Cogeneration & On-Site Power Production

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A new approach to financing - from mini-hydro projects to a portfolio approach to distributed generation opportunities

Lower than average rainfall patterns recently mean that Sri Lanka can no longer rely on its hydroelectricity schemes for power supplies, not even the decentralized, mini-hydro schemes built recently. Moves are being made to find ways to expand financing models to include other distributed generation technologies such as CHP - as Sandeep Kohli reports.

Sri Lanka, a tear-drop shaped island in the Indian Ocean, has been different things to different people - a tropical paradise, a spice island, a leading tea producer, and more recently, a place where renewable energy has built some serious inroads. The island nation has over 2500 MW of built capacity; half of it being large hydro units, while the other half consists of diesel-based generation. There is, however, another piece of this story: about 100 MW of mini-hydro capacity in operation, with an additional 100-150 MW under planning.

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Most of this capacity is locally owned, and all of it has been financed through local banks in Sri Lankan Rupees (SLRs). Individual projects are 1-10 MW in size, though most of them are less than 5 MW. The typical debt-equity ratio is 70/30, and debt financing has a typical tenure of 7-8 years. In a country where most banks focus on trade financing, even five-year loans were a rarity before a World Bank-supported initiative - Renewable Energy for Rural Economic Development or RERED - made the mini-hydro sector possible.

A key element to RERED was the recognition that long-term loans were needed for renewable energy projects to flourish and compete against lower capital cost fossil generation. The World Bank used a package of US$94 million to provide support to grid-connected mini-hydro, and small off-grid renewable projects (most are solar home PV and pico hydro) in Sri Lanka. The centrepiece of the plan was a 40-year, $86 million loan from the International Development Association (IDA) to the Sri Lankan government for the promotion of the renewables sector. This made it possible for the government to ‘on-lend’ funds to local banks for up to 13 years, who then lend the funds to projects exclusively in the renewables arena.

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In conjunction with the IDA loan, the World Bank worked with the government on a series of policy initiatives that resulted in a standard power purchase agreement (PPA) for mini-hydro projects, as well as national targets for renewable energy. This has spurred local entrepreneurship, and developers signed and executed nearly 25 PPAs and projects. Several local banks now have significant expertise in lending to the sector, and the repayment record has been very good to date.

LIMITATIONS OF MINI-HYDRO PROJECTS

Sri Lanka continues to see an 8% annual growth in demand for electricity. The capacity utilization of large hydro units has been falling as a result of lower-than-average precipitation, increasing the island's dependence on diesel generation. Small hydro projects also suffer from lower precipitation, and are therefore unable to diversify the risk to energy security as a result of increased global warming and greater uncertainty of monsoons. Furthermore, unlike the large hydro units, mini-hydro projects do not have significant water storage capabilities, and hence are even more prone to seasonal fluctuations.

The seasonal and 'interruptible' nature of mini-hydro projects has been penalized heavily in the Sri Lankan tariff system. While large diesel-based independent power plants (IPPs) were paid the equivalent of over 15 US cents/kWh in 2004, mini-hydro projects received the equivalent of just under 6 US cents/kWh during the same period. All diesel IPPs in the country have fuel as a pass-through item, and therefore will see ever higher tariffs as fossil fuel prices escalate. Furthermore, while the diesel-fuelled IPPs receive a two-part tariff, mini-hydro projects have energy-only tariffs, and hence depend on dispatch for recovery of capital costs.

The lower tariff for mini-hydro projects is partly due also to locational factors. Mini-hydro projects are located in the hilly regions of the island, away from major load centres, further reducing the value of the power generated. Thus, while the next generation of small hydro plants is planned, it is important to think more holistically and to address the limitations already outlined above.

THE NEXT STEPS

The Ceylon Electricity Board's (CEB's) 2004 Report shows that over 65% of the energy in that year was provided through diesel generation, even though large hydro is 50% of the built capacity. This points to an increasingly unsustainable future as fossil fuel prices continue to rise, and the potential for new hydro plants reaches a plateau. There is a greater need for energy diversity, and a more concerted effort to make clean distributed generation an even more significant part of the energy mix.

Given the heavy reliance on diesel-based generation, there is a need to promote cleaner diesel technologies as well as combined heat and power (CHP) applications on the island, and to better integrate diverse generation resources into the grid in a manner that matches the load profile. The new generation resources should be closer to the load centres, and also integrate use of waste heat where possible. Large efficiency gains can be made possible by simply using waste heat in industrial processes, or in the case of a tropical island, finding ways to turn that heat into cooling.

