

Chapter 5. A crisis in power

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Events of the past 20 years have transformed energy from a little-known technical issue into a matter of prominent civic and political concern. Dramatic increases of oil prices in 1973 and 1974 and the subsequent changes in the international oil market resulted in a proliferation of policies and publications on the subject of energy resources management. *The Limits to Growth* (Meadows et al. 1972) and *A Blueprint for Survival* (Goldsmith et al. 1972) warned of the consequences of industrial society's excessive use of natural resources such as oil. Eckholm (1975) compared diminishing oil resources with accelerated deforestation in Africa, Asia, and Latin America. This gave birth to the household energy sector as a legitimate concern in energy-policy analyses, and with it a focus on women. In 1981, the United Nations (UN) held a conference to examine the relevance of small-scale renewable energy technology for developing countries (Foley 1991). In the rush to address such problems, socioeconomic issues such as gender roles, which ought to have been useful in guiding policy formulation, were not fully appreciated (Leach and Mearns 1988). According to Sontheimer (1991, p. 83):

New agricultural technologies often make life even harder for women. When a male head of the household is given credit to buy a cultivator or share a tractor, he soon begins to cultivate more land. His wife and his daughters must then weed a larger area in the same time. When fast-growing "improved" tree species are introduced, they usually provide a cash crop, often at the expense of multipurpose species that are used by women for food and fodder production [as well as] a source of income. . . . In timber-rich Borneo, men and women have traditionally worked at wood-cutting as family teams. When heavy chain saws were introduced to improve productivity, women were effectively

excluded from an activity that had valuable social as well as fiscal functions.

Participants at the UN Conference on Science and Technology for Development acknowledged that the rewards of modern science and technology (S&T) were not enjoyed equally by all groups of society (UN 1979b). They may in fact have adverse effects on the socioeconomic status of women and their contribution to the development process. In addition, disparities are much more acute in developing countries than in developed ones (Sontheimer 1991). This viewpoint was reiterated in *The Nairobi Forward-Looking Strategies for the Advancement of Women* (UN 1985b), which stated that both the potential and actual impact of S&T on factors affecting women's integration into various sectors, their health, and socioeconomic status should be assessed.

However, conventional energy planning, which relies heavily on S&T developments, is based on the premise that the effects of energy technologies are gender neutral. This situation has been exacerbated by the fact that, until recently, we lacked information about women's active and productive roles in energy matters. Cecelski (1992) argues that this cursory approach has been inadvertent; not only women, but also socioeconomic issues, have on the whole been omitted from the energy paradigm.

For no cogent reason, prominent positions in society, as well as within S&T and hence the energy sector, are the exclusive province of men (Overholt 1984; Rothschild 1988; Østergaard

1992). The goals of S&T reflect the goals of society as well as the political structures in which S&T are set (Morin 1993). In this way, S&T as enterprises comprise both subjective (through value judgements) and objective elements (Bleir 1984). These influence the direction of scientific inquiry and its application to practical matters in energy: which energy problems are addressed, which experiments are performed, and which energy research is supported. The implication is not that S&T are inherently masculine, but, because S&T evolved within a patriarchal society, women's knowledge was excluded and the practical outcomes of these disciplines had a masculine bias (Harding 1986; Schiebinger 1989; Noble 1992).

Thus, energy means work, kinetic energy, potential energy, mass-equivalent energy, and heat. Energy technologies, for example, engines, breeder reactors, and turbines, harness energy in serviceable forms, such as useful heat, mechanical work, and electricity. Work done using metabolic energy and small-scale energy technologies based on biomass are considered peripheral. The status quo is biased toward the socioeconomic groups that have access to "high tech" energy resources and technologies and discriminates against

the vast majority of the world's population who cannot afford these technologies. This situation is especially acute in the South where a large proportion of the "poorest of the poor" are rural and urban households headed by women (Sontheimer 1991).

Energy and development

Energy is an essential component of a modern economy. A significant proportion of the global economy is dedicated to providing energy services in the form of cooking, heating, lighting, motors, appliances, and industrial processes. Nearly all available energy — fossil fuels, biomass, wind, and incoming radiation — can be traced to the sun or, as in the case of nuclear power, to the process of cosmic evolution that preceded the origin of the solar system. Smaller amounts of energy are derived from lunar motion (tidal power) or from the earth's core (geothermal power). Fossil fuels currently provide 78% of the energy consumed globally; renewable energy, including hydropower and biomass, account for 18%, and nuclear power provides 4% (Davis 1990).

