

**ENERGY, POVERTY AND GENDER IN RURAL
CHINA**

A REPORT FOR THE WORLD BANK

BY

THE INSTITUTE OF DEVELOPMENT STUDIES,

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TABLE OF CONTENT

| | |
|---|------------|
| PREFACE..... | v |
| ABBREVIATIONS & ACRONYMS..... | vii |
| UNITS OF MEASURE AND CURRENCY EQUIVALENTS | vii |
| EXECUTIVE SUMMARY..... | 9 |
| 1 INTRODUCTION | 15 |
| 2 ENERGY, POVERTY AND GENDER: AN OVERVIEW | 19 |
| 3 ENERGY SERVICES AND ENERGY POVERTY | 353 |
| 4 TOWARDS AN ANALYTICAL FRAMEWORK | 53 |
| 5 REPORT ON THE CHINA COUNTRY STUDY..... | 70 |
| 6 FINDINGS | 89 |
| 7 CONCLUSIONS..... | 113 |
| A1 TERMS OF REFERENCE..... | 116 |
| A2 THE LANGUAGE OF ENERGY SERVICES | 121 |
| A3 ENERGY AND SUSTAINABLE LIVELIHOODS TABLES:..... | 123 |
| A4 FIELDSTUDY MATERIALS..... | 132 |

Preface

This report was carried out under contract to the World Bank's ASTAE programme with funding from the Government of the Netherlands.

The project has taken place in three phases:

- First, a framework document was generated, which was used to develop plans and instruments for fieldwork.
- Second, field work was undertaken by multinational gender-balanced teams in two Chinese provinces;
- And third, the findings of the field work were summarised together with a revised version of the initial framework document.

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Comments on earlier stages of the work have been received from a panel of reviewers and these have been considered in the preparation of this final report, however any errors or omissions that remain are the responsibility of the main authors alone.

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Abbreviations & Acronyms

| | |
|-------|---|
| CRED | Center for Renewable Energy Development |
| CREIA | China Renewable Energy Industry Association |
| DFID | UK Department for International Development |
| ESMAP | UNDP/World Bank Energy Sector Management Assistance Programme |
| GEF | Global Environment Facility |
| IDS | Institute of Development Studies |
| PRSP | Poverty Reduction Strategy Paper |
| PV | Photovoltaic |
| SETC | State Economic and Trade Commission |

Units of Measure

| | |
|-------|---------------|
| 1 Mu | 0.07 hectares |
| 1 Jin | 0.5 Kg |

Currency Equivalents

| | |
|--------|---------------------|
| 1 Yuan | U.S. dollars \$0.12 |
|--------|---------------------|

Executive Summary

1. This study is part of a number of case studies to ‘identify the linkages between access to energy/electricity, poverty alleviation and gender equity’ in general, and in this report, specifically in China¹. More general conclusions are drawn about ‘the lessons learned which may improve the impact of projects of the World Bank and ASTAE on poverty alleviation and gender equity in China and possibly in other countries’².
2. The report takes as its starting point the empirical fact that women and children not only form the majority of the poor people in most communities in developing countries but they are universally the major users and suppliers of energy resources in marginalised communities. Women (together with their children) collect much of the biomass used by households, and women manage most of the energy used by poor households.
3. In the first part of the report framework is developed through which poverty, gender and energy can be viewed. In the second part, this framework is used to select and record empirical evidence on the nature of these linkages in the Peoples’ Republic of China. The field research was conceived as a series of case studies, using both qualitative and quantitative methods, in selected poor rural counties in two Chinese Provinces, Gansu and Hubei.
4. China is different (paragraphs 1.6 and following).
 - It has experienced massive economic growth over the last two decades, associated in part with an astonishing growth of “Township and Village Enterprises”
 - There has been a strong commitment to poverty reduction (in the traditional sense of reducing the number below the poverty line) with the result that there are institutions and ‘delivery mechanisms’ not available in many other developing countries.
 - Some 96% of villages and 94% of households are now said to be served by large or small grid systems, leading to a strong sense of “exclusion” for people who do not have access.
 - Great size – the small proportion of people who still rely on batteries or small diesel generators still represents some 77 million people in 30,000 villages
 - It is highly decentralised. Provincial and county governments are largely self-financing and have a great deal of autonomy. Central government often leads by example and persuasion - not by issuing detailed policy directives.

¹ The full text of the Terms of Reference can be found in Annex 1.

² Terms of Reference, See Annex I.

- While the study areas in Gansu and Hubei provide important insights into the relationship between energy, gender and poverty, both areas had suffered recently from drought
5. A number of analytical frameworks are considered for examining the links between energy, poverty and gender. Two of the most actively developed frameworks, the Sustainable Livelihoods approach and the Poverty Reduction Strategy Papers, exhibit considerable convergence. However both are under development, and do not yet deal with energy in an entirely satisfactory way.
 6. The report builds on these approaches and contributes insights that are specific to energy systems and recent changes in the institutional arrangements characterizing the energy sectors of developing countries.
 7. The insights gained from this exercise are related mainly to a *perspective* rather than some finite set of energy-poverty-gender linkages. There is unlikely to be a set of rules or fixed input-output relationships that provide a ‘magic bullet’ to ‘solve’ energy poverty. There is a new situation in which poverty reduction is seen as the main objective of development, while the agencies no longer consider huge ‘energy sector loans’ as part of their arsenal. The key to the new situation is an awareness among practitioners that energy interventions will have important role to play in all attempts to reduce poverty and improve the well being of both women and men.
 8. The analytical framework, and the associated empirical work, suggest
 - The sustainable livelihood approach worked well in generating a rich set of insights about the energy situation in Western China, and its gender dimension.
 - Multiple interactions and synergies between energy inputs and the other complementary inputs associated with poverty reduction. Energy provides a necessary but not sufficient (enabling) input, probably in the same way as other infrastructural services such as water supplies, education and health.
 - That there two important perspectives: what impact can energy interventions have on poverty and gender; and how can other poverty reduction interventions be improved by a more energy- sensitive approach?
 - A component of the newer, multi-dimensional view of poverty, will be the sense of exclusion of those people who do not have access to electric lighting and communications.
 9. The study confirms the methodological difficulties of establishing rigorous quantitative relationship between energy inputs and poverty/gender outputs at the project level. This is particularly so in the absence of time series data and the large volumes of data necessary for a general equilibrium approach. However there would appear to be clear and long standing ‘associations’ between energy the human well-being at the macro level of whole countries.
 10. The report confirms that

- the impact on poverty and gender relations of energy interventions are strongly affected by “complementary inputs” such that the “bundling” of a number of interventions, together with improved energy services appears to have more than proportionate effect.
- The choice of energy end-use technology plays a large part in determining, the nature, scale and distribution (between women and men) of energy interventions.
- The pattern of impacts of energy interventions are often complex, involving both direct and indirect linkages to the reduction of poverty of women and men.
- The vicious circle of energy poverty will often be broken only by combining improved energy services with end uses that generate cash income (3.10 and following)

11. Among the specifically gender related issues, the report notes:

- The considerable importance of disaggregated data (on needs, uses, technologies etc) because the different and unequal roles in the division of labour mean that women and men have different needs and priorities, and these are reflected in their different energy needs.
- The ‘productive’ and ‘reproductive’ aspects of women’s lives are matched by energy for production and energy of consumption(2.42)
- Given the importance in energy end-use in determining impact, women’s energy needs will not be met until they have a ‘Voice’ in determining options and priorities
- Similarly in order to improve women’s access to the energy services they need, programmes will need to address their unequal access to the necessary ‘livelihood assets’, including credit, extension and training (2.57)

12. The findings in China.

- Women are marginalized in the rural energy economy (6.39).
- The great importance of electric lighting for promoting social inclusion, well being and social capital in China. For example, the marriage-ability of rural men is significantly affected by lack of electricity (6.6). A general view was that the major impact of electricity on livelihoods arose from its capacity to reduce general workloads and lengthen the working day, thereby increasing the possibilities for diversification of activities. Electricity was used for smaller domestic equipment and viewed mainly as a consumption item. Its importance lay in its less tangible benefits, allowing women to do tasks in the evening, allowing children to do their homework and read and providing access to television.
- There were direct impacts of energy services on production: there was a clear correlation between powered production and transport equipment and living standards (6.56). Diesel was the primary fuel associated with production activities(6.17).

- Out migration was a major livelihood strategy. Improvements in women's access to improved energy services enabled men to migrate (6.13).
 - Richer (salaried) people obtain and then hire our end use devices at what appeared to be relatively low prices (6.57).
 - Attempts to introduce ad-hoc energy services, such as Photovoltaic home systems had failed (6.31). This was partly a function of remoteness, but more fundamentally because the delivery of spare parts and maintenance was not embedded in a proper system of 'intermediation'.
 - Energy services had numerous indirect impacts on poverty and gender. Perhaps the most important was the impact on vulnerability of energy for irrigation pumping. When the power was there vulnerability was reduced, but in some sense the unreliability of the energy supply to the irrigation system increased people's vulnerability(6.19, 6.34).
13. While only a small proportion of Chinese people are without access to modern energy services, the absolute numbers are large and are concentrated in the more remote areas. Remoteness increases the costs of all energy supply options, but not all options equally. Clearly those with low fuel transport costs are likely to be favoured (ie micro hydro, wind, biogas, PV etc). However the example of PV systems suggests that the distance related costs of installation maintenance and spare parts can be severe. Lack of integration with the external market, due to remoteness and lack of transport infrastructure, severely limits the range of income generating options (and technology supply options) necessary to break the cycle of energy poverty.
14. The Lessons learned for the World Bank and the ASTAE programme are listed in Chapter 7.

1

1 Introduction

- 1.1** The overall aim of this study was to ‘identify the linkages between access to energy/electricity, poverty alleviation and gender equity in general and specifically in China’³. It attempted to gather empirical evidence on the nature of these linkages, based on a framework developed in the first stage of the project and discussed in an initial report⁴. This final report builds on these two elements and draws out more general conclusions.
- 1.2** There was a time when it was taken for granted that ‘development’ required energy. Indeed the history of the European Industrial Revolution is inextricably linked with increasing access to more convenient and cheaper sources of energy, at times as a driver of change and at others as a constraint. But in our own times ‘energy’ has recently fallen off the agenda of main stream development thinking and action. For example, World Bank lending to the ‘energy’ (mainly electricity) sector has declined rapidly from being one of the largest programmes in the 1980’s to one of the smallest now. This is partly as a result of refocusing on sector reform, and partly on the related assumption that the private sector would provide the bulk of the finance to the sector. Many other financial institutions have adopted a similar approach.
- 1.3** This project addresses these issues: but not with the intention of raising the electricity sector to its ‘former glory’; but with the intention of understanding
- how poverty reduction strategies will be more effective if they are both energy- and gender-sensitive and
 - how particular energy interventions can be designed to have a large impact on poverty and gender.
- 1.4** The report takes as its starting point that women and children not only form the majority of the poor people in most communities in developing countries but they are the major users and suppliers of energy resources in marginalised

³ Terms Of Reference, March 22 2000. The full text is attached as Annex 1.

⁴ Barnett, Andrew et. al., August 2000, *The development of an analytical framework to review energy, poverty and gender*, research report to ASTAE, World Bank.

communities. Women (together with their children) collect much of the biomass used by households, and women manage most of the energy used by households.

- 1.5** The research problem is not so much to elaborate all the possible links between energy poverty and gender (as they are everywhere) but rather more to than to identify which are the most important and which are the pressure points for change.
- 1.6** The main purpose of the report is to develop a framework for thinking about these issues and then apply it to the circumstances that exist in Western China. As it is hoped that the results will be useful across a wide range of countries, it is important to stress at the outset that China is in many respects a very special case. It has experienced almost unprecedented economic growth in the last two decades. The number of those officially defined as poor declined from 260 million in 1978 to 50 million in 1997 (Chen and Ravallion, 2000), though there are very large numbers of people with levels of income and food production slightly greater than subsistence needs (Piazza and Liang 1998).
- 1.7** China has also undergone radical and far reaching economic and political reforms of a very specific character (Cannon, 2000). In particular, the relationships between different level of government, between government and productive enterprises and between government and households, have elements which often appear uniquely Chinese. This network of relationships, combined with the ubiquitous role of the Communist Party, has profound implications in term of the possibilities for policy innovations in all sectors, not least in energy.
- 1.8** In terms of the rural energy focus of this study, China can also be seen in some respects as radically different from the ‘typical’ developing country case. Mainly in consequence of the astonishing growth of “Township and Village Enterprises” (Wider, 1999) there has been a dramatic increase in rural energy supply and consumption. In particular, the expansion of rural electrification has lead to a situation in which some 96% of villages and 94% of households are now served by large or small grid systems. Thus the great majority of even poor households have access to grid electricity, though possibly (particularly for isolated grid systems) with capacity, reliability or quality constraints on potential applications in terms of production activities. One aim of the research will be to consider the extent of the benefits which have arisen from such access.
- 1.9** In these circumstances, lack of access to electricity has become an important indicator of exclusion from the increasing prosperity of the majority. Those villages with no grid connection are typically in the most remote and sparsely populated regions with the most difficult terrain. They also have limited access to roads, markets and other services. Not surprisingly they are among the poorest in China. This minority who have no access to electricity or rely on batteries or small diesel generators includes some 77 million people in 30,000 villages (Beijing Jikedian Renewable Energy Centre, 1999). Particular attention will be paid to such areas, and to those in similar locations who have been

provided with grid-access, for example by means of small scale generating plants, in considering the impact of the introduction of electricity on individuals, households and communities.

- 1.10** The field research was conceived as a series of case studies, using both qualitative and quantitative methods, in selected poor rural counties in two provinces, Gansu and Hubei.
- 1.11** This report will initially review current thinking on energy, poverty and gender in order to develop the framework and perspective that is used to view poverty, gender and energy in China. The second part of the report will then present the empirical findings by first describing the methodology used to select the study sites and conduct the fieldwork; second, describe the general background on the study areas (the provinces, the selected counties, townships and villages); and third present the main findings. In a final section more general conclusions will be drawn about ‘the lessons learned which may improve the impact of projects of the World Bank and ASTAE on poverty alleviation and gender equity in China and possibly in other countries’⁵.

[Henry to note that the TOR also ask us to “contribute to the development of a methodology for monitoring the impacts of energy projects]

⁵ Terms of Reference, See Annex I.

2

2 Energy, poverty and gender: an overview

2.1 This chapter will begin by considering why energy issues appear to have fallen so far down the development agenda in recent times. It will then examine some of the evidence, both at the macro-economic and project levels as to whether this decline was justified in terms of the current concern with poverty reduction. Finally, it will review the arguments for a detailed gendered analysis of the energy-poverty links and consider how such an analysis might contribute to the development of an analytical framework.

Energy and the current development agenda

2.2 From the 1950s until relatively recent times, increased energy production and consumption was accepted as integral to the development process. Economic growth was seen as the engine of development and it was taken for granted that growth in output implied growth in energy inputs. In particular, increased generation and distribution of electricity was regarded by many as an essential component of ‘modernisation’. In Bangladesh, for example, rural electrification was seen as so crucial that it was written into the constitution⁶.

2.3 The concern with energy issues was reflected in the considerable share of development assistance provided for energy projects, particularly to expand electricity generating capacity. During the Cold War period, donor funding of dams or other large scale generating plants had the major additional advantage of providing highly tangible symbols of strategic political alliances. The situation has now changed radically. Donor funding to the energy sector has declined substantially in recent years and the major international development debates in the post-Cold War environment seldom mention energy at all⁷. It can be argued

⁶ The Constitution Of The People's Republic Of Bangladesh, As modified up to 30th April, 1996, Clause 16.

⁷ The first draft of the World Bank's recent World Development Report on poverty has no mention of energy. Despite publishing a large amount of material on energy and development, and undertaking significant research on energy and poverty, this does not appear to be reflected in the core of the World Bank's business. Similarly the UK's Department for International Development is developing a new “Livelihood Approach” to development, but it contains no mention of energy, and their new “Target Strategy Papers” contain only passing references to energy. A glance at some of the leading develop

that the gradual shift in focus from growth to poverty reduction as the overriding development concern for donor agencies is a major explanatory factor for this decline.

Changing priorities

- 2.4** In the 1950s, when modernisation, which to many economists meant industrialisation, was the primary objective, the importance of the energy sector was almost self-evident. The gradual recognition in the following decade that agriculture was not a backward sector that could be ignored, but fundamental to growth in most countries, resulted in a shift of emphasis in terms of energy strategy but did not diminish its importance. Integrated rural development projects almost always included a major energy component, often in the form of rural electrification. Energy issues remained central to the growth agenda which was the primary policy focus. Poverty was mainly regarded as a human or social development issue, to be addressed through poverty alleviation projects implemented by ministries of labour or social development.
- 2.5** The ‘Redistribution-with-Growth’ paradigm of the early 1970s attempted to bring issues of income and wealth distribution into the debate around growth strategies. It argued that a more integrated approach to growth and public investment that included all sectors and a recognition of the distributional implications of alternative strategies, could achieve a synergy between growth and a more equitable distribution of benefits. In the late 1970s, poverty issues were more directly addressed by the ‘Basic Human Needs’ approach, which urged, often in language which mirrors current discussions, that ensuring an acceptable level of living to all members of society, including the poorest, should be the primary task of any government. Growth, it was asserted, should be seen as a means to achieve this objective, not as an end in itself.
- 2.6** Whatever the merits of these arguments, they were largely swept away in the 1980s with the debt crises and the resurgence of neo-liberalism. Economic growth was once again very much centre stage. Short run financial stabilisation and longer term structural adjustment policies dominated the agenda. Debates on poverty reduction mainly revolved around the possible consequences of stabilisation (particularly in terms of reduced public expenditures), the extent to which adjustment policies promoted growth, and whether that growth had a direct impact on poverty.
- 2.7** The 1990s brought a gradual acceptance that it was not sufficient, even in growth terms, to focus exclusively on economic issues. Many countries which appeared to have got the macro-economic fundamentals right, including those which had followed standard IMF prescriptions relating to public expenditure, deregulation, exchange rates and improving revenue collection, were not experiencing the expected returns in terms of growth rates. It was certainly

research institutions, such as the Institute of Development Studies and the Overseas Development Institute in the UK, or the ISS in the Hague shows that they do no work on any aspect of energy and development.

evident that the measures followed were not translating into poverty reduction. Multilateral donors were put under pressure to justify their existence and come up with a coherent aid strategy, particularly given the increasing evidence of the wastage of money on ineffective projects.

- 2.8** In recent years, there has also been a fundamental shift in the aid agenda in response to the end of the Cold War. Now that development assistance cannot be readily justified in terms of support for strategic alliances, the case has to be argued on other grounds. Basic humanitarian concerns are the most frequently cited. It is simply seen as intolerable that such a large proportion of the world's population lives in conditions of desperate poverty, lacking what would be regarded as the most essential elements of a reasonable life. This position is sometimes reinforced by reference to the implications of large scale poverty for social stability, particularly in terms of the costs of social instability and the potential effects of poverty-induced large scale migration. It is also possible to argue that there are considerable potential benefits for industrialised countries if developing country growth leads to an expanded global market in goods and services. Whatever the merits of these positions, they do not appear to have reversed the steady decline in aid funding experienced in the 1980s. All major donors reduced aid relative to their GNP between 1991 and 1997⁸, and total DAC aid declined by one-third.
- 2.9** The humanitarian argument naturally focuses attention on the needs of the poorest. The 1998 agreement on Core Indicators for the OECD Development Assistance Committee⁹, identified the key target indicator of economic well-being as 'Reduce extreme poverty by half'. The primary growth indicator, GNP per capita, was listed among 'other selected indicators of development'. The priority given to extreme poverty reduction creates a much more complex environment for discussion of the role of the energy sector. As suggested above, the link between energy and output growth or between electrification and modernisation needs little justification. But to argue that a specific energy intervention should be seen as a priority in terms of extreme poverty reduction, particularly given the more limited funds available, is a much more demanding undertaking.
- 2.10** Descriptions of poverty will typically focus on a lack of adequate food, clean water, shelter, basic education, health care, etc. While energy in one form or another will almost certainly be required as an input to the production of all these needs, the essentially intermediate nature of energy services, as with other infrastructure investments such as roads and communication systems, makes it extremely difficult to estimate the poverty reduction potential of a given energy sector investment. The complexities of the analysis have been compounded by increased concern with non-income dimensions of poverty and the focus on

⁸ World Bank, 1998, *Assessing Aid: What Works What Doesn't and Why*, Aid Effectiveness Research, Policy Research Report no 7, World Bank.

⁹ OECD Development Assistance Committee, 1998, <http://www.oecd.org/dac/indicators>

institutional issues which are central to the most recently developed frameworks for poverty analysis.

Energy, growth and poverty reduction

- 2.11** Notwithstanding the above, does the existing empirical evidence suggest that investment in energy services should retain a central role in poverty reduction strategies?

The Macro Picture

- 2.12** It has been established for many countries over many years that there is a strong empirical ‘association’ between Gross National Product and energy use. Typically for each additional percentage of GNP growth in “all market economies” there is a 0.85% growth of primary energy demand. In “developing market economies” the elasticity is likely to be one-to-one¹⁰. These relationships are not fixed by natural laws and it is clear (and of vital importance, given environmental trends) that energy efficiency could in principle be increased to allow growth in production without necessarily increasing energy demands. However, these relationships have proven remarkably stable. Breaks have frequently been mere temporary “blips”, for example those associated with the oil crises of 1973-4, and 1979.
- 2.13** In the poorest parts of the world the relationship between energy and output appears to be even more crucial. For instance it has been shown that for Indian agriculture in the 1980’s a one percent increase in agricultural output was associated with a 3.5% increase in the use of modern fuels¹¹. This is due to the fact that increases in agricultural productivity were associated with mechanised land preparation and harvesting, and the pumping of irrigation water. While increased access to improved energy supplies will not necessarily initiate rural development, a major element in agricultural growth is clearly associated with the replacement of “sweat intensive” human labour with more convenient and efficient sources of energy and the technology (often capital equipment) that enables more to be produced with less.
- 2.14** Similar ‘associations’ hold for the relationship between per capita energy consumption and changes in the Human Development Index (HDI). A recent example is by Professor Carlos Suarez¹². This shows a very strong association

¹⁰ World Energy Council, 2000, *Energy for Tomorrow’s World – Acting Now*, Atalink publications, London, page 30. WEC estimates of Primary Energy are about 15% higher than those of the International Energy Agency, as IEA data exclude all non commercial fuels while World Energy Council do not. The term ‘commercial energy’ is explained in Annex 2 below.

¹¹ Christopher Hurst and Andrew Barnett, *The Energy Dimension: A practical Guide to energy in rural development programmes*, Intermediate Technology Publications, London, 1990.

¹² Energy Needs for Sustainable Human Development by Carlos E. Suarez. In J. Goldemberg and T.B. Johansson, (Editors) *Energy As An Instrument for Socio-Economic Development*, United Nations Development Programme, New York, NY, 1995 Copyright © 1995, all rights reserved, by the United Nations Development Programme 1 United Nations Plaza, New York, NY, 10017, USA . Gerald Leach

between increasing commercial energy consumption and rises in the HDI.

- 2.15** However these ‘associations’ cannot be interpreted as showing that increasing energy consumption necessarily *causes* increases in well-being . It is likely that the direction of causation operates in both ways, namely that the richer people become the more commercial energy they consume, and the more energy they use the richer they can become. However, such research does highlight the extent to which use of energy services is intimately linked to other aspects of well being. It further suggests that while increased access to more convenient energy supplies may not be a sufficient condition for development, it may well be a necessary condition.
- 2.16** This is important because one central characteristic of the current poverty debate has been a move away from a focus on aggregate income measures. Current descriptions of poverty will typically focus on a lack of adequate food, clean water, shelter, basic education, health care, etc. While energy in one form or another will almost certainly be required as an input to the production of all these needs, the essentially intermediate nature of energy services, as with other infrastructure investments such as roads and communication systems, makes it extremely difficult to estimate the poverty reduction potential of a given energy sector investment. The complexities of the analysis have been compounded by the concern with non-income dimensions of poverty. Energy services have the potential to impact on almost every area of human activity from increased economic activity through improved child literacy and safer drinking water to lower rates of domestic violence. and the focus on institutional issues which are central to the most recently developed frameworks for poverty analysis.

The Micro Picture

- 2.17** At the micro level the relationship between energy and poverty becomes less clear. There seems general agreement that it is empirically difficult to attribute measurable poverty impacts to relatively small investments, such those associated with improving access to modern energy services. This is because in such cases there are a host of other factors, including climatic variation and macro economic change, that affect the measurable poverty status of particular communities over any particular time period. These large effects can swamp the effects of the planned intervention.
- 2.18** Similar problems arise in trying to “prove” the causal links between any small development project and overall reductions in poverty. It is even difficult to be certain of such links in the case of specific sectoral inputs, for example potable water supply on improved health status. However it can usually be asserted that there are strong underlying reasons to believe that such inputs are likely to produce positive benefits.

has argued strongly against the use of these “associations” on the grounds that they divert attention from the other major aspects of development including other infrastructural development, social and political development.

2.19 Ideally, some form of general equilibrium approach could be adopted that would track not only the first round impacts of a given energy intervention, but also the secondary and “nth round” effects, possible over a considerable number of years, such that macro-economic effects and other “causes” of increased well-being (such as rainfall) could be “normalised”. Such a general equilibrium approach would (potentially) be able to catch the various positive and negative effects as they “ripple” through the system. Relying on direct, and first round changes, can be very misleading. For example:

- The positive improvement in the productivity of an enterprise that gains access to (say) electricity (a first round effect), has to be matched with the displacement of labour and consequential reduction in incomes from the non-energy using enterprises that may become unprofitable in the new situation. (a second round effect). The mechanisation of agro-processing has certainly displaced women’s labour, and whether this is beneficial will depend on how different socio-economic groups of women view the situation and what else they do with their labour.
- Improved energy services to productive enterprises can raise the incomes of employees, and they in turn may then be able to afford better energy services in their own homes.
- Improved stoves may initially reduce the “cost” of using wood fuel (people need less wood to obtain the same amount of heat) leading to a rise in the use of wood fuel as woodfuel becomes cheaper than other fuels.
 - If biogas plants are introduced, this may well have benefits for the owner and their family. However they have been shown to increase the value of dung to the point that landowners prevent poor people (usually women) from collecting dung for their own use.
 - Increases in fuel availability (or reductions in its cost due to better distribution) can reduce the cost of transport, which both allows more of certain products into the village (at lower cost) thus reducing local consumption, while at the same time increasing the market for village products. The net effect may be uncertain.

2.20 However such general equilibrium approaches are very demanding, particularly in terms of the cross section and time series data that are required. Given the current state of knowledge, understanding of energy, poverty and gender linkages would probably benefit more from additional detailed qualitative studies, based on in-depth interviews with a modest number of key informants (in particular with men and women living in poor households), than from a further round of questionnaire based surveys.

2.21 Qualitative studies may be better suited to interpreting issues of causality, determining the sequence of events by which people gain increased income through access to improved energy services or access to improved energy services because they have increased income. The effectiveness of such an approach will depend on obtaining a clear idea of the range of possible interventions and their consequences, and comparing this, through sensitive and

skilled questioning, with people's perceptions of past experiences and future expectations.

- 2.22** Many studies were carried out in the 1970's and 1980's that looked at energy and development mainly in rural areas (where at the time most poor people lived). Initially these studies were concerned with electrification, and at the time this almost invariably involved extensions to the main electricity grid. Subsequently there was a growth in studies looking at the impact of domestic energy systems, primarily cooking fuel systems. Here the main concerns were on the impacts of deforestation. It was assumed (wrongly in both cases) either that the 'oil crises' experienced in the 'modern economies' in 1973-4 and 1979 would have a major impact on poor people, or that the use of fuel wood was the major cause of deforestation, and that this fuel source was being 'mined rather than harvested'.
- 2.23** Studies on the impact of electrification showed very mixed results. The schemes were often very costly (often using ludicrously inappropriate technical standards imported uncritically from snow prone areas of Europe and North America) and the benefits very often uncertain. A relatively recent summary of this type of work is the 1995 World Bank Operations Evaluation Department's report . This states that:

“All the evidence to date, including that from Bank-financed RE projects in Asia, shows that RE does not directly reduce poverty by helping the poorest rural people. Most of the direct benefits from rural electricity go to wealthier people.Once connected, the amount of electricity consumed, and therefore the benefits obtained, depend on the ability to buy electrical equipment, whether light fixtures, televisions, fans, water pumps, or motor-driven machines.... RE reduces rural poverty only through a general rise in rural income obtained by productive uses. And - again with the exception of irrigation pumping - these productive uses of electricity appear to come about only when other factors are already raising rural and national per capital income.”¹³

- 2.24** As a consequence of these and earlier findings of a similar kind, many donors stopped programmes of grid-based rural electrification, in part because the 'best' sites (those with the highest density of demand) had been dealt with, but also because they felt that such programmes were a bottomless pit of expense,

¹³ “One of the most persistent claims for RE is that it can induce industrial growth in otherwise lagging low-income rural economies. The evidence from developing countries does not support this claim; RE has not, by itself, triggered industrial growth or regional development..... The study found that where other prerequisites of sustained development were absent, demand for electricity for productive uses did not grow..... RE is economically justified only when the emerging uses of electricity are strong enough to ensure sufficient growth in demand to produce a reasonable economic rate of return on the investment. RE may be in a unique position to promote a paradigm shift in agricultural production, by making possible irrigation and associated modern technology and practices”, Rural Electrification: a hard look at costs and benefits, World Bank, OED, Précis number 90, dated 05/01/95

which frequently added to the insolvency of state run utilities¹⁴.

2.25 The use of biomass energy was largely ignored by energy analysts until the 1970's. This was in part because it was a largely non-monetised source of energy, involved the 'invisible labour' of women and children, and was not captured in conventional energy statistics produced by governments¹⁵. The early studies established that biomass fuel systems were often complex, involving multiple fuels and different appliances, and difficult to quantify, not least because of important seasonal variations. The margins of error in estimates of biomass energy use and the production often overlapped, making it difficult to determine just how sustainable the systems were. Gradually a clearer picture emerged in which sites of over consumption were identified, women and children were the main collectors and users, and that such fuels could inflict a huge burden on health of women and children. These issues are discussed further both in Annex 2 and in paragraph 3.22.

Energy Impact Mediated by Complementary Inputs

2.26 But the importance of these studies is that they showed *why* the impacts of energy projects were so variable at the micro level. It became clear that as energy is a derived demand the impacts (for example of electrification schemes) were likely to be a function of the '*complementary inputs*' that are associated with it¹⁶. For example the benefits of supplying electricity to water pumps is likely to be far greater if a system of irrigation channels is already in place than if it is not.

2.27 In recent years this idea of complementary inputs has been further developed by staff at the World Bank¹⁷. These studies found that the "bundling" of services

¹⁴ There are a number of notable exceptions. For instance NRECA has continued to provide support to rural electrification schemes, most successfully perhaps in Bangladesh. Similarly in the richer countries such as Chile and Thailand, grid extensions have continued to provide by far the most cost effective means of providing rural people with access to electricity. (see for instance Alejandro Jadresic, *A case study on subsidising rural electrification in Chile*, Chapter 9, ESMAP Energy and Development Report 2000: Energy Services for the World's Poor, World Bank, Washington, 2000, ISBN 0-8213-4705-5. There have been a number of other studies that showed that major impacts on poverty could *not* have been achieved without improved energy services. For instance in the evaluation of DFID's huge investment to up grade the Greater Power Distribution System it is stated that:

"The projects made a decisive contribution to a wide variety of benefits of different social groups. Where these benefits reached disadvantaged groups they were often fortuitous or indirect and had rarely been explicitly so targeted at the project's inception. The most dramatic indirect benefit has been the financial emancipation of thousands of women employed in the mushrooming garment factories in Dhaka. The lives of large numbers of poor people were also significantly improved by the use of very modest amounts of electricity for lighting, fans and (less so) even in cooking."

See http://www.dfid.gov.uk/public/what/evsums/asia/ev_s550.htm

¹⁵ The exception to this was often charcoal which was usually produced by men and sold for cash either as a primary source of employment or as a casual source of extra income.

¹⁶ Fluitman, Fred, 1983, The socio economic impact of rural electrification in developing countries: a review of experience, World Employment Programme Research Working Paper WEP2022/wp126, ILO.

¹⁷ Henry Peskin, Doung Barnes, Aleta Domdom, Virginia de Gui-Abiad *New Approaches to Evaluated Rural Electricity Projects*, Power Point Presentation at the World Bank, September 27th 2000 In the

like water, sanitation and education with electricity has disproportionate welfare benefits for local populations – the whole was substantially greater than the sum of the parts. In Peru, for example, the effect of bundling of a number of social services is said to be such that the impact of adding a fourth service for rural households is about seven times greater than the addition of the second service. In the Philippines, the combination of electricity with education similarly resulted in an increased impact on a family's earnings .

- 2.28** These findings suggest a most important conclusion: that the impact of poverty-reducing energy interventions will be a function of the existing complementary inputs (production equipment or other “livelihood assets”), and that if these inputs are not in place, then the impact will not be achieved unless additional investment is made.
- 2.29** It also suggests that, as no human activity is possible without the use of energy, **all** studies that purport to show an impact on poverty from one or more inputs (eg land reform, irrigation, micro-credit, women's education, agricultural improvement) are necessarily also affected by the use of energy (and probably many other inputs). Therefore a *prima facie* case can be made that these interventions owe at least part of their success to the presence of these energy services, *or* that they would have had a greater impact had they been associated with greater access to effective energy services.
- 2.30** This in turn means that there will be poverty benefits from considering how, and at what additional cost, improved access to energy services might “add value” in terms of poverty impact to other leading poverty reduction interventions. Or, to put it another way, the key “energy issues” relating to the development of any poverty reduction strategy are whether that strategy would be improved or worsened by adding an “energy perspective” to the diagnosis of the problem and whether the effectiveness of specific interventions would be enhanced significantly if they had access to improved energy services.
- 2.31** A large evaluation of the energy and development projects carried out by the European Union in its first 25 years of operation concluded that energy activities needed to be integrated into development projects and therefore agencies need to design administrative procedures to ensure that this happens¹⁸. It was suggested that it would be relatively easy to identify those development activities likely to have a significant energy dimension. These would include:
- those projects that use considerable inputs of inanimate energy (such as agricultural mechanisation, pumped irrigation, rural transport);

Philippines, the study finds that one year of education increases, on average, annual income by about 13 thousand pesos. However, this increase is augmented by an additional two thousand pesos if the household has electricity. .

¹⁸ This is described in Christopher Hurst and Andrew Barnett, *The Energy Dimension: a practical Guide to energy in rural development programmes*, Intermediate Technology Publications Ltd, London, ISBN 1-85339-074-7, page 14.

- those projects that are highly dependent on small but secure supplied of energy (medical supplies, telecommunications);
 - project that are known to have large indirect effects on local energy systems (land clearance, changes in land use, projects increasing the density of populations etc).
- 2.32** For these projects it was suggested that the people involved in designing such interventions should be required (through their terms of reference) to:
- examine how robust their suggested intervention was to changes in the cost or availability of energy supplies;
 - examine whether the value (or where appropriate the profitability) of the planned intervention could be increased by additional investments to improve or secure adequate energy supplies
 - examine whether the planned intervention was likely to have effects that would indirectly affect the local energy situation (page 17).

Energy, poverty and gender links

- 2.33** Women carry a disproportionate burden in terms of both of both poverty and energy systems in developing countries. There comes a point, therefore, when an un-gendered aggregate approach, whether at macro or project levels, hides more than it reveals. Analysis has to take account of the fact that there are substantial differences in the way women, men and children contribute to and are affected by energy systems.
- 2.34** To explore the theoretical and conceptual relationships between energy, poverty and gender two related sets of arguments can be distinguished: gender and poverty linkages, and gender and energy linkages. First, it is necessary to consider the relationship between poverty and gender. The following discussion provides a brief summary to current thinking.

