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INSIDE

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Community Energy: A Powerful Force

By Lori Pottinger

There are very few similarities between Rangkhani, Nepal and Feldheim, Germany. Rangkhani is just one of many struggling rural villages in a remote region in one of the world's least-developed countries. Feldheim is a thriving modern farming community in one of the world's richest nations. Yet both have turned to locally owned energy projects to bring light to their homes and local control over a critical resource.

Rangkhani's fortunes turned a decade ago, when a micro-hydro plant brought the village into the electrified era, bringing light to homes and electricity for small enterprises. Local incomes and educational opportunities have gone up, while health impacts from dirty kerosene lanterns have gone down. The village is one of thousands in Nepal that have been electrified by micro-hydro plants.

The 2011 launch of Australia's first community wind project, Hepburn Wind, was cause for celebration.

Nepal's community energy boom starting taking off 17 years ago, when the giant Arun III Dam was rejected by the World Bank – in part because local engineers successfully argued that small hydro projects would be more appropriate for meeting Nepal's energy demands. Nepal has a very low rate of electrification, an inefficient and limited grid, and one of the largest untapped hydropower resources in the world. Large dams are being proposed mostly for export, and at great cost to Nepal. At the same time, a healthy and growing decentralized renewable energy sector is changing lives. Hundreds of thousands of Nepalis have a better quality of life because of the nation's expansion of rural micro-hydro projects. The UNDP estimates that each new micro-hydro system creates 40 new businesses. Small companies selling biogas plants and solar home systems are also thriving.

So, too, has life improved for many German communities – though not as dramatically as in Nepal. Like most wealthy nations, Germany has 100% coverage of its electricity grid – mostly supplied by four giant energy companies. Yet it is also home to a large and growing population of small community-owned energy systems.

The village of Felfheim is one example. Its 128 inhabit-

Continued on page 10

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Commentary

A SHINING LIGHT

As I write this, the failure of India's electricity grid has created what surely must be the world's largest blackout (see story, page 4). *The New York Times* reported that over 600 million people live in the impacted area. In case anyone is feeling numb to the number of zeros in that figure, the *Times* points out that we are talking about roughly 10% of humanity affected by the outage.

This news is being spun in a number of ways, for a range of motives. Was an operator asleep in the control room? Is India's electricity demand outstripping its generation capacity? Is this an indicator of mismanagement in national energy planning? So the speculation, finger pointing, and opportunism goes.

Whatever the specific causes, what seems clear to me from this massive grid failure in India – and the blackout that swept the eastern United States in 2003 and the rolling blackouts in California in 2001 – is that large, centralized and inter-tied systems are by their nature vulnerable to systematic failure. And once a chain reaction begins – whether it's in a system such as an electricity grid, or perhaps, too, in ecological systems on Planet Earth – it's not easy to contain the fallout.

India's grids are fed largely with coal, with a strong and increasing percentage of hydropower. And while the dam-building industry and others who are in a position to profit from large infrastructure projects will surely use the blackout as a rallying cry for new dam construction in India and the Himalayas, forward-thinking planners might offer another approach.

International Rivers and our partners in India have long worked to raise awareness of the risks involved in building large dams in the mountainous regions of South Asia. The latest hydrological science and modeling results suggest that Himalayan precipitation regimes are shifting under climate variability and that the total ice pack is diminishing. This creates great risk and uncertainty for the existing dams of the Himalaya – in terms of their safety, their longevity, and their ability to produce the power for which they were designed. Indeed, most of the news coverage of the Indian blackout picked up on the fact that the drought in India caused a reduction in hydropower production and thus likely contributed to the strain on the grid.

In an increasingly unreliable climate, energy planners should use great caution before investing huge sums in building monuments to the 20th century on rivers that may lack reliable water flows to generate power. And with the current proposals for upward of 500 dams planned in the Ganges River basin alone, this is no minor investment decision. Indeed, it will decide the fate of Himalayan rivers, and the communities that depend on them.

As our Policy Director Peter Bosshard lays out in our recent report, "Infrastructure for Whom?", there are substantial trade offs in terms of beneficiaries of big dam infrastructure investment vs. decentralized solutions. For about half the estimated cost of the proposed Grand Inga Dam on the Congo River, for example, a decentralized energy investment would bring basic electricity access to 79 million people and provide improved cooking stoves for 200 million more.

We've all heard of what the alternative solutions might be for meeting the needs of the 1.5 billion people without electricity. Technological innovations in wind, solar and geothermal have a role to play in bridging this divide, and also in a broader transition of global energy production to renewable sources. This issue of *World Rivers Review* focuses on the *how* of energy solutions. Community energy initiatives put appropriate technologies to use at a human scale that offers community self-determination, resilience to risks, and keeps economic benefits near the origin of production. Scaling up such decentralized solutions is ultimately a matter of investment priorities and public policies that incentivize such enterprises.

The blackout in India serves as a reminder that a transition away from hyper-centralized electricity systems may ultimately be inevitable. What we need now are investments and incentives to hasten the transition to community-scaled energy production while we still have living rivers to nourish and replenish our communities.

Jason Rainey

MAKING WAVES

In the News

"The Mekong River is the lifeblood of Southeast Asia, feeding and employing millions of people. To move forward with the Xayaburi Dam would be reckless and irresponsible, as the dam would fatally impact the river's ecosystem and fisheries," said Ame Trandem from the NGO International Rivers."

"Battle for the Mekong Heats Up," *The Diplomat,* August 2, 2012

"We're talking about devastation and human rights violations on a huge scale in an extremely fragile ecosystem," says Zachary Hurwitz, [International Rivers] policy coordinator."

"Brazil's All-In Bet on Amazon Dams Jeopardizes Economic Growth," *Bloomberg Markets Magazine,* April 10, 2012

Victory for Mokihinui River

The Mokihinui River, one of New Zealand's largest and most pristine wild rivers, will continue to flow freely after Meridian Energy announced its decision not to move forward with the planned Mokihinui Dam. Forest & Birds – an organization that has been campaigning to protect the Mokihinui River and its many diverse species – welcomed the announcement. "It's great to see that grassroots campaigns can still win against developments backed by huge businesses," said Andrew Cutler, President of Forest & Bird. In 2010 a flotilla of rafts and kayaks filled with activists and photographers journeyed down the river to oppose the planned project. The dam would have flooded the greatest area of conservation land in New Zealand. As a next step, Forest & Bird plan to take measures to properly protect the river by adding it to the neighboring Kahurangi National Park.

Indian Dams Cancelled

A multi-year campaign of unrelenting pressure by affected communities against dams proposed on the Teesta River and its tributaries has resulted in four more dams being cancelled by the government of Sikkim, India. The communities, which oppose the dams on social and environmental grounds, refused to allow dam surveys and investigations to be carried out. This prevented project authorities from being able to prepare Detailed Project Reports, a prerequisite for any large dam project. The opposition intensified after the September 2011 earthquake (the dams would be built in a seismically active zone). The four cancelled dams are the 99 MW Bop Dam, 99 MW Bhimkyong Dam, 99 MW Lachung Dam and 280 MW Teesta State-I Dam. So far, 10 dams have been cancelled by the Government of Sikkim due to protests.

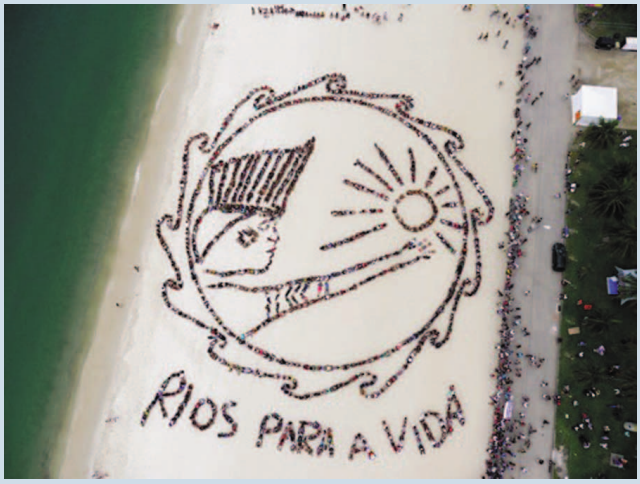
Southeast Asia Office News

Accolades: Pianporn "Pai" Deetes, International Rivers' Mekong campaigner for the past three years, has been recognized by Thailand's leading English-language newspaper, *The Bangkok Post,* as one of Thailand's most influential young leaders shaping the country's future. In her 10 years working to protect Southeast Asia's rivers, Pai has chalked up one victory after another, from getting the Thai government to shelve dam projects on the Salween River to helping to build a movement of Thai villagers committed to keeping the Mekong free-flowing. Congratulations, Pai!

