye fabrics and basketry material for craftwork. Some of the profits have enabled members to purchase solar cookers for their own household use (SCI Review, Aug, '02). The German electric utility, Bayernwerke, has made possible the provision of parabolic cookers for a local fishing village, as well, and a number of sponsoring organizations have made possible the building of a workshop and solar powered kitchen. (SCI Review, Aug '00).

On mainland Tanzania, a religiously affiliated group, EAG (T)Church - MJIMWEMA in Kigoma produces locally made parabolic or "bowl" type cookers. The Evangelical Lutheran Church of Tanzania in Morogoro Province has conducted research on fuelwood use, and then began using parabolic cookers, sent from Germany, for cooking, pasteurizing water, and firing clay bricks. The Kilimanjaro Biolgas and Solar

Centre sponsors many types of renewable energy and has been active in solar cooking promotion for many years. (SCI Rev Dec 00). Many of the devices promoted by Anna Pearce (see "multiple-nation" promoters section above) are in use in Tanzania, particularly the "Anahat" cooker/hatbox combination. Other organizations working in Tanzania are the Ilemi Secondary School of Mbeya, Net-Score of Malinyi, and Solar Innovations of Tanzania.

In the summers of 2001, 2002 and 2003, Project AHEAD, an American non-governmental organization, demonstrated the use of solar cookers for water pasteurization in two areas of Tanzania, first in Shinyanga District, in the northwest of the country, and the second in Kisarawe, near Dar es Salaam. National and district health officers have attended workshops on the technologies of water testing for contamination, followed by demonstration of the use of solar cookers for water pasteurization. In the summer of 2003, household surveys were conducted in both districts to serve as baseline data and an evaluation tool for a large project to be mounted in the period, 2004-2006, funds permitting. This will be the first major demonstration project focused on the use of solar cookers for this purpose. Because of the innovative nature of this project, a case study on this topic is included with this report.

Western Sahara

Nothing concerning projects on solar cooking or individual promoters has been found for Western Sahara. This largely desert area, with a small population and a desert landscape for the most part, could be very suitable. Conflict between Spain and Morocco over the area, coupled with an internal insurgency, has effectively kept this area closed to outside contact, making development slow and difficult.

Zambia

A small solar cooking project has been started in Zambia with the assistance of the Rotary Club of Lusaka Central and the Lusaka Girl Guides. At the time of reporting, December 1999, 50 people had been trained to use the solar cookers. Rotarian Nic E. Money is carrying on the work, which was started by American Rotarian, Wilfred

Pimentel, and Girl Scout trainer, Barby Pulliam, also an American (see above for "multi-nation" promoters.)-

Zimbabwe

Discussion above in the Multi-National Promoter section, has described the project in Zimbabwe which was started in 1997 in conjunction with the meeting of the World Solar Summit Commission, a group of Heads of State from representative nations of the world, announcing the start of the World Solar Decade, 1996-2005. Prior to that time, SCI, with the aid of a financial grant from UNESCO, had quickly initiated a project in Zimbabwe, in collaboration with the Development Training Center, a unit of the University of Zimbabwe. The history of the project, while having an auspicious beginning, is not altogether a rosy one.

Initially, the project went very well. A corps of experienced trainers traveled to Zimbabwe, to two selected areas, one rural, the other a peri-urban area near the nation's capital, Harare. Staff from DTC assisted in organizing local contacts with appropriate organizations; training of women in both sites was accomplished swiftly and effectively. The Commission meetings went well; they were able to enjoy solar cooked food produced by Zimbabwean women, pronounced as excellent by the national Heads of State and other high officials present. In the years following, between 1996 and 2003, over 6,000 cookers have been sold and their buyers trained in solar cooking methods.

However, after the "brass" departed, the Commission's work accomplished, the project was less secure financially and promised funds for future years were not made available to SCI and the DTC. Adjustments had to be made in expenses, the projects were considerably curtailed and new modes of operating were sought. Over time, the peri-urban project was dropped, while the other, located near Zimbabwe's second major city of Bulawayo, was changed to one that conceptualized individual trainers as independent entrepreneurs, selling the cookers plus a training program for a fee, which generated a small income for the trainer. While still in existence, many difficulties ensued in latter stages of the project: transportation in rural areas is difficult and erratic, supplies were not always available in timely manner, and staff changes at DTC required continuous reorientation to the project. Kindhearted trainers sold cookers on time, and

then had trouble collecting the funds from buyers. Misunderstandings were occasionally present between the two major sponsors, separated by 8,000 miles. Funds for use of the solar cooking programs from Solar Decade money allotted to the Department of Energy never became available. And finally, as backdrop for the work, the nation has been in extraordinary political and economic turmoil for several years with no end in sight. Many hours have been spent re-examining what went wrong with this project, which though continuing to operate on a small scale, surely might have been more effective (Kimberly, p.217). A small Rotary funded project however now operates in the same area of the country, near Bulawayo, utilizing a number of the trainers from the SCI project.

Summary of Solar Cooking Programs on the African Continent

The following table shows the distribution of countries between the various categories of the scale used above. As can be seen in the table below, 27 or just over half of the 56 African countries have had no known solar cooking programming. The table shows which countries have been placed in each category.

Table III A. Distribution of Nations by Experience with Solar Cooking

No Programs N=27,	Algeria, Angola, Benin, Burundi, Cape Verde, Central African Republic, Comoros, Congo, Democratic People's Republic of the Congo, Djibouti, Equatorial Guinea, Gabon, Guinea-Bissau, Liberia, Libyan Arab Jamahiriya, Mauritania, Mauritius, Reunion, Saint Helena, Sao Tome and Principe, Seychelles, Sierra Leone, Sudan, Swaziland, Togo, Tunisia, Western Sahara
Individuals Promoters N=10,	Botswana, Cameroon, Chad, Cote d'lvoire, Eritrea, Mozambique, Namibia, Niger, Somalia, Zambia
Small Scale Projects, 1-100 N=7	Gambia, Guinea, Malawi, Mali, Morocco, Nigeria, United Republic of Tanzania
Medium sized Projects, 100-1,000 N=9	Burkina Faso, Egypt, Ghana, Lesotho, Madagascar, Rwanda, Senegal, South Africa, Zimbabwe
Large Projects 1,000-30,000 N=3	Ethiopia, Kenya, Uganda
Mass, national	
Exporters	
N=56	

As seen in the table, 27 of 56, or just over half of the countries have no solar cooking programs. Twelve countries on the other hand have rather large programs, serving more than 100 and in a number of cases, many thousands of households and their family members.

CHAPTER III B

SOLAR COOKING

ASIA

The Asian continent has the largest area and the largest population of the earth's continents. It stretches across nearly ten time zones and has 30% of the earth's land surface. Its climatic and geographical diversity is enormous, as well, containing as it does the world's highest mountain, as well as deserts, jungles, volcanoes, long coastlines, great rivers, inland seas and lakes. North-South, Asia extends from roughly 10 degrees below the equator to well beyond the Arctic Circle in the North. The bottom, half of that latitudinal range would appear to be appropriate for solar cooking, making Asia. potentially a viable marketplace for solar products.

Asia's great size and geographical diversity is accompanied by thousands of years of history with great variation in its inhabitants. As one would suspect, there are more ethnic and national groups than any other continent, and an amazing range of contemporary cultures, with considerable extremes of wealth and poverty. Part of the continent, the so-called Fertile Crescent of the Middle East, is credited with the emergence of agriculture over ten thousand years ago. Central Asia, with its famous Silk Road, has been a melting pot for much of that period, as traders traversed the breadth of the continent, sharing goods and knowledge. Japan and China were other entry points for European connections to the vastness of Asia. War and conquest are integral, but less pleasant, parts of that history as well. The area is thought to have been originators of many consumer goods for trade, including gunpowder, silk, and many medicines.

In the section below, solar cooking programs found in the nations of Asia are described.

AFGHANISTAN

This country, much in Western news in the last years as the refuge of Al-Quaeda members, has actually had solar activity for some time. A newspaper account (Kabul New Times, July 6,1985 (in the Soviet era) discusses research activity for utilization of

solar energy, conducted under the auspices of the Solar Energy Institute, a part of the Academy of Sciences of the Democratic Republic of Afghanistan. The effort was principally directed towards the potential heating of houses (not cooking, in the article shown) in recognition of "an increasing deficiency of traditional (presumably meaning wood) and other energy sources". The article further states that since Afghanistan has 300 sunny days per year, conditions are favorable for generating solar energy. The device pictured in the article is a flat plate collector, with two scientists working on its development. Not long after this article was published however, the solar research work most likely ceased with the end of the Soviet regime and the beginning of the Taliban period.

In a later era, this one under Taliban rule, the SERVE Solar Project, operating in Peshawar, Pakistan, moved its operations to Jalalabad, Afghanistan, in order to serve the population of refugees then returning to Afghanistan, after the departure of the Soviets. SERVE is a British humanitarian agency with projects in health, disability services, relief, and environmental issues. Its work in Pakistan began in refugee camps filled by an Afghan population in 1980. While working on other problems, SERVE discovered the severity of fuel shortages and based on that need, developed a large scale and very successful solar cooking project (see the report on Pakistan). Refugees who moved back took their box cookers with them and demand in Afghanistan was substantial. Initally, SERVE trucked box cookers to Kabul for sale in the market places. Later, they established an office in-country. In 2001, as Taliban rule tightened, SERVE (considered to be a "Christian" organization and hence not acceptable) was forcibly ejected from the country, its gates locked, its staff deported. (Newspaper clipping, NYTimes, date?)

After Taliban rule ended, and under the present US led military assistance while the provisional government becomes established and stable, solar cooking has returned to the country. Several projects are underway currently, all too new to have been evaluated for the achievement of their goals. The following agencies are known to have a presence in the country, with a solar cooking component.

Under the leadership of retired SERVE staffer, Gordqn Màgney, who returned to live in Kabul in 2002, a small project is underway utilizing a new box cooker developed by an American NGO, the Solar Oven Society. (See section in chapter Multi-National Promoters) The new cooker, called "The Sport" is made of recycled soda bottles with a mylar cover and (soon to be available) shiny reflectors. Four hundred of the cookers were shipped to Kabul, unassembled, along with the equipment required to assemble the finished product. Under the supervision of Magney, that has now been accomplished. Training of users and sale of the cookers at a cost subsidized by a number of Minnesota churches is underway.

Another project in Afghanistan is sponsored by the Rotary international network (also discussed in the Multi-National Promoter section). A humanitarian unit called The Temple Solar Project was established by several Rotary groups in November of 1998. It has been supplying large community sized cookers called The Villager (produced by Sun Oven) to communities around the world. The cost of each villager is $10,000, plus shipping costs of an additional $3,500. Five of the Villagers have been shipped to Afghanistan; two are already installed and in operation. The others are in transit or awaiting delivery. The first oven was installed in a school, in collaboration with an organization called Friends for Afghan Redevelopment, cooking food for students and staff.. Some smaller solar cookers are not particularly effective in cooking the traditional Afghan bread, an unleavened "naan"type, which is however easily made in the Village. The large oven can also be used for bakeries as income generating projects or in institutional settings such as schools or hospitals. Logistical difficulties are continuous, including moving the goods through customs, appropriate training, and so on, but the projects are proceeding according to plan.

An individual, Laila Petty, was prepared and equipped, by an experienced solar cook associated with SCI, to promote solar cooking, prior to a extended visit she was planning to make to Afghanistan. A native Dari speaker, Ms. Petty was particularly interested in the plight of the "internal displaced persons"(IDP) in Afghanistan who do not receive international assistance from refugee organizations, but are nonetheless homeless and poorly served by charitable organizations. Early in her yearlong stay in

Afghanistan, she made a number of contacts with relief agencies; did a number of demonstrations, more or less on her own, and conducted training for cooks in several IDP locations. Her work was well received, but agencies in the country were already overburdened by the difficulties of working in the country and none took up her offer to assist in development of a solar cooking project. She was even able to locate a potential manufacturer of CooKits, the device she was using to demonstrate, and the cheapest solar cookers available. However, none of her work resulted in any substantial interest. She ultimately found a different cause to work on, but would be willing to assist in a solar project should one develop.

Yet another project is on the drawing boards. A New York woman named A.J. Lederman has long experience and extensive contacts in Afghanistan. She is interested in pursuing a solar cooking project that would utilize the network of women's organizations, focusing initially in the Kandahar area. To date, security problems there have not permitted this project to move forward. One step towards that goal however occurred in the U.S. when a group of Afghan women teachers were invited to participate in a month long workshop on science education. Solar cooking was introduced to the teachers under the auspices of this educational project, creating a pool of knowledgeable persons in good positions to assist with solar cooking promotion when that becomes feasible in Afghanistan in areas beyond Kabul.

ARMENIA

No information about solar cooking is known in this country.

AZERBAIJAN

The search for information on solar cooking has shown nothing in this new nation, formerly part of the USSR.

BAHRAIN

No information has been found on solar cooking in Bahrain. The country is a small nation on the Arabian Peninsula, oil rich, and hence currently without substantial need for solar cooking.

BANGLADESH

No systematic promotion of solar cooking is known about in Bangladesh, although representatives of a Catholic order have expressed interest and requested information from SCI.

BHUTAN

This neighbor to Nepal has kept its border difficult to pass for some time, in the interest of preserving its environment and relatively pure Buddhist orientation. As an example, only a limited number of tourist visas are issued in any given year. To the best of existing knowledge, no solar cooking activity has taken place in the country.

No solar cooking programs are known to be present in Bhutan. However, a substantial number of Bhutanese refugees, currently living in Nepal, are users of the technology (see commentary below on Nepal).

BRUNEI DARUSSALAM

Nothing is known of any solar cooking activity in this small nation, located on the northeast corner of the island of Borneo (surrounded by one segment of Malaysia.

CAMBODIA

Nothing is known of solar cooking programs in this nation located in peninsular southeast Asia.

CHINA

The world's largest solar cooker programs are found in China. One contemporary spokesperson for this issue in China is Chen Ziaofu, Deputy Secretary General of the China Association for Rural Energy. He writes that China has been active in designing devices, in materials technology, in establishing technical standards for industrial production, and in dissemination and sales for over 20 years. An earlier spokesman, speaking at the First World Conference in Solar Cooking, held in 1992, provides an even longer history. Wang Xiping, a participant in that meeting in Stockton, California, outlines the use of light-collecting and focusing devices in China back into antiquity. He tell his audience that solar cooking had appeared in China before the beginning of the 20th century, with Peking duck roasted in Xiao's Duck Shop, ChengDu, China, in 1894. (Pejak,ed., 1993, p. 12).

Both gentlemen and other reporters tell of a number of efforts within China in the 1980 and 1990s. Following up on an initial meeting in 1973 on solar cooking as a new technology, the first China National Solar Energy Congress was held in 1975, a second in 1979. From initially using principally circular parabolics and simple box cookers, new and improved designs were introduced during this period, and materials for several new designs were explored and tested. In 1982, at the national level, a United Key Task Team on Solar Cooking was created, under the auspices of the Ministry of Agriculture, since the technology was particularly needed in rural areas where fuelwood was increasingly in short supply. The work of the Task Team was to begin the rigorous assessment and establishment of standards for solar cooking devices to assist consumers and policy makers in comparing the efficiency and consumer acceptability of solar stoves. Even as this was occurring, solar cooking was spreading rapidly through the countryside as the new designs emerged. The need for mechanisms to evaluate cooking equipment became clear; by 1990, National Standards for examining and testing focussing cookers were ratified by the China State Standard Agency. Over time, these beginning have led to movement from experimentation to industrial production, and from strong government support to semi-commercial dissemination strategies.

Most of the effort has been focused on rural areas. Districts with cooking fuel shortages have shown strong support for cookers using the sun's energy. Even as subsidies have been reduced, sales have continued to grow. Factories supply most of the cookers, which are made of metal or concrete, with glass as reflecting mirrors. Others are made by hand, and in both modes, new and improved designs continue to be developed and tested. Government sources continue to provide technical and financial assistance, both to active and potential manufacturers and to low income consumers, through subsidies and tax reductions.

The most recent estimate of cookers in use in China is 560,000. While there is considerable variance by region, each cooker is believed to have saved from ^600-1000 kilograms (somewhat under 300 to 500 pounds) of fuel wood per year, important benefits to both economic and environmental circumstances.

Tibet appears to be a special case in regard to solar cookers. The Solar Energy Research and Demonstration Center of Tibet, in Lhasa, indicates that approximately 70,000 solar cookers, mostly of the concentrator type, have been sold in Tibet. Initially, these sales were heavily subsidized, but that seems no longer to be the case. The cost of the devices is roughly $60, but fuel savings amortize the cost quickly. The devices are more popular in rural areas than in cities, as agriculturalists and herders are eager to save animal dung for use as fertilizer rather than as cooking fuel.

An example was seen recently by American subscribers to the National Georgraphic magazine. Many were startled when they opened the January, 2002, National Geographic, to find a picture of a woman making herself tea beside a modest house in the middle of China's Alashan Plateau, an isolated high natural desert in the far north of China, bordering Mongolia. The surprise was the stove she used, a mirrored solar collector. The brief story said that she was a widow of Mongolian heritage, 72 years old, living alone since the death of her husband almost 30 years ago, existing on earnings from herding camel and sheep. The lonely life meant she saw few people and had few opportunities to spend her small income. She therefore decided to invest in some "creature comfort" for herself and purchased a parabolic solar cooker for about $150.

She uses it regularly to cook her meals, make tea, and prepare food for occasional visitors, in this area where the sun shines most days. She was very pleased with herself and her purchase.

Many reports of correspondence from manufacturers, research institutes, social organizations confirm the steady interest in China in solar cooking. Perhaps this interest, expertise, and promising experience with solar cookers might be harnessed in some way to assist other nations of the region.

To that end, a September 1994 International Solar Energy Applications Training Workshop was held for citizens of other Asian nations, sponsored by the National Energy Research Institute of Gansu Province, Academy of Science, and aided by the Ministry of Foreign Trade and Economic Cooperation. The workshop is one excellent model for dissemination of the technology in Asia. China was also represented among those demonstrating solar cooking at the 2002 Johannesburg World Social Summit.

CYPRUS

Yet another troubled site, (and one not usually thought of as Asian) is Cyprus, where no solar cooking project activity has been reported. However, a representative of Rotary, Demetrius Lordos, is knowledgeable about the building and use of solar cookers, as is a former consultant to SERVE in Afghanistan, David Morris, who now runs an organization called Natural Energy in Cyprus.

PEOPLE'S DEMOCRATIC REPUBLIC OF KOREA

Solar cooking activities are known to have taken place in this country, located on the northern half of the Korean Peninsula, but the current status has not been possible to confirm. The activity involved the Adventist Development and Relief Agency (ADRA) through its church offices in Switzerland, and the cooperation of governmental authorities of the Democratic Republic of Korea. ADRA planned a first phase goal of building 1,000 Solar Kitchen Units, each with cooking capacity for about 120 people, along with

substantial food aid. Solar Brueke in Germany (see Multi-Nation Promoters) assisted in providing the technical equipment.

The project began in 1999 with shipment of food supplies, followed by mobile cooking units, consisting of parabolic cookers mounted on trailers. Automatic tracking systems, built out of bicycle parts, adjusted the parabolic towards the sun.

The most recent information on this project is dated July, 2000. Requests for information on the current status of the project have received no answer. The current unstable political situation may well be making this activity more difficult.

GAZA STRIP

This small, but extremely densely populated area, is one of the two parts of the territory occupied by Palestinians since the creation of Israel in 1948. The Gaza Strip is physically separated from the West Bank area and can be conceptualized as a separate unit. Its average density is 2,834.2 persons per square kilometer, making it something close to one large refugee camp, with huge needs.

While solar cooking would be useful and feasible, no evidence is found of any activity of this type.

GEORGIA

This new state, carved out of the former USSR, reports no solar cooking activity.

INDIA

India, Asia's second largest country, next to China, has also the second largest number of solar cookers. The situation in India is more complex than that of China. More is also known about Indian programs. The Third World Conference on Solar Cooking was held in India, permitting the history and progress of solar the technology's uses to become better known around the world.

An official government report informs the reader that the Ministry of Non-Conventional Energy Sources (MNES), Government of India, was established in 1982, first as a Department and later as a Ministry. The Ministry's mandate extends well beyond solar cooking, including fuel efficient wood and charcoal stoves, power from other renewable sources, energy from industrial wastes, research and development in a number of related fields (photovoltaics, biogas, and pollution prevention, for example). MNES began seriously to promote solar cooking in the early 80s, with an initial focus almost entirely on the box cooker.

The population of India is roughly 70% rural. MNES states that "cooking accounts for a major share of the total energy consumption in rural homes (Singhal, correspondence, 2003, p. 1). Sources of that energy are largely fuelwood, animal dung, or crop residues, all of which emit smoke, pollute the atmosphere, and are deterimental to health and safety of family members, particularly women. Fuelwood is become scarcer each year. FAO data show that 21.6% of the Indian land mass is forested, and conservation efforts are in place to reverse previous loss. The effort is affected by the large and dense population and a slowing but still substantial birth rate (continuing to increase at 1.7% per annum, or 17% in a decade). Solar cooking has been viewed as one way to alleviate a number of India's problems and as such was supported by government efforts.

Considerable research and development was done in the 1980s, expanding much earlier work done in various research institutes as far back as the 1950s. In- and out-of-fashion manner, early interest waned, only to be revived in the 80s. The box cooker chosen for promotion was a square, flat topped box with single reflector, large enough to hold 4 Indian pots (which are relatively small in size, compared, for example, to African pots). A subsidy of about 30% was provided by the central government; the subsidy subsequently was reduced to 15%. The scheme was implemented through state government agencies established to promote renewable energy. Local NGOs and women's groups were called on to aid the promotion.

An important hallmark of the scheme was governmental development of quality standards, along with intensive efforts to recruit entrepreneurs for the manufacture of devices. The incentive scheme continued until 1993-4 when it was discontinued for box cookers. In the 12 years of subsidies, about 340,000 cookers were sold. Some attempts was made to encourage users by preparing cookbooks, and holding demonstrations in cooker use, but apparently the effort was not adequate. Studies showed that over 70% of the owners were not using the cookers, citing climatic conditions, time constraints, non-availability of appropriate cooking sites, etc. Repair of damaged cookers was also a problem as after-sale service was not in place. All those factors apparently contributed to the decision to end subsidies.

In 1994, India's program turned more towards commercialization with manufacturers being encouraged to improve cooker design and to sell through their own commercial networks, instead of the government agencies as had been the case previously. The idea was to harness the power of the market place and encourage adaptation to particular market niches with different models for different parts of the country and segments of the population. The subsidy began to go to manufacturers to encourage awareness building, demonstrations, training, repair and other services. That support was available on a 50% cost sharing basis. Interest free loans were also made available to wholesalers or to institutions to supply cookers to employees. Loans at attractive rates were available to manufacturers for new equipment. The government also subsidized creation of showrooms in the various states of India for renewable energy products of all kinds, including cookers. The sites will not only be showrooms but will provide repair services for users. Some states also offer consumer subsidies.

This more market oriented approach is seen as responsible for the development of improved models, with the down side being reduced sales as the newer models are more expensive and the subsidies of the past to users has been ended. However, the average sales per year still averaged 25,000 new cookers, largely to urban people, since the unsubsidized price is high for most rural dwellers. India is clear that more affordable but durable models are needed for rural areas. Limited use of the CooKit dates to the 1996 conference when many saw this very low cost device for the first time.

More recently, the parabolic concentrating cooker has been introduced to India, both the household size and the far larger, community sized installations. Most of the parabolics introduced are those promoted by EG Solar and the Sheffler group, both German organizations (see the section on Multi-National Promoters). EG Solar uses several types, the dish (in several sizes) for household use, while ULOG-Sheffler promoters focus on large community cookers, now being manufactured in India. The latter can be used to cook indoors, by focusing the large parabola through a wall aperture and then reflecting that onto cooking pots. The most unusual are steam solar cooking systems which link a number of tracking solar dish concentrators to create high pressure steam for cooking large quantities of food. Other new developments in large scale cookomg are under study, as well, including hybrids which have back-up oil or gas burning systems.

India is also undertaking intensive study of the potential of other uses, such as solar food processing, to tackle the problem of excess food at harvest times, which goes to waste if not preserved in some manner. Common usage in India is open air drying which is unreliable and unsanitary. The Government of India has offered subsidies of up to 75% to companies to design and create systems for this purpose. During the subsidy period, 60 solar drying systems and 70 timber seasoning plants were installed in the country. Similarly, solar air heating to dry products such as spices by using roofs as solar collectors has been attempted as a means to slow use of electricity or fossil fuels. This government is making renewable energy a major component in its development planning.

In addition to governmental activities, a number of organizations have pioneered solar activities in various parts of India. As described in the introductory chapter on solar cooking history, the Third World Conference on Solar Cooking was held in Coimbatore, Tamil Nadu State, in 1997, on the campus of Avinashilingam Institute for Home Science and Higher Education for women, Deemed University. Coordination of conference planning and implementation was under the direction of the Institute's Chancellor, Rajammal P. Devadas, a towering figure - though short in stature - in education of women and in solar cooking promotion. An impressive display of Indian made solar

cooking equipment, plus contributions from other nations, comprised the exhibit area. Participants from every Indian state meant that solar cooking was widely noticed on this huge continent. Impressive representation of many governmental units was present. The conference attendees were treated to heartfelt welcome and gracious hospitality by the young female students of the Institute. In addition, attendees enjoyed superb Indian food during their stay in Avinashilingam quarters! But most importantly for purposes of this report, theoretical and applied research and development regarding cooking devices and dissemination/promotion issues were presented by and for the international group gathered from around the world for the occasion, making powerful learning and networking possible.

Representatives of two state government agencies, in Maharashtra and Gujarat, both responsible for implementing the national government's subsidy programs, spoke at the conference, describing the operations in detail, describing marketing strategies, product design issues, successes and challenges still ahead in solar cooking promotion, giving conferees a better picture of how the system was working throughout India.

Institute faculty and students had instigated considerable solar cooking training and promotion in the South India area; Institute members has also studied the design and assessed the efficiency of various stoves. Dr. Devadas herself, a home economist by training, had conducted considerable research on the important topics of nutritional value of solar cooked food, as compared to traditionally prepared. A representative of the Indian Institute for Technology, H.R. Garg, has contributed substantial scientific knowledge about the field at world conferences, along with a number of other Indian scientists who have presented their findings at the various world meetings.

A number of programs have been established in India in collaboration with overseas agencies. As described above, many large scale parabolic installations for mass cooking are in place in India. The German ULOG group began this work in 1990 in several places in Gujarat State. Since the technologies were relatively new and not previously evaluated, a rigorous evaluation was conducted, a relatively rare part of solar cooking projects. The work is described in a paper presented at the Coimbatore

conference. Thirty-one community kitchens had been installed in social service institutions. The evaluation was focused on four topics: technology, acceptance, energy saving, and financial efficiency, and was conducted 5-6 years after the installation. The findings were not all positive: 2/3 of the kitchens were not in use, largely because appropriate servicing and repair was not available. A number were used regularly, however. The technical efficiency of the equipment was acceptable, when problems with maintenance were solved. Regarding acceptance, most policy makers were committed to the technology, but disappointed about the repair need, while kitchen workers were more satisfied (less smoke, easy cooking, etc.) Energy saving per kitchen amounted to a ton of wood per year, though with increased use, much more could be saved. Complex calculations about payback time and financial savings in this field (cost of wood, climatic circumstances, etc.) are very difficult to calculate, involving many complex variables. Under optimal circumstances, the ULOG kitchen could achieve payback in half a year, according to the study, but if used irregularly or inefficiently, are not financially viable. The ULOG group are to be congratulated on this ambitious and rigorous evaluation, relatively rare in the solar cooking world.

In other parts of India, larger installations designed by Wolfgang Scheffler of the ULOG group (see the section on Multi-National Promoters) are in place. In 1997, a large system was installed at the Bramakumari Ashram, Mount Abu, India, equipped to prepare food for 1,000 persons. Recently a yet larger installation was built at a different Bramakumari location, Taleti, also near Mount Abu, this one cooking for 10,000. The devices are solar steam cooking systems, with units made up of 14 dish concentrators, each of which has an 11 square meter reflecting surface. Six such units are connected to a central steam pipe which transfer cooking power to the kitchen. This system was for some years called the world's largest solar cooking installation. The most recent addition to the list of large solar steam kitchens was completed in October of 2002. Located in the Andrha Pradesh town of Tirmula, this latest is the biggest yet, capable of cooking up to 30,000 meals a day. In each of these instances, the Government of India has been an active participant, as described above, in collaboration with members of the ULOG group.

Smaller organizations also promote solar cooking in India. The Barli Institute for Rural Women in Jhabua District of Madhya Pradesh demonstrates and uses solar collectors, both household and community sizes. The School of Energy and Environment Studies at Devi Ahilya University in Indore has worked closely with the Institute to serve rural women. An outstanding aspect of this program is an emphasis on extended training and motivation, deemed necessary to change long held cooking habits for new. Beginning in the 1980s, the Institute used solar box cookers for its own cooking and later, two Scheffler type reflectors with thermal heat storage capability. Many women were interested, and therefore the next phase was placing household size parabolics in villages served by the Institute. With assistance of the German agency, EG Solar, 50>parabolics are now in place in the area. The programs of the Institute have received recognition from UNESCO and UNEP for outstanding environmental achievement. But most importantly, the village women, comfortable with using the cookers, tout the technology as improving their lives. (Bahai International Community, One Country. Vol. 1, Issue 3, Nov.-Dec, 2002.)

