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Economic Growth and Poverty Reduction through Geothermal Development: Integrated Policy Measures to Rural Development & Economic Sustainability

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ABSTRACT

Community-based Geothermal Resources Development for Poverty Reduction: Most geothermal sites in the developing countries are located in rural areas where the population generally lives below the national poverty level. The challenges facing economic development efforts in these remote areas for poverty reduction are varied and complex and include: (a) lack of employment-generating programs; (b) lack of electric power supply to sustain economic development; (c) limited livelihood opportunities; (d) limited human capital investment and development; (e) lack of empowerment; (f) lack of financial services for the poor; and (g) piecemeal approach to poverty reduction and limited over-arching anti-poverty programs. The community-based geothermal energy projects will help to (i) meet local electricity demand in an environmentally and socially sustainable manner; (ii) improve access of rural areas to modern electricity services, (iii) support rural development and economic activities in remote areas while yielding positive environmental and social impacts, (iv) reduce pressure on forestry resources which are used to meet household heating and cooking needs, (v) reduce greenhouse gas emissions that would otherwise be produced from diesel-based generator use, and (vi) reduce poverty and improve standards of living for the poor through provision of community-level infrastructure.

Policies for Private Sector Funding Sustainability: The investment requirement for geothermal development is huge. However, because of limited resources, and the competing demand of other sectors of the economy, most governments of the developing countries cannot allocate such a large capital outlay from their budgetary appropriation, and thus, will have to seek private sector investment. To attract such large private sector investments for geothermal development and power generation, the governments must ensure investors confidence by setting a competitive tariff structure to yield a reasonable return on investment; establish a transparent legal and regulatory regime with adequate enforcement mechanisms; ensure transparent bidding and tendering procedures for new projects which must be perceived as fair by all concerned parties; and a fair and favorable taxation regime. Thus, a policy framework for the development of geothermal resources specifically for those located in remote areas should be formulated by the governments. What is also needed is a development framework, acceptable to all, to manage and to develop the untapped geothermal resources for a least-cost generation expansion plan. If all aspects are designed appropriately and implemented well within responsibly-managed fiscal space, addressing environmental and social issues, benefit sharing, using state-of-the art analytical tools, strengthening institutions and capacity building, and the consultation process fully integrated into the decision making norms, the geothermal resources will be a major source of growth and prosperity for these countries.

1. INTRODUCTION

1.1 Rural Poverty

About 70% of the world population lives in rural areas and about half are classified as poor people. These also include the poorest of the poor, often indigenous people or vulnerable groups with little or no economic opportunities, and rely mainly on traditional forest wood for cooking and heating, and some kerosene for home lightning. The majority of rural poor live in marginal dry land, wetland, mountainous areas, and their numbers are likely to increase with global warming. Environmental threats disproportionately affect the poor and climate change is making the situation worse. Air and water pollution, desertification, land degradation, loss of biodiversity, and exposure to hazardous materials affect the poor more than others, leaving them vulnerable to natural and man-made disasters. Poverty forces rural poor to migrate to large cities where they create sprawling slums and social problems; it drives illegal trans-border/trans-continent migration; promotes bonded labor which remains enforced for decades if not centuries, and a root cause of human trafficking, prostitution, and HIV spread.

The governments of the developing countries face huge challenges: the unemployment rate is persistently very high; there is severe poverty in rural areas and on the urban margins; and access to the basic human needs of food, health, education, electricity, water, sewage, and transport are still very limited. For these poor people, initiation of special development program with focus on job creation in targeted remote areas, for indigenous and mountainous people, and forest communities is urgently needed. Provision of modern form of commercial electricity supply in these areas will be critical for the effectiveness and success of the program. The economic activities in the program may include, among others, the high mountain agribusiness and livelihood improvement program for employment opportunities, new forms of social protection, and managed migration to urban areas. Sustainable energy is thus a key enabler of sustainable development for all countries and all people and for poverty reduction.