New Staff: A big sigh of relief came when Chochoe Devaporihartakula joined the Southeast Asia Team as the Thai Administrative Assistant. Chochoe's diverse experience and her dynamic energy and insight have been enormously helpful in supporting our endeavors. Outside of office hours, Chochoe is diligently writing her thesis on energy issues for a Master's Degree in International Rivers from Chulalongkorn University.

We are also excited to welcome Tania Lee as our new Lao Program Coordinator. With a background of extensive campaigning experience on a variety of social and environmental justice issues, Tania will be spending the bulk of her time advocating against some of the most destructive Mekong tributary projects in Laos, while working to build on Laos' nascent movement of activists working on hydropower issues. Tania's enthusiasm and willingness to tackle challenges makes her a great new addition to our team.

Putting Their Bodies on the Line



Just in time for the Rio+20 environmental meeting, held in Brazil in June, some 1,500 people created a human canvas on Rio's Flamengo Beach to promote the importance of free-flowing rivers and including indigenous knowledge as part of the solution to climate issues. The activity was led by Brazil's many indigenous peoples organized under the umbrella of the Articulation of Brazilian Indigenous Peoples. Photo: Spectral Q/Chico/Paulows

Too Big Not to Fail: India Blackouts Highlight Need for Change

By Lori Pottinger

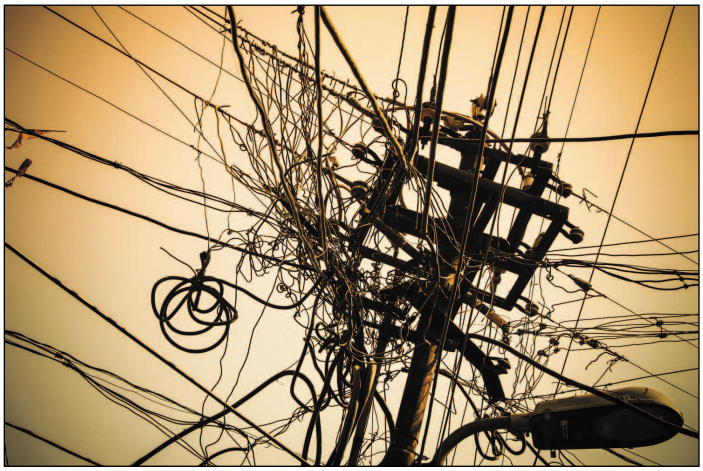
The world's biggest power outage, which struck northern and eastern India over two days in July, affected nearly 10% of the world's population, and 19 of the country's 28 states. Many factors were behind the catastrophic failure, but one that is especially troubling in a changing climate is the relationship between water and the blackouts.

Robert Kimball of the World Resource Institute blogged that the blackouts "were created as much by pipes and pumps as they were by power plants and transmission lines. In many ways, the country's power problems are symptoms of a growing water crisis."

The excessive use of water pumps by India's drought-struck farmers was one factor that tripped the system. Commercial growers in India are requiring ever-more-powerful pumps, thanks to having over-pumped groundwater. Because Indian farmers receive electricity free of charge, there is no incentive for conserving energy.

Another factor was the drop in hydropower from India's large dams. Rainfall is down nearly 20% across India (and in the state of Punjab, India's largest producer of wheat, it's down by an astonishing 70%). India gets about 20-25% of its electricity from hydropower dams, and this year hydropower production is down 19% from last year, due to low rainfall.

The high use of water in conventional power systems contributed to the problem too. WRI's Kimball notes, "Conventional power plants are just as dependent on water as hydroelectric plants. Thermal power plants (such as fossil fuel and nuclear plants) need water to keep their equipment cool and functioning. A lack of water for cooling has threatened to force some of India's nuclear power facilities to shut down." A 2010 report by WRI found that 79% of new thermal and hydroelectric power plants planned for construction by the three largest power companies in the country were to be built in water scarce regions.



India's grid system is in poor repair, as symbolized by this ad-hoc collection of connections in Raipur, India. Photo: Phil Putnam

The international NGO Alliance to Save Energy, working with USAID, has had an Indian "watergy" program (an effort to save water and the associated energy used by water systems) since 2002. The program has yielded impressive results in a number of municipalities, but the need to reduce the electricity sector's water use remains great.

Which path?

There are competing visions on what the blackout might mean for India's energy sector. While many hope it will provide an opportunity to increase the nation's decentralized renewable energy resources, the reality is that the national system is deeply rooted in big grids, big coal and big dams.

"Unfortunately, a lot of developers and lobbyists are using the opportunity of blackouts to push the case for building more big hydropower, thermal and nuclear power projects. But building more large dams would be an invitation to bigger disasters," said Himanshu Thakkar of South Asia Network on Dams, Rivers & People. "What these incidents are telling us is that we need to ensure proper management of our existing electricity generation, transmission and distribution infrastructure to get optimum benefits, and go for better methods for controlling our growing water use – such as better cropping patterns, restoration of groundwater through rainwater harvesting, a shift to less water-intensive crops and to water conserving farming methods such as rice intensification, and other prudent water management practices. Most importantly, we need a more democratic, more transparent, and accountable governance of our water and energy systems."

After the recent mega-blackouts, many in India may be ready for more democratic decision-making and greater local control over their energy supply. India suffers frequent blackouts (though not usually on this scale), and the unreliability of the national grid has pushed many communities and companies to develop local microgrid and backup power systems. Bloomberg news reports that some of India's biggest electricity-using companies have already spent US$29 billion on energy systems "to quarantine their plants from the national grid," and thus were mostly shielded from the big blackout. The wire service reports that five of India's biggest electricity users generate 96% of their electricity requirements.

The nation's energy planners could take a clue from corporate India. Expanding the reliance on microgrids centered around a diversity of renewables would not only reduce the chance of massive blackouts affecting whole states, but would also be a better solution for meeting the energy needs of India's remote rural areas, where most of the nation's 300-400 million unelectrified citizens live.

Wind and solar systems have been credited with softening the blow of the blackout in a number of instances. For example, in Jodhpur state a local energy official reported: "We immediately switched to wind power and resumed power supply at hospitals, water pumps, railways, high court and administrative offices." Solar-powered pumps and solar panels kept many awash in water and power.

India's 970MW of grid-connected solar systems kept working despite the grid failure. The nation is planning a massive rollout of new solar systems, which along with a global drop in prices for panels is expected to result in solar grid parity (e.g., costing the same as conventional electricity supply) by 2017, according to a national solar center.

Efficiency should be priority

India's grid is riddled with problems and inefficiencies. A McKinsey Institute report on India's power system estimates that modernizing the grid, which loses 30% of its power in the course of transmission, would cost $110 billion.

Continued on page 7

China's Nuclear Backlash Fosters Local Power

By Wen Bo

When Ding Jie, a water program officer for Wuhu Ecology Center, travelled to Wangjiang County, in China's Southern Anhui province, to examine local water pollution cases this spring, she encountered something surprising. Ding was amazed to learn of Wangjiang's popular protest movement against a nuclear plan being built in neighboring Pengze, across the Yangtze, in Jiangxi province. Wangjiang is located downstream of Pengze, where Jiangxi's first nuclear power plant was underway.

Pengze was poised to be the first nuclear power station in this inland province. However, the Chinese government halted its construction after Japan's Fukushima nuclear accident in March 2011.

Local opposition at Wangjiang, led by retired local governmental officials, has been strong. When Ding Jie shared information about the protest movement with her office colleagues in Wuhu, she learned that their city is also proposing a nuclear power plant.

Southern Anhui is a mostly rural agricultural region, and so the investment in intensive megaprojects like nuclear power appears to make little sense, especially given local water constraints and the high liability that nuclear plants bring.

Even with growing demand for energy, inland provinces like Anhui and Jiangxi do not seem to have a crushing need for nuclear power. The incentive for local authorities appears to be that the construction of nuclear power plants poses a lucrative business opportunity.