Avinashilingam Deemed University staff members have conducted substantial research over the years. One particularly well done evaluation focused on solar cooking acceptance in Andhra Pradesh. A mailed questionaire was sent to a purposively selected sample, in an area where much solar cooking was underway. The findings included: families were using cookers at an acceptable usage rate, most daily, a few twice a week; other uses besides family food preparation included baking cakes and biscuits for sale, roasting spices, making ghee, and storage of spices in rainy weather; taste and consistency of food was excellent; and most were clear about its economic value. The researchers concluded that solar cooking was proving to be ideal in this developing country with a low per capita income.

Another project is largely the work of Ms.Didi Contractor, an American woman, long resident in the north western state of Himachal Pradesh. The area extends from southern plains up to the Shivalik Mountains and across the Himalayan watershed into an arid region bordering Tibet. As a part of larger efforts to improve long term sustainability

of this mountainous region, Ms. Contractor and a number of other agencies and government units, had in 1985 created an organization, the Society for Environmental and Rural Awakening, to work on a range of issues.

The Ghauladhar Solar cooker, was one of the initiatives of the group. The cookers are box type but fixed in the ground on a brick structure, facing south. Two standard sheets of glass cover the box which has an inner matte black oven made from used ghee or oil containers. The oven part is tightly sealed with fabric, and rice hulls are used as insulation between the metal oven liner and the brick stand. An opening on the front of the box permits the food to be put in and removed. The stoves, using locally available material, are made by villagers with few tools and a day of training. A water proofed fabric cover protects the stove when it is not in use.

Early support for the work was provided through an Indo-German Project. However, that support was not sufficient to sustain the proposed promotional scheme, called "the solar seed centers" in which satellite centers in neighboring villages would be created in places where women naturally congregate. Training would be provided in response to demand stimulated by demonstrations and considerable follow-up of trainees/new cooks was considered essential. No information exists on how the project developed beyond its initial stages.

In another part of that same area, an interesting project has been in place for some years. The isolation of the area makes communication difficult and information scarce, but fortunately, a book by the well known Swedish sociologist, Helena Norberg-Hodge tells the early story of solar promotion in the area around Ladakh. The book, called Ancient Futures (San Francisco: Sierra Club Books (1991), tells a fascinating story of the author's life and work in Ladakh, sometimes called Little Tibet, and described as a "wildly beautiful desert land high up in the Western Himalayas" (book jacket). Ms. Norberg-Hodge has spent many years in Ladakh and the book is about far more than just solar cooking - indeed, more than just the area itself. She poses serious questions about technology and its impact, about modernization, about the meaning of

life itself, all in beautifully thoughtful prose, well illustrated by personal encounters and with illustrative photos.

The landscape and very life of Lakakh is dictated by the seasons; it is scorchingly hot in summer and frozen solid for nearly eight months of winter. At an altitude of around 10,000 feet, agriculture consists principally of animal husbandry, with barley almost the only crop feasible. At lower elevations, fruit and vegetables can be grown. Ms. Lakahk in 1978, then a well known part-time resident, began to work on obtaining government support for simple solar technologies. The first was the elegantly simple passive solar Trombe wall for heating houses, using South facing glass panels and black, heat absorbing walls behind it, which works well in Ladakhian winters.. Eventually she and her Tibetan colleagues formed the Ladakh Ecological Development Group, which promote appropriate technologies for the area, including solar ovens, water heaters, and greenhouses which permit year round cultivation of vegetables. The organization's headquarters models and demonstrates by using a wide range of renewable technologies. She believes the group has been instrumental in instilling in local people an understanding of the importance of ecological perspectives in all development which will allow them a development path based on self-reliance and self-respect rather than dependence. She argues persuasively for understanding the interconnectedness of all life, a basic idea which is deeply rooted in Ladakhi culture, thus an idea is not new but ancient.

The Ladakh Project continues, and specific solar cooking projects have been a part of its work in several communities. An intensive evaluation of the solar projects in the area was carried out in 1992 by American anthropologist, Cynthia Hunt. The project was health oriented, with the solar work only one portion of the whole. Rather simple solar technologies take advantage of Ladakh's most abundant resource: solar power. Cookers, water heaters, room heating systems, greenhouses had been installed in numerous refugee camps and villages of the area.

Ms. Hunt was asked to conduct the evaluation, which took place over several years and several trips to this hard-to-reach part of India. Part of the research project

produced a case study of adoption of technology in Ladakh, focusing on solar cookers. The sample covered 26 villages in central Ladakh. The study is one of the most carefully done of its kind, well conceptualized, meticulously carried out, artfully communicated. The objective of the study was to examine this specific form of appropriate technology, in terms of its adoption and impacts on this traditional culture.

Using archival resources, surveys, repeated observations, interviews, and participatory research techniques, the work of Ms. Hunt provides valuable insights into the process of introducing new technologies. A basic consideration was, of course, the technical capacity of the cookers, particularly as perceived by the user, since she found that usage was linked to perception as well as actual performance. Linkage to need was crucial as well, as were aspects of the alternatives (for example, the unpleasant smell of kerosene). Where fuel was a serious problem, acceptance was higher as would be expected. In general, she found a strong willingness to use new technologies which worked well and met economic household goals. Even in remote Ladakh, change is everywhere and while many still resist, the inevitability of modernization and other influences of the rest of the world is acknowledged. Understanding that, competent facilitation towards acceptance of this specific change may ease the transition to more general societal changes.

This document, much in the spirit of the work of Norgard, is well worth studying, both for its competent use of evaluative methods and for the cultural sensitivity displayed in this description of introducing technological interventions into a deeply traditional setting.

In a different part of India, an interesting example of solar cooking usage occurred, described in the November '01 SCI Review. Dr. Girja Sharan describes the use of solar cookers in response to a major earthquake which occurred in Gujarat State in January of 2001. A number of agencies and individuals worked collaboratively on the effort. The Khadi Village Iinudstry provided a number of cookers, which were given free through financial assistance of the Gujarat Energy Development Agency. Personnel from

the Indian Institute of Management (an institution which trains civil servants) were key organizers. The Cummins (India) Foundation of Pune provided financial support.

Teams went to the earthquake area quickly and set up 100 meal solar kitchens, in a small community 45 kilometers from the quake's epicenter which was not receiving help as quickly as the nearer towns. After receiving an urgent request from yet another unserved community, they quickly provided a similar program in the second community, home of a large boarding school. Teams speedily taught local women to make lunch and dinner for many people every day until more permanent arrangements were made for victims. Participants slept in the open along with those displaced by the earthquake.

The idea of making solar cooking equipment available for emergency situations has been discussed frequently by promoters. (See the case study of Turkey below, for additional information). Examples of use in such situation are rare however, therefore this is of particular interest.

An overall summary of the use of solar cookers in India was provided at the Coimbatore meetings by representatives of the Gujarat Development Agency, one of the state nodal groups responsible for implementation of the national subsidy schemes. Looking back on the experience of nearly two decades of the Solar Cooker Promotion Programme, first launched in 1982, the authors come to a number of conclusions: 1) solar cooking is appropriate climatically and in terms of fuel scarcities, 2) solar cooking is far cheaper than electricity and more economical than LPG or kerosene, and 3) a subsidy to manufacturers was a good idea but not implemented sensibly in some cases. Too many entrepreneurs began manufacturing cookers before the market was prepared to purchase their output. Some would-be buyers were not even able to locate stores where the stoves were for sale. The researchers also concluded that users were not given sufficient training in the use of the new technology, nor were services for repair or refitting available to the user. They conclude that additional retail outlets, complete with repair service, were needed, as were extensive demonstrations and training to maximize use and benefits. .

Before leaving this account of solar cooking activities in India, additional mention should be made of the manufacture of solar cookers in India (see the appendix item on manufacturers.) In addition to the manufacture of SunOvens, mentioned above in the section on Multi-Nation Promoters). The Solar Cooking Archives list 29 manufacturers of box cookers in India and another seven producing parabolic cookers, more than found in any other nation. Most appear to be manufacturers of other consumer goods, who added solar cookers to their repertoire when the government encouraged them to do so {www/solarcooking.org}

No doubt there are others projects in this large and diverse nation, which has seen varied development and sponsorship of devices and promotion of projects. Many names are listed in the SCI International Directory of people who are involved as individuals or small groups. The above is however a good sampling of work in the past decades in India.

INDONESIA

The principal promoter of solar cooking in Indonesia, a scientist named Herliyani Subarta, is associated with the Technical Implementation Unit Energy Technology Laoratory, BPP Technologi. Good accounts of activities in solar cooking are provided in papers which Suharta has written in collaboration with her colleagues. The articles describe the Indonesian Sun Cooking Project, sponsored by Earthwatch since 1995, in which almost 1,000 local participants have been trained in a new technology by over a hundred international volunteers from 11 countries. The local participants have in turn become mentors for others in their own communities; an additional 440 cookers were constructed and cooks trained at the time the article was written. A careful analysis of obstacles and constraints was made, as well, and changes in the project made to overcome them. While not entirely clear from the article, it appears that local people were initially taught to make box cookers, which are fairly complex to build. One of the problem factors was therefore the sheer difficulty of construction. The government was not very interested in the project and provided no support. Shortages of wood for cooking were not present, so immediate need was not a large factor.

In response to the analysis, a variety of courses have been followed. A detailed analysis of fuel usage and its cost was done, in order to illustrate the potential savings possible by the use of solar cooking, which turned out to be considerable. At the policy level, an analysis of carbon emissions that could be curtailed was also made. Some of the attempts made to utilize the information for more effective dissemination strategies included community education programs on the energy saving topic and its application at the household level. Another was the creation of a "home based worker" mode of delivering the product and training; the solar oven would be available through micro businesses in "kit" form, then assembled and sold by the potential saleswoman. Micro financing of solar oven purchasing was also suggested.

The same group has also done technical work in Indonesia, assessing climatic circumstances carefully and exploring design issues towards enhanced efficiency and lower cost. The Indonesian solar cooking promoter group remains active and committed to this effort. There are other groups working in Indonesia, but less information is available (See International Directory on the Solar Archives for contacts.) .

IRAN

No information has been found concerning solar cooking activity in Iran. However, recent communication from a representative of the Taravat Bahar Toos Institute in Mashad, Iran, indicates the planning of a project to promote the technology there (SCI International Directory, found at {www.solarcooking.org}.

ISRAEL

The nation of Israel has had little experience with solar cooking, although the climatic circumstances would appear to be near ideal. However, the National Physical Laboratory of Israel (NPLI) in 1996 experimented with the building of a solar concentrating type cooker. The design and materials used created an efficient cooker. The promoting group was initially operating on the assumption that any solar cooker should lend itself to construction in local villages, largely around cost issues - that is, the intent was to serve the poor of the nation. That goal put considerable constraint on the

venture, leading Harry Z. Tabor, author of an article in the proceedings of the Varese Conference (1999), to suggest that while the appliance could be made or assembled locally, the critical elements could only be made in central shops (or even overseas). The NPLI research was limited to parabolic cookers, but the article argues that the principle pertains to box cookers as well. As example, glass cut to appropriate size(s), reliable and weather resistant hinges, bright aluminum in sheets, etc. could be prepared in regional workshops, while the insulation materials, wood, paint could be purchased locally.

A recent Canadian visitor to Israel, Randy Shulman, lived in a kibbutz for some months, where she attempted to introduce solar cooking to her hosts. The work is only recently concluded and no word has been received of results.

No other solar cooking work is known about in Israel.

JAPAN

A Clean Energy Utilization Research Study Group was established in Japan in 1994 to organize activities for a range of environmental initiatives in that country. A Solar Energy Festival is held annually in the north of Japan; the Solar Energy Society's International Symposium was held in the country in 1992. Most Japanese people are not interested in solar cooking for themselves, as they use gas or electricity for cooking and find that to be satisfactory. But many view solar cooking as an opportunity to teach people about larger energy issues. A book on Solar Cooking, "Cooking by the Sun" was published in Japanese in 1995, edited by members of the group, and several types of cookers are manufactured in Japan, largely for learning more about the technology and for additional research.

Japan has one particularly faithful solar cook, however. Her name is Yasuko Torii, and she has invented a number of cookers that she displayed at several world conferences. One was a very small box cooker, the other a larger version made of an aluminum product used in Japan as a drip pan for ovens. She has been an active promoter of solar cooking for over ten years. She had recently created a solar cooking mailing list for the country, with most of the individuals living in Tokyo.

Recently, an announcement was made about the manufacture in Japan of a household size parabolic for sale in the Japanese market. The device is a dish reflector, mounted on a tripod. One other related commercial product manufactured is a stainless steel, well insulated hay box made by Toyota, and sold in various nations of the world. Both devices are expensive and not well suited therefore for poor countries, but could be marketed to middle class audiences in Asia, Europe, and North America.

JORDAN

No record has been found of solar cooking activity in Jordan.

KAZAKHSTAN

No solar cooking activity is known to exist in the new state of Kazakhstan, another of the nations carved out of the former Soviet Union.

KUWAIT

No information has been found about solar cooking in this country, which is one of the oil rich nations of Southwest Asia, hence with little perceived need at this time.

KYRGYSTAN

No solar cooking activity is reported in this nation, formerly a part of the USSR.

LAO PEOPLE'S DEMODRATIC REPUBLIC

Nothing is known of solar cooking activity in this r Southeast Asian country.

LEBANON

No information has been found about solar cooking activity in Lebanon.

MALAYSIA

The Penang Girl Guide Assocation is among those national organizations affiliated with the World Association of Girl Guides and Girl Scours (WAGGS),

described above in the Multi-Nation Promoter section, visited by Ms. Barby Pulliam of California, USA, the chief promoter of the organization. Instruction in making and using solar cookers was provided to a group associated with the local Girl Guides unit; it has continued to demonstrate and promote usage among Girl Guides in this nation.

MALDIVES

The Maldives, a nation of islands southwest of India, has no record of solar cooking activity.

MONGOLIA

In 1998, Al Ligtenberg, a California solar cooker supporter and global promoter, was asked by the Netherlands government to explore the potential of various solar energy modes in Mongolia. While a good bit of his work concentrated on the potential for photovoltaic use (at the request of the Netherlands authorities), Ligtenberg was also able to demonstrate solar cooking in several locations. The population is "widely dispersed and infrastructure limited, but he found great interest in the technology and planned to follow up when feasible.

MYANMAR

A brief report found in the SCI files indicates that one firm, Robin Saw Enterprises, in conjunction with Trickle Up, an organization which assists women with very small loans for business ventures, produced and distributed solar cookers in the 1980s. Unfortunately, no further information is available.

NEPAL

Al Ligtenberg, mentioned above re Mongolia, is the American name most closely associated with the introduction of solar cookers in Nepal. His small organization, FAST (Friendly Appropriate Solar Technologies), mainly Ligtenberg himself, has dedicated endless hours to the cause. For a number of years, this engineer, now retired from Hewlett Packard, has spent three months in Asia, principally in Nepal. His dissemination

program is as simple as ABC, he states: A for awareness creation, B: for building infrastructure; and C: for continuous follow-up and creating new links. In Nepal, he began the task of visiting government officials, universities, voluntary organizations, embassies, service organizations, until he finally reached the office of the Centre for Rural Technology (CRT). They struck up a collaborative relationship that has held over a number of years and been productive in promotion of solar activity. Ligtenberg carries with him cookers, recipe books, "how to" manuals, reference books, etc. and works to create a full fledged program of training new cooks, follow up, and promotion modes, program evaluation, etc. CRT staff have taken the ideas up with so much enthusiasm that he calls them the "champions of solar cooking" in this country. In the CRT program, a wide variety of cookers are shown and demonstrated in use, earning good media coverage and attracting wide public attention (crt@wlink.com.np)..

Special attention has been paid in Nepal to the remote lodges that serve trekking tourists in the Anapurna and other mountain areas. With the growth of the tourism industry, considerable environmental degradation was seen in the form of shrinkage of forests and their wildlife populations, excessive trash dumped on the trails, water pollution even at high altitudes, and signs of global warming. Renewable energy usage is strongly encouraged by the government, and many smaller lodges are now equipped with solar water heaters and solar food dryers. Solar cooking is a natural here. With high altitudes and thus little to impede the sun's rays, household size parabolic devices, or even larger ones, are very appropriate for these installations.

A number of such installations are is use, as described by Dieter Seifert of EG Solar, the German distributor of these models, on trekking trails in the Mt. Everest area, in Sagarmatha National Par, and a number of schools. The same type of parabolic is in use in Dhullikhel Hospital in Katmandu, where four such units provide hot water for patients.

In 1994, an organization from Finland, Technology for Life, conducted a series of solar experiments and evaluations of their potential for Nepal. Their search was for devices which would fit the needs of "near-subsistence" economies such as Nepal. They

tried box cookers and home made parabolics but found that the cdst of all was out of reach of many, as poor quality was not acceptable and good quality not affordable. Not a dilemma found only in Nepal, but a rather common scenario.

Another group is also at work in Nepal, the Foundation for Sustainable Technologies (FoST). This group is a recently established NGO with the goal of widely promoting and disseminating sustainable technologies to improve the quality of life of Nepalese people. They support a wide range of solar technologies and some others such as the haybox and fuel efficient stoves. Quickly after their founding, some of the members were setting up demonstrations in various parts of the country. Their goals are ambitious and long range in nature. However, the organization is too new to have as yet much of a track record, (e-mail: fost@ntc.net.np\

Solar cooking has also been initiated in camps serving the large population of refugees from Bhutan currently resident in Nepal. In one or more of these camps, a program funded by the Vajra Foundation, The Netherlands, mounted solar cooking programs in refugee camps.. The Project was run by a man named Maarten Olhof who distributed 400 box cookers of the ULOG type (slanted top) in the camps. Working cooperatively with CRT (and Ligtenberg, also of Dutch origin), Olhof also worked in a rural area in the Katmandu Valley, near the capital city, conducting demonstrations and training. He hopes to involve more organizations, such as Rotary, in these efforts.

Cookers of the parabolic type are also known to have been promoted in Nepal by the IBEU group, located in Germany at Julich. The device they used in Nepal is one with thermal storage capacity, accomplished with reflector plates, a steel vessel filled with pebbles, and vegetable oil as a heat transfer means. The devices are highly efficient, and retain heat for up to one day.

Substantial public awareness about solar cooking must be advanced in Nepal compared to many countries, given the number of places in the country where solar cookers are in use. But they are clearly far from a common sight, perhaps because the types of cookers in use are mostly on the expensive end and thus require some type of

subsidy scheme to be available for to poor people. One niche, for solar cooking is almost certainly found in services for the tourist trade, since it both reduces cost to providers and reduces damage to the valuable environment.

OMAN

No evidence was found of solar cooking in this sun rich, but also oil rich, nation at the southern base of the Arabian Peninsula.

PAKISTAN

The country of Pakistan hosted one of the larger privately sponsored solar cooking program ever carried out. A British based organization, SERVE (Serving Emergency Relief and Vocational Enterprises) began work with refugees from Afghanistan in 1980. The previous year, after the Soviet incursion into Afghanistan, nearly 3 million refugees had fled to Pakistan, principally to the Northwest Frontier Province and Baluchistan. The population was made up of largely illiterate rural people, most of whom had lived near the border with Pakistan. A variety of relief and educational programs were offered to the group as they settled in for what turned out to be a lengthy stay in refugee camps.

In 1983, SERVE conducted a survey to assess what the refugees felt to be their most urgent needs. Done very professionally with assistance from UN experts, the survey's results revealed the greatest felt need was for assistance in obtaining cooking fuel. The area had 300 sunny days a year and it thus appeared to SERVE staff that solar cooking would be useful. Devices that were within their financial reach and adequate training in solar usage would be essential, however.

Initially, a small pilot project was conducted in one camp with 50 families. These pioneers were each loaned a cooker and taught to use it. The ovens were similar to those in use in India, boxes with glass top and a mirror reflector. At the end of the project, 80% of the families wanted to buy the cooker. A few modifications, based on the pilot experience, were made in the device, making them somewhat larger, using shiny mylar rather than mirrored glass for the reflector. The cost of the boxes was between $60 and

$70, more than refugees could afford; donor assistance was found to subsidize that cost partly, with refugees paying around $18. A small workshop made the cookers, and supply was able to keep up with demand. The happy users of these cookers were their best advertisement.

Eventually, the refugees felt able to begin the trek homeward, after political events changed the situation in Afghanistan. Many took their ovens along, and by that action advertised solar cooking to new audiences. Demand was high enough that a shipment of 780 ovens was sent to Kabul and sold out, from the back of the truck in a marketplace, in five days. Demand in Afghanistan was higher even than in Pakistan, perhaps due to the ever-present danger from unexploded mines in fields and ^growing shortages of wood.

By the turn of the new century, SERVE donors were suffering from "donor fatigue" and, although there was still demand in both Pakistan and Afghanistan, the solar program was ended. (See Afghanistan above) Between 1985 and then, SERVE had distributed around 20,000 solar cookers in the area.

Solar cooking has not however disappeared in Pakistan, though almost certainly curtailed by the absence of a major promoter. As reported in 2003, The Building and Construction Improvement Programme, a Project of the Aga Khan Planning and Building Services, is working in remote areas of Northern Pakistan. The project has introduced a number of energy efficient and renewable devices, including a line of solar cookers. Like the SERVE model, the project chose to use a box model. Construction materials were selected on the basis of availability in the area with provisions built in for replacement of the glass box top. As of the time of writing, no further information was available on this new project.

Brief reports of other users surface from time to time, for example, Master Fazal ur-Rehman of Kundian City in the Punjab, indicates that he has built a number of types of cookers)SCI Rev., Jul 02). Pakistan remains heavily rural (62.5%) and the forested area is both small (3.1%) and shrinking (-1.5% per annum), meaning that woodfuel must be

extremely scarce. With the strong record of solar cooking acceptance demonstrated by SERVE in the 1980s and 90s, it is likely that at least some Pakistanis are making cookers themselves and using them to meet their needs.

PHILIPPINES

The Metro Manilla Council of Women Balikatan has spearheaded solar cooking demonstrations in the Philippines for over ten years. No further information on their work is available beyond this fact.

QATAR

Nothing has been found about solar cooking in this country, another of those located on the Arabian peninsula, in an area with oil but also much sun.

REPUBLIC OF KOREA

This country, more often called South Korea, or simply Korea, does not appear to have had any activity in the use of solar cooking. No information on the topic has been located.

SAUDI ARABIA

No evidence of any solar cooking activity has been found in this large, wealthy, and oil and sun rich nation.

SRI LANKA

A solar cooking project was established in Sri Lanka in 2001 by E. Abeyrathne of that country's non-profit organization, EMACE. The country is very suitable for solar cooking, with good annual sunlight, an everdiminishing supply of wood and a large proportion of people living in rural areas. Twenty-one percent of the country's land area is forested (FAO, though more recent estimates of the National Geographic Society suggest 17%, with a substantial rate of decrease {-1.6%}, from what was estimated as

around 84% in 1880). Alternative fuels are very scarce, and the nation's civil wars have created scarcities of many kinds along with substantial violence and economic instability.

EMACE is an NGO in Sri Lanka. In early 2000 the organization contacted Solar Cookers International to inquire about how the organization could go about introducing solar cooking to the people of Sri Lanka. After several interchanges, EMACE director Abeyrathne went on-line with the solar cooking discussion group and posted a request for experienced solar cooks to come to Sri Lanka to help. Two Canadians, Lee Sentes and Kathleen Manion, were at the same time looking for just such an opportunity. The two had recently returned from a project assessing solar cooking suitability in Madagascar and had good experience to share.

They spent eight months in Sri Lanka, providing skills training to EMACE staff and to villagers in four separate locations in Sri Lanka, based on criteria which included: amount of sunlight, shortages of fuel, levels of deforestation, and villager income. Workshops on how to build, use, and maintain solar cookers were conducted, In addition, several larger cookers were built for bakeries and to serve the needs of refugees living in camps. Public interest in the work was very high, with extensive coverage by various media. EMACE also brought a range of other organizations into the work, including women's groups, to further spread knowledge of solar cooking.

In the original project, a simple box cooker design was used; the device is relatively easy to make in a village, using locally available materials and workmen. Village groups quickly had distributed over 50 cookers. Later, carpenters were found who would make the wooden box cookers used in the project, and distribution for these and other solar products were started in the cities. All profits from these centers were funneled back into the project to allow sustainability and hopefully, expansion. Later the project expanded to 11 villages. Part of their planning included purchase of machinery which permit them to make other wood products such as furniture, as well as the cookers, as a way of funding the organization's future. Sri Lankan solar cooks are working on a solar cookbook that shows ways to adapt traditional Sri Lankan foods to cooking with the

sun. The possibility of demonstrating other varieties of cookers has also been discussed; a French variety of parabolic is under consideration.

A planned follow-up evaluation has yet to occur, but a reply to a 2000 SCI survey indicated continuing growth in the program. EMACE is clearly the largest ongping solar cooking program, but another group also works in the country, the Saviya Development Corporation which indicates it produced and distributed over 100 cookers in 2003. The recurring hostilities in the country do not make any of the work easy, but the need is substantial and most ingredients for success appear to be in place.

SINGAPORE

No record of solar cooking activity has been found for Singapore. The nation is almost entirely urban and wealthy, in addition. Almost certainly little need is felt for devices such as solar ovens, although the climate would be suitable.

SYRIAN ARAB REPUBLIC

No record has been found of solar cooking activity in this nation.

TAJIKISTAN

The Physical Technical Institute of the Academy of Sciences, Government of Tajikistan, has designed and evaluated two types of cookers in their laboratories. The first one, tested in 1992, was a somewhat elongated box with 3 layers of glass for lid, and room enough for two pots. The second, built somewhat later, was in the form of a three-cornered prism, all transparent, with two concentrators above and two below. A third was a truncated pyramid with the pot suspended from the top. All worked satisfactorily in the summer months, easily reaching over 100 degree Centigrade, but failed to be useful in the colder winter months (6-7 months of the year).

The research group then turned to more standard types of cookers, boxes and concentrators, the first simple and inexpensive, the second more complex and costly. They found good thermal insulation to be necessary and also that a high degree of solar

radiation is necessary. In this higher latitude area, also fairly mountainous, winter days are short and solar radiation must therefore be used very efficiently. Their experiences with concentrators suggested that since most energy flowed to the bottom and sides of the pot rather than the top, it was important to use pans that considered this factor. Solar trackers for cooking were also explored, but, because of the cost of higher tecti versions, they principally recommend a variety of hand adjustable methods to accomplish the adjustments needed to follow the sun's rays.

Noteworthy is the fact that this nation, with less than optimal conditions for solar cooking, was nonetheless exploring the potential of solar cooking over a decade ago. Like many others, they continue to search for efficient cookers in their particular climatic situation, and with minimum expense to the consumer.

THAILAND

Archival records show that several persons in Thailand know about and use solar cooking devices, including the Asian Institute of Technology, located in Bangkok. However, no specific promotional activities or projects have been identified.

TIMOR-LESTE

This small and new nation, fashioned out of the former East Timor, a part of Indonesia, in only getting a start as an independent nation. No evidence of any solar cooking activity has been found.

TURKEY

A large project was initiated in 2001 in the central Turkey city of Adana, through the initiative of Rotarian Abdullah Paksoy and his colleagues in the Sehan Rotary Club of that city. Working with a California Rotary member, Wilfred Pimintel (see Rotary listing in Multiple Sites section, above), and aided by several other Rotary clubs in England and Canada, the project began with a visit to Adana by three Rotary volunteers.

The chosen site was a small town, Misis (new name for the former Yakapinar), located some 20 kilometers from Adana. Activity centered at the local elementary school in a section of numerous new houses, mostly built or repaired after the area was hit by a major earthquake in 1998.

The elementary school principal, also a Rotarian, assembled a group of mothers of his pupils to meet with Abdullah and the volunteers shortly after their arrival. Women were skeptical, naturally, but agreed to come and listen. Twelve women were trained, assembling in the school's "teachers' lounge, a tiny free standing building with one gas burner and an Asian-style toilet. All training, including considerable solar cooking was conducted in the sunny schoolyard, watched constantly by an endless stream of curious and very friendly children.

The initial training required two days (translation takes considerable time), but the Turkish women were intrigued enough to stick it out, and had the usual amazed reaction when wonderfully well cooked food emerged from their pots. On the first day, the volunteers cooked lunch for all; on the second, the trainees brought food from home to cook and take home to their equally incredulous families. All but one of initial trainees purchased their CooKit, with pot (already painted) and bags. (The one who did not purchase was found to be unable to afford the small amount [roughly $5] and one was made available to her by a soft hearted member of the training team.)

More details of this are available in the case study presented below. The case studies are intended to give the reader a better sense of the kinds of events that transpire in solar cooking training with people for whom this is a brand new idea. Therefore the description of the Turkish Rotary program here will be brief.

In the week following the training, all the new cooks were visited in their homes by the volunteer team members, checking on location used, bag procedure, orientation to the sun, etc., just to be sure all had understood the essentials. It was quickly clear that the trainees had caught on to all, were excellent cooks themselves, and that the Turkish cuisine was well suited to solar cooking. The group convened again regularly to discuss

with one another the results they were having, their families', reactions, etc. Following that, the next step was another training process - converting the new cooks into trainers. Nine of the 12 were willing to become trainers (some had family responsibilities that prevented them from so doing). The day was filled with role playing, with many practical tips on teaching, and focused on participatory learning practices. Solar Cooking International's excellent teaching manual was translated into Turkish so each new trainer had a copy, plus enlarged diagrams illustrating the major points their students needed to know, the "must haves" for solar cooking. After the training, all were requested, in teams of two, to recruit neighbors and friends for the kind of training they had received from the international volunteers. Once again, the team visited all of their early training provided by the new trainers and provided feedback on improving their instruction. All proved adept here, and of course the whole training process was faster as no translation was required.