Biomass-based CHP units can add a potent new power generation source to Sri Lanka's energy mix

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Sri Lanka is one of the world’s largest tea producers, and tea plantations need both heat and power. In addition, they also have residual biomass, as well as the possibility of growing energy crops. By developing efficient biomass-based CHP units, Sri Lanka can add a potent new generation source to its energy mix, while at the same time providing more firm power that better matches the load profile of the end-consumer. Another advantage of such plants is their proximity to the user, and hence the ability to avoid transmission over large distances. Municipal waste is another potential fuel source found mostly near large urban centres where most load requirements are.

Both these cases tap into two key selling features of distributed generation: use of waste heat, and location close to load. Sri Lanka has significant untapped potential in the area of biomass utilization, and the policy debate is only now beginning to focus on the policy and tariff-related challenges that need to be addressed to promote biomass or wood-based generation (or ‘dendro’ generation, as it is called in Sri Lanka). It must be recognized, however, that one technology or fuel source cannot be the silver bullet. Over-reliance on woody biomass can lead to biomass supply constraints, and consequently a run-up on the price of the fuel for such projects. In order to avoid this, different technologies and fuel sources must be supported.

Wind energy, for example, is a source of power that requires no fuel. In this instance, while there are risks in mapping and siting the plant, as well as with choice of equipment, one can come up with highly predictable costs for power that link into the capital costs and financing assumptions. This is an important characteristic, even though wind power comes with locational constraints and non-firm power characteristics. By focusing on smaller-sized wind technologies that operate at lower wind speeds and that can also be located close to end-consumers, it is possible - through technological innovation and operational experience - to convert wind power to something closer to firm power, produced close to the end-consumer. Here, too, we can see a lot of potential in Sri Lanka, provided the appropriate enabling environment is created.

Sri Lankan policymakers have now decided to focus on technology-based tariffs in the area of renewable energy. This approach recognizes the different characteristics and economics of different renewable systems of power generation. However, there is still no linkage into the efficiency of such systems, or for that matter, incentives for promoting CHP-type applications. Nonetheless, these are welcome first steps in the evolution of a diverse portfolio of technologies that are more sustainable, and reduce overall risk to energy security. The Portfolio Approach to Distributed Generation Opportunities (PADGO) seeks to systematically promote a cleaner, more robust energy future through a ‘private sector-centric’ approach in Sri Lanka.

PADGO OPPORTUNITIES …

As pointed out earlier, in Sri Lanka there are significant opportunities as well as challenges in the clean energy arena. The PADGO initiative takes the first steps to move towards expanding the technology platform and building upon the existing experience in the mini-hydro sector. The objective of this initiative by the International Finance Corporation (IFC) is to stretch local capacities for the next crop of technologies and projects in a replicable and cost-effective manner.

The island has substantial untapped biomass potential, as well as a tradition of well run plantations in tea and spices with well understood CHP needs. However, providing a reliable and affordable supply of biomass is key to the development of biomass-based projects. Sri Lanka appears to have the essential ingredients, but there is need for significant hand-holding and learning from best-practice and experiences elsewhere. PADGO seeks to bridge the information gap through seminars or workshops that will bring together technology providers, original equipment manufacturers (OEMs), local entrepreneurs, as well as experts in the field of biomass production. Through this initiative the IFC will also develop and disseminate information on general project economics, contracts, as well as the typical relationship between counterparties.

In the arena of wind energy, Sri Lanka has only one pilot project at Hambentota that has shown capacity utilization factors in the teens. Yet, across the straits, wind energy projects in India have been in bloom for over a decade. Significant wind potential exists along the island’s long coastline, as well as along the central hillsides. It is possible to turn potential into reality with the right mix of policies, incentives, and entrepreneurial risk-taking, and PADGO will attempt to do just that.

… AND CHALLENGES

The RERED initiative used some $83 million of concessional funds to promote total estimated projects worth $133.7 million in the mini-hydro sector. Going forward, the availability of such large sums of concessional funds is unlikely. Thus the financing of the next generation of (larger) mini-hydro projects, as well as the new wind and biomass projects will require greater risk-taking by local banks than has been the case in the past.

Furthermore, in the mini-hydro sector, the average project cost was less than $1000 per kW installed, and an off-take price (purchasing price) of less than 6 US cents per kWh was mandated per the standard mini-hydro PPA. By contrast, most biomass projects will have capital costs that exceed $1500/kW installed, and will also have material fuel costs during operation. Hence a higher off-take price will be needed if such projects are to be financiable. Sri Lankan authorities are aware of this need, and seek to address this through the technology-based tariffs mentioned earlier. On the positive side these biomass projects will be more attractively economically than those using imported diesel.

