Summary of "Renewable Energy in Central Asia: Enhancing Food Security and Improving Social and Economic Conditions in Remote Locations"

Introduction

There has been growing international attention towards the need to develop renewable energy resources and other forms of "green" technology in order to alleviate some of the negative effects of climate change as well as to prevent its exacerbation. Green technology can also serve as a major developmental spur. Throughout Central Asia, despite the regions' vast reserves of traditional energy, seasonal energy shortages are commonplace, making the implementation of renewable energy projects critical to addressing the region's developmental challenges as well as meeting environmental goals.

To the end of trying to facilitate this, on November 10-12th 2008, diplomats, scholars, government officials, and renewable energy experts from Central Asia and other nations gathered in Tashkent, Uzbekistan for an international seminar titled, "Renewable Energy in Central Asia: Enhancing Food Security and Improving Social and Economic Conditions in Remote Locations." The seminar was co-sponsored by the Carnegie Endowment for International Peace, Foundation of Regional Policy (Uzbekistan), and the Central Asia Regional Economic Cooperation Institute (ADB). The immediate goals of the seminar were to provide a forum for dialogue and interaction between Central Asian renewable energy experts. Additionally, it sought to discuss policy frameworks that could help to facilitate the introduction of renewable energy projects in the region. In this way, the seminar sought to take one small step towards alleviating some of the developmental challenges plaguing the region.

Introductory remarks at the conference highlighted the importance of hosting such a conference in Central Asia. Several participants remarked on the progress that Central Asian countries have been making towards increased use of renewable energy sources. U.S. Ambassador to Uzbekistan Richard Norland agreed, saying that Central Asian leadership on water and energy issues was clearly being witnessed. One participant underscored that one of the central aspects of this seminar being held in Central Asia is that this indicated that the Central Asian nations did indeed have greater engagement on these issues. The representative from the Foundation of Regional Policy (Uzbekistan) emphasized the fact that holding a conference specifically in Uzbekistan fit well with government priorities, as the Uzbek government had recently passed numerous environmental and renewable energy laws.

A keynote address from Kori Udovički, UN Assistant Secretary-General, UNDP Assistant Administrator and Regional Director for Europe and the CIS, touched upon the crucial interconnection between the three areas vital to Central Asia's present and future-water, energy, and food security. She explained that in Tajikistan and Kyrgyzstan 90 percent of all electricity generated comes from hydropower. Alarmingly though, water levels have been significantly decreasing in recent years. For instance, water levels in hydropower stations and reservoirs in the Aral basin are at unprecedentedly low levels and the Toktogul and Nurek hydropower stations may see a drop to dead water levels

even before this winter is over. This means that millions of people could potentially lose heat and electricity. And, this crisis may be closely looming as Kyrgyzstan and Tajikistan both generated significantly less electricity during the first three quarters of 2008.

However, water shortages are not limited to affecting electricity. They also significantly impact food production as the livelihood of half of Central Asia's population depends directly or indirectly on irrigated agriculture. For instance, drought conditions have caused the U.S. Department of Agriculture to forecast that in 2008-2009 wheat harvests will decline all over the region, by as much 25 percent in some areas.

Dr. Udovički went on to identify four areas where addressing water, renewable energy, and food security issues can affect living standards across the entire region.

> 1) Preventing the deepening and expansion of the compounded crisis of energy, food, and water insecurity that took hold in Tajikistan last winter.
> 2) Making national water management frameworks more sustainable.
> 3) Helping Central Asia respond to climate change threats by capturing the benefits of renewable energy and carbon finance.
> 4) Helping Central Asia respond to the human security risks posed by uranium tailings and other environmental hot spots.