Countries in the South depend largely on noncommercial energy. Therefore, their per-capita energy consumption is much lower than that of the North, which, however, uses two-thirds of the world's energy. Technological advances allow industrialized countries to employ more efficient means of energy consumption. Because of widespread inefficiency, developing countries require 40% more energy than developed ones to produce the same value of goods and services (Lenssen 1993). This gross inefficiency — of cement plants, light bulbs, vehicles, stoves, and so forth — offers untold opportunities to reduce the amount and cost of energy while expanding the services it provides (Wakhungu 1993).

In their efforts to improve the lives of people in the South, multilateral and bilateral energy planners have clung to a questionable assumption: a growing energy supply is requisite to raising standards of living. Because high energy use is a conspicuous trait of most developed countries, this assumption seems logical. In practice, however, the fallacy of equating energy consumption with economic performance has become more apparent. In the past 30 years, countries in the South have more than quadrupled their energy consumption. Yet the energy policies that have facilitated this growth have left these countries staggering from oil-price shocks, grappling with foreign debt, and suffering from environmental and health problems, while still facing severe energy shortages (Lenssen 1993).

A new model for energy use is needed. The emerging belief is that the links between energy, the environment, and social welfare are inextricable. Although energy is an integral component of development, increasing energy supplies (for example, through large-scale energy projects) does not guarantee improved social welfare. The energy services, not energy per se nor “techno-fixes,” satisfy people’s needs (Wakhungu 1993). Focusing on people, who must be empowered with know-how and access to resources, makes the issue of energy and development much more receptive to gender considerations.

Empirical knowledge about gender and energy issues

Substantive interest in gender and energy can be traced back to the fuelwood crisis during the 1970s in many countries in the South. Although a substantial body of research developed (see Cecelski 1992) and UN initiatives to explore women’s role in energy issues intensified, most of this work focused on fuelwood and stove programs. In the 1980s, energy-policy initiatives identified and described the critical role played by women in the household energy and forestry sectors. They portrayed women variously as:

- Victims of energy scarcity and related ecological problems, which were manifested by a decline in the standard of living of women and their families;
- Managers of energy and other natural resources in the household, agricultural, and small-industry sectors;
- Marginalized by development programs on the whole, including those related to energy, and having less access to credit, technology, education, land, and services; and
- Actors instrumental in developing innovative energy strategies, in taking remedial action, and in disseminating new ideas at all levels from global to local.

Cecelski’s (1992) literature review, in particular, is a stark reminder that the nuances involved in factoring gender into energy and development have yet to be fully understood. For example, research on the implications of S&T know-how, S&T advancements, and modern energy-sector policies on women’s livelihoods is urgently needed (Sontheimer 1991, pp. 83–84):

For example, shea butter is the major cooking oil used in many semi-arid areas of Africa. It is processed from

the nut of the tree *Butyrospermum parkii* by women who sell the surplus. The process, however, requires heating and prolonged whipping. Women have often requested labor- and energy-saving technologies for the job, but these have yet to be developed.

Nevertheless, the foundation for future initiatives that put S&T and gender issues on the energy agenda has been laid and has potential for helping to solve many of our current energy problems. Will women increasingly be able to participate in shaping our future energy agenda? How can organizations such as the UN be instrumental in facilitating this process? Women have contributions to make to energy policymaking at every level: R&D, implementation, and leadership in international forums.

Key policy themes and suggestions for future research

Although S&T are essential ingredients for innovation in energy, substantive efforts devoted to ameliorating women’s subordinate position in the energy policymaking arena by making

explicit use of S&T knowledge are minimal. Gender aspects of issues affecting innovation and diffusion within the energy sector are discussed here in relation to

- Education and training in energy resources management;
- Global energy policy;
- Small- and medium-scale enterprises; and
- Poverty and basic needs.

Regarding the first two themes, there are no exemplary models to evaluate per se, but suggestions for future research are highlighted. This oversight illustrates the lacuna between policies and substantive action, as well as the paucity of information on women's issues in the prevailing energy sector. The other two themes are well documented. Significant strides have been made in improving the basis for policy formulation as well as the nature of policies themselves. However, much remains to be done, especially mobilizing and integrating, more effectively, women's concerns in energy policy-making and planning and making more effective use of S&T to further this process.