1.2 Poverty Reduction: Promoting Inclusive Pro-poor Growth

To achieve the vision of a world free of poverty, the global community must support pro-poor growth in the developing countries that is inclusive, environmentally sustainable, and draws on the region's increasing levels of cooperation and integration. Pro-poor

economic growth can effectively reduce poverty, provided it is accompanied by a comprehensive program for social development. Human capital is the primary asset of the poor, however, their lack of access to education, health services, and social protection blocks social development opportunities and the improvement in the quality of life.

1.3 Poverty Reduction Strategy

The poverty reduction strategy must also emphasize increased harmonization and alignment of poverty reduction programs among donors and regional member countries, as well as the fostering of partnerships for poverty reduction. It should also put increased emphasis on managing for development results, as well as capacity development. The strategy should have three pronged approach: provision of energy for pro-poor sustainable economic growth; inclusive social development; and good governance, which should also include the cross-cutting priorities of environmental sustainability, gender equity, private sector development, and regional cooperation.

1.4 Private Sector Support for the Poor

A dynamic private sector, often driven by small and middle income households, is the prime promoter of pro-poor growth, but about 90% of the these households lack access to institutional finance. Financial services for the poor help improve productivity and living standards of the poor. Microfinance is an effective development tool for promoting pro-poor growth and poverty reduction. Financial services enable poor and low income households to take advantage of economic opportunities, build assets, and reduce their vulnerability to external shocks that adversely affect their living standards. The governments as a policy should support the commercial and rural banks, cooperatives and semi-formal institutions, including non-government organizations, to ensure permanent access to institutional financial services for the poor people and their micro and small businesses.

2. ENERGY SECTOR IN DEVELOPING COUNTRIES- ISSUES, CONSTRAINTS, AND CHALLENGES

Sustainable energy supply is a prerequisite for sustainable development. No country has developed and will develop without access to reliable and affordable energy. Energy directly impacts on people, communities and countries in terms of economic growth, health, education, security, food and poverty.

Inadequate power supply has emerged as one of the most serious infrastructure constraints on sustainable economic growth in developing countries. The lack of energy services directly correlates with key elements of poverty, including low education levels, and restriction of economic opportunity to subsistence activity. Access to energy services is a key component of alleviating poverty and stimulating economic growth. According to the International Energy Association, access to energy is an "indispensable element of sustainable human development. Without access to modern, commercial energy, poor countries can be trapped in a vicious circle of poverty, social instability and underdevelopment." Modern energy, especially electricity, allows the introduction of relatively low cost capital goods and value added processing, both of which can improve labor productivity and living standards. At the same time, activities to address energy poverty must realize and internalize the negative consequences on sustainable development of perpetuating low-cost conventional energy systems without accounting for their long-term impacts.

Despite improvement in the electric power sector of the developing countries over the past few decades, the electrification rate still remains low. The majority of the population is not connected to electric power networks. The electricity cost remains high as imported fossil fuel is the major source of power generation in these countries. The developing countries face considerable challenges in fulfilling their responsibilities in providing electricity for economic growth, reduction in poverty incidence, and a reasonable improvement in the quality of life for their people, particularly extending commercial energy to about 70 % of the people who presently rely on traditional forest wood for cooking and heating, and kerosene for lightening purposes, and ensuring environmental sustainability.

The challenges in the energy sector are enormous; possibly the most pressing are the higher prices of petroleum products in the international market which has resulted in substantial increase in the cost of importation, and the distortion in the energy pricing structure in the developing world, requiring unsustainable energy subsidy and the resultant macroeconomic imbalances. The energy subsidies in the developing countries have resulted in inefficient energy utilization and wastage in consumption by all categories of consumers, provided disincentive for instituting energy conservation and efficiency improvement programs in the industrial sector, and the root cause for the lack of public desire to save energy particularly in household and the transportation sector. The government subsidies in the energy sector, have stymied investment in the development of the alternative energy resources. There is general consensus, even in developing countries, that the current level of subsidy is unsustainable and that the energy subsidies must be reduced. Reducing energy sector subsidy will make funds available to the governments for undertaking the energy sector development and other social sector programs that will help the governments to expand the poverty reduction program for improving the quality of life of the people. What is needed is a support, hopefully, from political parties, all stakeholders, NGOs, and the civil society so that the governments of the developing countries could institute urgently the much needed action for subsidy reduction.