Wuhu Ecology Center decided to try to empower local communities with decentralized energy supply practices. In one of the center's project areas along the Qingyi River, Xiuli Village is using the "pig/marsh-gas/tea" ecological model – a circular agriculture practice which generates gas from pig waste in a clean, simple biogas digester, which is used for cooking and electricity. Each household also grows organic tea with this method, which benefits from the fertilizer by-product of the digesters. The cost of construction is around $700 per household. Subsequently, trees around the village are thriving again as villagers no longer have a need to collect fuel wood.

A biogas digester system in China.

Such traditional energy projects are not uncommon in China. In the past, Chinese government programs led to a huge rollout of biogas digesters in rural areas, but national programs did not reach every area, and such support may have dwindled in recent years. Thus, NGOs and private business are well positioned to help promote such indigenous knowledge and scale up good practices.

While high-profile environmental protests in Dalian, Shifang and Qidong were able to stop risky projects at the local level, there is a growing need to promote alternative energy solutions to deter government and industry's excuses for more megaprojects such as big dams and nuclear plants.

"Four nuclear power plants are being proposed in Anhui province alone. It is a bit too much," said a local governmental official of Wuhu. "Can we stop one, at least the one in Wuhu?"

His words would be called "nimbyism" ("not in my back yard") in the West, but they represent many Chinese people's thinking that China is going too far, too fast in its rush to build large, dirty energy projects that can do more harm than good to local communities in their path. But as the "pig/marsh-gas/tea" model shows, there is a better way. The growing movement to build clean community-run energy projects is leading the way. ●

Wen Bo is the Program Director for the National Geographic Society Air and Water Conservation Fund. Contact him at china-conservation@ngs.org

Japan Goes Geothermal Post-Fukushima

After the 2011 earthquake and tsunami devastated the Fukushima nuclear plant, all of Japan's 54 nuclear reactors were temporarily shut down, reducing the nation's power-generating capacity by about a third. But thanks to its location in a geologically active zone, Japan sits on about 20,000 MW of geothermal energy – equivalent to about 20 nuclear reactors.

Although three Japanese companies control more than half the global market for geothermal turbines, the nation has barely tapped its own steam power; it currently gets about 0.2% of its energy from geothermal. The government has introduced feed-in tariffs to force the 10 regional electricity monopolies to buy renewable energy at above-market rates, including geothermal. Japan's new Renewable Portfolio Standard calls for doubling the nation's geothermal energy in the 10 years. Two new plants planned for the tsunami-hit region are due to open in 2015 and 2020 respectively.

Renewable Energy News notes that, because a typical geothermal plant takes five to 10 years to develop, Japan will have to turn to wind and solar for immediate renewable energy sources. Japan has about 1,900 GW of potential wind energy. The online magazine reports: "None of the country's wind farms were damaged by the tsunami or earthquake, although some power lines were damaged. Many wind turbines near the hardest-hit coastlines continue generating electricity today."

Small Hydro a Potential Bridge for Africa's Energy Divide

By Wim Jonker Klunne

Africa is home to one of the world's largest off-grid populations: approximately 590 million people live with no connection to their national electric grid, according to the International Energy Agency. Grid expansion in Africa has been notoriously slow, and thus new solutions are needed to bridge this energy divide.

Small hydropower can play a pivotal role in providing energy access to large parts of Africa, either in stand-alone isolated mini-grids or as distributed generation in national grids. The potential role of small hydropower in eradicating energy poverty has been recognized by a number of national governments and donors, and is a key element of the UN Energy Access for All program.

Yet for all the potential, most African nations have done little to tap this resource. The lack of small hydropower development in Africa is the result of a host of persistent barriers.

Long history in Africa

Internationally, small hydropower has a long track record of providing energy at the community level, long before centralized electricity generation became the common standard. Early gold mines in South Africa, for example, were powered by micro-hydro turbines as early as 1892. Church missions built small hydropower installations in many nations – for example, in Tanzania more than 16 small hydropower systems installed by churches during the 1960s and '70s are still operating. Large scale commercial farmers in the Eastern Highlands of Zimbabwe installed hydro stations as early as the 1930s.

Many countries in Africa have a rich history of small-scale hydropower, but over time large numbers of these stations have fallen into disrepair. In some cases this was because the national grid reached that location, but in many others the problem was a lack of maintenance or even pure neglect.

Recent initiatives reveal that a number of countries in Africa are poised to revive the small hydro sector, either through international development agencies or through private sector initiatives. New initiatives are being launched in Central Africa (Rwanda), East Africa (Kenya, Tanzania and Uganda) and Southern Africa (Malawi, Mozambique and Zimbabwe). In South Africa, the first new small hydro station in 20 years was opened in 2009, with more under development.

Barriers

Most of the challenges facing small hydropower are generic for all types of renewable energy and rural electrification projects. General barriers include the absence of clear policies on renewable energy, limited budget to create an enabling environment for mobilizing resources and encouraging private sector investment, and the absence of long-term implementation models that result in the delivery of renewable energy to customers at affordable prices while also ensuring that the industry remains sustainable. Although there is widespread desire for modern energy services in Africa, cost of electricity continues to be an issue for many rural communities, which needs to addressed with appropriate implementation models.

Looking specifically at small hydropower development, the following barriers can be identified:

• **Policy and regulatory framework:** Many nations have unclear or non-existent policies and regulations to govern the development of small hydropower. In some countries hydropower developments under a certain threshold are not regulated at all, while in other countries it might be part of a broader regulatory framework for rural electrification in general. Generic frameworks often lack clarity on a number of hydropower-specific issues, including access to water, ownership of water infrastructure, and the related issue of associated payments to use this infrastructure.

• **Financing:** More than other sources of renewable energy, hydropower developments (even small ones) are faced with high up-front costs and low operations and maintenance costs, something most available financing models do not favor. Nearly all of the new developments on the continent are relying in one form or another on donor financing. Development of alternative financing models, including tapping into alternative funding sources, is needed to facilitate small hydro developments.

• **Capacity to plan, build and operate hydropower plants:** National and regional knowledge and awareness on the potential of small hydro for rural electrification is missing or very minimal. This includes knowledge at political, government and regulatory entities, as well as knowledge on local production of parts and components.

• **Data on hydro resources:** Linked to the limited knowledge about the technology is the lack of proper resource data on water availability and flow on which hydro developments can be based.

Opening the sluice gate on a small hydro project. Photo: Wim Klunne

Communities and hydropower

Hydropower installations up to 300 kW of installed capacity are able to provide essential energy services to many rural areas in Africa, including mechanical power for services like maize grinding and electricity connections for individual households and small businesses. For most rural African communities, it could be many years until the grid comes near enough to their towns to be practical. But most rural Africans also live closer to a river than to the grid. What is needed is greater support for helping communities tap into their local power, especially technical help, financial assistance and guidance in how to operate and maintain the system. A microhydro plant, while relatively low cost and low tech, may still strain local resources. Although the costs of microhydro are very site specific, communities can help bring down the capital required by in-kind contributions specifically for the civil works required (diversion weir, intake, canal, etc.).

Continued opposite

Rural electrification with microhydro has been implemented in a number of different ways, each with its own pros and cons. Delivery models include national utilities providing hydropower-based localised mini grids, private entrepreneurs setting up energy supply companies, community owned and managed systems, and systems initiated by churches, charities and NGOs.

In Mozambique, the German development organization GIZ is using the so-called "operator model" in which electricity production is taken care of by entrepreneurs who invest in electricity generation using their own funds or assisted with a commercial loan, while the local distribution grid is donor-funded and community-owned. In contrast, the national electrification agency FUNAE is following a model in which government owns the infrastructure, but "leases" that out to an operator who is then responsible for generation and distribution of electricity.

Microhydro plant detail

In Tanzania, church missions have been at the forefront with regard to installing microhydro systems. An example is the Matembwe village hydro scheme, which powers a vocational center run by a mission. The system has an installed capacity of 150 kW and supplies electricity for commercial uses and individual households in two villages located 5 km apart, with the bulk of the electricity being used at the vocational center. For the first few years, two village committees were responsible for managing the project. As the capacity of these committees was found to be insufficient, management was handed over to the Matembwe Village Co. Ltd., who manages the vocational training center. The ownership of the scheme is shared by the Diocese, an NGO, the village authority and the District Authority. Since the inception of the hydro project, the national grid has reached the villages concerned and the villagers now have the choice between electricity from hydropower or from the grid, with most of them staying with the cheaper local hydropower option.