Within a month, and about the time the volunteers were due to leave, the newly trained solar cookers held a solar picnic for the Adana Rotary Club and wives on a sunny Saturday. 150 people were fed from 33 pots of delicious food, including stuffed grape leaves, chicken, ratatouille, pilafs. The food disappeared in moments and the women were touted as spectacular cooks and masters of the new cooking technique.

The next step was application for a substantial grant from Rotary International, which was granted and became available in late 2002. The project limped along a bit in that interim period, doing demonstrations, training others, etc., but without resources to undertake much systematic expansion until the larger grant dollars arrived. Now, an ambitious program of expansion is in place, exporting the project to similar places by simply replicating the process in other towns, spreading outward from Misis itself to neighboring communities, and adding special populations to its concern (handicapped children, homeless, migrant workers, earthquake victims, etc.).A small building on the school grounds in Misis has been converted into a resource center for the project (no doubt to the joy of the teachers, who can have their lounge back). The project has in addition been given a Villager (community sized box cooker) which will be used in a home for handicapped children, also initiated by Rotary). Interested persons are urged to

turn to the case study for a more detailed description and many stories of the training and expansion process.

It is sometimes said that "imitation is the most sincere form of flattery". That was the case when an Adana manufacturer of cookware, intrigued by the promise of the CooKit in this country where the sun's power is strong a good bit of the year, began to offer a free CooKit as incentive to consumers to buy his brand of high quality cooking pot. The pots are Caphalon quality, heavy and impervious to food sticking to the metal, and expensive for the Turkish market. The line of pots is sold in stores and also marketed by a chain of salespersons across the country.

The Rotary Club members were initially taken aback by the sudden appearance of a rival solar cooking promoter. They worried, rightly, about the training in use of the CooKit that people would get if they only purchased a pot in a store, and were given a CooKit. There was however nothing they could do, other than a bit of grumbling, about the circumstances. There is no patent on the Cookit and all are freely urged to copy it and make use of it as fits their needs.

The pot manufacturer is also manufacturing a parabolic cooker, which he will offer as inducement to buy whole sets of pots. The parabolic is smaller than the German variety, but should cook well in the Turkish sun. In two short years, this area of Turkey has gone from absolutely no conception of solar cooking to experience with a wide range of devices, to programs in a range of settings (including emergencies), and from a borrowed space to a nice, if small, Resource Center, as headquarters for their work. The credit is due to the perseverance of the Rotary leadership and to the nature and dedication of the kindly, mature, enthusiastic women of the trainer corps.

TURKMENISTAN

No solar activity is known to have occurred in this new nation, formerly a part of the Soviet Union.

UNITED ARAB EMIRATES

The Emirates, a collectivity of a number of small principalities with emirs as their political heads, are oil rich but noteworthily modern in their thinking. No solar cooking activity is known to exist in any of the emirates, but a recent visitor (Michael Port of the Sun Oven Society (see Multi-Nation Promoter section) to the city of Dubai created considerable interest and inspired a good article in a Dubai publication about solar cooking. Considerable interest was in evidence from his brief demonstration. While oil is plentiful in the area for the generation of energy, the emirates seem to be very forward looking and were interested in another potential energy source for their future.

UZBEKISTAN

No solar cooking activity is known to have occurred in this nation, another of those formed out of the old USSR.

VIET NAM

The search for information on solar cooking activity around the world revealed the existence of a group in Da Nang City which describes the building and distribution of 700 solar cookers between 2001 and 2003).

WEST BANK

This area is the other part of the Palestinian homeland, physically separated from, but politically allied with, the Gaza Strip. No solar cooking activity has been initiated here.

YEMEN

No information has been found about solar cooking in this country located at the base of the Arabian Peninsula.

with one another the results they were having, their families' reactions, etc. Following that, the next step was another training process - converting the new cooks into trainers. Nine of the 12 were willing to become trainers (some had family responsibilities that prevented them from so doing). The day was filled with role playing, with many practical tips on teaching, and focused on participatory learning practices. Solar Cooking International's excellent teaching manual was translated into Turkish so each new trainer had a copy, plus enlarged diagrams illustrating the major points their students needed to know, the "must haves" for solar cooking. After the training, all were requested, in teams of two, to recruit neighbors and friends for the kind of training they had received from the international volunteers. Once again, the team visited all of their early training provided by the new trainers and provided feedback on improving their instruction. All proved adept here, and of course the whole training process was faster as no translation was required.

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The table below summarizes information on solar cooking programs in Asia.

Table III2 Solar Cooking Programs in Asia Categorized by Scale

No known solar cooking programs N=31	Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, Cyprus, Gaza Strip, Georgia, Iran, Iraq, Jordan, Kazakhistan, Kuwait, Kyrgestan, Lao People Democratic Republic, Lebanon, Maldives, Oman, Qatar, Republic of Korea, Saudi Arabia, Singapore, Syrian Arab Republic, Timor-Leste, United Arab Emirates, Uzbekistan, West Bank, Yemen
Individual Promoters N=8	Israel, Jordan, Malaysia, Mongolia, Myanmar, Philippines, Tajikistan, Thailand
Small Programs 1-100 users N=1	Democratic Republic of Korea
Medium Programs 100-1,000 N=2	Sri Lanka.,Viet Nam
Large Programs 1,000-30,000 N=5	Afghanistan, Indonesia, Nepal, Pakistan, Turkey
Mass National Programs N=2	India, Peoples Republic of China

As the figures in Table III show, 31 countries of Asia's 49, or 63.2%, have had no exposure to solar cooking use or promotion, at least as indicated in existing literature found in this study. However, the world's largest programs are found on this continent, in China and India, with overall estimates between the two nations approaching one million users. Five other large programs are also found on this continent, as well as a smaller number of individual promoters.

CHAPTER III C

SOLAR COOKING
EUROPE

The European continent is the second smallest continent, with only Australia (which here is considered to be part of Oceania) smaller in area. It is, however, more densely populated, the third of six continents in number of inhabitants. Much like Central and North America (in the grouping of nations used here), the continent has both poor and rich countries. Ten of the 40 countries have Gross Domestic Products pqr capita (GDP) of over $25,000, with another 7 between $10,000 and 25,000. It also however hosts a number of countries with low GDP per capita, with 12 under $5,000, many of those being the new countries that were formally components of the USSR.

Europe has undergone massive transformation in the last decades, particularly in Eastern Europe, associated first with the breakup of the former Soviet Union into a number of independent states, and later with the disintegration of Yugoslavia into five separate countries. In Western Europe, the movement has been in the opposite direction, towards more political activity on an all-European basis with the formation of the European Union and the current moves towards use of a common currency, the Euro. In this more cohesive portion of Europe, all citizens of participating countries can move freely across borders, work wherever they can be employed, share uniform laws, and achieve a commonality of lifestyle to a degree. Both developments are important for the future of the area, albeit in very different ways.

Most of the area is bounded by water, the Arctic Ocean to the North, the Atlantic to the West, and the Mediterranean to the South. Europe and Asia meet in the region of the Black and Caspian Seas roughly. Most of the climate lies above 35 degrees north of the equator, extending to more than 70 degrees north at the top of Scandinavia, thus quite northerly. Overall, only the southernmost parts of Europe are suitable for solar cooking, and that in a relatively short period of the year. Only the most expensive parabolic devices or other efficient cookers are useful in the bulk of European climates.

Despite that, there is a degree of solar usage, perhaps more than would be expected. Perhaps that is related to the fact that the majority of solar cooking invention and design improvements have come from the European continent, interesting in view of the climatic circumstances. The section on Multi-nation Promoters (above) discusses the contributions of promoters in Germany, France, and Switzerland, particularly *homes to organizations whose dedicated efforts over many years have contributed to the rise in solar cooking activity literally around the world.

But evidence of solar cooking programs, that is, programs that are aimed at use of solar cookers in country in Europe, can be found in only a very few European countries, as will be seen below.

Albania, Andorra, Austria, Belarus, Belgium and Luxembourg, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia

In the above countries, no report of solar cooking activities has been found.

Finland

The non-governmental organization, Technology for Life, has been described above in connection with its work in Nepal. No evidence of work in country has been found.

France

The Multi-nation Promoter, Andre Kotovsky of the Virtual Laboratory of Solar Cooking (see above) can be credited with a range of attempts to demonstrate and sell solar cooking equipment via the web site, which is the principal means of communication. No information is available about the amount of equipment which has been sold.

Germany

This nation has been an outstanding exporter of solar cooking equipment, knowledge, and promotion over many years, as seen in the country reports which provide information about the many places they have been active. EG Solar, active in

many international sites, attempts to provide education and equipment for people in Germany, as well.

Information that would provide the full picture of use in these major European countries is not available, though most would estimate it to be limited. Though the price of much of the equipment produced in Europe and shipped elsewhere is sufficiently high that it must be subsidized abroad, it could however be sold for backyard or patio use in Europe, and some attempts in that direction are underway. No overall information on the success of that is available.

In Germany, one small experiment in using carbon trading is in place, mentioned in the section on EG Solar. Dr. Dieter Seifert has led the solar cooking community through his thorough investigation of the potential of the Clean Development Mechanism (CDM), a collaborative effort of nations growing out of the Convention on Climate Change (Rio, 1992), extended in 1995 in Berlin, and finalized into action in Kyoto in 1999. From 2000 onward, the CDM has functioned as a framework for cooperation between developed countries that need to reduce their greenhouse gas emissions and developing states, some of which are engaging in work to reduce emissions, literally around the world. Nations providing financial support to those activities, even if not within their borders, are granted "credit" towards meeting their own emission-reduction goals. Only a portion of the required reduction of states party to the Kyoto Protocol can be met in this way, and strict criteria apply. The mechanism has substantial potential for the solar cooking movement. To take advantage of this opportunity, promoters must become substantially more knowledgeable about the potential, and the steps necessary to initiate such agreements. U.S. citizens are disadvantaged here in a sense, since our nation has not chosen to sign the Kyoto agreement and hence American manufacturers have no legal obligation to reduce emission, (though common sense - and certainly most environmentalists - suggest they should be doing so anyway).

The only example known to this writer of the mechanism being used by solar cooking promoters is one in which a small program in Nepal has been financed with funds from the German government on the basis of carbon exchange credits. Dr. Seifert has taken the lead on this matter, and the solar cooking community would do well to

learn more about the potential offered by the international framework of the Kyoto agreement.

Greece

Greece, one of the European countries that have a climate favorable far solar cooking; is home to at least one manufacturer producing solar cookers of high quality. Solar Systems of Athens manufactures devices made of stainless steel, others of aluminum and plastic.

Hungary, Iceland, Ireland

No record of solar cooking activity has been found for these countries.

Italy

Several individuals have indicated an interest in solar cooking, but current knowledge does not show any organized promotional activity in Italy.

Latvia, Liechtenstein, Lithuania, Malta

No record of specific solar cooking activity in these nations has been located.

Netherlands

The work of the Kozon Foundation, headquartered in Holland, has been described above in the Multi-nation Promoter section, as well as in connection with promotional activities in the Sahel region of Africa.

In the country, a number of other individuals and organizations are active in promotion of solar cooking. They include the Solar Cookers Sliedrecht working group, which recently reported that the Dutch Minister of the Environment has indicated an interest in the effects of increased solar cooker usage on global carbon dioxide levels. The group began its work with attempts to illustrate that solar cooking can be used in higher latitudes with efficient equipment, something they have demonstrated with a device called the Dierx wooden box cooker made in Holland. The group is hoping to

persuade their government to explore additional work in developing countries, in the quest for carbon emission reduction.

Others also produce and promote solar cookers, including R.Blom and H. Schoenmakers who promote both box and parabolic cookers on a web site (http://home.planet.nn. Solar Cookers V, managed by P.H.F. Smeele, produces expensive box cookers ($180)(www.go.to/solar-cooker).

Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, San Marino, Slovakia, Slovenia

Goodmund and Signe Aardal of Norway engage in small scale manufacturing of a high quality metal box cooker in Norway, principally for sale in the developing world. Recently, Sun Co, Companhia de Energia Solar S.A., announced the manufacture of an innovative device called the Sun Cook. The cooker is a combination of box cooker and concentrator, with non-imagining optics inside the box. A diagram and more informationaboutthe device can be found in the Solar Cooker Review of November, 2003. No information is available about reception of the device. With those two exceptions, nothing is known of solar cooking promotion in any of the nations listed above.

Spain

A formal center for research on solar energy exists in Spain. Called the Solar Energy Training Centre, its mandate includes all solar usage. It made a major contribution to the field by the publication, some years ago, in 1993, a book that contained Mean Values of Solar Irradiation on Horizontal Survaces (International H-World Database), representing over six years of work to accumulate, test, and standardize the information. The volume contains, for 109 countries (usually for its major city, the following data: latitude accompanied by average daily mean solar irradiation value in each month, that is, the total solar energy (in megajoules) received (on average) in a day, on each square meter of horizontal surface. (Note: to obtain the more commonly used kilowatt hours per square meter, (kWh/m) one must divide these figures by 3.6.) While

not all nations are covered, the volume contains a huge amount of information of considerable use to many planners of solar cooking activity.

In addition, Spain hosts an institution known as Fundacion Terra, which is an NGO working on environmental activities. The group annually holds a worldwide meeting called "Encuentro Solar" (Solar Encounter) on the Mediterranean coast at Benicarlo. It both promotes and demonstrates solar cooking, as well as other solar technologies. It engages in efforts to effect governmental policies, and came to the notice of many as Home Power"s "Guerrilla Solar" of the month in September of 2002 for its not-quite-legal feeding of solar energy into the local utility grid.

An organization called ManosUnidos is also active in this nation. Its mandate appears to be braoder than solar cooking, including dryers, distillers, water heaters and other alternative technologies. The organization has produced manuals on the usage of the devices, and offers workshops, as well.

Several other small scale promoters are also known; Spain appears to be moving quickly in renewable technology knowledge and usage.

Sweden

Nothing is known of domestic promotion in this country.

Switzerland

Most informed promoters think that Switzerland is the European nation with the highest percentage of solar cooking usage. One report (from ULOG) suggested that up to 7,000 cookers were in local use in the country. The work of the ULOG group, with its long history, is recounted above in the Multi-nation Promoter section, as well as in the accounts of individual countries where members of the ULOG group have worked.

Perhaps the most interesting part of the work of ULOG for this section is their work in Europe. They travel in summer months to Germany, Croatia, France and Spain, in addition to various sites in Switzerland. For some years, they have participated in various community events with what they call the "Solar Creperie" or solar pancake shop, a trailer equipped with solar cookers and kitchen equipment. When crowds

assemble, they prepare food for waiting customers, no doubt enticed in by curiosity and tempting scents. In addition to pancakes, they make chili, potatoes, curry with rice, coffee and tea, and other dishes. Their persuasive argument is that eating a solar dish is the very best argument for the value of solar cooking. Up until now, they have worked in daylight hours, but are planning to add heat storage capability cookers, in order to be able to feed people who come to events after work and are hungry after the sun goes down. The major point of the effort is, of course, that solar cooking is possible in Europe as well as in distant parts of the world. Their work can be seen with photos of the "Creperie" on the website, {www.cuisinesolar.com/E/Benicarlo.htm}. The basic website of the ULOG group is {www.cuisinesolaire.com}

The bulk of the work of ULOG however appears to be their efforts to export the idea and to promote solar cooking around the globe.

The Fyr of Macedonia (Former Yugoslavian Republic), Ukraine

No information about solar cooking in either of these countries has been found.

United Kingdom

The principal promoter in the UK is Anna Pearce, whose work is described in the section on Multi-Nation Providers. She has however also made an attempt to promote the Wonderbox (a retained heat cooker) and the Anahat (a combined cooker and retained heat device) for use in country. No information is however available about the number sold or the population targeted in the country.

Yugoslavia

No information on solar cooking promotion or projects has been found for this nation.

Table IIIC. Summary of Solar Cooking Activities in Europe - Categorized by Scale

No known solar cooking programs N=31	Albania, Andorra, Austria, Belarus, Belgium and Luxembourg, Bosnia and Herzegovina; Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Malta, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, San Marino, Slovakia, Slovenia, Sweden, The FYR of Macedonia, Ukraine, Yugoslavia
Individuals Only N=l	Greece *
Small Programs N=l	Spain*
Medium Programs N=0	
Large Programs N=0	
Mass/national Programs N=0	
Exporters or Promoters Abroad N=7	Finland, France, Germany**, Netherlands, Norway, Switzerland**, United Kingdom

* It is unclear at the time of writing if Greece should be placed in the exporter column, or if work there is aimed at a domestic market

** Note that Swiss and German solar promoters do aim a portion of their effort towards domestic audiences. Switzerland, for example, is thought to utilize more solar cookers than any other European country.

In summary of activities in Europe, it is easy to see that this continent is not one on which a good deal of solar cooking promoting for use there takes place. The area has however provided a substantial amount of research, promotion, and considerable assistance in the mounting of activities overseas. As will be seen below, much of the continent is not particularly well suited to the technology. In addition, well-developed infrastracrure nearly everywhere means no pressing need for solar cooking exists.

CHAPTER HID

SOLAR COOKING
NORTH AND CENTRAL AMERICA

The North American continent ranks third in size among the continents. Its dimensions stretch from the northern tip, Greenland, to the border of Panama with South America, thus from far into the Arctic Ocean at more than 80 degree north to about 8 degrees north where it meets its conjoined sister continent to the South. The North-South range creates great climatic diversity obviously, perhaps even more than the range of, for example, Asia, with its more East-West orientation. The continent contains climates from tropical to arctic and the longest coastline of any continent, with many bays and inlets. The interior has vast lakes and mighty rivers; the exterior is surrounded by oceans in all directions.

For many centuries, North America was isolated from much of the rest of the world, a fact that influenced both its history and its habitat. Both changed dramatically with the nomads who are believed to have first crossed the Bering Straits into now-Alaska, then moved southward, over time going far into Latin America. Much later, Columbus arrived from Europe on a Caribbean Island near the east coast of the continent. Rapid invasion by Europeans to that coast followed. The continent's isolation was a thing of the past, and as human populations grew, the economic and political landscape was transformed into a new age for North and Central America.

The area encompasses the world's richest and most powerful nation, the United States, and some of its poorest, such as Haiti. Currently, waves of newcomers to the area bring additional ethnic and cultural diversity. The U.S. and Canada have become rich countries, but many of the other nations are still hampered by poverty and lack of resources for the basic needs of education, health care, adequate housing. This fact has created yet additional pull towards the northern nations, which continue to host waves of immigrants annually.

As will be seen below, those facts are reflected in the history of solar cooking in this region, with the U.S. and Canada being major exporters of the idea and often the

devices themselves, and the other nations mainly recipients Qf the technology. Some of the smaller nations, particularly the island states, have seen little if any solar cooking promotion, others have been very active, as seen below.

Antigua and Barbuda

No solar cooking activity is known to be present on these islands of the Caribbean.

Bahamas

No solar cooking promotion information has been located for the Bahamas.

Barbados

This search has revealed no information about solar cooking activity in Barbados.

Belize

No significant information is known about solar cooking activity in Belize, although several people have corresponded with SCI, either requesting additional information or describing their interest in the topic.

British Virgin Islands

No information has turned up in this search regarding solar cooking activity in this area of the Caribbean.

Canada

Much of the nation of Canada is not well suited for solar cooking, at least for significant portions of the year, and with any other than very expensive equipment. However, the nation has provided consistent support and considerable financial resources to the cause of promoting solar cooking in places better suited than their own nation.

Examples of this support are numerous. A community in Canada has consistently supported solar cooking activities over many years in the extremely poor nation of Haiti. As far back as 1977, Dr. Thomas Bowman and his associates from the Florida Solar

Energy Center conducted a survey to learn about the situation of cooking fuels in the country. That survey told what was fairly obvious to the eye - that cooking fuel was a major problem in this very poor nation and that some solution would be needed in the near future. A Canadian group constituted itself as Communities in Partnership and began to work seriously in Haiti not long after that time. They found an excellent resource in the Haitian -American Institute, which created a small solar cooking resource center. The Canadian members systematically sought materials to stock the resource center, and it became the de facto core of solar cooking activity in the country for some years.

Haiti has, as all know, experienced considerable political tension and unrest, and still does. Through all the turmoil, solar cooking activity has gone on. After a coup in 1991, the Canadians began even more systematic activity, creating a manual on how to conduct a solar cooking project, teaching local people to carry out training, follow-up, project evaluation, and so on. The Canadians have systematically gathered information from other projects, evaluated it for potential use in Haiti, and then transferred idea to action in applied work there. (See section on Haiti below for further detail on programs in that nation.)

Canadian Rotary Clubs have also been active in the support of solar cooking projects. As explained in the description of Rotary activities, the support of Rotary International for initiating a project requires a number of Rotary Clubs to contribute financial resources for the pilot activity. Much of that activity, spearheaded by Rotarian Wilfred Pimentel of California, has drawn on Canadian clubs for support.

Interestingly, a number of manufacturing firms making solar cookers are located in Canada. Their offerings can be viewed on the Solar Archives, under Manufacturers {www.solarcooking.org} that is, for the readers' convenience, reproduced in the Appendices of this report.

Cayman Islands

No solar cooking activity is known to have occurred on this island.

Costa Rica

Costa Rica has a rich resource in the presence of Indian-born Shyam Nandwani, a Professor of Physics at the University Nacional in Heredia, a city near San Jose. Dr. Nandwani's personal interest and long time demonstrations of the power of the sun for domestic purposes have been an inspiration to many, not only in Costa Rica but also around the world. He has been a speaker at numerous international conferences, including all of the world conferences on solar cooking, and has been a guest lecturer at universities in Germany and the United States, among others. He is a sparkplug in the coordination of networks of solar cookers, both in Central America and for the entire continent; almost single handedly, he was responsible for-the organization and implementation of the Second World Conference, held at his university. Surely, most Latin American solar cooks and promoters are familiar with his professional contributions.

Another outstanding contribution to the world of solar cooking is a demonstration site at the Universidad Nacional, where an outstanding collection of solar cookers and dryers of many types and varied size and scope, from household to field army, can be seen. Here one can see, touch, and thus understand the use of devices usually only seen in diagrams and pictures. Students in the university continue the research of Dr. Nandwani by working on and testing new designs, making old ones more efficient, and teaching others about the technology.

Dr. Nandwani not only demonstrates solar devices in his laboratory; his home is also a model for all who want to live lightly on the earth. He uses solar cookers, one of which has electrical backup in case of rain, solar water heaters, even a microwave powered by a photovoltaic cell. The house is a delight to see and visit, a "must" in Costa Rica for solar cooker enthusiasts. .

Another major actor on the solar cooking scene in Costa Rica is the organization called Fundaccion Costaricense Sol de Vida (Sun of Life). This organization was one of those initiated in Central America by the work of an American, Bill Lankford. The network is known in the area by its Spanish name of PROCESO. More details of this work are given in the section on Guatemala, where the initial and largest project has been underway for some years, as well as in this section in headings under the other Central American states where similar organizations exist.

An early activity of Sol de Vida in Costa Rica was (in keeping with Latin traditions of celebrations) establishing one such event - La Fiesta del Sol, honoring the sun and held annually. It proved to be a marvelous event for publicizing solar cooking, calling attention of many to this technology. It is not an isolated activity but rather an integral part of the larger project, Sol de Vida. In 1999, the organization was awarded the National Prize in Energy ~ Innovative Project for its work. The Ministry of Environment and Energy, the National Power and Light Company, the Chamber of Industries and the Association sponsor that award for the Investigation and Development of Energy and the Environment.

Sol de Vida has also created an educational facility, EduSol, to house its promotional and teaching activity. The organization is recognized as an innovator beyond the borders of Costa Rica, as well. Above, in the Multi-Nation Promoters section, the United Nations Development Fund is mentioned, specifically its Small Grant Program, which operates on the national level in many countries. Sol de Vida was one of the Costa Rican awardees in 2001, and is featured in the Annual Report of the organization's work, accompanied by an outstanding photograph.

Another Costa Rica project was honored at Johannesburg by the award of the Equator Prize, offered by the same Small Grants Project program of UNDP. Association ANAI, a local NGO in Costa Rica, promotes solar cookers that enable women to engage in income generating activities, thus improving their living conditions and reducing fossil burning. They report a strong focus on encouraging women to pass on their knowledge to their children, thus promoting the use of solar cookers into the future. The Equator initiative prize is offered for community work associated with a World Heritage Site, thus attempting to reconcile bio-diversity conservation with local livelihoods and household issues.

As can be seen, Costa Rica, noted for many forward looking national objectives, is a major player in solar cooking promotion in Central America.

Cuba

When planning was underway for the Second World Conference on Solar Cooking, to be held in Costa Rica, in July of 1994, an abstract for a presentation to be

made was received from a Cuban staff member of the Solar Energy Research Center in that nation. The letter told of their work, particularly with solar drying of food and even construction materials, as well as the use of solar energy for purifying and distilling water. What happened is unclear, as the paper does not appear in the program. However, it is evident that some action regarding the use of solar energy for household was taking place at that time.

Two years later, in 1996, an SCI volunteer and trainer of many, Don Coan of Sacramento, California, attended a conference on sustainable energy use in Cuba. He recounted some of the uses of solar energy he was shown during his visit. Sun Oven box cookers, gifts from a visitor, were in use at an Eco-restaurant at the National Botanical Garden. One secondary school had a large parabolic solar reflector that directed sunrays to pots inside the building - it was however not in use at the time of Coan's visit. Considerable use of photo-voltaics was evident, and small streams were used to generate hydroelectric power. Waste from the production of sugar is burned as a major source of energy, producing a good bit of pollution, and use of renewable energy would obviously be useful. However, the embargo on goods has made any and all importation difficult and costly.

The Renewable Energy Group at Eastern University, Santiago de Cuba, indicated in 1998 that they had been working on solar cookers for over ten years and had at that time disseminated 200 cookers to families and 50 to schools of the area. It is evident that substantial interest and experimentation has been present in Cuba.

Cuba has excellent sunshine and few other fuel resources; hence it could almost certainly utilize solar cooking. Cuba may well be doing more than is known without communicating that information to the international community.

Dominica

There is no written record of solar cooking activity in Dominica, one of the Windward Islands.

Dominican Republic

For some years, Sophie Jakowska, an associate of the World Conservation Union, has demonstrated the use of solar cookers, in connection with children's exhibits at a new national park. The cookers generated much enthusiasm. Another individual has created a small organization, Estufas Solares Dominicanas, in several towns, with the purpose of demonstrating and promoting cookers. No large-scale project in the nation has been reported.

El **Salvador**

This nation is another of those in which solar cooking activity is based on the model known as PROCESSO, developed in Central American countries with the assistance of American Bill Lankford. The project was started in the southern part of El Salvador, in an area where refugees who had been living in Nicaragua during a period of civil strife, were housed after repatriation. Women, who are, of course, the cooks, were taught how to build wooden box cookers and to use them. Cookers were built by teams of women, continuing until one had been built for each member of the group. Later, each of the new solar oven owners assisted in teaching others how to make and build ovens for themselves. The method of technology transfer has proven to be effective though time consuming and therefore costly. (COSENI Case Study, 1996).

More recently, a number of students from a San Salvador high school built a variety of solar cookers, a parabolic, a box booker and a solar panel device, as a science project. The cookers generated considerable enthusiasm and the students next conducted demonstrations in poor neighborhoods.

Several other organizations participated in solar cooking demonstrations and promotions in the early 1990s, communicating with SCI on their work, but nothing is currently known about outcomes or activities in the new century.

Greenland

Nothing is known of any solar cooking activity in Greenland, nor would any be expected in the relatively harsh climate.

Grenada

No information on solar cooking activity has been reported from Grenada or found in any of the literature searched.

Guadeloupe

Nothing about solar activity has been located for this island of the Lesser Antilles in the Caribbean area.

Guatemala

The Central American Solar Energy Project (CASEP) includes projects in five Central American countries. The model is explained in more detail here, as Guatemala was one of the first projects; others have developed in similar manner, with minor differences for specific cultural, economic or ecological reasons. The model is based on a number of assumptions, including the need to shift from fuelwood and health problems involved with indoor air pollution. But other aspects of the model are unique to CASEP and need to be stressed. One relates to the assumption that innovations introduced by foreigners, who leave after the initial dissemination of information, are not likely to be sustained by local people. The process therefore carefully assesses suitability in a lengthy trial period, designed to assess the technology, the climate, and, most importantly, local interest in the potential offered by solar cooking devices.

Public demonstrations of solar cooking are carried on and ovens are loaned to families for trial periods, in order to be certain of suitability and interest. Only when those have been carried out for a period of up to six months does the workshop, the heart of the effort, take place. In the workshops, teams of women (based on the assumption that since they are the cooks, they should be the students) are taught how to make their own ovens. They work collaboratively and continue until ovens have been completed for all team members. The ovens are expensive (around $100 or more) since materials are purchased locally to be certain that the project can easily be duplicated in other parts of the country. An extended period of follow up occurs after the workshops, with experienced cooks visiting each new user to encourage and help solve any problems with the new method of food preparation. This period can last for a year or more. Each

recipient of a stove signs an agreement that they will return the stove if they do not find it useful, or if they move to a different locale. Each also agrees from the beginning that she will work cooperatively with others in the making of ovens until all participants are equipped with an oven for their family. In a larger sense, the introduction of solar ovens is conceptualized as but one part of a much larger community and national development effort, in which individuals and families are both personally empowered by the experience and materially aided, while families and their collective environs are protected.