Meeting the growing demand for sustainable energy supply in the developing world will require (i) stable national policy framework which inter alia foster investment, promotes sustainable consumption and production patterns; (ii) the promotion of energy efficiency and demand side management; (iii) the removal of barriers to efficient production which addresses affordability – because if not considered it will result in less energy requirement; security – because it reduces dependence on imports; and sustainability – because it reduces emissions; (iv) the promotion of a diverse mix of fuels and technologies, which supports the transition to a lower carbon economy; (v) providing an appropriate enabling environment for the development and expansion of renewable energy in the national energy mixes; (vi) promotion of technology transfer to support sustainable energy goals; and (vii) introduction of and implementation of appropriate legal and regulatory regime with transparent enforceable measures for expanded private sector investment in energy development.

Regardless of the level of development, a country risks being destabilized when appropriate energy sector policy is not in place, when effective measures of long term planning and management are absent, and the sector is not well-regulated. Energy crises can be very costly: It can paralyze the economic development, lead to massive job losses, bring large scale political unrest in the country resulting in deaths, and bring financial and human suffering to millions of households. To prevent energy crises, and to protect the gains in poverty reduction, developing countries must learn from past crises, not necessarily their own, and continue their efforts to strengthen institutional structure and organizational set up with capacity building program. Putting a country's own energy sector in order is extremely important, but the possible effects of cross-border contagion mean there needs to be cross-border dialogue as well.

The prevailing situation in the developing countries needs to be rectified by instituting policy framework that are the pillars of electricity power development and energy efficiency and conservation programs, such as the market based tariff structure; measures to stimulate market mechanisms; appropriate legal and regulatory framework with enforcement mechanism; strong institutional and organizational structures-reflecting their national culture and characteristics, with capacity building program to ensure sustainability; and the promotion of behavioral changes at all levels of government and civil society. These policy instruments, it is envisaged, will help attract international private investment to find its destination to the developing countries.

The future strategic direction for a sustainable energy path in the developing countries, policy tools and financing mechanisms of maintaining economic growth, mitigating climate change, and improving energy security would require a paradigm shift to a new low-carbon development model. The developing world needs to transform the energy sector toward much higher energy efficiency and more widespread deployment of low-carbon technologies. In addition, the governments will need energy-pricing reforms that no longer encourage the use of fossil fuels, put in place regulations and incentives that improve energy efficiency and support low-carbon technologies..

The integration into the regional electricity market is desirable and should be accorded a policy priority. To achieve this objective, radical but achievable reforms, institutional strengthening and restructuring suitable to local culture, and measures for its operational improvements for efficiency gains, are needed to transform utilities into an entity that will meet not only the present day challenges but be equipped to cope with the changing environment, technical advances, and the funding sustainability during the next few decades.

Thus, the economic growth, poverty reduction, and political stability in the developing world will be sustainable only on effective management of energy sector. To ensure long-term sustainable development, the country needs to develop its energy sector in a socially and environmentally sustainable way as a major source of economic growth and to generate revenues to implement the poverty reduction initiatives.

3. OPTIMIZATION OF FUEL MIX TO REDUCE GHG EMISSIONS AND DEPENDENCE ON IMPORTED FUEL

The current energy path, which focuses on expanding fossil fuel burning, is neither environmentally nor economically sustainable. There is an urgent need to incorporate in the energy sector policy a framework to expand the energy infrastructure that is based on fuel that is free and self-renewing: the sun, the wind, geothermal, biomass, hydro, and others, and gradually reduce the energy infrastructure that depends on fuel that continuously rises in price, is dirty, dangerous, causes global warming, and destroys the habitat of this planet.