Education and training in energy resources management

In the prevailing S&T model, energy is a highly technical field and, therefore, dominated by practitioners of the basic sciences, engineering, mathematics, and economics, as well as political scientists, sociologists, and lawyers. These areas, especially basic sciences, engineering, and mathematics, remain male bastions. For example, in the United States, only 16% of employed scientists and engineers are female. Despite efforts to redress this imbalance, worldwide attrition rates of women in the sciences and engineering — especially in physics, geology, and engineering — are high (Holloway 1993). This situation is compounded by the fact that male scientists have great difficulty understanding the obstacles that women must overcome to pursue careers in science, mathematics, and engineering (Lane 1994). As reported by Kammen and Lankford (1991):

In their commentary on solar cooking, Kammen and Lankford gave pride of place to the box-type-cooker. But this design suffers from several drawbacks. . . . [They] require that cooking be done in direct sunlight and during the middle of the day . . . [and] they lack storage facilities and have no provision for frying.

In a bid to overcome some of these problems, a cooker with fresnel lens was designed. A large fresnel lens is used to heat a container surrounded by an annular cavity filled with ammoniated salts of magnesium chloride and calcium chloride. Heat is stored chemically in these compounds and is released on demand at 300°C.

Another system that has storage but is less expensive than the above, uses heat pipes for parabolic as well as flat-plate collectors. In this arrangement, an evaporator with minimum shading effect is placed at the focus of the solar collector. The energy reaching the evaporator is conveyed rapidly to the condenser end of the heat pipe. The condenser, in the form of cooking chamber, is located in the shade or inside the kitchen. As the shaded cooking chamber is well insulated, pot losses associated with wind will not arise. This system uses energy from sunshine and will not allow reverse circulation losses, due to its diode-like operation. Because of the unique feature of isothermal operation of heat pipes, temperatures on a flat-plate collector equipped with a heat pipe will be forced to follow the temperatures in the condenser section. A. Jagadeesh,

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[K & L reply] Jagadeesh's letter is similar to several that we have received in response to our article. It describes technically sophisticated designs for solar cookers that will achieve higher temperatures than our simple box cooker. The question is whether they will be used or not.

Not only are the designs technically complex and rather expensive, but one of them uses magnesium chloride battery salts that could be harmful to livestock or children if the batteries were dumped or broken and the salts consumed.

We strongly support the notion that a diversity of solar and other renewable technology systems is necessary to support energy self-sufficient development, but we feel that Jagadeesh has missed the essential point concerning ovens. We have found that when the end-user (nearly always a woman) makes her own oven, her interest in using it is very high. If someone else makes and donates the oven or significant components, her interest is substantially less. For this reason we believe that until solar cooking equipment has become commonplace a design that can be made locally is essential for widespread acceptance of this technology.

Examples of the ramifications of male bias in the household-energy sector of developing countries are well known. They include:

- Designing stoves that were incompatible with end-users' (primarily women) needs;
- Disregarding women's knowledge about the properties of various fuels; and
- Assuming that energy efficiency was the predominant household concern.

Ramifications, if any, of male bias in the modern energy sector of various countries remain unexplored.

Neglect of appropriate education and training can seriously hinder energy-development efforts as well as undermine the full participation of women in the development process. Too often, women are perceived as not having the ability to apply relevant knowledge to their energy issues, and as lacking the negotiating skills that are essential for designing and implementing energy-policy reforms.

A host of documents recommend policy formulation in this domain. For example, *The Nairobi Forward-Looking Strategies* (UN 1985b) stated that women should be offered more opportunities and be encouraged to pursue studies in the sciences, engineering, and mathematics. It called for "the full and effective participation of women" in all decisions about and implementation of S&T.

However, the relevant knowledge and skills that women require to improve their effectiveness in energy-policy analysis have not been fully defined. In turn, it is difficult to devise curricula and design associated teaching materials without a clear view of training needs. The gap between discourse and action, in the energy context, is most evident here; efforts to educate women in the S&T of energy are few despite attempts by the UN and other international agencies to improve this situation.

The sole exception is the work of the International Research and Training Institute for the Advancement of Women (INSTRAW), which, in cooperation with Volunteers in Technical

Assistance (VITA), is implementing a project to “improve linkages between women and energy sector policies, programs and projects with special reference to new and renewable sources of energy.” Funded by the UN Development Programme’s (UNDP’s) Office for Project Services, the project seeks to

Develop a systematic approach to integrating women fully into the mainstream of energy planning and programming for energy development by demonstrating through pilot projects how women can be drawn into participating fully in these sectoral issues. The project will also contribute to redirecting, refocusing and orchestrating the imperfectly coordinated efforts existing in different ministries, departments and agencies to secure the more efficient involvement of women in energy programs and projects [INSTRAW mandate, para. 60].

The expected output for the first year of the project includes a situational analysis, draft methodological approach, framework and plan of operations for involving women more effectively in the energy sector activities, preparation of a national high-level consultative meeting and preparation of prototype training curricula [para. 62].

