Youth Employment Opportunities in Renewable Energy : A Report

YOUTH EMPLOYMENT SUMMIT
Education Development Center Inc

Table Of Contents

Introduction

Vibrant, creative, and energetic – these words essentially sum up today's youth. Ironically, the same qualities in youth, if thwarted, lead to social unrest, conflict, and economic instability. Young people when productively employed are an asset to their communities and to the world. It is imperative that structures be generated to ensure sustainable employment and sustainable environments for young people. But the reality is that there are a billion young adults – between the ages of 15 and 24 – in the world today, eighty-five percent of them live in developing countries where there are few opportunities for productive work. The International Labor Organization indicates that the unemployment rate in 1997 for OECD nations for youth ages 15 to 25 age was 13.4 percent, more than twice as high as the comparable figure for adults (5.9 percent). In developing countries, existing data suggest that the gap between youth and adult employment rates is far wider. This large group of young people cannot be absorbed in urban and industrial employment, at least in the short run. High levels of youth unemployment contribute to poverty, discontent, alienation, social unrest, conflict, and urban migration, all of which hinder economic growth and threaten political stability.

Young adults must have meaningful employment opportunities in order to build stable and sustainable communities. Young people, when gainfully employed, represent a tremendous resource for developing and industrialized nations; they bring energy, creativity, and imagination to many nation-building tasks, from building infrastructure to preserving the environment. But until a global, collaborative approach is developed that empowers youth to promote environmental sustainability, and make this an economically viable alternative, a valuable asset to help address global environmental goals will remain untapped.

A global consensus has now been reached on the urgency of solving the youth unemployment 'problem.' It is essential that young people do not feel disenfranchised and threaten the social structure and safety of their nations – and the world. Youth must be provided with a stake in their future so that they will sacrifice their 'today' for a better 'tomorrow.' Now is the time to empower young people with a supportive environment and appropriate opportunities for employment. Youth are the principal agents for social change, economic development and technological innovation.

However, for this to be possible, some radical thinking is required. Today's world faces challenges in the form of population growth, resource consumption and environmental degradation. The environment is threatened by the perils of global warming, climate change, and energy crises. Unless some immediate remedial measures are taken, things are only expected to get worse. There is a need to protect the

environment and at the same time to provide young people with opportunities for sustainable livelihoods. If youth get involved with conserving the environment by producing clean energy, then we will simultaneously address the problems of youth unemployment and environmental degradation.

The environmental deterioration that we are experiencing is primarily due to global warming and climate change. Global warming occurs when greenhouse gases like carbon dioxide and methane stay trapped in the earth's atmosphere. These gases are known as greenhouse gases because of their capacity to retain heat, and this effect is known as the greenhouse effect. Originally, it was this effect that made the earth a habitable place, or it would have been too cold to live in. However, retention of excess heat, or the "enhanced greenhouse effect" is a serious threat to the planet as it leads to an increase in global temperature; (global warming) which in turn is the cause of global climate change. Land degradation, air and water pollution, sea-level rise, flood of coastal and low lying areas, and loss of biodiversity are only a few examples of the consequences of climate change.

It is now widely accepted that if concerted efforts to reduce greenhouse gas emissions (GHGs) are not taken, it is possible that the levels of GHGs will triple by the year 2100. Resolving the problem of climate change requires multiple, long-term strategies that will demand enormous sustained effort, engaging the cooperation of both developed and developing countries. Currently, developed countries account for the larger share of greenhouse gas emissions, but developing-country emissions continue to rise steadily. By the year 2025 emissions from developing countries are expected to represent some 50% of the global total. This calls for immediate action globally.

While it is imperative to take corrective measures to combat climate change, equally important is the necessity for developing countries to produce increasing amounts of energy – energy being a vital need for the development of any modern society. One solution that allows production of energy to continue without any adverse effect on the environment is the use of renewable energy. Renewable energy makes use of natural resources like wind, sunshine, and water to create energy. It thus prevents the release of carbon emissions into the atmosphere, thereby mitigating climate change while at the same time producing the energy much needed for development. At the United Nations Conference on Environment and Development (UNCED), or the Earth Summit, held in Rio de Janeiro in 1992, it was considered essential to develop environmentally sustainable technologies and industrial practices. It was agreed that the concept of sustainable development needed to be viewed in terms of ecology, social and gender equity, employment and economics. This is the focus of Agenda 21, the action plan of the UNCED for the 21st century.

Quoting Chapter 9 of Agenda 21 on 'Protecting the Atmosphere':

"Energy is essential to economics and social development and improved quality of life. Much of the world's energy, however, is currently produced and consumed in ways that cannot be sustained, if technology were to remain constant and if overall quantities were to increase substantially. The need to control atmospheric emissions of greenhouse and other gases and substances will need to be based on efficiency in energy production, transmission, distribution and consumption; and on growing reliance on environmentally sound systems, particularly newer and renewable sources of energy."

Quoting Chapter 25 of Agenda 21 on 'Children & Youth In Sustainable Development':

"Governments should ensure access for all youth to all types of education, wherever appropriate, providing alternative learning structures, ensure education that reflects the economic and social needs of the youth and incorporates the concepts of environmental awareness and sustainable development."

These two quotations sum up the essence of this report, that is, combining the goals of youth employment and environment protection. Using renewable energy is one way of protecting the environment while at the same time allowing developing countries to produce energy.

This report looks at youth employment opportunities in the renewable energy sector. This sector has many eco-job opportunities. As a positive step towards understanding their role in solving the problem of the energy crisis, it is essential that youth first understand what the problem is, where the solution lies and how some organizations have already started working on this issue. Working towards creating an environmentally sustainable world, while also providing employment opportunities.

Global Warming and Climate Change

The past few decades have seen a host of treaties, conventions, and protocols in the field of environmental protection. As early as 1896, the Swedish scientist Svante Arrhenius had predicted that human activities would interfere with the way the sun interacts with the earth, resulting in global warming and climate change. His prediction was borne out and climate change is disrupting global environmental stability. Land degradation, air and water pollution, sea-level rise, and loss of biodiversity are only a few examples of the now familiar issue of environmental degradation due to climate change. One of the most important characteristics of this environmental degradation is that it affects all mankind on a global scale - without regard to any particular country, race, or region. This makes the whole world a stakeholder and raises issues on how resources can be allocated and responsibilities be shared to combat environmental degradation.

One of the main human activities that releases huge amounts of carbon dioxide into the atmosphere is the conventional use of fossil fuels to produce energy. Scientists and environmentalists have studied, over the past few years, the impact of conventional energy systems on the global environment. The enhanced greenhouse effect from the use of fossil fuels has resulted in the phenomena of acid rain and accentuated the problem of ozone depletion and global warming, resulting in climate change. Due to the increased use of technology and mechanization in human activities, the delicate ecological and environmental balances are being disturbed. For instance, carbon dioxide is being pumped into the atmosphere faster than the oceans and flora can remove it and the rate of extinction of animal and plant species far exceeds the rate of their evolution.

The reason that global warming and climate change are considered serious global threats is that they have very damaging and disastrous consequences. These are in the form of:

- Increased frequency and intensity of storms, hurricanes, floods and droughts;
- Permanent flooding of vast areas of heavily populated lands and the creation of hundreds of millions of environmental refugees due to the melting glaciers and polar ice that causes rising sea levels;
- Increased frequency of forest fires;
- Increased sea temperatures causing coral bleaching and the destruction of coral reefs around the world;
- Eradication of entire ecosystems

The Intergovernmental Panel on Climate Change (IPCC) was set up by the United Nations Environment

Program (UNEP) and the World Meteorological Organization (WMO) in 1988 to assess scientific, technical, and socio-economic information needed for the understanding of the risk of human induced climate change. According to the IPCC assessments, if the present rate of emissions continues, the global mean temperature will increase by 1°Celsius to 3.5°Celsius compared to 1990 levels by the year 2100. The best estimate is at 2°Celsius. The IPCC concludes that:

- Concentrations of greenhouse gases could exceed 700 ppm by 2100 under the "business as usual" scenario –levels not seen on the planet for 50 million years. The projected temperature increase of 1°Celsius to 3.5°Celsius over the next 100 years could exceed rates of change for the last 10,000 years.
- Increased temperatures are expected to speed up the global water cycle. Faster evaporation will lead to a drying of soils and in some areas increased drought. Overall, however, due to the faster global cycling of water, there will be an increase in precipitation.
- Sea levels are expected to rise between 15-94 centimeters over the next century. A 50-centimeter sea level rise could double the global population at risk from storm surges- from roughly 45 million to over 90 million, even if coastal populations do not increase. Low-lying areas are particularly vulnerable.
- Human health is likely to be affected. Warmer temperatures will increase the chances of allergic disorders. Diseases that thrive in warmer climates, such as dengue fever, malaria, yellow fever, encephalitis and cholera are likely to spread due to the expansion of the range of disease-carrying organisms. By 2100, there could be an additional 50-80 million cases of malaria each year.

Moreover, the impacts of global warming and climate change could become a source of increased tension between nations and regions. For instance, in many countries, a severe disruption of the world's food supplies through floods, droughts, crop failures and diseases brought about by climate change would trigger famine, wars and civil disorder.

Historically, it is the developed world that is responsible for most of the emissions into the atmosphere. However, it is the underdeveloped parts of the world that will suffer its worst effects. For example, as sea levels rise, a country like Bangladesh will suffer much more from the loss of valuable arable and populated lands than North American or European countries, even though, in comparison to the latter, the former would have much less emissions.

There is an thus an urgent need for a coordinated effort between the developed and developing countries to solve the problem of global warming, while at the same time not compromising on the needs of the developing countries to produce more energy in order to develop. Since the 1972 United Nations Conference on the Human Environment in Stockholm, tremendous advances have taken place in deriving

strategies and action plans for environmentally sustainable development. The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1994, paving the foundation for intergovernmental efforts at combating climate change. Signed by an overwhelming majority of the world's nations, the UNFCC has a key assumption that countries can successfully tackle the problems of climate change best by finding ways to work together as a team. It is important that diverse stakeholders work together to institute a broad range of strategies, technologies, processes and products focusing on mitigation and reduction of negative effects on the environment. To further public and political acceptance of the UNFCCC goals, it is critical to demonstrate that adoption of these goals will not slow economic development and growth but rather enhance overall development goals.