Similarly, the low plant utilization factor at the Hambentota site, coupled with the large backlog of orders for wind turbines, poses a special challenge in the arena of wind project development in Sri Lanka. The absence of reliable wind data, and a very shallow pool of experience with both biomass and wind development in the country, also make banks and financial institutions wary of financing the first few projects that use these technologies.

SMALL POWER - IN NEED OF BIG THINKING

The power sector is one of the most capital-intensive sectors, with most power plants costing upwards of $1000,000/MW installed. It should therefore be no surprise that for larger power plants with over $100 million in costs, project financing with leverage ratios of 70% are needed in order to provide equity-holders with reasonable returns at tariff levels that are economic. Figure 1 outlines risk levels, spend rates and the ultimate revenue stream as viewed in such a project finance context.

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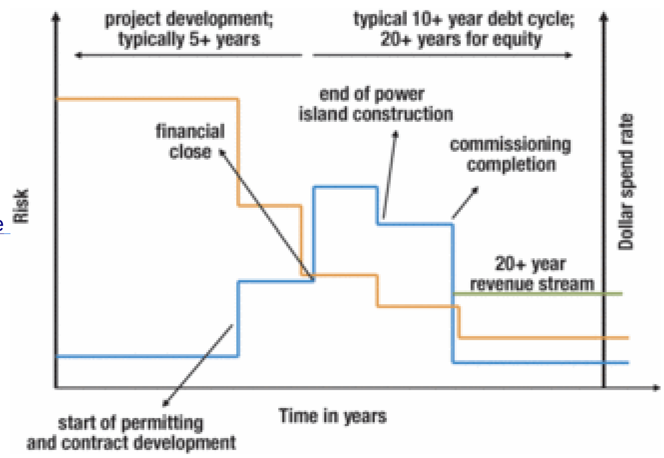

Revenues (shown in green) begin only after the plant has begun commercial operations, while the spend rate (shown in blue) has to be sustained over several years before the plant can be built and operated. The risk associated with funds spent (shown in orange) decreases as the plans to build the plant become more firm, and as contracts, permits, financing and construction progresses.

It is important to note that the most risky funding occurs during the early development stages of the project when very little is firmly known about the project's outcome. During this stage funds are used for market assessment, feasibility studies, early negotiations, and in some cases market awareness efforts. Typically, donor funds have been used to fund certain high-risk activities during the early development stages of smaller or more risky projects. This is called technical assistance (TA). Pre-feasibility studies, some training activities, as well as market studies fall into this category. Post financial close (when debt funding is obtained for the project), while the actual spend rate goes up exponentially, the risk associated with the funds spent is significantly lower as a result of firm off-take contracts, guarantees, as well as siting and permits.

When this model is applied to smaller investment sizes such as small distributed generation units, one sees significant problems. For purposes of this article, small power projects (SPP) are those power projects that are an acceptable or good match for local entrepreneurial and financing capacities. In the Sri Lankan context, mini-hydro projects of less than 10 MW size fall within this umbrella. At the other end of the SPP spectrum are rooftop photovoltaic (PV) installations of a few watts each.

These diverse technologies have been locally financed, constructed and maintained. As Figure 2 shows, SPPs cannot sustain the high transaction costs of typical project finance, are perceived to be higher risk and hence require a larger proportion of equity, and also fail to interest large international banks since the volume of financing is small per project.

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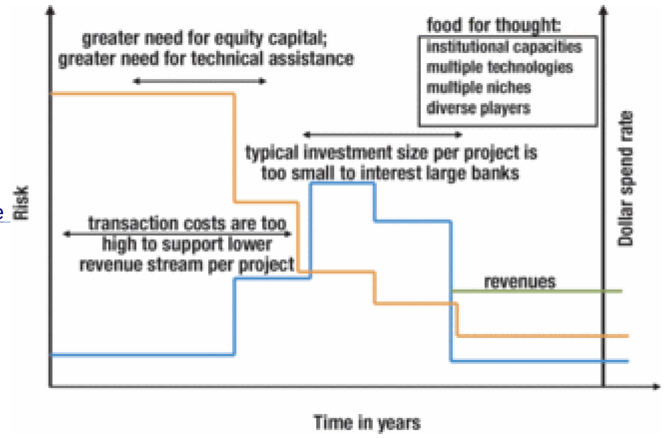

Even the larger mini-hydro plants in this category need the equivalent of about $10 million of financing per project, while a small PV installation may cost less than $500. As against this, large central generating plants may need several hundred million dollars in both local and hard currencies for each project. The latter can, therefore, afford the customized project finance approach which can have associated legal and development costs of several million dollars per project. The same is not a feasible option for SPPs.