The major constraints to involving women more effectively at various levels in the energy sector, as indicated from the situational analysis for the two project countries, included lack of education, lack of participation or consultation of women in energy projects,

energy projects that did not target women, lack of information and training, lack of involvement of women [para. 65].

The few other initiatives, although worthy, emphasize women’s prominent role in the household energy and informal sectors. For example, the food technology source books developed by the UN Development Fund for Women give women instructions for labour-saving food technologies (see, for example, UNIFEM 1993b). The Intermediate Technology Development Group (ITDG) and the Stockholm Environment Institute (SEI) have developed instructional materials on a range of renewable energy technologies for a variety of sectors (Kristoferson and Bokalders 1991). The Economic Development Institute (EDI) of the World Bank conducts energy policy and planning seminars for senior staff (some of whom are women) of various energy agencies (Siddayao 1990). However, these do not highlight women per se.

Because energy issues affect virtually every sector of society, the scope for energy education and training programs is large. It covers universities, research institutes, technical training institutes, formal and informal programs for energy policymakers and planners, and activities designed to improve the general public’s understanding of energy issues (Unesco 1981). Research should focus on finding the pedagogical approach needed to equip women from all walks of life with the skills required to make informed energy choices. This entails expanding on INSTRAW’s initiative and monitoring the results of the pilot projects in Burkina Faso, Malawi, Mali, and Zambia.

Women must develop a better understanding of energy issues: where we are headed with current policies and where we ought to go. Globally, some difficult choices — forced by economic, political, and environmental considerations — will have to be made soon. Eventual solutions will rely on conservation (the cheapest alternative in the short run) and alternative energy supplies. Alternatives will include those currently in use, such as hydropower, but a greater role will be played by renewable sources such as the sun and wind. Many energy

resources must be used; research conducted by both men and women is needed so that the best options will be available when we need them. Areas where women's input is currently lacking include:

- Long-term energy planning, coordination of education among all sectors, and international cooperation to deal with problems of future supply and global ecology that stem from current practices;
- R&D on long-term energy alternatives: sunlight, wind, biomass, geothermal energy, fission breeder reactors, and fusion;
- Development of national and international standards for energy use in all sectors;
- Information concerning the state of the art in pertinent energy technologies;
- Increasing the energy efficiency of end-use technologies;
- R&D on alternatives to petroleum for transportation, for example, electric and hydrogen-powered vehicles; and
- Energy conservation for buildings, appliances, windows, and lighting.

How can women's participation in energy policymaking be expanded? If energy education and training for women were pursued, what form would this training take? How can gender considerations be represented in teaching methods? The following study areas are suggested.

Long-term education and training: Explore how long-term education and training for both men and women can be conducted by introducing energy considerations into the curricula of all relevant disciplines. It is worth investigating whether there is a niche for energy education throughout the schooling process, from primary and secondary schools to technical institutions and universities. Investigate how the training of teachers at each of these levels can be conducted, as well as the preparation of curricula and teaching materials dealing with energy. Energy issues can be presented as part of a complete picture (for example, from energy resources to technologies to power generation) and in the context of development.

In rural areas of developing countries, focusing on energy issues at the primary level may be particularly important as this may be the only formal education most girls receive. Moreover, attitudes about energy inculcated at this time could have a profound effect, not only on the students but also on their parents. This may enhance energy awareness in the general public (for example, of energy-efficiency techniques). Curricula might include the maintenance and repair of energy devices and adaptation of nonlocal designs to local needs and materials (Unesco 1981).

Short-term education and training: To disseminate the latest developments in energy, short courses for energy planners at all levels, teachers, civil servants, private-sector personnel, and extension agents have been developed in many countries (Unesco 1981). Research on updating course materials to include gender

considerations is warranted. At local, national, and international levels, priorities for research and action should be

- Assessing specific education and training needs and the capability of existing institutions to meet these needs;
- Establishing or strengthening formal and informal training programs for policymakers and energy-planning specialists, technical specialists, fieldworkers, extension workers, local administrators, and teachers;

- Establishing programs to promote and improve public understanding of energy, preferably within a broader program of understanding of the role of energy-resources development;
- Developing and distributing appropriate curricula and teaching materials to facilitate training; and
- Reviewing and, where appropriate, increasing scholarships and fellowships for in-country and foreign study and exchange of students and faculty.

Gender issues and global energy policy

Although a forum for articulating a uniform global energy policy does not exist, multilateral and bilateral policies have widespread effects on energy availability, environmental quality, and the social welfare of a cross-section of people — especially in developing countries (Cecelski 1992). To further compound the issue, energy planners at the international level have not paid much attention to the relations between gender roles, energy-resource management, and social welfare.