Renewable Energy and Sustainable Development

The economic development of modern societies is crucially dependent on energy. Energy is vital for sustainable development. It is used to generate electricity for a variety of needs, among which are domestic needs, transport needs, and industrial needs. The methods of production, supply and consumption of energy are key issues in sustainable development because they strongly affect the local and global environment. However, the current methods of energy production are primarily by the use of fossil fuels. These fossil fuels are largely responsible for global warming and the greenhouse effect, as they are accompanied by huge emissions of carbon dioxide and other greenhouse gases into the atmosphere. These methods of production are not sustainable in the long run and therefore do not contribute to sustainable development.

Sustainable development has been defined in various ways, but some of the most well known definitions was provided by the Brundtland Commission or the World Commission on Environment and Development in 1987 as:

> *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs".*

This describes a situation that is "sustainable" that is, it can be continued into the future as it does not harm either the environment or the people. However, the use of fossil fuels to generate energy is not conducive to achieving sustainable development. Coal, oil and natural gases are all fossil fuels. Over millions of years, the decay of plants and animals resulted in the formation of fossil fuels, with these fuels lying buried between the layers of the earth. While underground heat and pressure today are still creating more fossil fuels, they are being consumed more rapidly than they are created. When fossil fuels are burned, they release huge amounts of carbon dioxide into the atmosphere, adding to global warming and climate change. Given that energy usage will continue to increase with the demands of growing population, with the gap between the demand and supply of energy growing wider than before, the use of fossil fuels has two distinct disadvantages. The first is that they are environmentally harmful since they release greenhouse gases into the atmosphere. The second is that they are physically unsustainable, as they will ultimately get exhausted as the demand for them outstrips the supply, leaving the world searching for alternative methods to produce energy.

We need a solution to this problem. Firstly, governments and communities must collectively choose to

change their pattern of energy use. Secondly, more sustainable sources of energy must be tapped. This would not only mean moving away from the current situation in which most world energy is supplied by fossil fuels but a reduction in the energy and pollution intensity of economic activities.

Ideally, we need perennial energy sources. Renewable energy systems provide the solution. Renewable energy, as the name suggests, makes use of resources that do not get exhausted by usage. This has three broad implications.

- The energy created is "clean" as opposed to fossil fuels that generate huge amounts of carbon dioxide into the atmosphere. Thus it protects the environment and contributes to the mitigation of climate change.
- Renewable energy uses natural resources like wind, sunshine and water. It is not dependent on limited supplies of coal, petroleum, diesel, etc. that will ultimately get depleted, resulting in a fuel shortage. Renewable energy is thus sustainable in the long run, as it can be continued indefinitely into the future as long as there are natural resources like sunshine, wind, and flowing water.
- Energy is a crucial factor in bringing about development in poor countries and these countries usually face a chronic shortage of energy. Most of these developing countries are not in a position to import huge supplies of petroleum or coal to meet their energy needs, so the shortage persists. Thus these countries should encourage the adoption of renewable energy to meet their growing energy needs. This will not only reduce their dependence on imports of fuel to generate energy, but will also ensure a continued local source of energy.

There is an increasing amount of awareness on renewable energy nowadays, and many countries have set up renewable energy initiatives, which are expected to grow in the future. Examples of renewable energy systems include solar, wind and geothermal energy. Renewable energy currently meets around 6 per cent of European energy demand. The European Commission estimated the world market for renewable energy at £31 billion in 1990, and projects that European business in 2010 will be valued at 37 billion ECU, with a further 17 billion ECU from exports into the expanding world markets. The European Commission is proposing doubling the contribution from renewable energy to 12 per cent of Europe's energy needs with an investment of 165 billion ECU by 2010.

TABLE 1: Growth Of Renewable Energy Worldwide (IN MWs)

Technology	Total Shipments/ Installed Capacity in Most Recent Year of Data [a]	Shipments/Installed Capacity in Previous Year of Data	Annual Growth (In %) [b]
PHOTOVOLTAIC (PV)	288 (2000)	201 (1999)	43%
WIND	17,300 (2000)	13,500 (1999)	28%
BIOMASS	14,000 (1998)	N/A	N/A
GEOTHERMAL	7,974 (1999)	6,797 (1995)	3%

a. Annual shipments data pertains to PV, for which reliable data on global installed capacity is unavailable

b. Annual growth for geothermal is extrapolated from 1995 and 1999 annual data, and assumes constant growth between 1995 and 2000

SOURCE:

A) http://www.Crest.Org/Articles/Static/1/Binaries/LABOR_FINAL_REV.Pdf

B) World Watch Institute. Vital Signs 2001. C) Geothermal Energy Association D) AWEA. E) U.S.DOE Bio-power Program

The trends listed above have contributed to the impressive growth of the renewable energy industry, as table 1 indicates. The figures clearly show the growth of renewable energy, particularly, photovoltaic (PV) and wind. Biomass and geothermal are likely to grow due to their ability to run as often as fossil fuel plants, unlike solar or wind energy which are dependent on those moments when the sun shines or the wind blows. The figures also indicate that renewable energy is not yet a significant portion of electricity supply worldwide. In fact, statistics reveal that, renewable energy provided just 1.6% of electricity worldwide in 1998. However, these percentages mask the absolute growth of the industry and what renewable energy's potential can mean for creating jobs and speed up economic development.

Nations such as Japan and Germany are leaders in the solar photovoltaic markets, both as suppliers and consumers. Denmark, Germany and Spain mark the same trend in wind power. While NEG Micron (Denmark) and Vestas (Denmark) now lead the global wind industry, firms such as Kyocera (Japan) and Siemens (Germany) dominate the PV industry. Beyond the developed world, developing nations are buying more renewable energy to meet energy needs.

Geothermal energy is an important source of power in Indonesia, the Philippines and Central America. India and China have made significant progress in providing wind energy facilities. In addition, India, already having a nascent solar energy industry, is applying small-scale biomass energy technologies to supply gas and power to its many villages located far from electricity distribution networks.

Renewable energy is a means to combine the goals of youth employment (therefore income generation) and environmental protection, thereby contributing to sustainable development. One method to implement this potential link between youth employment and environmental protection is to develop youth-led enterprises to produce and market renewable energy to off-grid consumers. Youth-led renewable energy enterprises are a viable means of achieving sustainable development, as they promote technologies that are less harmful to the global environs (as compared to conventional technologies), while at the same time providing sustainable income-generating opportunities for youth.

Tapping the energy of youth for promoting renewable energy will have a three-fold effect.

- It will release new energy in accomplishing many of the goals set by the global community for climate change
- It will move young people into productive and long-term nation building activities, away from non-productive pursuits
- It will direct youth to income generating activities in this sector.

Thus renewable energy projects offer promising results and should be adopted on a global level. Ultimately, the need is to promote youth employment in renewable energy enterprises in as many national settings as possible. The development of renewable energy can bring positive and tangible effects on employment because this energy is local in nature and can usually be made available without the existence of heavy infrastructure. Developing countries have great potential for renewable energy, especially in rural areas. It is usually rural areas that are not connected to the grid for electricity. Urban areas are usually well connected to the grid, even if the power generated is by conventional fuels such as coal. Rural inhabitation is often scattered non-uniformly, with many rural communities located far away from other rural communities. In such cases, it is not economical to try to connect these rural pockets to the grid. At the same time, these communities do need access to electricity. Renewable energy provides the solution to this. Thus it is in the rural areas of developing countries that renewable energy should be focused.

Apart from rural areas, another area that holds promise is the tourism sector. This sector offers particularly good opportunities for the increased use of renewable energy. If a region enjoys tourist traffic, then the region's environment needs to be preserved while providing for the increased energy demand during peak periods due to the steady inflow of visitors. Furthermore, there is growth in tourism

in isolated areas such as on islands and in mountainous regions, where fuel deliveries and grid connections are costly, leaving renewable energy as one of the most feasible options.

A term commonly used to signify employment that is environmentally friendly and ecologically sound is "eco-job". Eco-jobs are not restricted only to youth-entrepreneurs setting up renewable energy enterprises. Gainful employment with organizations that deal with or promote renewable energy is an equally significant option. Promoting alternative sources of energy must form a part of regional policies as it can bring employment to regions, which were not previously industrially developed. Studies worldwide have revealed the labor-intensive nature of the renewable sources of energy. According to the European Commission, that the employment impact of renewable energies can be five times higher than that achieved with further development of fossil fuels.[2] Most importantly, job creation takes place in the rural areas where unemployment is often very high. Availability of job opportunities in rural areas would prevent the rural youth from migrating to the cities to seek employment. This will not only ease the pressure on urban centers, but will ensure that the rural youth will not leave their villages, thereby ensuring the presence of a valuable asset needed for development – dynamic and hard working youth. Compare this to the contrast of the youth that migrate to the cities hoping for jobs, and become frustrated, discontent, and disenfranchised, threatening political and economic stability. Consisting predominantly of small and medium sized enterprises, the renewable energy sector is recognized as a major source of new employment opportunities.

The renewable energy industry can be termed a "sunrise" industry. It has been predicted that globally, jobs in the renewable energy and energy efficiency industries will rise to more than 3 million over the next twenty years and lead to the opening up of a new range of career opportunities. The global benefits of promoting off grid renewable energy projects are indirect if measured alone. These projects contribute to a global initiative to catalyze markets for rural renewable energy applications that together will serve large shares of the two billion people in developing countries currently without electricity. These markets will also be the opportunity for young people to earn their livelihoods and preserve the environment.

The use of renewable sources of energy and renewable energy technologies should therefore be an important element for supporting entrepreneurial initiatives and employment. In order to create a favorable climate for the exploitation of the renewable energy technologies and its diverse applications it is essential to train the men and women who would implement them. Thus, essential components of any developmental effort are education and training. The early involvement of individuals and community organizations benefiting from the implementation of renewable energy projects is an important step towards its success.

[2] European Commission "Energy for the Future: Renewable Sources of Energy"

The signs are positive already. Shell Oil Company recently announced that by 2050, 50% of its entire business is likely to be through renewable energy technologies. BP Solar has announced that by 2007, its photovoltaic cell business would have grown to a $1 billion per year business. The Australian Federal & state Governments has introduced initiatives and funding schemes to expand the horizons in the field of sustainable energy industry in the next decade.

Trained staff are needed at the technical and professional levels to meet the current and expected increase in jobs. With the knowledge and skills to develop, promote and implement new methods of sustainable energy production, they are expected to improve the efficiency of existing systems and appliances.