Another hydroplant initiated by the same church was built in a village where the nearest power line is 180 kms away. The main motivation behind the project was the high cost of running a generator to power the local health center. The Diocese, in collaboration with German donors, introduced the idea of building a small hydroplant to the local government and community. Plant construction was completed in 2002. The plant electrifies the whole Mavanga ward, comprising of the villages Mavanga and Mbugani. The Mavanga electricity project is owned by the Diocese, the communities and the donor. The scheme is managed by a local committee known as MEPC. While the donor and the church are there to advise and help when the need arises, the committee is responsible for day-to-day activities including bill collection, conflict resolution, if any, and solving technical problems. Technical sustainability is ensured through a contract with the installing engineer to provide technical backup for the first eight years of plant operation, with a gradual skills transfer to MEPC.

Also in the southern Africa region, British NGO Practical Action is implementing an EU-funded project to bring microhydro to remote villages. At this stage, three different financial models are being implemented for nine microhydro stations in total and will be evaluated on their merits. In the "ShareD" financial model, as is implemented in Chipendeke in Zimbabwe, community members provide "sweat equity" to the project, which will be converted to shares in the commercial enterprise that will run the plant. The "generator model," which will be implemented by Practical Action with their Mozambican counterpart Kwaedza Sumukai Manica (KSM), is based on a private entrepreneur generating electricity for the community. In this model the local transmission and distribution infrastructure will be owned by the community. Finally, Practical Action is applying an adapted version of the Build, Operate and Transfer model which they implement in Malawi, which is expected to result in a smooth transition towards community ownership of the plant.

Way forward

Small hydro is a very mature and robust technology, but the jury is still out on the best way to implement this technology to ensure a long lasting sustainable operation of the system. But given the widespread potential across Africa, it is clear that small-scale hydropower can play a pivotal role in providing electricity – and development opportunities – to rural communities.

Interest in the technology in many parts of Africa is finally beginning to flow. Hopes are high that governments and communities alike will get on board and adopt policies and programs to encourage growth in small-scale hydro. The potential to help bridge the energy divide and bring light and hope to communities across the continent is huge, and the time to move forward is now. ●

The author is an expert in microhydro with a specialization in Africa. He has worked on a wide range of education, research and implementation projects for the African Development Bank, World Bank, UNDP, GEF and others. He currently works for the Council for Scientific and Industrial Research in South Africa. He manages microhydropower.net and hydro4africa.net.

India Blackouts *continued from page 4*

A 2009 study by WRI noted that an investment of $10 billion in energy efficiency improvements in India would save 183.5 billion kilowatt hours each year – equivalent to the yearly output of 183 Sardar Sarovar dams (one of India's largest, and most controversial, dams). A stuvdy by the energy efficiency group ACEEE found that a five-year model energy efficiency program for appliances and lighting could reduce domestic energy use by about 30% from a "business as usual" scenario.

Many destructive megaprojects could easily be avoided if these savings were tapped, and new blackouts avoided. Tapping into energy efficiency is also faster and cheaper than new power plants.

"Indian power planners must rethink the megaproject model, and move more quickly to expand clean, decentralized energy systems and tap into our huge potential for energy efficiency," said Samir Mehta of International Rivers' India program. ●

Building Local Econo

Innovative

By Jenny Binstock

Solar is the ultimate community-owned energy source. It's widely available for purchase, and is relatively easy to install and maintain. Many of the many millions of people who lack access to electricity live in places where the sun shines steadily. "Solar is so important since the grid is never going to reach many remote communities because of expense, location, and so many other reasons," says Laurie Guevara-Stone, a solar expert with decades of experience bringing solar to rural communities throughout Latin America. "Giving people who have never had it access to electricity is huge. Education levels and health care go up, microenterprise rises, and so on."

Solar Energy Foundation technicians test a system in Ethiopia. Photo: SEF

The price of solar panels has dropped dramatically in recent years, and while affordability remains an issue for the poorest, solar is the most cost-effective way to electrify huge swaths of the world's off-grid regions. Solar infrastructure is fairly easy to install, operate and maintain, and creates jobs at higher rates than many other energy systems. "Even though the upfront costs of solar might be expensive, once the infrastructure is in place there is really not much to do – it's such a readily available resource," says Guevara-Stone.

According to *The Guardian*, it would cost US$10 billion to purchase and finance solar power for the world's 1.2 billion unelectrified people. Compare this with the $80 billion spent annually to subsidize fossil fuels in the 11 countries with the largest number of unelectrified households. Clearly, financing priorities must evolve. According to Guevara-Stone there are also significant financial barriers for rural low-income communities who want access to solar: "Many rural communities are miles away from the nearest bank, and low literacy rates make loan applications difficult." Additionally, Guevara-Stone says that despite the growing popularity of solar, there are still many communities where solar is not really known or trusted.

While bringing solar energy to rural and low-income communities has many challenges, a new wave of small businesses, social entrepreneurs, investors and charitable groups are taking the lead in bringing the technology to the world's poor. Here we profile two groups with unique approaches to spreading solar enlightenment.

Solar Energy Foundation, Ethiopia: Electrifying Rural Villages

Ethiopia barely sips electricity compared to the rest of the world. According to the World Bank, Ethiopians use on average just 200 kWh of electricity per year (the average for Sub-Saharan Africa is 510 kWh; the global baseline is considered to be around 13,000 kWh/year). The main energy source for most Ethiopians is wood or charcoal, which has resulted in a serious deforestation problem across the country. The Solar Energy Foundation (SEF), a German-based network of organizations and companies working to bring socially and financially sustainable solar projects to rural and marginalized areas throughout the world, is working to change this. SEF has distributed over 19,000 different sized home solar systems to rural communities throughout Ethiopia, established "solar centers" across the country, and is training technicians and installers.

The group uses a revolving fund model – an increasingly popular mechanism for financing distributed solar projects, which helps the group fund future projects. The fund is replenished from monthly payments from SEF customers and is used to pay for installation and maintenance of new systems, and technicians that are trained and supported by SEF.

Because Ethiopia has a virtually nonexistent solar industry, SEF has had to build one from the ground up. The group developed a comprehensive 6-month technical training program that has so far

Crowd-funding Solar for the Poor in California

Innovators and entrepreneurs the world over are changing how disadvantaged communities are able to access solar power – even in wealthy countries like the US. Solar Mosaic in Oakland, California uses crowd-funding to democratize the financial and environmental benefits of solar by creating opportunities to invest in solar projects that benefit low-income communities. "Our first projects have significantly benefited low-income communities and communities of color," says Lisa Curtis, Community Builder for Solar Mosaic. "Together, our first five projects created 73 kW of clean solar energy, saved cash-strapped community organizations more than $600,000 on their utility bills, and produced over 2,700 job hours for local workers."

Innovation and smart economics is helping to create greater access to solar for communities that otherwise could not afford to make the investment in solar. The Asian Resource Center, which serves communities in Oakland, California by addressing issues surrounding affordable housing, health care, youth programs, and environmental justice, is the first community-funded solar project in the city thanks to Solar Mosaic. By going solar the organization expects to save more than $100,000 a year, which will have a tremendous positive impact on their programs.

mies with Solar

Models Help Poor Communities Light Homes, Grow Businesses

Solar Sisters training in Uganda. Photo: Solar Sister

produced 62 solar technicians. These technicians serve in SEF's 17 solar centers to provide technical expertise, products, and information to customers in areas where SEF has installed solar infrastructure. SEF's solar technicians are equipped with the skills and know-how to eventually start their own businesses to further spread the benefits of solar throughout Ethiopia. "Creating private business for our technicians is one of our most important plans," says Samson Tsegaye, SEF's Ethiopia Country Director. "Our technicians are really committed to doing difficult work in the really rural areas, and our promise for them was that they can have their own business in the future."

While SEF relies substantially on donations, the organization is working to challenge the mindset of short-term charity projects that traditionally provided infrastructure to the rural poor for free, but rarely do the needed follow-up work to ensure their systems are still working years down the road. Tsegaye says this is an unsustainable model, which is why SEF asks their customers to pay for material costs, save money for upgrades or next steps like batteries, and contribute to infrastructure such as building reservoirs for solar water pumps. According to Tsegaye, people are motivated. "Our customers understand the advantage of solar technology," he says. "They even prefer to have solar over the conventional power, as they are the manager of their own system."