Further troubling the region, and emphasized in the introductory remarks as well as throughout the entire seminar are the negative climate change effects that are already impacting and that will continue to impact the region. For example, the melting rates of Central Asia's glaciers have significantly increased since the 1970s. Although this boosts water flows to the Aral Sea basin today, it is changing the amount of water available annually, altering the flood patterns and affecting the region's hydroelectric stations. If this continues and there are not other types of adjustments made, it will prove very harmful to Central Asia's development. To help mitigate these impacts, the UNDP has established an MDG Carbon Facility that is aimed at aiding Central Asian countries in capturing more of the benefits of carbon substitution financing, which can then be used to pay for initiatives that achieve Millennium Development Goals (MDG). The Facility will do so by helping to develop projects that reduce carbon emissions in ways that stimulate economic development. The generated carbon credits are then purchased by Fortis Bank and the hard currency obtained through the sale is used to finance investment and promote development. The project is still in its early stages, but Uzbekistan has been one of the first four, and the only Central Asian country, to join the initiative. Currently a methane capture project is being developed.

In organizing these projects, the Carbon Facility is trying to address environmental and developmental issues at the same time. This is extremely relevant to Central Asia. Because access to electricity is sparse outside of the capitals, local and sustainable energy sources are the most cost-effective ways of providing electricity to remote areas. Thus, increasing renewable energy use will not only help the environment, but will also stimulate development for large swaths of the population.

Another project making headway in Central Asia in this format is called CRETA (Curriculum Development in Renewable Energy Technologies in Central Asia Universities). The project is sponsored by the European Commission and run through TEMPUS (The Trans-European mobility scheme for university studies). Speaking at the conference, Dr. Akhrorova, a TEMPUS representative, explained that the project enabled three European Universities- Technological Educational Institute of Athens- Greece, Royal Institute of Technology- Sweden, and Helmut-Schmidt University of Hamburg- Germany- to collaborate with the European Union to provide advanced educational materials and laboratories to post-graduate Central Asian students, as well as to retrain teaching staff and engineering students at two Central Asian universities- the Tajik Technical University- Tajikistan and the Innovative University of Eurasia- Kazakhstan. All of these activities are done to promote and develop renewable energy technology. Additionally, the project has created Master level courses on renewable energy.

While the leadership of international and regional organizations has been important in fostering the use of renewable energy technologies, the Central Asian countries themselves are not sitting back idly. With the help of international organizations, they are working towards addressing related security issues, and greater implementation of renewable energy sources. In the Kyrgyz Republic, for example, the UN country team helped draft the country's *Winter Response Plan* which attempts to strengthen the government's abilities to protect those most vulnerable to increases in prices for energy, food, and water. Dr. Udovički also revealed that a major pledging conference is also planned for mid-2009 to help gather funding for alleviating some of the worst environmental problems in Kyrgyzstan. Meanwhile in Tajikistan, a UN country team launched a food security appeal in order to address the urgent nutritional needs of some the country's 2.2 million urban and rural residents.

The Global Environment Facility (GEF) is an independent financial organization that provides grants to developing countries for projects that benefit the global environment and promote sustainable livelihoods in local communities as well as participates in helping with research and analysis. GEF provides about $1.9 billion in grants for clean energy use and this funding can be obtained by organizations, governments, or companies.

Uzbekistan has used its $10 million grant from GEF to finance projects based on GEF's strategic program, "Stimulation of Market Approach in Renewable Energy." Some of these projects include "Promoting Energy Efficiency in Public Buildings" and "National Capacity Needs Self-Assessment for Global Environmental Management." In the pipeline for Uzbekistan are projects like "Identifying energy potential for wind currents at the surface layers of the atmosphere and developing concepts for using wind in Uzbekistan up until 2020," and "Using renewable energy sources to generate energy in a centralized energy system."

Central Asian countries in partnership with international organizations are also working on projects that will introduce tried technologies that are new to the region. For instance, for hydropower the UNDP is helping Central Asian countries apply innovative and

integrated water resource management principles. One innovative water usage method currently being built in Khorog, Tajikistan as well as being implemented in Pakistan and Nepal, is the application of the run-of-river small hydropower technology. These stations can generate electricity all year round and require only minimal capital investments. Crucial for Central Asia, the stations do not affect water flow for downstream countries and avoid the worst of the trade-offs between electricity and food that are now plaguing hydropower use. Dr. Udovički emphasized that small community investments are best used for replacing depreciated pumping systems, as they are the most cost-effective solutions.