The heavy reliance on imported fossil fuels in the energy mix exposes many developing countries to volatile and rising oil prices, limits economic development, and also raises major environmental concerns at the national, regional, and global levels. The burning of fossil fuels emits greenhouse gases (GHG) that cause climate change and impose substantial environmental and economic costs. The phenomenon of global warming driven by fossil fuel consumption worldwide places fragile environment in developing countries, particularly the small countries, at the frontline of vulnerability to the adverse impacts of climate change on water supply, agriculture output, natural disasters, and especially the sea level. The coasts and low lying areas of cities, the habitat of mainly the poor people, will be threatened by rising sea levels, and many ecosystems, plants and animal species will be in serious danger of extinction. As a result many millions of poor people will be at risk from extreme events such as heat waves, drought, floods, and storms. It is therefore considered essential that the country must reduce emissions of greenhouse gases, ease growth in fossil fuel energy demand, curb the upward pressure on energy prices, and improve energy security.

4. THE NEED FOR RENEWABLE ENERGY DEVELOPMENT

The most serious infrastructure constraint on sustainable economic growth in the developing world is the inadequate power supply. The energy plan which focuses on expanding fossil fuel burning is neither environmentally nor economically sustainable. It is now recognized by all, the governments, and the civil societies that additional investments in traditional commercial power supply sources alone will not be sufficient to bridge the demand-supply gap. Due to the high cost of grid extension and the lack of alternative resources, onsite renewable energy development projects have been shown to be the most cost-effective power source for remote areas of the countries. Power generated from renewable energy sources is economically attractive when compared with power generated from commercial energy sources if the economic costs of inputs and the environmental costs of fossil-based generation they displace are considered. The competitiveness of RES vis-à-vis commercial energy sources rises further when the electricity tariffs are aligned with long-run marginal costs. Thus, power systems based on renewable energy sources (RES) such as solar, wind, geothermal, hydro, biomass, etc, and improvements in the energy efficiency and conservation programs in the existing facilities are considered promising solutions for alleviating some of the power shortages in the country and also in reducing GHG emissions.

4.1 Policy Framework for Renewable Energy Development

A Policy Framework for the development of renewable energy specifically for remote areas should be formulated by the governments which should provide the government's policy statement on renewable energy development, as well as defining the strategy to be followed in the medium to longer terms. The policy should place increased emphasis on the design, demonstration,

and pilot testing of dispersed off-grid, community-embedded, and standalone renewable energy systems, including their financing and marketing modalities and integration with other social and physical infrastructure development (e.g., poverty alleviation, rural electrification). The framework should list all potential RES projects, outlining priorities and sequencing, along with funding requirements which should be based on completed studies and prototype evaluations with specific RES and market targets and funding arrangements.

Thus, a strategy acceptable to country's stakeholders is needed to develop the renewable resources for a least-cost generation expansion plan for the power sector. If these aspects are designed appropriately and implemented well within responsibly- managed fiscal space, addressing environmental and social issues, benefit sharing, using state-of-the art analytical tools, strengthening institutions and capacity building, and the consultation process fully integrated into the decision making norms, the developing countries large renewable energy sources (RES) will continue to be a major source of growth and prosperity.

New financing modalities will be needed to fundamentally change the way projects in the past were planned, funded, and implemented. Financing will need a blend of multiple sources with private sector as the leading financier. The possible involvement of the multilateral institutions in the project will also bring standards of transparency, and accountability, and will provide increased level of comfort to private investors. Their due diligence process would add value to the development of complex geothermal resources and would help the governments manage project risks, safeguards, and stakeholders expectations including civil society.

The reform program and the investment decisions that will be taken by the developing countries will be critical in determining the security of energy supplies, lay the foundation for sustainable development, poverty reduction, and the improvement in the quality life. It is for this reason the governments must work closely in creating an enabling environment for the private sector to undertake development of renewable energy sources (RES), and to invest in demand side management; energy efficiency improvement; and conservation programs. To meet the large investment needs for these activities, the governments should also seek assistance from the Multilateral Development Banks, other development partners, and the international financial institutions, to extend not only the needed investment funds but also provide new and bold innovative financing instruments, unlike the old traditional lending modalities, that would enhance the provision of private capital, goods and service.