Poverty and gender

- 2.35** Work on poverty has increasingly recognised that the social processes and trajectories by which people fall into poverty are differentiated by gender. That is, poor women and poor men do not necessarily become poor in the same ways through the same processes. They also have different capacities for accumulation. The impact of migration on poor rural areas is a particularly clear example of this in China. Migration is usually gendered. Whilst able bodied men may move to work in other rural or urban areas, women may be left as the majority of the population managing both food production and household based reproductive work. Remittances may or may not flow to individual households. In many rural areas, households are increasingly female headed, lacking in labour and other resources and prone to greater vulnerability from income fluctuation and shocks.
- 2.36** As a consequence of these differences, poor women and poor men may have different livelihood strategies. Thus, asset interventions that benefit poor men

do not necessarily benefit poor women. This is because women and men are positioned differently in relation to the *productive* and *reproductive*¹⁹ economies. This in turn affects their assets and entitlements.

- 2.37** Poor women (and often also girls) spend a disproportionate amount of their time on unpaid household and farming tasks. This time use pattern places gender specific limits on the capacity to accumulate resources through value added economic activity.
- 2.38** Intra-household relations tend to determine members' access to utilities and resources. Intra-household data may reveal hidden gender/age differentiated discrimination. For example, inheritance patterns mean that women's ability to act fully in relation to property may be less than that of men and is usually mediated through male kin. Intra-household decision making reflects this imbalance of resources. Men are more likely to take decisions on behalf of households and in terms of their own economic and social priorities.
- 2.39** Measures of poverty and well-being have tended to focus narrowly on income and basic needs. A fuller understanding of poverty should take into account the ways in which both women and men experience poverty. This means considering social autonomy, power and agency as dimensions of poverty reduction strategies and acknowledging gender differences in the capacity to exercise these.
- 2.40** There has been a tendency to equate men with production based needs and women with welfare based needs. A gendered analysis of poverty is not just concerned with welfare needs but also addresses women's as well as men's capacity to access productive resources.

Gender and energy

- 2.41** A second set of arguments links gender and energy. They focus particularly on the relationship between the sexual division of labour and the reliance of the poor on traditional energy sources.
- 2.42** Women and men, boys and girls are situated differently in the division of labour. Women generally work in both the *productive* and *reproductive* economies, bearing most of the reproductive tasks associated with child-rearing, food processing and cooking, care of the sick and management of the household's physical environment. Girls are more likely than boys to provide support in these tasks. The poorer the household, the greater the time, physical and health burdens associated with these tasks. The absence of basic labour saving and "clean" technologies such as fuel efficient stoves not only burdens poor women in these ways, it also has high opportunity costs, as it diminishes their capacity to undertake other productive activities. The disproportionate health impacts of traditional energy use on women, girls and young children is a further

¹⁹ The human resources and labour time required to enable households to reproduce themselves both intergenerationally and on a daily basis. In many households much of this burden is borne by female labour

consequence of the division of labour²⁰.

- 2.43** Women and girls also work in production, often as unpaid family labour in physically arduous and/or time consuming tasks such as food processing for local markets. The greater the degree of gender segregation in rural divisions of labour, the greater the association of women and girls with “traditional” low technology, low value added tasks using mainly human energy. A similar pattern is found in income generating activities. Gender inequalities mean that women generally have less access to productivity generating resources such as labour, collateral, credit facilities, information and training. These inequalities stem from household based discrimination (see above) and from broader societal and cultural constraints. For instance, women may need permission from senior men, there may be ideologies of appropriate and inappropriate roles for women, female literacy rates are often lower etc. Hence, their capacity to increase their labour productivity and improve their incomes is limited²¹.
- 2.44** The division of labour between “productive and reproductive tasks” has a strong parallel with energy use. Household requirements, such as cooking and lighting are commonly referred to as “energy for consumption”. But in practice there is often no clear distinction between production and consumption activities in poor households. It may well be, for instance, that lighting allows both men and women to undertake productive work for longer hours within the household, and that “cooking” might including the processing of food for sale.
- 2.45** Electric lighting appears to be particularly important for creating a sense of inclusion and well-being (see paragraphs 2.56 and 3.6). However the most important energy end uses in terms of directly contributing to a reduction in income poverty are likely to be those that enhance the major production activities, either by increasing productivity, extending the range of outputs or improving output quality (see paragraph 3.10). However, women’s employment can be threatened by the introduction of more efficient forms of energy (see paragraph 2.48).
- 2.46** Because of their different and unequal roles in the division of labour, women and men have different needs and may have different priorities. This means that they may make different trade-offs between time and energy. For example, Dutta found in her studies of biogas that women valued smoke reduction on health grounds and to reduce the drudgery entailed in cleaning smoky pots. Men, on the other hand, valued fuel savings above other considerations. “Community” level interventions need to take particular note of this. Communities are differentiated in a number of significant ways, including gender. It is important to look at who speaks for communities, how decision making takes place and whether the voices of minorities and women have been heard.

²⁰ See paragraph 2.55

²¹ Elizabeth Cecelski estimates that only 10% of Households will use household energy technologies for income generation, reviewers comments 16th February 2001. This is important to the arguments that follow.

- 2.47** The critical conclusion that emerges from combining the gender perspective with the energy perspective is that the *poverty impact of improvements in energy services is largely determined by the choice of end-use²² to which the energy is put, and by implication, by who chooses what the energy will be used for (and how it is obtained)²³*. Women are less likely to benefit from energy interventions unless they are involved in the choice of energy end-use technology and can capture the benefits of the improved energy service.
- 2.48** Even though this appears so self evident as to be almost trivial, it is surprising how little attention is given by analysts and policy makers to these choices. If energy services are directed to tasks that are traditionally considered in the woman's domain, (in many societies this will include agro-processing, textiles, pottery, soap making etc), or to new activities not yet dominated by men, it can have a considerable (targeted) impact on women's lives. However there are clearly are circumstances in which the introduction of improved energy services results in the task (and the surplus) being taken over by men. For example, in Bangladesh, the replacement of traditional paddy huskers operated by women, with small scale mechanised milling has displaced significant amounts of female employment. Men have largely taken the jobs in milling. This underlines the need to produce gender disaggregated analyses of energy related impacts on the poor.
- 2.49** But perhaps equally important, in the case of electricity, even the impact upon people in unconnected households can be greatly affected by the choice of energy end-uses. For example, it has been suggested that the addition of one type of mill (eg for chilli) can produce more benefits to an excluded group (a group of women) than say the addition of a battery charging station. Furthermore unconnected households have been shown to benefit from access to TV²⁴. In one case it was found that the advent of television had a significant cultural impact in that women said that they could see that they "don't have to remain as second class citizens"²⁵.

²² The choice of energy-end use will also often determine the type of energy and conversion technology required.

²³ This was shown in *Social Impacts of Electrification: Micro Hydro in Gandruk, Nepal*, by Joshua Thumin, MSc Thesis, 1999, Imperial College London. In this case only one quarter of the households were electrified, with the richer households consuming more power than the poorer ones. Thirty households were interviewed (of which some 30% of the interviews were with women). The data are not disaggregated by gender.

²⁴ This is illustrated in a path-breaking piece of research on the gender related impact of micro hydro which was carried out in Sri Lanka in the mid 1990's. Kiran Dhanapala, 1995, *Report on the Gender Related Impact of Micro Hydro technology at the Village Level*, Intermediate Technology Development Group, Study Report Number 2, 59 pages. The benefits of the schemes were largely at the household level (lighting, TV and battery charging) for connected households, but unconnected households benefited by access to TV and the possibility of hiring lights for special occasions. See also S Khennas and A Barnett *A Synthesis of Best Practices for Micro Hydro Electrification Programmes in developing countries*, for The Department for International Development, UK and The World Bank, ESMAP Technical Paper 006, August 2000.

²⁵ The study by Thumin (footnote 23).

Elements of the energy/gender framework

- 2.50** Until relatively recently, energy issues have not had much attention from gender analysts. This has begun to change. There have recently been a number of energy studies taking gender as a significant variable, and in the last year at least two important conceptual and synthesising papers have appeared, which provide an excellent basis both for further empirical investigation and for the development of a analytical framework²⁶. Their approaches are summarised and commented on here.
- 2.51** Cecelski provides a comprehensive review of current thinking in the field. Her approach is characterised by a concern with broadening out the relationship between poverty and energy to encompass recent thinking on poverty reduction. She challenges the technocratic, infrastructure focused approach to thinking about energy and poverty and asks what it means to introduce concepts such as empowerment and security to the energy-poverty question. This is highly relevant to thinking about gender in relation to energy. Many of the issues which surface are ones connected to access to and control of technologies within households, communities etc., rather than about technologies per se. This is a reiteration of findings from other studies of gender and technology. Technologies are rarely gender neutral: because of the sexual division of labour, women and men have different relationships to a given technology and therefore derive different utilities from it.
- 2.52** Cecelski notes that the main focus in the gender and energy literature so far has been on poor rural women, wood energy, and the micro-economic/project level. In the context of rural electrification schemes, she picks out four key issues which are central to a gender and poverty analysis.
- 2.53** *Data needs and analysis* - disaggregation of energy use, supply and impacts by gender as a basis for applying methods and tools for incorporating gender in project design and implementation. As she points out, lack of data ties in with the absence of a gender perspective in macro level energy policies. A particular area of relevance is the pricing of fuels which are also used for cooking. Gender disaggregation of any data collected is thus a first, essential step in understanding the connections between gender and energy. A further implication lies in the kinds of methodologies which are needed for this. Particularly for information on demand side use and needs, a range of methods will be appropriate. This will include qualitative forms of enquiry which can elicit information on e.g. how hierarchies and relationships within households

²⁶ See for instance the work of Energia (<http://www.energia.org/>), papers by Elizabeth Cecelski (eg *Enabling Equitable Access To Rural Electrification: Current Thinking And Major Activities In Energy, Poverty And Gender*, 7 Feb. 2000, Briefing Paper prepared for a Brainstorming Meeting on Asia Alternative Energy Policy and Project Development Support: Emphasis on Poverty Alleviation and Women Asia Alternative Energy Unit The World Bank, Washington, DC 26-27 January 2000), and *Gender and Energy: How is Gender Relevant to Sustainable Energy Policies?* May 2000 UNDP Bureau For Development Policy Sustainable Energy And Environment Division Energy And Atmosphere Programme. Contact Michael Pedersen at (212) 906-5569 michael.pedersen@undp.org or Gail Karlsson (212) 267-4239 gail.karlsson@undp.org.

affect access to technologies.

2.54 *Wood energy, cooking and health* - seeking integrated approaches and solutions (including fossil fuels and electricity) that recognise the importance of these. In poor rural areas, cooking is usually the most intensive use of inanimate energy by women, often requiring long hours in fuel wood collection as well as the cooking process itself. High levels of use of traditional fuels can contribute to environmental problems and is a leading cause of respiratory infections and early deaths among women and children. The poorer the household the greater the use of these fuels. Actions to reduce this reliance would have a major impact on the health of poor rural women and children.

2.55 It has taken the world a long time to realise just how much the smoke that results from cooking with solid fuel (often woody biomass) kills people and produces life long health problems. Careful and persistent work by Professor Kirk Smith and other researchers over the past thirty years has quantified the causes and scale of the problem. A recent example of his work suggests that cooking with solid fuel (mainly woody biomass) is the third largest cause of death and disease in solid fuel using households in developing countries.

“Acute respiratory infections in children under five years of age are the largest single category of deaths [and disease] from indoor air pollution, apparently being responsible for about 1.2 million premature deaths annually in the early 1990s”²⁷.

2.56 *Women’s specific electricity needs* - in water pumping, agricultural processing, security, work productivity and health. Women and men use electricity differently. They may also have conflicting priorities (for instance, productivity related uses of electricity taking precedence over domestic uses, or the siting of light fittings inside a house). But energy policy needs also to recognise women’s specific time and labour needs to enable them to make more effective trade-offs between their domestic and income generating activities. Women also have greater needs for certain kinds of community based energy resources such as street lighting, which improves security. Also, at a community level, women are the most affected by the potentially health enhancing effects of water purification, refrigeration, etc. as they tend to be the main informal carers. While the emphasis here is on electricity, women’s energy needs should be looked at as a whole. This is particularly and obviously the case with food processing technologies and cooking. However women have important energy requirements related to transport where women are restricted in their use particular forms of transport (not using bicycles, or being required to travel only

²⁷ ²⁷ See *The Burden of Disease from Indoor Air Pollution in Developing Countries: Comparison of Estimates* by Kirk R. Smith and Sumi Mehta, Environmental Health Sciences, University of California Berkeley, CA 94720-7360, Prepared for the USAID/WHO Global Technical Consultation on The Health Impacts of Indoor Air Pollution and Household Energy in Developing Countries May 3-4, 2000 Washington, DC. See also Smith KR, Corvalan C, and Kjellstrom T. "How Much Global Ill-Health is Attributable to Environmental Factors," *Epidemiology*, in press, 1999.

in closed taxis).

2.57 *Equal access to credit, extension and training* - to assure energy supplies for women's domestic tasks and micro-enterprise needs. Poor women have particular difficulties in gaining access to these resources. Credit is already on the agenda for improving access to energy in poor rural areas, but gender differences in access must also be addressed. This needs to take into account both women's domestic and income generating activities. The experience from micro-credit schemes geared particularly to women users is relevant. However, caution is needed on the extent to which credit alone can greatly improve access by the poor and women without other supporting poverty reducing measures.

2.58 Other gender related access issues which need to be considered are:

- The modalities and timing of any payments. The poor, and especially women, tend to have irregular income flows.
- The potential for "overloading" micro-credit with yet another demand on limited resources.
- Household level decision making and entitlements. Women are often not able to make decisions independently, needing to consult with and defer to male household members
- Community level demands and who voices them. A number of studies point to the absence of women's voices and concerns, in community consultations on energy use and resources.

2.59 The UNDP "Energy and Atmosphere Programme" derives its remit from the 1992 UN Conference on Environment and Development. It is particularly concerned with the balance to be struck in the "trade-off triangle" between economic growth, social equity and environmental protection. Their "Initiative for Sustainable Energy" regards energy as a means of achieving its key human development goals, including gender equality. The Programme co-ordinates a project on "Energy and Women: Generating Opportunities for Development" which is concerned with the linkages between sustainable energy and improving women's situation in the three areas identified as of particular relevance: time, health and income generating activities. The project has an African focus and supports sustainable energy pilot projects to create income generating opportunities and other benefits for women. They have produced a briefing paper called "Gender and Energy: How is Gender Relevant to Sustainable Energy Policies?"²⁸. This paper makes the following additional key points.

2.60 Women and girls bear heavy time and physical labour burdens acquiring traditional fuels such as wood. These burdens are not accounted for in calculating national energy needs and expenditures. (It could also be added that this burden of unpaid labour, which is highest amongst the very poor, is not

²⁸ *Gender and Energy: How is Gender Relevant to Sustainable Energy Policies?* May 2000 UNDP Bureau For Development Policy Sustainable Energy And Environment Division Energy And Atmosphere Programme. Contact Michael Pedersen at (212) 906-5569 michael.pedersen@undp.org or Gail Karlsson (212) 267-4239 gail.karlsson@undp.org.

accounted for in national productivity and employment statistics, thereby making it appear a “free” good – see Annex A2 The language of energy services) Furthermore, this low value added activity reduces time for higher value added tasks and for important social investments such as education.

- 2.61** Women are “traditional energy managers” and can play a major role in the adoption of less polluting fuels and technologies, particularly renewable energy resources such as small hydro-power, wind and solar power. This argument resonates with some current environmental discourses which see women as guardians or conservators of the environment (e.g. Shiva). This association between energy and the environment is taken up further below (paragraph 3.22).
- 2.62** Women have been largely excluded from participation in energy policy and in processes of decision making. They lack access, or equivalent access to men, to the resources needed for economic or political participation. Yet they are key stakeholders in producing sustainable, equitable development policies. There is a need for gender specific data to inform policy on gender, poverty and energy linkages. Women also need to be included in the design of energy interventions. Evaluations of solar cooker projects in poor countries have found that successful projects have been ones where women users were involved in the design stage.

Gender-poverty-energy links: some reflections

- 2.63** Both of the above papers break new ground in spelling out the links between gender, poverty and energy. They make a major contribution to thinking through the methodological needs for better informed energy policy. Cecelski focuses more on the gender aspects of the micro economic determinants of access and their link to macro-economic policy. The UNDP paper places stronger emphasis on environmental links. In keeping with its mandate on gender equity it also flags more centrally the importance of enabling women’s voices to be heard in data collection, consultation and programme design.
- 2.64** Both papers focus centrally on women’s relationship to energy/electrification. This is not altogether surprising, as evidence is emerging that poor women in particular experience specific disadvantages, such as their high degree of reliance on inefficient, human energy intensive and health harming energy technologies. A focus particularly on the lives of individual poor rural women brings dramatically into vision the drain on women’s time, energy and health of lack of access to such a key resource. An approach centred on individual women and their burdens, however, does also have some limitations.
- 2.65** What is apparent from the literature is the essentially synergistic (complementary) nature of energy interventions with other interventions in successful poverty reduction strategies. Concentrating on one element or one technology is insufficient in evaluating the impact of programmes to improve energy access. A parallel argument applies in assessing gender impacts. Taking gender into account means adopting a relational approach as well as focusing on women as a specifically affected group. This is important in two particular respects.

- 2.66** First, it is useful to disaggregate possible direct and indirect gender benefits mentioned earlier, . Some interventions, such as fuel efficient cooking stoves, may directly benefit women and their households. Others may have an indirect benefit. For instance, interventions to improve infrastructure may benefit children's education, the health of household members (such as through cold chain improvements), or provide greater household income security. Any of these may have knock-on benefits for women, even though they are not the direct beneficiaries.
- 2.67** Second, improvements in the lives of poor people will always involve trade-offs. While women and men may have different perspectives and priorities, they also have common interests, particularly in relation to longer term survival and well-being strategies. A gendered approach needs also to take this into account. For example circumstances may arise where there are conflicting priorities in energy use or acquisition. An obvious case would be the possible introduction of technologies which enable men to gain more income but place a higher workload on women. In China it seems likely that improved energy services have 'released' men from the heavier work and enabled them to migrate, as more previously human energy consuming tasks can be performed by women. It is important to uncover these effects and their potential implications for poverty reduction. At the same time, judgements about the desirability or otherwise of these tradeoffs, cannot be made by researchers. That is a matter for those making them.

3

3 Energy services and energy poverty

- 3.1** This chapter illustrates the pervasiveness of energy in the lives of poor women and men by considering the standard list of ‘energy services’ and the fuels that are used by different income groups to obtain these services. This provides a first step in the process of understanding the pathways by which increased access to energy services can contribute to poverty reduction and sustainable livelihoods. It also offers an initial insight into the gender dimension by indicating the energy inputs associated with particularly gendered activities. The concept of ‘energy poverty’ is introduced and linked to the notions of ‘vicious’ and ‘virtuous’ circles linking energy services and poverty. The special issues associated with provision of energy services to remote areas and the environmental concerns relating to reducing energy poverty are then addressed. Finally, the chapter considers recent development in the debate around energy supply systems.
- 3.2** As will become clear through the discussion which follows, the benefits deriving from energy services are often diverse and complex. They range from the direct benefits of contributing to increased *production* and reducing ‘sweat energy’, through the contribution that energy can make to health and *human capital*, for example in terms of pumping water or provision of lighting and other services to health facilities²⁹ and schools, through to more intangible benefits of “*security*” (via street lighting, back-up energy supplies, or pumped water reducing risks from drought) to a sense of ‘*inclusion*’ in the modern economy (via communications media).

²⁹ The difficulty of measuring the impact of improved energy service on health facilities is noted by GTZ who suggest that “To really measure the impact, these different preconditions have to be taken into account. Some suggestions to precisely define possible impacts [are]:

- Better working conditions due to electricity lead to more motivated medical personnel
- Better diagnostic possibilities lead to better medical treatment
- Better hygienic conditions from hot water and sterilization lead to a reduction of infections

Comments provided to EnPoGen by GTZ in 20.04.01

Typical end uses by energy source in developing countries³⁰

| | Income Level | | |
|-----------------------------------|----------------------------|--|--|
| | <i>Low</i> | <i>Medium</i> | <i>High</i> |
| Household | | | |
| Cooking | wood, residues and dung | wood, charcoal, residues, dung, kerosene, biogas | wood, charcoal, kerosene, LPG, coal |
| Lighting | candles, kerosene, none | candles, kerosene | kerosene, electricity |
| Space heating | wood, residues, dung, none | wood, residues, dung | wood, residues, dung, coal |
| Other appliances radio/television | None | grid electricity and batteries | grid electricity and batteries |
| Space cooling and Refrigeration | None | Electricity (fans) | Electricity, kerosene, LPG |
| Agriculture | | | |
| Tilling | human labour | draft Animals | animal, gasoline, diesel, |
| Irrigation | human labour | draft Animals | diesel, grid electricity |
| Processing | human labour | draft Animals | diesel, grid electricity |
| Industry | | | |
| Milling/mechanical | human labour | human labour, draft animals | grid electricity, diesel, gasoline |
| Process heat | wood, residues | coal, charcoal, wood and residues | coal, charcoal, wood, kerosene, residues |
| Cooling/Refrigeration | none | none | grid electricity LPG, kerosene |
| Services | | | |
| Transport | human labour | draft animals | diesel, gasoline |
| Telephone | none | Batteries | grid electricity |

Energy Efficiency and the Idea of “Energy Services”

3.3 A wide range of devices convert these primary sources of energy into the various ‘services’. The use of energy entails its conversion from one form to another and this always has a cost (both in terms of conversion processes, such as engines, and in terms of efficiency losses). The cost of “useful energy” can be quite different from the cost of the “primary energy” or fuel. Therefore energy specialists increasingly refer to the provision of energy services rather than merely the supply of energy (energy service plus energy supply/fuel plus conversion equipment). Energy conversion efficiencies are illustrated in the

³⁰ Based on World Bank, 1996, *Rural Energy and Development*, World Bank Publication, page 25

following table. This shows in particular how much more efficient electricity is for lighting than candles and kerosene, and how much more efficient gas is for cooking than wood.

Relative energy conversion efficiencies (typical values)³¹

| Cooking | | Lighting | | Appliances | |
|----------------------|-------------------|----------------------|----------------------------|----------------------|-------------------|
| <i>Energy Source</i> | <i>Efficiency</i> | <i>Energy Source</i> | <i>Luminous Efficiency</i> | <i>Energy Source</i> | <i>Efficiency</i> |
| electricity | 1.00 | electricity | 1.00 | grid electricity | 1.00 |
| propane | 0.77 | candles | 0.02 | dry cell battery | 0.90 |
| fuelwood | 0.15 | kerosene | 0.01 | car batteries | 0.90 |

3.4 If these data are combined with typical energy price data (in this case from Guatemala), the impact on people's lives becomes even more stark. The next table shows that nominally high cost fuels such as LPG (propane) can be as cheap as fuel wood when providing the energy service of cooking. It can also be seen why people have a very strong desire to switch from kerosene to electricity for lighting. There is also a strong motivation for people to switch from solid to liquid or gaseous fuels³². The replacement of traditional sources of energy with commercialised fuels of increasing efficiency is known as the *energy transition*. The balance between the various sources of primary energy has changed for all countries as their economies developed. In Europe the transition has been from wind and water, to coal and steam, through to oil and gas. This transition has a parallel (and is in part caused by) changes at the level of individual energy users. For, as people acquire more assets, they move up the energy ladder to more efficient or more convenient energy sources, while at the same time moving up to end use technologies that better suit their needs.

³¹ Based on Vivien Foster, World Bank, *Measuring The Impact of Energy Interventions on the Poor*, paper to conference in London June 2000

³² Comparable data for kerosene as a cooking fuel was not included in the original table..

The cost of Useful Energy (excluding appliance costs)³³

| | <i>Gross Cost (\$/ kWh)</i> | <i>Cost of useful energy (\$/kWh)</i> |
|-------------------------|-----------------------------|---------------------------------------|
| Fuelwood | 0.01 | 0.06 |
| Propane | 0.05 | 0.06 |
| Electricity | 0.08 | 0.08 |
| Dry Cell Batteries | 0.59 | 0.53 |
| Car Batteries | 2.57 | 2.31 |
| Kerosene [for lighting] | 0.05 | 5.87 |
| Candles | 0.26 | 13.00 |

Multiple Fuels and Many Appliances

3.5 It is important to note that as people become richer and proceed through the ‘energy transition’ the introduce new, more convenient and efficient sources of energy into their lives, they may well continue using the traditional energy sources as well. This is in part for cultural reasons (for example the taste of food cooked on a particular fuel) and in part to minimise the risk of interruption in supply (for example back-up diesel generator to cover the risk of cuts in power from the electricity grid). This multiple fuel use means that the impact of fuel switching and efficiency improvements is often not as dramatic as more simplistic models and policies might predict. This is perhaps at its most extreme with cooking, where households may graduate to LPG but women still use wood and charcoal to cook certain types of food (note that the relatively rich also behave in this way, continuing to cook with charcoal over “primitive” stoves in their gardens despite having lavishly equipped kitchens - though in this case cooking often becomes a predominately male task). Even very poor households may retain a variety of options to reduce the costs or risks associated with a particular fuel/technology system. For example, in poor rural China it is not difficult to find households with a solar cooker, biogas ring, and both coal and residue burning stoves.

The Unique Attractiveness of Electricity

3.6 The energy transition is also driven by the fact that each end-use needs to be matched by an appropriate energy source. Electricity is not only by far the most efficient source of lighting, but it is also frequently the *only* energy source that can drive many “modern” technologies such as telecommunication, radio (clock work radios remain expensive) and television. People really want electricity for lighting and will go to extra-ordinary lengths (and expenditures) to get it³⁴. This

³³ Such figures are available from many sources, these are taken from Vivien Foster, World Bank, *Measuring The Impact of Energy Interventions on the Poor*, paper to conference in London June 2000

³⁴ While the capital cost of dry cell (torch) batteries may not be very high, they represent a very expensive way of buying electricity - in terms of energy supplied, such electricity probably costs more than \$400 per kWh!. see *Solar Battery Charging Stations: An Analysis of Viability and Best Practices*, A Report

contributes strongly to the equation of electricity with “modernisation” and frequently results in voters asking for, and politicians promising, electricity connection.

- 3.7** However, it is important to recognise that there is great diversity in the nature of electricity supply technologies. For example, batteries and photovoltaics which can produce very small amounts of electricity, cannot be used to supply the “electrical power” required by modern machinery, refrigerators, heaters or ovens. All too often the word “energy” is interpreted by policy makers as “electricity”. Providing poor people with access to tiny amounts of electricity may improve their lives, sometimes significantly, but it will not meet their “energy” needs for cooking, motive power, heating and cooling. Conventional modern forms of energy (predominantly from fossil fuels) will remain the *fuel of first choice* for most poor people for many years to come, while biomass fuels will remain the main *fuel of necessity*.

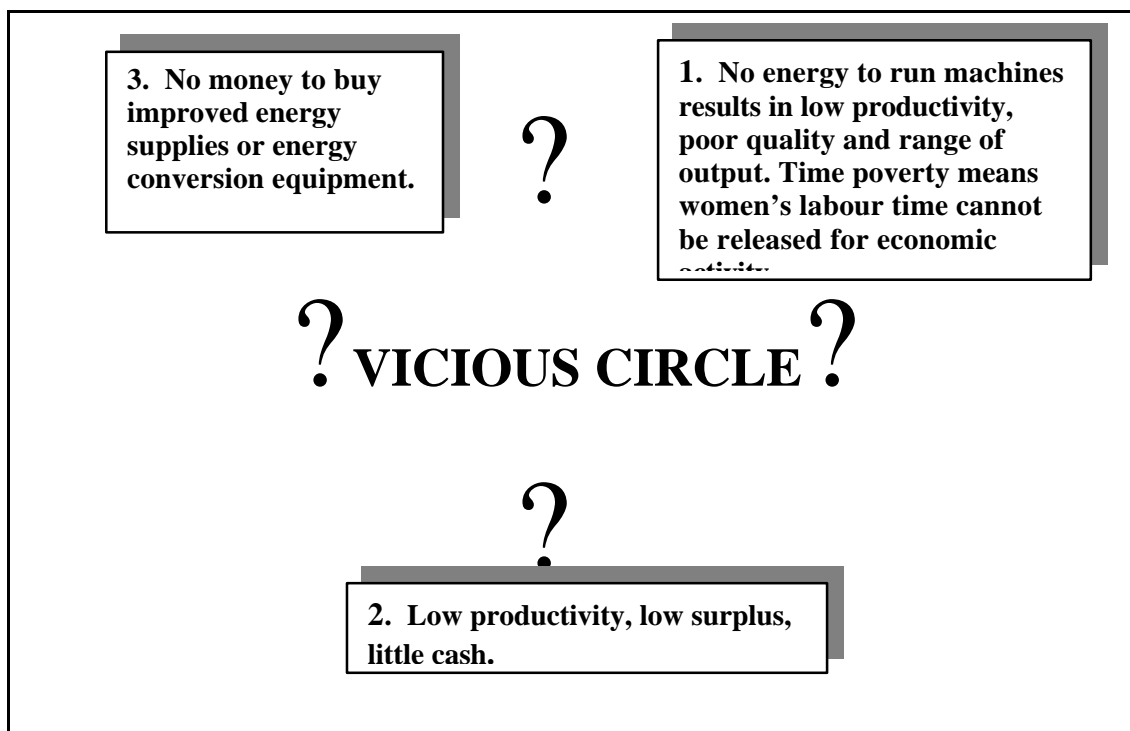
Capital and the Conversion of “Renewable” Energy

- 3.8** It is also important to note in this context that all modern renewable energy technologies share a particular characteristic that often militates against their use by poor people. That is that they have high initial capital costs and low recurrent (fuel) costs relative to fossil fuel based technologies. This is particularly so for photovoltaic electricity, hydro-power, and wind energy. The poorer a person, the less likely it is that they can afford this kind of renewable energy (technically because the opportunity cost of capital increases with lower incomes so they are forced to value the present more highly than the future). For this reason, poorer people often pay more per unit of energy used simply because they cannot afford the initial (front-end) costs of supply options that have the lowest life-time cost.
- 3.9** Similarly, where generating utilities have very severe limits on capital expenditures, their opportunity cost of capital at the margin rises to very high levels. They will then commonly opt for technologies with a lower initial capital cost, for example diesel generators, over an apparently preferable renewable option such as micro-hydro

The central problem of increasing the ability to pay for improved energy services.

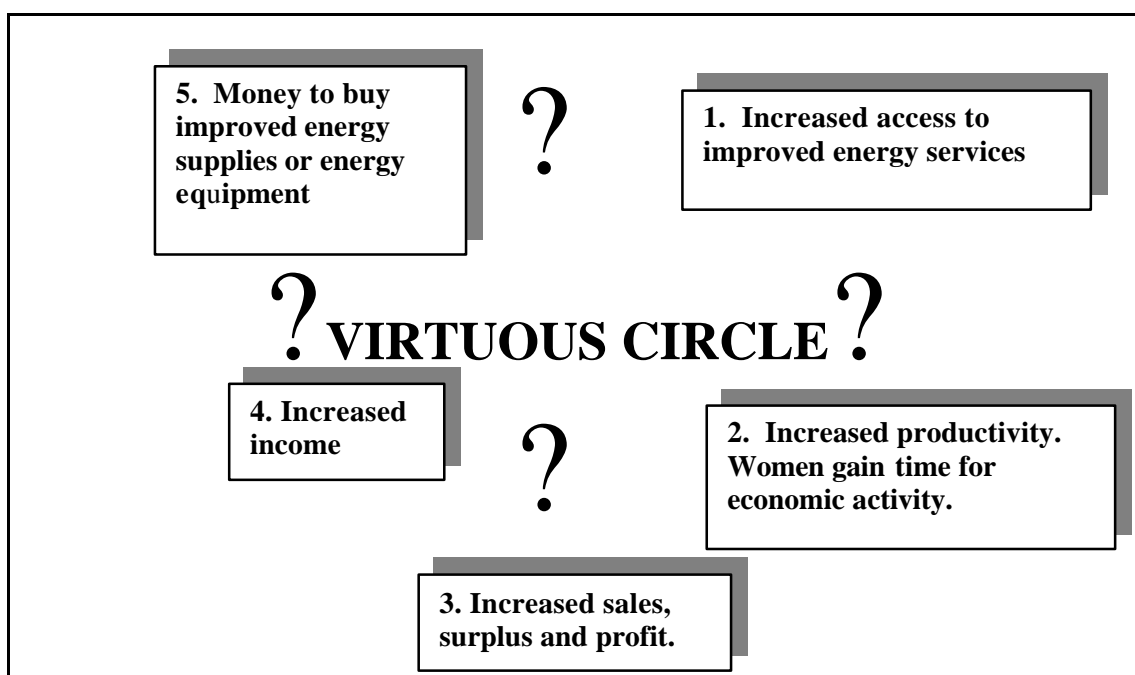
- 3.10** Large numbers of people in effect suffer from a “vicious circle” of energy poverty where they are “energy poor” because they do not have the means to buy improved energy services, even if they have access to them (in the sense of being in close proximity to a supply). Furthermore, even people who can afford improved energy supplies, still may not be able to afford the ‘conversion technology’ that makes that energy useful (for example, a stove, radio, light bulb or motor). This can be illustrated diagrammatically (figure 1).

Figure 1: The Vicious Circle of Energy Poverty



- 3.11** Increased access to cash becomes crucial. Improved energy services at the household level frequently necessitates switching to an energy technology that costs money from one that does not, particularly in relation to stoves and cooking fuels. But this is critical to release women from the constraints of time poverty. Even where improvement in lighting results in cash savings because the new source replaces more costly but less effective supplies (such as batteries and candles), there is frequently a *net increase in money expenditures* because people make more use of the improved energy services .
- 3.12** This means that attempts to energy poverty (particularly using *electricity* supply technologies) face a particularly difficult issue in terms of the stated preferences of intended beneficiaries. When rural people express their needs for improved energy services they often give high priority to lighting, a perfectly understandable position for those forced to live much of their lives in the semi-darkness provided by candles or kerosene. But the most financially sustainable de-centralised electricity supply options are likely to be those which provide power to productive enterprises that can sell their output profitably.
- 3.13** An important conclusion follows from this. The cycle of energy poverty will often be broken only by combining improved energy services with end uses that generate cash income. These are likely to be the productive energy end-uses that enhance production activities, either by increasing productivity, extending the range of outputs or improving output quality. This might be labelled a 'virtuous circle', and is illustrated in figure 2.

Figure 2: A Virtuous Circle to Break Out of Energy Poverty



- 3.14** Clearly the vicious cycle of energy poverty (as with other forms of poverty) can be broken through the redistribution of wealth by means of grants and subsidies. But the level of funds available from government, aid donors and Non-governmental organisation is likely to be far less than those required to provide all people with adequate energy services.
- 3.15** There is a further corollary to this central conclusion. Experience suggests the dictum that when undertaking rural energy projects ‘it is easier to make the profitable social, than to make the social profitable’. That is, when planning pro-poor energy interventions it is important to consider means of using the energy to secure cash income at an early stage of the development process, and only subsequently to see how the impact of improved energy services can be extended to the other aspects of sustainable livelihoods. It has proven extremely difficult to produce financially sustainable results with energy projects if they are started with the mind set of “social development” (akin to feeder roads, clinics and schools) that are free at the point of service³⁵. Such projects often fail when the governments, aid agencies and NGOs who finance such schemes initially cannot sustain their support for recurrent expenditures.

The Issue of Remoteness

- 3.16** Even if improved energy services were affordable to poor people with easy access to equipment, advice and credit, these options are certainly likely to be more expensive and more difficult to obtain for people in isolated rural

³⁵ Though it is clear that in recent years attempts have been made to place such services on a more financially sustainable basis.

communities. Such people are likely to have more difficulty in obtaining sufficient information and contacts to identify credit sources, credit terms, existing technical alternatives, etc. Development activities with such populations result in high transaction costs for both financial institutions and for the suppliers of equipment and technical assistance, making them unattractive to customers and suppliers alike. Consequently, this section of the population is likely to be most 'excluded' from both market and state delivery systems.