Having light on demand has huge ripple effects on people's lives. "The changes are uncountable," says Tsegaye. "In the areas we are working, mothers get more time to do their home chores, kids can do their studies in the evening, shop owners can close late in the evening, people no longer have to travel to fetch water, clinics can provide service in evenings – it goes on and on."

Solar Sister: Lighting Africa by Creating Female Solar Entrepreneurs

"There is widespread energy poverty in Africa, and women are not integrated in clean technology solutions that can have a transformational impact on this situation," says Neha Misra, Chief Collaboration Officer of Solar Sister. "Seventy percent of people without electricity are women. Simply from the market perspective, how do you build up a green economy without women's participation?"

Solar Sister is a social enterprise working to marry green power with women power. Solar Sister uses a direct-sales network that invests in women entrepreneurs to build their own businesses in remote communities in rural Africa. By selling a variety of high-quality solar products through their networks, Solar Sisters are not only spreading solar light throughout the region, they are creating economic opportunities for themselves as entrepreneurs.

Many of the women working with Solar Sister do not have the financial muscle to secure a loan. Through a micro-consignment model, the Solar Sister entrepreneurs are given a "business in a bag," complete with training materials, marketing support, and a portfolio of clean energy products to sell. The women earn a 10 percent commission on all sales, and the remaining funds are channeled into paying for the cost of inventory and operations, and start-up kits for new Solar Sister entrepreneurs. The kits offer a variety of products, which give customers choice and allow them to keep up with innovations in solar technology, and scale their purchases as needed. "For a lot of people in rural Africa, a lot of great products might as well not exist because people don't have access to them where they need them," says Misra. "Solar Sister has come up with this model of woman-to-woman direct selling to fill the gap, because women have immense social capital in their communities."

Solar Sister has grown from 10 women entrepreneurs in early 2010 to 171 entrepreneurs in Uganda, Rwanda, and South Sudan today. The organization has set up a leadership structure that works to recruit, mentor, and support entrepreneur teams. On average, each Solar Sister sells around 10 systems a month, and to date Solar Sister's entrepreneurs have sold 6,370 solar lanterns to customers throughout the region.

The group's funding comes from a combination of private grants, impact investments (those driven by social and environmental goals) and revenues from *Continued on page 14*

A Solar Sister demonstrates products in a village in Uganda. Photo: Solar Sister

ants now get all their power from 43 wind turbines dotting nearby fields, and a smattering of solar panels. Building heat comes from a biogas plant that uses manure from local farms. The shift to community-generated energy cut electricity bills by a third.

Another German village, Wildpoldsried, is producing at least 300% more energy than it needs. The rural village is generating US$5.7 million in annual revenue from renewable energy it sells back to the national grid. The village uses solar panels, biogas digesters, windmills, and micro-hydro power plants.

Germany's federal government encourages community renewable energy projects with policies and incentives, such as feed-in-tariffs (guaranteed payments for small-scale renewables). The clean-energy co-ops are part of a national change of direction toward energy, called the Energiewende (energy transformation) which aims to cut overall energy consumption, increase the percent of renewables, and break the monopoly of the four major energy companies. An annual "100 Percent Congress" brings together community representatives for the growing number of towns and villages trying to get all of their energy from renewables. According to *The Economist,* "The number of energy cooperatives has risen sixfold since 2007, to 586 last year."

Elsewhere around the world, energy co-ops are being set up by forward-thinking communities for a variety of reasons, including building community, more reliable power, creating local jobs, and of course, sustainability. A heavy reliance on dirty energy by their local utility is prompting many communities to adopt cleaner energy at the local scale. Then there are the twin issues of mistrust of large for-profit utilities, and a craving for control over such a vital element in our lives.

In poorer communities, creating a locally owned energy supply is often borne of necessity. The benefits of electricity are not evenly shared. An estimated one in five people on the planet do not have access to electricity. (Articles elsewhere in this issue describe community-driven solar and microhydro in the Global South.)

A strong wind

Community-owned wind is one of the most widespread types of "local power." In Denmark, the birthplace of community wind, about 80% of installed wind capacity is individually or co-operatively owned; in Germany it's about 51%, reports *Renewable Energy World.*

Although it's been slower to take off in the United States, in the past two years community wind has been the fastest growing segment of the US wind market.

Community wind farms not only bring clean electricity and energy independence, but they can also help diversify rural economies, and keep more money and jobs in the community. A 2009 report from the US National Renewable Energy Laboratory showed that the number of construction and operation jobs created by community wind project are significantly higher than for other kinds of projects.

Community ownership can also help allay local concerns about having turbines in the neighborhood. The green energy blog Clean Technica reports: "The Danish cooperative model involves private persons in the ownership of wind turbines, because you want the project to be accepted, and also to avoid the NIMBY or 'Not In My Back Yard' effect," said Hans Christian Soerensen, board member of the Middelgrunden Wind Turbine Cooperative. In the Danish model, shareholders buy shares in the wind farm. Of the 20 turbines in the Middelgrunden project, for example, the local utility owns 10 of the turbines and the co-operative owns 10.

Australia's first community wind project, Hepburn Wind near Daylesford, was in part inspired by an ex-pat Dane who had seen the power of wind cooperatives in his native land. He helped tap local resistance to a massive wind farm proposed for their area into a community-led effort to build a smaller wind cooperative. The two-turbine wind farm, launched last year, provides electricity for 2,300 homes.

Taryn Lane, the community officer for Hepburn Wind, told Deutche Welles: "I really believe that energy is like the veins that keep everything operating. As non-renewable resources run out, we really need to think about what is the best way that we can still keep pumping our blood and keep existing. Generating our energy, bringing that home so we are connected to where our energy is coming from – that's an empowering process for communities on so many levels."

The world still embraces the "big is beautiful" model of long-distance grids tied to massive energy projects. But change is coming, as people "occupy the grid" and bring back this vital service to their communities. For the planet's 1.5 billion people who have no electricity, most living in communities that may never be connected to a national grid, a locally owned electricity supply is a powerful vision. For communities threatened by large-scale, profit-motivated energy development, locally owned energy is a well-tested and adaptable approach that empowers citizens, rather than displacing them.

Nepal's appropriately scaled distributed energy projects are bringing electricity to communities faster, and at lower cost, than the Arun III Dam ever would have. But more importantly, Nepal's micro-energy revolution is building Nepal's green economy from the ground up. ●

More Information

Here are a few resources on setting up community energy systems.

- "Guide to developing a community energy project in North America" by Commission for Environmental Cooperation, 2010: http://tinyurl.com/8bjn4dr
- "Revitalizing Rural Communities through the Renewable Energy Cooperative" (Heinrich Boell, 2012): http://tinyurl.com/8cknj6h
- Global Village Energy Partnership: http://tinyurl.com/9eo3kw3
- Practical Action: practicalaction.org/energy
- Community Energy Partnership Program: While group focuses on developing projects in Canada, its website ists many resources from around the world: http://tinyurl.com/9myf899

Thai Power Plan Offers Sustainable Energy Future

By Ame Trandem

For more than a decade, Thailand's Power Development Plan has been the subject of great debate in the Mekong region. The Thai government has long favored conventional means of generating electricity (oil, coal and large hydropower dams) over the promotion of renewables, demand-side management and energy efficiency measures. Because many of these projects come with costly adverse impacts to people and the environment, Thai civil society has produced a new independent Power Development Plan. The plan was presented to the Thai Energy Regulatory Commission and submitted to the Ministry of Energyv in April.

"Thailand's energy planning process is in a state of crisis," said Ms. Chuenchom Sangasri Greacen, one of the plan's authors. "Persistent over-forecasting of energy demand has led to over-investment and steep economic burdens on consumers. Risky and environmentally unsound power plants are being built in Thailand and neighboring countries, while safer, cleaner and cheaper alternative energy options are being disregarded. This new power plan identifies barriers and offers realistic energy solutions, which will bring social, economic and environmental benefits to Thailand."

The report was commissioned by International Rivers and conducted by researchers Ms. Greacen and Mr. Chris Greacen. Endorsed by more than 140 civil society groups in Thailand, the plan provides a blueprint for meeting the country's energy needs in a more sustainable and less costly manner. Thailand is one of the largest consumers of electricity in the region, and its appetite is fueling plans for new large hydropower dams on the Mekong River.