Potential Development and Uses of Renewable Energy in Central Asia

Kazakhstan

Despite having 0.5 percent of the world's fossil fuel reserves, six regions of Kazakhstan still experience an electricity deficit. Dr. Valeriy Dvornikov and Dr. Albert Bolotov from the Almaty Institute of Energy and Communications in Kazakhstan cited that while the average Kazakh uses roughly 10 kWh per day, individuals in these regions have access to five times less than that. Nevertheless great promise remains for renewable energy use, particularly in the form of wind, solar, and heat pumps, within the country.

Experts estimate that the potential energy attained from wind power can be 1,820 billion kWh per year. Solar power can produce 1,000 billion kWh per year, and hydropower can provide 170 billion kWh per year. Of these three, only hydropower is currently being utilized- generating 8.2 billion kWh per year and this represents 5 percent of potential hydropower energy. Although hydropower is currently an important source of electricity, producing 12 percent of all electric power generated within the country, thermal power, mainly in the form of carbon-emitting coal, remains the main source of electricity

Today, as Dr. Dvornikov and Dr. Bolotov explained, the Kazakh government is signaling change however by making plans to realize its renewable energy potential. Its goal is to increase renewable energy usage to 5 percent of all energy resources by 2018 and then to 10 percent by 2024. Additionally, by 2024 Kazakhstan aims to produce approximately 10 billion kWh a year from renewable energy sources, excluding hydroelectric power. Should these goals be realized, Kazakhstan will be well-prepared for a future devoid of excessive fossil fuel use.

Wind

Kazakhstan's vast territory of 2.7 million km² could allow for extensive wind power usage. All but the regions of Almaty, Zhambyl, Qarghandy, and parts of East Kazakhstan are suitable for some wind energy production. The majority of this wind-producing land receives wind at speeds ranging from 4-5 meters/second, making this portion best utilized with small wind turbines. Regions such as Astana and parts of Qyzlorda and Mangghystau have greater winds and thus can produce 25,000-30,000 MWh/km². Small slivers of Kazakh land surrounding the eastern shore of the Caspian Sea as well as its eastern border with China have wind capacities great than 6 meters/second. This will allow Kazakhstan to produce 40,000 MWh/ km².

One of the current wind projects described by Dr. Valeriy Zhiltsov that is being implemented is a joint venture between the Kazakh government and UNDP in order to promote wind-energy market development. As part of this project, there are plans to build enough wind turbines in 9 regions in order to generate a total of 300-500 MW by 2015. By 2024, they plan to build enough wind turbines to generate 2000 MW.

Solar

Solar energy is a particularly useful energy source because it can be used to produce both heat and electricity through a variety of forms including water heaters, collectors, photovoltaic system, and concentrating solar power systems.

Kazakhstan's low population density situated on expansive territory makes Kazakhstan ill-suited for expensive power lines. As a result, more than 5000 small villages and farms have no electricity. With Kazakhstan experiencing 2200-3000 sunlight hours per year, solar power, on the other hand, would serve well to fill in this gap. Dr. Dvornikov and Dr. Bolotov explained that for the villages and farms, small solar power stations would be ideal; whereas, for some of the large rural areas unsuitable for agriculture, larger solar structures could be built to produce solar power. These large structures can be made quite powerful. For instance an area 320 km² in Kyzylordy can produce 10,000 GWh in the summer and 5000 GWh in the winter.

As with wind power, solar energy projects are also beginning to take hold in Kazakhstan. The current leading company in the photovoltaic sector is ND & Co. However, Kazakhstan is also beginning production of key elements of Solar Energy Systems. Furthermore, one Kazakh company that has recently received a grant from the National Innovation Fund is building a solar power station in Almaty with a total production capacity of 40 MWh per year.

Heat Pump

Another possible form of renewable energy products discussed at the conference for Kazakhstan is heat pumps. A heat pump is a machine which allows for a heat transfer to occur between a less heated source (air, ground water, and ground) to a more heated object, thus increasing its temperature. Although it takes some electric energy to power this process, it nevertheless increases the efficiency of heating and cooling systems.