Beyond the activity described, each of the projects was assisted until the time when it became able to achieve an independent status in its country, i.e., finding the necessary local funding to continue the work and create a non-profit governing group, indigenous to the nation. Each NGO is legally and fiscally independent, with its own board and procedures, but with CASEP (U.S. based) acting as backup and advisor when called upon. From the national organizations, new community projects have followed in many parts of each country. Each of the national projects is slightly different; linkages exist largely for exchange of information and encouragement to one another rather than to insure uniformity or to conform to group regulations.

This large and well-organized project has drawn considerable attention to solar cooking in the Central American region. A number of overseas volunteers have worked for short or long periods, as technical and communication advisors. However, the special genius of CASEP is the degree to which the affiliates exercise true ownership of their project, adapting it to the specific needs of their own country, and administering activities in manner appropriate to their particular circumstances. In total, more than 1500 solar ovens have been introduced by these separate but linked organizations in the period since 1986 when the work of CASEP began in Guatemala (Varese, p. 97).

Another project of note in Guatemala was one sponsored by the New Forests Project, a Washington, D.C., and organization. The project occurred in the early 1990s on the south coast of Guatemala, working collaboratively with the National Association of Peasant Farmers for Land (ANACAMPRO). Two women trainers from Honduras, members of the organization for the Entrepreneurial Development of Women (ODEF) in that country, participated in the training of representatives of Guatemalan NGOs. They

estimated that around 850 people participated in over 60 demonstrations held in six communities in the area. Solar cooking training was provided to 180 people at a New Forest Project (NFP) training center.

THE NFP method utilized leaders from community organizations, preferably women, as trainers. They held demonstrations widely, and then offered specific and detailed training to those who were interested. Following the training, an intensive period of follow-up was employed.

NFP also made a careful examination of obstacles. They found the following to be barriers which required careful thought to overcome: cultural resistance to change, cost of the cookers (around $46); and climatic-factors such as humidity (affecting the cardboard cooker they used). Programs, which followed, made attempts to deal with the obstacles by hiring community promoters/extension workers to educate users, the use of partial subsidies of the cookers, and testing other materials for the cooker (Costa Rica, p. 260).

No recent news of this project has been located; reports indicate that it was suspended some years ago.

HAITI

As mentioned above in the discussion of Canada, early work in solar cooking was done by a Canadian organization, Communities in Partnership, a charitable group founded in 1984 in Powell River, British Columbia. Their work, in turn, was inspired by a 1977 feasibility study in Haiti, accomplished to assess the suitability of the county from a climatic/insolation perspective. This work of Dr. Tom Bowman, James Sharbar and Joel Blatt focused on factors of weather in the different parts of Haiti. They measured insolation in more than a dozen areas, some at different seasons of the year. Without providing all of the detail of their research, the document's overall conclusion is that good solar cooking conditions, generally speaking, exist in Haiti, with, as everywhere, seasonal and some regional variations, probably enabling families to save at least half of their fuel costs.

The original Canadian partnership was with a small community called Saint Marc, but later the program expanded to a number of communities in Haiti. They began by building solar cookers jointly with residents of Saint Marc, and were preparing to start an

ambitious pilot project when a major coup interrupted normal life in Haiti (1991). In that disturbed time, the Canadians decided to turn their efforts to a survey of all solar cooking activity in the country. They had heard bits and pieces of other small projects but had no overall picture of the situation. In the next months, they devised a questionnaire that was sent to over 30 locations in the country where solar cooking had been tried or demonstrated. Thus, while the information is now dated, a picture does exist (even if admittedly not complete) of what is a substantial portion at least of solar activity in the country at the time.

The conclusions of this study proved to be difficult (or impossible?) to summarize numerically, but excerpts from reports received give the flavor of work in a wide range of communities, allowing some generalizations to be made. Short reports are provided from 19 of the 30 communities surveyed. Key figures in solar promotion in this country included the Brace Research Institute of McGill University, a number of religious organizations, the Canadian Communities in Partnership group, a number of individuals, and one enterprise promoting a particular cooking model.

Commonalities and differences are seen in the reports. A variety of cooker designs are in use: the box cooker (the most common), a steam cooker, and parabolics, all in a variety of materials, wood, cardboard, metal, two different approaches were seen, one believing that uptake would be higher and longer lasting if people made their own cookers, investing their own time and energy. Other disagreed and felt that efficiency, perhaps more certain with a manufactured product, was more important than the "ownership" conveyed by self-building. Strong and regular usage was fairly rare, despite the extreme need. The various groups were not working together for the most part, thus not maximizing their learning from one another's' experiences. Need was everywhere great, but cost of the cookers was nearly prohibitive for many.

Two additional resources in Haiti in the early days of solar promotion are: the solar cooking resource center, created in the Haitian-American Institute by librarian Eleanor Snare and, in 1992, a first Haitian National Solar Cooking Conference held in Port-au-Prince. In that same period, a number of Haitian solar cooks traveled to other solar cooking conferences, regional and worldwide.

Since the early years, a range of sporadic attempts continues the good beginnings of the earlier era. The country has however continued to experience political unrest, always hampering any development efforts. Nonetheless, efforts at promotion have continued. The Free Methodist Church of Haiti, located in the capital Port-au- Prince, has worked diligently, despite personnel changes, at solar promotion. Over the years, they have distributed over 1,000 solar cookers, primarily of the panel variety, the least expensive version available today. To help with follow-up, they have formed committees of solar cooks in several towns.

The Rotary Club of Brookings, South Dakota, U.S.A., along with other clubs in its Rotary district, have joined Solar Oven Partners, a cooperative project with the United Methodist Church. The collaboration began in 1998 and by December of 2002, the project had distributed more than 300 ovens (on a subsidized basis) and trained 2,500 Haitians to use them. An on-site infrastructure is being organized, working with the Methodist Church of Haiti. Using a basic philosophy of "empowering people through self help", the Rotarians and Methodists are continuing the long tradition of "harvesting sunlight" in this nation. Deforestation here is already at an extreme stage, hence need continues to be great.

A long time advocate of solar cooking in Haiti, Jack Anderson (an early Communities in Partnership leader), has tried a range of dissemination methods, employing "animatrices" or extension workers initially, then re-conceptualizing them as small-scale entrepreneurs. His knowledge of Haiti is extensive, but political events have continued to make efforts very difficult. In the last project described below for Haiti, Jack has played an important role in yet a different method of promoting solar cooking. That most recent addition to the range of solar offerings in Haiti is structured differently from its predecessors. In this instance, a business, Sun Oven International, has begun operating in the country, using a very interesting distribution mechanism. As described on the Sun Oven website (www.sunoven.org)> the plan includes a number of components.

The project selected 500 women in one area of Haiti for initial training in solar cooking, using the cardboard panel cooker called the CooKit This device serves as a teaching tool; participants are requested to keep records of their cooking attempts, results, and fuel savings for a periodof three months. Those who prove to be regular users of the

CooKit can turn in their logs, along with an account of the money they have saved, to obtain a SunOven, sometimes thought of as the "Cadillac" of box cookers. Initially, Sun Oven International has established an assembly plant in Haiti, in which U.S. manufactured components will be put together in country (and perhaps even for export?) When demand justifies, a full scale manufacturing plant will be established that can serve the needs of the Caribbean basin for this top of the line solar cooking model. (A similar plan is in effect for Ethiopia) It is too soon to know how this will progress, but it is clearly an interesting and unusual tactic for promotion - and one to be watched carefully.

This activity is at least partially supported by a loan from the Overseas Private Investment Corporation (OPIC) and a grant from the U.S. Agency for International Development. Sun Oven owner, Paul Munson, was recently honored in the office of the Speaker of the House of Representatives, Dennis Hastert (Munsen's congressman), with the award of the U.S. Department of Commerce's Export Achievement Award for this innovative work in Haiti.

Given the desperate situation of the forest situation in Haiti, combined with favorable insolation in most of the country, the country will remain a prime possibility for solar cooking promotion, particularly if or when the political climate improves.

Honduras

Another of the PROCESO organizations is located in Honduras. The organization in Honduras is called Centro de Hornos Solares; a woman named Martha Corina Carranza is the main contact for the group. The group operates somewhat in similar manner to that described above for Guatemala and the other Central American nations. The group is an independent organization, with loose links to CASEP and its founder, Bill Lankford.

In 1993, a regional conference on solar cooking was held in San Pedra Sula in June, bringing together many of the promoters from the region. Solar Cookers International (SCI) was instrumental in this event, providing some small start-up money for the conference, and playing a role in the meetings themselves. The basic idea was the encouragement of networking among the solar promoters of the region, an objective that clearly was achieved. M.A. Flores and R. Carlderon, two faculty members from the

Universidad Nacional Automoma, Department of Physics, Energy Section, have long been active promoters and were instrumental in organizing a major Latin American Solar Conference in 2001.

Jamaica

Early in the 1990s, the Minnesota Home Economics Association (MHEA), the Jamaica Home Economics Association (JHEA) and the College of Agriculture, Science and Technology, Kingston, Jamaica (CAST), undertook a solar cooking project in Jamaica. The project was conceptualized as a research project, with surveys before and after an action program, with the purpose of assessing the acceptability and feasibility of solar cooking in the nation, and its impact on family resources. The rationale of the project was related to two main factors: the high cost of energy for households and a national concern about deforestation.

Data were collected from 40 households in three climatically different communities on the island. The respondents were 90% female, living in households with a mean household size of 4.1 persons. Minnesota home economists were trained in the construction and use of the solar box cooker (made of cardboard), and then a team traveled to Jamaica to provide instruction to Jamaican household cooks. A complex evaluation instrument was created, and all Jamaican participants were interviewed before the training and later, after an extended period of using their solar cookers. The project is relatively unusual in the careful evaluation and documentation of results.

Jamaican women were willing to make the required changes in customary cooking practices, once they were convinced it would benefit them personally and their environment, as well. Since most were at income levels considered being "not" or "barely" adequate, monetary savings were important. Most participants were satisfied with the cooker's performance, but unusually rainy weather limited use somewhat and thus savings as well, noted as a major problem. Even with that circumstance, the fuel usage of the group dropped substantially in the period of 6-10 months of cooker use. The final conclusion was the solar cooking was useful to participants, with the proviso that other backup resources for cooking will always be needed.

Several other persons in Jamaica have indicated interest in solar cooking but no additional organized project has been instituted there, to the best of current knowledge.

Martinique

No information on solar cooking on this French island is known.

Mexico

A substantial amount of solar cooking activity has been instituted in Mexico under a wide range of auspices, almost certainly more than can be described here. Girl Scout leader Barby Pulliam has conducted training programs for Girl Scout leaders and other representatives of NGOs in a number of cities and towns. Rotarian Wilfred Pimentel has also conducted a number of pilot programs in various cities. In some of those places, Rotary and Girl Scouts joined forces. A number of missions and other religious groups have promoted solar cookers in various parts of the country. One example is the Mission Mazahua, in Atlacomulco, which has produced around 600 cookers. Several university faculty members have conducted research on cooking devices, as well.

Currently, a large project is underway in an unusual venue, a nature conservancy area, the Sierra Gorda Nature Reserve. In the spring of 2003, Louise Meyer of Solar Household Energy, Inc. (SHE, Inc.) conducted a training program to test user acceptance of a new solar device called the HotPot. The device uses a modified CooKit design, initially of a plastic material rather than cardboard, and later metal. The black pot is enclosed within a tempered glass "greenhouse" instead of the plastic bag used in the original CooKit.

The Director of the Mexican Fund for the Conservation of Nature, Lorenzo Rosenzweig, has partnered with SHE, Inc. in planning and implementation of the project. Within the confines of nature conservancies in Mexico, as elsewhere, trees cannot be cut down for use as fuelwood. Households living within the area thus must find other sources of energy for cooking. Therefore, the managing group of the Sierra Gorda site, the Grupo Ecologico de Sierra Gorda, was delighted to explore the potential of solar cooking. The town of Purisima and a village, Mavi, were selected as the site for the initial training program.

Ms. Meyer traveled to Mexico in May, and conducted training for Sierra Gorda women, who were given HotPots and trained in their use over a two-day period. After the training, Ms. Meyer visited the women in their homes as follow-up for days of further training and coaching. The women were all interested in what others were cooking, and eventually a throng of cooks accompanied Ms. Meyer on most visits, enhancing the group learning substantially. Two women from the group were chosen for additional training in "how to teach others". The new trainers were again visited and coached in the art of training.

This pilot project, growing into a large scale follow up in other areas of Mexico, was among the winners of the 2003 Development Marketplace competition, held annually by the World Bank. The award of funds to SHE, Inc. in collaboration with the Fondo Mexicano will permit faster dissemination of the new Hotpot in this area and perhaps in other parts of South America. Reports on this activity will become available later in 2004 on the SHE, Inc. web site (she-inc.org).

The Sun Oven organization, an offshoot of Sun Ovens International, is also working in Mexico, though its main offices for the area are in Europe. They report promoting both Sun Ovens and Sheffler type parabolics in Cuernavaca and Mexico City (info@sunoven.de) The parabolic portion of this work, conducted by the Grupo Scheffler de Mexico installs large commercial and institutional cooking and water heating.

Montserrat

Nothing is known of any solar cooking activity in Montserrat.

Netherlands Antilles

No information has been found on solar cooking activity on this small island, affiliated with the Netherlands.

Nicaragua

The Central American country of Nicaragua has been active in promotion of solar cooking for some time. One of the organizations connected to the network associated with William Lankford's long standing work in Central America is located here, and has

been active in training women in the construction and use of solar cookers for a number of years. The project here, known as Centro Girasoles Proceso, uses methods similar to those described above, that is, assistance to women to build their own solar ovens, carefully and exactly, to produce excellent functioning. Training is continuous, and follow-up is as intensive over an extended time period as any solar program anywhere. In the view of the Proceso groups in the Central American countries, solar cooking is a critical, but only one, element in the overall process of improvement of life for Central Americans. Girasoles believe that the cookers are used over 80% of the time, once the training and follow up has been completed. They continue to work in the community, extending their activities to other needs as indicated.

Centro Girasoles Proceso has also reached out to extend knowledge of solar cooking to other groups working in Nicaragua. A more recent arrival on the scene in Nicaragua is Grupo Fenix, an organization that provides a range of renewable energy resources in the country. Girasoles, as the knowledgeable group on solar cooking, worked with Fenix to pass on knowledge and experience. Fenix has in that manner developed skills in teaching low-income people how to build simple, effective, and low cost box cookers. The ovens are made of scrap cardboard, newspaper, aluminum foil and plastic in an afternoon, or over a week for a large and durable oven made of wood and other materials. They have learned, as all solar promoters must, that follow up for new trainees in solar cooking is an essential ingredient in the program, since the cooking method is quite different. They have also learned to pasteurize milk and water, and are working on other techniques for sterilization, using the most efficient of the oven types.

The group also promotes photovoltaic lighting, working with Terrasol, a US/Nicaraguan volunteer project. In addition, they are working to exploit the abundant rainfall, which feeds streams and rivers, ideal for small-scale generation of electricity to supplement that which comes from the national system and often fails before reaching remote rural areas. To assist local people with acquisition of this range of renewable technologies, Fenix is working to establish micro-loan programs like those successfully in place in many parts of the world.

Panama

Two individuals are noteworthy in the promotion of solar cooking in Panama. Don Alberto Fajardo Cruz, using the name "Usando el Sol" (Using the Sun) has been building and demonstrating cookers in Panama for many years. He estimates that around 1,000 people know about cookers, with an unknown number of those using them. A colleague and collaborator, Professor Pedro Salazar of the University of Panama has recently published a small guidebook on solar cooking, dedicated to Don Alberto. The guidebook was designed to serve students who were working on field projects in marginal parts of the country, where they are also doing demonstrations of solar cooking. Professor Salazar is hopeful that at least 500 people will be introduced to solar cooking in this manner.

Puerto Rico

No reporting of solar cooking activity has been found in the Commonwealth of Puerto Rico, affiliated with the United States of America.

Saint Kits and Nevis

This small nation is a federation of two islands. No known solar activity has been reported here.

Saint Lucia

No solar cooking activity is known of on this island nation of St. Lucia.

Saint Pierre and Miquelon

This tiny territorial collectivity of St. Pierre and Miquelon, a dependency of France, has no reported solar cooking activity. It is not located in an area suitable for solar cooking, namely, offshore from Canada's Maritime Provinces.

Saint Vincent and the Grenadines

This Caribbean nation, one large island and several smaller ones, reports no solar cooking activity.

Trinidad and Tobago

No reported solar activity of any type has been located for this pair of islands. Interest in the technology has been expressed by women's organizations, but no specific activity has been reported.

United States of America

A number of the organizations listed at Multi-nation Promoters, above, are located in the U.S., including the hub of the network of solar cooking organizations, Solar Cookers International (SCI). Others are Rotary International, the Sun Oven Society, the Solar Oven Society, and SHE, Inc.

While much of the climate of North America is not suitable for year round solar cooking, a substantial portion, particularly the American Southwest, is very appropriate. Therefore, most activity in the use of solar cooking is reported from that area, and in California. The American southeastern states would also work, though the weather is somewhat less predictable and less activity has developed there.

No precise numbers are available, but estimates suggest that many households in Sacramentó, California, home of SCI, may at least occasionally use solar cookers. The electrical utility of the area, the Sacramento Municipal Utility District (SMUD), has been a strong supporter of solar energy usage. SMUD serves an area of more than a million people. Under earlier leadership, it pioneered the development of cleaner electricity generation, including building the first solar powered generating station in the United States. It has offered rebates for replacing old appliances with energy efficient equipment, it cooperating in planting of trees to lower the cost of air conditioning to consumers, as examples. For purposes of this report, it is important to note the strong support of SMUD for solar cooking education, including outreach to schools and community organizations. They have placed solar cookers with Scout troops, offered workshops in 65 schools of the area, and made available plans to build cookers to customers throughout their service area. In 1991, SMUD even produced a solar cooking cookbook. Reducing the use of electricity is in everyone's interest; this interesting example of a public utility's contribution to solar cooking as one contribution to solving the problem was noteworthy.

Considerable activity can also be found in the State of Arizona, probably the sunniest of the U.S. fifty states. The most important solar cooking fact about Arizona is that Barbara Kerr, the foremost expert on solar cooking in the U.S., lives in a small community in this state. She has created, and lives in, a Sustainable Living Center that demonstrates a wide range of ways to live lightly, rather than destructively, on the earth. Barbara is the author of several books and articles on solar cooking, the creator and marketer (with her colleague, Sherry Cole) of a cardboard box cooker, the refiner of the CooKit as the first inexpensive but efficient solar cooker, and a never-ending source of information to those who seek her knowledge on the internet. A visit to Taylor, Arizona, is a trip to an important piece of solar cooking history.

Solar devices are also manufactured in this area. Early pioneers, Bob and Heather Larson, produced cookbooks and plans for solar dryers until their untimely deaths. Jay Campbell, a New Mexican engineer, has invented a range of cooking devices that won prizes for ingenuity and efficiency, though he is not a manufacturer but rather an idea person. One firm, Zone Works, makes and sells parabolics out of Albuquerque.

Unlikely as it may sound, the State of Minnesota has also made contributions to the development of solar cooker. Mike and Martha Port, founders of the Solar Oven Society, have worked in a variety of Central American and Caribbean nations on various projects. Recently, they completed research and development of a new cooker, manufactured from recycled soda bottles; the device will help to fill the gap between the very inexpensive (but not so long lasting) CooKit and the more expensive box or parabolic cookers. With the assistance of a small business development grant from the State of Minnesota, charitable contributions from a range of churches and organizations, and the dedicated volunteer labor of the Ports over many years, they have recently been able to begin the sale and marketing, both in the U.S. and abroad, of the Sport. A collectivity of Minnesota churches made possible the shipment of 400 unassembled cookers to Afghanistan for sale at a subsidized price to people whose need for cooking energy is great (see the country report for Afghanistan for additional information).

A very recent news item indicated that a solar cooking group had been formed in the U.S. State of Nevada, a neighbor to both Arizona and California and sharing their similarly favorable cooking climate. The Nevada Solar Cookers Association was formed

to share recipes, ideas and stories, and to spread the news about solar cooking in their area (SCI Review, Mar 2003). Other U. S. contributors have been noted above, including those of the Rotary, the Girl Scouts, SHE, Inc. SCI, etc. in the Multi-Nation Provider section above.

While use of the solar cooker is not unknown in the U.S. it is by no means widely used. Most work of American promoters appears to have been devoted to projects in other parts of the world.

United States Virgin Islands

No solar cooking activity has been reported for these small islands.

Solar cooking activities in North and Central America are categorized by scale in Table III D.

Table III D. Solar Cooking Programs in North and Central America, Categorized by **Scale.**

No Known Solar Programs N=21	Antigua and Barbuda, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Dominica, Greenland, Grenada, Guadeloupe, Martinique, Montserrat, Netherlands Antilles, Puerto Rico, St. Kits and Nevis; St. Lucia, St. Pierre and Miquelon, St. Vincent and the Grenadines, Trinidad and Tobago, U.S. Virgin Islands
Individuals Only N=3	Cuba, Dominican Republic, Jamaica
Small Programs 1-100 users N=1	Panama
Medium 100-1,000 N=6	Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua
Large 1,000-30,000 N=1	Haiti
Mass/National N=0	
Exporters and Promoters N=2	Canada, USA

While some promotion is done in the US, the nation is largely engaged in exporting and promoting solar cooking, rather than using the technology domestically. Of the 34 nations in the whole region, 22 or 64.7% had little or no exposure to solar cooking. Two are primarily exporters or promoters and the remaining 10 have active programs, small or large.

CHAPTER HIE

SOLAR COOKING

OCEANIA

Most persons do not think of "Oceania" as a continent, and correctly so. However, the usage in FAO's series of publications on The State of the World's Forests, the major source for forestry and demographic information used in this document, utilizes needed a way to organize all of the world's "nations and areas" for presentation of data. Since all the other parts of the world are found on continents, that is the usage - and Oceania, therefore, made up of the small and large island states (or collection of islands) in the southern part of the Pacific Ocean, becomes a continent for this purpose.

The only islands of substantial size included here are Australia, followed by Papua New Guinea and New Zealand, that latter two of which are in area, respectively, only six and four percent of their larger neighbor. The remaining islands, or collections of islands with some degree of self-governance, are all smaller yet.

It is perhaps not surprising therefore that the nations of the region are seldom thought of, on the global scene, as promising markets for most consumer goods. In addition to being small, they are separated from one another, sometimes by substantial distances, ethnically diverse, and relatively underdeveloped. Information on the area is also relatively scarce.

The area focused on in this section straddles the equator in the southern Pacific. It extends from 20 degrees north of the equator to almost 46 degrees south at the southern tip of New Zealand. There are literally thousands of small islands, stretching in a downward crescent nearly halfway across the Pacific. Some of the islands are independent; others are dependencies of Australia, France, New Zealand, the United Kingdom, and the United States. Given the geographical range, physical diversity is huge; the area encompasses some of nature's greatest wonders such as the Great Barrier Reef, many volcanoes, mountains, deserts, and rainforests.

The nations of Oceania, with the exception of Austrajia, appear to have had little exposure to the potential of solar cooking. Of the twenty nations, only Australia is known to have a number of supporters and users of the technology.

Australia

A number of individuals are known to be makers and promoters. They include the following: Graham Boyle and Donald Mackenzie, both of who were doing demonstrations of solar cooking in the early 1990s. Noel Bourke of Perth builds and sells around 45 cookers per year. Rayner Sturton specializes in teaching solar cooking in primary schools to students and their parents. One industry, Jura Sol (perhaps an offshoot of an Indian company of that name) makes and sells both solar cookers and solar food dryers (SCI Archives: International Directory).

A recent article in SCI's Review told about the work of Dave "Sunny" Miller, who is a very active promoter and has instigated a Solar Cooking Interest Group in West Australia. Their most recent product is a large community-sized box cooker with a photovoltaic-powered air circulation fan. The cooker is on a wheeled mount so that it can be taken to a variety of schools in the area for demonstration purposes (sunnymiller@linet.net.au) and (SCI Rev Nov. 02).

Another Australian, Derrick Hobbs of Barefoot Engineering has designed a different type of cooker that he tests and demonstrates. The cooker is made from half of a large oil drum, resting in a wooden frame. It is fitted with an internal moveable shelf to hold pots level. The reflector, made from the other half of the drum, fitted with a shiny surface, closes down when food is cooked, keeping food warm for some hours.

Noel Bourke reports he has been making and selling solar cookers in Western Australia since 1994, with sales of around 45 per year. Importantly, he has also become skilled in cooker repair (SCI Rev., Nov 02).

All of the above individuals connect with the world of solar cooking through contact with SCI; it is certainly possible that others may also be active. The summaries above of information on activities of promoters mentioned principally from the SCI website (solarcooking.org), International Directory, which refers readers to the specific issue of the Solar Cooking Review which carried the information.

While not directly related to solar cooking, an interesting hews item on sun power in Australia told of a power company's plan to build the world's tallest structure - a solar tower- in the middle of the Outback area. The tower will be more than twice as high as any of the world's existing high structures, standing at more than one kilometer tall. It is expected to provide sufficient electricity for 200,000 homes, and will save 700,000 tons of greenhouse gasses from being emitted into the atmosphere.

The structure will be as wide as a football field and will have a huge glass roof, spanning 7 kilometers. The sun will heat the air under the roof, causing air currents to flow into 32 turbines that spin and generate the electricity. A model of the design has been previously built in Spain. Regional governments of Australia are supporters and financiers of the scheme (www.news.bbc.co.uk - 1/5/03).

The remaining independent nations and dependencies are the following: **American Samoa, Cook Islands, Fiji, French Polynesia, Kiribati, Marshall Islands, Micronesia, Nauru, New Caledonia, New Zealand, Niue, Norfolk Islands, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu.**

No information on solar cooking activity is known for any of the above. Given the fact of no solar cooking programs outside of Australia, no table is presented.

CHAPTER III F

SOLAR COOKING
SOUTH AMERICA

The continent of South America runs, like Africa, more North-South than East-West. It is the fourth largest continent, linked to North America by the narrow Isthmus of Panama. Its shape somewhat mimics the much larger African continent, but its location on the globe is further to the South. The continent stretches from around 13 degrees north of the equator to 55 degrees south, with only a fairly narrow strait separating it from Antarctica. The equator crosses the continent some five degrees north of its widest part.

In the categorization used in this document, the nations of what are usually thought of as Central America are included with North America; South America stops at the Panamanian border with Colombia, though parts of the latter and an area of Venezuela actually extend further to the North. The continent itself has great physical diversity, with three major geographical features dominating the landscapes: the Andes Mountains which stretch along the western side of the continent almost its entire length, the great basin of the Amazon, and the broad plains of the southern countries. The Andes comprise the longest mountain range in the world, with volcanoes and sometimes earthquakes of frightening proportions. The interior of the great bulge of the continent is filled by the Amazon and its maze of tributaries, more than a thousand in number. Not the world's longest river, the Amazon does however hold more water than any other river in the world by a factor often. The Great Plains, called "pampas" in Argentina and Uruguay, produce beef cattle for the world, and an abundance of other agricultural products.

As would be expected, this diversity has produced many and varied ways of life, notably the great Amerindian cultures culminating in the powerful Inca kingdoms, which greeted the Spanish explorers in the 16th century. Colonialism occurred quickly in South America; local populations were thinned by disease and wars, quickly becoming virtual slaves. Later, Africans were imported to South America as slaves as well, bringing yet other cultures to the mix. Missionaries flooded into the country in the footsteps of the

conquerors. By the end of that century, virtually the entire continent was under foreign rule, with the military and the Roman Catholic Church dominant institutions.

Early in the 19th century, the era of colonialism came to end, with local revolutions taking power into South American, though mostly wealthy, hands. Military rule was unfortunately not yet over, nor was autocracy, though each of those institutions had a local rather than foreign face. Democracy in most nations came only late in the 20th century, but economic problems persist, and the distribution of economic resources remains seriously skewed.

Latin America, by contrast to Africa, is a heavily urban continent. Roughly 80% of the population lives in cities, some of which are among the world's largest, Sao Paulo, Buenos Aires, and Rio de Janeiro. Teeming slums line the city's hills and valleys in virtually all Latin cities, as rural dwellers continue to flee the countryside in favor of cityscapes.

The population of Latin America has grown by many waves of immigrants. Africans came for the most part as slaves, and a substantial population of their descendants lives in Brazil. Many people from India immigrated to Surinam and Guyana and form major populations groups in other areas, as well. Later waves included other Europeans, adding French and German blood to that of the earlier Spanish, Portuguese, and Italian. The mix brought rich cultures, including distinctive Latin American contributions to music and dance: samba and bossa nova rhythms, the tango dance form, newer Latin rock. Writers of the continent have given the world memorable literary contributions and artists have enriched world culture. And who can forget the prowess, energy, and skills of Latin soccer teams with their multitudes of fans?

Because of the geography, most of the citizenry live around the perimeter of the continent, with large areas of the interior nearly uninhabited. This population, though diverse in many ways, is less so on the religious dimension: the population is roughly 90% Roman Catholic.

The weather, given the length of the continent and its North-South orientation, varies from warm tropical rainforests in the North and mid-section to cooler drier climates in the South. The high mountains of the Andes are of course cooler but lightly populated. Much of the inhabited part of the continent is suitable for solar cooking, with

the exception of the southernmost tips of Argentina and Chile, where for a substantial portion of the year the sun's angles are too low for optimal cooking opportunities.