5. GEOTHERMAL DEVELOPMENT– A RENEWABLE ENERGY RESOURCE- FOR POVERTY REDUCTION IN REMOTE AREA

The developing countries have considerable potential for developing a broad range of renewable energy resources (RES), principally solar, wind, geothermal, biomass, mini hydro. Renewable energy resources can contribute to energy supply and security while helping change the mix. Geothermal and other RES can support rural development and economic activity in remote areas while yielding positive environmental and social impacts. A systematic assessment of economically viable resources should be undertaken for specific renewable energy technology applications such as geothermal, biomass, micro-and mini- hydropower and solar power. By improving access for the rural poor to modern forms of energy, in particular electricity, geothermal and other form of RE can play an important role in creating new economic activities in the rural areas of the country and in reducing poverty. Development of geothermal, biomass, and bio fuels – a renewable energy source in which most developing countries have substantial potential – would offer an important contribution to resolve power shortage issues, create a wider market base for RES among both industrial and residential energy users, and reduce GHG emissions.

5.1 Issues, Constraints, and Challenges Relating to Geothermal Renewable Energy Development in Developing Countries

Although the potential supply of non-conventional energy in most developing countries is significant, the pace and magnitude of its development has been slow. The lack of access for RES users and developers to appropriate tariff structures and financing mechanisms has been a constraint to RES adoption. RES options also tend to be relatively dispersed in nature and highly dependent on localized conditions. These features require innovative promotion, delivery, and financing mechanisms to render RES feasible and affordable to target end-users. The present practice of subsidized energy prices (e.g., kerosene and electricity), especially to the rural and agriculture sectors where RES options are most often targeted, makes it difficult for RES technologies to compete on price with conventional options. The lack of a commercial market base has prevented a faster build up of the necessary infrastructure support and has inhibited opportunities for expanding the production of these systems. Past barriers to the import of new technologies have also resulted in a delay in the adaptation of new and cost-effective developments in many advanced RES options.

One of the critical constraints delaying implementation of renewable energy projects in the developing world is the lack of financing in the amount and terms required owing to the lack of a long-term debt market. Financing from multilateral institutions or international lenders carries the burden of repayment in foreign currency, as very few renewable energy development projects have income in foreign exchange and hence are unable to repay in foreign exchange. Thus, the onus of managing the foreign exchange risk, which is subject to interest and exchange rate fluctuations, has to be borne by the small entrepreneurs engaged in renewable energy development. The developing countries may need to promote schemes to facilitate foreign exchange risk management for small entrepreneurs engaged in renewable energy development projects under financing from multilateral and international lenders.

Other barriers to the financing of renewable energy development are: (i) renewable energy projects have very high front-end capital cost per kW installed and negligible variable costs (operation and maintenance). This calls for debt with much longer maturity than is usually available in the commercial market; (ii) unlike in the case of conventional energy projects, they have very high project development costs compared to the actual project cost itself which leads to high level of transaction costs for financing (such as due diligence reviews, environmental and social studies etc.); (iii) it is difficult to guarantee cash flows for renewable energy projects, since they cannot operate in the absence of adequate water flows, steam, wind, or sun light or adequate backing of diesel generation sets or batteries; (iv) renewable projects' asset values are perceived to be "suspect" by the financing agencies since they have limited marketability compared to the assets of conventional power projects; and (v) many renewable energy technologies remain expensive, on account of higher capital costs, compared to conventional energy supplies for bulk energy supply to urban areas or major industries.

6. PRIVATE SECTOR PARTICIPATION FOR GEOTHERMAL DEVELOPMENT

Geothermal resources generally are located in remote, isolated, and difficult terrain. The costs of geothermal resources development and power generation are country and site specific, and on the average about $3.0 million to $5.0 million per MW[1]. Thus, a developing country rich in geothermal resource will need a large capital investment for geothermal electricity generation. However, It is evident that the governments of the developing countries cannot allocate such a large capital outlay from their budgetary appropriation, and thus, will have to seek private sector investment.