PADGO recognizes that in order to get to a comparable volume of generating capacity as one large central generation unit, several SPP transactions must occur. As an example, in Sri Lanka, there are some 25 mini-hydro financings to arrive at a cumulative generation of about 100 MW. If the same were to be done using 2 MW biomass units, 50 financings would have to occur; and for 100 W PV installations, the equivalent number is a million. From this example it is clear that for a diverse set of SPPs to rapidly penetrate the market, one must increase the volume of transactions exponentially, while reducing costs in dollars and time spent dramatically.

TRANSACTION VOLUME AND WHITE GOODS

When one looks at the experience to date with large volume financing, we can see parallels in white goods (high-end electronics, cars, large kitchen appliances) and even home financings. In all these cases a securitization approach is used to produce standard lending contracts and credit checks, as well as a possible lien on the equipment. In many cases, there is also the sale of warranties bundled together with the financing package.

For power plants, such an approach has not been tried to date, and presents some challenges. One key challenge is the linkage to performance by multiple parties such as developer, lender, EPC contractor, plant operator, power off-taker, fuel supplier etc. The typical IPP covers these risks under a project finance structure using multiple customized contracts such as the power purchase agreement (PPA), fuel supply agreement (FSA), and so on. This is not going to be possible for SPPs, if we are to lower transaction costs and build volume rapidly.

PADGO CONTRACT STANDARDIZATION

The PADGO approach seeks to develop a system of standard templates and contracts that can incorporate a mix of the project finance approach which focuses on performance of multiple stakeholders, and elements of the securitization approach that allows for parsing and aggregation of distinct risks and assets. The PADGO Sri Lanka pilot is designed to take the first steps in the direction of lowering transaction costs and developing enough experience with transactions to build larger volumes that are needed to move towards securitization. It must be made clear that we do not expect to reach the securitization goal during the pilot phase in Sri Lanka; never-the-less, this remains the ultimate goal.

The PADGO approach, by inherent logic, requires innovative thinking and planning by practitioners with experience in both project finance and securitizations. Knowledge about the functioning of a power project from inception through operations is needed from a risks perspective. PADGO proposes to work closely with banks, developers, and governmental agencies in Sri Lanka to help promote new projects in mini-hydro, biomass, and wind based power generation. It will seek to:

- lower transaction costs of new financings through standardization of contracts
- provide financial instruments and multiple funding sources that match the needs of local banks for financing the next generation of clean distributed generation projects
- provide funds for training and technical assistance to help banks get more comfortable with the technology risks in the biomass and wind energy sector
- foster partnerships between local and global players based on their expertise and commitment to clean and reliable generation
- induce banks and developers to take increasing exposure to the next generation of technologies by ratcheting down concessional funding and risk sharing instruments over time.

As a result of these interventions, our belief is that over the next decade a more diverse and robust portfolio of clean energy projects will develop in Sri Lanka. This will provide the country with greater energy security, and will support local entrepreneurs and use local lending capacity in a sustainable manner. The development of standardized contracts and instruments will have applicability beyond Sri Lanka.

The PADGO approach is being designed to be replicable for new technologies as well as new geographies. We see particular applicability in countries of Southeast Asia, where the right resources and enabling regulatory environment is available. Over time, the database of applicable technologies and practices will increase and evolve towards cleaner and more sustainable technologies, and local banks and developers will be able to undertake such projects without large sums of concessional financing. This then, would be the true measure of sustainability.

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PADGO and CHP

PADGO will also include clean/efficient fossil-based technologies as needed. This is a departure from previous initiatives that focussed exclusively on renewables. It should also be noted that most small fossil-based generation is financed as part of larger corporate loans rather than through project finance. Hence such generation does not show up as an explicit item of financing. This makes it very difficult to track the full extent of the use of small fossil based generation for back-up or baseload applications. For all these reasons, local banks may not be thinking along lines that include efficient fossil based generation as a distributed generation technology for financing.

PADGO, as structured, can include fossil projects, so long as they are efficient, which means that CHP-type applications are very welcome. In this manner, PADGO is seeking to bring out into the market, clean and efficient fossil based alternatives for those who may currently be forced to use cheaper but less benign fossil options for their captive needs. There is now an increasing awareness of CHP applications, and given the high price of fuel and the widespread use of back-up generators, we believe that this is the right time to promote the next generation of cleaner fossil technologies with CHP-type modes of operation. The PADGO financing model would be equally applicable to CHP using fossil fuel as it would the other technologies.

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