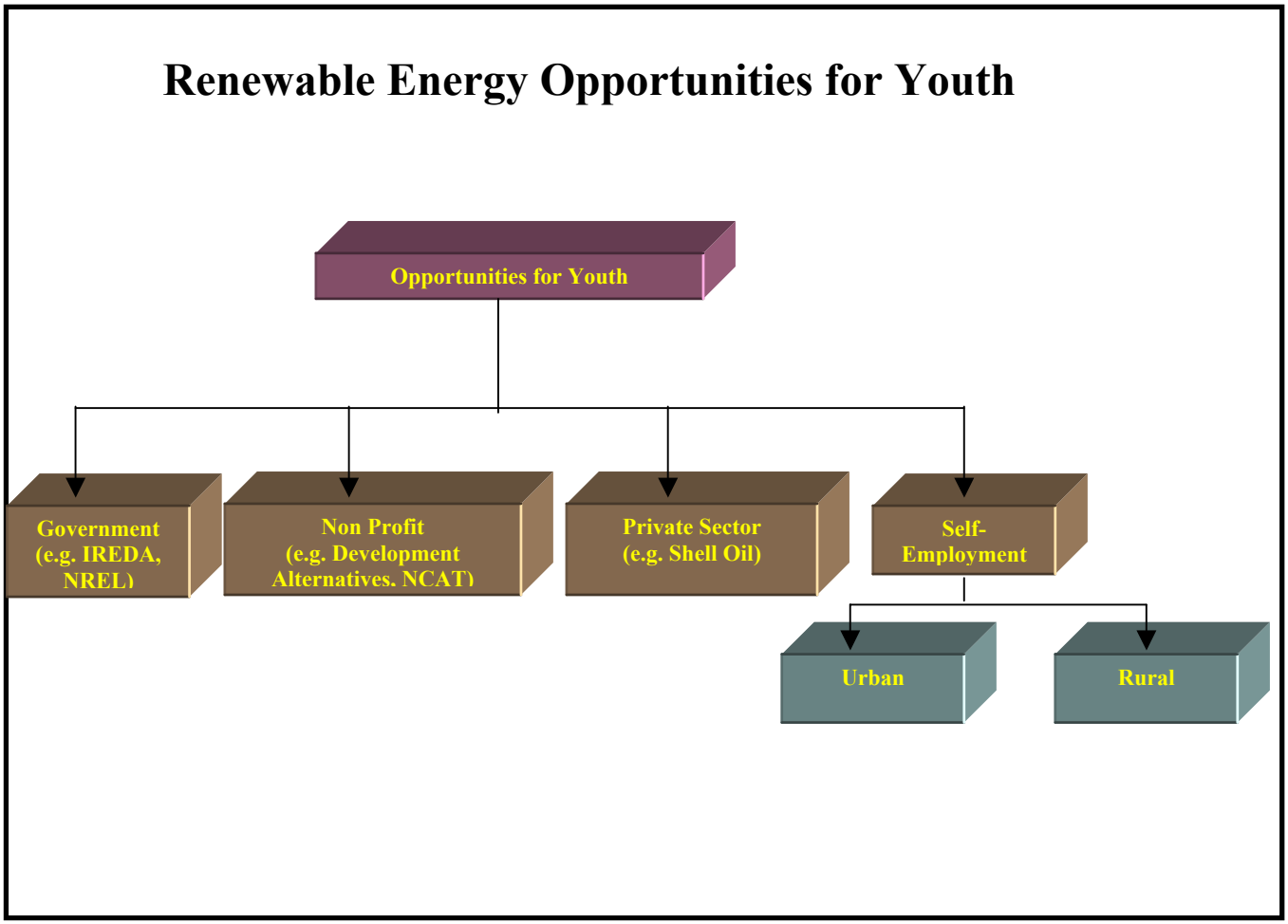
Opportunities for youth in the renewable energy sector can be generated by government institutions, non-government institutions, and the private sector or can be purely self-employment. Several governments and organizations have identified ways and means of conserving and preserving renewable sources of energy.

Expected job opportunities in renewable energy lie in the following areas:

- Design and Planning,
- Energy Policy Analysis and Development,
- Energy Economics and Energy Management,
- Energy Efficiency Consulting,
- Assessment of Social and Environmental Impacts of Energy Systems,
- Research and Development

The organizations that could offer such employment opportunities are:

- Renewable energy manufacturing and installation companies
- International aid organizations
- Energy efficiency and environmental consultancies
- Universities and private industry research organizations
- Energy companies exploring possibilities of alternative forms of energy
- Non government organizations


Renewable Energy Opportunities for Youth
Opportunities for Youth
Government (e.g. IREDA, NREL)
Non Profit (e.g. Development Alternatives. NCAT)
Private Sector (e.g. Shell Oil)
Self-Employment
Urban
Rural

Type of Job	Organization
Solar Energy Mechanic Energy Specialist Manufacturer & Marketer of Solar Lanterns and Solar Energy Based Systems.	Center for Scientific Research (CSR), Auroville, India
Solar Energy Mechanic Energy Specialists Biogas Energy Mechanic Bio-plant Mason Plant Architect & Designer, Wind Meteorologist Wind Turbine Engineer	The Intermediate Technology Development Group (ITDG), France
Biogas Energy Mechanic Bio-plant Mason Plant Architect & Designer	Development Alternatives (DA): Bio-mass power plant at TARAGram in Orchha, India
Geothermal Geologist Resource Economist	'The geysers' geothermal field in Northern California & Yellow Stone National Park, USA Kokonoe-machi geothermal power generation station, Japan
Biogas Energy Mechanic Bio-plant Mason Plant Architect & Designer	M.S. Swaminathan Research Foundation, Biovillage Project, Chennai, India
Entrepreneurial Development	The African Rural Energy Enterprise Development (AREED), Mali, Ghana, Senegal, Zambia, Tanzania,
Entrepreneurial Development & Funding	Indian Renewable Energy Development Agency (IREDA), Delhi, India
Manufacturer & Marketer (solar PV, biogas systems & accessories and wind turbines) Solar Energy Mechanic Energy Specialists Wind meteorologists Wind turbine engineers	Grameen Shakti (Wind & Solar), Bangladesh
Solar Energy Mechanic Energy Specialists (Solar Water Heating Systems) Mechanic Manufacturer & Marketer (Solar Lanterns, Wood-stoves) Biogas Energy Mechanic Bio-plant Mason Plant Architect & Designer Recycling Engineer Community Recycling Manager	Renewable Energy Plan 2012: Government of India Initiative, India
Eco-Infomediary Eco-Campaigners	Renewable Energy Power project (REPP), Washington, USA
Energy Mechanic	The Home Employment and Lighting Program (HELP), Kathmandu, Nepal.

Barriers to the Adoption of Renewable Energy

There are several barriers in the form of limited information, lack of technical skills and institutional capacity, prohibitive costs, and inaccessibility to technology. These make it difficult to adopt renewable energy in poor countries.

- Lack of Information: Rural communities frequently have limited access to existing knowledge bases that promote the use of renewable energy through economically and financially sustainable models. They lack knowledge of the market potential for renewable energy, the potential for providing renewable energy services to customers, successful replicable projects, potential financial partners, and means for establishing renewable energy systems.
- Lack of Technical or Commercial Skills: Even if they have the above-mentioned knowledge base, rural communities, and their youth frequently lack the skills and experience to produce and promote renewable energy. This includes financial management of the businesses, creation of business plans to market renewable energy, analyzing and dissemination of information, and technical know-how to maintain and service the equipment.
- Inaccessibility of Technology: Rural communities often do have access to renewable energy technologies and thus may not understand these technologies or the technical assistance to support its promotion and adoption. In off-grid areas, there is a natural market for services that may be tapped into by young people marketing and maintaining renewable energy systems, in coordination with larger efforts to provide renewable energy systems to those areas.
- Lack of Institutional Capacity for Promoting Renewable Energy: Throughout the developing world there is a lack of institutions serving youth that have expertise in renewable energy technologies and business development. Institutions that exist have an overwhelming task to do in which they need a great amount of support. There is therefore a need to find ways of integrating development initiatives, where possible, with capacity building exercises.
- Risk Involved with High Costs: Some forms of renewable energy are very expensive to produce and local institutions cannot afford to adopt these without adequate financial support from other organizations. Businesses are not always ready to invest in renewable energy technologies because of the lack of a guarantee that it will become commercially viable or profitable.

Apart from the above, there is another barrier with regard to youth employment in the area of renewable energy. This is the lack of youth involvement. Young people generally have the energy, the vision and the belief to get involved with new and innovative projects. However, in the majority of poor countries,

there is a lack of infrastructure to support youth employment projects, and youth are not provided the necessary coaching, trust and enabling environment to make viable contributions to the local economy and environment. To be able to link sustainable development and youth employment, there is a pressing need to involve youth and to give them the necessary coaching, trust, and enabling environment.

Solutions

The promotion of youth led renewable energy enterprises will tackle jointly the issues of youth unemployment as well environmentally sustainable development. The rural youth needs an enabling environment for the successful and continued implementation of renewable energy. Thus they need to be equipped with the skills that could enable them to set up viable and sustainable enterprises. To create this enabling environment, a variety of measures need to be taken. These include dissemination of information on renewable energy – its potential in providing income generating activities for youth – and other issues such as creation of business plans to market renewable energy, and access to technology and technical know-how. This will build the much-needed institutional capacity to develop renewable energy enterprises.

In addition, the energy and dynamism of youth needs to be tapped. Development agencies have in the past succeeded in empowering women as a group previously disadvantaged and prejudiced against, to one that is universally accepted as effective change and development agents. This can be observed in such innovative solutions as micro-credit systems that focus on women as the main implementers. Youth need to be given similar attention. They need to be coached and trained in all the relevant areas for setting up and successfully running renewable energy enterprises. Youth involvement in community based initiatives, taking into account the different cultural factors, gives added value to grassroots development. Empowering youth helps reach a wider spectrum of the communities.

In order to promote off-grid renewable energy, close and continuous engagement with local community members is essential. Thus if the stakeholders (i.e. the local community members) are the ones who are developing and operating these enterprises, it will ensure viability, sustainability and effective operation of these autonomous renewable systems. This community involvement, however, will be far more effective if these local groups stand to gain economically if the systems are properly installed and stay operational.