In Kazakhstan there are several companies who are working on the development and production of heat pumps. For instance, a hardware plant in Ekibastuze is in the process of building a cooling and heating system using 500 heat pumps. Dr. Dvorknikov and Dr. Bolotov mentioned that a similar project is currently planned for a cement plant.

Tajikistan

Coal is currently the major source of energy in Tajikistan. The country's twelve thermal power stations produce energy equal to 867.3 tonnes of coal equivalent (tce). Meanwhile, according to Dr. Kurbonjon Kabutov from the Institute for Physics and Technology, Academy of Sciences of the Republic of Tajikistan, oil, gas, and

hydropower provide the rest of the nation's energy needs with oil and gas only supplying 52 tce and hydropower stations producing 64.7 tce.

Although renewable energy sources, other than hydropower, are virtually nonexistent, use of renewable energy sources and other types of hydro projects are possible and important to implement.

Putting up solar panels, using biofuel, and/or wind turbines can provide a cost-effective way of supplying rural and remote populations with electricity. This in turn can stave off some of the ecological problems within the country. For the large sections of the population who are cut off from traditional power sources, burning wood for heat and light remains a primary energy source. However, this also leads to massive deforestation, and this in turn triggers further environmental damage, such as erosion of mountains. General erosion occurs and causes mud slides and eventual desertification.

Nevertheless, the government of Tajikistan is currently taking some actions to increase renewable energy use. As part of its effort, Dr. Kabutov highlighted that Tajikistan has approved an official renewable energy strategy begun in 2007 and scheduled to run through 2015. The strategy provides recognition of the need to use renewable energy, as well as, the need to prepare more higher education specialists in the renewable energy sector. Furthermore, it is recognized that implementation of the program will require special laws that will support the development and production of renewable energy sources as well as the creation of incentives for importing the necessary equipment and technology. Unfortunately, as the situation stands today simply adding laws will prove inadequate and implementing this strategy successfully will likely prove to be problematic.

This does not mean though that renewable energy sources cannot be used in Tajikistan. On the contrary, Dr. Kabutov put forth a detailed map showing the country and its appropriate deployment of renewable energy sources. In addition he presented many examples of simple and inexpensive devices, albeit with limited storage capacities, that are readily accessible and could serve to produce renewable energy.

Small Hydropower

One of the ways to increase hydropower energy use, while also supplying electricity to many different areas is through building small hydropower stations. The total potential energy generation for small hydropower stations in Tajikistan is 100 billion kWh per year. And, there is a technical potential to build about 1000 small hydropower stations in the country that each have a power capacity ranging from 10 to 3000 kW. In addition an economic analysis conducted of fourteen future small hydropower stations showed that with a capital investment of $44 million, these could generate 348 million kWh in the near future.

Wind

There are several high mountain regions in Tajikistan that have wind speeds equal to 5-6 meters per second making these areas suitable for wind power generation. While

no such wind turbines are fully implemented, there are some pilot programs. One such program is currently being tested in Siyakukh and has a power generation capacity of 4kW.

Solar

One of the most promising forms of renewable energy in Tajikistan is solar power. With a total average sunlight time of 2500-3000 hours per year, Dr. Kabutov estimates that solar power can provide 60-80 percent of the country's needs for ten months of a year. This would outstrip current power generation through coal by being equal to 400 thousand tonnes of coal equivalent.

Implementation of solar projects is currently ongoing only in pilot and test programs. One example of such a program is solar water heaters. These heaters produce 80 to 100 liters per meter^2. Portable solar stoves have been tested in Dushanbe and Fayzabad. These stoves can achieve temperatures of 100 to 130 degrees Celsius. Finally, photovoltaic systems, with a generation capacity of about 200 watts, are also currently being tested.

Biomass

A final potential renewable energy source in Tajikistan is biomass. One possible device that can be made from biomass is a biogas generator. Using 8 kg of manure, one could create up to 2 m^3 of biogas. This figure is equivalent to 300 W of electric power. One biomass project currently being tested in the Bakhdat region is a small system for the home that has the capacity to produce 5 tons of biogas and that is used to generate 500 watts of electricity.