Against that backdrop, the scale of solar cooking programs in the fourteen countries of South American is described below. (The reader is reminded that Central American nations are here found under the heading of North and Central America

All South America

Local enthusiasts who wanted to learn about what others on the continent were doing created a network of solar cooker promoters in South America some years ago. Its founders named it the Red Iberoamericāna de Coccion Solar de Alitnentos (RICSA). The group sponsored an all Latin American conferences and several which were regional in nature, including one in Costa Rica in 1998, organized by Las Cocinas Solares en Costa Rica. Another group with similar interests is known as RECOSOL, for Red de Cocinas Solares de Latina America. The groups were provided with limited support from Solar Cookers International, which was itself always seeking funds for its programs. Latin solar promoters had great difficulty raising funds locally, since the costs were principally travel expenses for participants, always a hard sell to funders. Many of the promoters were eager to learn from one another, and to insure that they were not duplicating efforts.

One earlier conference was held for the entire continent, including both South American and Central America in Honduras in 1988. The conference was known as CLES or Conferencia Latinoamericana/Caribe sobre uso y tecnologia de las estufas solares. A survey of participants was done during that meeting, and gives an idea thus of the nature of the gathering. The 98 participants came from the following nations: Belize, Chile, Costa Rica, Ecuador, El Salvador, the United States, Guatemala, Honduras, Mexico, Nicaragua, the Dominican Republic, Tobago, Venezuela, and Haiti. 52 persons responded to the questionnaire distributed, 17 men and 35 women. Most of the group represented non-governmental organizations (65%), a smaller proportion came from universities (11.5%), and still smaller numbers represented government, private business, and others. The group of participants, between them, described a total of 46 separate projects in eight different countries. More subjective responses asked participants about perceived benefits, fuel savings, and the like. In general, and with some limitations, solar

cookers were positively received at this very early stage in contemporary promotional projects. Another conference was held in Honduras in May of 1993, this one regional in nature. Leadership of these meetings and the continental collaboration they aided included Pedro Seranno of Chile and his colleagues from the University of Chile, and Shyam Nandwani of the Universidad Naccional, Heredia, Costa Rica.

More recently, news came of another networking activity in Latin America, linking that continent with Spain and Portugal. The program is called CYTED; it focuses broadly on the range of rural renewable energy sources including heating and cooling, water pumping, food drying. Recently they have added solar cooking to the portfolio. The activities include research on new techniques, such as heat transfer methods and ways to store heat for evening use. Members are interested also in industrialycookers for institutions and for commercial enterprises such as bakeries or restaurants. Research has also been conducted on ways to combine box cookers and parabolics, using concentrators inside the box, for maximum efficiency. In addition the group has sponsored a number of solar cooking workshops for participants from all over South America, most recently in Argentina and Guatemala.

Participating countries and institutions include the following: Argentina - the University of Salta; Chile - the University of Chile; Cost Rica - University of Heredia; Cuba - Centro de Energias Renovables; Honduras - University Nacional Autonoma de Honduras; Mexico - University IberoAmericana; Paraguay - Instituto Nacional de Technologia e Normalizacion; Peru - Universidade Nacional de Ingeneria en Lima; Portugal - INETI-DER -Renewable Energy Department and AO SOL, Energia Renoveveis; and Spain - University Complutense de Madred, Facultad de Fisicas. (SCI Review, Nov 2003).

The above assistance is undoubtedly very welcome, since, unlike Africa, for example, considerable distance exists between capitals of South American nations. Creating networks has been a difficult task. (It should also be noted that the African continent is divided into 51 countries, while South American, though indeed smaller, has only 14.) The Latin framework still exists but has been relatively inactive in recent years; thus, this Spanish addition to networking capacity is vital to advancement on the continent.

Argentina

Interest in solar cookers has been present for some years in Argentina, although until recently there has been little organized promotion. At the Second World Conference in Costa Rica, a team of Argentinean engineers presented a paper on their research in building parabolas for use in their country. Almost a decade later, in 2003, parabolas came to Argentina in a project sponsored by Proyecto Fertil, funded by Fondo Camper of the island of Mallorca, Spain. The project is taking place in the town of Salsipuedes, and while solar cooking is its main focus, the basic idea is yet broader, the building of a successful community life through productive ways of living in harmony with nature and each other.

Twenty large household parabolas were shipped, unassembled, to Salsipuedes, then assembled by local people working in teams with assistance from experienced assemblers. Each day included lessons on how to use the devices safely, on the range of foods that could be cooked and how cooking should be done. The activities were of great interest to people in the surrounding areas and considerable excitement has been generated over this activity. The assistance of Manolo Vilchez of Fundaccion Tierra in Barcelona, Spain, should also be noted. At the grand finale of this initial phase of the project, the new cooks prepared food for a large and enthusiastic community audience. Both donor and recipients plan to continue the project, hoping to include yet more people in the future (SCI Review, July '03).

Another European group reported on its work in Argentina, this time at the 2000 conference in South Africa. High in the Altiplano (high plains) of the Andes, where the weather is very cold much of the year, solar heating is a need along with solar cooking. The Altiplano is arid, and has meager vegetation, thus expensive fuel.

To work on this problem, representatives of the German Solar Institut Julich, in Karlsruhe, undertook an interesting project in an exemplary school, Misa Rumi, situated at an altitude of 3700 metres. The buildings were unheated, though the temperature dropped to 5 degrees (Centigrade) above freezing in cold months. The school already had solar water heating and a solar community cooker. The team of engineers form Solar Institut Julich, after considerable engineering research, designed a scheme with earthen

and pebble filled Trombe walls that could considerably reduce the cold and could be built at a reasonable cost. The elaborate scheme, too complex for the non-engineer to plan, has proven workable and has thus great potential for this area where fuel is very scarce but sunlight abundant.

A new network of solar cooking promoters has sprung up in Argentina, after one of the group, Laura Garat de Larran of Salta Province, obtained information and instructions from SCI for making and using cookers. She first taught 25 women to make and use cardboard cookers. Since then she has held workshops in other communities of the area.

The new cooks have established a network of promoters who can exchange their ideas and recipes using the postal system. They have also experimented with soy products, making soymilk from soybeans, using the cooker. Another member, Maria Ceccarelli is trying to see if making jam and jellies could become an income generating activity for low income women. Yet one other member of the group, Susanna , works in Jujuy province and has taught hundreds of women to cook. She has now trained three builders of cookers, as well, and is spreading solar cooking information through schools in Buenos Aires province most recently. The group is active and energetic, based on their reports (SCI Rev, Nov 2003).

Bolivia

A very active promoting team, David Whitfield and his wife Ruth, have established what is most likely the largest program on this continent. It is organized in conventional manner, with workshops held in various villages in which people are taught how to build their own wooden box cookers. Ruth is a Boliviana, and David an American who has lived in Bolivia for more than 30 years. In the last two years, they estimate they have taught more than a thousand people to make and use their own solar cookers. Fuel shortages are a substantial problem in this part of the mountainous region of South America, and the purchase of gas, sometimes a necessity, is very costly.

For a number of years, Ruth and David struggled along (and undoubtedly still do) with minimum resources of dollars but endless enthusiasm and faith in themselves and the potential of solar cooking. Several years ago, they were privileged to receive financial

and technical assistance from the French organization INTI (see above under "multi-nation" promoters) and for two years were yet more optimistic. Now that support has ended, and they are waiting for word on a pending Rotary International grant application. The pilot program, required prior to application for a larger grant, was begun in 2003, when Wilfred Pimentel visited Bolivia for that purpose. If they receive the larger grant, the efforts of Sobre La Roca will be considerably enhanced.

Thus far, while more or less a hand to mouth operation, they have assisted households in dozens of villages to make and build their own cookers. They have also attempted to evaluate the usage of new cooks. When calculating the carbon emissions that did not enter the atmosphere because of the solar cookers, the figures are quite impressive, if hard to conceptualize. The story of the large Bolivian project is one of the continent's most impressive. It is important to note that estimates of having made and trained cooks of 1,000 households would make this among the larger programs on the continent, if not indeed the largest (personal correspondence).

The Whitflelds have actively sought to educate themselves about the entire range of solar devices and, indeed, about fuel efficient stoves and hay boxes, in the interest of assisting people to develop a complete and integrated cooking system for the household. They have promoted parabolics with the cooperation of EG Solar, a German group, which states that 200 such parabolic cookers have been distributed in South America, at a cost of around $90 (Costa Rica, p. 97). The usual means of doing that is shipment of components, with local assembly, making shipping costs less and thus the device cheaper to the purchaser.

Currently, they have submitted a proposal for the U.S. Environmental Protection Agency, which sponsors a grant program that provides assistance for sustainable environmental activities around the world {solarl@zuper.net}

Brazil

Brazil is the giant of the continent, as seen below in the assessment of nations for solar cooking usage. However, little solar cooking activity has, to our knowledge, taken place in the country. The only indication of interest comes from an individual, Arnoldo Moura Bezerra, an instructor at the Universidade Federal of the Paraiba, who designed

and demonstrated the use of a parabolic solar cooker to be used in campgrounds. (SCI Review Nov '02).

Chile

The long thin nation of Chile, stretching along the western flank of the Andes for close to half of the continent, has another lively and extensive solar cooking programs in this part of the world. Considerable collaboration between a number of university faculty members, government units, and voluntary organizations has produced a situation, which provided enormous publicity for the use of solar cookers. Even though the technology cannot be used in all parts of Chile for-all months of the year, a number of projects have been carried out successfully and use is widespread in areas where solar cooking is appropriate.

Faculty members of the Institute of Nutrition and Food Technology, University of Chile, were instrumental in starting early programs in various regions of the country, testing devices and project methods in arid and semi-arid regions where fuel had become extremely scarce. In early stages, a "national contest" was held to encourage innovation in design and to create widespread interest in the potential. Twenty-two designs were submitted to the competition, clearly reflecting strong interest. Eight of them proved to function satisfactorily and were later used in the demonstrations. Next, an "encounter" was held, focusing on how to make cookers available economically and how to adapt them to the specific needs of households. A project was then developed in a rural municipality town, Lampa, north of Santiago (central in the country), employing a population of 72 families as interviewees to explore issues of fuel usage and expense, household size and food preferences, cooking patterns, etc. A small number of cookers were made available for use of selected families as "experimenters". Considerable interest was generated, other community meetings were held, and ultimately the community decided to build cookers themselves. This experiment served as the basis for projects in different areas. A portion of this work was accomplished in connection with a UNESCO project focused on use and conservation of hydrological resources in Latin America and the Caribbean. Representatives of this university unit have also prepared an excellent solar cookbook fonise in projects in Spanish-speaking countries.

A number of other institutions have collaborated in solar promotion in Chile, including the Universidad Technica, School of Architecture, where a prominent promoter, Pedro Serrano, is affiliated. The best known project in Chile is located in Villaseca, also north of Santiago. In this community, virtually all residents cook with solar power. The area is ideally suited, being blessed with 310 days of sunshine in a year and plagued by dramatic fuel scarcity. Perhaps the best known part of the work in Villaseca (and certainly the best publicized) is the open-air solar restaurant using ten large reflecting ovens and providing employment for members of 26 families. It serves meals to around 60 people a day and must turn down 40 others until it can increase its capacity. It is a frequent stop for tourist groups from many nations. The owners also use homegrown organic vegetables and fruits and are reputed to serve the best food in Chile.

Many stories are associated with the Villaseca experiment, including one about the local safety inspector who insisted they needed a chimney for smoke to pass through. But for the most part, the work garners praise and its proprietors are kept busy responding to questions from other villages that would like to emulate the project. Serrano estimates that there are around 300,000 potential users of solar ovens in Chile. Villaseca women have also been lending a helping hand to women in neighboring Paraguay who are interested in learning more about solar cooking.

The experiments in Chile appear to have substantial support from government and other organizational sources. In addition, as long ago as 1992, the German group, Solar Institut Julisch, had demonstrated the use of parabolic cookers with retained heat capacity, an experiment later repeated in India, Egypt and elsewhere. Chileans have thus been exposed to a range of types of cookers, in the search for designs powerful enough for their climate.

Colombia

As early as 1994, solar cooking activity was reported in Bucaramunga, Colombia, by the German organization, EG Solar. Parabolics costing around $90 were sold there, after shipment unassembled and local assembling. However, no other sustained activity has been noted in this country. Torn as it has been by civil unrest and violence for many years, that is not unexpected.

Ecuador

In Ecuador, solar cooking has had support from the government, largely through the involvement of representatives of a semi-official unit known as IECAIM, or the Ecuadorian Research Institute for Women's Training. The group was organized to serve as a focal point for the country in connection with the work of the United Nations agency called the International Research and Training Institute for the Promotion of Women (INSTRAW), a specialized agency focused on the issues of women. One of its areas of interest was the use of new and renewable forms of energy, which encompassed solar cooking and solar drying of foods. IECAIM took up that challenge and has been the most active promoter of solar cooking in Ecuador, under the leadership of its Director, Fabiola Cuvi Ortiz. IECAIM has been active since 1986 in providing training courses for women on building and using solar cookers. Workrooms were established for meetings and training courses. Initially, 300 solar cookers were built, mostly women themselves, who were also trained in the new mode of cooking. Both newspapers and television media were used to publicize the efforts and results of this work.

After the pilot efforts proved to be very successful, promotional activity was carried out in many places where women and girls congregate, schools, factories, and women's groups. In a situation of unrest (a border dispute with Peru), cookers were provided for the displaced families. In the course of this work, four small production industries have been started, building cookers to sell to others, with work done by women. In total, nearly 1,000 cookers have been disseminated in Ecuador. The Institute has also published two books, one on solar oven construction, and the other on cooking.

Falkland Islands

These small islands offshore to the east of Argentina are claimed by the British Empire. Located far to the south, they are out of the ranges considered as promising for the use of solar cooking. The small population of around 3,000 has to our knowledge had no experience with the technology.

French Guinea

This small department of France lies on the northwestern shoulder of the South American continent. No record of solar cooking activity has been found.

Guyana

Often confused with French Guiana, Guyana is an independent country, also lying on South Africa's northwest shoulder. No solar cooking activity in this country has been noted to date; SCI has heard from two people who indicate interest and limited efforts.

Paraguay

The best known name in solar cooking in Paraguay is that of Dr. Martin Almada, President of the Celestina Perez de Almada Foundation, an organization that has been active in the promotion of solar cooking for more than a decade. Dr. Almada is a collaborating member of the Virtual Laboratory of Domestic Solar Applications, a networking and information dissemination network headquartered in France (see Multi-nation Promoter section). Dr. Almada is also known as a specialist in medical uses of herbs of the region, on which he has published a number of articles and books.

The Foundation has been instrumental in creation of the Centro de Energia Solar (CEDOSAL). Its major project is the creation of "First Solar Village—Zero Pollution", a project that began in the small community of Chamococo in the Karcha Baluth region of Alto Paraguay. A bargain was made with the villagers, in which they agreed to refrain from cutting trees for fuelwood in exchange for the provision of a range of sustainable energy sources. Solar power is now used to light a school and a number of homes. Solar refrigeration is used to preserve fish. Several types of solar cookers have been introduced, as has a solar dryer to be used in the preservation of fruits, herbs, and medicinal plants. The ULOG organization has contributed its skills and knowledge to the planning and implementation of the Solar Village.

In addition to the Village project, the Foundation has been active in establishing micro-credit opportunities, in training and support for women's income earning activities and small businesses. Solar dryers in particular have proven useful in preventing malnutrition in children who are now able to eat dried fruit off-season, fruit that

previously rotted on the ground in time of abundance because no means to preserve it was available.

Peru

Two staff members of the Centro de la Familia Anna Dengel in Arequipa, Peru undertook a pilot project early in the 1990s. The project included both a pilot and an implementation stage. In the pilot part, they considered a range of cooker designs, and settled on a box cooker of cardboard. After that decision, an implementation process involved the construction of 30 cookers by persons who were also trained in cooking methods. All 30 persons were able to complete the construction process successfully. Next, 24 people were trained in use of the cooker; 80% or 19 family cooks successfully used the boxes they had made. With that project behind them, the two promoters began to seek additional resources to expand their efforts. To the best of our knowledge, they were not successful in locating funds for a larger effort.

Currently, each is however working separately to promote cookers. Sister Patricia Gootee continues to make and sell a small number of cookers, and Geovana Rivera also teaches solar cooking, and designs and builds new types of cookers.

More recently, a Center of Renewable Energy has been created in Lima. Its work includes design, research, and construction of several models of solar cookers. In addition, Jorge Anrmanda Choque Chacolla, of the Centro Poblado Menor in Tacna, an Andean area, is also working to spread solar cooking in mountainous areas (SCI International Directory, www.solarcooking.org).

Suriname

No information is known about any solar cooking promotion in this nation.

Uruguay

Nothing is known of any solar cooking activity in Uruguay.

Venezuela

Two small-scale efforts on the part of individuals to promote solar cooking are reported as having occurred in Venezuela. Carlos Manuel Mujica of Urban Fundalara demonstrates cookers and teaches others how to use them. Similarly, Flor Isabel Tur of the Centre for DesarrolloY Ambiente (Development and Environment) uses cookers and holds workshops to teach others. (SCI Archives)

Currently, NORVEX, an ecological cooperative, is starting a solar cooking program for poor families in Venezuela. Financial assistance comes from the German embassy in Caracas. Families are taught how to construct and use the cooker, and how to pasteurize water. Seventy cookers had been made at the time of writing the news report, with most new solar users residing in rural areas where water is often contaminated. No information on future plans is available.

Table III Fl. Solar Cooking Programs in South America

No Knowledge of Solar Programs N=6	Colombia, Falkland Islands, French Guiana, Guyana, Suriname, Uruguay
Individuals Only N= 2	Brazil, Venezuela
Small Programs 1-100 users N=2	Argentina, Peru
Medium Programs 100-1,000 users N=3	Chile, Ecuador, Paraguay
Large Programs 1,000-30,000 N=1	Bolivia,

The data show that, while nearly half of the total countries do not have any solar cooking activity, the six countries in that category are mostly small and one (Falklands) is not very suitable for solar cooking. As noted above, while some of the original information on solar cooking came from outside the continent, via university research and dissemination of information, the projects found in this region are "homegrown" as opposed to outside donor driven. The majority of programs appear to have been started by citizens of Latin America and continue to be led by local people. Limited involvement of governments can be noted in a few instances.

IIIC World Summary of Solar Cooking Activity

A summary of the data above for all the six continents is provided in Table IIIF2

Table III F2. Status of Solar Cooking Programs by Continent

Continent	None	Individual	Small	Medium	Large	Mass	Exporters
Africa (49)	29	9	9	6	3	0	0
%*	51.7	16.1	16.1	10.8	5.3	0	0
Asia (56)	31	8	1	2	5	2	0
%	65.3	*163*	2.0	2.0	10.2	4.1	0
Europe (40)	31	*2*	0	0	0	0	7
%	77.5	5.0	- - 0	0	0	0	17.5
North/ Central America (34)	22	4	2	3	1	0	2
%	64.7	11.8	5.9	8.8	2.9	0	6.9
Oceania (20)	19	0	1	0	0	0	0
%	95.0	0	5.0	0	0	0	0
South America (14)	6	2	2	3	1	0	0
%	42.9		14.2	21.4	7.1	0	0
TOTALS (213)	138	25	15	14	10	2	9
%	64.7	11.7	7.0	6.6	4.7	.9	4.2

In this table, all percentages pertain to the figures in the ROWS.

As seen in the table, the continents have fairly different patterns. Oceania, with the exception of Australia has no solar cooking programs. At the other end of the spectrum, over half of the nations of South America have programs, those without being principally the smaller countries. On the African continent, roughly half the nations have some form of solar cooking program, half are without. In Asia, Europe, and North and Central America, the majority of nations do not have any solar cooking promotion activity. The global average shows just over one third of all nations have had some introduction to the technology via individual promoters and projects, large or small.

To place this information into an appropriate context, the reader must of course have information on another topic, namely, what proportion of the nations (and, in fact,

what nations) are suitable for solar cooking? A rough beginning at answering that question is the topic of the next chapter.

CHAPTER IV

SUITABILITY OF NATIONS FOR SOLAR COOKING

In general terms, suitable conditions for solar cooking are found in a large band around the middle of the earth, within the latitudes of 40 degrees north and south of the equator. Those figures are a rough "rule of thumb" to be used in preliminary judgments about appropriateness of planning and implementing solar projects in any region, nation, or portion of either. Higher latitudes in either direction will, of course, have seasonal periods when solar cooking is feasible. Similarly, more powerful (and thus more costly) equipment can stretch the suggested boundaries of suitability. For rough estimates, however, this guideline will be used, accompanied by other factors, discussed below.

The analysis of countries in this chapter is based largely on climatic suitability (implying the amount of insolation), and secondly on other social and economic factors which either facilitate towards or militate against successful promotion of solar cooking. The categorization therefore takes into account the economic and political circumstances of nations as well as climate, to the degree that they are related to need for solar cooking technology. That is, some countries are eminently suitably from a climatic perspective, but the energy infrastructure has moved beyond the use of wood as fuel; most if not all households have modern energy supplies such as electricity, natural gas, or bottled gas alternatives. Or a nation might be hampered currently by the existence of widespread civil strife or actual warfare, which suggests that beginning a new project would be difficult. The disruptions could be long lasting or alternatively, short lived, suggesting that some of the nations in the "suitable, with limitations" may well shift into the "suitable" column in the short or long term, or vice versa.

The simple scale used in this analysis is the following:

1 - Suitable, based on geographical location - no known counter indication

2 - Suitable, based on geographical location - limiting economic or political circumstances exist

3 - Unsuitable because of established infrastructure or oil wealth suggest limited need

~" 4 - Unsuitable based on high altitude location and associated climatic conditions.

Using the information above, a tentative look at the market potential of combining the nations seen as viable can be seen. Rather than listing the continents' nations alphabetically, as above, market analysis can be more easily made by placing nations into appropriate intra-continental regions. This perspective is offered as a guide to prospective entrepreneurs or organizations interested in solar cooking promotion in potentially viable parts of the world. In the present world of many small nations, market analysis may require, and benefit from, regional planning of this nature. In some nations, marketplace promotion will clearly be possible, in others, the assistance of governmental or private subsidies and/or charitable organizations may be indicated. Perhaps some combination of the above can be achieved with careful planning and hard work.

Following these analyses for each of the six continents, using an internal regional categorization scheme (based on that used in the 2002 National Geographic Atlas) a global summary will be provided, combining geographical and socio-political information with the history of solar cooking in nation and continent. Hopefully the data will serve promoters, entrepreneurs, government policy makers, and funding organizations as a beginning basis for longer range planning of global solar cooking promotion.

CHAPTER IV A

CONTINENTAL SUITABILITY
AFRICA

The continent can be divided into somewhat natural groupings based on history, geography, culture, and so on. A small number of areas is used for Africa, where there is somewhat less diversity in terms of geography since most of Africa is one large land mass. Four major areas are used to divide that landmass, while a fifth consists of the islands off shore from the continent.

Northern Africa (Algeria, Chad, Egypt, Gambia, Libya, Mali, Mauritania, Morocco, Niger, Senegal, Tunisia, Western Sahara)

This grouping of nations and areas covers the northern coast of the continent in a thick crescent swerving from the point where Africa and Asia meet at the Sinai Peninsula to more than halfway down Africa's western bulge. Seven of the countries are large, helping to make this sub-grouping of nations cover perhaps two-thirds of the area of the bulge that tops the continent. The five smaller nations lie along the Atlantic and Mediterranean seacoasts. The latitudes enclosing these nations run from 9 degrees north to about 35 degrees. Much of the area is very dry - Sahelian - and warm for most of the year. More precipitation falls in the coastal areas and in the southern parts of this sub-area of Africa. For the most part, the nations in this region are not densely populated, other than along the seacoasts. Few very large cities, except Cairo, are found here. The bulk of all populations are rural agriculturalists, and some nomads.

In general, it can be said that this entire grouping of nations is well suited for solar cooking, in major parts of the individual nations and areas. All climates are temperate to hot, insolation is high in the entire region.

Of the nations, Chad, Egypt, Mali, Morocco, Niger, and Senegal, or half of the nations, have had solar programming, for the most part, small introductory projects. This part of Africa, largely French speaking along with many local languages, is potentially one of the most promising markets found anywhere. While in many nations, the population has

only a small income; the relatively low cost cookers will be very suitable to the climate. The programs that have been tried (and done well for the most part) have been very successful, based on current knowledge.

In this grouping of nations, serious political constraints, present currently, might make a major market promotion program difficult. Western Sahara is not a nation. A former colony of Spain (then called Spanish Sahara) it has been administered by Morocco since 1979. An internal independence group, the Polisario, has been in conflict with Morocco for much of that period. A UN team brought about a tentative agreement between the parties in the early 1990s, but no final agreement has ever been reached.

Libya, on the other hand, is a large Islamic nation, with substantial petroleum resources. Until recently, (Fall, 2003), the nation had been the subject of economic sanctions on the part of a number of European nations and the United States, around the bombing of a civilian American airplane over Scotland. Finally, an agreement has been reached about guilt and reparations, with most European nations removing the sanctions and resuming normal relationships with Libya. The U.S. has yet to conclude its sanctions, which continue to block investment in and travel to Libya.

All of the nations in this grouping are principally Muslim, though some also host local religions and smaller Christian communities. Given proximity to Western Asia, where the Israel-Palestine problem remains a source on conflict with international ramifications, the area will need sensitive approaches if promotion is to be undertaken by non-Muslim nationals.

Scores: Algeria: 1; Chad: 1; Egypt; 1; Gambia: 1; Libya: 2 (political issues); Mali: 1; Mauritania: 1; Morocco: 1; Niger: 1; Senegal: 1; Tunisia: 1; Western Sahara: 2 (political issues, logistical problems).

Eastern Africa (Burundi, Central African Republic, Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Sudan, Tanzania, Uganda)

This is a broader grouping of nations than that usually considered as East Africa. The territory included covers a large proportion of the central part of the continent, under and to the east of the crescent of nations identified above. This area has mostly large nations, with Burundi, Eritrea, Rwanda, and Uganda the exceptions. The equator passes

through the center of this area, making it truly "equatorial", ranging from 14 degrees South to 22 North of zero latitude. Quite obviously, climatically, much of the terrain here is suitable, although the Democratic Republic of the Congo, Burundi, Rwanda, and Uganda (all countries lying along the Great Lakes of Africa which are in the Rift Valley floor) have heavier rainfall. Somalia, parts of Kenya and Ethiopia, most of the Sudan* on the other hand, are areas of low rainfall. In the entire region temperatures are always moderate, with relatively little change by season of the year.

The populations of countries in this region are more densely distributed on the land than in Northern Africa. The area's people are predominantly rural (excepting Djibouti), with only one or two good-sized cities per nation. The agricultural population is denser than Northern Africa, as well, with very high populations per square kilometer, many up to and some over 500 persons per square kilometer. Small-scale agriculture is very small indeed here.

The Democratic Republic of the Congo is the only country with substantial forest reserves - much of its interior is heavily forested; averaged over its entire land mass, 60% remains forested, with only a moderate loss registered officially (-0.4). Burundi and Rwanda, by contrast, are forested at 3.7% and 12.3%, respectively, and registered substantial rates of decline (-9.0% and -3.9% annually). The remaining countries are midway between those two extremes. Uganda, for example, has 21.0% of its land area forested, and a loss of -2% yearly. Gathered wood, or charcoal made from it, is far and away the major cooking fuel in use in the rural areas of this region, indicating serious need for alternatives as populations rise and forest shrink.

Other countries of the region are dryer and in the northernmost sectors, near Sahelian dryness. Considering all of these factors, it can safely be assumed that much of East Africa is well suited for the promotion of solar cooking. Indeed one of the large projects in Africa is found in northern Kenya, another in Ethiopia, both in refugee camps. Projects, from small to large, are found in 7 of the 12 countries in this region, further indicating a favorable climate, both physical and economic, for solar technologies. As is true everywhere, micro-climatic circumstances may mean that solar cooking is not optimal in all parts of all countries.

Scores: Burundi = 1; Central African Republic =1; Pembcratic Republic of the Congo =2; Djibouti = 3 (largely a city state, Djibouti has a minimal rural population); Eritrea = 1; Ethiopia =1; Kenya = 1; Rwanda =1; Somalia: 2 (lack of governance currently); Sudan = 2 (ongoing civil conflict in much of the southern half of the nation); Tanzania =1; Uganda =1.

West-Central Africa (Benin, Burkina Faso, Cameroon, Congo, Cote d'lvoire, Equatorial Guinea, Gabon, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, Sierra Leone, Togo)

This area is very different from the above regions. It is made up mostly of a number of small states, with only Nigeria among the large nations of Africa. This regional location is on the underside of the African bulge, curving around the Gulf of Guinea where Cameroon, Gabon and Congo meet the states of Eastern Africa. The bottom tip of Congo, the southernmost tip of the region is at 5 degrees south of the equator; the top, northern Burkina Faso, is 15 degrees north. All are therefore located in an area well suited, climatically speaking, for solar cooking. However, as with many coastal regions - all these nations with the exception of Burkina Faso (which is a bit more like the Sahelian region) have a relatively high rainfall and substantial humidity at least for portions of the year.

Colonial histories of this area are different from the first regions discussed as well. A larger number of the nations here, though not all, were colonized by the French, hence, the colonial experiences were dissimilar in many ways. Religious diversity is more marked here, with Islam present in many nations but not often the majority belief. Indigenous beliefs and Christianity (particularly Roman Catholicism) are common in all the nations.