- 3.17** Remoteness adds to the costs of all energy supply options, but not necessarily in the same way and to the same degree. Thus, remoteness is likely to increase the attractiveness ('comparative advantage') of energy supply options that do not require the transportation of fuels relative to those that do. This will tend to favour options that rely on local energy resources (such as biogas, gasification, hydro, wind, passive solar and photovoltaic systems) rather than fossil fuel based systems. However this transport cost advantage may be offset by the cost of imported spare parts and the frequent visits from urban-based technicians required to maintain novel or delicate systems.
- 3.18** Policy makers face difficult choices in terms of the trade-off between providing improved energy access to the *most* people or to people in *specific locations*. There is an ongoing argument between the advocates of de-centralised (often "renewable") energy systems and Ministries of Energy and their conventional utilities. Proponents of decentralised systems are often disappointed that utilities will not take them seriously. Certainly small decentralised systems often face unfair competition from a highly subsidised grid, and from subsidised fossil fuels. But there is a genuine trade-off between maximising the access of people to efficient and affordable energy, and doing so in those places where a particular technology (such as photovoltaic, wind or micro hydro) provides the least cost option.
- 3.19** Indicative of this trade-off are the statements in evaluations of renewable energy technologies that they "are the least cost options in the areas investigated" (to repeat the careful phrase used in many recent World Bank evaluations). These locations are likely to be remote sites or where there is a low load density.
- 3.20** The scarce resource in most countries is not energy but the capital to make energy both accessible and useful. Therefore if the objective is, for instance, to provide electricity to as many people as possible, the most cost-effective way of achieving this may well be through extensions of the existing grid, or more likely 'intensification' of the use to which the grid is put rather than to distribute electricity evenly across the country³⁶.

³⁶ Where utilities have very severe limits on capital (or where the private sector has requires a high return on its investment), the 'opportunity cost' of capital at the margin rises to very high levels, explaining perhaps why they then opt for diesel generators rather than hydro with its higher initial capital cost. There has been a marked reduction of investment in medium and large scale hydro as utilities have been "corporatised" or privatised. See evidence for this "perverse" shift away from "economically justifiable hydro dams towards..... less environmentally friendly, thermal plants" (page 58, see also page

3.21 On the other hand, if equity considerations form part of the objectives of energy policy, for example between regions or population groups, then small scale decentralised technologies such as diesel engines, photovoltaics and micro-hydro are likely to have an important role, even if the intended users cannot meet the full cost. A review of recent micro hydro programmes in Peru, Nepal and Sri Lanka suggest that they have been explicitly motivated by ideas of social justice and fairness³⁷. Certainly people in remote rural areas in many countries can be expected to ask why they should not be entitled to at least the same levels of subsidy on energy services as those often provided to urban dwellers.

Environmental aspects of reducing energy poverty

3.22 Environmental impacts are both a driving force in raising awareness of issues of energy and poverty but they also form a major constraint to action. The huge impact on the health of women and children of indoor air pollution caused by the burning of solid fuels, particularly biomass, has been mentioned already. Similarly, the collection and burning of woody biomass can have effects on ground cover, and the burning of dung can affect the level of nutrients being returned to the soil. But, the link between the energy uses of biomass and deforestation varies from location to location. In principle biomass can be a renewable energy resource, but there are areas of fuel pressure where the use of the biomass is more akin to non-renewable ‘mining’³⁸.

3.23 In a significant proportion of cases the energy options that best meet the needs of poor people will involve fossil fuels³⁹, and their use can have a negative effect on the local and global environment. There are very few alternatives to fossil fuels for transport (though animals are extensively used and Bangladesh still has a huge commercial in-land sailing fleet) and the cheapest electricity for most people will come from large power stations fuelled by gas, coal, or even oil. Even in remote rural areas, diesel engines will provide the ‘optimal’ solution for providing both shaft power and electrical power for machines.

57), World Bank Operations Evaluation Department review of renewables as an input to the new draft environmental strategy for the energy sector, *Fuel for Thought* (September 1998).

³⁷ S Khennas and A Barnett, *A Synthesis of Best Practices for Micro Hydro Electrification Programmes in developing countries*, for The Department for International Development, UK and The World Bank, ESMAP Technical Paper 006, August 2000.

³⁸ The FAO (who probably are best placed to know) have asserted for many years that the main cause of deforestation is the clearance of land for agriculture. This truth was largely disregarded by “rural energy specialists” for a long time. The more balanced view is that although changes in land use are the major cause of deforestation, there are areas of “fuel wood stress”, usually surrounding urban areas and refugee camps, where the demand for fuel exacerbates the balance between the production and consumption of the biomass.

³⁹ Such a view is clearly open to misinterpretation. It is not a simple argument against renewable energy. Clearly renewable energy will be the “best solution” for some people, at some locations, at some times. Indeed it is clearly the case that renewable wood fuel is already the least cost energy solution for very large numbers of people. But it does suggest that more might be achieved by focussing both on those options that best increase energy access and on those options that best reduce the environmental costs of energy conversion and use. Neither objective is likely to be effectively achieved if both have to be pursued with only one rather limited weapon, namely “new renewable sources of energy”.

- 3.24** There is therefore an evident trade-off between the objective of tackling energy poverty and the objective of improving the environmental problems linked to energy conversion and use. *Under current prices and other incentives*, actions to reduce energy poverty can harm the environment.
- 3.25** However, a great deal of the interest in rural energy, and much of the funding is driven by concerns over Global environmental issues (The Global Environment Fund, The Clean Development Mechanism, and the Group of 8 Renewables Fund). This means that these new initiatives often are forced to limit the range of options for meeting the energy needs of poor people to “new” renewable options.
- 3.26** If the primary objective is meeting the energy needs of the un-served, and under-served populations neither the optimal solution nor the most equitable solutions will be found if their energy options are restricted just to renewable sources (either old renewables such as biomass, or new renewables such as photovoltaics). The move towards ‘empowerment’ as a development objective implies that people in power should allow the excluded majority to make informed choices from the *full menu* of energy options, so that they can select the option that best meets their needs. They certainly cannot be expected to restrict their options willingly, while northern industrialised countries are not doing enough to reduce the pollution burden of their current and past energy consumption⁴⁰.
- 3.27** The complexity of the arguments over renewable and non-renewable energy options is well illustrated by a particularly important finding from recent empirical research. This suggests that if the people who are currently cooking by inefficiently burning “renewable wood fuel” were to switch to “non-renewable” gas (LPG) there would be a strongly positive environmental impacts and a massive reduction in green house gases per person meal⁴¹. Simplistic assumptions as to the relative merits and demerits attaching to “renewable” and “non-renewable” energy sources can be very misleading, and lead to damaging policy responses.
- 3.28** The UNDP’s Initiative for Sustainable Energy (1996) goes some way in making more explicit the trade-off between poverty reduction and the environment. It shows why the trade-off exists and what can be done to reduce it. The UNDP report argues in particular that “poverty eradication and improved living standards cannot be achieved sustainably without major changes in the current

⁴⁰ It is also clear that if the poorer countries of the world were to consume per capita as much energy as industrialised countries currently do, global warming would be severe and probably irreversible. There is no longer much doubt that global warming is likely to exacerbate the problems of those parts of the world that are already deeply stressed, economically and environmentally. But the question remains whether the poorest people on earth should carry this burden as well as all the others that they carry.

⁴¹ This is due to the considerably greater efficiency with which liquid and gas fuels can be converted into heat for cooking. Burning wood fuel in a normal cooking fire or traditional stove is not “green house gas neutral” because of the products of incomplete combustion. See Kirk Smith, et al 1998, Report for the US EPA, *Green House Gases from small scale combustion devices in developing countries: Phase IIA Household Stoves in India (October 12)*.

energy system”, including bringing energy prices in line with their full cost⁴². This results in a strong argument for energy sector reform from the points of view of both environment and social efficiency. The World Bank’s “Fuel for Thought” similarly identifies the need for more analytical work to develop pragmatic ways of “internalising the externalities” associated with the environmental impact of energy conversion and use⁴³.

Recent developments in energy supply systems

3.29 It was suggested in Chapter I that ‘energy’ has recently fallen off the agenda of main stream development thinking and action. But at the same time fundamental changes have also taken place that make the energy sector of today quite different from that of even 10 years ago. In addition to the widespread efforts at energy sector reform, two changes in particular have had a bearing on the poverty, gender, and energy framework. First in what is technically possible in the conversion of primary energy into useful energy, particularly at the small scale. And second in the realization that even poor people already pay significantly for energy services.

3.30 *Technological change and increased energy supply options.* Policy thinking in the energy sector has been significantly affected by massive technical changes in recent years. A great deal of the change has been in the large scale industrial sectors (effectively removing a major element of utilities’ “natural monopoly”). But advances in small scale technology have also increased efficiency and reduced costs, opening up a wide number of options for profitable small-scale, decentralised energy supply. This was most apparent in improvements to diesel and small petrol engines, but there have also been promising developments with photo-voltaic cells (where prices have fallen dramatically), wind generators, micro-hydro (particularly with the introduction of electronic load controllers), biogas, and gasification.

3.31 *The willingness and ability of poor people to pay for improved energy services.* While energy poverty is clearly a function of more general poverty, it has recently become clear that many rural people, and the urban poor, already pay significant amounts of cash to meet their energy requirements. In many cases the amounts they pay for energy will be a much higher proportion of total cash income than is the case for richer people⁴⁴. And in some cases, the poor

⁴² UNDP *Initiative for Sustainable Energy, June 1996*. It goes on to say that “the transition to this new paradigm will inevitably take many decades” page 18. “Improvements in end-use efficiency and greater use of renewables have long been discussed as major hopes for the future. They have not yet, however, made the substantial contribution to increased energy services for which they have potential” - however, the UNDP is unequivocal in its belief that it is “technically possible to meet all of the environmental changes associated with energy while increasing the supply of available energy and the living standards of billions of people (page 34). However it notes a great deal of uncertainty about performance and cost characteristics in more environmentally benign options - but this will only be known if the world puts in place “strong and sustained investment in R and D” (page 40).

⁴³ World Bank, *Fuel for Thought* (September 1998).

⁴⁴ This is the case for instance in Hyderabad. See ESMAP, *Household Energy Strategies for urban India, The Case of Hyderabad, 1999*.

will even pay more in absolute terms than their richer compatriots⁴⁵.

- 3.32** Evidence of what poor consumers are paying for energy is coming from a wide range of countries across the globe. One type of evidence is provided by data on the widespread use of 12 volt (car) batteries for lighting, radio and TV where alternative sources of electricity are unavailable. Recent survey data from Uganda show that in 1996 94% of households not connected to the grid used dry cell batteries, and were thought to spend about \$6 per household per month on them⁴⁶.
- 3.33** This “discovery” of significant cash payments for improved energy services even among relatively poor people means that in principle it may be possible to meet their needs with market based solutions. Such people do not necessarily have to wait for the state, aid agencies or NGOs to extend energy services to them. While the supply of improved energy services to poor people is by definition unlikely to be the most profitable area for private sector investment, there is a new optimism that modest profits can be earned from such businesses, particularly if the relevant social, legal and physical infrastructure is in place.

The role of intermediation.

- 3.34** Experience over the past twenty five years demonstrates that at the heart of the problem of developing decentralised energy supply options are the very high costs associated with putting together the various elements of technology, finance, community development and management required to make such schemes work (often described as the “the transaction costs”⁴⁷).
- 3.35** For many of the larger schemes many hundreds of tasks are necessary to get them off the ground and running sustainably. A number of analysts have found that the idea of ‘intermediation’ offers a convenient way to group and understand these activities. The approach extends the idea of ‘financial intermediation’ and considers three additional forms of intermediation: technical intermediation; social intermediation; and organisational intermediation.

⁴⁵ This situation arises partly because it is the richer people who tend to benefit most from existing energy subsidies to both electricity and to kerosene, but it is also a function of the greater amounts of primary energy that poor people have to buy because of the low efficiency with which they can convert primary energy into useful energy.

⁴⁶ The same survey found that there were at least 44,000 lead acid batteries in use among the 550,000 households represented in the 12 districts. It is estimated that some 100,000 peri-urban and rural households in Uganda use lead acid batteries for electrification. The total expenditures on these batteries (including charging, transport, and capital depreciation) could be as much as \$10 million per annum. Households that use both lead-acid batteries and dry-cells for rural electrification (approximately 4.3 percent of rural households) spend \$16 per month, or approximately \$192 per year, on these sources of electricity. Similar World Bank data are available in other countries as diverse as India and Zimbabwe. In Sri Lanka comparable expenditures are implied by the fact that several thousand electric generators of less than 75 kVA are regularly imported into the country at an annual cost of over \$10 million (1996 data).

⁴⁷ See “social overhead investment” in Barnett, A., *The Diffusion of Energy Technologies in the Rural Areas of Developing Countries: A Synthesis of Recent Experience*, World Development, Pergamon Press, Vol. 18, No. 4, April 1990, pp.539-553.

- 3.36** *Financial Intermediation* involves putting in place all the elements of a financial package to build and operate a decentralised energy supply company in place. A process sometimes referred to as ‘financial engineering’. It covers:
- the transaction costs of assembling the equity and securing loans;
 - obtaining subsidies;
 - the assessment and assurance of the financial viability of schemes;
 - assessment and assurance of the financial credibility of borrower;
 - the management of guarantees;
 - the establishment of collateral (‘financial conditioning’); and
 - the management of loan repayment and dividends to equity holders.
- 3.37** *Financial intermediation* can also be used to cover whole schemes rather than just investment in an individual plant. In this way projects can be ‘bundled’ together in away which:
- makes them attractive to finance agencies;
 - establishes the supply of finance on a ‘wholesale’ basis from aid agencies, governments, and development banks; and
 - creates the mechanisms to convert these flows into a supply of retail finance (equity and loan finance at the project level).
- 3.38** *Technical intermediation* involves both improving the technical options by undertaking research and development activities and importing the technology and know-how ‘down’ through the development of capacities to supply the necessary goods and services. These goods and services include: site selection; system design; technology selection and acquisition; construction and installation of civil, mechanical and electrical components; operation; maintenance; trouble shooting; overhaul; and refurbishment.
- 3.39** *Organisational intermediation* involves not only the initiation and implementation of programmes, but also lobbying for the policy change required to construct an ‘environment’ of regulation and support in which the energy technology and the various players can thrive. This involves putting in place the necessary infrastructure, and getting the incentives right to encourage owners, contractors, and financiers. Organisational intermediation may be usefully distinguished from a related activity, *social intermediation*, which involves the identification of owners and beneficiaries of projects and the ‘community development’ necessary to enable a group of people to acquire the capabilities to take on and run each individual investment project. Here, it is essential to break down all these groups by gender.

The role of subsidies

- 3.40** In addition to overall poverty, the number and range of “intermediation tasks”, low density of demand and remoteness of location, raises the costs and reduces profitability of energy supplies to rural areas. Furthermore a certain amount of “social overhead investment” almost always has to be put in place to support such schemes (training, technical assistance, capacity building within communities). The burden of these overheads will be particularly high for

innovative schemes, though they may eventually be spread across a large number of enterprises.

- 3.41** A recent report from The World Bank confirms the view held by many people involved in the practical implementation of rural energy schemes when it says that:

It is illusory to expect that increasing access to electricity for a significant part of the population traditionally excluded from grid based electricity can be financed only by the private sector⁴⁸.

- 3.42** If the cost of energy is too expensive for poor people who need it, then the issue of subsidies and/or grants cannot be avoided. The political acceptability of subsidies has undergone wild fluctuations in recent years. All governments provide subsidies, and it is clear that some have done more harm than good (destroying markets and benefiting people who are already better off). However, the essential question that has emerged from the ideological posturing of recent years is less about the rights and wrongs of subsidies in principle, but rather as to whether a particular form of subsidy is actually likely to achieve its intended purpose.
- 3.43** The arguments for using money that is supplied at less than full commercial rates of interest are overwhelming if large numbers of people are to be given access to improved energy services. This ‘soft money’ will be required to enable people with insufficient purchasing power to gain access to electricity, and to other more convenient forms of energy .
- 3.44** If the case can be made for subsidies, experience suggests that the use of soft money can both help the expansion of decentralised energy supply options and harm them. As always the ‘devil is in the detail’ and in the specifics of each context. Hence the phrase ‘smart subsidies’⁴⁹ has been coined to put some distance between current forms of subsidy and the earlier forms, for example subsidies on grid-based electricity, kerosene and diesel, that have been shown to

⁴⁸ Best Practice Manual: Promoting Decentralised Electrification Investment, ESMAP World Bank, 1999, Page 10.

⁴⁹ The term “Smart Subsidies” was first coined by Charles Feinstein at the World Bank, and details of what is involved can be found in *Best Practice Manual: Promoting Decentralised Electrification Investment*, ESMAP World Bank, 1999. In essence Smart Subsidies should:

- follow pre-established rules that are clear, and transparent to all parties;
- focus on increasing access by lowering the initial costs (technical advice, capital investment) rather than lowering the operating costs;
- Provide strong cost minimisation incentives such as retaining the commercial orientation to reduce costs;
- Remain technologically neutral;
- Cover all aspects of the project including end-use investments, particularly to encourage pro-poor end-uses; and
- Use ‘cross subsidies’ within the project to pay for life line charges or tariffs and other ‘pro-poor’ recurrent cost subsidies (e.g. enable transfer from richer sections of the community, and commercial users to marginal connections).

stultify innovation, destroy markets, and support the already rich.

- 3.45** A large number of technology driven schemes currently adopt a strategy of trying to increase sales through subsidy. This is particularly the case with photovoltaics. It is argued that increased sales will reduce the cost of production and, more importantly, enable the overhead costs of providing technical support and supplying retail credit to be spread over a larger number of unit sales. The evident danger of such an approach is that ‘soft’ money intended for social investment is often used to subsidise the costs of these supply options for those who could readily afford to pay the true cost if they genuinely regarded this as a priority area of expenditure. Furthermore the use of subsidies linked to a particular supplier can “pollute the well” for other entrants to the market.

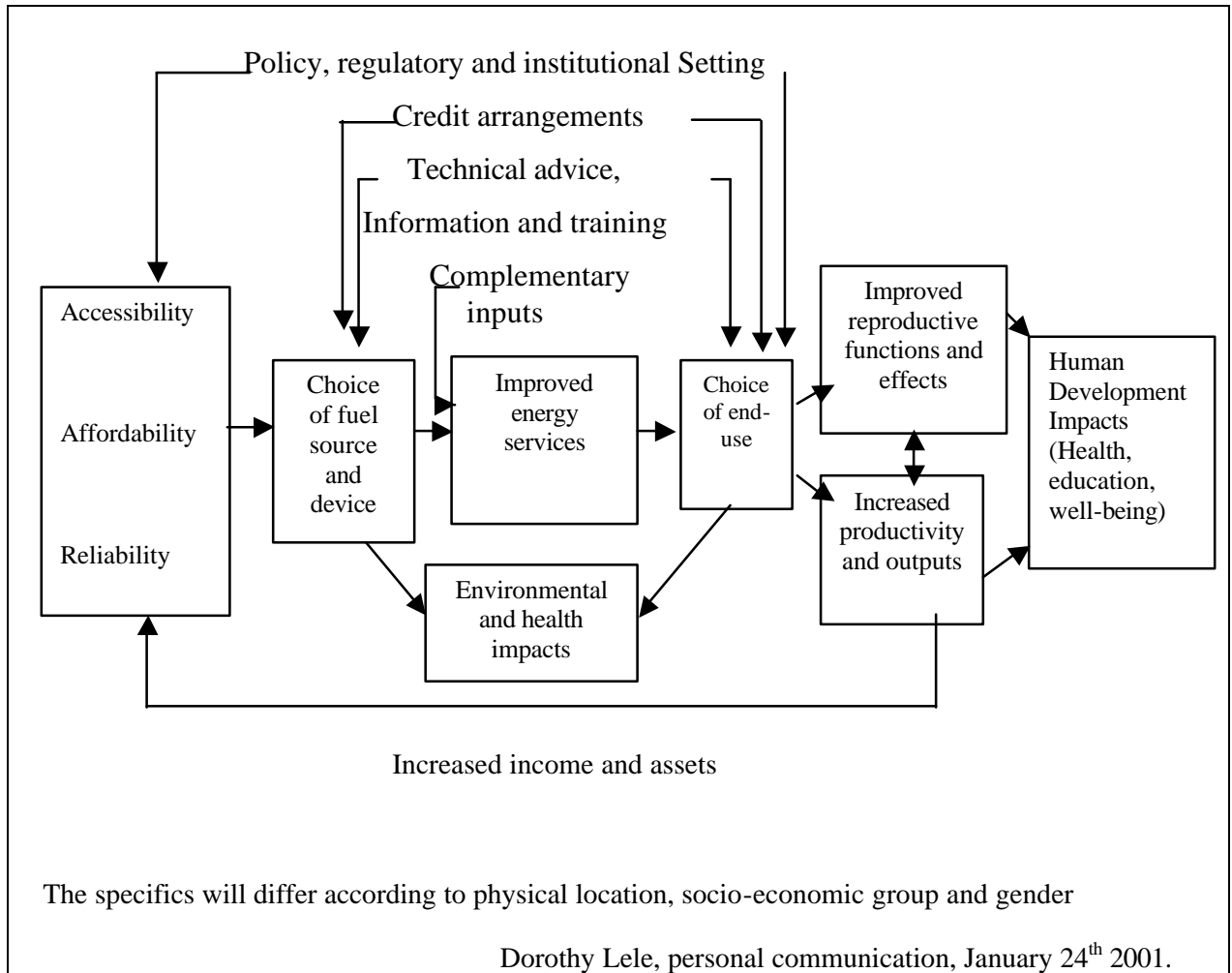
The Enabling Environment

- 3.46** The state clearly plays a crucial role in the provision of subsidies, even where it has been “rolled back” from direct involvement in providing energy services to poor people. However, subsidies should not be considered in isolation from other aspects of state intervention. Although the climate is growing more favourable to decentralised energy supply options, in most countries the existing regulatory framework is often the major barrier to development. It can be hostile, contradictory or uncertain. Taxes and subsidies still often undermine markets, rather than encourage them. The supporting infrastructure of training institutions, or finance may be non existent or inaccessible. Competitors may be able to gain privileged access to subsidies that enable them to sell their products below cost. Without changes to this policy environment, the flow of private sector finance and innovation will be restricted. These are the areas currently at the focus of much analysis, innovation and reform.

Putting the pieces together

- 3.47** There are clearly many ways in which the overall energy supply and use system might be conceptualised. The next chapter will describe the construction of a framework that was used for the fieldwork in China undertaken by this project. One of the commentators on an earlier draft of this paper contributed the following useful diagram which stresses the key ideas of ‘complementary inputs’, the choice of end-uses technology and the division between ‘reproductive’ and ‘productive’ outputs.

Figure 3: Energy supply and use system



4

4 Towards an analytical framework

- 4.1** In recent times, much of the debate on poverty reduction has focused around two main analytical frameworks. These can be broadly identified with work on ‘Sustainable Livelihoods’ and ‘Poverty Reduction Strategy Papers’. This chapter outlines the main features of these two approaches and considers their relevance to energy issues. An initial synthesis is attempted and a framework for the field research in China developed.

Existing frameworks for poverty analysis

Sustainable Livelihoods

- 4.2** Following the early work of Chambers & Conway⁵⁰, the United Kingdom Department for International Development (DfID) adopted the following definition of sustainable livelihoods:
- “A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation: and which contributes net benefits to other livelihoods at the local and global levels in the long and short term.”⁵¹*
- 4.3** This definition identifies three elements: human capabilities such as education, skills, health; access to tangible (financial, capital) and intangible (access to services, information, etc., claims on relatives, the state, etc.) assets; and the existence of economic activities. A ‘livelihood strategy’ is defined by the interaction between these elements and ‘livelihood security status’ is measured in terms of both consumption and asset levels. The approach derives from Sen’s

⁵⁰ Chambers, R. and Conway, G. 1992, *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century*, IDS Discussion Paper 296. Brighton: Institute of Development Studies.

⁵¹ DfID Sustainable Livelihoods Guidance Sheets, 1999.

entitlements model as modified by Swift⁵². In terms of poverty reduction, it focuses attention on ways in which the capabilities of vulnerable people can be enhanced, such that specific households and individuals can secure their livelihoods, whether through production and income generating activities or by other means.

- 4.4** The analysis of livelihoods focuses on households, but looks both outwards, to examine the relationships between households, community organisations, local government and other actors; and inwards, to examine intra-household relationships, for example between men, women children and the elderly. In terms of external relationships, a key element concerns the difference between household assets, whose use is determined solely by household members, and community assets in which the household may hold some interest and over which it may exercise some limited control.

Poverty Reduction Strategy Papers

- 4.5** Launched by the World Bank in early 1999, the Comprehensive Development Framework (CDF) was seen as a means by which countries could implement integrated strategies for economic development and poverty reduction. It attempted to bring together current trends in development thinking with the aim of facilitating countries to achieve a balance between good macroeconomic management and sound social, structural and human policies. The Poverty Reduction Strategy Paper (PRSP) is based on CDF principles and aims to integrate poverty reducing policies within a coherent, growth oriented macroeconomic framework.
- 4.6** As outlined in the WDR 2000-2001, a PRSP has three action pillars – empowerment, security and opportunity. The empowerment agenda is a reflection of the remarkable rise of participatory approaches within the development community: “once a shout from the radical fringe, the call for participation has resurfaced as a dominant voice in development thinking”⁵³. It emphasises the need for decentralisation, support for poor community groups and organisations, and giving poor people a ‘voice’ in all stages of decision making. It focuses on the institutional context, where institutions are defined very broadly as “humanly devised constraints that structure human interactions”. The section on security can be seen as deriving from earlier work on safety nets, risk management and coping strategies, combined with elements of the rights based approach to human development. The discussion on opportunity links economic growth to elements of the entitlements agenda and emphasise the need to enable poor households to improve their livelihood strategies by asset building. This should include not only include financial and capital assets, but a range of non-tangible assets such as employment, education,

⁵² Swift, Jeremy, 1989, ‘Why are rural people vulnerable to famine?’, *IDS Bulletin*, 20, 2.

⁵³ da Cunha, Paulo Viera and Maria Valeria Junho Pena, 1997, “The Limits and Merits of Participation”, *Policy Research Working Paper 1838*, The World Bank.

health, and access to clean water.

Comparisons between the two approaches

- 4.7** Sustainable livelihoods has been developed into a major analytical framework by the UNDP and DfID. It has clearly influenced both the approach and language adopted by the World Bank in developing the PRSP. Broadly speaking, in the latter framework, income and capabilities would correspond to opportunities and how they are used. There are also similarities in the extent to which attention is focused on the role of institutions and on the definition of poverty. On the former issue, one key question in sustainable livelihoods can be seen as determining what it takes to translate different types of assets into capabilities. That process is mediated by institutions, defined in very broad terms to include rules, laws, norms, and markets. In terms of poverty definition, under the influence of Sen's thinking on the relationship between capabilities and functionings, the livelihoods framework encourages an exploration of the multidimensionality of human ill-being, rather than concentrating only on the material aspects.
- 4.8** WDR 2000-2001 stresses the need for a more sophisticated, multi-dimensional approach to the concept of poverty, which recognises the importance of non-income dimensions such as education, health, insecurity and powerlessness. It also moves away from the prevalent use of national average figures for poverty incidence, and examines how economic growth might impact on the poverty status of particular population groups.
- 4.9** Both frameworks run into similar problems when moving from concepts to measurement. For example, while they embrace the multi-dimensionality of poverty in theory, the monitoring agenda will usually adopt a much narrower perspective when there is a need to derive relatively simple indicators to determine, for example, the impact of specific poverty reduction initiatives. This is particularly evident in much of the econometric work undertaken within the PRSP rubric. The participatory methodology which is often adopted in studies on sustainable livelihoods is also problematic, in that it tends to have a community perspective and often fails to focus on poor individuals and households.. Much that is written in the name of poverty reduction is about community development: 'look at all of us we are all poor, we all suffer from the same deprivations'. Poverty mapping, which attempts to combine participatory and money-metric measures, has been suggested as a way of determining the degree to which such measures converge in practice, but the evidence is not yet convincing.
- 4.10** Two major influences on the development of both the sustainable livelihoods and PRSP frameworks have been the 'good governance' and 'participation' agendas. Driven by the neo-liberal agenda of the 1980s and early 1990s, there was much on the failures of the state and the need to pursue market solutions. The tendency within some donor agencies was to identify 'good' states with 'minimal' states. Governments were often sidelined, with resources being channelled through NGOs. In many countries the majority of development

assistance was outside the state budget. Many of those working in the governance area were largely concerned with multi-partyism, removal of corruption, downsizing and reform of administrative structures, and rethinking of judicial and legal systems. More recently, both markets and government interventions in markets are recognised as having 'strengths and limits'. There is once again an attempt to define a role for government, particularly in terms of its regulatory function, where markets are either failing to deliver or giving rise to major equity concerns. This has led to an emphasis on 'good governance', with a particular focus on the need for institutions that can effectively implement 'good' policies (World Bank, 1997). Governments are now seen as in need of 'strengthening' with the aim of improving the quality of public decision making and public expenditure in terms of the poverty reduction agenda.

- 4.11** The late 1990s also saw an increasing recognition of the potential role for strong grassroots movements in poverty reduction, a view that had been long promoted by those working on participation. Developments were also taking place in this area, with the realisation that to be effective it was essential to involve both local and national governments, in order to influence policy and budgetary allocation decisions which could either reinforce or undermine local community initiatives. Thus in recent years, governance experts have tended to move away from promoting democracy and reducing corruption, and identified poverty reduction as central to their agenda. Advocates of participation have 'scaled up' their activities to bring in the voices of the poor and marginalised into the mainstream. Both groups have focused on poor people as citizens and active members of communities, the need for analysis of the institutions that impact on poverty, and the concept of an 'enabling environment' structured around the concepts of regulation and accountability.
- 4.12** The PRSP agenda in particular can be seen as primarily concerned with poverty reduction through good governance that involves consultation and participation. But as analysts of democratic local government have pointed out, there are typically no specific benefits for poor people as a result of democratic processes at the local level. Benefit often only accrues if, as a consequence of local government being more responsive to local demands, there is strengthened provision of a universal benefit. In practice, it may be even more difficult to direct resources to poor people through a local government that becomes accountable to local elites. In general, lessons learnt from poverty reduction do not indicate a strong link between governance, participation and the well being of the poor. In a number of countries, successful programmes – drinking water, micro-finance, family planning, agricultural planning – have been very much top down, no participation or consultation has taken place and yet there has been massive poverty reduction. There is a risk that an exclusive focus on governance and participation may crucially divert attention away from issues of production, increased productivity and associated infrastructure investment, which must remain central to any realistic poverty reduction strategy.

Similarity of basic concepts

4.13 Although there are differences in terms of language and emphasis, there appears to be considerable agreement at least in terms of core concepts between those developing the PRSP and Sustainable Livelihoods approaches. Both clearly accept a broad concept of poverty which goes far beyond the traditional definition based on minimum income levels. Both speak of the ‘dimensions of poverty’ and focus on the complex interrelationships between these dimensions.

“This Report accepts the now traditional view of poverty as encompassing not only low monetary income and consumption but also low human development such as in education, health and nutrition. It also goes beyond these dimensions to include risk and vulnerability, voicelessness and powerlessness”⁵⁴

4.14 Cause and effect relationships are seen as existing in both directions between the various dimensions of poverty. For example, low income tends to result in lower levels of human development but is often also a consequence of poor education, sickness and malnutrition. Increased income tends to reduce vulnerability and powerlessness, while greater participation in decision making may lead to the creation of opportunities for improved income earning. Both approaches emphasise the need to take a holistic view of the complexities of the lives of the poor and structure their arguments around three key areas. Sustainable Livelihoods focuses on:

- the assets (natural, physical, social, human and financial) which allow people to ‘make a living’. A sustainable livelihood is one which allows a household to at least maintain and hopefully increase its stock of assets.
- resilience to the multiplicity of ‘shocks’, natural, economic or social, to which the poor are particularly vulnerable. Much early work on Sustainable Livelihoods was focused on Livelihood Security⁵⁵.
- the ‘institutions’ (from informal civil society organisations to the private sector and the State) and ‘processes’⁵⁶ (ranging from social norms and gender relations to policies and laws) which influence both ‘Livelihood Strategies’, adopted by the poor in an attempt to attain sustainability, and ‘Livelihood Outcomes’. Interventions will often target these institutions and processes, empowering the poor in order to expand the range of available livelihood strategies and/or reduce vulnerability.

4.15 There are clearly very close parallels to the ‘three pillars’ of the World

⁵⁴ World Bank, World Development Report 2000/2001, consultation draft, January 17, 2000.

⁵⁵ Drinkwater, M. and McEwan, M., “Household Food Security and Environmental Sustainability in Farming Systems Research: Developing Sustainable Livelihoods.” A paper presented to the Adaptive Research Planning Team (ARPT). Biannual Review Meeting. Manju, Zambia 13-16 April, 1992.

⁵⁶ The terms ‘institutions’ and ‘processes’ are here interpreted loosely, reflecting their common usage. See Mahta, Lyla; Melissa Leach; Peter Newell; Ian Scoones; K. Sivaramakrishnan and Sally-Anne Way, “Exploring Understandings of Institutions and Uncertainty: New Directions in Natural Resource Management”, IDS Discussion Paper 372, 1999.

Development Report:

- *Opportunity: Expanding economic opportunity for the poor by building up their assets and increasing the returns on these assets, through a combination of market-oriented and nonmarket actions.*
- *Security: Helping the poor to manage the risks they face in their everyday lives, and managing national downturns to minimize their impact on the poor.*
- *Empowerment: Making state institutions pro-poor and removing social barriers to poverty reduction.*

Integrating the Energy Dimension

4.16 Neither of the frameworks offered by the Sustainable Livelihoods nor the PRSP deals very effectively with energy in their current configuration. However, both approaches are under development and can be expected to improve and, probably, converge. A comparison of categories used by both approaches shows that there is considerable overlap (see table below). Maxwell reminds us that these similarities in the various approaches are to be expected. “The discourses may differ, but it is hard to escape a vocabulary which deals mainly with raising and spending money, the incentive and regulatory framework, the reform of public services, issues of voice and participation, and the contribution of international aid”⁵⁷

4.17 However each framework has a slightly different focus: the Poverty Reduction Strategy Papers are aimed primarily at the macro and meso scale of development activity. This reflects the national focus of the poverty strategies, but is also consistent with the Bank’s recent emphasis on sector reform rather than projects. The PRSP specifically deals with energy through an ‘Energy Tool Box’ in the form of an ‘energy chapter’ of the forthcoming guidelines for writing Poverty Reduction Strategy Papers. In the current version (2000) the energy chapter covers two main domains of activity: “household welfare” and “growth”. It provides a check list of issues including the interactions between energy policy and improved fiscal stability, and sets out the arguments for different fuel pricing principles and forms of subsidy. It does cover a number of issues at the micro level, particularly in relation to the health effects of biomass fuel use in cooking (page 17) and the benefits of encouraging “community participation” (page 24).

4.18 The Sustainable Livelihoods, on the other hand, emphasises individual interventions at the micro level of projects and “participatory development”. But the version advocated by DfID does not (yet) deal adequately with the energy dimension of development⁵⁸. Energy supply and use systems are mentioned as forming part of “physical capital” which includes both ‘access’ to

⁵⁷ Simon Maxwell, *Attacking Poverty: World Development Report 2000/2001*, ODI Briefing Paper forthcoming 2000.

⁵⁸ An attempt at such an integration is to be found in Annex 4

basic infrastructure and the ownership of “producer goods” needed to support livelihoods. “Infrastructure consists of changes to the physical environment that help people to meet their basic needs and to be more productive and producer goods are the tools and equipment that people use to function more productively”.