Increasing women's participation in energy policymaking is consistent with *Agenda 21's* (UN 1992a) call for engaging all relevant stakeholders, especially women, in the development process and in managing technological change. Yet women's substantive participation is minimal. For example, the UN has yet to fulfill its promise to promote women to fill 25% of its decision-making positions (Cecelski 1992).

What ramifications does energy decision-making at the global level have on local environments, women's livelihoods, and other marginalized groups in both the North and South? What mechanisms link these issues at the international level to the local level? Who makes these decisions?

These issues were the subject of an expert meeting *Women and Energy: New Directions for Policy Research* held in Dakar, Senegal, in January 1994 (IFIAS and IFAN 1994). The objective of the meeting

was to explore a phenomenon that has been given little attention: the critical analysis of global energy issues; the politics that shape these issues; and the political, social, and economic implications of these issues for women and for society as a whole. Another goal was to identify prime areas for future research (such as energy pricing and energy policy and planning) and to establish an informal network of researchers, organizations, and donors interested in furthering this agenda.

Some of the recommendations made by workshop participants include the following research:

- A review of existing regional mechanisms for energy policy in the Americas, Asia, and Africa;
- Including women in regional institutions concerned with S&T education;
- Including women in national institutions that make energy-policy decisions;
- Devising criteria for energy policymaking that incorporate the allocation of resources to benefit people rather than simply using financial and technological criteria;
- Promotion of S&T research grants for documentation of successful energy technology interventions; and
- Getting beyond the "stove" mentality concerning energy issues in Africa and Asia.

Outside the household energy sector in developing countries, little effort is made to correlate women's command of energy issues with the successful identification of women's needs and effective diffusion of new energy technologies. Therefore, it is unclear to what degree the absence of women energy planners impedes the resolution and identification of women's energy requirements. The increased representation of women will not automatically make energy organizations function differently. Research on the attitudes of professional women in energy-planning institutions is needed.

Gender-disaggregated information is also required on where women stand in relation to men regarding energy decision-making; how various energy policies affect women and men; and how women are affecting these energy policies. Can a cadre of women energy planners and policymakers bring a distinctive perspective to energy policymaking?

Small- and medium-sized enterprises

Women play a dominant role in many energy-intensive small- and medium-sized enterprises and home industries, especially in food and beverage processing (see also Marcelle and Jacob, this volume). Women's roles in the energy sector have been viewed almost exclusively in relation to domestic energy use. Relatively little research has been carried out on energy use in small- and medium-sized enterprises, generally, and even less on *women's* roles in productive energy uses (Gordon 1986; Carr and Sandhu 1987; de Treville 1987). For example, participants at the 1981 UN Conference on New and Renewable Sources of Energy adopted the *Nairobi Program of Action* (UN 1981), which recognized energy as a women's issue; however, the focus was primarily on subsistence uses.

Traditional biomass production, that is, collection and transport of firewood and charcoal production, and its sale are a major source of employment for women. In Fazoum, Egypt, 48% of women worked in minor forest industries of one kind or another. In Sierra Leone, 80% of urban fuelwood sellers are women. Some 250 000 women are employed in collecting forest products in Manipur, India (FAO 1991). In Gujarat, India, most of the income earned by women fuelwood carriers was used for buying food (FAO 1989).

Home-based industries often depend on biomass as a source of energy. These industries tend to be low paying and labour intensive; the work is tiring and sometimes dangerous to women's health. As much as 106 hours are required to process 30 kg of shea nuts. Preparing palm and other oils requires lifting and moving heavy containers of hot liquid. Women in industries using biomass as an energy source are exposed to burns and smoke, even more than the well-documented exposure of women using biomass as domestic fuel. Operators are exposed to smoke, other harmful emissions, furnace heat, and steam, often for long periods (RWEDP 1988).

The energy consumed by these industries, both in human labour and fuel, is not insignificant. An estimated 816 865 t of fuel-wood is consumed annually by hotels, restaurants, guest houses, and tea shops in Nepal, nearly half the total consumption by rural industries. In Mopti, Mali, fish processing uses 40 000 t of wood each year. In Abidjan, street food vendors, fish smokers, and restaurants were estimated to consume 60% of wood fuel and 26% of the charcoal used in the city. On average, small industries probably use 10–50% of fuel-wood in rural areas and about the same proportion in biomass-using urban areas.

Efforts to adapt traditional technologies or introduce imported ones are aimed at saving women's time and effort, releasing

labour for other uses, increasing incomes, increasing profits and yields, saving fuelwood and reducing deforestation, increasing safety, and improving health. Many activities carried out in small and medium-sized enterprises use a disproportionate amount of fuel. Most of the fuel is used by a relatively small number of entrepreneurs, many of whom are already members of organized groups, making dissemination and marketing of new techniques promising (Cecelski 1992).