The report provides a new vision in which power from the planned Xayaburi Dam and other Mekong mainstream dams is not needed. By establishing a more realistic demand forecast for 2030 based on historical trends over the past 25 years, and revising the GDP growth rate to the past five-year average, the authors found that the power sector still needs an additional 14,387 MW of power by 2030 in order to maintain a 15% reserve margin. However, the report contends that investment in renewables, co-generation and energy efficiency measures could lower electricity bills for consumers by 12% by 2030 and avoid unnecessary investment of US$60 billion (2 trillion baht).

The report's recommendations have begun to be slowly incorporated into Thailand's official plans. In June, Thailand approved its revised Power Development Plan 2010, with an amendment that reduced its overall peak demand forecast by 6.27%, while the total energy demand decreased by 5.58% between 2012-2030. Furthermore, the plan commits to increase electricity from renewable energy by 5% and foreign power imports are also now capped at 15% of the country's total generating capacity. Despite these changes, destructive projects like the Xayaburi Dam and Theun Hinboun Expansion Project remain in the plans, and the government aims to add 8,194 MW from foreign countries over the next seven years.

"There is growing consensus of the need to improve the power sector planning in Thailand to better integrate energy efficiency, which is cheaper and greener than building large-scale power plants such as dams. This would benefit consumers, and improve the country's economic competitiveness," said Ms. Greacen.

As Thailand begins to prepare its Power Development Plan 2012 later this year, which will mark energy plans for the next 20 years, International Rivers along with Thai civil society groups will continue to call for meaningful public participation in the planning process, while continuing to highlight why destructive dams are not in the interest of Thai energy consumers. ●

Read the report: www.internationalrivers.org

Environmental Groups in Korea and Japan Push for Green Energy

By Wen Bo

A few minutes from Gyeongbokgung, Korea's ancient Royal Palace, stands a three-story glassy eco-building. A wind turbine atop its roof generates power at 1 kw per hour. Though modest and symbolic, it demonstrates how locally tapped wind energy could be utilized in the center of a bustling city like Seoul.

The building is the headquarters of the Korean Federation for Environmental Movement (KFEM), one of the most dynamic environmental groups in Asia. Since 1995, the group envisioned creating a permanent office as the size of its staff and number of projects grew. Within two years, more than ten thousand individuals and institutions in Korea contributed 2.4 billion Korean Won for the establishment of the office building.

The 300 solar modules installed on the roof provide sufficient electricity for interior lighting, computers and other office facilities. Windows are adjustable for wind direction and strength to take full advantage of the natural air conditioning of local breezes.

A model of green architecture, KFEM's building not only serves as a public education center for its members and visitors, but a living example of an eco-friendly work environment that is also comfortable and efficient.

The dream of green buildings is not just a passion of groups like KFEM, but also the Korean government, which has created a presidential committee on green growth and has developed a breakthrough low-carbon growth strategy.

Japan groups push for green energy

In 2011, Tetsunari Iida, founding director of the Institute for Sustainable Energy Policies, launched the Japan Renewable Energy Foundation, which brought international experts to analyze obstacles to renewable energy use and offer policy recommendations to the Japanese government. His straightforward idea is "that Japan can go 100% renewable." To translate his perspective into reality, Iida even ran for governor of Yamaguchi prefecture in Western Japan.

Japan for Sustainability (JFS), a Tokyo- based group, initiated its "Energy Shift Japan" campaign after Fukushima nuclear accident. The group also holds a "Sustainability College" which recruits citizens, particularly youth, for public training and empowerment to spread the concept of sustainability in Japanese society.

These environmental organizations are just a few of the many groups in Asia working to ensure that clean energy plays a more prominent position in their societies. ●

Wen Bo is Program Director, National Geographic Society Air and Water Conservation Fund.

News Briefs

by Kate Ross

The Elwha River is getting a boost from dam removal. Photo: Jason Dunham for USGS

US dam removals to help fisheries

The US should get a gold medal for its recent dam removal efforts, and the restoration of essential wildlife to its rivers and ecosystems. The following are a few highlights.

Penobscot River, Maine: The removal of the Great Works Dam officially began in June, capping a 13-year campaign to decommission three dams that have choked the lower river since the 1830s. The project brought together conservation groups, the local Native American tribe who share a name with the river, federal and state governments, and two hydropower companies. The Penobscot River once flowed with salmon, shad, sturgeon, alewives, eels and smelt, all of which were almost wiped out by the dams. The river still has the nation's largest run of Atlantic salmon, now listed under the Endangered Species Act. The next step is to take down Vaezie Dam, which is expected to happen by July 2013.

Elwha River, Washington: Just months after the first dam was removed on the Elwha River, wild salmon were seen spawning in two tributaries. The largest dam removal project in US history, the work to bring down the Elwha and the Glines Canyon dams began in September 2011. At this writing, the first dam is gone and a second is partly demolished, and parts of the river are flowing freely for the first time in centuries. Tagged fish are being released into the river to jump-start the re-colonization of the habitat. The return of wild, un-tagged fish, which found their own way up the river without help, is a sign that they can sense the river is open again, say government scientists.

Carmel River, California: California is hoping for improved fisheries in the wake of a long sought-after decision by the California Public Utilities Commission to permanently remove the San Clemente Dam from the Carmel River. The decision will enable the largest dam removal project in California history. The 106-foot high water supply dam is more than 90% filled with sediment. Removing the dam will restore access to 25 miles of spawning habitat critical to the South Central California Coast Steelhead's recovery.

Community energy competition energizes UK

The Community Energy Challenge was launched in February to support and showcase communities around the United Kingdom who are working toward innovative, community-owned energy solutions. The intended outcome is a set of community energy initiatives that can be replicated and which display a range of technologies, along with the lasting benefit of community ownership.

Community and cooperative projects in the UK have the potential to generate 3.5GW of energy if they receive effective government support, according to a leading expert. That's enough for three million homes. Yet the community energy movement has been slow to grow in the UK. The competition is a fun way to bring public attention to the need.

Out of 120 entries, seven communities were chosen to receive a portion of the £200,000 prize money, along with specialist mentoring, enterprise development and technical advice. The winners include the Wey Valley Wood Fuel in Surrey, which raises money through community shares to install biomass boilers and generate free heat energy for community spaces such as schools, churches and recreation centers. Brendon Energy, another winner, is a group working with local people to find the best sites for a small number of medium-sized wind turbines in the ten parishes around Wiveliscombe in Somerset. These will be owned by the community, and all profits will be invested in new energy projects and donated to a fund to benefit the local community. Two other winning communities, in Wales and in the Midlands, are developing small community-owned hydropower projects.

Indian NGOs expose flaws of Clean Development Mechanism

Activist groups in India have opposed granting Clean Development Mechanism (CDM) credits to the 780-MW Nyamjang Chhu Hydropower Project in Arunachal Pradesh state, in addition to at least 15 other ill-conceived projects proposed for credits in 2012 alone. Under the United Nations Framework Convention on Climate Change, CDM projects in developing countries can earn certified emission reduction credits, which can be sold to industrialized countries to help meet their emission reduction targets under the Kyoto Protocol. But the system is being gamed by developers of large dams around the world.

Indian civil society groups, including the South Asia Network on Dams, Rivers and People, argue that projects like Nyamjang Chhu would be a significant emitter of greenhouse gases resulting from tree felling, the submergence of forest and organic matter, and the release of water from powerhouses. More than 89 hectares of forest will be destroyed to make way for the project.

As of July 1, India had 232 hydropower projects in the CDM pipeline, according to the UNEP Risoe Center. Overall, India has more projects in the CDM pipeline than any other country except China. In the past year, groups in India have been taking a more active role in opposing these projects, facilitated by the newly formed CDM Watch India Network. While the CDM has helped finance thousands of projects since its inception in 2005, it has also set off serious concerns over human rights violations, the environmental integrity of its projects, and its genuine contribution to sustainable development. The international CDM Watch Network, of which International Rivers and many of our partners are

members, works to strengthen the transparency of the process, enabling comments and input by those directly affected by these projects.