Further biomass projects are occurring in Tajikistan through entrepreneurs, as the owner of a bioethanol plant, Ms. Sadafmo Abdullaeva, described to the seminar. Building on a former vodka factory, her recently opened plant is a joint venture with a group of Hungarians whose technology is being used for the project. Right now, she is working on another joint venture for growing root plants that will be used to produce the bioethanol.

Uzbekistan

Today, Uzbekistan relies on nuclear and fossil fuels for over 86 percent of its energy needs. Biofuel is the only renewable energy source that currently makes up a significant portion (10.76 percent) of Uzbekistan's total energy consumption.

Nevertheless, renewable energy potential most certainly exists for the country, with solar energy showing the most promise. Energy experts estimate that the technical potential for solar energy equals 176.8 million tonnes of oil equivalent (toe) and a total potential of 50,973 million toe. Nevertheless, other renewable energy sources can also be used to direct the country towards cleaner energy. Following solar, biomass has the next highest technical potential with 4.7 million toe and a total potential of 10.8 million toe. Hydropower is next with a technical potential of 1.8 million toe and a total potential of 9.2 million toe. Wind power, although exhibiting the least quantitative potential (technical potential of 0.4 million toe in Uzbekistan, and total potential of 2.2 million toe) can still also be implemented in the country.

While the country is far from realizing renewable energy on a mass scale, there are several large renewable energy projects functioning within the country. These projects use photovoltaic, solar collectors, biofuel, or wind sources and are mainly located around Tashkent. However, several projects are found in other areas around the country. For instance, biofuel is produced in Andijan, Naiwoiy, and the Jizzakh region. Solar collectors are located in Qarshi and Bukhoro while photovoltaics are found in Samarkand, Bukhoro, Naiwoiy, Qarshi, Samarkand, Jizzakh region, and Qoraqlpoghiston region. Wind power however is only used in Tashkent.

Energy experts warned though that several major reforms need to occur in Uzbekistan in order to continue development of renewable energy sources within the country. The recommendations posed included implementing a national strategy for developing renewable energy sources which would be reinforced by laws. Additionally, a proposal for the formation of a government agency that could organize and coordinate renewable energy activity as well as a proposal to create government and technical standards for renewable energy sources were also voiced. Finally, economic incentives for renewable energy development both in the form of tariff changes in addition to increased international financing were also called on.

Solar Power

Solar energy, Uzbekistan's best option for energy independence, is slowly being more utilized. There are currently several technical institutes devoted to studying solar and other renewable energy sources in Uzbekistan. Seminar participants were able to visit a solar furnace created by one of these institutes, the Academy of Sciences of Uzbekistan Scientific-Production Association "Physics-Sun" Institute of Material Sciences. The massive solar furnace uses glass ceramic technology in the Parkent region of Uzbekistan and boasts a capacity of 1000 kW of thermal power. The institute is taking full advantage of the facility, as it uses the furnace, apart from producing energy, for also research purposes. Apart from the furnace, the-"Physics-Sun" Institute is also involved in developing and installing solar collectors. Experts explained that in Uzbekistan it is necessary to develop and produce solar collectors with a minimum production capacity of 100,000 square meters per year.

On a smaller scale, the "Physics-Sun" Institute is also currently involved in building solar projects. It has developed street lights that use solar panels and LEDs that are meant to light towns and villages in remote areas. Additionally, the institute has developed autonomous water heating and lighting systems for medical offices in remote areas. The heating system relies on solar collectors, while the lightening system uses LEDs. Furthermore, the institute has developed a multifunctional system, meant for mass production that uses solar power to provide light and heat as well as to purify and distill water.

The "Physics-Sun" Institute is not alone in its development of small-scale solar energy instruments. Other companies and institutes have been working on constructing photovoltaic systems in order to provide energy on a local level. Energy experts at the

seminar discussed a few of these systems. For instance, the village of Kosturba received a photovoltaic system that helps the villagers get energy to power their daily needs and to obtain drinking water. Additionally, several medical clinics have begun using photovoltaic systems to provide their own energy, as is the case in the Surkhandarinsk region where one clinic uses a photovoltaic system to power its surgery division.