In recent years, civil wars have disrupted a number of the nations in this region, Liberia, parts of Nigeria, Sierra Leone, as examples. Particularly brutal behavior on the part of rebel armies has brought outcries of horror but not always systematic assistance in solving the problems. While all the nations are independent entities, the remnants of colonialism are not entirely erased, as is true in many parts of the world. And, all too often, events in Africa are not publicized as widely as those in Europe or Asia, for reasons perhaps of distance, or racism, as asserted by some.

Despite its recent problems the area could be a potential place for solar cooking promotion. The cheapest cooking device, the cardboard CooKit, might not hold up well

enough in the humidity and rains of this area. Altered or different technologies could be required, but if accomplished, the small nations of West Central Africa would make a viable market for demonstration and commercial sale of solar cookers, since the combined population is considerable, given its high density.

Scores: Benin: 1; Burkina Faso: 1; Cameroon: 1; Congo: 1; Cote d'lvoire: 1; Equatorial Guinea: 1; Gabon: 1; Ghana: 1; Guinea: 1; Guinea-Bissau: 1; Liberia: 2 (civil strife); Nigeria: 1; Sierra Leone 2; Togo: 1.

Southern Africa (Angola, Botswana, Lesotha, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe)

The often-called Southern cone of Africa consists of 11 nations, including the big island of Madagascar, lying offshore from Mozambique. All countries on the mainland are average to large in size, with the exception of Lesotho and Swaziland both of which are tiny, and enclosed by South Africa. The area all lies within latitudes from 35 to 5 degrees south of the equator, hence in good to excellent solar cooking range. Temperatures are moderate throughout the year, for the most part, with seasonal average temperature variation between January (the warmer season) and July (the colder) of only 20-25 degrees. Solar cooking could be done in most of the region for most of the year. Much of Namibia and half of South Africa are very dry, while other areas have moderate to heavy rainfall in the coastal and some inland area, and on the islands.

Historical circumstances have created more extensive infrastructure and industrial development in South Africa than in other parts of the region, or for that matter, the continent. That nation enjoys a higher average GDP per capita, but continues to have great disparities in income between different populations within the country as it moves forward in a post apartheid era. Other nations of the region are also struggling hard to catch up. A few are progressing nicely: Botswana and Namibia have recorded GDPs of $6,600 and $4,300, for example, with export income from mining of diamonds and various metals. Others remain with GDPs under $ 1,000 per capita per annum.

Considerable variation is seen in the forest situations in the countries of Southern Africa. A number of the countries have close to no forests, Lesotho, Namibia, and South

Africa each have under 10% of forested land. Others have substantial proportions of forests: in Angola, Zambia, and Zimbabwe, roughly half of the land is forested. The others nations are in between, none in situations of extreme deforestation. Without exception however, all are losing forest cover at a substantial rate annually, as populations rise and more land is needed, and as rising populations will always need to cook their food, predominantly using wood or charcoal.

In 2003, all the nations excepting Zimbabwe are relatively stable economically and politically, if poor. The populations of most countries practice Christianity or a form of indigenous religion; Islam is rare in the region, found everywhere, but in smaller proportions than in, for example, Eastern or Northern African nations. All but Botswana and South Africa are more than half rural, some up to 80%. rural. Only South Africa has large cities.

With the end of apartheid in the 1990s and cessation of hostilities in Angola and Mozambique, most of this part of the region is stable. Only Zimbabwe, a country expected to make good progress at the time of its independence because of its advanced infrastructure, has been beset by political unrest for a number of years, with no end in sight.

Seven of the eleven countries have had some type of solar cooking activity, plus one with a plan developed by the government with, however, no solid information on implementation. Only three countries therefore have had no exposure to solar cooking concepts. That is not surprising, given the good potential for use of the technology offered by the climatic situation in the region. An area with excellent potential accompanied by substantial knowledge and experience with the technology, even in small projects, has exceptionally promising market and project potential.

Scores: Angola: 1; Botswana: 1; Lesotho: 1; Madagascar: 1; Malawi: 1; Mozambique: 1; Namibia: 1; South Africa: 1; Swaziland: 1; Zambia: 1; Zimbabwe: 2 (civil strife).

Islands of Africa (Comoros, Mauritius, Reunion, Seychelles, St. Helena)

Three of the islands are in the Atlantic Ocean. The island of St. Helena is far to the west of Namibia; Cape Verde is not as far from the continent, offshore to the west of

Senegal, and Sao Tome and Principe lies near the coast of Gabon. The remaining four other islands or clusters of islands are in the Indian Ocean, east of the continent: the Comoros between Madagascar and the mainland, the Seychelles to the north of Madagascar, and the others, Reunion and Mauritius beyond. All the African insular states are located are located within a band from 20 degrees north to 20 degrees south of the equator, hence climatically suited but most likely, as withother islands, quite damp.

People on the islands make their livings from agriculture, fishing, tourism and related activities, such marketing of local crafts. A mix of religions is found on all islands, which have differing colonial histories and patterns of migration to and from the island.

All are very small, and most have little industrial development. None is large enough to be alone a site for most types of commercial venture, given their small populations. 7,000 persons live on St. Helena, for example, the smallest of all. Others have populations ranging from 85,000 on the Seychelles to the big crowd of 1,213,000 on Mauritius. Taken as a total, the populations would be under 3 million people.

However, the climate is equable, the sun shines a lot, and all would appear to favorable for solar cooking, with the caveat about dampness and humidity associated with sea island living. Clearly major logistical and transport problems would be involved in solar cooking promotion in this area, as well as a likely need for testing of equipment in terrain where little solar cooking has been done, a problem similar to that suggested for the islands of Asia (see later section in this chapter).

Scores: Cape Verde: 1; Comoros: 1; Mauritius: 1; Reunion: 1; Sao Tome and Principe: 1; Seychelles: 1; St. Helena: 1 (all rated 1, but there clearly are logistical difficulties in of serving these island populations).

- It should be noted that there are yet additional islands in waters surrounding the Africa continent, i.e. the Azores, Madeira, the Canary Islands and Mayotte. They are however dependencies of Portugal, Spain, or France and as such not included as "nations or areas. Organizations and entrepreneurs intending to promote products that make life better for human beings and their communities need not, of course, be concerned about legal status, but rather about the persons who live there.

The table below shows the distribution of African countries, by region, on this variable of "suitability".

Table IV A. Suitability of Asian Nations for Solar Cooking

Regions	Suitable	Suitable/Limitations	Unsuitable/Economic	Unsuitable
Northern Africa N=12	Algeria, Chad, Egypt, Gambia, Mali, Mauritania, Morocco, Niger, Senegal, Tunisia N=10	Libya, Western Sahara N=2	0	0
East Africa N=12	Burundi, Central African Republic,, Eritrea, Ethiopia, Kenya, Rwanda, Tanzania, Uganda N=8	Democratic Republic of Congo, Somalia, Sudan N-3	Djibouti (urban) N=l	0
West Central Africa N=14	Benin, Burkina Faso, Cameroon, Congo, Cote d'lvoire, Equatorial Guinea, Gabon, Ghana, Guinea, Guinea-Bissau, Nigeria, Sierra Leone, Togo N=12	Liberia, Sierra Leone N=2		
South Africa N=ll	Angola, Botswana, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia N=10	Zimbabwe N=l	0	0
Insular Africa N=7	Cape Verde, Comoros, Mauritius, Reunion, Sao Tome and Principe, St. Helena, Seychelles N=7	0	0	0
TOTAL=56	N=47	**N = 8**	**N= 1**	N=0

For Africa, only one nation can be excluded, and even that is questionable, Djibouti, deemed not totally appropriate, as it is largely an urban city-state, with only a minimal rural hinterland. However, at least some small efforts are made in the nation indicating that solar cooking must be feasible. All the states are located in geographical terrain that is suitable for solar cooking. A few are noted as perhaps not appropriate at the moment, because of civil or political strife which would make any active market research or product promotion difficult, probably dangerous, and unlikely to be very successful. Those factors will change over time, of course.

However the overwhelming number of African countries are suitable on both geographic and social indices, 10 nations in North Africa, 8 in East Africa, 14 in West Central Africa (many of which are fairly small), 10 in Southern Africa, and all 7 insular African areas.

CHAPTER IV B

SUITABILITY FOR SOLAR COOKING
ASIA

Asia is, as described above, a huge continent with great diversity of national size, geographical characteristics, and cultures. The attempt made here groups the nations with relatively common geography, and to a limited extent culture, to facilitate estimates of suitability of the continent and its component sections as potential markets for solar cooking devices. At the conclusion of the brief narrative provided, a score will be assigned to the nations as a rough guide to market and promotional planning.

Asia can be divided into a number of sub-areas, drawn from the National Geographic Atlas used in this study. While full climatic assessment for each nation is beyond the scope of this report, guidelines described above are used in these analyses in the attempt to provide guidance for further research. (Obviously, in the following section, nations are not listed in alphabetical order, other than internally to the region.) For the reader's convenience, the "score" of each nation is provided at the end of each descriptive section, and summarized in a table at the end of the chapter..

Asia Minor and Transcaucasia (Armenia, Azerbaijan, Cyprus, Georgia and Turkey)

In terms of geographical suitability for solar cooking, Cyprus and Turkey (principally the latter's southern, Mediterranean coastal areas) are considered as excellent for solar cooking, while Armenia, Georgia, and Azerbaijan are not. Portion of the latter nations lie above 39 degrees north of the equator and have cool winters with an average temperature barely above the freezing point. Solar cooking is clearly possible in those latter nations for parts of the year, but more efficiently principally with relatively expensive technology. Moreover, each of the nations has

a relatively small Gross Domestic Product, making them appear unlikely as prime markets.

Both southern Turkey (at least a major portion of the country) and Cyprus on the other hand are excellent candidates, geographically and in terms of somewhat higher Gross Domestic Products. Turkey has one large and growing solar cooking program, sponsored by Rotary International. Cyprus has no solar cooking programs. Unfortunately, Cyprus has long standing political strife, with the nation divided into two sections, one Greek, one Turkish, and in continuous civil conflict for decades. Serving almost as a metaphor for other issues between Turkey and Greece, the situation in Cyprus requires solution before any program development there would appear feasible.

Were resolution of the political problem to occur, as one day it surely must, Cyprus alone would be a relatively small market, with a population of less than a million people. Once the political issues are resolved, the Turkish program could quite readily expand to include Cyprus, which lies only about 60 miles off of the southern Turkish coast, from the city of Silifke, and not far from the major port city of Mersin. Or, alternatively, Cyprus could be thought of as a sub-market associated with Greece (see the European chapter). The political circumstances of the region make neither very rather likely at the moment since no imminent resolution is on the horizon.

Scores: Armenia = 4; Azerbaijan =4; Cyprus = 2; Georgia =4; Turkey =1.

Eastern Mediterranean (Israel, Gaza Strip, Jordan, Lebanon, Syria, West Bank)

These nations lie from about 28 degrees to 38 degrees north of the equator, mostly within desirable solar cooking parameters. The climates are tropical with averages in January in the high 40s to mid-50s, and moderate rainfall.

Only Israel of the nations in this sub-region has evinced any interest in solar cooking, and that quite minor. The area is highly appropriate climatically, but, as all are aware, political instability has dogged the area and occupied the minds of many in Ihe region. Given the dense populations and the high insolation, this area of the

world would seem particularly ripe for promotion of solar cooking, if and when political circumstances allow.

Scores: Israel =2; Gaza Strip =2; Jordan =1; Lebanon =1; Syria =2; West Bank =2.

Southwest Asia (Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen)

This part of the continent, (called in Western nations, erroneously) the "Middle East", is characterized by extraction and refining of petroleum, making it a poor candidate for alternative energy sources at the present time. That situation may well be drastically changed in the next two-to-three decades, or sooner, as global production of oil peaks and, at some point, declines. Then the result may well be that this part of the world will need to scrape the bottom of its oil barrels to survive and quickly develop other economic modes. The price of oil will go to new heights as production slows. Without rational responses from world leaders, not only Southwest Asia but also the world as a whole will be in crisis, given the heavy reliance on petroleum of most nations. But in Southwest Asia, which has for generations relied principally on revenues from oil for its very survival, intensive advance planning is indicated. Given its rich resources of sunshine, use of solar energy would surely appear to be an appropriate technology for development while oil revenues still flow. Will there be a role for solar cooking? It is hard to imagine that sensible people would not consider this and other renewable options. But at the moment, little if any thought on the topic appears to have occurred.

The Arabian Peninsula and its Asia neighbors of Iraq and Iran would be a splendid market, in terms of climate and insolation, as need becomes an issue, provided that the current conflicts in the region are resolved.

Scores: Bahrain =3; Iran =2; Iraq =2; Kuwait =3; Oman =3; Qatar =3; Saudi Arabia =3; United Arab Emirates =3; Yemen = 3.

Central Asia (Kazakhstan, Turkmenistan, Uzbekistan)

The bulk of these three Central Asian republics, all created out of the breakup of the former Soviet Union, lies between 35 and 55 degrees north of the equator, and thus outside the realm of maximum solar cooking climate. They are however dry and sunny for the most part, having light precipitation and warm summers with cool winters (average temperatures around freezing in January). One of the nations, Kazakhstan, has oil resources; the other two nations rely on agriculture and livestock, including the raising of cotton. While not maximal for cooking, with good equipment such as sturdy box cookers or parabolics, solar cooking would be feasible in this region of little rainfall. However, no effort has been made to promote the technology of solar cooking or other solar uses in the sub-region. This would appear to be a potentially promising area for future research, demonstration, and manufacturing of solar cooking devices, perhaps particularly for promoters of parabolic cookers.

Scores: Kazakstan =4; Turkmenistan =4; Uzbekistan =4.

Central South Asia (Afghanistan, Kyrgyzstan, Pakistan, Tajikistan)

These nations of Central South Asia lie between 24 and 44 degrees north of the Equator, meaning that the northernmost countries, Kyrgyzstan and Tajikistan, are close to outside the range of feasibility for optimal solar cooking. Like the Central Asian countries just discussed, however, these nations are for the most part arid, with high temperatures in the summer and just above freezing in winter, on average. Afghanistan and Pakistan are larger nations, extending further to the south, and both have proven to be very suitable for solar cooking. Both of the latter countries have had substantial programs, and Afghanistan has growing programs currently. (See country reports, above)

Market planning could combine the three Central Asian countries with those of this region, all of which could benefit from promotion of high efficiency cooking devices powered by the sun. The situations in the two areas (Central and Central South Asia) are climatically similar, though there are major cultural and political differences. Five of the nations, all of Central Asia, plus Kyrgyzstan and Tajikistan, are former Soviet Republics; hence with somewhat common political backgrounds.

Afghanistan and Pakistan, on the other hand, have traditions of independent nationhood, albeit fraught with conflict over much of their histories. All are Islamic nations. Deforestation is a common problem in all of these nations. The region could be addressed as an entity from a marketing standpoint, particularly as economic development takes place in each of the nations (understanding that Kyrgyzstan and Tajikistan might require more complex strategies and equipment than the others, because of their higher latitudes).

Scores: Afghanistan =2; Kyrgyzstan =4; Pakistan =1; Tajikistan =4.

South Asia (Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka)

All of these nations are within the climatic range for good solar cooking, with only the northernmost parts of India beyond 30 degrees north of the equator and all others between there and the equator. (The climates are characterized by heavy rain but with predictable seasonality.) Hence, all of these nations are suitable, and half (India, Nepal, and Sri Lanka) have substantial solar cooking histories. Given the very substantial number of manufacturers of solar cooking devices in a wide range of types and prices, both in India and China, this area is promising for substantial growth in use of the technology.

Almost certainly, there would be barriers of inter-country tariffs and transportation problems. Governmental assistance in mitigating such barriers would be required. The area represents however a truly mass market, in a place where need is great. The countries have dense populations and considerable infrastructure in place. All the nations are heavily rural; considerable use is made of animal dung as fuel in this part of the world, an unfortunate use of this natural fertilizer of the soil. Forest cover is relatively small in all countries except Bhutan, and is decreasing further in all but India where the forested amount is roughly stable (this figure is not available for Bhutan or the Maldives). With the regional variations found everywhere a given, it can however be clearly said that these countries represent prime prospects for solar cooking promotion.

Scores: Bangladesh =1; Bhutan =1; India =1; Maldives =1; Nepal =1; Sri Lanka =1.

China and Mongolia (China, Mongolia)

The bulk of vast China lies in a climatic range which is suitable for solar cooking. The two arms which enclose Mongolia to its north are the only sectors of China that, like Mongolia itself, lie generally outside the range, above 40 degrees north of the equator. The southern half of China is close to optimal. As explained above, China has the largest programs in the entire world, but Mongolia, understandably, has none.

Scores: China = 1; Mongolia =4.

The Korean Peninsula (Democratic People's Republic of Korea, Republic of Korea)

The Korean peninsula occupies an area between roughly 34 and 42 degrees north of the equator, hence is outside of the range for maximal solar insolation on a year round basis. Both also have heavy precipitation, warm summer temperatures but winter averaging below the freezing point. Neither would be prime locations for solar cooking, although some attempts have been made, using parabolic technology, in North Korea. No information on programs in South Korea was noted.

Scores: Democratic People's Republic of Korea =4; Republic of Korea =4.

Japan

This nation of islands lying to the east of the Korean peninsula stretches North-South from approximately a latitude of 26 degrees at the southern tip of Okinawa to the northern island of Hokkaido whose northernmost point is 45 degrees north. The climate for the mid section of Japan is similar to that of the Koreas. Most of the main island of Honshu would support solar cooking, the northern part not optimally. Hokkaido would be not very compatible with the purpose. The southern island of Kyushu and the long chain of small islands off to the south and west of Honshu would however be appropriate, lying as they do between 26 and 35 degrees north latitude. Most of Japan has warm summers, and moderate winters, with the exception of Hokkaido

Japan is however a highly developed nation; as well as heavily urban and industrialized. There would be little perceived need, at this time in history, for solar cooking, other than as indication of a commitment to sound environmental living. Japan has some, but limited experience with solar cooking, and minor export of cooking devices. The most promising potential of this nation might be encouragement for the promotion of solar cooking in its substantial development assistance to poor nations in other parts of the world. Bringing its technical capacity and financial assistance to research and financing of solar promotion would be useful to many countries.

Score: Japan =3.

Southeast Asia (Cambodia, Laos, Myanmar, Thailand, Vietnam)

All of the nations of peninsular Southeast Asia lie in a potentially excellent location for solar cooking. All are located between the equator and about 27 degrees north latitude. The five nations are relatively well supplied with forests, with three having around half of their territory forested, the other two around one-third. However, three of the four on which information is available, are also witnessing heavy forest loss annually. All the nations are heavily rural, meaning limited access to fuel sources other than wood or animal dung. One down side in this area, from the point of view of solar cooking, is a substantial rate of precipitation in these entire nations, good for the trees and agriculture but perhaps limiting solar cooking days. Incomes, as related to Gross Domestic Product data, are relatively low with the exception of Thailand, the most prosperous of the group, perhaps thus a good entry point.

In general, it can be stated that this area of Asia is promising as a place for promotion of solar cooking, with the cautions noted. Myanmar is relatively difficult to access, commercially or politically, and thus would require specific knowledge-

Scores: Cambodia —1; Laos =1; Myanmar =2; Thailand =1; Vietnam =1.

Insular Southeast Asia (Brunei, East Timor, Indonesia, Malaysia, Philippines, Singapore)

This last region of Asia to be considered is more diverse than some of the others. Its common geographical situation is composed of many small and large islands, lying south and east of the Asian continent. The latitudes between which the area lies is between 11 degrees south of the equator and roughly 18 degrees north, hence all with substantial insolation. The equator runs roughly through the middle of the region.

Its economic and political makeup is yet more diverse than its geography, ranging from nations with high average incomes (Brunei and Singapore) to very low (East Timor). Some are highly urbanized (Singapore, essentially a city state, and Brunei), the others largely rural. Many have long and distinguished histories as nations, while East Timor (Timor-Leste) is a new nation, celebrating its independence in 2002, after periods colonization by Portuguese and Indonesian powers.

All the nations are suitable from a climatic perspective. However, Brunei Darussalam and Singapore are not very likely places for major promotion since both are largely urban and, in addition, have well developed infrastructures, including electricity. People in those nations would see little need to shift to solar technology for cooking, although solar water heating is common there currently.

In the other nations, however, those with low to modest average incomes ($300 in East Timor to $10,300 in Malaysia, with Indonesia and the Philippines between those extremes), the promotion of solar cooking would appear to have good potential for success. Relatively high rainfall would no doubt mean that cooking with the sun has limitations, even though temperatures vary little around the calendar - all of them hot. (As seen in Oceania, little solar cooking promotion has taken place in the island nations of Asia and the Pacific. Particular attention to the needs of users in high temperature and fairly damp climates may be required for market efforts to be maximally successful.)

Scores: Brunei =3; East Timor =1; Indonesia =1; Malaysia =1; Philippines =1; Singapore =3.

A summary of the suitability of Asian nations is seen below in Table IV B.

Table IV B. Suitability of Asian Nations for Solar Cooking

Regions	Suitable	Suitable/Limitations	Unsuitable/Economic	Unsuitable
Asia Minor and Transcaucasia N=5	Turkey N=1	Cyprus N=1	N=0	Armenia, Azerbaijan, Georgia NT3
Eastern Mediterranean N=6	Jordan, Lebanon N=2	Gaza Strip, Israel, Syria, West Bank N=4	N=0	N = 0
Southwest Asia N=9	N=0	Iraq, Iran N=2	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen N=7.	
Central Asia N=3	N=0	N=0	N=0	"Kazakhstan, Turkmenistan, Uzbekistan N=3
Central South Asia N = 4	Pakistan N=1	Afghanistan N=1	N=0	Kyrgyzstan, Tajikistan N=2
South Asia N=6	Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka N=6	N=0	N=0	N=0
China and Mongolia N=2	China N=1	N=0	N=0	Mongolia N=1
Korean Peninsula N=2	N=0	N=0	N=0	Democratic People's Republic of Korea, Republic of Korea N=2
Japan N=1	N=0	N=0	Japan N=1	N=0
Southeast Asia N=5	Cambodia, Laos, Thailand, Vietnam N=4	Myanmar N=1	N=0	N=0
N=6	Timor-Leste, Indonesia, Malaysia, Philippines N=4	N=0	Brunei, Singapore N=2	
TOTAL = 49	N= 19 (38.8%)	N= 9 (18.4 %)	N= 10 (20.4%)	N= 11(22.4%)

Of all Asian nations, a smaller proportion is suitable for solar cooking than found on the African continent (see section above). Just under two-fifths (38.8%) of all nations

fall into the suitable category, with another 14.3 % being suitable from a climatic/geographical perspective, but currently experiencing civil or other forms of strife. This suggests that systematic assessment of market potential or promotional plans based on the outcome might be delayed until the conflict situations have been settled. Entrepreneurs or organizations indigenous to the countries noted as "with limitations" might well be able to operate successfully, but it would clearly be difficult for outsiders to undertake new activities in the current situation in the countries listed as "with limitations."

The area is extremely diverse, with a large number of nations considered to be unsuitable, not from climatic or geographical reasons, but because of their resources of petroleum deposits and related average incomes. That situations will, of course, change markedly in the future, on an as yet only estimated timetables.

While the proportion of nations is smaller than Africa, the population of the large suitable countries in this region is very substantial, making Asia potentially an important market for solar technologies of many types. They offer a major opportunity to curtail emissions from the burning of wood or dung, thus aiding both householders and the world's atmosphere.

As described in the previous chapter, 31, or 63.2%, of the nations of Asia have had little or no exposure to solar cooking, while 18 or 36.8%, roughly two-thirds and one-third, have had some programs. Those with some experience of the technology include eight nations having only a small amount of activity on the part of interested individuals. One nation had one small, another one medium sized, and five had large projects. This continent however has the only mass scale projects found anywhere. Found in China and in India, these are defined as national in scale, and involved over 30,000 households using solar cooking. In actuality, each of the two nations have programs involving several hundred thousands households. The two projects that are in place on this continent are the world's largest, both accomplished by strong advocacy and financial assistance on the part of the governments of China and India. In the remainder of the region, two thirds of the nations have no solar cooking projects.

CHAPTER IV D

SUITABILITY FOR SOLAR COOKING NORTH AND CENTRAL AMERICA

This slightly unusual grouping of nations presents two quite different pictures. While linked geographically by the narrowing connection between North and South America, the two countries in the Northern part, far the largest and far the wealthiest, are quite different from the smaller isthmus and island nations of Central America.

Of the total nations in this part of the world, about two thirds have had little or no exposure to the idea of solar cooking, that is, no one seems to have attempted any sort of promotion. The one third are a mix of small and larger projects, described above.

Much of the latter territory, south of the U.S. and Canada, is suitable for solar cooking, and as might be expected, is where much of the activity has occurred.

North America (Canada, St. Pierre and Miquelon, United States of America)

The hypothetical "cut-off' line for good solar cooking is thought to occur at around the 40th degree of north latitude, both north and south of the equator. That line (north) crosses the US roughly at its mid-point on the west coast and slightly half on the east. The line's location makes it clear that Canada's climate is not a hospitable one for the technology. While it would be possible in the long days of summer to cook, no one would claim it to be optimal. The strong interest of Canadians in solar cooking has been directed towards seeing that households in more favorable climes have equipment and training to utilize the technology.

St. Pierre and Miquelon, a small set of two islands, is associated with France. It lies between Nova Scotia and Newfoundland, and is entirely above 60 degrees north latitude, and hence not suitable for solar cooking.

The situation in the United States is somewhat different from Canada and St. Pierre and Miquelon. The southern half part of this large nation could be considered as favorable for solar cooking, based on climate. Most solar cooking activity occurs in the American Southwest, the states of Arizona, Nevada, New Mexico, along with the coastal

state of California. All of those areas have rainy seasons, when solar cooking is not as usable, but for well over half the year the technology works very well in this portion of the nation. Relatively little promotion has occurred in the southeastern states, though they are also within the climatic range for solar cooking. It must however be noted that alternative sources of cooking are readily available, hence need cannot be asserted.

Other parts of the country also host solar cooking enthusiasts. As far north as Minnesota (home of the writer), cooking works well for 4-5 months of the year, although interrupted by periodic rainy days or periods. With advanced equipment - good reflectors, well-insulated boxes, or parabolics - it is entirely possible to cook, even in cold weather when there are many days of considerable sun. However, to be realistic, solar cooking is not ideally suited to climates in roughly the northern half of the country.

Scores: Canada =4; St. Pierre and Miquelon =4; United States =1*. * Indicates that selected portions of the nation are suitable for solar cooking.

Mexico and Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico)

These nations are located to the south of the U.S., along the long, sometimes thin, stretch of land connecting the continents, ranging from about 9 degrees north of the equator to around 31 degrees north at the northernmost part of Mexico, where it meets California. Thus, all of the area is well suited for solar cooking. Temperatures throughout are well above freezing year around, with the January average temperature in the 60s or above, the June average in the high 60s to 70s, with one or two places even warmer on average.

It can safely be said therefore that solar cooking would work well in this climate. The issue of humidity and rainfall must of course also be considered. Most of the largest state, Mexico, has fairly minimal average rainfalls, less than 24 inches per annum, except for the Eastern Caribbean coast and the Yucatan Peninsula where more rain falls. The Central American countries uniformly have higher average rainfall, many averaging between 50 and 80 inches per year. This suggests careful attention to the type of devices promoted in the area. They would require durability against high moisture. Some

limitations on use also accompany this fact, but on "balance, the Central American communities are well suited to solar cooking.

Scores: Belize =1; Costa Rica =1; El Salvador =1; Guatemala =1; Honduras =1; Mexico =1.

Bahamas and Greater AntiDes (Bahamas, Bermuda, Cayman Islands, Cuba, Dominican Republic, Haiti, Jamaica, Turks and Caicos islands)

The area known as the Greater Antilles forms an arc to the south and west of mainland USA. The western end of Cuba is located between Mexico's Yucatan Peninsula and the Florida Peninsula and Keys. They are between approximately 17 and 27 degrees north latitude, thus all are inside the zones considered as suitable for solar cooking. (Bermuda is not, strictly speaking, a part of the "West Indies" being located considerably further north, at around latitude of 32 degrees. It is however usually included in this area, as it is not close to anything else either.) All the islands have rather high rainfall rates, as do most islands. Relatively little attempt has been made to promote solar cooking in the smaller four of these nations and areas, as far as is known. Of the others, Cuba, the Dominican Republic, and Jamaica have all had small programs at one time or another, while Haiti has had long lasting promotional activity for several decades. Some of the islands are very small; almost surely market promotion should be done in regional, rather than national, terms, since all nation populations are also small. Some have fairly low GDPs per annum. Many of the islands are utilizing their natural beauty and excellent climates for the promotion of tourism, quite successfully in some cases, Bahamas, Bermuda and the Caymans. The same nations receive substantial financial resources from off shore banking. Development of this sort means that a number of the islands have built substantial infrastructure, meaning that need may be less.

As far as is known, all of the area would be well suited to solar cooking, with the same proviso as above, that equipment choice should take into account the potential high humidity present in island nations.

Scores: Bahamas =1; Bermuda =1; Cayman Islands =1; Cuba =1; Dominican Republic =1; Haiti =2, Jamaica =1; Turks and Caicos Islands =1.

Lesser Antilles (Antigua and Barbuda, Barbados, British Virgin islands, Dominica, Grenada, Guadeloupe, Martinique, Montserrat, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, U.S. Virgin Islands.)