New York's first self powered building

From the street, it looks rather like any other modern, hip, multistory apartment building. But inside, The Delta – New York's first self-powered property – is full of energy-saving surprises. Designed and constructed by Brooklyn-based alternative energy company Voltaic Soltaire, the two-unit building was unveiled in July. Its solar awnings, solar thermal system and roof-mounted wind turbine help ensure it produces more electricity than it needs. The positioning and location of the building also play an important role in optimizing power generation efficiency. The developers positioned the building in a triangular shape facing south, so that its "solar skin" can absorb the most sunlight. The building also has insulated pipes and energy-efficient windows to conserve as much power as possible.

The property has a give-take relationship with the grid: During the day the solar panels and wind turbines generate electricity which is sent straight to the power grid, contributing to the whole area's grid system as a small independent power plant. At night, electricity is supplied through the power grid. At the end of the month, a meter measures the electrical production versus consumption. If production is greater than consumption, the owner will receive a check from the energy supplier. The Delta is estimated to be able to produce 18,000 to 20,000 kilowatt hours of energy throughout the year, far more than the property needs.

"Our hope is to serve as a model, and inspire other developers around the world to do the same," Ron Faia of Voltaic Solaire told *Inhabitat NYC* magazine. "This is a matter of energy independence, of environmental responsibility, and frankly of national security."

Xayaburi Dam causing conflict and uncertainty

In June, staff from International Rivers travelled down the Mekong River in Northern Laos to visit 15 of the villages near the Xayaburi Dam site. International Rivers found that Thai dam builder Ch. Karnchang has already placed the future of one village in jeopardy, and people in other villages are confused and concerned about what lies ahead. In December, the Mekong governments postponed deciding on whether to proceed with the dam, while agreeing to conduct further studies on the impacts of Xayaburi and other proposed Mekong dams. However, this recent field revealed that Ch. Karnchang has already undertaken significant resettlement and construction activities, contrary to claims that only preliminary work is underway, and despite opposition from Cambodia and Vietnam.

On a visit to Laos in July, Secretary of State Hilary Clinton urged Laos to carry out more studies before moving forward with the US$3.6 billion hydropower project. The Prime Minister of Laos assured Clinton that the Xayaburi Dam would not move forward without the agreement of neighboring countries. Subsequently, at a high-level meeting in Cambodia on July 13, the Lao Foreign Minister publicly announced that the Lao government had decided to postpone the project. But just three days later the Lao government seemingly changed its position once again when the Ministry of Energy and Mines announced that construction activities on the project would continue. In many ways the Xayaburi Dam is also a Thai project: it is being built and financed by Thai companies, and 95% of the electricity will be sold to Thailand. The Thai government has remained silent about the controversial megadam.

Alaskans push back on Susitna dam

Two significant events in July brought increased complications to the State of Alaska's push to build a large dam on the free-flowing Susitna River.

The Federal Energy Regulatory Commission (FERC) issued a second scoping document in response to 175 public comments submitted by individuals, state agencies, Alaska-based businesses, and national NGOs. Nearly nine out of ten expressed some concern about the proposed dam's impacts and risks. The new scoping document incorporates those concerns, and acknowledges many uncertainties of the dam's impacts. Major concerns included loss of salmon and wildlife, economic risks to tourist-oriented economies, lower water flows in summer, and as much as 480% greater flows in winter. The fact that the dam is sited in a major earthquake zone where a 7.9 quake in 2002 reduced the sides of mountains to rubble is another major, unresolved issue.

In the same month, the Alaska Energy Authority filed a study plan listing 58 separate studies to be done over the next two years, which will attempt to address these and other issues. Many of the agencies charged with doing the studies have publicly stated that two years is insufficient to return conclusive data.

Meanwhile, the Coalition for Susitna Dam Alternatives is now backed by 3,000 members in opposition to the dam, and is growing by about 75 per day. No national media has yet to report on what would be America's tallest dam since the 1966 Glen Canyon dam, making the extent of the opposition particularly surprising.

Richard Leo

Low rainfall sparks power shortages

As climate risks mount for hydropower-dependent nations, energy shortages caused by low rainfall are growing. Here are some recent examples:

Burundi is facing a shortfall of nearly a fifth of its electricity demand because of a shortage of rainwater to run its hydropower dams, the East African nation's power and water distribution company told Bloomberg news service. Rationing began in August. Burundi produces 32 megawatts and imports the remaining 15 megawatts from neighboring countries, mainly Congo. Burundi's electrification rate is less than 3% of its population of 8 million. Burundi, Congo and Rwanda plan to build the 145-megawatt Ruzizi III Dam along their common borders, although none has the money to start construction on the project. All three nations are heavily dependent on hydropower, and have all suffered energy shortages due to dropping river flows.

In **Eastern Europe,** a prolonged drought has lowered hydropower output in a number of countries. Hydro output is about 40% below target in Romania and Bosnia. Serbia had to pay 1 million euros a day to import as much as 18 million kilowatt-hours, or 15% of national consumption. Montenegro, Serbia's southern neighbor, has seen "the lowest rainfall on record," reports Bloomberg; its hydro plants were at just 5% capacity earlier in the year.

Sri Lanka has lost an estimate 85% of its hydropower generation capacity due to drought this year. Power cuts have been imposed since July. This is the nation's third drought-related power shortage since 1996. Dams supply about 40% of the nation's electricity. To combat its hydrodependency, wind farms are being quickly brought online. This year, Sri Lanka doubled its wind capacity, adding 30 megawatts of wind power to its national grid, with another 10MW planned by year's end. The nation has set a goal of having 400 MW of wind by 2020.

Itaipú Dam Reservoir Changing Microclimates in Brazil

By Zachary Hurwitz

When one thinks of the climate impacts of large dams in the tropics, the first thought is usually of greenhouse gases produced by rotting vegetation in a dam's reservoir and released at a reservoir's surface and a dam's turbines and spillway. But evidence is accumulating that large dam reservoirs do more than emit greenhouse gases: they are also capable of changing a region's microclimate in ecologically and economically devastating ways.

Take for example the huge reservoir of Itaipú Dam, which produces hydropower for Brazil and Paraguay. At 170 kilometers long and 12 kilometers wide, it is one of the world's largest reservoirs, with a capacity to store 29 billion cubic meters of water. According to a class-action lawsuit filed by a thousand of the region's farmers against dam operator Itaipú Binacional, a temperature increase of 4°C has been recorded on the lands surrounding the reservoir.

The farmers claim that the temperature increase has caused a 30% decrease in soy production since 1984, the year the reservoir was filled. They say the hotter temperatures have also decreased animal fertility, and decreased the value of the farmers' lands, many of which directly border the reservoir.

The hot tub effect

Building a large dam reservoir is like creating a huge, solar hot tub: water stores solar radiation better than land, absorbing and trapping the sun's energy. Eventually, evaporation releases this as hot moisture into the air, increasing the overall heat and precipitation balance. In short, water's low albido – its index of solar reflectivity – can turn large reservoirs in hot climates into huge steam furnaces that can pump heat and moisture into the atmosphere.

The Brazilian government knows that climate change is transforming the country's agricultural production. A 2008 study of the Brazilian Agricultural Research Corporation EMBRAPA ("Aquecimento Global e a nova Geografia da Produção Agrícola no Brasil") estimates that as a result of climate change, large areas of soy planted in the country's southeast are likely to be replaced by crops that perform better in hotter, wetter conditions, such as sugarcane, cassava, and coffee. However, the government has yet to admit that large reservoirs are playing a role in exacerbating regional climate change.

Instead, Itaipú Binacional has tried to sweep the phenomenon under the rug. The company has attempted to intimidate the farmers into dropping the lawsuit, which was first filed in 2003, by telling them that they would receive no compensation, while pressuring the government to throw out the case. Prosecutors have been successful in maintaining that the case falls within the government's 20-year statute of limitations. Yet, if the lawsuit is settled rather than litigated, the Brazilian government would seek to impose a gag order, restraining publication of all documents and studies that provide evidence of the microclimatic phenomena caused by Itaipú.

According to the case's lead lawyer, the farmers are pushing forward with the lawsuit, arguing not only for compensation for damages, but also that the government should create a 10-kilometer-wide buffer zone of native forest around the reservoir to temper its microclimatic effects. The buffer could be tied to conservation areas in the country's remaining *cerrado* savannah, the plaintiffs argue, to act as a wildlife corridor.