Another smaller project that was discussed at the seminar was the Karakalpakstan Solar Project. Following the launching of the Uzbek National Energy Project of 2003-2004, the Uzbek government approached UNDP and asked for their support in implementing a pilot solar energy project in Karakalpakstan. The goal of the project is to provide solar energy to remote and rural villages in the region. As of today, 15 solar panels for household electricity generation have been installed; as well as another 10 for water pumping. With phase I completed, the project is now undergoing phase II.

The practical experience of one of Uzbekistan's photovoltaic producers, OAO "Foton," shared at the seminar, provided optimism for Uzbekistan's future solar development. OAO "Foton" began to produce photovoltaic systems in 2003 based on the launched initiative of the Agency on the Transfer of Technology. Since its beginnings, OAO "Foton" has been able to develop and successfully implement photovoltaic systems with powers of 100, 200, 300, 500 1000, and 1200 W. Today, the company continues to innovate, with stations in the works that have power capacities of 1600, 2000, 3000, and 5000 W.

Hydropower

At this moment, under the overseeing of the Uzbek Ministry on Agriculture and Water Resources, there are currently four hydropower stations under construction. One is a station located in the Andijan oblast with a capacity of 50 MW. The station being built in the Tashkent oblast is smaller with a 21 MW capacity. Kashkadaraya will see a station with a 45 MW capacity. The smallest stations, meanwhile, are being built in the Samarkand oblast- with a capacity of 6 MW- and in Fergana- with a 2.1 MW capacity.

Plans for a further six hydropower stations are also in the works. These include two stations in Andijan oblast, one in the Tashkent oblast, two in the Samarkand oblast, and one in the Fergana oblast.

There was also discussion of Uzbekistan's hydropower usage and potential. Hydropower continues to serve for Uzbekistan, as it had in the Soviet era, as an important energy generator. Uzbekistan produces the largest percentage of its hydropower's technical potential- 25 percent. Comparatively, Tajikistan's 143.6 billion kWh represents only 11 percent of its generating potential. Although, of the four Central Asian countries examined at the seminar, Uzbekistan produces the least amount of energy from hydropower- 27.4 billion kWh.

One Uzbek expert explained that sources of hydro energy power can be divided into four categories. Each group of rivers represents varying kinds of potential power. The largest rivers have a potential power of over 200 MW. Smaller rivers, but with still powerful

currents have a potential power ranging from 100 to 200 MW. Medium currents have potential power of 2 to 100 MW and small currents offer potential power of 2 MW. The expert went on to elaborate that as a result of studying the hydro energy potential of 27 existing currents in Uzbekistan, researchers found that the rivers have an established power potential of 2920.53 MW, which makes up about half of Uzbekistan's unused energy potential. Using this discovered hydro energy potential, an Uzbek energy expert then recommended building 122 hydro energy stations of which 88 are on free-flowing parts of the river and 21 hydro energy stations on reservoirs that are either existing, planned, or currently under construction. Finally, the last 13 of the hydro energy stations were proposed to be built on the cascades of irrigation channels.

Of all of the proposed hydro energy stations sixteen are mid-to-large stations. Of these, twelve are located on free-flowing portions of the rivers. Meanwhile the large stations will be capable of utilizing 70 percent of their potential power stemming from their natural currents. Finally the other 106 will be small stations which have power capacity ranging from 0.5 to 30 MW each and which combined will produce on average for the long-term 3960.4 million kWh.

The Uzbek energy expert also shared a list of the most suitable regions on which to develop hydro energy stations on free-flowing areas. The Tashkent oblast is by far the best area for the stations as it has a power capacity of 1729.60 MW. On the other hand the next best region, Surkhandarya has only a 414.60 MW capacity. Next is Kashkadarya with a 182.33 MW capacity, followed by Dzhizak with 14.83, and finally Fergana with 11.29 MW.

The river with the most potential energy, of those studied, is the Pskem, which has a power capacity of 1324 MW. This number makes up 45.3 percent of all possible hydro energy sources of Uzbekistan. Following this river in order by potential is the Tupalangdar'ya, Chatkal, Sangardakdar'ya, Koksu, Akhangaran, Ugam, and finally Khalkadzhar rivers.