Each day more energy reaches the earth from the sun than would be consumed by the globe in 27 years. Solar energy is renewable as long as the sun keeps burning the massive amount of hydrogen it has in its core. Even with the sun expending 700 billion tons of hydrogen every second, it is expected to keep burning for another 4.5 billion years. Solar energy comes from processes called solar heating, solar water heating, photovoltaic energy and solar thermal electric power.

Solar Heating – An example of solar heating is the heat that gets trapped inside a closed car on a sunny day. Today, more than 200,000 houses in the United States have been designed to use features that take advantage of the sun's energy. These homes use passive solar designs, which do not normally require pumps, fans and other mechanical equipment to store and distribute the sun's energy; in contrast to the active solar designs which need the support of mechanical components.

A passive solar home or building naturally collects the sun's heat through large south facing windows, which are just one aspect of passive design. Once the heat is inside, it is captured and needs to be absorbed. A "sun spot" on the floor of a house on a cold day holds the sun's heat and is perhaps, the simplest form of an absorber. In solar buildings, 'sunspaces' are built onto the southern side of the structure, which act as large absorbers. The floors of these 'sunspaces' are usually made of tiles or bricks that release air.

Passive solar homes need to be designed to let the heat in during cold months and keep the sun out in the hot months. Using deciduous trees or bushes in front of the south-facing windows can do this. These plants lose their leaves in the winter and allow most of the sun in, while in summer, the leaves will block out a lot of the sunshine and heat.

Solar Water Heating - The sun can also heat water for bathing and laundry. Most solar water-heating systems have two main parts: the solar collector and the storage tank. The collector heats the water, which then flows to the storage tank. The storage tank can be just a modified water heater, but ideally, it should be a large well-insulated tank. The water stays in the storage tank until it is needed for something, say a shower or to run the dishwasher.

Like solar-designed buildings, solar water-heating systems can be either active or passive. While a solar water-heating system can work well, it cannot heat water when the sun is not shining and for this reason,

homes have conventional backup systems that use fossil fuels.

Photovoltaic Energy - The sun's energy can also be made directly into electricity using photovoltaic (PV) cells, sometimes called 'solar cells'. PV cells make electricity without noise or pollution. They are used in calculators and watches. They also provide power to satellites, electric lights and small electrical appliances such as radios. PV cells are now even being used to provide electricity for homes, villages and businesses. Usually, PV systems are used for water pumping, highway lighting, weather stations and other electrical systems located away from power lines. As PV systems can be expensive, they are not used in areas that have electricity nearby. However, for those who need electricity in remote places, this system is economical. However, PV power is "intermittent", that is, the system cannot make electricity if the sun is not shining. These systems therefore need batteries to store the electricity.

Concentrating Solar Power - Solar thermal systems can also change sunlight into electricity by concentrating the sun's rays towards a set of mirrors. This heat is then used to boil water to make steam. This steam rotates a turbine that is attached to the generator that produces electricity. Solar thermal power, however, is intermittent. To avoid this problem, natural gas is used to heat the water. Solar thermal systems should ideally be located in areas that receive a lot of sunshine all through the year.

Solar power is a good energy option in developing countries. With a third of the world's population still without electricity (mostly living in developing countries), the usage of solar panels will be increasing greatly as the demand for electricity spreads throughout the world. BPSolar, previously Solarex, is one of the first large companies to start catering to the need for electricity in developing areas. They have recently completed two $30 million projects, one in Philippines and another in Indonesia.

Examples of large-scale solar power applications are not limited to developing countries alone. For example, in Murcia, Spain, AstroSolar is planning to supply a Spanish power plant with 13 MW of solar cells. This Spanish power plant will be four times larger than any other PV plant and will cover an area the size of 57 soccer fields.

The Japanese are currently spending 10-20 times more than the U.S. to commercialize PV, hoping to install 4,600 MW of Solar power by 2010. The energy consumption in Japanese homes has doubled over the past 20 years by the growing demand for better amenities and is expected to increase at high annual rates of 4 to 5%.

A leading Japanese housing industry, Misawa Homes Co. Ltd., has completed its first photovoltaic (PV) low-energy house in Asahikawa, Hokkaido, the coldest place in Japan. Based on an original wooden

panel bonding method developed by Misawa, this two-storied house has a total floor area of 220.7 m^2 including the basement of 57.2 m^2, with advanced heat insulation and airtight properties for cold climates. This is further reinforced by outside insulation which is comprised of 80 mm glass wool boards, low-emissive double glazing which encloses argon between panes of low-emissive glass, and other measures for heat insulation and air-tightness. In order to mitigate the increased heat gain from the outside during the summer, features like deep overhanging roof edges, a balcony, and windows with awnings were added. In order to provide a comfortable indoor climate, heating and cooling by the natural convection of air circulating through open gaps in the ceilings and stairwell has been facilitated. All these measures result in a highly energy efficient house with high standards of comfort and reduced energy consumption. Its 12.5 kwp PV system of solar cell roof panels and the solar hot water system with a 5-m² collector can produce enough energy to meet the annual energy consumption. From February 1997, the zero-energy house has been occupied by a family of four and is still being monitored.

This house is already on the market. Increasing their target to include "zero-loads on environment" Misawa has started the development of "zero energy" houses, which produce as much energy as they consume. This initiative has resulted in the reduction of energy consumption to 1/5 of the equivalent consumption in ordinary houses in Asahikawa, and has also met the demand of its consumers by providing then with better amenities. Not only did the energy produced by these houses fully meet the consumption needs, but also the surplus in sales of PV power helped earn 150,000 Yen of net income.

Another company that has won recognition in the area of 'green buildings' is Johnson & Johnson. Based in New Jersey, this company manufactures healthcare products, serving consumer, pharmaceutical, diagnostics, and professional markets. It has taken a systematic approach to improving the energy efficiency of its buildings. All aspects of the buildings were taken into consideration – lighting, fans, motors, boilers, chillers, windows, and doors. Because of its efforts to increase energy efficiency, the company received the 1995 Green Lights Partner of the Year Award for large corporations, and the 1996 Sustained Excellence Award for completing and maintaining lighting upgrades for more than 94% of its workspace.

Fetzer Vineyards in Hopland (a partner in EPA's Climate Wise Program) California has committed to reduce its greenhouse gas emissions. As part of this commitment, Fetzer has adopted solar energy to meet a portion of its electricity needs. A 32-kilowatt photovoltaic array, generating approximately 62,000 kwh per year, supplies electricity to the company's administration building. Fetzer's photovoltaic project is the largest known solar project among all wineries in the world.

A national non-profit organization headquartered in Butte, The National Center for Appropriate

Technologies (NCAT), promotes sustainable technologies and community-based approaches that protect natural resources and assist people in becoming more self-reliant. The Montana Solar Initiative is said to be the cornerstone of NCAT's renewable energy project area. NCAT has successfully obtained a Million Solar Roofs planning grant for Montana from the U.S. Department of Energy. Through this, the NCAT and its partners wish to develop a statewide implementation plan to remove barriers and strengthen local demand for solar energy technologies. The plan will help encourage the installation of at least 1,000 solar energy systems in Montana by 2010. Montana has an abundant solar resource that can be used to save energy in residential and commercial construction, and farming, ranching, recreation and other industries. Using solar energy to supply a million homes with energy would reduce CO_2 emissions by 4.3 million tons per year, the equivalent of removing 850,000 cars from the road.

The Council for Advancement of People's Action and Rural Technology (CAPART) encouraged community initiatives to harness non-conventional sources and provide employment opportunities. It sanctioned the use of solar energy to electrify 30 non-formal night schools. A 10-kilowatt solar energy unit was installed in the new campus of Saskatchewan Waste Reduction Council (SWRC), for electrification. Two biogas units were installed to provide the requisite fuel energy. The residents of the campus, their families, the mess, the hospital and the offices have been provided with solar electricity through 350 tubelights. All the computers, the water-testing laboratory and the audio-visual studio have been provided with solar electricity. A solar deep well pump has been installed in the new campus to lift water from a well 150 ft deep. The libraries as well as training camps for puppet-making, traditional craft persons and night schools have been provided with lighting facilities through solar energy. The Solar Electronic Workshop that produces ancillary components for the solar power packs as well as testing instruments have been provided solar electricity. Wherever solar lighting units have been installed, rural youths from the poorer sections of society have been trained in Tilonia. The initiative plans to provide 400 families with adequate independent lighting systems over the next two years. They will train unemployed rural youth in the fabrication, installation, repair and maintenance of these systems.
They have already conducted training programs for people from countries like Tanzania, Costa Rica, Canada and Uruguay. This project was funded by the UNDP.

Governments are finding its modular, decentralized character ideal for filling the electric needs of the thousands of remote villages in their countries. It is much more practical than the extension of expensive power lines into remote areas, where people do not have the money to pay for conventional electricity.

There have been several initiatives by various countries to adopt solar energy. India is becoming one of the world's main producers of PV modules, with plans to power 100,000 villages and install solar-powered telephones in 500,000 villages. Mexico planned to have 60,000 villages electrified with solar power by 2000. Zaire's Hospital Bulape serves 50,000 outpatients per year and is run completely on solar power, from air conditioning to x-ray equipment. In addition, in Moroccan bazaars, carpets, tin ware, and solar panels lie side by side for sale. Probably the most outstanding example of a country's commitment to solar power is in Israel. In 1992, over half of all households (700,000) heated their water with solar energy systems. In addition, there are 50,000 new installations every year.

An assessment of alternative technologies confirms that solar energy alternatives to fossil fuels have the potential to meet a large portion of future energy needs, provided that countries are committed to the development and implementation of solar energy technologies and that energy conservation is practiced. Apart from this, as has already been mentioned earlier, there are several entrepreneurial and employment opportunities in the area of solar energy.

Center for Scientific Research (CSR), Auroville – A Case On Harnessing Solar Technology

Auroville township is in Pondicherry (India) and stands today as a modern day symbol to signify humanity's oneness & harmony with nature. The township has successfully realized a happy marriage of science & spirituality. The center for scientific research in Auroville was set up in 1981. In the area of renewable energy, solar energy is key focus. The CSR has successfully designed the solar kitchen/solar bowls that is a standing example of achievements possible from solar energy.
Solar Kitchen - The solar kitchen presently in operation in the Auroville Township is designed to provide meals for 1000 people per day. Sources in the CSR informed that there are presently only around 3-5 such solar kitchens in Asia. The mentionable ones include Kitchens in Mount Abu, Saibaba Ashram and Thirupathi (India). It is said that there has been very small-scale usage of solar energy in Asia for hospitals, marriage halls, ashrams etc.