The implication of the Itaipú case is significant: the world has many large reservoirs, and the climatic changes produced by them could be causing similar damage. Plans for large reservoirs as so-called "green economy" investments may actually do harm than good to local agriculture, especially in Africa, where rising temperatures are already taking a high toll. Energy planners would do well to pay attention. ●

Solar *contined from page 9*

sales. As the organization is scaling up, the goal is to replace larger and larger parts of organizational funding with revenues from business growth. The organization is also partnering with Kiva, a crowd-funding organization, to scale up their operations. Crowd-funding models are becoming increasingly popular as mechanisms to create opportunities for solar projects where they previously did not exist by pooling together investors for projects. Similar to SEF, Solar Sister customers pay market price for their products. Payments are made up-front, in installments, or through creative mechanisms like "merry-go-round" schemes set up by women's groups. "We want to change the culture of purely charitable efforts," says Misra, "because that doesn't last."

Misra cites clear communication as key for expanding the market for solar home systems, as it can be difficult for potential customers to envision the long-term savings associated with solar because they are often not aware of how much they spend on kerosene each year. "You have to communicate that women are already spending a lot, and that they would be better to invest their money in a solar product" says Misra, who estimates that for a typical solar light, customers could break even on their investment in 3-4 months.

Most Solar Sister customers start with smaller-scale solar home products such as simple solar lights and mobile phone chargers, and then move to bigger systems such as power-packs for multiple lights. "Once people see the economic value, and see other benefits such as improved business hours, better study time for their children and cleaner indoor environment, they want to invest in more technology," says Misra.

The group's approach intertwines market-based solutions, gender inclusivity, and bottom-up distribution. "We looked around and saw very few projects here and there that recognized the importance of women in spreading the use of clean energy. We didn't see any organized efforts to institutionalize innovative solutions and then scale them up," says Misra "No one else was doing this with a laser-sharp focus on gender and energy poverty."

Substantial challenges will persist in the effort to bring light to the world's poor. The solar industry is still dependent on subsidies, and governments throughout the world are moving too slowly to create a level playing field between renewable energy and fossil fuels. In the meantime, it is reassuring to know that innovators throughout the private and non-profit sectors are finding ways to fan the flames of a burgeoning solar revolution. ●

Artist is Batty for Rivers

The Rillito River in Tucson, Arizona was a perennial river for the first part of the 20th century. After World War II, however, Tucson began a decades-long growth spurt that ran the river dry. Today, the river flows only during heavy rain particularly during the torrential monsoon season. But life still thrives here. Most dramatically, some 45,000 Mexican free-tail bats roost on the underside of a bridge that spans the now-dry river. Beginning in 2007, a group of artists and environmentalists began what would be an annual celebration of the bats, and a call to action for the river. We talked to *Ellen Benjoya Skotheim,* the founder and creative director for the Rillito River Project's annual "Bat Night."

Rillito River Project creative director Ellen Skotheim. Photo: Tim Fuller

The Rillito River Project aims to raise awareness of the impact of overuse and climate change on the vanishing rivers of the Southwest. We try to increase consciousness of the delicate balance of life and river ecosystems in the desert through art performance and installations.

Rio Vista elementary student performs at the Rillito River Project's Bat Night 2012. Photo: Tim Fuller

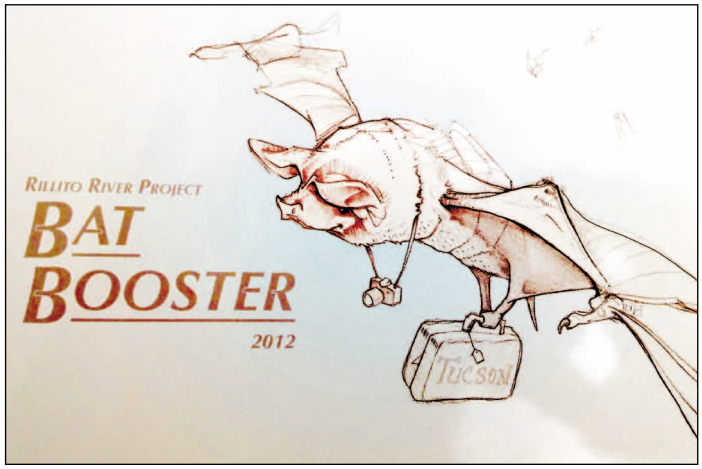
Many people in the area would drive over the river bridge and not even know it had ever been a river. They thought it was a dry wash. We've lost the riparian corridor and so much else. Our groundwater has been affected by the loss of the river, too. There used to be groundwater about 10 feet below the surface in that area; now it's at 200 feet. We drank it, we pumped it for agriculture, we didn't think of it as a resource that could disappear.

The bats fly at dusk every night, and the first thing they do is look for water. People are attracted to the bats, and also a little frightened of them. We draw them in with the bats, and then raise their consciousness about the river.

Bat Night is a community project. In the early days, I would put on impromptu Bat Nights with my friends, and it just kept growing. For our most recent Bat Night, a local choreographer gave daily dance lessons for a month to 120 fourth-grade kids froma school that backs up to the river. The kids also got lessons from a world-renowned bat expert. The kids' families and community members helped make their costumes – some were bats, some were insects. We built a sand stage in the middle of the riverbed, covered it with carpets, and the kids performed beautiful bat dances for more than 5,000 people. At the end, everyone in the audience got to participate in a short bat dance. These kids will never forget that experience.

We also have our Art Lab project, in partnership with the University of Arizona, Biosphere 2, the Institute of the Environment and Cuenca los Ojos Foundation. We bring six artists to Tucson each year to have an in-depth experience on environmental issues. They spend a week together, learning from experts and spending time in the local landscape; then they go home and make art based on this experience. I think artists can play a big role in helping the environment.

Rivers can only go forward in time. This river won't come back in my lifetime, but we are making progress in raising people's awareness about the river. That's the first step you have to take – people wanting it to be a real river again. I also think that the problem in front of you may not be the problem you solve. We may still be able to save other rivers in the region. ●



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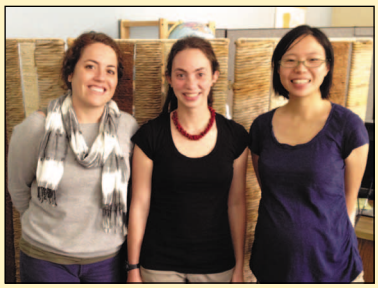
Here's to a great group of interns!



International Rivers is honored to have the help of four brilliant young women in our Berkeley and South Africa offices this summer. Pictured, from left to right: Jenny Binstock brings experience with Greenpeace to our Climate team as a researcher and writer on climate adaptation. Simone Adler is working with our policy team to expose the poor practices of dam developers that have signed onto the Hydropower Sustainability Assessment Protocol. Dan Ruan, our China Program Intern, coordinates our Chinese-language social media and online communications, as well as providing valuable translation and research assistance. Last but not least, Annette Fay (not pictured) is working in our South Africa office, helping to investigate the Inga dams on the DRC's Congo River. Thank you all for your enthusiasm, creativity and hard work!

Dam Drawdowns an Overlooked Global Warming Culprit

by Katy Yan

New research from Washington State University-Vancouver has revealed that dam reservoirs can produce a significant surge in methane emissions during drawdown periods, which is when the water level in a reservoir drops rapidly and exposes a "drawdown zone" of decayed organic matter. Bridget Deemer, the lead researcher on the study, measured dissolved gases in the water column of Lacamas Reservoir in Clark County and found methane emissions jumped 20-fold when the water level was drawn down. While emissions from drawdown regions have long been recognized by researchers and international research bodies such as UNESCO as being possibly significant, this is the first study to actually demonstrate and quantify the relationship between water-level drawdowns and greenhouse gas releases. Drawdown emissions have previously been studied and modeled to a limited extent for tropical reservoirs as well as for China's Three Gorges Dam.

While dam reservoirs cover a small portion of the earth's surface, they harbor biological activity that can produce large amounts of greenhouse gases. When you think of the number of large dams in the world – more than 54,000 that are over 15 meters – and the countless others that are being proposed or are under construction, continuing to overlook reservoirs as a carbon source and treating dams as a "carbon neutral" energy source is no longer viable. An important first step to address this situation is for governments and dam builders to recognize that dams have a carbon footprint and that these emissions should be reported in their national greenhouse gas inventories.

The Three Gorges Dam drawdown zone.