6.1 Issues, Constraints, and Challenges Relating to Geothermal Renewable Energy Development in Developing Countries

A development framework, acceptable to all, is needed to manage and to develop the untapped geothermal resources for a least-cost generation expansion plan for the power sector so as to meet the country's growing power deficit. If all aspects are designed appropriately and implemented well within responsibly-managed fiscal space, addressing environmental and social issues, benefit sharing, using state-of-the art analytical tools, strengthening institutions and capacity building, and the consultation process fully integrated into the decision making norms, the geothermal resources will be a major source of growth and prosperity in the country.

The framework should include an assessment of the adequacy of the institutional structure; identify gaps, if any, in terms of roles, responsibility, and authority. The capacity building program will assist the governments in implementing the institutional structure best suited for the country. The program will formulate and implement the short-, medium-, and long-term capacity-building in the geothermal sector. The program will also enhance and strengthen the provincial capacities, municipal, and local governments.

6.2 Financing Options

There could be three possible financing options for the governments to undertake systematic geothermal resource development and power generation.

6.2.1 Option1: Government to Undertake all Upstream Development Activities

Under option 1, the government undertakes all upstream activities for geothermal development such as detailed survey, exploration drilling for delineation of potential areas, drilling to establish exploitable proven reserves, and the production wells etc. It should also establish a Central Surface Gathering Facility for a cluster of geothermal resources in a particular area of the country. To ensure operational efficiency, reliability and credibility of resulting data, all these activities should be contracted out by the government to the private sector. For the financing of these activities, the government could seek assistance from the multilateral development financial institutions and other donor agencies like the Asian Development Bank, the World Bank, JICA and others for securing soft loans and grant funds from such windows as the Clean Energy Fund, Climate Change Fund and others. The completion of these activities will ensure the availability of geothermal resources and the on-time delivery of steam to the private sector for the generation of electricity. These operational arrangements will eliminate the perceived risk and apprehension of the private sector which they associate with the development of geothermal resources.

The government will provide steam to the private sector for power generation at a cost which will recover the cost incurred in undertaking the operations option 1 noted above. The guaranteed delivery of steam will relieve the government of private sector pressure for higher tariffs for geothermal development and power generation.

6.2.2 Option 2: Private Sector to Generate Power Using Geothermal Resources

The government should invite the private sector to establish facilities for power generation with guaranteed supply of steam. The private sector will also be required to provide infrastructure facilities to transmit steam from the Central Surface Gathering Facilities to the power plant. The government will buy electricity from the private sector at an agreed rate stipulated in the PPA.

6.2.3 Option 3: Geothermal Development and Power Generation Under Public Private Partnership

Option 3 is basically a combination of options 1 and 2. Under this option, new financing modalities will be needed to fundamentally change the way projects are planned, funded and implemented. To proceed with the development of geothermal resources and to generate electric power under option 3, the Government should set up a New Independent Company (New Company), which will be owned by an international investor or a consortium of international investors, federal/central government, the provinces/municipalities and local governments with geothermal resources, and the domestic private investor. The combined equity holding of the government/provinces/municipalities and local governments should be a maximum of 25% of the New Company's equity. The New Company will take the geothermal development and power generation as build, own, operate, and transfer (BOOT)[2] model, and will take all risks and liabilities associated with the operation.

International Financial Institutions (IFIs) and other development partners may also take equity in this New Company. The multilateral development financial institutions and other donor agencies like the Asian Development Bank, the World Bank, JICA and others could provide loans, concessional loans and grants from the Clean Energy Fund, Climate Fund and other windows, to the governments to pay for their equity holding in the New Company. The New Company would raise the debt from the market. It is envisaged that with the backing of the IFIs and other major donors and the financial strength of the New Company itself, it would raise debt at a favorable rate. It is possible that the Asian Development Bank and other donors could also facilitate the issuance of local currency bond and currency swap for financing the local currency cost of the project.