The solar kitchen employs a gigantic parabolic shaped bowl (solar bowls). Solar bowls are concave (parabolic) bowls. This parabolic structure is 50 mts diameter with generation capacity of 76 kilowatts (at peak) with an investment of Rs.30 lakhs. These solar bowls have a concentrator arm in the center. This concentrator arm moves depending on season & movement of the sun. Thus, the "hot spot" (the point which will give maximum sun rays) is accessed every 5 minutes. This concentrated heat energy is used to heat up a working fluid. This fluid that heats up then enters a heat exchanger wherein the heat of the fluid is transferred to water, wherein the water is converted to steam.

Forms of Renewable Energy : Wind

Winds are created when various layers of the atmosphere absorb different amounts of heat and expand differently. For centuries, wind has been used to sail ships, grind grains, and pump water. Today's wind turbines have two or three blades that turn when the wind blows. However, the blades on wind turbines are much longer than the blades that one might see on windmills, and can be up to 82 feet long. The longer the blades and the faster the wind speed, the more the electricity that the turbine generates. To produce the maximum electricity possible, wind turbines need to be located in areas where the wind blows at a constant speed. Large groups of wind turbines, called wind farms or wind plants, are connected to electric utility power lines and provide electricity to many people. An advantage of wind turbines over some other forms of renewable energy is that they produce electricity whenever the wind blows (at night and also during the day). However, even in the windiest of places, the wind does not blow all the time. Therefore, small wind systems need back up batteries. Hillsides, hill tops and open places are the best locations to set up wind turbines.

Germany, USA, Spain, Denmark, and India are among the world's leading nations in the acquisition of wind energy. Navarro, Spain utilizes wind power to generate 23% of its electricity needs. Denmark now generates 8 percent of its electricity from wind power. The *Worldwatch Institute* reported that wind generated energy is growing by leaps and bounds. According to *Worldwatch Institute Online*, the world added 2,100 megawatts of new wind energy generating capacity in 1998 alone, an all-time record, and 35% more than the wind power that was added in 1997. Wind power is now the world's fastest growing energy source and has become one of the most rapidly expanding industries, with sales of roughly $2 billion in 1998. Major offshore developments are likely in northern European waters in the early part of the next century. This will be the next major step for this technology and will result in a dramatic increase in decentralized electricity generation.

Offshore wind has the potential to deliver substantial quantities of energy at a price that is cheaper than most of the other renewable energies, as wind speeds are generally higher offshore than on land. Worldwide, wind energy capacity has expanded at an annual rate of 25.7% during the 1990s, with the total doubling every three years. The cost of production has been declining steadily as each doubling occurs and economies of scale are realized.

The Muppandal experience has proven beyond doubt that alternative technologies can not only deliver

the much-needed electricity but also provide employment to a large number of people and pave the way for economic prosperity. With an aggregate wind power capacity of 425 MW, Muppandal- Perungudi region near Kanyakumari in Tamil Nadu, South India, has the unique distinction of being one of the largest concentrations of wind turbines at a single location. This renewable source of energy has brought about Rs.2500 crores (approximately $500 million) of investment to this region. This region has never seen this kind of investment, nor has there ever been such a large employment opportunity for the youth. The developments in this region are a fine example of renewable energy having brought prosperity to an otherwise barren area. Wind power has proven to be an effective environment-friendly way of producing electricity, and a viable alternative to electricity generated by thermal, hydro and nuclear routes. Muppandal has added other dimensions to this, namely, the social thrust given by this energy source, and creation of wealth in a remote, backward region of the country. Wind power development has benefited landowners, who had no means to cultivate their otherwise barren land. Ample employment opportunities have been created for manufacture, operation and maintenance of wind turbines.

One environmental concern about wind power is bird mortality. Turbine blades normally spin at high speed and are difficult to see. Birds that drift into turbine blades are instantly killed. A proposed solution is painting the turbine blades in colors and patterns that visually emphasize their presence. Another solution would be to change or remove vegetation in that area.

Energy from the water in rivers and streams is known as hydropower, or hydroelectric power. Hydropower is among the most widely used forms of renewable energy in the world. It accounts for about 20% of worldwide electricity supply. The most common way in which a hydro-electric power plant works is the following: energy is released when water falls through a vertical distance (called "head", measured in meters) and this energy moves turbines which produce electricity. The magnitude of the electricity produced by a hydropower plant depends on the head and on the flow (the volume of water per unit of time, measured in cubic meters per second). The greater the head and the flow, the greater the amount of electricity that can be generated. One of the most common methods of generating hydropower is to dam a river to create a large reservoir of water. The water is then released from these reservoirs, and the flow causes the turbines to spin, thereby creating electricity.

In Brazil, hydropower produces more than 90% of the electricity. The Tucuruí dam is located on the Tocantins River, 300 kilometers south of the city of Belem. It is the largest dam built in a tropical rainforest and boasts of a reservoir that is the largest artificial lake created in this area. The purpose of the reservoir is mainly to generate hydropower. The recent completion of Brazil's North-South electricity transmission grid has not only given Amazon a good reason to exploit its hydro potential but this would also mean that Tucuruí power can be sold nationally and not just locally. The Tucuruí has the world's largest spillway discharge with a huge capacity of 110,000 m^3/s. It has a total generating capacity of 8,000 MW. The construction of this grid was an estimated US$5.5 billion.

China's physical situation with regard to water and energy development is somewhat unique providing water and energy services for over 1.2 billion citizens. In the process, it has built 45,000 large dams – almost half of the world's estimated dams. Built for flood management, irrigation power and water supplies, dams in China enjoy considerable political and institutional support. China has, however, had to face problems such as displacement of people and alterations in the flow of rivers more than any other society.

Residents of a remote fishing community in the city of King Cove, Alaska, live faraway from the nearest utility grid. In December 1994, after years of studies and planning, a run-of-the-river hydroelectric facility was started to meet King Cove's power needs. The 800 KW plant exploits the abundant precipitation and glacier melting in the area. Funded by a loan, as well as state and federal grants, the plant will provide electricity to residents for the next 30 to 40 years. King Cove is a demonstration of

clean energy production for other remote Alaskan communities and for those with sustainable water resources. This initiative opened up employment opportunities to those who live in King Cove in the areas of maintenance and distribution of electricity.

However, the drawback to hydropower is that damming rivers can change the ecology of the region. For example, it could result in changing natural river flows, degrading the water quality, blocking seasonal fish migration, impacting fisheries, flooding large areas of land, and affecting plants that grow along the river banks.

Although hydropower currently provides about one fifth of the world's electricity supply, development of the world's remaining technical potential could, by no means, cover the growth in future demand. However, carefully planned hydropower development can, and does, make a great contribution to improving electrical system reliability and stability throughout the world. In addition, future development will play an important role in the improvement of living standards in the developing world, where the greatest hydropower potential still exists. This development, together with the existing installed hydropower capacity (some 700 GW), will make a substantial contribution to the avoidance of greenhouse gas emissions and related climate change issues.

Ocean energy draws on the energy of ocean waves, tides or on the thermal energy stored in the oceans. Oceans cover more than two thirds of the Earth's surface, and are thus the world's largest solar collectors. The heat from the sun warms the surface of the water more than it warms the waters in the deep ocean. This temperature difference between the surface water and the deep ocean water creates thermal energy, which can be used for many applications including electricity generation.

The total power of waves breaking on the world's coastlines is estimated to be two to three million megawatts. The Wave Energy Converter (WEC) to be installed off the coast of Portland, Victoria will be the first commercial offshore wave power generator in the world to provide publicly available power. The system, developed by Ocean Power technologies (OPT) is known as the Power Buoy and is able to harness wave energy by using a piston like device. A computerized system housed in a watertight canister at the top of the buoy allows uniform power to be derived from the random motion of ocean waves. The power is then carried via underwater cables to the shore. The project aims to demonstrate the potential for wave energy in Australia. Each buoy generates on an average, 20 KWs of electricity, or enough to power 25 households. The system's minimal visual and noise impacts are one of its major advantages.

Since this form of energy is available on 70% of the earth's area, more research is necessary to exploit and use it in the process of sustainable development. As the main source of energy from the oceans is through the sun's rays, ocean energy systems offer certain advantages. They have no fuel costs, and do not release greenhouse gases into the atmosphere, unlike coal, oil and natural gas. However, the technologies for tapping ocean energy are very expensive with high initial costs and so have not been implemented on a large scale worldwide.

Bioenergy is the energy from biomass or organic matter such as wood. Biomass has been used for thousands of years, right from the time people started burning wood to cook food or to keep warm. Even though wood, in various forms, is still the largest biomass resource for bioenergy, there are now other sources such as agricultural residues, plants, and waste materials. Even though the use of bioenergy generates as much carbon dioxide as fossil fuels, each new plant that grows removes carbon dioxide removed from the atmosphere, thereby maintaining an ecological balance, with net emissions being close to zero if new plants are grown each time an old one is burnt. To increase agricultural profits while at the same time maintain environmental balances, fast growing trees and grasses can be planted. These plants are called bioenergy feedstocks.

The following are considered bioenergy applications:

- Bio-chemicals: Converting biomass into chemicals to generate electricity.
- Bio-fuels: Converting biomass into liquid fuels for transportation
- Direct Power: Burning biomass directly, or converting it into a gaseous fuel to generate electricity

The Intermediate Technology Development Group (ITDG) in Europe was formed with a view to contribute towards creating a more sustainable world. Providing eco-friendly options such as micro-hydro, biogas, solar and wind power in order to improve the living standards of backward villages is ITDG's main work. The biogas unit is capable of providing sufficient gas to provide thermal electricity to the households for about 4-5 months and is estimated to cost Rs.1.5 million (approximately $32,000). The digestor is capable of containing up to 10 tons of straw, which is roughly the amount collected from 10 acres of paddy land. The sludge left behind in the digestor is as good as any conventional compost and can be easily used as organic manure. The Funding sources for this project were the European Community, Japan's TFSR, Britain's DFID and Netherlands's HIVOS.

Cuéllar is a small town with a population of 9,200, on the north of the province of Segovia bordering with the province of Valladolid, with a great biomass source. The District Heating Plant of Cuéllar allows the use of forest residues as well as other types of forest biomass as fuels for a thermal power plant in which water is heated and distributed to the users through a network consisting of double insulated pipes. This District Heating (DH) system supplies energy directly to the consumer, avoiding the need to manipulate and store fuels.