However, inadequate needs assessment and lack of attention to local knowledge has frequently resulted in the transfer of "improved" technologies that are inferior to traditional methods. In Tanzania, for example, preparing flour from maize using an imported hand mill required several siftings and regrindings before the quality was deemed acceptable. Moreover, increasing efficiency usually implies larger-scale production and can easily result in the marginalization of women producers, who often work part time on a small scale, and transfer of control of the production process to male owners who can afford the necessary capital investment. In Indonesia, the government promoted the use of mechanized rice hullers; between 1970 and 1978, 90% of rice hulling was carried out using the new technology, but as many as 1.2 million jobs in Java alone and 7.7 million in all of Indonesia were lost as a result. The loss of income among women handpounders in Java amounted to US\$50 million annually, or 125 million woman-days of labour (Cecelski 1990a). In Ghana, a project was aimed at improving the efficiency of charcoal-making from sawmill residues. However, the small-scale itinerant producers were unable to secure land on which to establish fixed kilns, to invest in the new equipment, or to purchase the now more valuable residues. Although only about 300 charcoal-makers would have been affected, most were women (Cecelski 1990b).

Successful projects have paid careful attention not only to technical feasibility but also to factors outside the production process, such as access to raw materials (including land ownership and control over cash crops), access to credit, social and cultural context, management and organization, leadership, and marketing. Extending credit and assisting women's groups in other ways has been one of the most effective strategies to enable women to own and profit from larger-scale, more efficient processing technologies. The Food and Agriculture Organization of the United Nations (FAO) has tried to identify minor industries based on forest products that are economically viable, making them worth supporting and improving (FAO 1991).

Although research and project experience exists, gaps in many areas make setting a future research agenda critical. For

example, basic research on women's roles in energy-intensive, informal-sector enterprises is needed. We need to know more, not only about fuel consumption and scarcity and its effects on these enterprises, but also about women's roles in the profitability of enterprises and family income, constraints on improving productivity (such as access to credit and marketing), the organization of the sector, and the effects of the availability of street foods on diet, nutrition, and health (Cecelski 1990b).

Case studies of the choice and use of energy technologies are needed as examples of success and models for replication. These models could be disseminated through an extension of the food technologies source books, as proposed by UNIFEM. Donors supporting relevant small-

scale enterprise and energy projects could also identify and document their own cases, especially

- Case studies and models of energy technologies that have recently been disseminated, that is, new and renewable sources of energy (NRSE); and
- Case studies of the impact of technological change on women, in terms of use of time, productivity, and economic returns to labour before and after a technology has been introduced, in the same location, or with and without the technology in similar locations (Carr and Sandhu 1987).

Gender issues must be considered in ongoing efforts to develop shorter-term, less-expensive methods to evaluate impact, for use by development projects and agencies, and ways to include informal-sector and unpaid labour in national accounts.

Poverty and basic human needs

Energy is not only a basic need in itself, but is required for services, such as transport, industrialization, education, health, water, and communications, that release people from time- and energy-consuming tasks and allow them to turn to more productive activities. Women's role at the centre of the "rural energy crisis" — as users, producers, victims, and activists — as well as in meeting the family's basic needs has been well documented (Cecelski 1992). However, women are also pivotal in the urban energy situation.

Women have been portrayed as subsistence users of biomass energy in rural and urban stove-improvement programs. In the 1980s, with the realization that household chores, specifically cooking, consume the largest portion of total energy (especially biomass energy) in low-income, developing countries, women became the target group for achieving major fuel savings. Initially, however, many improved-stove programs failed, largely because of the tendency to seek universal "technical fixes" rather than analyzing local and national fuel use and supply conditions. Data were frequently based on the limited knowledge of men, and male engineers designed stoves without consulting the women who would have to use them. Many professional technologists found it difficult to elicit, acknowledge, use, or respect women's traditional knowledge and expertise regarding the properties of fuels, food preparation, stove construction, and community education — all so relevant for successful stove design and dissemination (Kammen and Lankford 1991; McGranahan and Kaijser 1993).

Women's role as collectors of fuelwood and other forest products has also been well documented, together, by extension, with their role as managers of trees and forest resources (FAO 1989):

Trees are important in rural economies largely as a result of the uses to which they are put by women. In many societies, it is women who must find and transport the fuelwood that their families need. It is often women, not men, who gather wild fruit and nuts, find fodder for their domestic stock, and make medicines and other products from woody materials. Women also earn what little cash income they have from activities that relate, directly or indirectly, to trees and forests. In many rural societies, a special relationship therefore exists between women, the family and trees. . . .