Kyrgyzstan

Much of the work on renewable energy in Kyrgyzstan occurs as part of a larger program on ecology and the environment. As Mr. Edilbek Bogombaev, from the UNDP described, this program seeks to stimulate cooperation between government, scientific community, civil society, and institutions in order promote sustainable development, especially in the area of ecology. In Kyrgyzstan this program receives widespread support and recognition from the UNDP, Kyrgyz government, ministries, local businesses, international organizations, and others.

Increased use of renewable energy sources is also one important aspect of this program. As part of its goal to augment this use, Kyrgyzstan is working towards reforming the necessary legal structure. It is doing this through a legal project titled, "Law on Renewable Energy Sources," and a regulations project, "Adding Small Hydro Power Stations to a Distribution System." In addition, the program has identified a number of important tasks that need to still be elaborated upon in Kyrgyzstan in order for

sustainable development to take place. Some of these tasks include the recognition and development of a National Program for using small hydropower stations, as well as, the development of laws and regulations to support the legal project on renewable energy. Additionally, more support should be given to local initiatives in producing and servicing renewable energy sources, and, more information on the benefits of using renewable energy sources should be made accessible to the population. Finally, there needs to be integration between the results of using renewable energy sources with the overall strategy for socio-economic development of the country.

While these are tasks that still need to be worked on, a pilot project for small hydropower stations is already taking place. In Kyrgyzstan, 13 small hydropower stations, that each have an output of 0.2-5 kW were installed in remote villages like Bozteri, Tamga, and Darkhan.

The UNDP's work in Kyrgyzstan has further yielded critical information regarding targets and purposes for sustainable development. For renewable energy sources to become a viable means of energy production, three steps that need to occur have been identified. First, support must be granted for the institutional structure and development of normative acts that seek to improve the politics and practice of governing over renewable energy sources, as well as, protecting the environment. Next, with the required public support, there needs to be better and more equal access to social services and an increased political interest for the impoverished portions of the population. Additionally, more information needs to be made available to local communities regarding the benefits and uses of renewable energy, as well as, other measures for protecting the environment. Finally, improvement in the integration of the use and governing of environmental resources on a community level needs to occur. Market mechanisms must also be created. This last step though, requires first commercial attractiveness of renewable electricity generating systems and a surplus of electricity.

Conclusion

Central Asia clearly has a long way to go towards implementing renewable energy sources, but as the conference illustrated it has already begun the process. Additionally, the presentations in the seminar clearly show that Central Asian leaders are taking the lead role themselves in addressing the issues of energy and water. This important step is necessary and must continue. However, for renewable energy measures to take hold, the continued support of the international community is also needed, and especially that of international financial institutions.

This seminar was an important step in encouraging cooperation, especially at the expert-to-expert level. The seminar offered formal and informal opportunities for this to occur, from be it through small steps, like seating experts alphabetically rather than in national delegations, by study tours to renewable energy research institutes and hydro-electric stations, and lots of occasion for social encounters.. Furthermore, the seminar offered the chance for a rather large delegation from the Uzbek government to network with an unusually large delegation of experts from Tajikistan, which included both Tajik and Russian citizens.

Further recommendations presented during the seminar:

The energy experts unanimously voiced the need for policy changes to stimulate the development of renewable energy in their respective countries. On the legal front, experts argued that a legal framework that encourages renewable energy use must be implemented and the government should be used to coordinate research and development.

Experts also urged the government to enact economic incentives that would foster renewable energy development. Among these incentives, they urged for changes to tariffs and increased funding for renewable energy research institutes.

The seminar also exemplified that the only successful national solutions are those based on local empowerment and effective markets. Thus, empowering communities and investors on a local level are the types of solutions most critical to Central Asia's development.

As a result of the meeting:

When adjourned, participants from the seminar expressed a desire to create a developmental portal which would serve as a common information base for Central Asian energy experts. They planned to apply to the CAREC Institute for funding this initiative.