The project starts from a preliminary case study carried out in several municipalities of Spain with enough forest biomass sources and municipalities with enough heat consumption. The participation of the residents was immediate once the project was defined in its basic elements. This was done through regular meetings with the presidents of owners associations, who were given extensive oral and written information, and then through open plenary sessions in the town hall. Every representative explained it to his neighbors and at the end of the process, each community decided whether they would participate in the project or not. The City Council guaranteed from the beginning that it would participate with its public buildings: the school, sports center and cultural center. After a year in operation, the group tested the yield of the boiler in summer, winter, and the services of the different customers. They also tested different types of biomass, its yield and the best conditions for storage in order to optimize the operation of the plant. The results have proved that enough energy is generated to supply to all the customers and that there is still some residual energy. The temperature in the buildings has been higher than in previous years because they have increased utilization hours. The benefits of this project were in terms of decreasing the use of imported fossil fuels, the use and revalorization of renewable and autochthonous residue, and the creation of new employment opportunities.

Development Alternatives (DA), established in 1983 with its headquarters based in New Delhi, India, is a Non-Government Organization (NGO) that believes in creating large-scale sustainable livelihoods, which will ultimately lead to a poverty free India. The mission of the Development Alternatives Group is to promote sustainable national development, using environmentally sound practices and technologies. The activities of Development Alternatives cover a broad array of development issues, related to promoting environmentally sustainable approaches in all possible fields – local, rural, urban, national, and global.

The DA Group is dedicated to bringing about a better balance among the basic prerequisites of sustainable development: social equity, environmental quality and economic efficiency. One of their projects has been the setting up of a biomass power plant at TARAGram in Orchha, Madhya Pradesh. A careful site analysis and feasibility report was prepared for the Orchha plant. The primary purpose was to assess the potential demand for electricity in the neighborhood, and the availability of renewable fuels. To do this, the studies investigated possible clients, number of diesel generators currently in use, purchasing power of households for lighting and appliances, and the existence of alternative sources of power – including the grid. For availability of biomass fuels, surveys were conducted of the availability and calorific value of local agrowastes, industrial wastes, common weeds.

This biomass plant converts renewable biomass fuels (including mainly local agro wastes and unusable weeds) into 100kW of electricity using a highly efficient gasifier and diesel generating system. The available biomass, ipomea and Lantana are converted to charcoal through pyrolysis in village-based units. This charcoal is reprocessed at TARAGram into briquette fuel, engineered for various end-uses such as cooking, boiler and industrial applications.

The eco-jobs that this can create include biofuel energy mechanics, bio-gas energy mechanics, bio-plant architects & designers, energy specialists, renewable energy mechanics.

Forms of Renewable Energy : Geothermal

Geothermal energy, ("geo" for earth and "thermal" for heat) is energy that comes directly from the heat in the earth. Geothermal energy starts with hot, molten rock (called magma) miles below the earth's surface that heats a section of the earth's crust. The heat rising from the magma warms underground pools of water know as 'geothermal reservoirs'. Sometimes, the water can even boil to produce steam. If there is an opening through the rock to the surface, the hot underground water may seep out to form hot springs, or it may boil to form geysers. One such geyser is Old Faithful in Yellow Stone National Park. Geothermal energy is used to produce electricity. The steam is piped to the power plant where it rotates a turbine that generates electricity. Another source of geothermal power is 'The geysers' geothermal field in Northern California. This power plant is the largest source of geothermal energy in the world and produces as much power as two large coal or nuclear power plants!

Kokonoe-machi (Kokonoe town) in Oita, Kyushu, Japan has the largest geothermal power generation in Japan, having three geothermal power stations with a total output of 147.5 kW. They include the Otake power station of 12.5 MW built in 1967, the Hacchobaru power station with a No.1 unit of 55 MW built in 1977, a No.2 unit of 55 MW built in 1990, and the Takigami power station of 25 MW built in 1996. The Hacchobaru station, the biggest in Japan with a total capacity of 110 MW, has increased its output by 20% by employing a double-flash system, the first anywhere in the world. After separating steam and water, this system then generates secondary, low-pressure steam in flashers to supplement the primary, high-pressure steam for power generation.

The geothermal hot water is used to provide heat for the Sensui Rose Greenhouse, parks and many other greenhouses growing flowers and vegetables, to supply hot water for bathing, space heating and domestic hot water to 120 ordinary residences and nearly 60 lodgings, rest homes, health centres and meeting rooms. The Kokonoe Bio Center uses hot water supplied from the Otake Station to produce virus-free seeds and seedlings for farmers in the town. The annual heating load for the greenhouses with a total surface area of 39,953 m2 amounts to 30,170 GJ. Hence, the use of geothermal energy saves 884 kilolitres/year of fuel oil (heating value: 42,700 kJ). The Japanese Government has funded this entire initiative. The Eco-jobs that this can create include geothermal geologists, energy specialists, and renewable energy mechanics.

While geothermal energy is a good source of electricity, it may become unusable without proper management and preservation efforts. In addition, water from geothermal reservoirs often contains minerals that are corrosive and polluting.

Municipal solid waste has the potential to be a large energy source. In addition, it mitigates the problem of waste disposal especially in countries where there is not enough landfill space to dump the waste. This municipal solid waste can be burnt in large power plants to generate electric power. Municipal waste-to-energy plants currently generate about 2500 megawatts of electricity. There is also another way to trap the energy in garbage. When food scraps and wastes decay, methane, a greenhouse gas with 22 times the global warming potential of carbon dioxide is produced. It can be collected, cleaned and burnt to produce steam in a boiler or power generators to produce electricity.

In 1993, the Environmental Protection Agency estimated that the United States generated 207 million tons (118 million metric tons) of trash. Out of all that trash, however, only 32 million tons (29 million metric tons) were converted to energy.

The Vita Company of Wezep, The Netherlands, produces vacuum-packed peeled potatoes. The process generates about 700m^3/day of wastewater, which has to be cleaned before being discharged into the sewer. The water treatment unit incorporates an anaerobic digestion stage producing biogas. (Anaerobic digestion refers to the process of turning waste into soil conditioner using the process of biodegradation without oxygen, as opposed to aerobic digestion, which uses oxygen.)

Originally, the biogas produced was simply burned. In this project, a new biogas-fired three-phase fir-tube steam boiler has been installed next to an existing natural gas fire boiler. The steam generated by this new boiler is fed to the existing steam grid. Results from this project are of interest to the foodstuff industry in general as well as to other companies where polluted water is subject to anaerobic treatment. The aim of this project is to use biogas generated as a by-product of waste treatment, to generate energy in an environmental friendly way. The project saved the use of 325,000 m^3 of natural gas and reduced CO_2 emissions by 575,000 kg/year.

The Eco-jobs that this can create include: biogas energy mechanic, bio-plant mason, plant architects & designers, toxicologists, environmental planners, energy specialists, and renewable energy mechanics.

As with burning any type of fuel, municipal wastes can produce air pollution when they are burned and turned into energy. However, they produce a less harmful effect when burned (producing carbon dioxide) rather than if methane was allowed to escape freely into the atmosphere, since the global warming potential of methane is 22 times that of carbon dioxide.

Policies and programs of sustainable development were initiated in various countries by national and international organizations following the United Nations Conference on the Human Environment, held in Stockholm in 1972.

The efforts were intensified after the historic Agenda 21 (action plan for the 21st century) was adopted as the blueprint for sustainable development at the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil, in 1992. Sustainable energy development has been at the core of many of these programs, as energy production and consumption activities are closely linked with the issues of sustainable development. Hence, there is a need for sustainable energy development programs to be designed in economically and ecologically sound ways.

M.S.Swaminathan Research Foundation (MSSRF) – MSSRF is an organization whose mission is to create environmentally sustainable development and opportunities for employment. Established in 1988, it is a non-profit trust committed to harnessing science and technology for environmentally sustainable and socially equitable development. It is their belief that if energy so far has been a major cause of ecological damage, it can be a leader in finding methods that ensure that development is sustainable. Technologies rooted in the principles of ecology, economics and equity are now referred to as *ecotechnologies*. The MSSRF at Madras is the coordinating center for the Asian Ecotechnology Network. The network aims at creating *ecojobs*- jobs that are economically viable, environmentally benign and socially equitable. It recognizes the main cause for the proliferation of urban slums, as the lack of livelihood opportunities in rural areas and environmental refugees as the products of damaged common property resources in villages.

According to the MSSRF, their 'bio-village' program addresses three key areas – preventing resource degradation, improvement of crops and animal productivity, and the alleviation of poverty. The 'bio-village program' is in progress in villages in the Pondicherry area of India and places equal emphasis on off-farm livelihood opportunities and on-farm jobs. It regards the poor as producers and innovators and helps to build their assets through value addition to time and labor. The basic approach is on asset building and sustainable human development leading to the growth of entrepreneurship. Because of the market driven nature of the enterprises, which are chosen based on the marketing opportunities, the economic viability of the 'bio-village' approach is assured. Bio-villages around biosphere reserves would help in providing alternative sources of meeting the day-to-day needs for food, fuel, fodder and other

commodities of the families living near areas rich in bio diversity.

The African Rural Energy Enterprise Development (AREED) seeks to develop new sustainable energy enterprises that use clean, efficient and renewable energy technologies to meet the energy needs of under-served populations, thereby reducing the environmental and health hazards of existing energy use patterns. The AREED approach offers rural energy entrepreneurs a combination of enterprise development services and start-up financing. This integrated financial and technical support allows companies to plan and structure their concerns in a manner that prepares them for growth and makes eventual investments by mainstream financial partners less risky.

AREED provides training and tools to help entrepreneurs start and develop energy businesses, and provides support in areas such as business planning, structuring and financing, seed capital for early stage enterprise development and partnerships with banks and NGOs involved in rural energy development. The AREED initiative has now begun operations in Senegal, Mali, Ghana, Botswana, Zambia and Tanzania. The United Nations Environment Program's (UNEP) partners in AREED include E&Co and the UNEP Collaborating Center on Energy and the Environment (UCCEE). The United Nations Foundation finances the projects.

AREED provides early-stage funding and enterprise development services to entrepreneurs, helping build successful businesses that supply clean energy technologies to rural African customers. Services include training, hands-on business development assistance and, for promising enterprises, early-stage investment and assistance in securing financing. The AREED initiative also works to broaden the skills of organizations involved in the energy and investment sectors to nurture energy entrepreneurs. AREED works with African NGOs and development organizations on clean energy enterprise development. This helps prepare them to identify potential energy projects and to provide follow-up business support services to entrepreneurs. Resource tools that focus on business planning, management structuring and financial planning for the rural energy sector are also developed and disseminated.
This institutional support structure creates & nurtures entrepreneurial drive in youth in the arena of renewable energy sector.