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[1] This includes geothermal development costs (exploration, drilling and other related costs).

[2] A BOOT funding model involves a single developer, or a consortium, to design, build, fund, own, and operate the project for a defined period of time (usually 10 to 30 years), and then transfer the ownership to the government or to a partner at a previously agreed-upon price (generally for a $1.00).

To provide further comfort and incentive to the private sector for investing in geothermal resource development and power generation, the government may seek the provision of political risk guarantees under ADB, the World Bank/MIGA facility with government counter guarantee.

The involvement of multilateral institutions in the country's geothermal resource development will bring standards of transparency and accountability, and will provide an increased level of comfort to private investors. Their due diligence process would add value to this complex undertaking and would help the developing countries manage risks, safeguards, and stakeholders' (including civil society's) expectations.

6.2.4 Government to Provide Investors Confidence for Funding Sustainability

To attract such a large private sector investments for geothermal development and power generation, the government must ensure investors confidence by setting a competitive tariff structure to yield a reasonable return on investment; establish a transparent legal and regulatory regime with adequate enforcement mechanisms; ensure transparent bidding and tendering procedures for new projects which must be perceived as fair by all concerned parties; and a fair and favorable taxation regime. Equally important to the private sector investor is the concession agreement (CA) between the government and the investor, and the power purchase agreement (PPA) between the seller of geothermal electricity and the buyer (the government) which must be fair to both the parties. To provide further confidence to the private investor, the risks associated with the complete cycle of geothermal resource development and electricity generation should be shared by the government and the investor.

6.2.5 Institutional Set-Up, Organizational Structure and Capacity Building

The successful development of geothermal resources and the associated power generation would require the government to establish a central government entity that would be responsible for all the upstream and downstream activities and also to provide coordination among all concerned agencies and stakeholders.

The concession agreement between the Government and New Company (in Option 3) should include capacity-building activities for the government staff. The agreement will require the New Company to provide on-the-job training to government officials. The main focus of this arrangement will be to encourage knowledge transfer from sponsor/developer to the government as they work together on the Project.

7. COMMUNITY–BASED RENEWABLE ENERGY DEVELOPMENT FOR POVERTY REDUCTION IN REMOTE AREAS

The challenges facing economic development efforts in remote areas for poverty reduction are varied and complex and include: (a) lack of employment-generating programs; (b) lack of electric power to sustain economic development; (c) limited livelihood opportunities; (d) limited human capital investment and development; (e) lack of empowerment; (f) lack of financial services for the poor; and (g) piecemeal approach to poverty reduction and limited over-arching anti-poverty programs. The community-based renewable energy projects will help to (a) meet local electricity demand in an environmentally and socially sustainable manner; (b) improve access of rural areas to modern electricity services, and (c) improve standards of living for the poor through provision of community-level infrastructure.

7.1 Key Factors for Sustainability of Community-based Renewable Energy Development

Sustainability of the community-based RES projects is primarily linked to the capacity built up within the communities themselves. Key factors which should be addressed during program design include the effective implementation of the community mobilization process, and the provision of technical and capacity building support to the communities to ensure the effective operation and maintenance of the system. The focus should be to (a) develop self-reliant and self-managed organizations in the target communities; (b) promote information dissemination, awareness building, and knowledge sharing with other remote community areas; and (c) build strategic partnerships with the private sector and civil society.