[Nonetheless,] this fact has been only rarely acknowledged in past development programs. As in other areas, too many projects have been unwittingly targeted at men with the result that women have sometimes not only failed to benefit from such projects but even been actively disadvantaged by them.

Women's roles in the modern, urban energy sector have received much less attention, despite their importance. First, energy pricing and availability policies (including those on new energy technologies, electrification, credit, and fuel subsidies) determine women's access to more efficient fuels and appliances, and hence a significant part of their time and budgets. Energy costs affect family budgets (accounting for as much as 20% in African cities) and can decrease the amount of money available for other items such as food and education. Women can provide valuable input into energy pricing policy: their preferences, real costs (including labour in searching for fuels, scarcities, and appliances) and real benefits to them as fuel users, and acceptable trade-offs (Cecelski 1992).

Women can also make an important contribution to energy-conservation policies, especially regarding household uses. There is a tendency to believe that women's role in energy use ends once traditional fuels are abandoned and more efficient commercial fuels are adopted. On the contrary, women still play a key role in energy use in modern and modernizing societies, and in particular can make a large contribution to the efficiency of energy use and conservation programs. Women do most of the cooking; have definite preferences for fuel and appliance designs; and purchase or influence the purchase of stoves and other energy-using appliances as well as the procurement of fuels. Women influence their households' direct and indirect energy consumption for heating and air conditioning, hot water, and electrical appliances; when energy is used (therefore, peak use); and household transport. Women are the primary educators and formers of their children's future consumption habits (Cecelski 1992).

Efforts to improve the efficiency of existing technologies (ranging from appropriate technologies, such as grain mills, to more efficient kerosene stoves, to the use of renewable energy) can reduce the drudgery of much of women's work and release time for more productive developmental tasks. For example, the displacement of women from their traditional subsistence responsibilities as men take over more distant fuelwood collection with animals or carts or invest in grain-grinding mills is not necessarily a negative development, if women's labour is reduced and they are able to pay for services that formerly took many hours to perform. Women's traditional knowledge must also be valued and women must be involved in the design, construction, and maintenance of new facilities and services (Sontheimer 1991).

At present, a number of new and renewable forms of energy are technically feasible, but are financially practical in only a limited number of remote or specialized uses (although inclusion of social and environmental costs would make them economically much more attractive). However, rising prices for fossil fuels will eventually make both renewable energies and energy efficiency improvements financially attractive. Questions of centralized versus decentralized application of renewable energy technologies will likely influence the extent to which benefits accrue to women (Cecelski 1992).

One of the most important issues in relation to women, energy, poverty, and basic needs is the increasing activism of local and national women's organizations, and how these efforts can be supported and promoted. Because of their strong interests and distinct perspective, women and their organizations have been active and effective in changing some energy policies.

When convinced of the utility and practicality of an energy technology or forestry scheme, women have constituted a powerful lobby to persuade the entire household or community to invest the necessary resources to make the scheme work. When convinced of the negative effects and threat to their livelihoods, on the other hand, women have been equally forceful in blocking supposed “improvements.”

Although sufficient research and project experience exists to make many recommendations possible, several gaps make setting a future research agenda critical. Considerable research and experience exists regarding improved stoves, social forestry, and food processing. However, there is still a lack of focused, gender-relevant case studies that can be used as examples and models. Even less research and project experience exists on energy conservation, renewable energy, and energy planning involving women; what is available needs to be documented. Such case studies could be disseminated through an extension of UNIFEM’s work in food technologies. Donors funding renewable energy projects could also identify and document their own cases.

Women’s less-recognized roles as energy producers, workers, managers, and activists should be better documented. Women’s roles in the wider context of changing rural and urban energy and food systems and relations between local, national, and global institutions and actors are also important subjects for research. In particular, the implications for women of the energy transition, NRSE, and global energy policies are largely unexplored.

Gender concerns must be incorporated into implementable, policy-oriented methods for energy policy research; research models that translate women’s priorities effectively into energy research methods should be promoted. Some promising areas are total transport demand, including human load carrying; consumer-focused product development and marketing; national accounts including informal sector and unpaid labour; social and environmental cost–benefit analysis; and participatory action research and socio-economic analysis to elicit local knowledge and participation.