Indian Renewable Energy Development Agency (IREDA) is a Public Limited Government Company established in 1987, under the administrative control of Ministry of Non-Conventional Energy Sources (MNES) to promote, develop and extend financial assistance for renewable energy and energy efficiency/conservation projects. The motto of IREDA is "Energy For Ever". India is the only country in the world that has a Ministry exclusively for renewable energy. The Ministry is finalizing a Renewable Energy Policy Statement that will focus on policy interventions and the creation of a conducive environment to accelerate diffusion of renewable energy in the country.

The mission of IREDA is - "Be a pioneering, participant friendly and competitive institution for financing and promoting self-sustaining investment in energy generation from renewable sources and energy efficiency for sustainable development." The objective of IREDA is to operate a revolving fund for promotion, development and commercialization of New and Renewable Sources of Energy (NRSE), assist in the upgradation of technologies and extend financial support to Energy Efficiency & Conservation projects and schemes**.**

Renewable Energy Policy Project (REPP) of CREST: This is yet another effort in the area of sustainable development. Many states are considering Renewable Energy Standards or other legislative changes for the energy and environmental benefits they offer. Yet, it is has been seen that policy debates on renewable energy go beyond energy and environmental issues to include economic impacts with particular focus on job creation. REPP is undertaking a major effort to determine the job creation potential of Renewable Energy Standards and other initiatives. REPP's initial work has already been used by the Nevada AFL-CIO to support a strong RPS in Neveda and REPP hopes to expand the analytical effort and offer the model to unions, economic development programmes and renewable advocates in other states.

The Home Employment and Lighting Program (HELP): HELP is a multi-faceted program that incorporates the dissemination of renewable energy technologies with the creation of income-generating opportunities. HELP assists villagers set up and run income generating activities such as weaving and painting to maximize the benefits of extended evening hours made possible by renewable energy lighting systems. It acts as a link between these producers and the international market enabling the workers to find a market for their products. The villagers can repay the cost of the solar lighting system with handicraft items made in their home. They have started communications with organizations with experience in skill training, as well as those involved with village level handicraft production. They are

also using the Internet to find international markets for these environmentally friendly products. Local NGOs play a very important role in this project and they hope to connect with organizations, which could become a partner in implementing the project once the feasibility study is completed.

Grameen Shakti (Bangladesh) - Grameen Shakti (GS) is a not-for-profit rural power company whose purpose is to supply renewable energy to those villages in Bangladesh that have no supply of electricity. GS expects not only to supply renewable energy services, but also to create employment and income-generating opportunities in rural Bangladesh. GS will focus on supply, marketing, sales, testing and development of renewable energy systems such as solar PV, biogas and wind turbines. Grameen Shakti started its solar demonstration project in April 1996 by installing 26 solar household systems in selected villages in Bangladesh. More have been installed since then. In addition, two experimental wind turbines have been installed and an integrated bio-digested pilot project has been launched.

GS aims to

- Provide renewable energy to rural households with no supply of power;
- Market solar, biogas and wind energy on a commercial basis, focusing on rural areas, particularly the borrowers of Grameen Bank;
- Provide services that alleviate poverty and protect the environment through applied research and development of renewable energy-based technologies
- Undertake a project to progressively manufacture and market efficient and affordable household-based photovoltaic systems
- Implement projects to generate electricity from wind in the coastal areas and off-shore islands and operate small hydroelectric plants in the hilly area of Bangladesh;
- Develop and implement special credit, savings, and investment programs for generation, storage and utilization of renewable energy for the benefit of the rural people;
- To provide capital, technology and management services to renewable energy ventures.

The Eco-jobs that this can create include manufacturer & marketer solar PV, biogas systems & accessories and wind turbines, solar energy mechanic /energy specialists, wind meteorologists, wind turbine engineers

The Youth and Energy in the Americas (YEA) – The YEA Renewable Energy Training Program is being undertaken by the Young Americas Business Trust (YABT), affiliated to the Organization of American States Unit for Social Development and Education, and the Renewable Energy in the Americas

Initiative (REIA) of the Unit for Sustainable Development and Environment. This was in response to the rapidly increasing external debt, high levels of poverty, and critical environmental problems faced by the member states. This initiative is intended to introduce young people from Latin America and the Caribbean to sustainable energy technologies through an intensive orientation seminar and internship program. Through this, the youth will gain valuable experience in a rapidly growing field, develop skills that will lead them to successful careers, and encourage environmentally sound development of the energy sector throughout the region.

Renewable energy is especially useful in addressing the critical issue of providing electricity for the neglected rural population (huge sections of the rural populations in Latin America and the Caribbean are without access to the electrical grid). Sound energy policies and technologies benefit the provider, the consumer, as well as the environment. The YEA Program offers youth training and skills in this field, which serves to promote the industry and develop a proficient workforce.

There are abundant signs that global environmental problems can be more easily mitigated than before if the private sector gets involved, given its vast technical, managerial and financial resources. At the same time, the environment allows increasing opportunities for business investments that are not only profitable but also provide significant environmental benefits. The private sector's perspective is shifting as the long-term cost savings of environment-friendly processes become clear, and as consumers demand environmental products and services which result in global benefits, such as independently certified tropical wood, energy efficiency products, ecotourism and recycled products. At the moment, however, businesses engaged in supplying environmental goods or services often face a number of daunting market barriers, particularly in developing countries. They often find it difficult to obtain financing, as many would-be investors are deterred by their small size, unproven technology, high project development or start-up costs and transactions risks. They lack access to credit at reasonable interest rates, and face subsidized prices for competing products or raw materials, and institutional or structural hurdles. Energy pricing and fossil fuel subsidies, for instance, may prevent the private sector from investing in companies marketing renewables.

The challenge now is to align private sector incentives with public sector objectives to encourage the private sector to participate more actively in environmental investments. Finance is one of the crucial means through which projects can get moving smoothly. Some big players in the field of renewable energy have been identified.

The World Bank: The World Bank, along with key bilateral donors, established the Asia Alternative Energy Program (ASTAE) in January 1992, as a follow up to Project FINESSE (Financing Energy Services for Small-Scale Energy Users). ASTAE's mission is to mainstream alternative energy (renewable energy and energy efficiency) services in all Bank sectors, with priority emphasis on the Asia region.

To support this goal, ASTAE works with both Bank staff and client country decision-makers to incorporate alternative energy options into the design of energy sector strategies and lending operations for the Bank's client countries in Asia. Since its inception, ASTAE has generated substantial momentum, increasing the lending portfolio for alternative energy projects in Asia from about US$2.0 million in 1992 to over US$1.3 billion (1993-94). ASTAE offers assistance in the identification and preparation of renewable energy and energy efficiency/demand-side management (DSM) projects for World Bank/Global Environment Facility (GEF)-supported operations in Asia. ASTAE's strategy also includes

technical assistance to improve local technical expertise, system performance and institutional capability to design and implement alternative energy investment programs. Such activities have included offering training modules in energy efficiency and renewable energy options, formulation of alternative energy policies, assistance in the design and implementation of pilot innovative delivery mechanisms, provision of technical support to improve the performance and availability of alternative energy systems; and the strengthening of institutional capacities.

In addition, ASTAE collaborates with numerous donor agencies and has mobilized funding for critical technical assistance in support of its work program. ASTAE will work to ensure that its current project portfolio is successfully implemented and will seek to broaden penetration of alternative energy services into other sectors that contribute to meeting the Bank's environmental and poverty alleviation objectives.

The Official Development Assistance (ODA): This is yet another important player in financing sustainable development. It has been seen that, even substantially increased ODA flows would be insufficient to meet the tremendous needs. Other sources of resources must be sought.

Developing countries can generate some of the resources they need for sustainable development if the private sector, governments, donor agencies, and local communities contribute to this effort. Developing countries can take action on two overlapping and closely related fronts to generate additional resources to complement ODA flows:

- Attracting private sector resources. Throughout the world, the private sector is playing an increasingly important role. Yet, its contribution to sustainable development remains small and uneven. The challenge is to attract more of these private resources to developing countries, and to channel it to activities supporting sustainable development efforts.
- Generating public sector resources. The governments of developing countries already expend significant amounts of resources on a variety of activities. However, the evidence suggests that there is sometimes substantial scope for them to generate additional resources and – perhaps more importantly – to free substantial amounts of funds that have been allotted for conventional energy projects.

The Global Environment Facility (GEF) : GEF helps developing countries fund sustainable development projects that also protect the global environment. Established in 1991, GEF is the designated financial mechanism for international agreements on biodiversity, climate change, and persistent organic pollutants. GEF also supports projects that combat desertification and protect international waters and the ozone layer.

A lack of funding is one of the key obstacles in the promotion of renewable energy technologies, especially for those technologies that have not been tried and tested before. However, the trends are encouraging and nowadays there are increasing levels of investment for renewable energy projects.

The various renewable energy technologies available are not uniformly mature or cost effective. However, most forms of renewable energy still have a significant way to go before they become competitive with fossil fuel technologies, especially for power generation. This requires intensive R&D efforts. Unsuccessful attempts in the integration of social and environmental considerations into the economic decision making process can be identified as one of the main reasons for the unsatisfactory outcome of sustainable development efforts. Issues such as poverty alleviation and equity should be addressed in the light of energy and environmental factors.

The emphasis that is being placed on renewable energy worldwide requires a substantial devotion of financial and human resources. The increasing role of renewable energy forms the policy goal of several countries. However, at present many renewables are in a classic chicken and egg situation - financiers and manufacturers are reluctant to invest the capital needed to reduce costs when demand is low and uncertain, but demand stays low because potential economies of scale cannot be realized at low levels of production.

Action is required in key areas, which, depending on the energy sources and the needs of the country in question, can pave the way for substantial contribution to the world energy supply. An apparent mismatch has been identified between the importance of renewables in the international energy and environmental scene and the resources currently being exploited for their deployment and development. Here, the government needs to step in. Producing and delivering energy to the consumer involves environmental costs and energy prices should reflect them in a better way. Investments in new energy supply plants and the necessary infrastructure should be optimized from both economic and environmental stand points. Greater investment in research, development and demonstration should aim at bringing down the costs of renewable energy technologies. Attracting private investment in renewable energy, in both developed and developing countries requires initiatives such as guaranteed initial markets for the output of renewable energy. Raising public's awareness of renewables should be high priority. International funding bodies, public and private organizations, and development assistant agencies should engage themselves in the activity of promoting international cooperation.