A comparison between PRSP and Sustainable Livelihoods approaches

| PRSP Energy Toolkit | | DFID Sustainable Livelihood Guidance Notes | |
|-------------------------------------|---|--|--|
| <i>Poverty Alleviation Outcomes</i> | <i>Energy linkages and Impacts</i> | <i>“Livelihood Assets”</i> | <i>Sustainable Livelihood Outcomes</i> |
| Income | <ul style="list-style-type: none"> ▪ Essential input for businesses ▪ Macro stability (increase tax revenues and reduce fiscal burden) ▪ Enhance labour and capital productivity | | <ul style="list-style-type: none"> ▪ More Income ▪ Increase Well being |
| Capability | <ul style="list-style-type: none"> ▪ Essential health care and education services ▪ Essential complementary infrastructure ▪ Health improvements (reduced indoor pollution) | <ul style="list-style-type: none"> ▪ Human Capital ▪ Physical Capital ▪ Social Capital ▪ Financial Capital | <ul style="list-style-type: none"> ▪ More Income ▪ Increase Well being |
| Security | <ul style="list-style-type: none"> ▪ Energy price stability ▪ Illumination and personal security ▪ Environmental sustainability | <ul style="list-style-type: none"> ▪ Natural Capital | <ul style="list-style-type: none"> ▪ More Sustainable Natural Resources |
| Empowerment | <ul style="list-style-type: none"> ▪ Choice of energy services ▪ Access to information (radio, TV and communication) ▪ Increased accountability of service providers | | <ul style="list-style-type: none"> ▪ Reduced Vulnerability |

4.19 The DFID Guidelines argue that the components of infrastructure usually essential for sustainable livelihoods include:

- affordable transport;
- secure shelter and buildings;

- adequate water supply and sanitation;
- clean, affordable energy; and
- access to information (communications).

4.20 According to these documents “Many participatory poverty assessments have found that a lack of particular types of infrastructure is considered to be a core dimension of poverty. Without adequate access to services such as water and energy, human health deteriorates and long periods are spent in non-productive activities such as the collection of water and fuel wood. The opportunity costs associated with poor infrastructure can preclude education, access to health services and income generation.... The increased cost (in terms of all types of capital) of production and transport means that producers operate at a comparative disadvantage in the market” (section 2.3.4).

4.21 In the Sustainable Livelihoods approach ‘energy’ is likely to impinge on all aspects of the model (from the “vulnerability context”, through the “livelihood assets”, and the “transforming structures and processes”), and energy will play a major part in determining the nature and range of livelihood strategies that are feasible.

4.22 However, the lack of a specific emphasis on small and micro enterprise development seems surprising in an approach to livelihoods. This may result from the approach’s genesis in the areas of natural resource and agricultural development, rather than peri-urban and non-farm self-employment. By combining “energy supply and use” into the category of “physical capital”, the approach also appears to gloss over important distinctions between ownership of the means of production and the ability to gain access to energy inputs, such as fuel, in the process of earning a livelihood.

4.23 In common with other existing frameworks it does not deal adequately with “indirect” nature of the demand for energy services and the complexities introduced by the fact that that some energy systems are privately and individually “owned” (such as the self collection of woody biomass for use in cooking) while others are best provided either at the level of the community (small hydro systems) or the nation (large electricity systems or the supply of paraffin and LPG).

4.24 The central point of the Livelihood approach is the necessity to help stakeholders with different perspectives to engage with the many factors that affect livelihoods – in short “participation”. Such a message certainly reflects the trends in the search for de-centralised energy supply options for poor people. Cecelski points to the apparent success in participatory and gendered approaches in the area of water and sanitation and their applicability to energy and poverty⁵⁹. She refers in particular to the work of Rekha Dayal and others at

⁵⁹ Energy and Poverty Reduction: The role of women as a target group, by Elizabeth W. Cecelski, Director for Research and Advocacy, ENERGIA, International Network on Women & Sustainable Energy (www.energia.org) Paper presented at the Debate on Sustainable Energy in Danish Development Assistance, Copenhagen: Landstingssalen, Christiansborg, September 5, 2000.

the World Bank on the water sector, described in “Methodology for Participatory Assessments: Linking Sustainability with Demand, Gender and Poverty”⁶⁰. This approach which was applied in 88 villages in three continents has obvious similarities to that of Sustainable Livelihoods in terms of its participatory nature and emphasis on and environmental sensitivity.

- 4.25** Certainly people have made businesses out of selling water and sanitation services and these may provide useful models for the energy sector⁶¹. Similarly, there are strong parallels between water supply and energy supply when it is directly related to ‘production’ in term of irrigation and ‘consumption’ of drinking water. But as suggested earlier the main factor in determining whose livelihood will be secured by energy interventions will be the choice of end uses.

The final synthesis

- 4.26** Once the basic parameters of the energy links to poverty are laid out they can be ‘superimposed’ onto the categories used by the Sustainable Livelihoods Approach. An attempt to track these poverty linkages to and from the energy systems is made in Annex 4. This shows that it is relatively easy to generate a vast number of possible interconnections. These links specified in the annex are illustrative, and show that in practice the scale and nature of each link will depend on the local physical, cultural and political circumstances.
- 4.27** But this exercise also has another effect. It serves to emphasise that just as the people conducting livelihood assessments need to be aware of the gender dimension, so too they need to be aware of the ways that energy (and other inputs) impinge on poverty reducing strategies. In practice this will mean understanding how their interventions could be improved with the addition of appropriate energy services (or as important, how they would be constrained, in their absence) and being aware of the wide range of options and mechanisms that might best meet the energy needs of particular groups (differentiated by gender, health, class, location and so on). This is unlikely to be achieved by administrative *fiat*.
- 4.28** The Livelihoods Approach offers the considerable advantage of forming part of a lively on-going process of developing participative and other forms of Monitoring and Evaluation⁶². These, combined with the specifically energy focus offered in Annex 4, provide the foundations for systems to monitor and evaluate the impact of energy interventions on poverty and gender.⁶³

⁶⁰ Dayal, Rekha, Christine van Wijk, and Nilanjana Mukherjee, *METGUIDE Methodology for Participatory Assessments: Linking Sustainability with Demand, Gender and Poverty*, World Bank Water & Sanitation Program/ International Water & Sanitation Centre, 2000.

⁶¹ See for example the excellent Water and Sanitation Programme web site <http://www.wsp.org/english/activities/small-towns.html>

⁶² See Guidance Sheet 3.4 on M and E in , www.livelihoods.org/post/info/info_guidanceSheets.html. See also “Tools for Sustainable Livelihoods: Livelihoods Monitoring and Evaluation, by Kate Pasteur, IDS, February 2001.

⁶³ Another recent attempt to develop a system of monitoring evidence of improved energy access (though not energy impact in the strict sense) is provided by Vivien Foster “*Measuring the impact of energy*

The framework for research in China⁶⁴

4.29 The research framework adopted to consider the links between energy, poverty and gender in China drew on aspects of both the PRSP and Sustainable Livelihoods approaches. The study took livelihood outcomes for poor men and women as its central concern. These outcomes were seen as determined by the ways in which the poor used their assets within the existing geographical and institutional environment. The main components of the framework are discussed below.

Location, climate and natural resources

4.30 In order to allow comparisons in terms of the geographical environment, the study communities were selected to cover a diverse range in terms of location, climate and natural resources. Location is important in that it may strongly influence both the availability and demand for energy services. The distance from existing electricity grids, or markets where fuel supplies or energy using devices may be obtained will affect availability, cost and possible end-uses of particular types of fuel. Distance from urban areas will affect the possibilities for maintenance of energy generating or using equipment. Isolated communities that have difficulties in gaining access to markets may also have less incentive to adopt more productive energy-using devices. On the other hand the benefits derived from the 'social' uses of energy may be much greater for communities which have to travel long distances to health facilities, schools, or centres where communications or entertainment services are provided.

4.31 Access may also be limited by climate factors. Snow or rain may make roads and paths impassable or dangerous at certain times of year. Climate will also have obvious implications in terms of energy demand, for example in terms of heating, and supply, for example the possibilities for solar cookers or wind generation of electricity. Aspects of natural resources that need to be considered include: availability of bio-mass materials that can be used as fuel; soil conditions which will affect the types of crop that can be grown and the demand for irrigation; and water resources, which if plentiful may be used as a source of energy and if limited may consume considerable energy in terms of pumping, transportation or boiling to render it safe for drinking.

Livelihood Strategies

4.32 Poor households and individuals were viewed as adopting livelihood strategies which consisted of a wide variety of both market-oriented and non-market-oriented activities. The aim of these strategies will be to sustain, and if possible

reform – practical options” in World Bank Energy and Development Report 2000: Energy Services for the World's Poor, ESMAP, World Bank, 2000 ISBN 0-8213-4705-5 and Vivien Foster and Jean-Philippe Tre , *Measuring the Impact of Energy Interventions on the Poor – an Illustration from Guatemala*, World Bank/DFID Conference, May 2000, “Infrastructure for Development: Private Solutions and the Poor, London

⁶⁴ This section of the report was developed during a project workshop held at IDS over the period 31 August - 5 September 2000. It was attended by researchers from IDS, ETC and CRED.

improve, their situation by appropriate use of their stock of assets, both material (physical and financial capital) and non-material (human and social capital). Poverty reduction will imply the accumulation of assets over time. This can lead to both improved living standards and/or an increase in the range of possible future livelihood strategies. In difficult periods it may be necessary to draw on the stock of assets to maintain minimum living requirements.

- 4.33** Focusing on sustainable livelihoods provides a means whereby the balance between ‘productive’ and ‘social’ uses of energy can be understood. Both can be seen as the utilisation of energy services to increase asset holdings - in one case economic, in the other human or social. To understand the potential role of energy services in poverty reduction it is essential to have a clear understanding of the livelihood strategies currently adopted in the study communities. This is necessary to determine if the lack of access to specific energy services may be constraining the range of livelihood strategies available to the poor, reducing both incomes and the possibilities for asset accumulation.

Institutional and policy context

- 4.34** Institutions play a central role in the determination and effectiveness of different livelihood strategies. Central and local governments, community organisations, other informal community structures and private markets will determine the economic and social environment within which livelihood strategies must function. The associated policies, laws, customs and incentives will have a major influence on access to livelihood assets and the possibilities for transformation of assets to generate livelihood outcomes. The institutional context also plays a major part in terms of vulnerability and security. For example, it will determine the extent to which the poor can expect to receive organised assistance when confronted by natural, economic or social shocks.
- 4.35** Government policies will provide the framework for the development of energy services and determine which organisations are involved in the planning and implementation of such services. Institutional arrangements for the supply of energy and energy-using devices, whether through state organisations, township and village enterprises (TVEs) or private traders, will have a major effect in terms of both access and accountability. In addition, as frequently indicated above, energy is essentially an intermediate good whose benefits are realised only in conjunction with other complementary inputs. Energy policy must be considered in parallel both with policy on other sectors (for example employment, education, health, agricultural extension, water, and transport) and with specific policies on poverty alleviation and social security.
- 4.36** Gender relations and cultural norms will have a major influence on both the involvement of men and women in energy service decision making and the extent to which energy use in marketed or non-marketed activities is gendered. They may also largely determine the priorities for the application of new energy services and hence the distribution of benefits from their introduction.

Income and consumption

4.37 As indicated above, the research treated poverty as a complex multi-dimensional phenomenon. However, this broad definition does not minimise the importance of increasing incomes and consumption. Apart from the fact that income poverty would probably be seen as the key issue by most poor households in China, reducing income poverty can be one of the most direct means of, for example, increasing empowerment and reducing vulnerability. Similarly, earned income is itself determined by the levels of livelihood assets and the 'rates of return' on each of those assets. The role of improved energy services in increasing both the options for income earning activities and productivity in existing activities remains of primary importance.

Time use and time poverty

- 4.38** The poor are typically the most heavily dependent on human energy to undertake both production and other essential household activities. Such activities are in general characterised by low productivity and high labour-time inputs. Within poor households, women and girls bear a major share of the lowest productivity, most time-consuming work. 'Time poverty' arises where the rate of return on human assets is so low that household labour time has to be largely allocated to survival needs. Many of the poorest literally 'have no time' to earn additional income during periods when demand for labour is high, take advantage of social assets which might improve their situation or play an active role in decision-making within households and communities.
- 4.39** The consequent lack of 'leisure' time may also have dire consequences for both health status and other aspects of human capital, and thus further increase vulnerability. The role of energy services, whether by powering equipment or increasing day length, in liberating poor men and women from this cycle (low productivity constraining the ability to increase the stock of economic, social and human assets which could improve productivity), was an essential component of the research.

Physical asset ownership and access

4.40 The most obvious route to increased productivity via improved energy technology lies in the increased use of physical capital assets. This may be achieved through ownership or by gaining access to assets owned privately by other individuals or collectively by communities. This increased productivity may provide opportunities for additional income or reduce labour time spent on household activities. Physical assets may also directly act on human capital, for example by providing light for reading, access to educational communications equipment, or cooking arrangements which reduce household air pollution.

Human capital

4.41 In addition to their effects at household level, inadequate energy services, particularly in rural areas, may substantially impair the provision of community services such as education, health, potable water supply and sanitation. The

absence of effective lighting, heating, cooling and pumping equipment may limit the potential benefits of such services and hence the possibilities for maintaining or enhancing human capital assets. Using livelihood terminology, reduced human capital, through sickness or limited education, then leads to diminished capabilities and restricted livelihood strategies.

Empowerment and participation

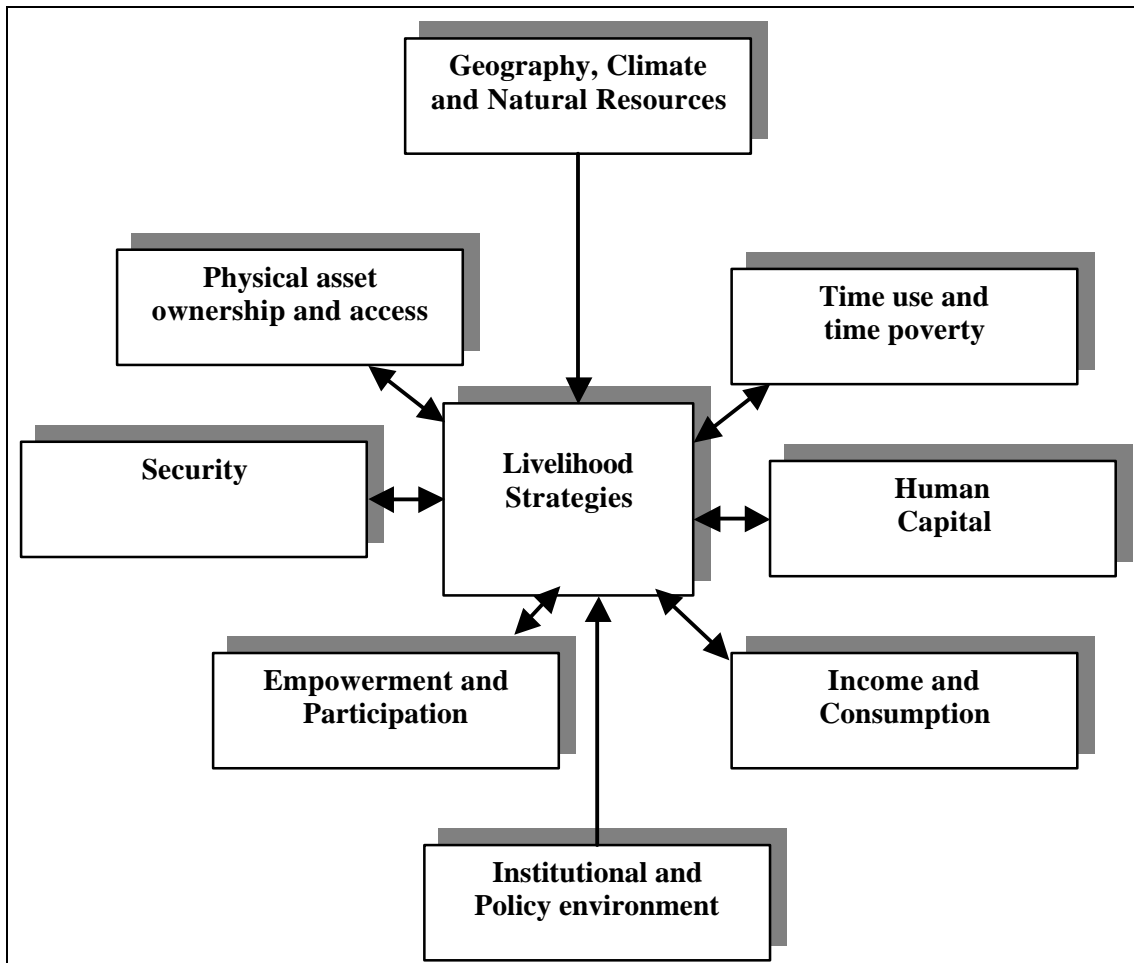
4.42 There is a tendency for the poor to be excluded both from specific decision making processes and more generally from community political, economic, social and cultural activities. Low levels of social and human capital assets result in reduced social participation. In terms of energy services two aspects are of interest. First, the extent to which poor households, and poor women within households, are involved in decisions about energy services, for example the introduction of new sources of energy or acquisition of end-use equipment. Second, the extent to which lack of access to energy services, for example in terms of production, communication, education or entertainment activities, in itself tends to reinforce the exclusion of the poorest.

Security

4.43 Security aspects of energy services should not be seen only in the limited sense of physical security, for example in terms of the role of lighting in preventing accidents or violent acts. As discussed above, the lack of economic, social, and human assets is the underlying cause of the insecurity of the poor and their vulnerability to natural, economic and social shocks. Their inability to access energy services may constrain the choice of livelihood strategies which would allow them to reduce this vulnerability.

4.44 None of the above factors can be viewed in isolation. The closely interlocking relationships between them are of equal importance. The figure below indicates one way of considering these relationships using livelihood strategies as the central focus.

Figure 3: Livelihood strategies and related factors



Research Questions

4.45 The above framework gave rise to a large range of potential research questions. Some of the key issues are listed below⁶⁵. It should be noted that, given the interrelationships between the various components described above, the location of a particular question under a particular heading is necessarily somewhat arbitrary.

Overall

- How important are improved energy services to the reduction of poverty?
- To what extent are alternative poverty reduction interventions dependent on improved energy services?
- What are the implications of improved energy services for gender equity?
- How should the impact of energy projects be assessed if poverty reduction and gender equity are taken as a primary goal?

⁶⁵ The specific questions are an attempt to reflect the main concerns expressed during the IDS workshop (see footnote 64)

Geography, climate and natural resources

- To what extent are the costs and benefits of energy services determined by geographical location, climate and natural resources?
- Do the effects of geography, climate and natural resources on energy service access and use vary between: rich and poor households; men and women?
- Can new approaches to energy services overcome the problems of poor communities in remote areas?

Livelihood strategies

- What are the principal livelihood strategies within the different study communities?
- In what ways are households poor or vulnerable?
 - What assets do they have/lack?
 - What institutions and policies affect them and how?
- What are the livelihood strategies of the poor? How do they differ from the non-poor?
 - How are the livelihood strategies of women distinct from those of men?
- How do energy services directly and indirectly affect people's livelihoods and the context that shapes them. What is the significance to poor people?
- How do people's livelihood strategies affect their use of and benefit from energy services?
 - Do particular households not use certain energy services? What are the constraints on use?
 - Which energy services are most important to the poor?
- Can improved energy services can reduce poverty by enabling livelihood diversification?
- Do new forms of energy service tend to increase the range of services used by households, or displace existing services?
- Who gains and who loses from the introduction of new energy services?
 - Do richer households benefit substantially more than poorer?.
 - Do men benefit substantially more than women?
- How can energy services be adapted to promote positive impacts which are relevant to the livelihoods of poor households and women?

Institutional and policy context

- What changes (including institutions, projects, programmes) are occurring at the micro level? How do these affect livelihoods (e.g. through conflicting with or complementing livelihood strategies)?
- Do institutional factors have a major influence on differences between rich and poor, men and women in terms of their input to energy decision making, their utilisation of energy services, the costs they incur and the benefits they derive?
- What are the key enabling/constraining factors and policies?
- What institutional and social arrangements could encourage more equitable distribution of the costs and benefits of energy services:
 - Between rich and poor households?
 - Between men and women?

- Are there any aspects of the policy and institutional environment that are likely to negate the beneficial effects of new energy services?

Income and consumption

- Do new energy services improve access to income-earning opportunities?
- How do these opportunities vary between rich and poor households?
- How do they vary between men and women?
- Do households prefer to invest in energy services and devices which tend to increase their capacity for income generation in preference to those which are consumption oriented? Who makes such decisions?

Time use and time poverty

- How are workloads related to energy services?
 - How do these workloads vary between rich and poor households?
 - How do they vary between men and women, adults and children?
- What are the implications of women's time poverty in terms of their livelihood strategies?
- In households which are reliant wholly or partly on traditional fuels for cooking and heating:
 - is significantly more time is allocated to human energy consuming reproductive tasks;
 - do women and older girls take on the burden of such tasks to a significantly greater extent than other household members?
- Can improved energy services reduce labour-time inputs to essential household activities?

Physical asset ownership and access

- How are energy services distributed within communities?
 - Who has ownership?
 - Who has access?
- Do improved energy services provide access to more productive technologies?
- Is powered production equipment very unevenly distributed within communities?
- Do poorer households benefit by gaining access to powered production and communications equipment owned by others?
- How do women and men differ in terms of their energy service investment priorities?

Human capital

- What is the impact of energy services on human capital (health, education) and social capital?
- Which households and individuals have access to communications assets (radio, television, telephone) and what human or social capital benefits flow from such access?
- How does this vary by gender and age?
- In households which are reliant mainly on traditional fuels for cooking and heating, do women and children suffer higher rates of self-reported illness?

Empowerment and participation

- What is the role of participatory approaches in the development of energy services?
- What are the community/household level processes for decision making on energy services?
- How do rich and poor households participate in these processes?
- How do men and women participate in these processes?
- Are people's own livelihood priorities being addressed in the development of energy services?

Security

- To what extent is fuel security, especially for the essential needs of lighting, cooking (including boiling water) and heating, a major concern for poor households and what labour-time do they devote to ensuring it?
- To what extent can improved energy services decrease the risks from natural, economic or social shocks by increasing the range of options available to poor households in terms of income generation, essential household activities and service provision?

5

5 Report on the China country study

- 5.1** The aim of the fieldwork was to explore some of the linkages between poverty, gender and energy in selected areas of rural China, based on the framework described in chapter 4. In terms of the overall discussion in this document it should be clearly stated at the outset that China is in many respects a very special case. For example, it has experienced almost unprecedented economic growth over the last two decades. The number of those official defined as poor declined from 260 million in 1978 to 50 million in 1997⁶⁶, though there remain very large numbers of people with levels of income and food production only just above subsistence needs⁶⁷.
- 5.2** China has also undergone radical and far reaching economic and political reforms of a very specific character⁶⁸. In particular, the *relationships* between different level of government, between government and productive enterprises and between government and households, have elements which often appear uniquely Chinese. This network of relationships, combined with the ubiquitous role of the Communist Party, has profound implications in term of the possibilities for policy innovations in all sectors, not least in energy.
- 5.3** In terms of the rural energy focus of this study, China can also be seen in some respects as radically different from the ‘typical’ developing country case. Mainly in consequence of the astonishing growth of “Township and Village Enterprises”⁶⁹ there has been a dramatic increase in rural energy supply and consumption. In particular, the expansion of rural electrification has lead to a situation in which some 96% of villages and 94% of households are now served

⁶⁶ Chen, S. and M. Ravallion, 2000, *How did the world’s poorest fare in the 1990s?*, World Bank.

⁶⁷ Piazza, A. and E. Liang, 1998, Reducing absolute poverty in China: current status and issues, *Journal of International Affairs* 52(1): 253–273.

⁶⁸ Cannon, Terry, 2000, “The economic reforms, demographic processes and environmental problems”, in Cannon, Terry (ed.), *China’s Economic Growth*, Macmillan, London.

⁶⁹ Wider, 1999, *The evolutionary dynamics of China’s small and medium sized enterprises in the 1990s*, World Development Studies 14, World Institute for Development Economics Research.

by large or small grid systems. Thus the great majority of even poor households have access to grid electricity, though possibly (particularly for isolated grid systems) with capacity, reliability or quality constraints on potential applications in terms of production activities. One aim of the research was to consider the extent of the benefits which have arisen from such high levels of access.

- 5.4** In these circumstances, lack of access to electricity has become an important indicator of exclusion from the increasing prosperity of the majority. Those villages with no grid connection are typically in the most remote and sparsely populated regions with the most difficult terrain. They also have limited access to roads, markets and other services. Not surprisingly they are among the poorest in China. This minority who have no access to electricity or rely on batteries or small diesel generators includes some 77 million people in 30,000 villages⁷⁰. Particular attention was paid to such areas, and to those in similar locations who have been provided with grid-access by means of small scale generating plants, in considering the impact of the introduction of electricity on individuals, households and communities.
- 5.5** The field research was conceived as a series of case studies, using both qualitative and quantitative methods, in selected poor rural counties in two provinces, Gansu and Hubei. These were seen as of particular interest for the purpose of the study, though for somewhat different reasons.
- 5.6** Gansu suffers from severe water shortages and arid soils which have impacted on agricultural productivity and household incomes. Deforestation, mainly resulting from clearance for agriculture but partly due to the prolonged use of fuel wood as a primary source of energy for cooking and heating, has greatly exacerbated the situation. This has encouraged policies targeted at the development of alternative and renewable energy sources.
- 5.7** Hubei is one of the most important provinces for hydro-electric power generation, both in terms of major dam developments and small scale hydropower installations. The mountainous terrain of western Hubei makes communications extremely difficult and there are a large number of remote, very poor villages, some of which have no electricity.
- 5.8** This chapter will initially look at some of the general issues relating to poverty, gender and energy in China. It will then describe the methodology used to select the study sites and conduct the fieldwork. The next section will provide general background on the study provinces and selected counties, townships and villages. The main findings⁷¹ are presented in chapter 6.

⁷⁰ Beijing Jikedian Renewable Energy Centre, 1999, *The first phase of the brightness program of China*, mimeo.

⁷¹ Separate reports on each case study will be published as part of the overall project.

Background on poverty, gender and energy issues in China

Rural poverty in China

“While the 'old' poverty is rooted in regions which are ecologically deprived and structurally outside market development, the 'new' poverty stems from the insecurities and vulnerabilities which arise in part from market-oriented development and can be found in 'rich', 'medium' and 'poor' regions. An analysis of poverty in contemporary China must move beyond the narrow ecological view and explore more dynamic and elusive forms of poverty.”⁷²

- 5.9** New forms of urban poverty caused by the withdrawal of the state from welfare activities, and the restructuring of the economy, have been well documented in China⁷³. In contrast, rural China, officially conceptualised as moving steadily away from poverty as remote regions open up to development, has had little research carried out to analyse the changing patterns of poverty post-reform. Rural poverty measures have been focused on geographic areas, where measurement of poverty is based on two criteria: annual cash income and annual grain consumption⁷⁴. In 1994 for example, the poverty levels were set at ¥500 and 200 kg respectively. If the average figures for a county fall below this, the area will be designated a poor county and become eligible for assistance. In the light of the retrenchment of collective welfare activities post-reform, the implications of defining rural poverty on a purely geographic basis, and the assumption that a market-oriented development will provide solutions needs to be rethought.
- 5.10** Both Cook and White⁷⁵, and Gustafsson and Zhong⁷⁶ found that the policy of targeting areas of chronic poverty misses large numbers of poor people. Looking at four provinces, the World Bank found that less than 50% of the poor live in counties designated as poor. In another study of Shanxi Province, in addition to the 3.81 million people living in poor counties, 1.46 million poor people were living in counties not designated as poor⁷⁷. Gustafsson and Zhong found even starker results: they estimate that two-thirds of China's poor are not reached by the targeting of poor areas⁷⁸. The limitations of using a geographic definition of poverty could include the obscuring of "significant variations between

⁷² Cook, S. and White, G., 1998, *The changing pattern of poverty in China: Issues for research and policy*, IDS Working Paper No 67, Brighton: IDS, p3.

⁷³ See, for example, Wong, S, 1998, *Marginalization and Social Welfare*, London: Routledge

⁷⁴ Beynon, L., and Zheng, B., 2000, Understanding rural poverty and poverty constraints in China: an analysis of the causes of poverty and poverty constraints in poor rural areas of China, and the impact and effectiveness of poverty alleviation projects, Report commissioned by DFID China Programme SDA, p3.

⁷⁵ Cook, S. and White, G., 1998, op. cit..

⁷⁶ Gustafsson, G, and Zhong, W, 2000, *How and why has poverty in China changed? A study based on microdata for 1988 and 1995*, The China Quarterly, No 164 December, p983-1006.

⁷⁷ Cook, S. and White, G., 1998, op. cit., p10.

⁷⁸ Gustafsson, G, and Zhong, W, 2000, op. cit., p1004.

households and communities"⁷⁹, making the non-poor beneficiaries. It is true however, that certain communities are more poverty prone. Whilst poverty indicators are improving for many, Gustafsson and Zhong found that in the decade between 1985 and 1995 people living in mountainous areas and minorities were experiencing worsening poverty.

- 5.11** Economic reforms, most notably the marketisation of health and education, are also changing the face of rural poverty. Evidence suggests that in education, for example, access for the poor has been reduced during the reform period⁸⁰. Households may also be more vulnerable to ill health: in a period of sickness health expenditure is compounded by loss of labour to create a major cause of poverty⁸¹. Whilst most age groups are experiencing improvements in poverty indicators this is no longer the case for children.⁸² With a government policy of targeting poverty through increased access to productive assets rather than welfare, sections of the population who lack labour may be increasingly vulnerable, namely the elderly, the disabled and children.⁸³
- 5.12** Using income and annual grain consumption as poverty indicators also largely proscribes the definition of what it means to be poor. DFID's study in Guangxi, Yunnan and Ningxia provinces found villagers' own perceptions of poverty to be far more complex and focused on individual households than that of the officials:

*"Officials' perceptions of the causes of poverty focused mostly on community level factors: natural resources; climate; infrastructure. The perceived 'low quality' of the rural poor was also emphasized. Villagers' perceptions of the causes of poverty focused on the specific situation of poor households; different stages of the domestic life cycle (newly-divided family, school-age children, elderly couple); ill health, mental illness or death in family; lack of investment or credit; lack of land or labour; poor family relations; bad household economy; laziness."*⁸⁴

- 5.13** Current thinking on poverty attempts to capture these complex and dynamic non-income aspects of the experience of being poor. A policy based on a conception of poverty as a linear progression up and over the poverty line is overly simplistic. From the birth of the entitlements approach two decades ago with "a recognition of the importance of public goods and common property resources"⁸⁵ to the most recent World Development Report in 2000/1:

⁷⁹ Cook, S. and White, G., 1998, op. cit., p60.

⁸⁰ Cook, S, 2000, *After the iron rice bowl: extending the safety net in China*, IDS Discussion Paper no. 377, Brighton, IDS, p4. Gustafsson and Zhong, 2000, op. cit., p1004.

⁸¹ Cook, S, 2000, op. cit.

⁸² Gustafsson and Zhong, 2000, op. cit.

⁸³ Cook, S, 2000, op. cit., p5.

⁸⁴ Beynon, L., and Zheng, B., 2000, op. cit., p3.

⁸⁵ Cecelski, E, 2000, *Enabling equitable access to rural electrification: current thinking and major activities in energy, poverty and gender*, Briefing paper prepared for a Brainstorming Meeting entitled "Emphasis on poverty alleviation and women", ASTAE, The World Bank.

“Our new view of poverty demands a more informed interpretation of the diverse and shifting nature of poverty among different groups, which requires disaggregated household and intra-household data, using more qualitative and participatory methods in addition to quantitative analysis for understanding the changing experience of poverty.”

- 5.14** The poverty policy process in China, has been based on a very narrow set of data that fails to capture the reality of the majority of the poor. Cook and White see a willingness within the government to move towards smaller units to identify and target poverty. In a context of what they describe as "the behaviour of complex bureaucratic institutions which involves both vertical and horizontal competition between levels of government and specific administrative agencies"⁸⁶, to effect a shift in the design and implementation of poverty policy is likely to be practically and politically challenging. Geographically targeted poverty alleviation strategies were primarily formulated in response to growing inequalities in the distribution of economic growth. The upheavals of Tiananmen in 1989 created political sensitivity to these inequalities and led to the establishment of a nation-wide poverty reduction programme⁸⁷. Between the start of reform in 1978 and Tiananmen it was assumed that the rapid rise in levels of productivity and growth in rural areas would lead to a general rise in living standards. By the middle of the eighties however, it had become clear that around 100 million rural Chinese were being left out of the economic boom, and that these people were mainly living in resource poor remote interior regions. Thus geographically focused poverty reduction programmes were established.
- 5.15** The Poverty Alleviation Office (*fupinban*) is held accountable to the State Council, and is separate to the arms of government responsible for welfare and relief. The measures employed to ensure enhanced capacity include: subsidised credit and agricultural inputs, training, micro-credit and public works programmes⁸⁸. Some members of society will be unable to take advantage of these poverty alleviation measures: the elderly, the disabled, children, and those women whose time may be taken up with labour within the household and reproductive labour. In fact they are most likely to benefit the better off sections of communities, who have surplus time and energy, and who are willing to take out loans. Gustaffson and Zhong note the degree of "leakage" to the non-poor; in fact a majority of those benefiting may belong to this category⁸⁹.

⁸⁶ Cook, S. and White, G., 1998, op. cit., p36.

⁸⁷ Cook, S. and White, G., 1998, op. cit., p5.

⁸⁸ Cook, S, 2000, op. cit., p16.

⁸⁹ Gustaffson and Zhong, 2000, op. cit., p1004.

Gender and poverty – the institutional Process

“The continued gender inequality in work, education, technical knowledge and health, points to the failure of poverty projects to adequately address the poverty constraints and needs of rural women”⁹⁰

5.16 How does gender influence vulnerability to poverty in rural China? Studies that have concentrated on household level data have found no evident gender difference in vulnerability to poverty. However, as White and Cook point out, these have failed to take into account the intra-household allocation of resources. Summerfield and Aslanbeigui's explanation of the feminisation of poverty in China, using Sen's entitlement theory, says that while "total availabilities of the Chinese household" have increased, the "source of earnings for women, the nature of their jobs, and their employment opportunities" may have been adversely affected⁹¹. The impact on rural women of the "responsibility system", where the production unit was changed to the household in 1983 has been great :

“First the shift in work environment has placed women in a setting where their command over income is less compared to work outside the home. Where household production is the result of the joint effort of men and women, tradition is expected to rule the assignment of tasks and labour previously decided by the collective...the traditional authoritative relations within the household may be reproduced.”⁹²

5.17 Under the collective system the contributions of individuals were made clear through the allocation of work points (women were typically given 8 work points per day and men 10); now the contribution of women to the household income has become much less visible.

5.18 Indicators that female poverty is more prevalent than male include: uneven sex ratios at birth and higher female infant mortality rates; higher female unemployment rates; higher female suicide rates; lower school enrolments for girl children. The uneven sex ratio at birth peaked in 1991 when 116.1 boys were born for every 100 girls⁹³. This figure speaks of widespread gender discrimination, the effects of which include sex-selective abortion, abandonment of girls, female infanticide and importantly the non-registration of girl children. The latter is likely to be a particularly strong indicator of the future face of female poverty: if a baby is not registered to the household it has no rights to schooling or any other state benefits. He, or more likely she, is in effect a non-person. Yi, Ping and Baochang estimate that in 1990 4 girls per hundred were

⁹⁰ Beynon, L., and Zheng, B., 2000, op. cit., p8.

⁹¹ Summerfield, G, and Aslanbeigui, N, 1992, 'Feminization of poverty in China?', *Development: Journal of the International Society for Development*, No 4, p57.

⁹² Summerfield, G, and Aslanbeigui, N, 1992, op. cit., p59.

⁹³ Gu, B, and Roy, K, 1995, 'Sex ratio at birth in China, with reference to other areas in East Asia: what we know', in *Asia-Pacific Population Journal*, Vol 10 No 3, p20.

not being registered⁹⁴.

5.19 Infant mortality rates illustrate a significant gender difference: 25.4 for males and 29.4 for females in 1989-1990⁹⁵. According to Cook and White this is partly attributable to the difference in use in health services: 60% of baby boys as opposed to 40% of baby girls received medical attention in the 24 hours prior to death. Another health indicator pointing to gender discrimination is suicide rates: China is the only country to report a higher rate of female than male suicide (55% according to the WHO); the highest incidence of suicide is amongst young, rural women.

5.20 Migration and unemployment are significant factors in many rural poor women's lives. Female migration is lower than male, standing at 44% in the 1990 census⁹⁶. Moreover the gendered pattern of migration is quite distinct: women make up most of intra-provincial, rural to rural and urban to rural migration because of marriage migration. Rural to urban migrants are less likely to be married than male migrants. Women therefore, are more likely to be left behind by a migrating spouse, and to have to take on extra labour burdens in their absence. There is an additional burden on older women: the household registration system means that a child's registration follows the mother. Rural to urban female migrants therefore do not have the automatic right to schooling for their children in their new place of residency, leading to many children of migrant parents being sent back to their original village, often to be cared for by grandmothers.