This large cluster of islands lie to the south of the Greater Antilles, curves towards the South American mainland, with Trinidad and Tobago lying just off the coast of Venezuela, and a few continuing the arc into the Caribbean Sea itself. Enclosing the Caribbean, this area is a tropical paradise of blue waters and sunny skies, nearly year round. Its geographical range extends from around 10 degrees north of the equator on the southern coast of Trinidad to around 20 degrees north where the Virgin Islands are located.

A number of the islands are dependencies or parts of former colonial powers, i.e., Montserrat, the Netherlands Antilles, and the Virgin Islands, British and U.S. Tourism is an important economic resource for all of the islands, followed by agricultural endeavors and food processing. Most GDPs are in range up to $10,000 with Barbados, Martinique, and the two Virgin Islands all exceeding that amount. Stark poverty is not present on these islands with some in early stages of economic development, others more advanced.

The entire area would be suitable for the promotion of solar cooking. But as with the Greater Antilles, the individual nations or areas would be small for market promotion, hence regional thinking is required. The islands themselves have political frameworks and a range of institutions of regional character, for example, the University of the West Indies, with campuses on several islands. Hence thinking regionally is already a part of the Antilles way of thinking and should be utilized in planning for solar cooking promotion.

On none of these islands is any solar cooking activity recorded. The area is ideally suited, with the caveat expressed above about the need for research, development, and testing of equipment for use in a routinely rather moist environment.

A summary of the information above is found in Table IV D.

Table IV D. Suitability of North and Central American Nations for Solar Cooking

Regions	Suitable	Suitable/Conflict	Unsuitable/Economic	Unsuitable/Climate
North America N=3	N=0	N=0	N=0	Canada, St. Pierre and Miquelon, United States of America N=3
Mexico and Central America N=8	Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama N=8	N=0	N=0	N=0
Bahamas and Greater Antilles N=8	Bahamas, Bermuda, Cayman Islands, Cuba, Dominican Republic, Jamaica, Turks and Caicos N=7	Haiti N=1	N=0	N=0
Lesser Antilles N=15	Antigua and Barbuda, Aruba, Barbados, Bermuda, British Virgin Islands, Dominica, Grenada, Guadeloupe, Martinique, Montserrat, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, Trinidad and Tobago, U.S. Virgin Islands N=15	N = 0	N=0	N=0
TOTAL = 34	N=30	N=1	N =0	N=3

Data here indicate that the entire area south of the U.S. border (along with parts of that country) is appropriate for solar cooking. Few attempts outside of the Central American nations have been made to interest citizens of these small nations in the technology. They are however well suited for use of solar energy, and while each is small

and thus presents more difficulty in dissemination* the area has established patterns of exchange within the Caribbean Community. The problems of island nation mentioned below in Oceania must also be considered. In all likelihood, the suggested Research and Development for that region can have utility for this part of the world as well.

Climatically, Central American and the island nations located between North and South America are clearly well suited; most have an unknown degree of need. The presence of strong programs in Central America could be drawn upon to aid in further consideration of promotion of solar cooking in areas not yet served.

CHAPTER IV E

SUITABILITY FOR SOLAR COOKING OCEANIA

This continent" - not a very accurate use of the word - has only a few fair sized islands, Australia (sometimes called a sixth continent), New Zealand, and New Guinea Island (half of which is Irian Jaya, a part of Indonesia, the other half Papua New Guinea, an independent nation). In addition to those larger islands, this area is composed, as described in the previous chapter, of thousands of islands, mostly small, a few large, in the South Pacific Ocean. All together it has 12 independent nations, and more than 20 territories, a number of which are not included in the FAO listing of "nations and areas". Diversity characterizes nearly all groupings of nations, and is true in Oceania. The area contains both sophisticated cities and peoples living in close to Stone Age cultures in the highlands of New Guinea. About 12 million people in total live in Oceania, excluding Australia. More than three-fourths of that population lives in only two places, Papua New Guinea and New Zealand. Over 700 languages are spoken on the islands, many by small numbers of persons.

The islands are usually divided into three groups: Polynesia, Micronesia, and Melanesia. Not a single one of the islands, in any of the regions, outside of those mentioned above, has a population even approaching one million persons. There are no large cities, as the reader might surmise. The economies are dominated by subsistence agriculture, with limited export of products, a bit of tourism (Fiji, Tonga) and some sale of handicrafts. This would appear to be a difficult market in which to promote the use or the sale of anything.

However, the area basks in sunshine. Most lie only slightly below the equator, in totally suitable solar cooking territory. Many of the islands have a reasonable amount of forest cover, but most tropical wood is not the most effective fuel. Some use kerosene, which must of course be imported. Other infrastructure support is inadequate on many of the islands. The problem of rising sea levels, related to global warming and the resulting melting of polar ice caps, is seriously affecting some.

The problems are thus daunting as to how this grouping of nations and areas might be introduced to a technology that should hold promise for many. Since this area is almost completely new to any and all solar cooker promoters, to the best of our knowledge, it is obvious that some very careful in-depth study would be useful in further analyzing the situation. That research should include technical studies to determine type(s) of devices useful in this situation, as well as climatic assessment, cultural problems, logistical issues and solutions, political realities, and so on. The area is simply too little understood by most in the solar cooking community for promotion to be planned without such background study. In no other part of the earth discussed in this document is there quite the same lack of knowledge and basic information as is found on the islands of the Pacific. (As a footnote, while this section was being proofread, a copy of the periodical Energia. which focuses on women and energy issues, arrived. The theme of the entire issue was the energy situation in Oceania, thus an excellent starting point for the background study suggested here.)

The Large Islands (Australia, New Guinea, and New Zealand)

As stated in the preceding chapter, only Australia has had exposure to solar cooking programs in substantial manner. Much of the country is dry, even sere. Areas around the coast, where most of the population lives, is not as dry, but with only moderate rainfall. It would appear for the most part to be ideal for solar cooking. A number of serious promoters live and work here and continue solar promotion, although largely on their own. The country is large, and while many areas have well-developed infrastructure, the interior areas do not, and solar cooking could be very useful in many such situations.

New Zealand, on the other hand, is different in many ways from Australia. Of its two main islands, only the North Island lies within a suitable range for solar cooking. The South Island, and even the southern part of the North Island, lies below 40 degrees south of the equator and hence out of the boundaries suitable for solar cooking. New Zealand also has substantially more rainfall, more forests than Australia, and a similarly well-developed infrastructure. It is not likely to be a major market for this technology, from either a climatic or a need perspective.

Papua New Guinea is also different in other ways. This half of the Island of New Guinea is one of the least known of nations, with huge differences between its few small coastal urban areas and the inland, mountainous parts in which populations have maintained traditional ways of living. One aspect of the nation is rapidly attempting to enter the modern world - this writer's university home has engaged in a long-term development process with the nation, helping to remodel its education system from top to bottom. All accounts of participants in that project concur in saying that Papua New Guinea is "another world", and one that, beyond doubt, will take time to achieve a fully participating role in contemporary world affairs.

The island has very heavy rainfall and is relatively heavily forested (67.6%), neither signs that the introduction of solar cooking would be very useful at this time. The climatic circumstances are satisfactory with those exceptions, but logistical and cultural would make working in this nation very dubious.

Scores: Australia =1; New Zealand =4*; Papua New Guinea =2.

Melanesia (Fiji, New Caledonia, Norfolk Islands, Solomon Islands, Tonga, Vanuatu)

No clear boundaries exist between regions here, as in the other areas, where national borders are clearly marked. In fact, various atlases and geographers do not always draw the same boundaries. However, for simplicity, the most common used grouping of these island, into Melanesia, Micronesia, and Polynesia will be used. Islands usually thought of as Melanesian are listed above. Melanesia is the grouping of islands to the north and west of Papua New Guinea, a shallow arc curving to the south beyond Australia and ending north of New Zealand. Some of the islands are independent nations, other dependencies of various other nations (Australia, France, New Zealand, and the United States). Most have very small populations; several number fewer than 100.000 people. All are within the designated 30 degrees of latitude, in these cases, instance, south of the equator. The major products of the area are fishing, agriculture (mostly tropical fruits and vegetables), some tourism and handicraft for sale to visitors, and in one or two cases, mining of phosphates. A minority of the islands has incomes higher than $5,000 per capita per annum; those principally are islands with either more tourism or a substantial resident expatriate population.

All are suitable for solar cooking, with the caveats above about lack of knowledge of cooking fuels, habits, and alternative fuels. Moist tropical air must be taken into account.

Scores: Fiji =1; New Caledonia =1; Norfolk Islands =1; Solomon Islands =1; Tonga =1; Vanuatu =1. »

Micronesia (Guam, Federated States of Micronesia, Marshall Islands, Nauru, Northern Mariana Islands, Palau)

The islands of Micronesia lie to the north of Melanesia, roughly on the level of the Philippines but further from continental Asia. They are between the equator and approximately 20 degrees north latitude. Their economies are similar to tho§e of Melanesia as are their histories and current status, some being dependencies, others independent nations.

All are suitable for solar cooking, with caveats similar to those above. Islands in all three regions are tropical, with year round warm climates and excellent insolation.

Scores: Guam =1, Federated States of Micronesia =1; Marshall Islands =1; Nauru =1; Northern Mariana Islands =1; Palau =1.

Polynesia (American Samoa, Cook Islands, French Polynesia, Kiribati, Niue, Samoa)

This last region is located further from the Asian continent than the other two, and stretches a considerable distance North-South, including in some categorization schemes the American state of Hawaii. Like Melanesia, this string of islands is shaped in a long arc, but swinging to the south and then east towards Latin America (but still with a good bit of ocean between Pitcairn, (one of the furthest islands from Asia) and the coast of Chile.

A similar description to those above pertains here, as well. Tourism is rather well developed on some of the islands of Polynesia and a leading portion of economies. As above however extractive industries also are found, fishing, agriculture, with an amount of handicraft for the tourist trade.

All of the Polynesian Islands, like the others, are suitable for solar cooking. None have had exposure to the technology in a systematic way, to the best of current recorded knowledge.

Scores: American Samoa =1; Cook Islands =1; French Polynesia =1; Kiribati =1; Niue =1; Samoa =1. »

Serving the area must be a matter of study and careful thought, for while there are many difficulties; nearly 12,000,000 people live in these islands, many of whom would be well served by exposure to this form of renewable energy. Given the health and environmental hazards of other fuels in common use in developing areas, improved technologies leading to cleaner air imperative here as elsewhere.

While very straightforward, and easy to understand, the data are summarized below in Table IV E.

Table IV E. Suitability of Oceania Nations for Solar Cooking

Suitable	Suitable/Unsuitable	Unsuitable	Limitations (Economic)	(Climate)
Australia, New Zealand, Papua New Guinea N=6	Australia, Papua New Guinea N=3	N=0	N=0	New Zealand* N=1
	Fiji, New Caledonia, Norfolk Islands, Solomon Islands, Tonga, Vanuatu N=6	N=0	N=0	N=0
Micronesia N=6	Guam, Marshall islands, Micronesia (Federation of), Nauru, North Mariana's, Palau N=6	N=0	N=0	N=0
Polynesia N=5	Cook Islands, French Polynesia, Kiribati, Niue, Samoa N=5	N=0	N=0	N=0
TOTAL N=20	N= 19	N=0	N=0	N=1

* Denotes that part of the country is suitable.

This part of the world presents an unusual circumstance. All of the nations or areas except for three, the first "region" above, are small, separated by ocean from one another. All have small populations, some tiny. With the exception of the South Island of New Zealand, all are well within acceptable solar cooking range. It must also be noted that many more islands could be included here, since there are numerous others, yet smaller and less well known entities, in addition to those listed. All the island, or island clusters, that are independent nations are included here, but some of the dependencies are not, as the listing would become too voluminous. While each have small numbers of people, together the islands of Oceania, excluding Australia, have a population of roughly 12 million.

To our knowledge, no solar cooking promotion has been located anywhere in Oceania, with the exception of Australia. The challenge is clear. Efforts to understand the situation more fully, to ascertain specific needs and/or barriers are required. Entrepreneurs, trainers, organizers are needed to study the situation, evaluating the potential of solar cooking thoroughly, and, based on those findings, determine if working in this potentially productive, though difficult to serve, part of the world is feasible.

CHAPTER IV E

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However, the area basks in sunshine. Most lie only slightly below the equator, in totally suitable solar cooking territory. Many of the islands have a reasonable amount of forest cover, but most tropical wood is not the most effective fuel. Many use kerosene, which must of course be imported. Infrastructure of all kinds is inadequate on many of the islands. The problem of ijsing sea levels, related to global warming and the resulting melting of polar ice caps, is seriously affecting some.

The problems are thus daunting as to how this grouping of nations and areas might be introduced to a technology that should hold promise for many. Since this area is almost completely new to any and all solar cooker promoters, to the best of our knowledge, it is obvious that some very careful in-depth study would be useful in further analyzing the situation. That research should include technical studies to determine type(s) of devices useful in this situation, as well as climatic assessment, cultural problems, logistical issues and solutions, political realities, and so on. The area is simply too little understood by most in the solar cooking community for promotion to be planned without such background study. In no other part of the earth discussed in this document is there quite the same lack of knowledge and basic information as is found on the islands of the Pacific. (As a footnote, while this section was being proofread, a copy of the periodical Energia, which focuses on women and energy issues, arrived. The theme of the entire issue was the energy situation in Oceania, thus an excellent starting point for the background study suggested here.)

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New Zealand, on the other hand, is different in many ways from Australia. Of its two main islands, only the North Island lies within a suitable range for solar cooking. The South Island, and even the southern part of the North Island, lies below 40 degrees south of the equator and hence out of the boundaries suggested as suitable for solar cooking. New Zealand also has substantially more rainfall, more forests than Australia, and a similarly well-developed infrastructure. It is not likely to be a major market for this technology, from either a climatic or a need perspective.

Papua New Guinea also differs in other ways. This half of the Island of New Guinea is one of the least known of nations, with huge differences between its few small coastal urban areas and the inland, mountainous parts in which populations have maintained traditional ways of living. One aspect of the nation is rapidly attempting to enter the modern world - this writer's university home has engaged in a long-term development process with the nation, helping to remodel its education system from top to bottom. All accounts of participants in that project concur in saying that Papua New Guinea is "another world", and one that, beyond doubt, will take time to achieve a fully participating role in contemporary world affairs.

The island has very heavy rainfall and is relatively heavily forested (67.6%), neither signs that the introduction of solar cooking would be very useful at this time. The climatic circumstances are satisfactory with those exceptions, but logistical and cultural would make working in this nation very dubious.

Scores: Australia =1; New Zealand =1 *; Papua New Guinea -2 (difficulty of access).

Melanesia (Fiji, New Caledonia, Solomon Islands, Tonga, Vanuatu)

No clear boundaries exist between regions here, as in the other areas, where national borders are clearly marked. In fact, various atlases and geographers do not always draw the same boundaries. However, for simplicity, the most common used grouping of these island, into Melanesia, Micronesia, and Polynesia will be used. Islands usually thought of as Melanesian are listed above. Melanesia is the grouping of islands to the north and east of Papua New Guinea, a shallow arc curving to the south beyond Australia and ending north of New Zealand. Some of the islands are independent nations, other dependencies of various other nations (Australia, France, New Zealand, and the United States). Most have very small populations; several number fewer than 100.000 people. All are within 30 degrees of latitude, in these cases, instance, south of the equator. The major products of the area are fishing, agriculture (mostly tropical fruits and vegetables), some tourism and handicraft for sale to visitors, and in one or two cases, mining of phosphates. A minority of the islands has incomes higher than $5,000 per capita per annum; those principally are islands with either more tourism or a substantial resident expatriate population.

All are suitable for solar cooking, with the caveats above about lack of knowledge of cooking fuels, habits, and alternative fuels. Moist tropical air must be taken into account.

Scores: Fiji =1; New Caledonia =1, Solomon Islands =1; Tonga =1; Vanuatu =1.

Micronesia (Guam, Federated States of Micronesia, Marshall Islands, Nauru, Northern Mariana Islands, Palau)

The islands of Micronesia lie to the north of Melanesia, roughly on the level of the Philippines but further from continental Asia. They are between the equator and approximately 20 degrees north latitude. Their economies are similar to those of Melanesia as are their histories and current status, some being dependencies, others independent nations.

All are suitable for solar cooking, with caveats similar to those above. Islands in all three regions are tropical, with year round warm climates and excellent insolation.

Scores: Guam =1, Federated States of Micronesia =1; Marshall Islands =1; Nauru =1; Northern Mariana Islands =1; Palau =1.

Polynesia (American Samoa, Cook Islands, French Polynesia, Kiribati, Niue, Samoa)

This last region is located further from the Asian continent than the other two, and stretches a considerable distance North-South, including in some categorization schemes, the American state of Hawaii. Like Melanesia, this string of islands is shaped in a long arc, but swinging to the south and then east towards Latin America (but still with a good bit of ocean between Pitcaim, (one of the furthest islands from Asia) and the coast of Chile.

A similar description to those above pertains here, as well. Tourism is rather well developed on some of the islands of Polynesia and a leading portion of economies. As above however extractive industries also are found, fishing, agriculture, with an amount of handicraft for the tourist trade.

All of the Polynesian Islands, like the others, are suitable for solar cooking. None have had exposure to the technology in a systematic way, to the best of current recorded knowledge.

Scores: American Samoa =1; Cook Islands =1; French Polynesia =1; Kiribati =1; Niue=l; Samoa =1.

Serving the area must be a matter of study and careful thought, for while there are many difficulties, nearly 12,000,000 people live in these islands, many of whom would be well served by exposure to this form of renewable energy. Given the health and environmental hazards of other fuels in common use in developing areas, improved technologies leading to cleaner air imperative here as elsewhere.

While very straightforward, and easy to understand, the data are summarized below in Table IV E.

Table IV E. Suitability of Oceania Nations for Solar Cooking

Regions	Suitable	Unsuitable Political	Limitations Economic	Limitations Climate
Australia, New Zealand, Papua New Guinea N=3	Australia, New Zealand* N=l	Papua New Guinea N=l	N=0	N=l
Nelanesia N=5	Fiji, New Caledonia,, Solomon Islands, Tonga, Vanuatu N=5	N=0	N=0	N=0
Micronesia N=6	Guam, Marshall islands, Micronesia (Federation of), Nauru, North Marianas, Palau N=6	N=0	N=0	N=0
Polynesia N=6	American Samoa, Cook Islands, French Polynesia, Kiribati, Niue, Samoa N=6	N=0	N=0	N=0
TOTAL N=20	N= 19	N=l	N=0	N=0

* Denotes that only part of the country is suitable.

This part of the world presents an unusual circumstance. All of the nations or areas except for three, the first "region" above, are small, separated by ocean from one another. All have small populations, some tiny. With the exception of the South Island of

rainfall, and all must have a generally humid atmosphere much of the year. It must also be noted that many more islands could be included here, since there are numerous others, yet smaller and less well-known entities, in addition to those listed. All the islands, or island clusters, that are independent nations are included here, but some of the dependencies are not, as the listing would become too voluminous. While each have small numbers of people, together the islands of Oceania, excluding Australia, have a population of roughly 12 million.

To our knowledge, no solar cooking promotion has been located anywhere in Oceania, with the exception of Australia. The challenge is clear. Efforts to understand the situation more fully, to ascertain specific needs and/or barriers are required. Entrepreneurs, trainers, organizers are needed to study the situation, evaluating the potential of solar cooking thoroughly, and, based on those findings, determine if working in this potentially productive, though difficult to serve, part of the world is feasible.

CHAPTER IV F

SUITABILITY FOR SOLAR COOKING SOUTH AMERICA

The continent of South America, perhaps more frequently called Latin America, has fourteen nations, which are readily divisible into three separate regions. Most of the region's nations were colonized by Spanish or Portuguese powers, with the major languages spoken reflecting that history. Current economic ties are however stronger in many ways to their neighbors to the north. The United States is in the process of attempting to widen an existing Free Trade Zone involving Canada, Mexico, and the US, into broader free trade arrangements with continental reach. If and when this might occur is uncertain at the time of writing this report.

As described above in the South American section on solar cooking programs, most of the continent is located within an appropriate latitudinal range for solar cooking. The southernmost narrow tip of South America (part Chile, part Argentina) continues for around 1,000 miles below the 40th parallel south of the equator. The topmost point, in Colombia is at approximately 11 degrees north of the equator. Therefore, the overwhelming proportion of the continent is well within an acceptable solar cooking range. The bulge on the northern cap of the continent, as far south as Brazil, is the more heavily forested portion and has the highest rainfall. The southern portion of the continent is considerably drier than the north.

Only six of the fourteen nations (42.9%) have not been exposed to systematic promotion of solar cooking, based on the current literature search, a lower proportion without solar cooking activity than any other continent. While variation exists between and within the nations, this area is somewhat more homogeneous than other continents, with a relatively common history of conquest and later independence, similar problems of unequal access to land tenure, and long struggles to achieve democratic governance. Conflict continues, particularly in Colombia, and intermittently in other countries also, as populaces assert their rights and demands to share more equally in nations' wealth.

The continent is one mainly of medium sized countries, with the exception of huge Brazil with its large Amazon basin, thinly populated but very large in scale. Three small countries are located on the eastern shoulder of the continent, and are relatively less known than the other nations.

Northern South America (Colombia, Ecuador, French Guiana, Guyana, Suriname, Venezuela)

This region contains three of the medium sized nations that characterize the continent, and three of the four little ones. While occasionally Colombia and Venezuela are in conflict about border issues, in general the area has little inter-state conflict. Colombia, for much of the latter half of the 20th century and continuing into the 21st, has had internal civil strife that has substantially slowed its development. The issues are complicated ones, involving land distribution, political power, and, affecting all the others, income from production and export of drugs. Periodically a truce is negotiated, followed by civil strife re-emerging. Kidnappings, many of foreigners who are held for ransom, are common. Violence has become a way of life in this country, held hostage by drug interests, with government rendered almost powerless. Visitors to this beautiful country mourn for its citizens who have for decades been unable to enjoy a life of peace and security.

The climate is eminently suitable for solar cooking. If or when "la violencia" should ever end, Colombia almost surely would be an excellent place for serious promotion. Like much of the continent, considerable forest cover remains, since the bulk of the population is located around the perimeter. Also like other Latin countries, the rural population is smaller than the urban, a disadvantage for solar cooking. Here, however, slum dwellers, are often located on hillsides clustered around huge urban centers, where space is more available than in, for example, the urban slums of Africa.

Considering the many factors, clearly more would have occurred on the solar cooking front, had not civil unrest consumed virtually all the citizens' energy and resources, and driven away potential assistance. In the future, hopefully, for the sake of Colombianas, this will at some point no longer be the case and marketing of this technology can begin again, along with a resumption of more normal living.

Ecuador is smaller than Colombia, considerably poorer, with a larger population of rural indigenous people than Colombia, and a smaller proportion of land with forest cover. The Andes run through the core of Ecuador, but despite that geography, the land is very densely populated, more so than any of the other Latin countries. The sun is intense when shining in the capital of Quito, for example, which is located at over 9,000 feet in altitude. In most Latin countries, the rural population uses wood as a major source of fuel, with city dwellers using either bottled gas or, in some cases, electricity. Over 60% of Ecuador's population is rural, living outside areas with infrastructure such as electricity; the cost of cooking fuel is a major issue for poor people. There can be little doubt about the need issue with regard to the potential of solar cooking.

Given the climatic situation, need of poor rural dwellers, and the existing history of acceptance of the technology demonstrated in many small programs, Ecuador would appear to be ideally suited for major promotion.

French Guiana area is a department of the Government of France. Small, with a small and not dense population distribution, French Guiana is very heavily forested (89.9%) and hence there may be little need for solar cooking. It also has very heavy rainfall that also might hinder any promotional attempts. A very hot place, French Guiana must be almost stereotypically jungle like.

Given the above circumstances, while its geographical location is well within suitable limits, its small size, small population, and tropical forest environment would suggest it is not quite as promising as most Latin countries for promotion of solar cooking technology.

Guyana shares some of the characteristics of French Guiana, but is larger, with considerably more rural dwellers. It, too, is heavily forested (78.5%) with heavy rainfall, particularly in the coastal area, and less in the inland, southern, more rural portion of the country.

Guyana thus looks somewhat more promising than French Guiana. It has a larger population, more rural, and has less rain. But careful thought would need to be given about promotion of solar cooking in this environment where need is presumably not high and climatic conditions not ideal.

Slightly smaller than Colombia, Venezuela nestles between it and the trio of small nations and area to its east. Like most of its Latin neighbors, Venezuela's population is concentrated along its lengthy and beautiful coastline; hence it has only a small rural population (13.0%). The inland area is mountainous, and marked by rivers, small and large, most of which flow into the Orinoco on its way to the Caribbean. Venezuela has substantial petroleum deposits that have, however, not made the country's GDP a high one; considerable profit must flow out of the country. Oil, plus mining and agricultural activities provide the major economic resources of this country. Much of these largely extractive products are further processed elsewhere, a common practice in many parts of the developing world.

Considering all those factors, the promotion of solar cooking is possible in this nation of South America. Surely the climate is satisfactory with adequate sunshine and temperate climates most of the year with little seasonal variation, particularly in the north. Few suffer from acute shortages of wood but most of the forested land is in high country with small populations. Urban, peri-urban, and small city dwellers could all benefit from solar cooking, particularly as petroleum revenues decline in the future. With abundant sunshine, solar cooking would be efficient in the nation. Promotional efforts might well require adaptation for urban and peri-urban householders - a topic to be considered for much of South America. The prospect for the area promising, if that obstacle can be overcome.

Scores: Colombia =2; Ecuador =1; French Guiana =3; Guyana =1; Suriname =1; Venezuela =1.

Central South America (Bolivia, Brazil, Paraguay, Peru)

This region, since it includes the giant of the continent, Brazil, covers a huge amount of territory. Much of that territory is not heavily populated, but rather contains the great Amazon Basin with its network of tributaries, and only relatively few settlements, mostly small. Peru hugs the Pacific coastline, as does the majority of its population. Bolivia and Paraguay, are both land locked. Substantial mountain ranges characterize all of the areas; the populations are between a fourth and half rural. The only really large cities are those of Brazil: Rio de Janeiro and Sao Paulo. Like those of

neighbors to the north, the economy is driven by a range of extractive activities, producing small amounts of petroleum and natural gas, minerals for export, and agricultural products. Only limited manufactured products add to national incomes.

All of the countries would appear to be appropriate for promotion and marketing of solar cookers; indeed some activity is found in these nations, as described above.

Bolivia has the lowest GDP of these nations, at $2,600 per capita per annum. It is the least densely populous, meaning its population is thinly spread through the mountainous terrain. People living in the mountains have little disposable income, and are largely subsistence agricultural workers or herders. They use wood as fuel, gathered or purchased, or resort to the more expensive bottled gas when absolutely necessary. All indications suggest that solar cooking is eagerly accepted in this country, which has seen considerable effort to sell the technology by particularly competent promoters.

The effort required to do so is considerable, since villages are small, remote from one another, lacking good transportation systems, which in turn limits the availability of supplies. However, the need is very substantial since deforestation is officially considered to be a problem.

All indicators are positive here. Based on the work of existing promoters, a strong market exists for solar cooking, even among middle class people who are readily able to purchase equipment. Low-income people may require some financial assistance, through micro-loans, or through subsidies from government or non-governmental groups.

Bolivia is a strong contender for solar cooking promotion, building on the success of existing promoters in the nation. Success here (described in the chapter above) predicts more success is possible.

At the time of writing, the political situation in Brazil is unusually interesting. The country has elected a popular figure, avowedly on the left of the political spectrum. Despite the nation's serious economic condition, he is not one of the national leaders who seek to gain the favor of their giant northern neighbor, the US, but rather is one of its sharp critics. What that portends for the future of Brazil is uncertain. The continent has been characterized in the last decades as making substantial movement towards democratic governance, with the departure of real dictators and the arrival of more democratically oriented figures in leadership positions. However, the road ahead is still

rocky for all nations of the continent as they continue to fight poverty, disease, ignorance, while lacking the resources for adequate economic development, health care, education, and so on. Whether Free Trade will ease that journey is a matter of debate, with widely differing views on the part of people in all nations, on both sides of the developing-developed nation divide. But the new leader of Brazil, known to supporters simply as "Lula" is not on the side of the developed nations, which makes the situation interesting to watch.

Brazil is a nation in which the remainder of the continent, and indeed the world, has a considerable stake. While details are not known with certainty, the thousands of square miles of forests in the Amazon-Basin provide an urgently needed part of the earth's carbon sink required to counteract other global warming factors. It is estimated by some that the Amazon's trees produce as much as a quarter of all the oxygen on the earth. Another issue is the rich biological diversity, much not yet even catalogued, that is found in the forests of the Amazon Basin. They hold unknown potential for medicines, food, and other uses in the future. The interests of all people in the future of our planet are involved with the future of this part of the world.

Like all Latin countries, and most developing ones everywhere, an insatiable need for additional land for agriculture exists in Brazil. Governmental policy on the Amazon is clear; the intent is to guarantee the survival of the area. But nonetheless, land and forests continue to disappear into feedlots and agricultural fields. The huge wilderness area, much reachable only by river, is difficult to monitor closely, with resources at the nation's disposal. Substantial danger to this major world resource is a reality.