The energy business is poised to become a service industry. It must be well equipped to respond to the diverse service needs of households and enterprises. In order to promote competition and entrepreneurial risk-taking, governments should set up legal and regulatory environments, and ensure transparency,

accountability, and access to information that will help in the process of decision-making.

A special status should be accorded to renewable energy, since it is environmentally friendly. It is possible to reduce the environmental impacts of conventional energy use by promoting renewable energy. In addition, renewable energy sources save foreign exchange since they are domestically available. Since this is a fast growing industry, it opens up opportunities for export industries as well. Thus, giving preferential treatment to renewable energy and energy efficiency projects would promote sustainable development by maximizing environmental and social benefits like reducing air pollution and creating new jobs.

The Implementation of Renewable Energy Projects in developing countries delivers clear benefits for energy efficient technologies. The ability to meet the needs of the consumers, the availability of maintenance and service spare parts, the participation of financing agencies and local stake holders, the ability to retain skilled personnel, and demonstrated cost recovery have been identified as some of the driving principles in the implementation process of these sustainable energy projects.

In the case of most of the less developed or developing countries, the technical-know-how is invariably transferred from the experienced developed countries. The transfer of technologies should meet three basic criteria: the presence of locally appropriate technologies and processes, they must reflect the best practices at the time of the project in order to avoid the dumping of obsolete ones and of course, they should be very low emitters of greenhouse gases.

The identification of the role-players and stakeholders in the local renewable energy sector is a prerequisite for the successful implementation of local to global renewable programs. First is the government, which must provide a policy framework and offer various incentives and measures to promote renewable energy technologies. Then there is the renewable energy manufacturing industry and the renewable energy service industries, including distributors, retailers, installers and consultants. Traditional energy companies can also be identified as potential vehicles of development. Trade union organizations, environmental NGOs, and consumers who need energy services can drive market forces.

Presented below is the example of the Indian Renewable Energy Programme, which has encountered some, or most of these issues raised above and how it has sought to address them.

The IREP Case Example

In India, significant efforts have been made towards the design, development, field demonstration and

large-scale use of a number of renewable energy products and systems. The Indian Renewable Energy Programme (IREP) is today among the world's largest programmes for renewable energy.

Among the rural energy programmes, large-scale use of biogas plants and improved cook stoves (commonly known as "chulhas") is promoted as part of the National Program. Over 3 million biogas plants and nearly 31 million improved cook stoves have been installed. These rural energy programs effectively save about 22 million tons of fuel wood every year and help in creating significant employment opportunities in rural areas.

In the area of solar energy utilization, solar photovoltaic and solar thermal technologies are finding ready acceptance for a variety of industrial and commercial applications, as well as in rural areas without electricity. More than 700,000 PV systems aggregating to 57 MW and covering over 30 different applications have been deployed. Solar lanterns and home lighting systems are now being used in nearly 390,000 homes and are contributing to substantial savings of kerosene. About 190,000 rural radiotelephones are also being powered by solar energy. About 500,000 square meters of solar collector area has so far been installed for solar water heating systems in domestic and industrial sectors.

More than 1600 MW capacity of grid power is now based on renewable energy sources. Major achievements have been made in wind electric generation with 1170 MW installed capacity. 217 MW capacity is set up through small hydropower and another 222 MW capacity through biomass power

A 140 MW Integrated Solar Combined Cycle Power Project, to be set up at Mathania near Jodhpur in Rajasthan has recently been approved by the Government. It will have a 35 MW solar thermal power component based on parabolic trough collectors, and a 105 MW combined cycle component using gas turbines and naphtha as fuel.

To encourage power generation from renewable energy, 14 States have so far announced policies to provide arrangements for wheeling, banking, third party sale and buy back of power for non-conventional energy based power generation. In line with those policies, the State Electricity Boards enter into remunerative Power Purchase Agreements for renewable energy projects.

The spread of various renewable energy technologies has been aided by a variety of fiscal and other support measures. The policy is clearly directed towards a greater thrust on overall development and promotion of renewable energy technologies and applications. The recent policy measures provide excellent opportunities for increased investment in this sector, technology upgradation, induction of new technologies, market development and export promotion. Indian Renewable Energy Development

Agency (IREDA), the corporate financing arm of the Ministry for Non Conventional Energy Sources, is the only agency of its kind in the world dedicated to financing of renewable energy projects. Interest rates vary from 0% to 15%, with special concessions being offered for projects in the Northeast, hilly areas, islands, and desert areas, and for special categories of borrowers.

The institutional structure for Research & Development is being strengthened. The Centre for Wind Energy Technology has recently been established in Chennai. A Wind Turbine Test Station is being set up as an integral part of this Centre to undertake standardization, testing and certification of wind turbines. A National Institute of Renewable Energy is being established by the Ministry near Jalandhar in Punjab as an apex autonomous institution to support R&D, human resource development, training and commercialization activities.

The Ministry is finalizing a Renewable Energy Policy Statement that will focus on policy interventions and creation of a conducive environment to accelerate diffusion of renewable energy in the country and set a goal for power generation from renewables in the energy sector.

Conclusion

The current global scenario warrants immediate and effective action. The need for a co-ordination of activities to ensure a simultaneous approach to youth employment and environmental sustainability cannot be overstated. The links between protecting the global environment while providing employment opportunities to the youth is critical in promoting sustainable development in the twenty-first century. Youth must be trained in the development of renewable energy businesses. Energy needs are among the most basic needs of rural communities and the availability of adequate energy can act as the driving force behind the transition from a developing economy to a developed one. Renewable energy is today one of the most promising options for combining the goals of youth employment and sustainable development. Youth involvement in renewable energy will provide rural communities with significant benefits. Youth in particular will benefit by the income generating opportunities and the social benefits that they will bring to their communities. The economic benefits will improve the standard of living of the entire community.

The enormous potential of renewable sources can meet the world energy demand several times over. Globally, the potential that exists in renewable sources can contribute to long-term sustainability, while it can also be harnessed effectively to create new employment opportunities. The renewable energy industry is in its nascency. Companies, in the long run, can benefit from the momentum of an early start. Enormous market potential in the field of renewable energies is a reality. For the unemployed youth, that means jobs, careers and business opportunities.

Renewable energy is not without its risks, some of them being that the markets for renewable energy systems may not develop sufficiently to permit the economies of scale to bring down costs relative to competitive fuel systems. Also, there might be a potential lack of future government involvement, and this could impede the adoption of renewable energy technologies by many developing countries. However, nowadays information of this type is dispersed among a variety of sectors, private and public companies, development assistance agencies, non-governmental organizations, and academia throughout the world. Thus the scope for successful implementation of renewable energy projects is very huge. This information is increasingly available via the Internet, where major knowledge resources are hosted, and in large institutions around the world. However, this information must be identified, analyzed and provided in a user-friendly format, which YES is working towards.

For renewable energy to be a viable and sustainable option for developing countries for youth

employment as well as environmental conservation, there needs to be increased and committed efforts in three broad areas. Firstly there needs to be an increased investment in building awareness among youth and old. They need to have knowledge about the potential of renewable energy and how it could not only help them improve their standard of living, but also protect the environment. For this to occur, there is a need to build media awareness and to disseminate knowledge to a wide audience, through a variety of media, i.e. web sites, newsletters, and workshops. Secondly, there is a need to engage in multi-stakeholder dialogues. The central question here is how eco-entrepreneurship and eco-employment can be launched in a sustainable manner. To address this, it is necessary to build knowledge resources and compile lessons learned in applying youth entrepreneurship and involvement for renewable energy enterprises. Thirdly, there is a need to train the local youth so that they can make the most of their natural resources to harness new forms of energy.

The Youth Employment Summit (YES) has undertaken a wide range of activities in all these areas and is actively striving towards the promotion of youth employment. The short-term goal of YES is to bring about large-scale youth employment through sustainable methods that can keep getting replicated over time. YES aims to launch a decade campaign of action in 2002 so that an additional 500 million young adults, especially youth facing poverty, will have productive and sustainable livelihoods by the year 2012. However, the long-term goal of YES is to bring about a world where all the youth are emancipated and productively engaged in sustainable activities, with poverty slowly but steadily getting eliminated. A world free of youth unemployment is a step towards a world free of poverty, which is the ultimate goal of YES.

ANNEXURE

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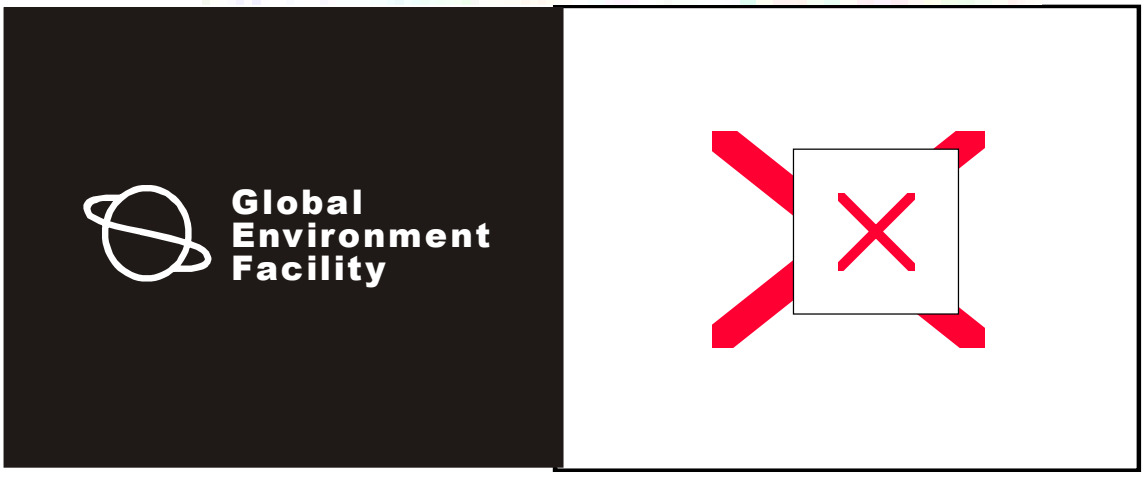
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