The gendered nature of energy poverty

5.21 The limited studies of demand side issues in rural China, focusing on the needs and constraints of energy users, have paid little attention to gender⁹⁷. It is known that women in rural China spend a great deal of their time both collecting fuel and cooking. Junfeng and Shuang estimate that in some areas it may be as high as four to eight hours a day⁹⁸. There are well-documented health risks associated with the use of biomass in cooking. The health risks of carrying heavy loads of fuel are compounded by indoor air pollution caused by cooking, the side effects of which include chronic lung disease. DFID's study of Dingshaping village in Guangxi⁹⁹, found that reducing women's labour burden through participation in a bio-gas project improved their general health.

⁹⁴ Croll, E, 1995, *Changing identities of Chinese women, rhetoric, experience and self-perception in twentieth century China*, London, Zed Books.

⁹⁵ UN, 1997, *Women in China: a country profile*, New York, UN/ESCAP, p81.

⁹⁶ Davin, 1996, "Migration and rural women in China: a look at the gendered impact of large-scale migration", *The Journal of International Development*, Vol 8 No 5, 655-665.

⁹⁷ Taylor, R, and Bogach, S, 1998, *China, a strategy for international assistance to accelerate renewable energy development*, World Bank Discussion Paper no 388, Washington, World Bank.

⁹⁸ Junfeng, L, and Shuang, Z, 1999, "Rural energy: power to the countryside", *Chinabrief*, Vol 2 No3, 25-29.

⁹⁹ Beynon, L., and Zheng, B., 2000, *op. cit.*

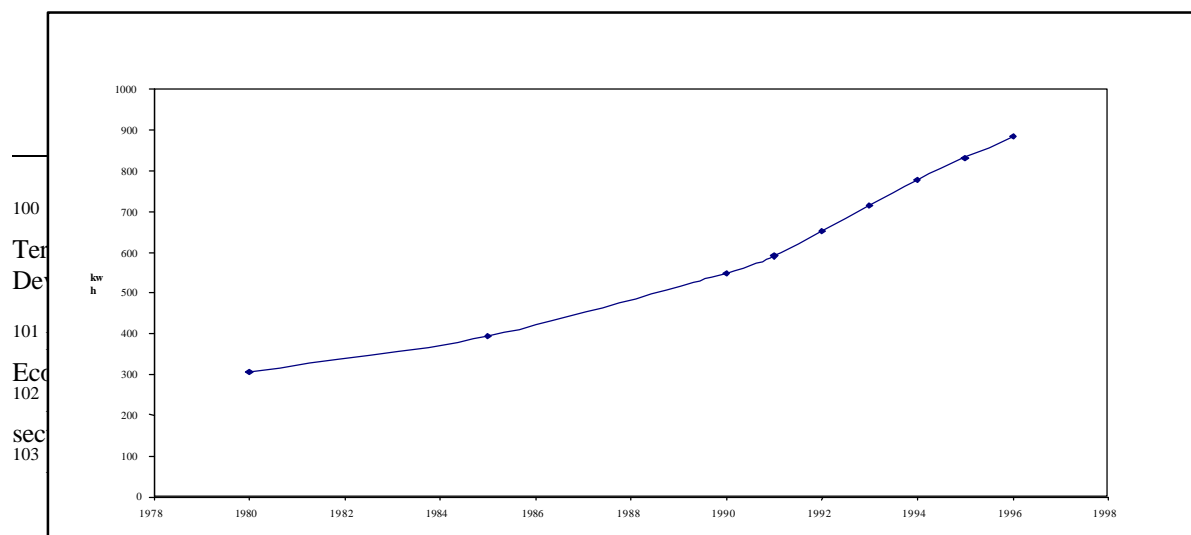
Energy supply and demand

5.22 Over the last two decades China has achieved the most rapid growth rates in the world. Annual GDP growth was 10.2% through the 1980s, 12.9% over 1990-1994, and 8.7% from 1995 to 1999. Industry has grown even faster, with rates of 11.1%, 18.8% and 8.9%¹⁰⁰. Over the period from 1980 to 1996 the consumption of coal, which provided around three quarters of total energy consumption, increased by 138%, some 5.6% per annum, and consumption of oil by 100%, around 4.4% per annum. Energy, and particularly electricity, shortage was identified as a major constraint on continuing high growth rates in the 1980s¹⁰¹ and this led to a rapid expansion in energy investment. In the 1990s, with supply coming more into line with demand, attention has focused increasingly on the quality of supply with diversification into oil, gas and renewable sources. China is faced with the unhappy prospect of becoming one of the world's largest emitters of atmospheric pollutants¹⁰² as the World Bank predicts a threefold increase in greenhouse gas (GHG) emissions by 2020. As a result, environmental considerations have also recently moved up the government's energy agenda.

5.23 The sector has been undergoing major reforms in the wake of the decision in 1998 to redefine the relationship between state industries and government ministries. Andrews-Speed et al, find three main objectives in these reforms: the reduction of the cost of government through the merging of overlapping functions; the separation of government from the commercial management of the industry and the improvement of the effectiveness of government in the management of the economy¹⁰³. However, because of the lack of "a strong institutional framework; a clear strategic vision for the sector; and well-defined ownership rights" they hold out little hope for energy sector reform, and even predict that unless the performance of state owned energy companies improves energy costs will increase.

5.24 Electricity demand has risen most dramatically, with per capita consumption increasing three-fold between 1980 and 1996, most rapidly (around 10% per annum) in the early 1990s.

Figure 5: Per capita electricity consumption



5.25 One aspect of this growth of particular importance for the current exercise, is that it reflects an extremely rapid expansion of rural electrification, partly to meet domestic consumption demands, but also to power the growth of the “Township and Village Enterprises”, which have been such a prominent feature of the economic reform process in the post-1979 era. Since 1980, overall rural energy consumption has seen an annual increase of 4.5%¹⁰⁴.

Rural energy: current trends in use

5.26 Rural households in China use a number of different forms of energy in order to minimise both the costs and the risks arising from unstable supply and technologies. Barnett et al state that "it is not unusual to find households with a solar cooker, biogas ring, and both coal and residue burning stoves"¹⁰⁵. Even though over 96% of villages and 94% of the rural population are connected to electricity (as opposed to 40% in Indonesia, for example¹⁰⁶), there is still a heavy reliance on biomass for cooking and heating. Biomass, either from crop residues or in the form of locally collected fuelwood, provides a cash-free option to the rural poor, whereas electricity may cost as much as ten times more than in urban areas. For lighting, kerosene is still much in use. Junfeng and Shuang report that even in households with an electricity supply, kerosene may be a preferred option because of the cost of grid electricity and the instability of supply¹⁰⁷.

5.27 In line with the global environmental concern with greenhouse gas emissions, China has a range of programmes aimed at providing energy to remote areas by renewable energy technologies, such as the "Brightness Programme". In addition, international assistance programmes working towards this remit include the World Bank/GEF Renewable Energy Development Project, the Global Environment Facility Energy Conservation and GHG Emission

¹⁰⁴ Shuhua, G, Daxiong, Q and Xiliang, Z, 1995, 'Evaluation of the biogas and improved cookstove programme in China', Pacific and Asian Journal of Energy, Vol 5 No 1, p107.

¹⁰⁵ Barnett, A, Lucas, H and Standing, H, 2000, *The development of an analytical framework to review energy, poverty and gender in China*, commissioned study report to ASTAE, World Bank.

¹⁰⁶ Junfeng, L, and Shuang, Z, 1999, op. cit.

¹⁰⁷ Junfeng, L, and Shuang, Z, 1999, op. cit.

Reduction in Chinese Township and Village Enterprises Programme, and the UNDP Capacity Building for the Rapid Commercialisation of Renewable Energy.

- 5.28** Renewable energy technologies, notably wind and PV are popular because they seem to address two problems: the provision of an electricity supply to remote areas beyond cost effective reach of a grid, and the limitation of the use of fossil fuels and other environmentally damaging energy sources. The projections of these programmes are ambitious: to electrify 23 million by 2010 according to official government figures. Even with subsidies from bilateral and multilateral aid programmes, the costs of wind power generation, for example, are CNY 200 to 400 higher than the cost of a coal-fired electricity supply. These costs are mainly borne by consumers¹⁰⁸ (Jufeng and Shuang, 1999), and the rural poor can ill afford them. Renewable energy sources may also require some degree of maintenance: a major problem in a remote area if there are neither local technicians nor local suppliers of replacement parts. Even if officials subsidise the installation of a renewable energy supply, it does not mean that the poor will be able to afford to use it. Thus the marriage between renewable energy and poverty alleviation may not be as happy as the official line suggests.

Vulnerability Context – the Choice of Provinces

- 5.29** The Provinces of Gansu and Hubei were selected as being of particular interest for the purpose of the study, though for somewhat different reasons. Gansu suffers from severe water shortages and arid soils which have impacted on agricultural productivity and household incomes. Deforestation due to the prolonged use of fuel wood as a primary source of energy for cooking and heating has greatly exacerbated the situation and encouraged policies targeted at the development of alternative and renewable energy sources. Hubei is one of the most important provinces for hydro-electric power generation, both in terms of major dam developments and small scale hydropower installations. The mountainous terrain of western Hubei makes communications extremely difficult and there are a large number of remote, very poor villages, some of which have no electricity.
- 5.30** It should be noted that 1999 and 2000 were extremely difficult years for farmers in both Gansu and Hubei. In a letter published recently in China, the party secretary in Qipan township, Hubei, stated that a family of five working eight mu of land had to pay \$365 a year - equal in many places to more than the annual farmer's income - in poll and land taxes¹⁰⁹. Gansu experienced severe drought conditions to the extent that many urban dwellers were rationed to a few hours of water per day. The richest village in this study, Xiapai in Yongchang, had crop income levels comparable to those in the poorest, because

¹⁰⁸ Junfeng, L, and Shuang, Z, 1999, op. cit.

¹⁰⁹ Pomfret, John, 2000, "Beijing Receives Wake-Up Call on Farmers' Woes", *Washington Post*, September 4, 2000.

water supplies were insufficient to feed their irrigation system. Low crop yields in some parts of Hubei and the demands of the rural taxation system, which is based not on outputs but simply on the size of land holding, were reported to have driven large numbers of farmers (in some districts the majority) into urban areas in search of income.

Methodology

Overview

5.31 As indicated above the aim of the fieldwork was to explore the linkages between poverty, gender and energy, with a particular focus on electrification, in selected poor rural counties. It was conceived as a series of case studies, using both qualitative and quantitative methods, in six counties in two provinces, Gansu and Hubei. The primary activity involved in-depth study over a period of 7-10 days in a selected village community in each county. Additional materials were gathered from the corresponding township and county levels, mainly using document reviews and key informant interviews. All but one of the counties was officially classified as poor according to national guidelines.

Research teams

5.32 The fieldwork was undertaken by two teams of four people, two men and two women. The team working in Hubei was led by a senior researcher from the Department of Agricultural Economics, China Central Agriculture University, supported by two colleagues. The team in Gansu was led by the Director of the Social Survey and Study Centre of Gansu Academy of Social Science, supported by a colleague from the Centre and a Deputy Director of the Institute of Sociology in Beijing Academy of Social Sciences. Each team was joined by a specialist energy researcher from the Centre for Renewable Energy Development (CRED) in Beijing. Two Chinese speaking research officers from the IDS supported the fieldwork in each province, and participated in four of the studies. In addition, one of the research officers, working in collaboration with a researcher from the School of Economics and Administration, Lanzhou University, undertook a study of three villages in Gansu which had provided with photo-voltaic equipment under a programme supported by the Poverty Alleviation Office.

Timetable and preparatory activities

5.33 Initial visits to Beijing and Lanzhou were undertaken at the end of July and beginning of August 2000. During these visits meetings were held with the fieldwork team leaders, the director and senior researchers of CRED, and Professor Liu Hongpeng of the Renewable Energy Division of the State Economic and Trade Commission (SETC). Formal collaborative arrangements were negotiated and discussions undertaken on the nature of the research activities and potential study sites.

5.34 A design workshop was held at IDS over the period 31 August - 5 September,

attended by researchers from IDS, ETC and CRED. This workshop developed a series of detailed research questions related to the project Framework document (Barnett et al, 2000) that had been previously prepared. It also prepared a range of initial draft survey instruments for use in the field studies. These drew on earlier work on poverty and gender in China undertaken by the IDS researchers, and specific studies on energy undertaken by ETC in various countries and by CRED in China.

- 5.35** Over the period from late September to mid-October, one IDS and one ETC consultant, accompanied by the IDS research officers, visited Beijing. They discussed research plans and choice of study sites with CRED and then each travelled to one of the study provinces where they were joined by the team leaders for discussions with local officials. Initial visits were then made to possible study sites and a final selection made. Agreement on the timing and arrangements for the fieldwork exercises was reached with county, township and village officials in the selected areas. The opportunity was also taken to undertake initial enquiries relating to energy, poverty and gender issues and data sources in each location.
- 5.36** A one week training workshop for all members of the field study teams was held in Beijing. This discussed, and where necessary modified, the study instruments and associated documentation, and agreed detailed procedures for the fieldwork exercises. The fieldwork began one week later and continued until the end of November.

Methods

- 5.37** Each exercise began with a review of routine statistical data and interviews with officials in relevant departments at county and township levels (including civil affairs, agriculture, poverty reduction, electricity sector). The latter focused on development issues, poverty, energy sources and uses, plans for electrification and perceived impacts of electrification projects.
- 5.38** The village studies began with key informant interviews with members of the village committee and party branch, the representative of the women's federation (where such a position existed), teachers and rural doctors. These focused on issues relating to poverty, gender, energy, and the impact of electrification where appropriate. A more general discussion was held with the village committee on trends over recent years in terms of production, investment, household incomes, migration and collective institutions such as schools and health facilities.

In each village the survey teams selected 36 households for interview. The approach varied somewhat depending on specific circumstances, but the basic principles were as follows:

- a meeting was held with the village committee to classify and group households;
- the 3 poorest households and up to five 'big energy user' households were identified;

- a systematic sample was then made of remaining households to reach the target number.
- 5.39** In most cases, where accommodation was available, the teams lived in their assigned villages for 7-10 days. Otherwise they lived in nearby locations and visited on a daily basis. During this time they used a variety of rapid appraisal and participatory techniques to investigate energy issues and the impact of electrification, where relevant, on households and particular household members. These included:
- additional key informant interviews with community leaders, teachers, health care workers and male and female members of households;
 - participatory mapping to indicate the layout of households and village institutions, including identification of those with and without access to electricity and related devices;
 - time line diagrams to examine the recent history of the area, particular in relation to electrification, other energy related issues and changes in production and activity patterns;
 - seasonal calendars to investigate seasonal variations in climate, activities, income, expenditures and demand for and supply of energy;
 - wealth ranking exercises to determine local criteria and ranking of households;
 - community meetings and focus group discussions to explore local perceptions of availability, utilisation and cost of different energy sources;
 - personal narratives of male and female household members who had experienced the changes brought about by electrification;
 - matrix ranking exercises by selected groups to compare the perceived relative costs and benefits of different sources of energy for different purposes.
- 5.40** The interviews covered relevant aspects of consumption, production, utilisation of services, access to information and communications. Changes in the mix of energy sources was traced and all uses of electricity and substitutes (such as alternative sources of lighting) identified. Consumption quantities were estimated, with prices of major suppliers being used to estimate costs. One important objective of the fieldwork at village level was to provide a clear elucidation of relevant gender issues. With this in mind, the activities were reinforced by time use exercises, which allowed estimation of the differential impacts of electrification on the activity patterns of men and women.
- 5.41** The formal fieldwork materials provided are attached as Annex 4. In addition to these, all researchers maintained fieldwork diaries in which qualitative information was recorded.

Box 1: Overall activity list:

1. County/township level information.
2. County/township: background on types of fuel used in villages.
3. Village energy systems.
4. Price survey on the cost of fuels and energy commodities at county/township/village.
5. Meetings with Village Committee and Party Branch members.
6. Group discussion on poverty with Village Committee members.
7. Village Mapping focus group with a group of local people.
8. Interview with teachers at school used by village.
9. Interview with doctors at health station used by village.

Box 2: Household survey components (activity 11):

1. Household composition and member characteristics.
2. Wealth status.
3. Income generating activities.
4. Other household activities.
5. Vulnerability and credit.
6. Sources, uses and costs of energy services.
7. Fuel use for heating, cooking and lighting.
8. Access to production or communications equipment.
9. Attitudes to electricity.

Case study reports

5.42 Following the fieldwork exercise, and debriefing workshops, the team leader produced an initial fieldwork report. This was then revised in discussion with the relevant IDS research officer and IDS or ETC consultants.

Fieldwork Teams

IDS

Henry Lucas (m)

Andrew Barnett (m)

Hilary Standing (f)

Lu Yuelai (research officer focusing on Gansu fieldwork) (m)

Susan Jolly (research officer focusing on Hubei fieldwork) (f)

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Hubei studies

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Gansu studies

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PV villages in Gansu

Zhang Jing (f), School of Economics and Administration, Lanzhou University

The study provinces

HUBEI PROVINCE

Background

- 5.43** Hubei province is situated in central China in the middle reaches of the Yangtze River. Administratively it is divided into 11 prefectural cities, an autonomous region, 35 town districts, 25 small towns, 39 counties, and a forest region. The total population is 59 million and total area 185,000 km². Much of the land is mountainous and some 56% is more than 500 meters high above sea level. There are more than 300 major lakes with a storage capacity of 3 billion m³, and more than 1,000 rivers including 42 that are longer than 100 km. The largest of these is the Yangtze, which flows west to east over a length of 1,060 km. The province has a sub-tropical monsoon climate in which most of the yearly precipitation occurs between May and September. The Yangtze River basin can receive in excess of 1,100 mm of rainfall per year. This uneven seasonal precipitation, and recurring low rainfall years, often leads to spring flooding and late autumn droughts.
- 5.44** Hubei is a major producer of both agricultural and industrial outputs. With 4.7% of the total Chinese population it produces 4.8% of food grains and 4.7% of overall GDP. Agricultural production is heavily dependent on the use of chemical fertilizers and pesticides, which has increased remarkably since the early 1980s. Fertilizer application rates are higher than those in the U.S. (some 253 kg/hectare, excluding animal and human wastes), while pesticides application rates of 4.5 kg/hectare are common. Between 1990 and 1994, annual sales of pesticide products increased by 13% per annum, from 14,000 tons to more than 26,000 tons. Fertilizer purchase in particular is a major production expenditure for poor rural farmers and a common reason for borrowing.

Hubei Province: Basic indicators

| <i>Indicator</i> | <i>National</i> | <i>Hubei</i> | <i>%</i> |
|------------------------------|-----------------|--------------|----------|
| Population (10,000) | 124,810 | 5,907 | 4.7 |
| Grain yield (10,000 tons) | 51,230 | 2,476 | 4.8 |
| Grain per capita (kg/person) | 412 | 420 | 101.9 |
| GDP (100 million yuan) | 79,396 | 3,704 | 4.7 |
| GDP per capita | 6,361 | 6,271 | 98.6 |
| Rural per capita: | | | |
| ▪ net income | 2,162 | 2,172 | 100.5 |
| ▪ consumption | 1,590 | 1,699 | 106.9 |
| ▪ cash expenditure | 1,128 | 990 | 87.7 |

Source: China Statistics Yearbook, 1999

Energy resources and development- Natural Capital Livelihood Assets

- 5.45** As might be expected, given its geography, Hubei has a huge potential for the development of hydro-electric power generation. Total exploitable capacity has

been estimated as high as 40 million kW. Total coal reserves are around 440 million tons, just 0.1% of the total for China. The coal industry was developed during the ninth five year plan, which focused on supporting potentially profitable coal fields or mines in ten counties. Township coal mines became a major source of supply to the provincial coal industry and output increased from less than 10m tons of raw coal in 1993 to more than 15m tons in 1996. In 1999, coal production in the province was around 9.1 million tce, while consumption was 59.9 million. Oil reserves have been estimated at 53 million tons, of which the exploitable oil resource is less than 30 million tons. Production in 1999 was 0.78 million tons and consumption around 7.21 million. There is one natural gas well with exploitable resources of some 2.5 billion m³. Overall, conventional energy production within the province is sufficient to meet around 20% of requirements.

5.46 Hubei was one of the first provinces to build power stations. In 1949 there was one installation with a capacity of 38,000 kW and annual output of less than 85 million kWh. During the economic reform period between 1981 and 1990, the province installed additional capacity of 4.1 million kW, based on both coal fired and hydropower projects. In the early 1980s, with the completion of the Gezhouba hydropower project, Hubei became the most important province in China in terms of hydro-electric generation. By 1999 total installed generating capacity had reached 13.2 million kW and total electricity consumption was 48.7 trillion kWh, of which 25.1 trillion kWh derived from hydro-electric power stations. The Three Gorges project is also located in the province and is due to start generating by 2003. This will have a total capacity of 18.2 million kW. In line with the power diversity policy, Hubei is currently preparing nuclear and wind power projects.

Renewable energy

5.47 Renewable energy projects in Hubei mainly focus on small hydro-electric power stations and biogas. The former are intended for areas without access to the electricity grid. As indicated above, total hydropower resources are very rich and 6.7 million kW are considered suitable for medium and small hydropower projects. Development started in the 1950s at Dayou station in Macheng, and to date the total capacity has reached 1.3 million kW, with annual output of 4 trillion kWh. 30 counties and 887 villages use electricity from these stations and they supply one third of the total area with access to electricity.

Biomass Energy

5.48 Hubei is an important province in terms of livestock production, and total animal waste is estimated at some 10.5 million tons per annum. The dissemination of household biogas systems is seen as a key task for local officials engaged in rural energy development. "The Ecological Home Construction and Poverty Alleviation Program" has established some 695,000 household biogas systems and the total biogas generation is around 16 million m³. Around three quarters of these are "Pig-Biogas-Fruit" systems which use the slurry from biogas production to fertilise fruit and vegetable gardens. In addition to the household

systems, there are 60 medium to large scale industrial biogas plants producing 0.79 million m³. Annual straw production and other forms of biomass energy resource amount to some 30 million tons.

Wind Energy

5.49 Thus far, 600 small wind turbines have been installed. Based on the Wind Power Development Program 1999-2030, two large scale wind farms are planned. One will be in Lichuan City, with a total capacity of 0.36 million kW, and one in Tongshan County, with a capacity of 0.156 million kW. These are expected to be completed by 2010.

Solar Energy

5.50 Hubei is not rich in solar energy. The average annual hours of sunshine range from 1,200 to 2,200. The total solar energy radiation is 7628x10¹⁴kJ. Solar energy utilisation is mainly limited to passive heating. By 1999, the total area of solar housing was 140,000 m² and the area used for solar water heating was 450,000 m².

GANSU PROVINCE

Background

5.51 Gansu province is located in north-western China, about 1,900 km west of Beijing. It is on the upper part of the Yellow River (Huang He), with a 1,000 km corridor extending north and west between the northernmost part of the Qinghai-Tibet Plateau to the south, and the Gobi desert to the north. The administrative divisions consist of two autonomous prefectures, 13 cities, 60 counties and 7 autonomous counties. The population is around 25 million, 8 million of which live in urban areas. Over 90% of the inhabitants are Han Chinese, with the rest belonging to various ethnic minorities. The total area is 390,000 km² mostly lying above 1,000 metres. Over 70% of the area consists of mountains and plateaus. The climate is subtropical and humid in the southeast changing to a temperate, dry climate in the west. Temperatures shift greatly from day to night as well as from season to season in the central and western parts of the province. Average temperatures vary between -14°C to 3°C in January and 11°C to 27°C in July. The average annual rainfall can be as high as 860 mm in the high mountain areas, with precipitation decreasing sharply to as little as 30mm in the north. 50-70 percent of the rain falls during the summer.

5.52 Droughts and arid soils have constrained economic progress. In 1997, 23 percent of the rural population in Gansu were below the national poverty line (Fan et al., 2000) and 41 counties were identified as national poverty counties. Among the villages within these counties, 16.2% had no or limited road access; 16.6% had no access to electricity; 40.6% had no health facilities; and 10.7% had no school. In recent times the province has experienced some degree of industrial development based on the abundant mineral resources. These include coal, petroleum, nickel, copper, sulphur and zinc. However, the economy is still primarily agricultural, with main crops including wheat, highland barley, millet, potatoes, corn, sorghum, rice, rape, soybeans and sun-cured tobacco. The staple

foods are wheat, barley, millet, beans, and sweet potatoes. With some 2.2% of the total Chinese population, Gansu produces around 1.6% of total grains and accounts for around 1.1% of total GDP.

Gansu Province: Basic indicators

| <i>Indicator</i> | <i>National</i> | <i>Gansu</i> | <i>%</i> |
|------------------------------|-----------------|--------------|----------|
| Population (10,000) | 124,810 | 2,519 | 2.0 |
| Grain yield (10,000 tons) | 51,230 | 827 | 1.6 |
| Grain per capita (kg/person) | 412 | 348 | 84.4 |
| GDP (100 million yuan) | 79,396 | 870 | 1.1 |
| GDP per capita | 6,361 | 3,453 | 54.3 |
| Rural per capita: | | | |
| ▪ net income | 2,162 | 1,393 | 64.4 |
| ▪ consumption | 1,590 | 940 | 59.1 |
| ▪ cash expenditure | 1,128 | 507 | 44.9 |

Source: China Statistics Yearbook, 1999

Energy resources and development- Natural Capital Livelihood Assets

- 5.53** Gansu has considerable modern energy resources, including coal, oil and oil shale. There are 164 surface coalmines with proven deposits of some 9.6 billion tons and large quantities of associated oil shale. The output of raw coal in 1999 was 18.92 million tons, around 80% of consumption requirements. Coal production is mainly from the Huating coalfield which has an assured geological deposit of 3.4 billion tons. The gasification coal at the field is described as having “three highs” - quantity of heat, chemical activity, and volatilisation and “three lows” - dust, sulphur, and phosphor. It is used for energy generation, chemical production, gasification, and providing raw materials for wood alcohol and chemical fertiliser. The designed production capacity is 10.15 million tons per year. Five additional major mine projects are planned in a project valued at 5.7 billion yuan.
- 5.54** Exploitable crude oil reserves are estimated as 80.6 million tons and output of crude oil in 1999 was 4.7 million tons. The oil and natural gas resource is concentrated in the Yumen area. A national oil line from Xinjiang to Lanzhou has been completed and a natural gas line from Xinjiang to the east China is under construction. This line will go through Gansu and contribute to available supply.
- 5.55** Gansu province lies in the upper reach of Yellow River with and has theoretical hydropower resources estimated at 17.2 million kW, of which 10.7 million kW is suitable for power generation. By the end of 1999, overall electricity generating capacity in the province had reached 6.1 million kW and produced 26.2 trillion kWh. Of this hydro-power provided 11.7 trillion kWh, 45% of the total. The 330 kV electricity power grid provides access to all but a few remote areas.

Renewable energy

5.56 Gansu is one of the most drought-prone provinces in China and suffers severe water shortages, both for consumption and irrigation. Over a long period, the reliance on fuelwood for heating and cooking has accelerated large scale deforestation, reduced water retention and intensified soil erosion, particularly from the Loess Plateau. This has impacted on agricultural productivity and contributed to the relatively high levels of poverty in the province. The provincial government now regards rural energy policy as central to its attempts to reverse the loss of vegetation and sustain the livelihoods of populations in remote rural areas. The Eighth Five-Year Plan period (1990-1995) emphasises the importance of both renewable energy sources and energy conservation.

Biomass

5.57 The total output of grain crops in 1996 was 7.99 million tons. This was estimated to produce around 9.6 million tons of crop residuals, 5 million tons of which could be used for rural energy, producing around 2.54 million tce (113kg/capita). The estimated dung resource is 11 million tons, 2.2 million tons of which could be used to provide some 1.1 million tce (54.83kg/capita). Around 54 thousand hectares of fuel forest could be used to provide an annually output of around 200 thousand tons of firewood, 114.2 thousand tce (5.79kg/capita). The use of biogas systems has expanded, with around 2,236 additional households establishing systems in 1996. However, output is still very limited, at around 6,000 tce. It has been estimated that only some 0.3% of the total potential has been realised, though some reports argue that this estimate does not make sufficient allowance for the low temperatures in many otherwise suitable areas.

5.58 To implement the Western Development Strategy and reduce deforestation and soil erosion, Gansu has decided to convert 30 million mu of cropland into forest and grassland. The southern mountainous areas and the middle and east Loess Plateau will be mainly affected. However, farmers in these locations heavily rely on biomass energy. Around 80% of domestic energy requirements consist of crop residues, dung and fire wood. It is estimated that the conversion will reduce the energy supply for around 1.4 million rural people and that the total reduction could be up to 1.8 million tce. (Department of Agricultural & Livestock, Gansu Province, 2000a).

Solar energy

5.59 Gansu is rich in solar energy resources. The average sunlight hours over three-quarters of the territory is more than 2500 hrs, and radiation is 500-620 Kj/cm². Around 100,000 solar cookers have been distributed in rural areas and are mainly used for boiling water and cooking in the summer months. By the end of 1996 more than 50,000 m² of solar water heater panel had been purchased, mainly in small towns, and some 190,000 m² of passive solar housing were constructed. In addition, more than 6,800 hectares of green house space was being used for agricultural production.

5.60 Gansu was one of the earliest regions to use solar energy to provide electricity to rural areas. In the 1980s, the UNDP supported the Gansu Natural Energy

Research Institute to develop a series of PV demonstration projects. Some 20 thousand PV systems have been installed over the years to provide lighting and television in remote areas. Four companies now provide PV products and services.

Wind energy

5.61 There are abundant wind resources, especially along the Hexi corridor which has 4,000-6,000 hours per year of potentially efficient wind-generation. Some 2,800 small wind turbines have been installed, with a total output capacity of about 448kW.

Small hydro power

5.62 There are 107 small hydro power plants in Gansu, set up to supply electricity to rural areas. The output capacity is about 1,120kW (the total potential output capacity of small hydro power generation is estimated at 220,000kW, and annual electricity generation at 6,743 kWh).

The study communities

5.63 The study sites were selected in discussion with local officials, following initial suggestion by CRED and Provincial officials and visits to potential counties and villages. The sites were selected purposefully to provide a wide range of circumstances but with a strong bias towards poverty, isolation. They were also intended to represent diversity in terms of the level of access to electricity:

Gansu:

- Gaozui Village in Huining County: an isolated group of natural villages without road access or electricity.
- Zhaoshan Village in Yongjing County: a village in a poverty county with good road access but relatively recent access to grid electricity capable of powering production equipment.
- Xiapai Village in Yongchang County: the only non-poverty county studied, in one of the most productive agricultural areas of Gansu and with long established grid access.

Hubei:

- Xiaozhu Village in Lichuan County: a very remote mountainous village without electricity.
- Duiwotai Village in Xianfeng County: a village in a relatively remote location with electricity provided by a small, “run of river” hydro-electric generator.
- Housanxi village in Jianshi County: a village in a poverty county with recent road access and grid connection.

Full details on the villages, townships and counties selected can be found in the individual study reports.

6

6 Findings

- 6.1** Detailed finding from each of the study sites are contained in individual reports which will be published separately. The selected findings presented here are grouped according to the framework described in chapter 4.

The Vulnerability Context - Geography, climate and natural resources

- 6.2** In China, the association of poverty and geography remains deeply entrenched, both in the minds of local officials and in existing administrative structures. In all the field study sites, the primary causes of poverty identified by local officials, village leaders and communities were location, climate and soil fertility. Focus group discussions, whether with women, men or village committees emphasised geography, poor land, altitude, remoteness, distance from urban areas, absence of nearby markets, and bad roads as the primary reasons for poverty.
- 6.3** Whatever the limitation of the geographical approach, such factors are of considerable importance and it is evident that certain communities are more poverty prone. Whilst living standards are clearly improving for the majority, as discussed above (5.10) there is evidence that in the decade between 1985 and 1995 people living in mountainous areas and minority populations were experiencing worsening poverty. Three villages in the present study were in mountainous areas, and many of their component natural villages¹¹⁰ were not connected to roads. Where roads did exist, they were typically in very poor condition, often hazardous, and in many places were accessible only to three wheel diesel trucks. In addition, two of the villages had no school, with young children facing a daily walk of up to two hours each way. None of the three had a health station or health extension worker and were forced to travel more than 10km to access their nearest source of treatment.
- 6.4** From the perspective of this study, those living in remote areas are of particular interest because of the obvious association between geography and access to

¹¹⁰ The word 'Village' in China is used to refer to an administrative unit composed of around 10 sub-villages or 'natural villages'.

energy services, particularly electricity. In a country where over 94% of rural households have access to an electricity grid, those without or with limited access are almost certain to be living in locations that are simply extremely difficult to reach, whether by electricity grid, telecommunications or road.

- 6.5** One of the most important issues raised by the project was the extent to which bringing improved energy services (whether through bio-gas installations, solar cookers, electric lighting, television or electric powered production equipment) to such remote poor areas should be seen as more than a short term palliative remedy. Can such initiatives assist in promoting the economic transformation that would be required simply to prevent their decline? The circumstances in China are very special in that many poor rural residents can rationally aspire to dramatically improve their standard of living by migration. Even members of some of the poorest households in the most remote areas surveyed were able to routinely watch television images of life in Beijing and Shanghai. They knew people from their village or a neighbouring village who had moved to an urban area and found relatively highly paid employment.

Livelihood Assets and Strategies

- 6.6** The livelihood strategies available to the households were largely constrained by their environment, human capital and land holding assets. Almost all of the households surveyed were relatively small in size, typically 3-5 members. The poorest village, Xiaozhu in Hubei, is in a mountainous and sparsely populated region and was the only location with a considerable number of single person households. Villagers explained that it was very difficult to find anyone who would marry into a community which had to live without electricity. Young men and women said that they would have to leave the village in order to start families. One man had met his wife in a city where they were both migrant labourers. She was still resentful that he had not revealed that his home village had no electricity until after the wedding.
- 6.7** Land had usually been allocated on a per capital basis with the introduction of the rural reforms in 1978/79 and there had been little reallocation since that time. Most households farmed between 0.5 and 2.5 hectares. The quality of land farmed was typically inversely proportional to the area, given that population densities tended to be less in remote, particularly mountainous, areas where soil fertility was lower.

Distribution by size and landholding per capita (hectares)

| Members | Gaozui | Zhaoshan | Xiapai | Xiaozhu | Duiwotai | Housanxi |
|--------------------|--------|----------|--------|---------|----------|----------|
| 1 | 0 | 0 | 1 | 8 | 1 | 0 |
| 2 | 3 | 6 | 2 | 9 | 2 | 2 |
| 3-5 | 18 | 20 | 29 | 18 | 27 | 32 |
| 6+ | 15 | 10 | 4 | 1 | 6 | 2 |
| Land/capita | 0.26 | 0.29 | 0.56 | 0.23 | 0.13 | 0.10 |
| Households | 36 | 36 | 36 | 36 | 36 | 36 |

6.8 Between 23-31% of household members were less than 15 years of age and 6-15% were over 60, giving dependency ratios of 0.4-0.7. Typically, around one third of households included three generations.

Age structure (%)

| Members | Gaozui | Zhaoshan | Xiapai | Xiaozhu | Duiwotai | Housanxi |
|-------------------------|--------|----------|--------|---------|----------|----------|
| 0-14 | 31 | 26 | 25 | 27 | 25 | 23 |
| 15-34 | 33 | 32 | 35 | 38 | 36 | 37 |
| 35-59 | 27 | 26 | 31 | 23 | 25 | 34 |
| 60+ | 9 | 15 | 8 | 12 | 15 | 6 |
| Dependency ratio | 0.67 | 0.71 | 0.50 | 0.64 | 0.66 | 0.41 |
| Total members | 185 | 155 | 153 | 102 | 151 | 145 |

6.9 Levels of education were generally low, particularly in the villages in Gansu, where around half of those over 15 had not completed primary education.