The prospects for solar cooking in this nation are mixed. Much of the Amazon is sparsely populated, with very heavy rainfall and high humidity more or less always, making the area not altogether a promising site. Outside of that area, temperatures are moderate to high, but so is the rainfall. The far southern part of the area, the most populous and site of the big cities of the country (and the continent) are all still within the preferred cooking range and thus more promising. But again, the urban issue becomes important, as southern Brazil is densely packed, averaging up to 100 persons per square mile. That does not, of course, mean uniform distribution over the land, and the big cities make the averages higher. It does however mean that the rural population (19.3%), the

major target usually for solar cooking promotion, is not veryjargè, even in the south with its agricultural plains but also with huge cities; other agricultural areas are found north of Sao Paulo where sugar is grown. Climate wise, Brazil is an excellent site for solar cooking. The many, many poor people in the "favelas" of Rio and Sao Paulo, as well as agricultural workers or artisans everywhere, may need a somewhat different approach to solar cooking. They bring different concerns, such as appropriate places for unattended cooking of food. The need for adapting the technology to urban and peri-urban environments is very important if solar cooking is to be truly successful here, and in much of South America.

The inland, mountainous nation of Paraguay is the smallest in this region and one less well known to outsiders. It has moderate rainfall across the country, 40-60 inches a year, and moderate temperatures around the year, with some but not huge variation by season. Its economy is largely one made up of extractive activities: agriculture, some mining, and a little manufacturing. Its GDP is just below $5,000 per annum, similar to that of Peru, its next-door neighbor.

Border disputes have plagued the two neighbors for some time, but quiet has prevailed on that front in recent years, at least as portrayed in world news sources. Internally, Paraguay has the highest literacy rate in this region, though all are high (Resources for education have traditionally been a high priority for most Latin countries, with, interestingly, higher educational achievement rates for females than for males - unique in the world.)

Paraguay's physical location is excellent for solar cooking. While not extensive, enough activity has taken place for potential promoters to feel certain the technology is acceptable to households. The country has average infrastructure facilities; working there would not be overly difficult. In general terms then, Paraguay would appear to be an ideal place to consider solar cooking promotion.

Peru lies along the Pacific coast between Ecuador on its north and Chile on the south. The Andes continues its long North-South path down the continent through the heart of Peru, creating a highlands area where indigenous people live, many in traditional manner. While there is some mining of copper, zinc, and gold, most make their living from fishing or various agricultural products. The rural population of about 27.6% is

primarily Indian, while mixed-race people or those of European extraction are more apt to live in the cities of Peru. The GDP is similar to that of Paraguay, just below $5,000 per annum.

Peru is somewhat more densely populated than Paraguay or Bolivia, but not as high as Brazil with its mega-cities. The Altiplano, or high plains, is primarily used for herding of animals, plus subsistence farming. The area is perhaps the most promising of all for solar cooking, as the sun's power is great at the altitudes of the Altiplano. The sunny coastal plains are also promising Difficulties of communication; of logistics, e.g. delivering supplies to remote areas; and the traditional nature of people with, perhaps, built-in resistance to change are however multiple and challenging.

While some activities have been conducted in Peru, particularly with indigenous people living in the Altiplano, no really large project has been attempted. All conditions appear to be suitable, in terms of both geography and need. Peru, while not in grave danger of deforestation, is concerned about saving its forest cover annual loss (-0.4% per annum). Using petroleum products is an option for many but a relatively costly one for poor families, and likely to be more so in the years ahead. Hence, all factors seem appropriate for the development of a plan for solar cooking promotion in Peru.

Scores: = Bolivia =1; Brazil =1; Paraguay, Peru =1.

Southern South America (Argentina, Chile, Falkland islands, Uruguay)

Uruguay, on the Atlantic side of the continent, nestles to the south of Brazil, and borders neighboring Argentina on its west. This is perhaps South America's most Europeanized country with well-developed infrastructure, educational system, and health facilities. But the nation has suffered severe economic problems in the last decades that have caused a decline in standard of living. The economy is based on agriculture, food processing and some manufacturing. Population density is low. Like much of the continent, its population is heavily urban. The climate is very suitable for solar cooking. Uruguay has very limited forest cover but the majority of the population, living in cities, has modern energy sources. Nonetheless, with the high and increasing cost of all energy alternatives, solar cooking could play an important role for at least a portion of the citizenry.

Two countries are yet to be considered on this long, partty narrow continent: Chile and Argentina, located in the narrow part of the continent, on its southern extremity. Also, offshore from Argentina, lying 500 miles east of Argentina is the small British dependency of the Falklands Islands, made famous in the heavily publicized war of the 1980s.

A portion of this region falls outside the range of suitable climatic conditions for solar cooking. The 40th parallel crosses the continent at a point about one third above the southernmost parts of Chile and Argentina. The Falklands lie entirely outside that latitude, at around 52 degrees south. Despite the latitudes, much of both Chile and Argentina appear to be relatively well-suited for solar cooking, since they have light precipitation, equitable temperatures (above freezing on average even at the southern most point on the continent), tempered somewhat by the warm waters of oceans surrounding them. The latter comments perhaps are not crucial as, in both cases, only very sparse populations are found in the southernmost sections.

Chile is largely a rather arid narrow plain, with a small proportion of forested land, and a lot of sunshine. The climate is not a luxuriant one, rather harsh winds off the ocean mean that box cookers and parabolas are more successful, although experimentation with CooKits has been done as well (see Chapter 3). Wood is extremely scarce in the high and dry plains, a fact that led university scientists and environmentalists to explore the potential of solar cooking and implement considerable activity (see above).

With t knowledge of existing programs, and the limitations (above) of climate, it can be said that the need is substantial in this nation. Chile has less than 20% of land in forest cover, a percentage decreasing slightly each year. The sunshine is obviously abundant, as the presence, for example, of a solar restaurant displays.

Argentina has very similar climatic circumstances, though characterized more by large plains than Chile. Both are fairly arid, have little forest cover; neither is heavily populated.

Without question, further promotion in these countries should be encouraged, utilizing the existing expertise of the outstanding pioneers of current projects. That practice must, of course, be taken as a given everywhere, but in the specific case of Chile,

where the organized promotion has been unusually competent arid successful, the advice is even more important. The assistance of Chileans should be encouraged in analyzing and planning for additional promotional efforts in Argentina, and perhaps starting an entirely new effort in Uruguay.

Scores: Argentina =1; Chile =1; Falkland Islands =1; Uruguay =4. /

The information on South America is summarized in the concluding table in this series, Table IV F1.

Table IV F1. Suitability of South American Nations for Solar Cooking

Regions	Suitable	Suitable/ Limitations	Unsuitable/ Economic	Unsuitable/ Climate
Northern South America N=6	Ecuador, French Guiana, Guyana, Suriname, Venezuela N=5	Colombia N=1	N=0	N=0
Central South America N=4	Bolivia, Brazil, Paraguay, Peru N=4	N=0	N=0	N=0
Southern South America N=4	Argentina, Chile, Uruguay N=3	N=0	N=0	Falkland Islands N=1
TOTAL =14	N=12	N= 1	N=0	N= 1

Only Colombia, around its long lasting conflictual situation, and the Falklands, unsuitable climatically, are not wholly appropriate for solar cooking promotion. Special efforts to solve problems associated with high humidity may be required for Amazonia, for the small nations on the northern shoulder of the continent, and for more humid areas of other countries.. Adaptations more suited to urban populations also deserve considerable thought in planning for South America, since urbanity is a major characteristic of the continent. Much has been accomplished on the continent already; that expertise must be brought to bear on planning for a yet more successful future for solar cooking on the continent.

substantial number of under-served nations can be thought of as potential markets, minimally deserving further consideration and study. The community of solar cooking promoters has a large and challenging task ahead.

Before moving to conclusions and recommendations, one final table will show the distribution of solar cooking programs among the suitable nations only. Displayed by continent, the table shows the scope of existing or past projects in each of the continents. The data is compiled from country information in Chapters 3 and 4, and presented as Table IV F3.

This final table thus looks at the 150 "suitable" nations (lumping those with some limitations and those suitable now, for-this purpose), arrayed against the number of countries with no solar cooking programs and those which have some programs (of all sizes, small to mass, lumped together here) The data re difficult to display and to interpret appropriately, since the figures in the columns are drawn from different information bases. The first column repeats the information in the table directly above, in more succinct form. In the second and third columns, the reference point is to the number of "suitable" nations shown in the first column.

TableIVF2.

Suitable Nations arrayed Against Solar Cooking Programs or None, by Continent

All Continents: Number of Nations "Suitable" for Solar Cooking/ % of Total Number of Countries	Number with No Known Solar Cooking Programs	Number of Nations with Solar Cooking Programs - Small to Mass / % of Suitable Nations
AFRICA 55 %of56= 98.2	27	28 % of 55 = 50.9
ASIA 28 %of49 = 55.1	31	18 %of28= 64.3
EUROPE 4* % of 40= 10.0	30	4 %of4 100 (+7 exporters)
NORTH AND CENTRAL AMERICA 31* % OF 34= 91.2	21	13 % of 31= 41.9 (+ 2 exporters)
OCEANIA 20* %of20= 100	19	1 %of20 = 5
SOUTH AMERICA 13 % of 14 = 92.8	6	8 % of 13 = 61.5
Total Suitable =151 of 213 = 70.9%	**	72 = 47.7%

. (It must also be remembered that a small number of countries are rated as suitable if at least some portions of the territory is "suitable". All are marked with an asterisk in the continental tables.)

** Totals here do not add up to the sample totals, as some of the unsuitables may have programs. For a complete picture, analysis, nation by nation, will be needed.

The reader will recall that two thirds of the world's nations and areas do not have any solar cooking activity, to our knowledge. The summary above provides a somewhat different and perhaps more useful, look at the situation by looking only at the pountries which appear to be suitable, compared to their history if any, with solar cooking. The data show that nearly half, 47.7%) of the suitable countries of the world have had exposure to solar cooking. These facts suggest that, for the most part, solar cooking activity is concentrated in suitable areas, as one would hope and expect.

The remaining slightly larger half of suitable countries have not had solar cooking programs large or small. The patterns differ quite markedly by continent. All of Oceania's suitable nations or areas are without any systematic promotion. Asia and Latin America are the closest to being fully covered by programming of one kind or another, with nearly two- thirds of their suitable countries having at least some types of programs. In between are Africa and North and Central America, each with 40-50% of their suitable countries having some cooking programs. Oceania is virtually unserved, and most of Europe is in a less suitable category in terms of cooking potential.. (It must be noted, however, that the picture presented here is overly optimistic, since the presence of a small or medium sized program surely does not imply that the majority of citizens know anything whatsoever of the potential of solar cooking.)

With that substantial caveat, the above is the worldview of solar cooking in early 2004. Some further information about the technology and projects are provided in the appendices, including several case studies, which are designed to help the reader see a detailed view of a few programs, augmenting the broad picture presented by the data. The case examples are intended to provide concrete details of operating programs. They are chosen not for their representativeness, but rather are related to the author's personal knowledge of the situations.

Based on the data of the study, the content of the case studies, and the author's knowledge from experience in two major U.S. solar cooking organizations, a set of conclusions and recommendations follow in the final chapter of this work.

CHAPTER V

CONCLUSIONS

Conclusions from the study data

The most obvious conclusion of the study is that the globe is not well covered by individuals, groups, and projects working to promote solar cooking. Despite Valiant efforts on the part of many hundreds of individuals and an impressive array of organizations (albeit it that some are very small, even one-person activities), formal activities of some type are found in roughly one third of the world's nations and areas. As backdrop to that fact, a cursory scan of factors related to "suitability" (geographical location on the globe, need or lack of need related to economic status) shows that two thirds of the nations would possibly be appropriate sites for solar cooking promotion. Those two data sets indicate that considerable public education, advocacy, demonstration, training, encouragement of entrepreneurs will be needed in the years ahead if the movement's goal is to ensure that all who could benefit from solar cooking are minimally informed of its potential.

(Before summarizing, another caveat must be stated here: suitability would be more accurately assessed if based on average hours of insolation rather than on average temperature. That data however has substantial variation, even within nations, related to altitude, prevailing winds, mountains, and numerous other factors. Obtaining that for 213 nations was simply not feasible in this work. Persons considering initiating or expanding promotion in any particular place would be well advised to obtain average insolation data for selected areas of any country or region under consideration.)

The categorization scheme employed in this study divides the world's nations into six "continents" (used by the FAO in its reporting of forest data and, with a little adaptation, by the National Geographic Society in its most recent Atlas). Of the six, the European continent is far and away the least suitable, since

the bulk of its nations are situated above the 40th parallel north of the equator, and thus not maximal for solar cooking. The sun is high enough in the sky only in the summer months, and while cooking is possible, more expensive equipment (accounting for the low sun in winter months) is required for performance year round. The same is true of the northernmost parts of the U.S., all of Canada, / Greenland, and some sections of Asia as well (Mongolia, the two Koreas, Japan). Details can be found above in the national descriptions by continent and nation that constitute the database of this report.

On the other hand, all of Africa, nearly all of Oceania and South America are eminently well suited, climatically-and in terms of need. In the categorization scheme used, continental North America is grouped with Mexico, Central American, and the Caribbean nations; the latter are all well suited for solar cooking promotion also, with limited exceptions noted in Chapter 4.

As seen in the descriptions and tables in Chapter Four, around two-fifths (41.9%) of the 146 nations considered as "suitable" for promotion have some solar cooking activity, ranging from a few individuals demonstrating this cooking method to large-scale, well-funded projects. The percentage of suitable nations with no programs or promoters is 58.9. Some of the nations not thought of as "suitable" have projects, though not many, illustrating the broad utility and diversity of the technology.

In addition to the statistical look at the world of solar cooking, a few other comments stem from the data collected. Somewhat different patterns of "sponsorship" can be seen in the programs of the various continents. While that aspect of programs was not systematically tracked (in hindsight, it should have been), patterns are discernible. The leading projects on the Asian continent are those instigated and implemented by governmental activity of one type or another. In Asia, with some exceptions (i.e., the large SERVE project), the large projects came about through official organizations of the continent. By contrast, most African projects (with the exception of the large South African undertaking) have not been implemented by government, or indeed, by citizens of the continent. They are rather largely initiated and operated by donor agencies

from outside the area. In Central and South America, citizens of the countries involved, in some cases, largely lead efforts with "start-up" assistance from outside (as in the Processo network in Central America) or with local government and university assistance. A more focused study on these observations, looking at similarities and contrasts in operating procedures and in outcome indicators, would be an interesting addition to the literature on technology transfer.

The role of the Multi-Nation Providers is relatively unexplored, given the important role they play on the world scene. This sector deserves to be studied more carefully and utilized more effectively, considering the important participants they clearly are on the world scene. Bringing their expertise to bear on the global situation, not only as separate providers, but also as planners for a future world with far wider access for all who need the technology, could be very valuable.

And finally, a few rather impressionistic observations can be made about the data. With few exceptions, the data emerge from self-reports without outside or formal confirmation of their accuracy in terms of numbers served. Actual usage data is minimal at best. While there is no reason to doubt the accuracy of the individual reports that are available, few social scientists would consider most to be scientifically valid or totally reliable in the scientific sense. Only a few of the reports describe actual evaluation studies with carefully defined and measured goals and outcomes. Considerably more of the information is anecdotal in nature, and, while useful in conveying consumer perceptions, a thousands anecdotes do not constitute hard data. Persuasive evidence, available only in carefully planned and carried out studies of promotional efforts and their outcomes, would be of considerable value in persuading the marketplace of the potential of solar cooking. Participation of market forces is needed, as partner to the many voluntary organizations and individuals who are currently seeking ways to spread solar cooking more widely around the globe and at a faster pace. Given the dimensions of need, what voluntary organization has the capacity to meet the needs of all who could use the technology? Rather, the power of

commercial markets to produce, persuade, and sell to the consumer is needed to meet the needs of the one-third of the world's people who still cook largely with wood or other biomass.

The other side of the lack of hard facts is, however, the clear and strong testimony of dedicated volunteers around the world who use and promote solar cooking. They are the backbone and the strength of the solar cooking community; they clearly both need and deserve assistance in their work to promote the quantity and quality of solar cooking programs.

Recommendations

As above, some of the recommendations flow quite directly from the data, others more subjectively from a broader analytical view of the world situation.

1. Research and Action: Governmental Policy Frameworks affecting Promotion

Little or no information has been found, other than an occasional anecdotal mention, on the topic of governmental policies that impact potential promotion of solar cooking. Few governments of the world, in all likelihood, have even given any thought to this possibility, with the exception of the few large projects in China, India, and South Africa described above. Most of officialdom, if not all, would however be aware of the fuel wood crisis, which has been widely publicized. Governments are asked to report on their national forestry situation at regular intervals; conferences on the topic are held under United Nations auspices. Some understanding of the implications of forest loss in terms of global climate change, erosion, desertification, and so on, exists in most nations. But the world and its nations are only slowly becoming conscious of the deadly health implications of burning biomass and only a few have seriously attempted remediation. Public health officials are currently, however, raising loud voices about the affects of Indoor Air Pollution both on individuals and on the larger environment where it ultimately ends, affecting all on the globe as humanity careens towards potentially disastrous climate

change. Solar cooking will not turn that around, but it is one means of amelioration of the problem, and clearly a major amelioration for the individual household for whose members smoke free cooking would be a great blessing.

Perhaps even more seriously than inattention, many governments have policy frameworks that actively work against implementation of the range of renewable energy technologies, often in the form of high tariffs or custom duties on imported equipment or on importing materials to manufacture equipment locally (creating both the needed equipment and jobs for residents). Another policy found in many countries subsidizes the cost of fossil fuels, such as kerosene or paraffin (as kerosene is called in much of Africa) for household use. This practice, popular with the citizens, is designed to provide assistance to the poor with their acknowledged need for cooking fuel. In actuality, the use of public funds for this purpose is counter productive in the long run, delaying the creation of more environmentally appropriate technologies, such as solar ovens and fuel-efficient stoves. At some point in the lifetime of most contemporary inhabitants of the earth, no more fossil fuel will be available - then what? Is the world willing to wait until the last trees have been cut down before more suitable policies are put in place? One hopes not.

Studying the policy frameworks of selected governments must be done as backdrop for promotion of solar cooking, and indeed, the range of technologies that address the cooking fuel problem. Following analysis, action plans much be created to change those policies detrimental to the long-range future of humankind. Obviously, the most effective actors in this kind of advocacy work are citizens of the specific countries where problematic policy frameworks exist. Knowledgeable persons in the solar cooking community around the world and promoters of other renewable energy are logical citizens to undertake such work. Local or national groups would almost certainly welcome assistance, however, through provision of background research, information on strategies used elsewhere, advice on advocacy methods, short term funding, etc. Global networking could be extremely useful to local people as they attempt to solve their own problems.

2) Linking the Multi-Nation Promoters for Action

Readers of the study will be aware of the various multi-nation providers, many of whom have been disseminating solar cooking equipment and knowledge in dozens of countries for more than a decade. While not easy to quantify the contribution made by these groups, without doubt, their contribution to awareness of the potential of solar cooking, and the opportunity they provide for many indiyiduals and organizations to become solar cooks in nations around the world is huge indeed.

No truly full picture of their accomplishments exists. Piecemeal accounts are found on websites and in conference proceedings but an overall view is hard to construct. The collective experiences and wisdom gained in the process is impossible to over emphasize. Many of the largest of the Multi-Nation Promoters headquarter in Europe, though the bulk of their work is elsewhere in the world. Against the background of data assembled here, it will be important to obtain their input as the solar cooking world asks itself "what next?" and "where do we go from here?" How can all promoters work together more efficiently?

For the most part, the European promoters (while individuals no doubt know one another) do not appear to have formal working relationships. The world would however benefit from the creation of an opportunity for representatives of these groups to come together, to share their experiences, expertise, needs, visions for the future, and thoughts on the "what next?" topic.

To that end, one recommendation is exploration of holding a meeting of solar cooking promoters from the major Multi-Nation Promoter groups. The objective of the occasion would be gathering their views on proceeding, against the current world picture, towards the goal of serving more effectively the global population, with a focus on nations and areas not well served currently. With their strong backgrounds of outreach to all continents, this group has expertise that is essential in planning for the future.

3) Utilizing local/national knowledge and expertise to aid others.

Of course, not only the "big promoters" above have important expertise and experience. The individuals and groups that make up the solar community in one-third of the world's nations also are repositories of knowledge. Finding ways to

mobilize that knowledge base will also be required to reach the ambitious goals of serving people everywhere who can benefit from solar technologies.

Networking made possible electronically today means that much of the world of solar cooking is already connected. The information flow facilitated by SCI's Solar Archives (www.solarcooking.org) is invaluable to all interested in the technology and its promotion. This study however demonstrates that even those in that connected world have a body of largely anecdotal information but without a larger context into which the data fit. An individual may know a good bit about a new project featured in the SCI Review or on the Solar Cooking Archives, but may know nothing about a decade long activity in the neighboring country. With a global database now available (though it is a first effort and clearly not exhaustive), it should be possible to maintain fairly easily, simply by adding new material at intervals, hopefully to see an expanding picture. Potentially, the interested person should be able quickly to locate current information on programs in virtually any country where work is ongoing, planned, or completed. Names, contact information, reference materials should be downloadable from websites or e-mail services. The existing chat room could be subdivided to accommodate special interests, in, for example, particular types of technology, evaluation strategies, promotional tactics, and so on, allowing the seeker to locate information more quickly and efficiently on the site of interest.

The entire community must think critically and strategically about achieving our collective goals, assumed by this writer to be something along the line of "assuring that people everywhere who can benefit from solar cooking can access the technology and means to be trained in its use". Against that ambitious scenario, it is critical to ponder about targets and methods for promotion. As suggested above, the efforts of voluntary organizations, while critical, laudable, absolutely necessary, are not now and probably never can be sufficient to meet the demand of the world's poor populations for cooking equipment. After all, historically, even poor populations everywhere have historically bought or made their own cooking equipment. The situation calls for a solution which is market-oriented; the task of the solar cooking community is to ensure that the market can provide satisfactory equipment to all

those who need and want it, with (as happens in all relief or welfare situations) special provisions made for the particularly needy.) The question now is how to get there from where we are now.

Commercial markets are obviously more attractive if they are of sufficient size to justify the expense in start-up costs, awareness creation about the product, education in its use, etc. In many parts of the world, with the emergence of many small nations, a regional approach seems practical and workable. The regional arrangements suggested in the data of the study are derived "from the book", not from on the ground learning. Obviously, the person power of the fragmented, though "sort of connected" solar community out there is needed to suggest alterations if needed, to be certain that some type of regional division works, and to develop further plans of action for specific regions and nations. Organizing such efforts, using electronic means when possible and when not, whatever works, is a continuation, in some cases, of former networks of solar cookers in, for example, Central and South America. In other places, regional activities will be started from scratch. In this era of mass communication, and the present political climate, the new modes of communication can and must be used. Considerable strength exists in the community of hard working, dedicated volunteer solar cooking promoters found around the world, quite accustomed to working with small budgets and lots of donated time. Even given that, it is likely, some "starter" assistance will be required.

In short, this recommendation calls for someone — or perhaps, a lot of some ones - to give hard thought to getting the existing multivariate solar cooking community organized for the big task of educating the world, piece by little piece, about the important technology espoused here. That will be best accomplished by recruiting leadership at the continental (and regional within continent) level, and asking them to take yet another responsibility on their already heavily burdened shoulders. As above, some reasonable starter assistance may be required to assist in this largely voluntary effort. Approaches developed may well vary by continent, given the differing circumstances.

In some circumstances, Oceania for example, special efforts are indicated. The logical place to ask for guidance is Australia, where a number of persons are

already involved in promotion of solar cooking, and where ^substantial part of governmental development aid is directed to its own back yard, the territories of the South Pacific and Asia. A way to initiate this effort must be found by connecting to known solar promoters and enlisting their contacts, expertise, and willingness to assist. /

Not a single island of Oceania has been exposed to solar cooking, based on the literature search. Special Research and Development is required here, taking into account the moist tropical climate that has, however, plenty of sunshine. Equipment types, food cooked, usual cooking practices, etc. must be studied before much else can be done. Much of what is learned could perhaps also be used in efforts to work in another underserved area, the islands of the Caribbean, where somewhat similar climates exist, although different cultures.

4) Enlisting women's organizations to the cause of solar cooking.

While obvious to all that solar cooking is an issue strongly connected to women, no systematic attempt has been made to involve international women's organizations in the work. With very few exceptions, women's groups, though operating everywhere in the world, are not knowledgeable about nor have been asked to aid in promotion of this technology. The one major exception is the World Association of Girl Guides and Girl Scouts, with its focus on girls. In addition, locally a number of promoters have worked through women's groups, or occasionally, women's groups have been initiators of projects.

A large and well-connected network of international women's organizations exists; most of them have consultative status with the United Nations and are represented at major UN meetings. Many headquarter in Geneva. Some of the organizations are all-purpose in nature; others espouse a particular cause or belief, yet others are made up of members of specific professions. Probably at least 50 such organizations each have up to 100 or even more branches in nations all around the world with which they communicate regularly, send information, discuss major issues, and so on. Unfortunately, there is no over all coordinating body for these organizations to make contact easier.

Might it be useful to make a serious attempt to contact relevant international women's organizations and solicit their assistance in making appropriate information available to their national affiliates, possibly even planning solar cooking programs in partnership manner? The places to begin such an effort are New York, London, Geneva, or Paris, where major groups have their world headquarters. Working with only 2-3 such organizations, such as Countrywomen of the World, the International Council of women, perhaps the International Home Economics Association, or ??? could potentially reach half or more of the world's nations. And it would reach the desired target audience of women. This task would, of course, be a major organizational and educational one.

Women have yet to make full use of their potential power, possible if they successfully organize globally. The several world meetings sponsored by the U.N., in Mexico City, Copenhagen, Nairobi, and Beijing made many aware of that potential, but no serious attempt to mobilize the world's women around a specific applied action agenda has been attempted. While a huge and daunting task, if we do not do it now, when? If not us, who? While all citizens of the world are the beneficiaries of solar cooking, women are those most directly affected by the never-ending search for fuel or money to pay for it, and the first to suffer the affects of Indoor Air Pollution, which kills women and infants more than other population groups. Sisters around the world can help others and should. Logical groups to work with on this issue are those women's organizations that have worked locally to spread solar cooking in their own nations, i.e., the Philippines and Ecuador. Can we enlist them to aid us think through how to organize an effort of this sort at the global level?

5) The lack of adequate evaluation data as a major problem.

The reader of the draft will have noted often that good information about the outcomes of projects is not often forthcoming. Information on acceptance of the technology, usage patterns, fuel savings made possible, health information, for example, are crucial components of knowledge needed, but not often available.

Strong encouragement and support for evaluation research is crucial if investors are to be persuaded to take on the commercial aspects of manufacturing and selling cookers. A substantial body of knowledge on this type of research exists in social science literature but efforts to translate that knowledge into accessible and practical know-how for promoters is needed. In the interim, a cadre of researchers could be trained for this specific purpose to conduct studies of major programs, training solar cooking leaders in the process in order that they can conduct the research themselves. Investors and government officials alike would react more favorably to solid scientific information about use of the cooker and related outcomes than to the most impassioned statements of belief in the technology's worth.

6) Update the global picture from time to time.

The leading networkers in the field should be encouraged to continue to provide global pictures of solar cooking, of the kind presented in this study. Starting from the beginning and attempting to go back some years was a large task; maintaining a data base by continent and country should not be as difficult.

For overall purposes, a piecemeal picture is not sufficient. Rather, snapshots of the global scene at specified intervals should be available. Without doubt, the present study is incomplete. As new information comes, it should be added, changing the overall picture with time. Only then will we know if progress towards the larger global goal is occurring. One of the major ongoing organizations should be recruited to take on this task, on behalf of the solar community. Without any doubt, that would require funding, as the bulk of solar programs, at least in the non-governmental arena, are bare bones operations, with barely enough support to get through a current year. However, support dollars are out there, both in government programs and the foundation world. The harder task may be persuading one of the major actors in the field to undertake this task on a recurring basis.

In summary, much remains to be done. The above are but a few suggestions of way to start tin's cause rolling at a faster pace, with a clear global

picture and a global goal to insure that all who can benefit from this technology have the opportunity to do so. The technology is free, ever-lasting, non-polluting, non-endangering to the environment, competitive in price with the alternatives, and able to improve health and survival chances of many women and children. Strategies and resources to make those benefits of solar cooking available to the very underserved globe we inhabit, seen so clearly in the information presented here, is the major imperative that emerges from the study.

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The majority of the information provided in this document comes from what most would think of as "unpublished" documents. Five are conference proceedings, listed below in

chronological order. For convenience of the reader; they are.referred to, in the text, by the conference location, rather than the name of the editor.

The first three conferences were sponsored by Solar Cookers International, Sacramento, California; the latter two by other organizations, as indicated.

Pejak, E., ed. (1992). Advances in solar cooking: Proceedings of the first world conference on solar cooking.

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As the reader has seen, much of the information has been derived from the Solar Cooker Review, a quarterly newsletter published by Solar Cookers International (SCI) for its members. All past editions of the Review are available to Internet users on the Solar Cooking Archives, activity also supported by SCI. The web site is called the Solar Cooking Archives, and can be accessed at http://www.solarcooking.org. Once on the site, much information can be located, including manufacturers, country reports, interviews with solar promoters, and so on. An international directory of solar cooking promoters active around the world is also included on the Archive.

When the reader sees a reference saying (REV., Aug. 02) the intent is to direct his/her attention, if more information is desired, to the article in the Solar Cooker Review of August, 2002. If internet use is not possible, the reader can contact SCI by mail at: 1919 21st Street, Sacramento, California 98514 USA.