The historical context

In 1979, the UN *Convention on the Elimination of All Forms of Discrimination Against Women* (UN 1979a) highlighted the need to enhance women’s condition in society by according them equal access in formal and informal education and S&T training; to elicit women’s knowledge and promote women’s roles in policymaking and implementation at all levels; and to enhance women’s living conditions by promoting the use of clean energy forms such as electricity. Although the conference on S&T for development (UN 1979b) did not deal substantively with energy (or natural resources for that matter), participants identified the disparate effects of S&T on different socio-economic groups, and on men and women. In addition, conference deliberations emphasized the urgent need to encourage women to pursue careers in S&T.

In May 1981, an international workshop on *Non-Technical Obstacles to the Use of New Energies in Developing Countries* was organized by the UN Educational, Scientific and Cultural Organisation (Unesco) in cooperation with the Center for Integrative Development, Le Commissariat à l’Énergie Solaire, the Commission of European Communities, the Commonwealth Science Council, the International Development Research Centre, the Rockefeller Foundation, United Nations University, and the United States Department of Energy. Participants recognized that the solution of technical problems alone was insufficient

to advance the development of new and renewable sources of energy. Discussions highlighted less tractable issues such as education and training, information, social and cultural conditioning, institutional structures, costs and financing, environmental impact, and other issues that affect the diffusion of innovations. Although the condition of women was not identified as a priority area, the importance of distinguishing among groups within the society was emphasized as requisite to facilitating the selection and adaptation of energy technologies to the specific needs of all people using them — men, women, urban, rural, poor, landlords (Unesco 1981).

In August 1981, the UN Conference on New and Renewable Sources of Energy adopted the *Nairobi Program of Action* (UN 1981), whose main objectives were to promote concerted action for the development and use of new and renewable sources to help meet future energy requirements especially in Southern countries. Women's concerns were articulated in this program of action in a more positive and integrated manner than in most previous UN documents. However, the focus was primarily on subsistence uses. As outlined in paragraph 13:

The successful achievement of the energy transition has direct implications for shelter, physical infrastructure, health, sanitation, nutrition and general well-being in rural and urban communities. . . . It should include, where appropriate, provisions to ensure adequate supplies of energy in case of acute shortage of energy for subsistence. The energy transition must include consideration of the social dimensions, including the role of women as agents in and beneficiaries of the process of development, in view of their special burdens as producers and users of energy, particularly in the rural areas.

The Nairobi Forward-Looking Strategies for the Advancement of Women (UN 1985b) included a section addressing energy (appendix A) and a paragraph on appropriate food-processing technologies and rural transport (para. 215). The energy section included references to “women as producers, users and managers of energy sources,” support to “grassroots participation of women in energy-needs assessment, technology and energy conservation, management and maintenance,” “substituting energy for muscle in the performance of the industrial and domestic work of women without loss of their jobs and tasks to men,” and in commercialization of fuelwood energy, avoiding “the loss of women's incomes to middlemen and urban industries.” There was mention at several points of the need for new energy sources to reduce women's labour demands (para. 219 and 221).

Recommendations concerning the involvement of women as both contributors and beneficiaries in energy measures and training, technology development and improved stoves and farm woodlots, and decision-making and implementation at all levels were also included. Governments and nongovernmental organizations (NGOs) were asked to provide women and women's organizations with information and incentives for training and education. Notably, there was no mention of health issues concerning women in the energy sector; little mention of forestry and environmental issues; and involvement of women in peaceful uses of nuclear energy is mentioned in several places.

In 1992, the UN Conference on the Environment and Development in Rio de Janeiro placed energy concerns mainly in the context of climate change and included a set of program areas as part of *Agenda 21* on protection of the atmosphere (UN 1992a). The major program areas are: promoting the energy transition, increasing energy efficiency, promoting renewable

energy sources, and promoting sustainable transport systems. The advancement of women is a cross-cutting issue in *Agenda 21*.

Chapter 24 of *Agenda 21*, “Global Action for Women and Towards Sustainable Development,” recommends “programmes to promote the reduction of the heavy workload of women and girl children at home and outside” through several measures, including “the provision of environmentally sound technologies which have been designed, developed and improved in consultation with women, accessible and clean water, an efficient fuel supply and adequate sanitation facilities” (UN 1992a, 24.3(d)).

The *Draft Platform for Action* of the Commission for the Status of Women (1994) does not highlight energy per se, but contains the following recommendations, which if implemented can serve to ameliorate women’s position in energy decision making:

- Training in S&T for women;
- Promotion of equal access to land, capital, technology, and so forth; and
- Enhancement of women’s position in managing natural resources.

Although worthy in principle, on the whole these UN initiatives and their attendant directives have been ineffective in advancing women’s position with respect to energy issues. Despite much debate reality has changed much less than rhetoric — the talk has come to little.