7.2 Empowerment of Women in Community-Based Renewable Energy Development

Women are the mainstream users and often providers of household energy in villages. Without their active involvement, renewable energy projects will not succeed. Women are not only the main users of household energy in the developing world, but also influence if not make many family purchases related to energy. Energy researchers who downplay or ignore the role of women in their energy research and analysis will be failing to understand a critical part of developing countries' energy consumption and production. Donors who do not support gender-sensitive energy assistance will be overlooking one of their primary target groups. To encourage women to be involved in renewable energy development programs, an entrepreneurship program, designed and targeted exclusively for women's participation, should be organized. The "Village Women Entrepreneurship" program should include special incentives and concessions so that they may invest in the renewable energy development in their respective areas and be a part of regional development and poverty reduction. To motivate women to set up renewable energy development projects, they should be extended special concessions, such as favorable financing terms, and fee waivers on loans, legal expenses, documentation charges, etc.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The global climate change presents one of the biggest challenges to human development and the humanity at large. The scientific consensus worldwide on global climate change issues is driving the policy makers of the national governments towards actions on emissions reduction and the transition to a low carbon economy. Some developed countries have substantially adjusted, and continue to change, their socio-economic policies in a move towards low carbon economic development. The move towards a low carbon economy is inevitable for the developing countries if they are to realize their development goals. There are significant and immediate economic benefits to be gained from improving energy and resource efficiency levels, and they should adopt rigorous policies to realize those benefits. These policies are important tools to kick-start a low carbon economy. Further, the developing

countries stand to benefit significantly from a transformation of its pattern of economic growth. Such a transformation will allow them to capitalize on new growth opportunities and provide increasing global demand for low carbon technologies.

The heavy reliance on fossil fuels has significant detrimental environmental impacts. Power systems based on renewable energy sources such as geothermal, biomass, bagasse, wind, solar, biomethanation, municipal and agricultural wastes, mini-hydro, etc. are suitable candidates for alleviating some of the power shortages and greenhouse gases emissions. The policy makers in the developing world must create an enabling environment for the private sector to undertake development of all forms of renewable energy sources including geothermal resources. It is also considered that: (i) renewable energy technology will have to improve at a very significant pace to provide low-cost impacts; (ii) significant increases in the use of geothermal and other renewable resources are possible, but only with substantial technical advances to facilitate greater use of less-productive locations; (iii) more moderate geothermal energy supply targets, such as 5 to 7 percent, are realistic and manageable to achieve; (iv) the government's policy approach to pricing of renewable energy will significantly affect fuel demand and country's total energy expenditures; and (v) there exists great opportunities in developing countries to expand the role of geothermal energy – a renewable energy resource in the national energy supply chain which will help reduce dependence on foreign fossil fuel supply, reduce GHG emissions, and meet the need to curtail foreign exchange expenditures.

For the sustainable economic growth and to improve the quality of life of the people, the management and development of energy resources must be improved to address the combination of rapid population growth, persistent poverty, deteriorating infrastructure, increasing energy demand among the various regions of the country, inadequate capacity, weakened institutions and governance issue. These could be addressed by undertaking a major program of geothermal energy development including both the rehabilitation of existing assets and construction of new assets. A comprehensive strategy for the development of geothermal resources is needed to manage the nearly untapped resources for a least-cost generation expansion plan for the power sector so as to meet the country’s growing power deficit. If these aspects are designed appropriately and implemented well within responsibly-managed fiscal space, addressing environmental and social issues, benefit sharing, using state-of-the art analytical tools, strengthening institutions and capacity building, and the consultation process fully integrated into the decision making norms, the geothermal resources will continue to be a major source of economic growth and prosperity in the developing countries.

8.2 Recommendations

The developing countries should focus on the interrelated institutional, regulatory, and financial reform issues that are considered essential to improve renewable energy sector performance in the 21st century. They should also move to establish an appropriate legal framework and regulatory processes, and support programs that will facilitate the involvement of private investors. The countries should focus increasingly on creating a policy environment that is conducive to private investment and help mobilize private capital.

There is an economic case for providing some financial subsidies in the initial phase of renewable energy including geothermal development program because of their positive externalities both locally and globally. The subsidies must be designed to kick start an infant industry but must have a limited time span.

The developing countries must implement market-based reforms; strengthen market regulations to ensure investor confidence and to attract private capital for geothermal thermal funding sustainability; and focus on creating competition as the driving force for improvement and private sector participation as a vehicle for progress in renewable energy.