Educational attainment of those over 15 and over (%)

| Members | Gaozui | Zhaoshan | Xiapai | Xiaozhu | Duiwotai | Housanxi |
|---------------------------|--------|----------|--------|---------|----------|----------|
| None | 49 | 61 | 35 | 29 | 21 | 12 |
| Primary | 28 | 23 | 40 | 54 | 56 | 67 |
| Lower Middle | 19 | 10 | 19 | 17 | 15 | 16 |
| Higher | 4 | 6 | 5 | 0 | 7 | 6 |
| Number 15 and over | 127 | 115 | 114 | 72 | 98 | 109 |

6.10 Households usually owned less than 5 larger animals (pigs, donkeys, sheep or cattle) and earned some ¥5,000 each year from their farming activities. Even in Xiapai, the wealthiest village, 1999 and 2000 were very bad years and net per capita farm incomes (allowing for costs and taxes) dropped below ¥1,000. Given the rising prosperity on other parts of China, it should perhaps not come as a surprise that when asked how households could improve their situation, both officials and villagers almost uniformly placed either migration or 'working outside the village' at the top of their list of options.

6.11 More than 25% of those counted as household members were living away from home at the time of the survey. The majority of these were male, 20-34 years of age and generally better educated than others in the village. Villagers said that the young, educated and healthy went in search of 'the bright lights'. The elderly, young children, the sick and those (often women) who cared for them remained behind.

Characteristics of household members living away from village (%)

| | Gaozui | Zhaoshan | Xiapai | Xiaozhu | Duiwotai | Housanxi |
|-------------------------------------|--------|----------|--------|---------|----------|----------|
| Men | 63 | 86 | 61 | 89 | 71 | 79 |
| Women | 37 | 14 | 39 | 11 | 29 | 21 |
| Aged 20-34 | 54 | 59 | 57 | 78 | 64 | 73 |
| At least lower middle school | 39 | 45 | 36 | 0 | 43 | 36 |
| Working outside province: | 20 | 23 | 46 | 33 | 79 | 91 |
| men | 7 | 23 | 25 | 33 | 57 | 73 |
| women | 12 | 0 | 21 | 0 | 21 | 18 |
| Total number of migrants | 41 | 22 | 28 | 9 | 14 | 33 |

6.12 Marriage provided women with one possible migration route out of a poor village. Although marrying out is usually seen as dis-empowering, often losing the woman access to land, family support and local connections, many women expressed the hope that they could marry into a better area. One woman in Housanxi whose husband had married into her family complained that this arrangement had been for the sake of her parents who had no sons, and that she had wanted to leave for somewhere better. In Xiaozhu, a few men had married out and many men were single and unable to find wives. In Duiwotai, most women married out, and in Housanxi, the richest village, some men had married in. Once married, women appeared to be much more tied to their villages than men. Reduction of manual labour for processing through the introduction of electricity had made it “easier” for men to migrate, leaving women to manage agricultural work. Women worked outside the villages to a much lesser extent than men and the lack of transport seriously affected their ability to get produce to market.

6.13 Improved physical infrastructure, principally roads, water and electrification, was seen by communities as essential if households were to find alternative ways to improve their situation other than migration. They were convinced that if only their village could be provided with these basic assets, households would themselves take strategic decisions to invest in physical and human capital and could thereby increase their incomes and living standards. However, there were alternative points of view. Officials in Yongjing County, for example, have decided that it would often be more cost-effective to simply move populations from inaccessible locations rather than struggle to provide them with the services which they lack. While understandable, this approach clearly raises major issues in a country where good farm land is very much a scarce resource. Relocated households might find that they had gained access to services and markets only at considerable cost to their productive capacity.

6.14 The capital investment required to extend the grid into remote areas is obviously considerable. This is the main reason why micro hydro was promoted in Hubei and PV systems in Gansu. However, once a village, or rather natural village, had been provided with access to the grid, almost all households usually elected to be connected and pay the required fees, even if their use was limited to a 40W light bulb turned on for a few hours each evening. Location rather than

individual household income was the main factor in determining connection in all the villages surveyed. Only in Duiwotai, where a total of 25 out of 168 households remain unconnected, and in Housanxi, where the party secretary reported that 20% of the 262 households were too poor to pay for connection, were the numbers of unconnected households in a village with electricity substantial. In Duiwotai, local officials said that those without access were not only low income but 'remote, stubborn and not wanting to change'.

- 6.15** As might have been anticipated, those without electricity had extremely high expectations of the potential benefits. They viewed the connection to the grid as an essential step on the way to greater productivity, higher incomes and a better way of life. They had no difficulty in explaining the investments in equipment they would make and the new activities that would be open to them. In Xiaozhu, for example, 29 of the 36 households said that having electricity would increase their incomes. Among the suggestions made were: buying a milling machine and charging for its use; buying a brick making machine; making wine; processing wood; breeding more pigs with a pig fodder cutting machine; breeding sheep; working later into the evening to allow time to breed chickens; doing more housework in the evening to allow time to grow more crops or dig for herbal medicines; and increasing productivity to allow household members to go out and do paid work.
- 6.16** In villages with electricity, on the other hand, the major benefits which came most readily to mind were concerned with the quality of life, not production. Lighting, television and reduced labour on domestic tasks usually ranked highest. Only on reflection was it argued that by increasing the length of the working day and reducing labour requirements for household chores, more time was available for production or other income generating activities. In Zhaoshan, village leaders said that they had previously been very enthusiastic as to the scope for developing small processing factories, once the capacity and quality of the electricity supply had been improved. However this potential not been realised because other elements, particularly access to credit had not materialised. In Housanxi, the richest village of those in Hubei, villagers had developed some minor new processing and income generating activities, such as potato flour processing, after the connection of electricity a few years previously. However, villagers regarded the possibilities for increasing incomes as very limited, and shared the general view that the most important livelihood development in recent years was the increased opportunity for outside employment.
- 6.17** In Xiapai, the community with the earliest, highest capacity and most reliable connection, and with by far the greatest accumulation of electrically powered assets, the strong impression given was that electricity was now largely taken for granted. Diesel was the primary fuel associated with production activities. Electricity was used for smaller domestic equipment and viewed mainly as a consumption item. Its importance lay in its less tangible benefits: allowing women to work in the evening; children to do their homework and read; and access to television.

6.18 A general view was that the major impact of electricity on livelihoods arose from its capacity to reduce general workloads and lengthen the working day, thereby increasing the possibilities for diversification of activities. In focus group discussions, women in Housanxi, a recently electrified village, were still very enthusiastic about electrification, and said that it had improved their lives in a number of ways. Households could raise more pigs if they had access to powered fodder cutting machines; electric milling machines both allowed the production of potato flour for sale and freed time to work on the land or seek other sources of income; physical work was less arduous; but most importantly men could migrate and leave women to farm with the help of machines. This last option was commonly expressed by both men and women and was clearly acted upon in many households.

Poverty and vulnerability

6.19 A large proportion of sampled households said they had inadequate food, clothing and housing. Food inadequacy was most commonly reported in Gansu in the two counties which had suffered most from droughts in 1999 and 2000. In Xiapai, the wealthiest village in the study with by far the greatest accumulation of productive powered assets (26 of 36 sampled households owned small farm vehicles), 64% of households reported food shortages during the previous year. They attributed these shortages to the failure, partly due to the unhelpful attitudes of local officials, of the irrigation system on which their livelihoods crucially depended.

6.20 All households cited the late spring and summer months, during which the produce from the previous harvest was running out and that from the new harvest not yet available, as the most difficult period of year. At this time demanding physical labour was needed, people did not have time to leave the village and seek wage employment, food was short, fertiliser and pesticide had to be purchased, and in some cases half yearly tuition fees were due for the children.

Household self assessment of standard of living (%)

| | Gaozui | Zhaoshan | Xiapai | Xiaozhu | Duiwotai | Housanxi |
|---|---------------|-----------------|---------------|----------------|-----------------|-----------------|
| Households reporting less than adequate: | | | | | | |
| Food | 36 | 72 | 64 | 44 | 17 | 28 |
| Housing | 22 | 19 | 19 | 47 | 22 | 42 |
| Clothing | 42 | 25 | 36 | 56 | 42 | 36 |
| Food shortages | 53 | 78 | 64 | 44 | 22 | 31 |
| Difficulties with: | | | | | | |
| • Health care cost | 78 | 69 | 86 | 78 | 67 | 83 |
| • Education costs* | 42 | 36 | 42 | 42 | 47 | 50 |
| • Taxes | 61 | 75 | 75 | 81 | 67 | 72 |

* Households with school age children

6.21 Education costs were a problem for a substantial minority of households.

However, while the legitimacy of fees was questioned they were generally seen as unavoidable to maintain at least a minimum standard of education. Almost all households reported problems in meeting health care costs. The direct and opportunity costs of illness had a particularly damaging impact on poor labour shortage households. Labour supply was reduced and reproductive labour demands on household carers increased. Cash expenditure on health care services could force a run down of financial and physical assets, reducing labour productivity still further.

- 6.22** Taxes were a major problem for households in all six villages. As discussed above in the section on Hubei Province, taxes are largely determined by the quantity of land farmed, not by the output produced. Taxes had to be paid in good times and bad and tended to increase year by year. In Xiaozhu, the village committee cited steadily increasing taxes on tobacco as the number one reason for the 20% increase in the number of poor over the last 10 years. As in most of the other villages, apart from land taxes there were multiple fees associated with education and livestock farming, though these have been banned by the central government. The party secretary in Xiaozhu remarked that due to the tax on slaughtering, some families could afford to raise a pig but not to kill and eat it.
- 6.23** This village operated essentially as a company town. The main cash crop was tobacco, and growers were required to buy a specified fertiliser from a tobacco company at high prices linked to a credit agreement. Local regulations stipulated that tobacco could only be sold back to the company – an effective monopsony. One villager complained that with recent higher tobacco taxes and falling tobacco prices, selling his tobacco to the company made just enough to pay back the fertiliser debt.
- 6.24** Borrowing money was the most important coping strategy in all villages. In Hubei loans were obtained from friends and relatives with almost no interaction with formal credit institutions. In Gansu, formal loans were available at village level and around one quarter to one third came from this source, with a few households, particularly in the richer Xiapai, approaching township banks.

Coping strategies adopted in times of need (%)

| | Gaozui | Zhaoshan | Xiapai | Xiaozhu | Duiwotai | Housanxi |
|-------------------------------|--------|----------|--------|---------|----------|----------|
| Borrow from relatives | 40.3 | 38.1 | 34.8 | 40.2 | 42.3 | 52.2 |
| Formal loan | 9.0 | 17.5 | 15.2 | 0.0 | 0.0 | 0.0 |
| Credit | 6.0 | 1.6 | 9.1 | 11.8 | 15.4 | 8.0 |
| Selling animals/assets | 11.9 | 14.3 | 1.5 | 7.1 | 9.4 | 8.5 |
| Selling grain/crops | 16.4 | 15.9 | 21.2 | 9.4 | 18.1 | 7.5 |
| Casual labour | 3.0 | 1.6 | 3.0 | 29.1 | 12.1 | 2.0 |
| Migrant labour | 13.4 | 11.1 | 15.2 | 2.4 | 2.7 | 21.9 |

Institutional and policy context

- 6.25** The agency with primary responsibility for implementing government policies on poverty is usually translated as the 'Poverty Alleviation Office' (PAO). This

agency was of particular interest to the study, not only because of their central role in poverty interventions in general, but because of their role in the allocation of funding for energy related projects in poverty counties. Their title, seemingly implying a desire to assist those in distress, is somewhat misleading. Poverty Alleviation is largely restricted to the operation of an absolutely minimal 'safety net' by the Ministry of Civil Affairs, which meets the survival needs of those households who are experiencing extreme difficulties. In the Hubei villages, for example, only the four 'poorest' households, as identified by the village committee, were usually provided with assistance, such as grain, clothing or bedding, from the local government. To some extent this can be seen as a continuation of the commune welfare system which was available only to those who really could not work, as those who worked automatically gained access to income and commune services.

- 6.26** Apart from this, Chinese government policy is heavily focused on poverty reduction through increased access to productive assets. For example, households taking loans through official channels to purchase agricultural inputs or productive assets were able to borrow, with the support of the PAO, at an interest rate of 2.5%. By comparison, rates of 6% would have been charged to those borrowing to pay healthcare costs, if they had been able to provide the required surety.
- 6.27** A common approach adopted by the PAO is the establishment of pilot interventions, which were described by one official as 'shining lights'. In most cases officials explained that these were intended to demonstrate the potential of new technologies or approaches to other households. One apparently successful example was evident in Gansu. Here the introduction of solar cookers in a number of selected villages, subsidised by the PAO, had resulted in their widespread acceptance by farmers, to the extent that they were prepared to purchase them at full cost.
- 6.28** The more problematic aspect of this approach, as openly stated by one county official, was that pilot sites were adopted because they could be shown to visiting provincial or national officials in an effort to win their approval. For this purpose it appeared that the site or beneficiaries would be specifically chosen to ensure a successful presentation. Ideally they should be in an area of economic growth. Good road access was essential and those taking part should be competent farmers who were capable of explaining the benefits of the initiative. One observed site included what appeared to be a very expensive energy efficient house which had been constructed for a village leader. It was difficult to understand the relevance of this project for the majority of poverty households. In Lichuan, government poverty alleviation policy was described as "seize the large, leave the small". Larger scale, more centralised projects were said to be preferred over those which dispersed resources to individual households, because they were easier to manage and the effects were more visible.
- 6.29** Though officials and sometimes village leaders tended to refer to the POA as 'providing funds', in practice they essentially facilitate subsidised loans. In Duiwotai Village, the elaborate procedures required to ensure collective

household involvement in such a loan appears to have caused major delays to the installation of their electricity system. The general impression formed during the research was that many PAO initiatives, because they were usually predicated on the provision of loan finance aimed at increased productivity, had a high entry cost which biased them towards the less poor.

Rural electrification initiatives

- 6.30** All provincial and county officials are clearly very conscious of the rapid economic growth in some regions of China (study visits to Beijing and Shanghai were cited as one of the main activities of one County Women's Federation) and their primary objective is to emulate that growth. Those poverty reduction activities which can contribute to that objective, for example by increasing productivity or encouraging diversification into higher income generating activities, claim most of the attention. Pure 'welfare' projects, designed to alleviate hardship are of less interest to aspiring officials. In terms of energy services it may be that village Photo-Voltaic electricity systems, for example, fall into this category. The PAO has been instrumental in installing such systems in a number of isolated villages in Gansu, but this activity appears to be seen as providing limited assistance for communities which are always going to be poor. After the initial provision of equipment, often funded by external donors, there appeared to be minimal interest in either sustainability or impact. It was therefore not surprising that within a few years various components had failed and the majority of the beneficiary households were once again without electricity.
- 6.31** Three remote villages with limited prospects of grid access which had been provided with PV systems were visited during the study, two at the suggestion of the Gansu Natural Energy Institute and one proposed by Huining County Government. There was initially some concern that in all cases the installation of PV had been subsidised by the PAO in collaboration with foreign donors and that the sites might provide an overly optimistic impression of the costs and benefits of such systems. In practice, two of the three interventions seemed to have collapsed very soon after implementation and the third, implemented only a few months prior to this study, had already experienced the failure of some systems.
- 6.32** The household PV system used in the villages could in principle power two 20W light bulbs and one black and white television. The life span of the battery was about three years. The cost of installation had been around ¥2,000, though most households were heavily subsidised. Initially, farmers were happy with the system. It provided brighter lighting than kerosene and was cleaner and easier to use. It could provide television, which farmers believed was an important way to educate their children. Within a relatively short period of time, however, most systems were no longer functioning. After installation the farmers rarely saw the engineers again. The light bulbs tended to last around 2-3 months and could only be purchased in the county town, up to eight hours away along very difficult roads. When batteries or chargers failed, some after only a year, the

farmers simply gave up on the system, knowing that replacements would have to be purchased out of their own pockets. They reported that they would prefer to save the money in case the opportunity for grid connection, which they now saw as much more beneficial, should arise.

- 6.33** In two villages in Hubei, Duiwotai and Housanxi, related issues were raised concerning the effects of the unreliability and costs of grid electricity in poor rural areas. In Duiwotai, ambiguity over ownership of the micro-hydro station and the electricity generated lead to problems over maintenance of equipment. Fuses were often blown when villagers used powered equipment and local men had learnt how to replace these on the village transformer. However, problems that required outside help were not so easily resolved. At the time of the fieldwork the transformer in the village had been out of action for two months, cutting off all electricity supply. It was only when the field team notified local officials that they were about to arrive that it was repaired.
- 6.34** The frequent power cuts, low capacity, fluctuating voltages and uncertainty over when or even if repairs and maintenance would be undertaken, appeared to be discouraging increased utilisation and investment in powered equipment. Dependence on this modern fuel would clearly have been a high risk strategy for farmers and hence they were forced, for example, to maintain at least one month's supply of kerosene for lighting. The poor quality of the supply was also reported to have direct cost implications in that, even at times when the voltage fell below that required to power equipment or provide reasonably bright lighting the meters would still be running. One interesting question arising from the evidence of the study is how the concept of 'access to electricity' should be defined and measured. Could measures of access be readily categorised in terms of the nature, capacity and quality of supply?
- 6.35** Clearly these are issues which the Chinese Government is treating very seriously, as witnessed by the Rural Energy Reform Programme (Nong Wang Gai Zao) which was active in both provinces. This national programme aims to equalise prices between urban and rural areas and improve rural electricity infrastructure and supply. In Zhaoshan Village in Gansu, where the programme has been fully implemented, it appeared to have been very successful in terms of repair and replacement of equipment, though there remained major differences of opinion between suppliers and consumers as to the cost of electricity. The programme is being implemented gradually, starting with pilot villages that are able to contribute to the costs of new equipment such as electricity meters. Neither of the two electrified villages in Hubei, Duiwotai and Housanxi, were yet implementing the programme, and the village committees reported that they were not likely to start soon. Villagers were still recovering from the cost of their initial electricity connection and the meters which they had purchased 2-3 years previously. Many were still in debt from this outlay.

Environmental policies

- 6.36** As discussed above, existing conservation programmes include regulations restricting wood collection in both Provinces. Nevertheless, in Xiaozhu a few

villagers reported gathering wood for sale, an arduous occupation resorted to only when other income generating opportunities had been exhausted. In Duiwotai, 3 households out of the 36 surveyed reported selling wood, and charcoal production was an important activity, both for the two households who had kilns, and for many others who made money carrying heavy loads long distances to sell in the neighbouring province of Sichuan. The kiln owners recognised that this activity could only last another few years, until they had exhausted the wood on the hillsides they had bought specifically for this purpose. In Housanxi, people reported having to travel much longer distances to collect fuel wood due to prohibitions on wood cutting introduced three years previously. In some cases, the poorer, more remote households, who lived far away from roads had better access to wood fuel, being located in areas where conservation regulations were unlikely to be strictly implemented.

Livelihood Outcomes - Income and consumption

- 6.37** The county, township and village data identify a wide range of initiatives to increase access to income-earning opportunities, sometimes developed by households or communities themselves, sometimes the outcome of interventions by government or party officials. Most of these have energy implications and would be enhanced or diminished depending on the availability and quality of energy services. It would be extremely difficult to identify and measure specific causal linkages between changes in energy services and poverty reduction impacts in what is inevitably a multi-factorial system with energy only one of a linked set of variables. It can be said that the absence of appropriate energy services can sometimes preclude areas from participation in poverty reduction initiatives. One among a number of cited examples was the exclusion of Housanxi Village in Jianshi, which has one of the largest tea plantations in Hubei, from a tea factory development project because it did not have a grid connection when the project was devised.
- 6.38** Complementary infrastructure is needed to tap the poverty reducing potential of improved energy services. One clear example is the importance of roads to allow access to an expanded market, without which there is little incentive to increase productivity. In addition, it was clear that in order to utilise improved energy services there is a need for dedicated credit arrangements and support to develop small-scale industry. As a minimum, the interrelationships between energy services, credit, transport infra-structure and agribusiness development must be considered. One other key area of complementarity which should be explored in the study provinces is that between energy and water services. Almost all of the villages emphasised the central role of a regular water supply in improving livelihoods. Even the relatively asset rich Xiapai village in Yongchan, suffered dramatic falls in income in 1999 and 2000, which were attributed to drought and the mal-administration of the local irrigation system. Interestingly, none of the officials, village leaders or communities in the two provinces linked the two issues of water shortages and energy services.
- 6.39** Women reported that expenditure on the purchase of items which reduced

reproductive toil would always come second to productive, income generating expenditure. It was noticeable that women tended to identify the labour they had to expend on human-energy-intensive basic reproductive tasks as one of the main characteristics of a life spent in poverty. This was especially the case for fuelwood gathering and water collection. The general impression across the villages was that women would benefit most, productively and reproductively, from expanded use of bio-gas, fuel forests, energy saving stoves and machines which reduced the labour inherent in the preparation of livestock fodder and pig swill. In general, electricity does not seem to have made serious inroads into the time spent by women on onerous and health harming reproductive tasks. There was little evidence that reliable energy sources have improved women's productive potential other than by extending their work hours later into the night. The essential need would appear to be for a "package" of inputs, such as credit schemes specifically directed at women to enable them to capitalise on energy potential.

- 6.40** Though they clearly had a different viewpoint from men on this issue, there was little evidence in any of the villages that women had an effective input to decisions on equipment purchases. It should be noted, as indicated above, that the line between domestic and productive activities was difficult to define. In Duiwotai Village, for example, every household used powered equipment to mill flour, a process which would previously have diverted considerable labour time from other activities. Interestingly, in this village the preparation of pig swill, traditionally undertaken by women when done manually, was taken over by men in those households which had purchased a machine for this task.

Time use and time poverty

- 6.41** In focus groups, when asked about the reasons for poverty, most responded by talking about the climate, geography and lack of infrastructure. When asked about who was better off, focus groups cited some individuals who had succeeded in taking advantage of improved roads or recent electricity connection. However, more often they talked about people whose lives had improved due to changes in life cycle and family composition. Household poverty were seen as greatly affected by the life cycle and related labour shortages. For example, as children grew older and more self reliant, they liberated their parents to go out and work as migrant labourers. Parents were seen as becoming better off when children grew up and supported them. Households were seen to become worse off when they had to support children or elderly parents in deteriorating health. In Xiaozhu village, land was plentiful, and the constraining factor in production was labour. Villagers emphasised the importance of women's strength and capability to determining household well-being, and cited the absence or ill-health of women as a major causal factor of poverty.
- 6.42** In most poverty households the combined productive and reproduction burdens were high relative to the available human capital available. The underlying causes related to high dependency ratios, particularly in terms of aged

dependants, long term absences of key workers, or long term sickness and disability. Such households were unlikely to consider hiring labour and often placed onerous burdens on women members or children. They had fewer livelihood strategy options and were particularly vulnerable to a variety of economic or social shocks. Any event which further decreased labour supply, increased productive or reproductive labour demands, or necessitated cash expenditures could precipitate a downward spiral into extreme poverty unless family or friends were able to help.

An extreme example: Xiao Jikai and his household

Xiao Jikai was the poorest family visited in the non-electrified village in Hubei. He owned the least physical assets, not even matches or a lighter. His 16 year old son, who kept house, kept the cinders alight from which to coax a fire every morning. The household had no stove, just a three legged grill, of which half was missing.

Different people gave different reasons as to why Xiao Jikai was so poor. His wife had divorced him ten years previously, apparently unwilling to cope with the hard life she had married into. She had since died. People said that the absence of a woman to manage the household and contribute labour was the main factor in pushing the household into poverty. Output on their land was also low because they had no money to buy fertiliser. The previous year, Xiao Jikai had gone to the city to do migrant labour but had earned nothing. Some said he had gambled it away. Although migrant labour was one of the most important ways out of poverty, there were many accounts of people migrating to urban areas and failing to earn back even the cost of their travel.

While Xiao Jikai was away, his 16 year old son ran the household and the farm with his 13 year old sister and 9 year old brother. Since their father's return, the two younger children had been released from farm labour long enough to go to school. Xiao Jikai managed to borrow their annual tuition fees which amounted to several hundred yuan. After school, they would spend several hours on domestic and farm chores before doing their homework by the light of the family's one lamp, which consisted of a wick in a small jar of kerosene. They said that the light was smoky, hurt their eyes and was inadequate, even though they took turns in using it.

Xiao Jikai's was one of just four households out of the 71 in the village that received relief assistance from the Bureau of Civil Affairs. In the previous year the township government gave Xiao Jikai 560 jin of grain, along with some bedding and clothing.

6.43 As is usually the case with rural household activities, it was not possible to distinguish 'productive' from 'domestic' tasks. It was however very clear that activities which were usually regarded as secondary to the main task of 'working in the fields' on crop production required substantial time inputs by all members of the household, though women undoubtedly took most of this burden. The table below show the time allocated to various 'non-income earning activities' (the form of words which seemed to capture this concept in discussions with

villagers) in the Hubei villages in winter. The table excludes the small number of single person households in order to avoid problems of interpretation.

Time spent on non-income earning activities each week: Hubei villages in winter

| Activity | Xiaozhu | | Duiwotai | | Housanxi | |
|-------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | Men | Women | Men | Women | Men | Women |
| Cooking | 2.7 | 18.6 | 1.1 | 20.2 | 0.6 | 23.9 |
| Fuel gathering | 8.0 | 5.6 | 5.4 | 9.2 | 6.4 | 5.2 |
| Fetching water | 5.7 | 2.0 | 3.7 | 2.4 | 4.8 | 1.6 |
| Washing | 1.1 | 3.9 | 0.4 | 2.2 | 0.4 | 3.5 |
| Grinding/Milling | 4.9 | 3.7 | 0.7 | 1.6 | 1.2 | 0.3 |
| Prepare food for pigs | 2.3 | 8.6 | 0.6 | 7.3 | 2.5 | 9.7 |
| Prepare food for cattle | 0.3 | 0.5 | 1.3 | 1.8 | 0.3 | 0.1 |
| Grazing cattle | 5.0 | 0.5 | 1.9 | 4.8 | 6.8 | 0.4 |
| Collect compost straw | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 3.0 |
| Other | 1.0 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 30.9 | 44.2 | 15.2 | 49.5 | 23.7 | 47.7 |

6.44 As can be seen, women estimated that they spent an average of 44-49 hours each week on these task and men between 23 and 31 hours. Note that this does not include childcare, because villagers found it impossible to estimate the time spent devoted solely to this activity. Typically, it would be combined with other household tasks and undertaken primarily by women.

6.45 Clearly, the labour required simply to sustain the household from day to day is considerable. Adding the time spent on the ‘main activity’ of crop production provides some indication as to why most households said that they ‘had to work all the time’ and had ‘no time to take on new activities’. For example, as can be seen from the table, preparing pig fodder was a major time consuming activity for women and was a key constraint in deciding how many pigs the household could raise, even though they had identified pig breeding as one of the few options for improving their situation.

Cooking

6.46 Women undertook primary responsibility for cooking in all the villages and devoted far more time than men both to the actual process and to the associated activities of fuel gathering and preparation and water collection. Modern energy services appeared to play a very limited role. A few richer households burnt coal, but the great majority used crop residues and firewood. A great majority of women were unhappy with their situation. Fire lighting was difficult, often involving the use of damp or green wood. Sufficiently high temperatures were hard to maintain and the fire required constant attention. Household smoke pollution was a major concern and recognised as a cause of eye problems, sore throats and coughs. There were also many complaints about the impossibility of maintaining a reasonable standard of cleanliness in the household while burning these fuels. Around 20% of households in Duiwotai and Housanxi villages had

energy saving stoves which were said to use 25% less firewood. Although in general men were said to make the decisions on stove design and building, most women with these stoves had heard about them from relatives in their mother's village and persuaded their husbands to get one of the same design.

- 6.47** Two notable innovations were observed in Gansu. First, as noted above, solar cookers were much in evidence and heavily used for much of the year. Interestingly, they were not rated highly in terms of fuels used for cooking, probably because their use was largely limited to boiling water. In China, unlike most countries, the use of boiled water is extensive. Solar cookers are well suited for this purpose as (within reason) timing is irrelevant. A container can be hung onto the cooker in the morning and is available when needed.
- 6.48** Second, many women were using small hand turned fans as bellows to increase the efficiency of the cooking fire. The stoves were clearly constructed to facilitate this process and it was very effective in producing both much higher temperatures and more complete combustion, greatly reducing the volume of smoke produced. The main problem was simply that they could not both operate the fan and attend to the cooking. Whenever they stood up to stir the food, the temperature would fall and they would be engulfed in smoke. The obvious solution, which a number of women suggested, was an electrically powered version of the fan (possibly using a small PV panel in villages without grid connection). However, no household possessed such a fan and they did not appear to be available for sale at the township level. Even the fans that were on sale in the county towns (costing around ¥40), would have been difficult to adapt for the stoves most commonly used in rural areas.
- 6.49** Biogas was much promoted at the prefecture level, and a government biogas project had been established near Housanxi village. However, due to what were described as prohibitive start-up costs and lack of information, no biogas was being used in the study villages. In Duiwotai, the village committee asked for governmental support in this area. They saw the potential of biogas as a clean and effective energy source for lighting and cooking, particularly appropriate where electricity connection too costly. The climate and altitude in the three study villages in Hubei were likely to be suitable, according to rough calculations undertaken by the energy specialists within the fieldwork team.

Heating fuel

- 6.50** Heating was a major concern in all of the villages and one of the most time consuming activities for both women and men. As indicated above, the fieldwork was carried out in the late autumn, when the weather was worsening and the temperature falling, particularly in field sites at higher elevations. Residence in the villages allowed the researchers to appreciate the extreme difficulties experienced in term of heating and cooking at this time of year. With or without access to electricity and coal, there was still a heavy reliance on biomass, whether in the form of animal dung, crop residues or locally collected firewood. These typically provided a cash-free option but one involving considerable labour time inputs, often borne by women. Coal, and even the

cheaper coal dust which was made into briquettes, was considered expensive to buy and usually had to be conveyed a considerable distance back to the village. Households buying coal would often carry it for 5 - 10km to avoid paying for transport.

- 6.51** Residual sources of firewood, which was the most favoured of the three in terms of ease of use and heat output, have diminished rapidly, given that most forest land has been cleared for agriculture. In most of the villages, collection of firewood entailed traveling distances of up to 10km and could occupy a full day at least once per month. In many of the areas surveyed, de-forestation is a matter of great concern to the Chinese Government. They are included within the scope of a recently introduced programme which offers farmers food grains in return for planting trees on previously cropped land. In Gansu in particular, soil erosion linked to the loss of forest lands has reached catastrophic proportions. Given the cost, it was said to be impossible for most households to substitute coal for firewood, even though villagers recognised the environmental consequences of destroying the forest. In Xianfeng, poorer households would produce or buy charcoal and then and sell it at a nearby market. They could not afford to use it themselves.
- 6.52** The table above indicates that with electrification the main time saving occurs in grinding and milling activities, where men play the major role, rather than in the preparation of fodder for pigs, which is women's responsibility. *Indeed, the total burden on women was greater in the villages with electricity.* The arrival of electricity does not of course impact on the time spent on most major domestic chores. In the grid connected village of Housanxi, cooking still occupied over 24 hours each week and fetching water and fuel gathering still required some 18 hours.
- 6.53** A specific exercise was undertaken in this village to examine how time allocation had been affected by the recent arrival of electricity. A focus group of women were asked to list their daily activities. The facilitator then grouped these in discussion with the participants, and drew a grid on the floor in chalk, with each activity being represented by a drawing. Each woman would take a handful of corn kernels and place these against each task to describe how she spent her time on a proportional basis. The task was then repeated for a second round, with participants adjusting their corn allocation to describe how they spent their time before electricity had been connected.

Time allocation by women before and after electrification: Housanxi village

| Task | Ratio of time spent before and after electrification (%) |
|--|--|
| Housework (cook, sweep, fetch water, child care) | 99 |
| Looking after pigs | 45 |
| Working on the fields | 157 |
| Resting | 132 |
| Sleeping | 101 |
| Total | 100 |

- 6.54** Clearly, the biggest change after electrification was a reduction in time spent looking after pigs, with mechanisation of pig fodder cutting and corn grinding. Women's resting time also increased substantially. However this was partly offset by an increase in the time spent working in the fields. This was said to be partly because time saved on pig feeding was transferred to an overall increase in household agricultural work, partly because some men migrated, leaving their agricultural work to women. The women indicated that seeking work outside the village became a much more realistic income earning option with the arrival of electricity, as this enabled women to continue farming in the absence of male household members.
- 6.55** The responses of one couple interviewed in Duiwotai village may suggest radically different gendered attitudes to the benefits of electricity. The wife was very enthusiastic because "I can work late into the night". The man was equally pleased because "I can sit around and talk to my friends in the evening". Similar comments might suggest that women worked longer hours than men, and that electricity might exacerbate this. However, questions to women about who was worse off, who worked harder, ate better, who was poorer, usually elicited the response "we're all poor, all tired". They did not declare their husbands or men in general had a better life.

Physical asset ownership and access

- 6.56** As might have been expected there was a clear correlation between powered production or transport equipment and living standards. In the poorer, more isolated, unelectrified villages the little equipment available was owned by one or two richer families. In the recently electrified and small-hydro villages, equipment was more plentiful and varied but again concentrated in relatively few private households. It was only in Xiapai, in the non poverty county, where assets were widely distributed throughout the community.
- 6.57** The households that owned such assets in the poorer villages were also relatively rich in terms of financial, human resource and social assets. A number had income from salaries, for example as local officials or teachers. The school teacher in Zhaoshan owned a variety of electrical equipment including a saw, milling machine and pasta maker. The party secretary owned the diesel grinder in Duiwotai, to which many people brought their corn. Some had non-farm incomes, for example from shops or healthcare clinics, and others had

remittance income from family members employed in urban areas. Indeed the ownership of equipment and the resulting agricultural productivity increases, which reduced the demand for labour was seen as allowing household members to seek wage employment or at least casual labour elsewhere.

- 6.58** In general, households with equipment were very willing to hire it out, at what appeared to be relatively low prices, and this provided them with yet another income stream. This implied that most households in electrified villages had access to powered equipment. Interestingly, in Duiwotai Village, access to machinery could often be obtained in exchange for labour, enabling the poorest to have at least some access to production equipment. However, the exchange rate, which would obviously determine who benefited most from this arrangement, was very difficult to determine.
- 6.59** Equipment was obviously in demand at harvest time for crop cutting, gathering and threshing. At other times, the hire of powered equipment appeared to be at least as much for domestic and subsistence production purposes as for market oriented processing. Common activities included wheat, maize and potato flour milling, rice husking, fodder cutting, production of cooking oil, noodle making and sawing of timbers for construction. There were a few processed agricultural commodities that were produced primarily for sale, for example, potato starch and refined vegetable oils, but the income from these was almost always marginal compared to the main household income from the sale of crops or livestock.
- 6.60** Many households saw the primary value of powered equipment as being to save domestic labour inputs and allow more time to be allocated to their primary production or other income oriented activities. The demand for acquiring equipment typically reflected the division of labour. Women seemed to be the motivators for purchase of pig fodder cutting machines, and energy saving stoves. Men were more interested in milling because they would either grind grain by hand or carry it to the nearest available equipment.
- 6.61** This was particularly important when a household member sought to earn income by casual labour or by short or long term employment outside the village. It was not unusual in these circumstances for women to take on the full burden of running the household farm in addition to maintaining the household and possibly caring for children or elderly parents. The ability of otherwise to access labour saving equipment in these circumstances might determine the feasibility of this option.
- 6.62** In practice, many labour shortage households were caught in a vicious circle, whereby those who could possibly have benefited most from the substitution of machinery for labour were simply too poor to gain access. And labour shortage was often cited as a major reason for their poverty. This situation was frequently related to stages within the household life cycle. As described above, the great majority of households in the study were relatively small, typically composed of 3-5 resident members. Small households with young children, frail elderly parents or suffering from the sickness of a key worker, had little time to allocate

to expansion of their productive activities or external income earning. They also faced a range of additional expenditure burdens, for example school or health care fees. Their financial situation would then preclude them from using those energy services which might have increased their productivity and allowed them to escape from their difficulties.

Human and social capital

- 6.63** Precisely because of the astonishing expansion of the grid in China, those without electricity are acutely aware of being excluded. Almost everyone in the communities without access had routine contact with others in very similar economic circumstances, and perhaps living only 10km away, who took it for granted. This is clearly a very different situation from that in many other countries where large sections or even a majority of the population live without electricity. In China, access has become not only a means to a better life but a key standard of living indicator and a necessary asset for full participation in society. Perhaps this is illustrated most powerfully by the examples given above of the difficulties experienced by those living in unconnected villages of finding a marriage partner.
- 6.64** In these villages there was an evident powerful desire to gain access at least to electric lighting. Statements such as “it would lift our spirits” and “it would make a hard life more bearable” were common. In one household, decorated electric light fittings were hanging from the ceiling “in the hope that one day they will be lit”. The children’s focus group in Xiaozhu village said they liked studying and wanted to learn characters so that they could go out as migrant labourers. When asked why they wanted to go out, the chorus of replies came “waimian hao” (it’s good out there!). When asked why it was good, they shouted out “they have electricity!”.
- 6.65** At the start of the project many of the researchers fell into the habit of speaking of approaches to electricity supply for populations in remote areas, such as PV or small wind generators, as ‘only’ providing lighting, television, and similar low power consuming services. Such approaches were clearly not going to lift people out of poverty in terms of dramatically increased production and income generation. However, the experience of living in the two villages which did not have electric lighting gave a very different perspective. Only one room would usually be lit and this by a tiny kerosene flame. From around 7pm each evening any form of productive, educational or domestic activity which required being able to see clearly was almost impossible. In Hubei, almost every girl and woman had scars across her hand from cutting pig fodder manually. They said this usually happened at dusk when they could not see clearly.
- 6.66** One interesting aspect of the social context of lighting arose in discussion with officials in Hubei, who pointed out that among the Miao minority, embroidery was not simply a pastime but an essential social skill. Households were judged by the quality of their clothing, and a woman seeking a husband would have to demonstrate their ability in order to satisfy his family. Being able to undertake this activity in the evening was extremely important in terms of the standing of a

woman within the community. In some cases it also allowed them one of the few opportunities to earn non-agricultural income.

- 6.67** It is clear from the study that television has become a very important part of rural Chinese social life. The ownership of television was remarkably high, even among the poorer households in these poor communities. Even the poorest in electrified villages said they had free access. People, or at least men, from the unelectrified village in Huining would often walk a considerable distance to the next village, often along poor roads and in darkness, to watch a favourite programme. Interestingly, there seemed to be some reluctance to report watching television simply for entertainment or relaxation. Adults would tend to stress the use for children's education, or the importance of television as a source of information, including on production and markets. Often only one or two channels could be received, mainly local county or provincial channels which included programmes on practical topics such as pig breeding.
- 6.68** The economic reforms have had major implications for health facilities and schools in China. Previously, village health stations and primary schools were largely funded by the collectives, with very limited fee payments. In the case of health stations, drug fees now account for almost all their income. Village doctors, previously paid in workpoints along with other workers, are now essentially private care providers. At most they may receive some technical support from township health centres and be contracted to provide preventive services such as immunisation. Village primary schools are in a somewhat better position, with some teachers salaries directly paid by government, but they also have to depend on local support for all other costs. Where township or villages had profitable enterprises, these would usually contribute sufficient income. Otherwise, fees are the only alternative. In poorer areas the support from all sources is usually minimal and both health facility and school managers sought to cut costs wherever possible. It was not surprising, therefore to find that energy expenditure in the study villages were kept to the absolute minimum.
- 6.69** Even though winter temperatures could fall to zero and below in at least four of the villages surveyed, there was seldom any provision for heating. In Zhaoshan, primary school children were asked to bring fuel to school each day. In Duiwotai, they each took a small brazier and some coal. In Housanxi, where teachers said that burning fuel in the classrooms would be unhealthy, they would "shut the doors and windows tightly on cold days and the children would jump up and down".
- 6.70** Very little use was made of electricity in either schools or health stations in poorer villages, even for basic lighting, on the grounds that it was simply too expensive. No electrical equipment was reported in any village level health facility. In Gaozui, though the school used by village children had electricity, teachers complained that they had to prepare lessons and mark homework each evening using small and very dim kerosene lamps. In Houshanxi, even though each classroom had a 60W bulb, one teacher claimed that these had never been used. Teachers were reluctant to turn them on even during the dark winter afternoons because they were concerned about the cost of electricity. In

Duiwotai, the school had no lighting apart for 2 oil lamps used by teachers, even though all the surrounding houses had electricity. Children from Xiaozhu, the poorest community in the study, had to walk to a school in the administrative district, up to two hours away. Even in this school, only two of the nine classrooms had electric light. Teachers reported that if it became too dark to do normal lessons, as sometime happened in winter, children would do physical exercises instead. Interestingly, the headmasters' office had a 29 inch TV, DVD, hi-fi, and recently connected telephone. Only the school used by pupils from the richest village, Xiapai, made formal use of television, radio and video for teaching.

Social Capital - Empowerment and participation

- 6.71** In all the study villages the local Village Committee and Communist Party Branch, which were often effectively indistinguishable, were the only active community level institutions. Even then they often seemed to see their role mainly as that of intermediaries between government and households, passing on new policy decisions rather than behaving proactively to further the interests of their communities. In Xiapai village, for example, it was said that major issues were in practice decided by the township government, who would pass on their instructions. Recent interventions from the township had included requiring increased output of maize, setting new production targets, deciding irrigation policy and establishing crop planting percentages. The Committee members would similarly inform male household members of new policies and decisions, usually via the head of each natural village. It would be very rare to call a general village meeting except at election time, and it was openly said that those who took part in village decision making were mainly those who were richer and more educated. Poorer people had few opportunities to participate.
- 6.72** The effectiveness of village committees often seemed to depend on personalities rather than formal structures or procedures. In Hubei, it was said that in principle each village committee should consist of at least a Party secretary elected by the membership, and a chairman, accountant and women's representative, all chosen by popular election. However in Xiaozhu village the chairman had resigned over a conflict with the party secretary, the women's representative had migrated, and the accountant had never been elected. This meant that the only village committee member left was the secretary, an old man who had held this post for decades. Weak village leadership was blamed by many in the community for the failure of an electrification scheme to which villagers had contributed ¥10,000 and which depended on negotiation with higher levels of government for matching funds. In Housanxi, the party secretary appeared to run the village without reference to the other Committee members, but many villagers remarked that he was very capable and attributed their road access to his effective way of relating to officials from township and county. In Duiwotai, the community was very divided, and the village committee weak in consequence, but electrification had been carried out and the road connected with the help of poverty alleviation funds. This was attributed to the influence of one official at county level who originated from the village.

6.73 The studies all strongly emphasise the lack of women's voice at village level. The general attitude was perhaps best expressed by one village head who explained that "Women are not notified of village committee meetings as they are held in the evening and it is not safe for women to walk in the dark". In Hubei all three village committees and district management committees were entirely male, though in theory each committee at village level should include a women's representative. In Xiaozhu, she was said to have migrated. In Duiwotai, the secretary's wife was said to be the women's representative, but she vigorously denied this. In Housanxi, the supposed women's representative said that she had been elected against her will and had no intention of filling this role, as she was far too busy running her farm.

7

7 Conclusions

- 7.1** In this final chapter consideration will be given to the more general conclusions that can be drawn about ‘the lessons learned which may improve the impact of projects of the World Bank and ASTAE on poverty alleviation and gender equity in China and possibly in other countries’¹¹¹.
- 7.2** Clearly Bank energy staff now face a situation that is significantly different from what it was only a few years ago. This includes:
- A focus on energy sector reform rather than large energy sector loans (mainly electricity generation)
 - A re-focus on poverty reduction
 - Sector reform in which the state run utility is no longer the main or only client
 - A concern for environmental and gender awareness, and a more participatory approach to development. While this improves the quality of projects, it considerably increases the time and transaction costs of developing new loans
 - Shortage of grant funds to finance the development of new loans, and the increasing importance of bilaterally funded trust funds with agendas that at times may not coincide with those of the Bank or its clients.
 - No clear administrative mechanism for ‘inserting’ energy issues into the Country Lending Strategies
 - An increasing focus on Poverty Reduction Strategies and large integrated programmes.
 - Additional soft money (mainly through the Global Environment Facility) to subsidise the preparation of projects that have a global environmental impact, but which limit the full menu of options to only those that are renewable (and which are not yet the least cost option without the subsidy).

¹¹¹ Terms of Reference, See Annex I.

7.3 This study confirms that

- The energy needs of women are likely to be significantly different from those of men, and that as the main actors in the energy economies of poor communities, women and their energy will have to be addressed specifically if energy poverty is to be reduced.
- A gendered Sustainable Livelihoods framework does provide valuable insights into the energy, poverty gender nexus of issues.
- However there is no magic bullet. In the same way that all poverty interventions need to be sensitive to issues of gender (and indeed many other issues such as the local, national and international environment) so to will they need to be sensitive to the enabling (and constraining characteristics of energy services.

7.4 The study also confirms that energy related programme need to be clear about their objectives. Certainly it would appear that the following entirely legitimate objectives are slightly different and require somewhat different approaches. These include:

- Maximising the use of renewable energy technologies – and therefore finding the circumstances in which they are likely to be the least cost (remote locations with no prospects of the grid), special end-uses (such as telecommunications) or to combat the unintended pressure of market forces to move away from hydro electricity¹¹².
- Increased access of people in general to improved energy services in the least cost way – probably suggesting a focus on those areas with a high density of energy requirements, and considering the full menu of options – both renewable and fossil fuels
- Improving the energy services to specific groups of people in specific (remote) locations using a find full menu of options that best meet the needs of the people themselves.

7.5 In the new situation facing donors generally, the task of all energy specialist become the difficult one of ensuring that “a gendered energy sensitivity” is introduced to the mainstream of development thinking (and in the case of the World Bank, into the agenda of the Poverty Reduction Strategy Papers and Country Assistance Strategies **at an early stage**. An impression is circulating that suggest that other social infrastructure (health, water, education) appear to have done a better job of integrating themselves in the mainstream of this poverty agenda than energy.

7.6 It also suggests that gender and other poverty specialists are also sensitised to

¹¹² Bank’s Operations Evaluation Department provided an input to the Bank’s environmental strategy for the energy sector, *Fuel for Thought* (September 1998) which found that some aspects of energy sector restructuring have had negative environmental impacts, particularly with the reduction in investment in large hydro power. They noted the “perverse” shift away from “economically justifiable hydro dams towards..... less environmentally friendly, thermal plants” (page 58, see also page 57).

the importance of energy to both their client group and to the success of the interventions that they propose.

7.7 In the end it is difficult to better the pragmatic advice of the Netherlands Development Agency when it says in its recent strategy:

“Most energy projects do not have the potential to completely change the gender balance and the inequalities of centuries, which are often deeply ingrained in cultures. However, they certainly could set the following near-term objectives:

- *Ensuring that the heavy work burdens of women are lightened by modernisation of the household fuel supply systems, the kitchen and agriculture;*
- *Identifying ways in which women can become more independently involved in the cash economy;*
- *Ensure that women are represented in local dialogue, extension work and resource management”*¹¹³.

7.8 At the very specific level of Western China, the report would suggest that

- Out migration may well be a more sustainable livelihood option than improving energy services to enable poor people to remain in “untenable places”.
- While electricity is essential to well being, ‘Energy’ should not be interpreted to mean only electricity.
- Ad-hoc attempts to address energy poverty through one-off decentralised energy options such as PV are unlikely to be sustained unless provision is made to cover the recurrent costs and the underlying “system” to supply operational and maintenance services.
- Some communities use their ‘social capital’ to gain better access to energy services than other and to put pressure on the relevant authorities to ensure that their energy services are of high quality. These processes need to be understood, and expanded.
- The restructuring of economies in general and the energy sector in particular provides both opportunities and threats to poor people. The poverty reducing and gender related impact of these reforms needs to be considered in advance so that the livelihood opportunities can be enhanced and the threats reduced.
- Poverty reduction could be enhanced by including an appropriate energy component in the current Western China Development Strategy.
- More work is needed to provide a toolkit that enables **local government** personnel to design appropriate energy interventions.

¹¹³ NEDA Policy Document Sustainable Energy Economy – II, Draft Version 17 November 1999.

Annex 1

A1 Terms of Reference

EnPoGen - China Field Studies

Background

Of the 2 billion people who lack access to modern energy services, 1.2 billion live in the Asia region. In this region the Asia Alternative Energy Program (ASTAE), a partnership between the Bank, UNDP and several bilateral donor agencies, has the mandate to promote alternative energy in World Bank lending operations in the energy sectors. ASTAE started in 1992 with the target of increasing the share of alternative energy in the Asia power sector lending with 10 percent from almost zero at its start. This target has been achieved and surpassed in 1999.

In the past ASTAE's efforts were guided by the need to promote environmentally sound technologies and by cost effectiveness. In recent years this has changed; poverty reduction has come to the forefront of international debates on development, and there has been a major international effort to devise effective strategies¹. It is for this reason that at present the alternative energy projects or project components supported by ASTAE address both environmental, poverty and rural transformation issues. The majority of projects 'addressing poverty alleviation, are in the energy sector. However, increasingly support in this field is provided to other sectors (health, education and water supply). The majority of the ASTAE projects are for the provision of electricity services, such as for instance wind, photovoltaic and micro-hydro systems, because the countries in Asia sought Bank assistance for the provision of electricity services and because renewable electricity could be the most effective considering the local situation.

A wide range of direct and indirect benefits can result from the provision of renewable electricity services to poor households. For instance about the ASTAE project 'China Renewable Energy Project' it is said that 'even though the project is not specifically poverty targeted, it will clearly have a significant effect on the poor population of the provinces in which it is implemented. The impacts on the poor are clearly set out, including providing improved quality of lighting and access to communication in homes,

schools and health clinics which will enhance the quality of life, reduce isolation, increase access to knowledge and support education and community development. Economic benefits are also identified¹¹⁴

In spite of the above recent statements regarding the needs of the poor and the main components of a poverty reduction strategy do not place energy or electricity high on the priority list. This may be due to the suggested linkages between access to energy services and poverty alleviation being insufficiently understood, problems of communication between those working in energy and poverty, and so on. Therefore, the aim of this project is to understand the linkages between access to energy and poverty alleviation and provide empirical evidence on the actual and potential benefits to the rural poor from electrification¹¹⁵. The final report will be targeted at ASTAE and experts in poverty, gender analysis and energy, with the aim of improving ASTAE's and the World Bank's future projects.

There is a high correlation between poverty and location in China, with the majority of poor households living in relatively remote areas that face difficulties in terms--of both agricultural and industrial production. The issues of electrification of these areas will be considered as broadly falling into two categories:

1. There has been an astonishing growth in rural electrification in recent years, and, some 93% of households and 96% of villages are currently served by large or small grid systems. Thus many poor households have access to gridelectricity, though possibly (for isolated grid systems) with limitations on potential uses, for example in terms of production activities.
2. On the other hand, some 77 million people in 30,000 villages still have no access to electricity or rely on batteries or small diesel generators. Those villages with no grid connection are typically in the most remote and sparsely populated regions with the most difficult terrain and are among the poorest@ with limited access to other services. Particular attention will be paid to such areas, both with and without grid-access, in considering the impact of the introduction of electricity on individuals, households and communities.

Objectives

The field study in China will:

- (a) identify the linkages between access to energy/electricity, poverty alleviation and gender equity in general and specifically in China,

¹¹⁴ For instance, The World Bank has undertaken a major review of existing approaches and will shortly complete an exercise to elicit the viewpoints of poor people regarding the measures most likely to address their needs. These efforts will contribute to the next World Development Report, which will propose a new framework for understanding and reducing poverty. The World Bank and IMF are supporting national efforts to apply this framework to the development of Poverty Reduction Strategy Papers. These will define priorities for the allocation of government budgets and for World Bank lending.

¹¹⁵ Many of the suggested benefits would seem to relate closely to the various dimensions of poverty (opportunity, security and empowerment) discussed in the WDR 2000

- (b) quantify the impacts of access to modern energy on poverty alleviation, gender equity and related development issues in China,
- (c) draw lessons learned which may improve the impact of projects of the World Bank and ASTAE on poverty alleviation and gender equity in China and possibly in other countries, and,
- (d) contribute to the development of a methodology for the monitoring of impacts of energy projects.

Scope of the Work

In general the team (see Annex 1) will work in close collaboration with ASTAE, and the national project management team and counterparts. The advisory committee of the EnPoGen project will comment and provide advises to the team. Moreover, the team will communicate and exchange ideas with the research team working on the field studies in Sri Lanka and Indonesia. The team will get access to a World Bank discussion group on the internet. This discussion group will provide project documents of general concern for the EnPoGen project and facilitate communication between ASTAE, the China team and the advisory committee.

Task 1: Electrification, poverty and gender review and development of analytical framework

The study will start with a review of current knowledge on energy/electricity-poverty-gender linkages. The aim will be to bring together a small expert group on energy, poverty and gender (see Annex 1) to produce a short position paper setting out what is known and what is not. The review will include recent analyses of energy-poverty-gender linkages by the World Bank and other international agencies and literature and secondary data sources on electrification-poverty- gender linkages in rural areas. It will be broadly focused, including, for example, women's time inputs to energy-consuming household work such as food processing, cooking and fuelwood collection.

The exploration of linkages will take into account the special characteristics of remote areas, the particular needs of residents of these localities and the constraints to energy-development linkages without other complementary inputs. The recent 'Voices of the Poor' exercise identified isolation as an important characteristic of one major sub-set of the poor, and it is envisaged that the potential benefits of electrification may be quite different in such areas.

The aim will be to establish an agreed analytical framework. This should clearly specify the potential links between electrification, poverty and gender, and identify key hypotheses and research questions. A small workshop will be held to allow a wider audience to consider and comment on the findings of this exercise. It is hoped that this will include at least one participant from the key collaborating agency in China and a member of ASTAE. Following revisions resulting from the output of this workshop, the framework will then form the basis for detailed fieldwork design.

Task 2: Preparation of the field studies in China (in parallel with Task 1)

- (a) In order to get access to research sites and local research resources initial discussions will be held in China with relevant officials, government departments

and academic institutions to identify potential collaborating agencies and local researchers. ASTAE will support in this process by initiating contact with the Chinese counterparts in ASTAE projects and liaise with the Chinese national and provincial governments to secure agreement to undertake studies

- (b) This will be followed by a visit to China by research managers to agree collaborative arrangements, discuss research sites and logistics and formally recruit local research teams.
- (c) During these visits 6 study sites (villages) will be selected in consultation with ASTAE each in two provinces; the first would be selected from those included in the recent ASTAE study to assess markets for renewable energy in Northwest China; the second would be in the Southwest where there are village-level micro-hydro projects. The selection process will include the following criteria:
 - Recent electrification intervention including grid, village-level grid and household-based technologies
 - Poverty county (ideally in a poverty alleviation program with a baseline study) and poor townships.
 - Willingness of local governments to collaborate.
- (d) As well as that a review of available materials on electrification, poverty and gender linkages in China will be undertaken. Sources will include information from both internationally assisted and national electrification projects and programs. Particular attention will be given to renewable energy projects (micro-hydro power, photovoltaic and wind power systems), the Integrated Rural Energy Development Program and the small hydroelectric power program for rural electrification (100 counties program). Recent poverty and poverty-related studies and surveys (for example on health and education) will also be examined to see if they can include data on electrification.

Task 3: Development of research instruments

Based on the analytical framework (Task 1) and the review of materials that relate specifically to China (Task 2) members of the research team together a member of the collaborating agency in China and in consultation with the expert group (see Annex 1) will develop the final field research plan and research instruments. Annex 2 describes the research methods that will be used.

Task 4: Execution of field research: collection of data

The final field research plan and research instruments will be applied in practice to collect data in China, see Annex 2. Consultants and research officers (one consultant and research officer will focus on each province) will visit China for three weeks where, they will discuss with collaborators and provincial officials and hold one-week training workshop for fieldwork teams. Next, selected counties will be visited by fieldwork teams. The fieldwork team leader will discuss with officials on issues and fieldwork plans at county, township and village levels and prepare initial reports of the first round of fieldwork at village level in each province. These reports will be debriefed during workshop visits by the consultants to each team. There after, final reports will be prepared by the consultants. Second and third rounds of data collection and workshops will take place as above.

Task 5: Preparation of the draft final report of the China field studies

The field study reports, together with the background materials previously reviewed will be used to prepare an overall country study for China. This will be presented for consideration to a small workshop of energy, poverty and gender experts including an ASTAE member. The findings from this workshop, including specific inputs from the project expert group, will then be used in the preparation of the draft final study report.

Task 6: Review of the final report of the China field studies

Before completion the draft report on the China field studies will be subjected to peer review..

Annex 2

A2 The language of energy services

1. An understanding of the linkages between energy and poverty it is important to develop a common understanding of the basic characteristics of energy services in developing countries. Even in poor countries the needs for energy are diverse and can be satisfied in different ways. In very poor societies the main forms of energy are likely to be animate energy provided by human labour and draft animals. Even the poorest people will also use some inanimate energy, typically biomass fuels for space heating and cooking¹¹⁶ .

“Biofuels in the form of wood, crop residues, brush and animal dung is today still the chief form of energy for the majority of humanity, just as it has been since the discovery of fire”¹¹⁷ .

“Approximately one third of all energy consumption in developing countries derives from the burning of wood, crop residues and animal dung, and by some estimates it amounts to 1,000 million tons of oil equivalent per year, or more than three times the coal mined in Europe in a single year, and twice the energy of the coal mined in the US and China”¹¹⁸

2. These energy sources are often referred to as traditional energy sources to distinguish them from modern energy sources such as electricity, coal, oil and gas. The essential features of modern energy sources are that they are more convenient (more energy per unit volume, easier to store or distribute) and more efficient at doing useful work.
3. All modern fuels and some traditional fuels are traded (wood fuel is increasingly traded for money, and charcoal is almost always traded). Published energy

¹¹⁶ Interestingly none of the major staple foods of the world (rice, wheat, maize, cassava, potatoes, etc) can be digested by humans without cooking, such that people can be severely affected by starvation even if they have food but they have no fuel.

¹¹⁷ Dr Kirk Smith, personal communication, quoting the late Professor David Hall.

¹¹⁸ Rural Energy and Development: Improving Energy Supplies to Two Billion People, World Bank, 1996, ISBN 0-8213-3806-4

statistics are usually confined to such commercial fuels (because data is available from market sources) and can therefore be highly misleading in terms of the energy consumption of poor people. While non-commercial fuels are not usually traded for cash, they are not “free”, usually requiring considerable expenditure of time for their collection and processing. These activities can have a high opportunity cost for the collectors, typically women and children. In addition both non-commercial and commercial fuels may incur costs on society (externalities such as environmental damage or health risks) that are not reflected in their price. Energy prices may also not accurately reflect energy costs, due to the usual culprits of taxes, subsidies and monopoly supply, nor energy values, where poverty or income inequality prohibits access to modern energy services by large sections of the population.

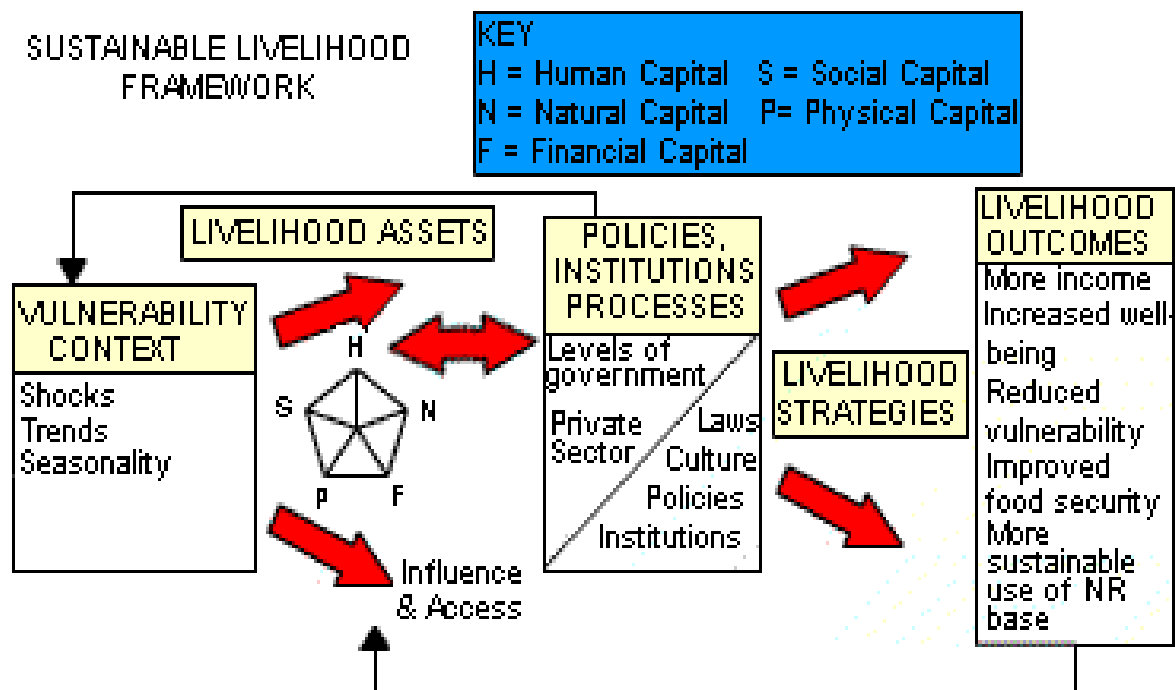
4. Some forms of energy from traditional biomass can be converted into more useful forms and are then known as modern biomass fuels. For example, biomass can be converted into liquid or gas fuels. Some energy sources are regarded as renewable while others, for example fossil fuels, are termed non-renewable. The distinction is not always clear in practice. Wood and other biomass fuels, for example, are only renewable if they are replaced by new planting. In many parts of the world this is not the case and biomass may be said to be mined not harvested. Similarly, energy (often electricity) obtained from hydraulic sources (hydro-electricity) is renewable, but is frequently not regarded as such because of the environmental and human degradation that has been associated with the building of dams and the resulting lakes. However, this is not a necessary effect of all hydro plant and some run of river schemes may be particularly benign. There are those who regard natural gas as being so plentiful (and so relatively clean to use) that it should be considered as “effectively renewable”. Similarly there are people who regard nuclear power as renewable, and indeed there was a time when nuclear power was predicted to become ‘too cheap to meter’.
5. It is misguided to suggest that developing countries have abundant “free” sunlight (or wind or falling water) and that these renewable sources can solve their energy needs. While having such resources is probably better than not having them, the cost of making energy useful for specific applications (such as generating electricity) is often very expensive. No one wants energy for itself, they want it for what it can do. It is always a derived demand. Typically energy end-uses include cooking, lighting, heating and cooling, static and mobile shaft power (machines and vehicles), and services such as communications and entertainment (telephone, television, radio, etc.). Often the cost of the end-use technology can greatly exceed the cost of obtaining the energy used. In developing countries different income groups have different “end uses”, and as income rises they meet their needs with different energy sources and different conversion technologies.

Annex 3

A3 Energy and Sustainable Livelihoods: A set of Tables¹¹⁹

An attempt is made In the following tables to take the categories of the “sustainable livelihoods approach” and consider the implications for energy systems in order to secure livelihoods.

The Sustainable Livelihood Framework – “the diagram”



¹¹⁹ The following five tables are produced by Andrew Barnett and are based on the Sustainable Livelihoods Guidance Sheets provided by DFID, The Poverty and Transport Toolkit, produced by Lucia Hanmer, David Booth and Elizabeth Lovell at ODI, June 2000. Useful comments on an earlier version have been received from a number of people.

Table 1: Linkages between livelihood assets and energy¹²⁰

“The livelihoods approach is concerned first and foremost with people. It seeks to gain an accurate and realistic understanding of people’s strengths (assets or capital endowments) and how they endeavour to convert these into positive livelihood outcomes. The approach is founded on a belief that people require a range of assets to achieve positive livelihood outcomes; no single category of assets on its own is sufficient to yield all the many and varied livelihood outcomes that people seek”. Sustainable Livelihoods Guidance Sheets, Dfid, 2000.

| <i>Capital Asset</i> | <i>Link with energy intervention/improvement</i> |
|--|---|
| <p>1. Natural Capital</p> <p>(natural resource stocks from which resource flows useful for livelihoods are derived)</p> | <ul style="list-style-type: none"> ○ The main natural capital asset of poor people is likely to be biomass (wood, twigs, leaves, crop residues, dung, human waste) that can be use as a fuel. In some cases hand-dug coal and peat are natural assets for poor people. Access to these natural resources is affected by many factors (eg land ownership, climate) and their sustainability is affected not only by their use as fuel, but also changes in land use (fuelwood becomes less available when land is cleared for food production) ○ Other energy related natural capital assets include falling water, wind, and solar insolation. However these sources require other forms of capital to convert them into useful energy. ○ Animate energy in the form of human and draft animal power also form a significant “natural” energy asset. ○ Changes in land use, and improved access can increase exploitation of local natural resources, e.g. forests. Increased competition for land and resources. |
| <p>2. Social Capital</p> <p>(social resources on which people draw in pursuit of livelihoods i.e. relationships, membership of networks)</p> | <ul style="list-style-type: none"> ○ Networks and social relations often determine individual’s access to natural resources (who can collect fuelwood from a particular location), access to energy conversion technology that is owned by others (grain mills, baking ovens, machines for preparing land, irrigation water pumps), access to other people’s skills (electricians, engine repairers), information about technical (and managerial) alternatives. <p>As women are the main users and suppliers of inanimate energy in poor communities their social capital of friendships and networks is likely to be particularly important.</p> |
| <p>3. Human Capital</p> <p>(skills, knowledge, ability to work, good health which enable people to pursue different livelihood strategies)</p> | <ul style="list-style-type: none"> ○ Formal and informal employment generation in construction, maintenance and provision of energy services. ○ Indigenous knowledge of local energy sources and their use in a sustainable environment. ○ Improved health of women and children as a result of access to improved energy services for cooking which reduce indoor air pollution – one of the biggest causes of death and ill health ○ Improved healthcare, education, communication as a result of energy for lighting, pumping, communication and transport. ○ Access required to skills for many aspects of energy service delivery, and for some aspects of energy use (eg people with knowledge of electric installations). |

¹²⁰ The perspective taken in the tables is largely that of “excluded” people and mainly at the micro level. Although the tables are read in sequence, it must be remembered that in practice there are strong links between them – particularly between livelihood outcomes and livelihood assets.

| <i>Capital Asset</i> | <i>Link with energy intervention/improvement</i> |
|---|--|
| <p>4. Physical Capital</p> <p>(basic infrastructure for the supply of energy, shelter, water, transport and communications, production equipment)</p> | <ul style="list-style-type: none"> ○ Access to energy sources (electricity) and fuels (fossil and biomass fuels) ○ Access to the technology required to convert energy into a useful form, particularly end use technologies such as stoves, lamps, machines, radios, motors and engines etc. ○ Production technology that enables inanimate energy to replace the drudgery of human labour. ○ Transport services depend on access to reliable and reasonably priced fuels. |
| <p>5. Financial Capital</p> <p>(financial resources available which provide livelihood options e.g. savings, credit, remittances, pensions).</p> | <ul style="list-style-type: none"> ○ The “lumpiness” of the investment in energy conversion devices or the lack of enough cash to make bulk purchase of (lower cost) fuels means that poor people often cannot get together enough cash to buy them, even though there would be considerable cash savings over the medium term future (kerosene is often bought by the cupful). ○ Modern renewable energy conversion technologies share a characteristic that militates against their use by poor people - they generally have higher initial capital costs and lower recurrent (fuel) costs relative to fossil fuel based technologies. ○ The increases in productivity and subsequent lower prices that result from increased access to improved energy services help improve savings and other financial capital. |

Table 2: Linkages between Vulnerability Context and energy

*“The Vulnerability Context frames the external environment in which people exist. People’s livelihoods and the wider availability of assets are fundamentally affected by critical **trends** as well as by **shocks** and **seasonality** – over which they have limited or no control.*

This box provides examples of trends, shocks and seasonal effects (incomplete list):

| Trends | Shocks | Seasonality |
|--|--|--|
| <ul style="list-style-type: none"> • Population trends • Resource trends (including conflict) • National/international economic trends • Trends in governance (including politics) • Technological trends | <ul style="list-style-type: none"> • Human health shocks • Natural shocks • Economic shocks • Conflict • Crop/livestock health shocks | <ul style="list-style-type: none"> • Of prices • Of production • Of health • Of employment opportunities |

Sustainable Livelihoods Guidance Sheets, Dfid, 2000

| Vulnerability Context | Energy Link |
|------------------------------|--|
| 1. Geography | <ul style="list-style-type: none"> ○ Sets conditions for energy requirements and opportunities. ○ Geography determines the extent and form of the biomass resource and the availability of falling water, wind, insolation, and other sources of energy (coal, oil, gas, geothermal energy etc). ○ Geography determines the choice of energy infrastructure e.g. pipelines, power distribution. ○ Geography influences the cost of improving energy infrastructure. ○ Climate determines the need for heating, and cooling; |
| 2. Location | <ul style="list-style-type: none"> ○ Remoteness adds to the costs of all energy supply options, but not necessarily in the same way and to the same degree. Remoteness increases the relative attractiveness (‘comparative advantage’) of renewable energy supply (such a micro-hydro and photovoltaic systems) relative to other options that require transportation of fuels. However this advantage may be insignificant compared to the cost of frequent visits from urban-based technicians required to maintain the systems. |
| 3. Seasonality | <ul style="list-style-type: none"> ○ The need for energy fluctuates in relation to ambient temperature, agricultural season, availability of raw materials etc. ○ Transport dependent costs of installing and maintaining infrastructure or delivering fuels, equipment and spare parts, and maintenance varies according to the season. ○ Energy supplies dependent on water, the biomass, wind also vary by season. ○ The moisture content of biofuels, and their combustion characteristics are affected by the season |
| 4. Population density | <ul style="list-style-type: none"> ○ “load density”, or the amount of the service used (or better, purchased) along an electricity line, or kerosene distribution route, is a major determinant of its unit cost (and price). Low density favours modular options such as Photovoltaic systems over grid extensions. ○ Rapid changes in population, eg through refugees, puts particularly |

| Vulnerability Context | Energy Link |
|--|--|
| | pressure on the sustainability of biomass (and other) fuel systems |
| 5. Trends in governance (including politics) | <ul style="list-style-type: none"> ○ Restructuring of the energy supply sectors is largely a political process resulting in both threats and opportunities for poor people's access to energy services. Particularly the availability of "safety nets" to cover the high costs to poor people of the "adjustment process". ○ Political promises of grid electrification may undermine people's willingness to invest in alternative decentralised options. |
| 6. Technological trends | <ul style="list-style-type: none"> ○ Massive technical change in recent years has altered people's ideas of what is possible. ○ Improvements in small scale energy conversion technology have increased efficiency and reduced costs (particularly with photovoltaic cells, but also small fossil fuel engines, wind generators, micro hydro - particularly electronic load controllers - biogas, and biomass gasification ○ The use of gas for power generation using gas-fired combined cycle gas turbines has meant that electricity can now be generated on a relatively modest scale at costs that are competitive even with the largest coal fired plant, reducing the power of "natural monopolies". |
| 7. Shocks | <ul style="list-style-type: none"> ○ The major energy related shocks have tended to be associated with the availability and price of oil products, which affect both the micro and macro economy. ○ All energy delivery systems are vulnerable to natural and man made disasters, to war and conflict. |

Table 3: Linkages between structures, institutions, processes and energy

“Transforming Structures and Processes within the livelihoods framework are the institutions, organisations, policies and legislation that shape livelihoods. Their importance cannot be over-emphasised. They operate at all levels, from the household to the international arena, and in all spheres, from the most private to the most public. They effectively determine:

- *access (to various types of capital, to livelihood strategies and to decision-making bodies and sources of influence);*
- *the terms of exchange between different types of capital; and*
- *returns (economic and otherwise) to any given livelihood strategy”.*

“Structures in the framework are the hardware – the organisations, both private and public – that set and implement policy and legislation, deliver services, purchase, trade and perform all manner of other functions that affect livelihoods. They draw their legitimacy from the basic governance framework”.

“If structures can be thought of as hardware, processes can be thought of as software. They determine the way in which structures – and individuals – operate and interact. And like software, they are both crucial and complex: not only are there many types of processes operating at a variety of different levels, but there is also overlap and conflict between them. The box shows just some of the transforming processes of importance to livelihoods.

| Policies | Legislation | Institutions | Culture | Power Relations |
|---|--|---|--|---|
| <ul style="list-style-type: none"> • Macro • Sectoral • Redistributive • Regulatory | <ul style="list-style-type: none"> • International agreements • Domestic | <ul style="list-style-type: none"> • Markets • Institutions that regulate access to assets • ‘Rules of game’ within structures | <ul style="list-style-type: none"> • Societal norms and beliefs | <ul style="list-style-type: none"> • Age • Gender • Caste • Class |

Sustainable Livelihoods Guidance Sheets, Dfid, 2000

| Institution/Process | Energy Link |
|---------------------------------|---|
| 1. National government | <ul style="list-style-type: none"> ○ Often responsible for the supply of electricity and for the regulation of all the energy supply industries (electricity, fossil fuels, and much of the monetised wood and charcoal markets); ○ Responsible for much of the “enabling environment” required for efficient public and private sector development in the energy service industries. ○ The main source of subsidies of energy related services, for energy price control and for energy taxes, and the taxes on imported energy conversion technology. ○ The main regulator determining the type of ownership and degree of competition at each part of the energy supply chain. |
| 2. Local government | <ul style="list-style-type: none"> ○ Often responsible for smaller scale energy infrastructure at district/local level, and particularly the rate and direction of grid extension. ○ Responsible also for transport infrastructure which affects the availability, reliability and cost of fossil fuel delivery costs. ○ Responsible for regulation and permits associated with small scale energy retail businesses (eg electricity supply to rural bazaars, the production and sale of charcoal), access to communal resources such as water (for hydro); “way leaves” for electricity. |
| 3. Community Level Institutions | <ul style="list-style-type: none"> ○ Often crucially important in the mobilisation, organisation and development of schemes to introduce decentralised energy supplies (diesel mini-grids, micro-hydro etc) and in the regulation of such schemes. ○ It matters less whether or not the community own these assets, than that they are run in a “business –like” manner. |
| 4. Firms | <ul style="list-style-type: none"> ○ Providers of energy services and, often in partnership with government, suppliers of energy related infrastructure. ○ Small and micro firms are likely to be the main actors in the supply and use of improved energy services that are used by poor people (eg ‘illegal’ retailers of electricity in urban slums, sellers of kerosene, candles and charcoal) |
| 5. NGOs | <ul style="list-style-type: none"> ○ Can play important role in interventions to improve energy services at the local level e.g. introduction of appropriate energy technologies, organising community-based initiatives to meet locally defined energy needs. ○ Represent important sources of technical and other information. ○ Sometimes restricted by funding, inclination or expertise to a limited range of technical options (eg specific renewables). |
| 6. Laws | <ul style="list-style-type: none"> ○ Regulate the provision of energy services including public health and safety. ○ Regulate contract tender procedures for infrastructure construction ○ Determine the monopoly powers of the state and utilities in the supply of energy services. |
| 7. Gender relations | <ul style="list-style-type: none"> ○ Determine how energy assets and technologies are used. Women are the main users and suppliers of energy at the household level in poor communities. The poverty impact of energy related interventions will be largely determined by the end-use technologies adopted, and the gender impact will in turn will depend on the extent to which women are empowered to choose. |
| 8. Other Power Relations | <ul style="list-style-type: none"> ○ Village hierarchies, caste, belief systems play important roles in determining the “space” in which energy services can be improved (access to common property resources for fuel wood collection; access to credit; access to information; the ‘rights’ to set up retail outlets, etc) ○ Religious beliefs are particularly significant in determining cooking practices, and the use of certain types of fuel (pig waste, human waste etc) |

Table 4. Energy related Livelihood Strategies

“The livelihoods approach seeks to promote choice, opportunity and diversity. ...Livelihood strategies [is] the overarching term used to denote the range and combination of activities and choices that people make/undertake in order to achieve their livelihood goals (including productive activities, investment strategies, reproductive choices, etc.)”

Sustainable Livelihoods Guidance Sheets, Dfid, 2000

| | |
|---|---|
| 1. Gaining additional income by retailing energy services up the “energy ladder” | <ul style="list-style-type: none"> ○ Fuels (wood, charcoal, dung, crop residues, kerosene, LPG) ○ Conversion Technology (stoves, lamps, batteries,, motors, Photovoltaic systems) |
| 2. Gaining access to improved energy services at the household level by saving time, or fuel switching | <ul style="list-style-type: none"> ○ Improved biomass stoves ○ Improved lighting (from candles to kerosene to electricity initially from batteries) |
| 3. Gaining access to improved energy services, by increasing production efficiency | <ul style="list-style-type: none"> ○ Improved energy services result in increased productivity (eg through mechanisation) which results in a greater ability to pay for improved energy services. Opportunities range from the lowest technologies, and the smallest scales upwards (agro-processing, small and micro enterprises etc). |
| 4. Grouping with others to obtain access to improved energy services, for production, household consumption or for community services (health centres, schools, security lighting, information and communication technology). | <ul style="list-style-type: none"> ○ Community based activities enable labour to be converted into capital (eg through civil works) and capture the economies of scale associated with energy supply technologies such as connecting to the grid (transformers and distribution systems) and installing micro hydro generators, small diesel engines, or acquiring mechanised transport services etc, or “pooling demand” to provide political or commercial pressure to gain access to energy services. |

Table 5. Livelihood Outcomes

“Livelihood Outcomes are the achievements or outputs of Livelihood Strategies. Once again, the important idea associated with this component of the framework is that we, as outsiders, investigate, observe and listen, rather than jumping to quick conclusions or making hasty judgements about the exact nature of the outcomes that people pursue. In particular, we should not assume that people are entirely dedicated to maximising their income. Rather, we should recognise and seek to understand the richness of potential livelihood goals. This, in turn, will help us to understand people’s priorities, why they do what they do, and where the major constraints lie”.

Sustainable Livelihoods Guidance Sheets, Dfid, 2000.

| | |
|--|--|
| 1. More Income | <ul style="list-style-type: none"> ○ Income from the sale of energy services ○ Income from energy related productivity gains ○ Income from energy related expansion of supply options and quality (eg doing things that are impossible without in animate energy) ○ Income from extending the working day through improved lighting. ○ Improved income from better access to fuel based transport |
| 2. Increased well-being | <ul style="list-style-type: none"> ○ Improved household and street lighting ○ Reduction of indoor air pollution (improved fuels or improved stoves) ○ Reduced burden from fuel collection and processing ○ Reduced drudgery by replacing human animate energy with inanimate energy ○ Increased education as a result of better lighting in schools ○ Better health from health services that have access to improved lighting, cold chain storage, and communication ○ Improved access to information through radio, television and other Information Technology. ○ Sense of inclusion in the “modern” electrified world. |
| 3. Reduced Vulnerability | <ul style="list-style-type: none"> ○ More secure water supply from pumped irrigation ○ Better security lighting ○ More secure fuel supplies ○ Production based on a wider range of raw materials |
| 4. Improved Food Security | <ul style="list-style-type: none"> ○ Improved agricultural output from mechanisation, and pumped irrigation ○ Improved post harvest processing and storage ○ Improved fuel based transport |
| 5. More Sustainable Use of Natural Resources | <ul style="list-style-type: none"> ○ More efficient and / or sustainable use of biomass fuels, ○ Replacement of “mined” biomass with more convenient, ‘efficient’ fuels and / or renewable fuels |
| [6. Improving the position of women] | <ul style="list-style-type: none"> ○ Reduced indoor air pollution ○ Reduction of time consuming tasks (fuel and water collection, milling, grinding, food preparation, and other productive tasks). ○ Safer night time environment due to improved lighting ○ Access to the outside world through radio and other information and communication technology ○ Better light for reading and other night time tasks. ○ Less frequent pregnancy (reflecting the high correlation of electric light with reduction in birth rates) |

Annex 4

A4 Fieldwork Materials

Provincial Level

Collect key background documentation on poverty, gender, vulnerability and livelihood issues.

Collect key background documentation on energy issues.

Identify the key institutions involved in energy, poverty, and gender both within and outside Government and map out current, previous and future areas of interest and involvement.

Review and summarise locally available information on poverty, livelihoods and energy interventions and in particular pay attention to vulnerability context, disaster preparedness and social issues (access to services and governance issues).

Highlight lessons from investments to date, particularly within the energy sector.

Describe differentiation of communities in terms of socio-economic, ethnic and well being groups.

Describe livelihood patterns in terms of capital asset ownership, activities, seasonality etc.

Discuss gender relations in the household and community.

Describe patterns of migration, causes and consequences; the extent of out migration and remittances.

County/Township Level

Collect key background documentation on poverty, gender, vulnerability and livelihood issues.

Collect key background documentation on energy issues.

Identify the key institutions involved in energy, poverty, and gender both within and outside Government and map out current, previous and future areas of interest and involvement.

Review and summarise locally available information on poverty, livelihoods and energy interventions and in particular pay attention to vulnerability context, disaster preparedness and social issues (access to services and governance issues).

Highlight lessons from investments to date, particularly within the energy sector.

Describe differentiation of communities in terms of socio-economic, ethnic and well being groups.

Describe livelihood patterns in terms of capital asset ownership, activities, seasonality etc.

Discuss gender relations in the household and community.

Energy Price Survey

County, Township and Village Price Survey

At county, township and village levels (as appropriate):

1. Record prices of common standard quantities of fuels, batteries, light bulbs, etc.
2. Collect comparative prices for a few staple foods and basic household items.
3. Check on stated reasons for differences between prices at the various levels.
4. Record prices of electrical equipment commonly used at village level.

| Description | County | | Township | | Village | |
|--------------------|-------------------|-------|----------|-------|---------|-------|
| | unit ¹ | price | unit | price | unit | price |
| Candles | candle | | | | | |
| Firewood | | | | | | |
| Charcoal | | | | | | |
| Coal/briquettes | | | | | | |
| Kerosene | | | | | | |
| LPG | | | | | | |
| Diesel | | | | | | |
| Gasoline | | | | | | |
| Dry cell batteries | | | | | | |
| Car batteries | | | | | | |
| Light bulbs | | | | | | |
| Torch bulbs | | | | | | |
| Staples: | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Equipment: | | | | | | |
| TV | | | | | | |
| Radio | | | | | | |
| Cassette | | | | | | |
| Water heater | | | | | | |
| Miller/Grinder | | | | | | |
| Electric motor | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

1. If the unit is not a standard measure, i.e. 'bag', 'bottle', 'drum' estimate an approximate equivalent standard measure using your best judgement.

Village Energy Systems: report by CREIA consultant

Based on key informant interviews, provide a general description of each energy supply/use system (one page for each); e.g. straw, dung, wood, charcoal, coal, kerosene, petrol, diesel, electricity, etc.

Where does the fuel come from?

How is it obtained/purchased (prices, tariffs)?

Who is involved (e.g. women and children collecting wood)?

How is it used (converted) in stoves, machines etc?

What energy using devices use the fuel?

Where do they come from? (record prices of devices in energy price survey)

Discuss how “typical” the recent past has been and how typical the study villages are in the local context. Factors to consider would be the existence of “special projects” or other events, the rising or falling of the prices of the main outputs; rainfall (more or less than usual) and other aspects of climate.

Village Focus Group: Mapping

A sketch map of the study village should be prepared, working with local people. The map should show:

1. Geographical features: streams, roads, paths, trees, fields, etc.
2. Location of main areas of housing
3. Special buildings and structures: schools, health facilities, shops, meeting places, eating places.
4. For all special buildings on the map:
 - a. describe how they are lit and heated.
 - b. describe any energy using, storage or generating devices they contain, e.g. candles, lanterns, stoves, lights, batteries, fans communications, television, radios, telephones.
5. Community assets: production equipment, water/sanitation facilities, others.
6. Energy related community assets: generators, fuel storage locations, grid-systems, loud speaker systems, radio, television, street lighting, etc.
7. Communication links to the outside – telephone, two way radio.

Focus Group: Poverty

1. What are the main reasons for poverty in this village?
2. Which times of year are most difficult for poor households? – Why?
3. What can poor households do in difficult times?
Check: working for others in village, working in nearby villages, working elsewhere, remittances, sale of assets, credit from relatives/friends, credit from community groups, other sources of credit.
4. Do you know of particular people from this community who were poor but have improved their situation? How did they do this?
5. Has the quality of life in the village improved, worsened or stayed much the same over the last ten years? What have been the main reasons for any changes?
6. Have particular events affected the quality of life in the village over the last 10 years?
Check: New production activities, new community assets.
Crop failures, bad weather conditions, natural disasters.
7. What do you think the government should do to improve the situation of poor households?
8. What benefits do you think households obtain from connection to the electricity grid?
Check: How do different household members benefit (men, women, children)?
Check: Do you think it allows households to increase incomes? How?

Village Committee Activities

The information should be gathered by key informant interview with key officials of the village committee. Ensure that the village accountant and women's representative are interviewed.

1. Brief description of the village committee: objectives, officials, membership (number, men, women, who decides), procedures (meetings, announcements).
2. Describe the way in which decisions are reached, with particular reference to the involvement of (a) poor households and (b) women in households. In dealings between the village committee and individual households. who would be seen as representing the household?
3. Describe in detail any activities relating to:
 - a. production.
 - b. fuel or energy.
 - c. health or education services.
 - d. poverty alleviation.
 - e. gender issues.
 - f. provision of credit.
4. What are the main crops grown by farmers in this village? What prices did farmers receive for each type of crop this year? Which of these crops could farmers process if they had the right equipment? What extra income would they get from each crop if they did this?

Village Committee: Poverty Prevalence and Causes

1. Explore local understanding of how to distinguish between individuals who are 'doing well' and those who have problems (poverty, sickness, etc.) or who are 'vulnerable' to a greater or lesser extent.
2. Ask about the main reasons for households being poor. Agree a score (out of 10) to indicate the importance of each of the main reasons.
3. Discuss the main ways people in this community have moved out of poverty.
Rank the above in terms of the number of households who have benefited.
Ask if some people increased their income from production activities?
If so, how have they achieved this - increased output/different outputs?
What investments, if any, were required?
Ask for specific examples of households who have moved out of poverty.
4. Has the proportion of people living in poverty increased or decreased over the last ten years? Is there an easy way to demonstrate this?
5. What are the main reasons for the increase or decrease in poverty?
Examples of particular events which have affected poverty in the last 10 years.
Check: New production activities, new community assets.
Crop failures, bad weather conditions, natural disasters.

Women's Decision Making Focus Group

Participants: 6-8 women selected from the household survey.

Criteria for selection: likely to contribute

happy to take part

not domineering

range of ages, household income levels

The aim is to ask a group of women to talk about their lives as compared to those of men and to what extent they are free to make important decisions. This discussion should be lead towards a focus on the

The group should be facilitated by a woman, working with a woman note taker. If the participants do no mind the meeting should be tape recorded. Even if it is recorded the note taker should keep detailed notes indicating which person makes which statements.

Record: time, date and location of interview, name, age, marital status of each participant

Facilitator and note taker introduce themselves and the facilitator explains purpose of discussion and who will have access to the information, and asks if they mind the use of a tape recorder.

Each woman introduces herself. Then the facilitator invites them to talk about the following topics:

1. What do they think about the life of men and women in the village.

Prompts:

Do men or women have to work harder?

Do men or women have more difficult lives? What is most difficult for women?

Who makes important decisions in the household (about farm, money, children)?

Are there sometimes disagreements? What happens then?

2. Who makes decisions about daily household life? For example what to eat?

How do people cook their food in this village?

(If there are various ways suggested) How do you decide which to use?

What are the kitchens like? Would you like to change them? Why have you not?

Prompts: smoky? light enough?

Do you have a light of some kind in the kitchen?

How good is the lighting in the rest of the house?

Who decided where the lights are located in your house?

Do you think they are in the best place?

3. Do your households have any mechanical equipment for production or other uses?

Who decided to buy that equipment?

Is there equipment that you would like to buy? Why can you not?

Village Health Facilities

For each facility in the village:

How many rooms are used ?

How is each one heated?

How is each one lighted?

Any problems with lighting?

Any problems with heating?

What are the opening hours of the facility?

Is the fuel supply reliable?

How is equipment sterilisation carried out?

Is there a refrigerator?

How is the cold chain maintained?

Have there been problems with the cold chain?

Give details of any other energy using devices in the facility.

Do they have radio or TV? Are these useful in terms of health information?

How do they communicate with people outside the village:

1. If they need advice or help with patient care or other health issues?
2. If there is a health emergency?

What are the most important needs of the facility?

Has the quality of health care improved or declined over the last ten years?

What are the main causes for the changes?

Village Schools

For each school in the village

How many rooms are used?

How is each one heated?

How is each one lighted?

Any problems with lighting?

Any problems with heating?

What are the opening hours of the school?

Is the fuel supply reliable?

Give details of any other energy using devices in the facility.

Do they have radio, TV? How useful are they for educational purposes?

Do they have any means of transport?

What are the most important needs of the school?

Has the quality of education improved or declined over the last ten years?

What are the main causes for the changes?

Are children expected to do school work at home?

If so, for how many hours each day?

Micro-hydro scheme: village level

- 1 When was the system installed? □□
- 2 What was the main purpose? 1 lighting 2 production 3 other_____ □
- 3 What was the original total cost of the system? □□□□
- 4 Who paid this cost? _____ □
- 5 Did villages provide labour? 1 yes 2 no □

Try to locate original cost details from county/township officials

- 6 What type of hydro is installed? _____ □
- 7 What is the head? (metres) □□
- 8 Is there some form of dam and catchment pond? 1 yes 2 no □
- 9 Is water flow adequate at all times of the year 1 yes 2 no □
If no, please give details_____
- 10 During a typical day when are the greatest demands for electricity? □□

- 11 What are the main uses of electricity at these times? □□

- 12 What is the total capacity installed? □□□□
- 13 How many hours each day is it operated? □□
- 14 How many kWh were generated last year? □□□□
- 15 Is capacity: 1 less than needed 2 sufficient 3 capable of meeting higher demand? □
- 16 Who owns the system?_____ □
- 17 What is the procedure for a household to connect to the system? □

- 18 How much do people pay to connect to the system? □□□□
- 19 If a household cannot afford to connect are there are schemes to assist ? 1 yes 2 no □
if yes, please describe the scheme: _____

Ask for a list of households who are connected

Micro-hydro schemes: village level

- 20 Who collects fees in the village? 1 village committee 2 township 3 other
If other please specify _____
- 21 How many hours each month are spent collecting fees?
- 22 How do households pay for electricity? 1 capacity 2 by meter 3 fixed fee 4 other
if other please describe: _____

Please obtain full details of tariffs

- 23 Are charges adjusted each year to keep pace with inflation/incomes? 1 yes 2 no
- 24 How does the money collected compare with full costs: 1 less 2 equal 3 greater
- 25 What happens if people fail to pay for electricity? _____

- 26 How many people in the village maintain the system?
- 27 How many hours in total would they spend on the system each week?
- 28 How many times each year do outside technicians come to maintain the system?
- 29 Does the system live up to your expectations? 1 yes 2 no
If not, why not? _____

- 30 Does the village need grid connection to replace micro-hydro system? 1 yes 2 no
If yes, why? _____

Long term grid connection: village level

When was the present system installed?

| | |
|--|--|
| | |
| | |

Who paid for installation (check: transmission from main grid? transformer? metering equipment?, distribution within village?)

Maximum capacity of the transmission line (kVA)?

| | | | |
|--|--|--|--|
| | | | |
| | | | |

Do you know how many kWh were used by the village last year? 9999 no

Where are the meters? 1 transformer 2 user premises 3 other _____

| | |
|--|--|
| | |
| | |

How far away is the main grid from the village transformer? (kms)

Is capacity: 1 less than needed 2 sufficient 3 capable of meeting a higher demand?

| |
|--|
| |
|--|

What is the procedure for a household to connect to the system? _____

How much do people pay to connect to the system?

| | | | |
|--|--|--|--|
| | | | |
| | | | |

If a household cannot afford to connect are there are schemes to assist? 1 yes 2 no
if yes, please describe the scheme: _____

Ask for a list of households who are connected and the tariffs they pay

Who collects fees in the village? 1 village committee 2 township 3 other
if other please specify _____

How many hours each month are spent collecting fees?

| | |
|--|--|
| | |
|--|--|

How do households pay for electricity? 1 capacity 2 by meter 3 fixed fee 4 other
if other please describe: _____

Please obtain full details of tariffs

What happens if people fail to pay for electricity? _____

How many people in the village maintain the system?

How many hours in total would they spend on the system each week?

How many times each year do outside technicians come to maintain the system?

| | |
|--|--|
| | |
| | |
| | |

Does the system need improvement or does it meet your needs? _____

Ownership and cost of PV system: household level

| | |
|--|---|
| What is the size of the system (Watts)? | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| How long have you had the system (months)? | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| How much did you pay when your system was first installed (¥)? | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Was this the total cost of the system? 1 yes 2 no | <input type="checkbox"/> |
| If no, how many more payments do you have to make? | <input type="checkbox"/> <input type="checkbox"/> |
| Who do you make payments to? _____ | <input type="checkbox"/> |
| How often do you have to pay? (months) | <input type="checkbox"/> <input type="checkbox"/> |
| How much is each instalment? (¥) | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | |
| Has the system needed any repairs? 1 yes 2 no | <input type="checkbox"/> |
| If yes, how many times? | <input type="checkbox"/> <input type="checkbox"/> |
| If yes, how much did this cost? (¥) | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | |
| Have there been any other running costs? | <input type="checkbox"/> |
| If yes, what costs were involved? _____ | <input type="checkbox"/> |
| What was the total cost? (¥) | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| | |
| Are you satisfied with the reliability of the system? 1 yes 2 no | <input type="checkbox"/> |
| If no, please explain: _____ | |
| _____ | |
| | |
| Are you concerned about someone stealing the system? 1 yes 2 no | <input type="checkbox"/> |
| If no, please explain: _____ | |
| _____ | |
| | |
| How did you meet your lighting/battery needs before you got the PV system? | <input type="checkbox"/> |
| _____ | |
| _____ | |
| | |
| Do you do things with the PV system that you did not do before? | <input type="checkbox"/> |
| _____ | |
| _____ | |
| | |
| Does the system live up to your expectations? 1 yes 2 no | <input type="checkbox"/> |
| If not, why not? _____ | |
| _____ | |

HOUSEHOLD MATERIALS

Section 1: Household composition and member characteristics Household: _____

1.1 Please complete the following table for all those currently living in household:

| No. | Name | Sex 1 M 2 F | Age in years | Relation to head 1 Head 2 Spouse 3 Son 4 Son-in-law 5 Daughter 6 Daughter-in-law 7 Grandchild 8 Parent 9 Parent-in-law 10 Other | How many years of schooling completed? 0 no schooling | For those of school age: 7-14 Attending school? 1 Yes 2 No | Marital status (where applicable) 1 Single 2 Married 3 Divorced 4 Widowed | For those over 15 Main occupation: 1 Farmer 2 Enterprise worker 3 Other (specify) 4 Student 5 Retired 6 No occupation |
|-----|------|-------------------|--------------------|---|---|--|---|--|
| 01 | | | | | | | | |
| 02 | | | | | | | | |
| 03 | | | | | | | | |
| 04 | | | | | | | | |
| 05 | | | | | | | | |
| 06 | | | | | | | | |
| 07 | | | | | | | | |
| 08 | | | | | | | | |
| 09 | | | | | | | | |
| 10 | | | | | | | | |

Comments:

1.2 Please complete the following table for all those currently living away from home: Household: _____

| No. | Name | Sex 1 M 2 F | Age in years | Relation to head 1 Head 2 Spouse 3 Son 4 Son-in-law 5 Daughter 6 Daughter-in-law 7 Grandchild 8 Parent 9 Parent-in-law 10 Other | How many years of schooling completed? 0 no schooling | For those of school age: 7-14 | Marital status (where applicable) 1 Single 2 Married 3 Divorced 4 Widowed | For those over 15 | How long living away from home? (months) (round up) | Where living: 1 Nearby village 2 In township 3 In county 4 Another county 5 City in Province 6 Another Province |
|-----|------|-------------------|--------------------|---|---|---------------------------------------|---|---|--|---|
| | | | | | | Attending school? 1 Yes 2 No | | Main occupation: 1 Farmer 2 Enterprise worker 3 Other (specify) 4 Student 5 Retired 6 No occupation | | |
| 01 | | | | | | | | | | |
| 02 | | | | | | | | | | |
| 03 | | | | | | | | | | |
| 04 | | | | | | | | | | |
| 05 | | | | | | | | | | |
| 06 | | | | | | | | | | |
| 07 | | | | | | | | | | |
| 08 | | | | | | | | | | |
| 09 | | | | | | | | | | |
| 10 | | | | | | | | | | |

Comments:

Section 2: Wealth status Household: _____

2.0 Respondent for this section 1 head 2 spouse 3 both 4 other _____

2.1 Make a simple plan of the house. Label the various rooms. Indicate doors and windows.

2.2 Of what materials is the house constructed (Please circle number)?

| Roof | Walls | Floor |
|--------------------|--------------------------|----------------|
| 1. Thatched | 1. Thatched | 1. Earth |
| 2. Mud and poles | 2. Mud | 2. Cement |
| 3. Iron sheets | 3. Unburnt bricks | 3. Tiles |
| 4. Asbestos sheets | 4. Burnt bricks | 4. Bricks |
| 5. Cement | 5. Burnt bricks & cement | 5. Stones |
| 6. Tiles | 6. Timber | 6. Wood |
| 7. Other _____ | 7. Cement blocks | 7. Other _____ |
| | 8. Stones | |
| | 9. Other _____ | |

2.3 Where do you get drinking water? 1 tap 2 hand pump 3 well 4 rainwater 5 other
If other please specify _____

How long does it take to walk to your source of drinking water (minutes)?
Is the water safe to drink or do you have to boil it? 1 safe to drink 2 have to boil

2.4 I would like to ask your opinion of your household's standard of living

| | |
|-------------------------|--|
| How would you describe: | 1. Less than adequate for family's needs 2. Just adequate for family's needs 3. More than adequate for family's needs 4. Not applicable "Adequate" means what the respondent considers to be the minimum consumption needs of the family |
| Your family's food? | <input type="checkbox"/> |
| Your family's housing? | <input type="checkbox"/> |
| Your family's clothing? | <input type="checkbox"/> |

2.5 Are there times of the year when your household is short of food? 1 Yes 2 No
If yes, which months? _____

2.6 Do you have problems paying health costs for household members? 1 Yes 2 No

2.7 **If they have children:** do you have problems paying education costs? 1 Yes 2 No

2.8 Do you have problems paying taxes? 1 Yes 2 No

Comments:

Section 2: Wealth status Household: _____

2.9 How many of the following assets/goods do members of the household own/have title to?

| Asset | Number | Comments |
|---------------------|--------|----------|
| Land (mu) | | |
| Irrigated land (mu) | | |
| Animals | | |
| Sheep | | |
| Goats | | |
| Donkeys | | |
| Cattle | | |
| Pigs | | |
| Poultry | | |
| Other _____ | | |
| Other _____ | | |
| Vehicles | | |
| Bicycles | | |
| Motor Cycles | | |
| Cars/Trucks | | |
| Productive assets | | |
| Small farm tools | | |
| Tractor | | |
| Production machines | | |
| Sewing machines | | |
| Solar cooker | | |
| Electrical goods | | |
| Torch | | |
| Radio | | |
| Tape Cassettes | | |
| TV | | |
| Telephone | | |
| Other _____ | | |

Comments:

Section 2: Wealth status Household: _____

2.10 Have you purchased any major items this year? 1 Yes 2 No

If yes: please specify _____

How much did they cost in total? (¥)

2.11 Does the household own powered production or transport equipment? 1 yes 2 no

2.12 If yes: please complete table:

| Type of powered production or transport equipment | Currently in working order? 1 yes 2 no | Fuel or energy source used | Do other households ever use? 1 yes 2 no | Charge for use? (amount paid per unit of quantity/time) |
|---|--|----------------------------|--|--|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Comments:

Section 3: Income generating activities Household:_____

3.0 Respondent for this section 1 head 2 spouse 3 both 4 other_____

3.1 What income do you get from crops?

| Crop | Total Output | Output sold | Approximate income last year (¥) |
|------|--------------|-------------|----------------------------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Comments:

Section 4: Other Household Activities Household: _____

4.0 Respondent for this section 1 head 2 spouse 3 both 4 other _____

4.1 What other common household activities do members engage in?

| Activity | How many hours spent per week: Summer? | | | | | How many hours spent per week: Winter? | | | | |
|-----------------|--|--------|---------------|-----------------|--------|--|--------|---------------|-----------------|--------|
| | Head | Spouse | Male children | Female Children | Others | Head | Spouse | Male children | Female Children | Others |
| Cooking | | | | | | | | | | |
| Fuel gathering | | | | | | | | | | |
| Fetching water | | | | | | | | | | |
| Washing clothes | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

Comments:

Section 5: Vulnerability and Credit Household:_____

5.0 Respondent for this section 1 head 2 spouse 3 both 4 other _____

5.1 Did your household borrow any money over the last year? 1 Yes 2 No

If yes:

What was the source? 1 relatives/friends 2 bank 3 other

If other, please specify_____

Who arranged to borrow the money?_____

How much did you borrow (¥)?

What was the purpose?_____

Have you repaid the loan? 1 Yes 2 No

5.2 Do you have other loans you have not yet repaid? 1 Yes 2 No

If yes: roughly how much money do you owe in total (¥)?

5.3 In difficult times do you have family, friends or others who would help? 1 yes 2 no

If yes, please identify who would help_____

5.4 Develop a 'time line' with the respondent, identifying 'difficult financial times' for the household over the previous five years. For example marriage, deaths, sickness, crop failures, floods. Describe the problem and how the household coped (may include reduced spending).

| Year | Problems | Coping Strategy |
|------|----------|-----------------|
| 2000 | | |
| 1999 | | |
| 1998 | | |
| 1997 | | |
| 1996 | | |

Comments:

Section 6: Sources, uses and costs of energy services Household: _____

6.0 Respondent for this section 1 head 2 spouse 3 both 4 other _____

6.1 Please rank the most important sources of energy in this household for:

| | Lighting | Heating | Cooking | Production | Transport | Water/ Irrigation | Radio/TV/ Cassette | Other _____ | Other _____ |
|---------------------------|----------|---------|---------|------------|-----------|----------------------|-----------------------|----------------|----------------|
| Human | | | | | | | | - | - |
| Animal | | | | | | | | | |
| Butter/Vegetable oils | | | | | | | | | |
| Candles | | | | | | | | | |
| Crop residues(stalks) | | | | | | | | | |
| Dried animal dung | | | | | | | | | |
| Bio-gas | | | | | | | | | |
| Firewood | | | | | | | | | |
| Charcoal | | | | | | | | | |
| Coal and coal briquette | | | | | | | | | |
| Kerosene | | | | | | | | | |
| LPG | | | | | | | | | |
| Diesel | | | | | | | | | |
| Gasoline | | | | | | | | | |
| Dry cell battery | | | | | | | | | |
| Car battery | | | | | | | | | |
| Solar Cooker | | | | | | | | | |
| Household Solar PV system | | | | | | | | | |
| Household wind generator | | | | | | | | | |
| Diesel generator | | | | | | | | | |
| Gasoline generator | | | | | | | | | |
| Grid Electricity | | | | | | | | | |
| Other: _____ | | | | | | | | | |
| Other: _____ | | | | | | | | | |

Comments:

Section 6: Sources, uses and costs of energy services Household: _____

6.2 Ask about purchases of candles, fuels, batteries, etc. to complete the following table:

| Description | Purchase Unit (As stated) | Equivalent Unit ¹ | Number of units usually purchased | Cost of purchase | How long between purchases (months)? | |
|--------------------|------------------------------|------------------------------|---|---------------------|---|--------|
| | | | | | Winter | Summer |
| Candles | candle | candle | | | | |
| Firewood | | | | | | |
| Charcoal | | | | | | |
| Coal/briquettes | | | | | | |
| Kerosene | | | | | | |
| LPG | | | | | | |
| Diesel | | | | | | |
| Gasoline | | | | | | |
| Dry cell batteries | battery | battery | | | | |
| Car batteries | car battery | car | | | | |
| Light bulbs | bulb | bulb | | | | |
| Torch bulbs | bulb | bulb | | | | |
| Other: _____ | | | | | | |
| Other: _____ | | | | | | |

1. If the unit is not a standard measure, i.e. 'bag', 'bottle', 'drum' estimate an approximate equivalent standard measure using your best judgement.

Comments:

Section 7: Household fuel use Household: _____

7.0 Respondent for this section 1 head 2 spouse 3 both 4 other _____

Where a woman undertakes most household activities, she should be main respondent

7.1 Is the lighting in your house adequate for your needs? 1 yes 2 no
If no, describe unmet needs: _____

7.2 Do you have any other problems with the way you light your house? 1 yes 2 no
(prompts: problems in getting fuel, candles, etc.; smoke; smell)
If yes, describe problems: _____

7.3 Is the heating in your house adequate? 1 yes 2 no
If no, describe limitations: _____

7.4 Do you have any other problems with the heating in your house? 1 yes 2 no
(prompts: problems in getting fuel; time required; smoke; smell)
If yes, describe problems: _____

7.5 Are the cooking arrangements in your house adequate for your needs? 1 yes 2 no
If no, describe limitations: _____

7.6 Do you have any other problems with the cooking fuels you use? 1 yes 2 no
(prompts: problems in getting fuel; time required; smoke; smell)
If yes, describe problems: _____

Comments:

Section 7: Household fuel use Household: _____

7.7 Describe the cooking arrangements in the household:

a) type of stove:

b) fuels used:

c) space:

d) ventilation:

7.8 Over the last four weeks has any household member suffered from one or more of the following symptoms?:

| Symptom | Head | Spouse | Male child | Female child |
|------------------------------------|------|--------|------------|--------------|
| Diarrhoea | | | | |
| Coughing | | | | |
| Other chest or throat problem? | | | | |
| Skin problems | | | | |
| Eye infection | | | | |
| Back or joint pain | | | | |
| Fatigue | | | | |
| Burns | | | | |
| Any other health problem (specify) | | | | |

Comments:

Section 8: Access to production or communications equipment Household: _____

8.0 Respondent for this section 1 head 2 spouse 3 both 4 other _____

8.1 Is there any powered production equipment in the village or nearby that the household can sometimes use? 1 yes 2 no

If yes: please complete table:

| Type of powered equipment | Currently in working order? 1 yes 2 no | Fuel or energy source used? | Who owns? 1 village 2 relative 3 other Household 4 other (please specify) | Cost of using? specify amount paid per unit of quantity/time | When did you last use? (year) 0 never used |
|---------------------------|--|-----------------------------|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

8.3 Is there a radio, television or telephone in the village or nearby that they can sometimes use? 1 yes 2 no

If yes, please complete table

| Type of communications asset | Currently in working order? 1 yes 2 no | Electricity source? 1 battery 2 grid 3 small generator 4 PV system 5 other | Who owns? 1 village 2 relative 3 other Household 4 other (please specify) | Cost of using? Specify amount paid per unit of time | When did you last use? (year) 0 never used |
|------------------------------|--|---|---|--|---|
| Radio | | | | | |
| Television | | | | | |
| Telephone | | | | | |

Comments

Households that have access to electricity

Section 9: Attitudes to electricity Household: _____

9.0 Respondent for this section 1 head 2 spouse 3 both 4 other _____

9.1 What are the main uses of electricity in the household?

9.2 What electrical devices do you have?

9.3 Which household members make use of electricity and for what purposes?

9.5 What are the running costs? (payment for electricity, bulbs, repairs, etc.)

9.6 How many hours each day is supply available?

9.7 Is the system reliable?

9.8 What are the main benefits that have resulted from access to electricity?

9.9 Are there income generating activities that your household could not do without electricity? (powered machines, ability to work in evening).

Households that do not have access to electricity

Section 9: Attitudes to electricity Household: _____

9.0 Respondent for this section 1 head 2 spouse 3 both 4 other _____

9.1 If you had electricity, what would be the main benefits for your household?

9.2 Which members of the household would benefit and how?

9.3 Would there be ways in which you might be able to increase your income if you had electricity?

9.4 Do you know people who have benefited from having electricity? (Please give examples?)

9.5 How did they benefit?

9.6 Did electricity allow them to increase their income? How?