Long Road to Cost Recovery in Rural Water Supply –

Intermediate Steps with a Photovoltaic Installation

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Abstract

"**Nearly 1 billion people in the developing world are still without access to clean water for drinking and bathing . . . World Bank experience has shown that new approaches are urgently needed – including changed roles for government, the private sector, and users' groups; and paradoxically, levying high charges."**

John Briscoe
Chief of Water/Sanitation Policy Unit, World Bank

Figure 1
Technicians mounting array

Until recently, few people seemed to take seriously the notion that cost recovery principles should (or could) be rigorously applied to the users of rural water delivery systems. As human beings, the notion of placing any significant cost barrier between another human being and water has always been difficult to even contemplate. A declaration by no less than the United Nations clearly proclaims that access to clean water is a fundamental human right. For many, implicit in this idea is the understanding that water should also be free. This is especially powerful in cases where those who wish to exercise their right are poor.

Because of the public health benefits attached to clean water, and because of the fact that the rural population is largely poor, governments of developing countries and non-profit development organisations have tirelessly attempted to bring water to rural areas at little cost to the users. But what has been the practical significance of this policy; has it actually helped bring a reliable long-term source of water to those who need it?

When water, a scarce economic good, is treated as a free public resource the results are

1. breathtaking waste of said scarce and valuable resource,
2. maximum consumption by those with the capital and privilege to take advantage of the water's free or low cost availability,
3. limited and irregular water delivery to those for whom the benefit of free or low cost water was intended, and
4. reduced capital available for replacement of existing water delivery systems at the end of their design life or for the construction of new systems to extend coverage.

The troubles that the subsidized approach has run into and the huge capital shortfall for reaching the goal of universal improved water supply have given the idea of cost recovery new respect. At least in some circles it is no longer seen as an impossible-to-achieve impediment in extending coverage but rather a key aspect in delivering the results that subsidised schemes have been unable to attain.

In spite of the shift in the intellectual terrain, lack of practical attention to cost recovery and realistic pricing of water continues to be a major contributor to the limited sustainability of rural water systems. The short answer is to simply begin metering the delivery of water and charging economically rational prices. But a single step transition to full cost recovery for water systems is almost impossible to imagine, much less implement, in rural areas. Traditions of low prices, lack of familiarity with new technology, difficulties in collecting small fees economically, and social philosophy all work against it. The road to cost recovery is not an easy one in Latin America especially, where "ideological resistance" in the words of one expert, to the notion of paying for water at the rural level is deeply rooted and guiding examples of rural full cost recovery water projects are rare[1].

1. Marginalized delivery schemes such as private water trucks are technically full cost recovery, and they are certainly common enough, but they are not usually seen as providing quality, quantity, efficient delivery, or a just price to rural users.

Figure 2
Technicians secure solar pump in the well

In light of the difficulty in making an abrupt transition to cost recovery principles, it is clear that alternative paths are needed. Intermediate, practical, "rural area applicable" steps on the road to improving cost recovery have not received adequate attention. It is the purpose of this article to examine a few. The focus of a recent solar powered water supply project in the village of El Fortin in the Choluteca province of Honduras, carried out by non-profit groups Enersol Associates and its local affiliate (ADESOL), Action Against Hunger, and the community water association, was on combining simple and available methods for improving the cost recovery equation – without going to a metered system.

Cost recovery is an important lateral issue for those working with solar powered community water delivery: while improved cost recovery gains recognition as a key to project durability, some of its biggest challenges lie with small populations in isolated rural areas, remote from electricity and other infrastructure. It is precisely those isolated and remote areas that are the most promising locations for the installation of solar powered community water delivery systems. In a very real way, the prospects for the long-term success of solar energy in community water supply are tied to the success of improving cost recovery in some of the most difficult of circumstances.

In the case of El Fortin, four intertwined factors played a role in bringing the water system closer to the final goal of full cost recovery in rural water delivery with solar energy. First, the system incorporated a tiered public/private tap distribution scheme. Under this simple design, the outlet pipe from the distribution tank for the private tap distribution network is placed 50 to 100 cm above the tank floor, while a separate outlet is placed in the conventional position just above the floor, connected to one or more central public taps. If the community members stay within use guidelines, water will consistently be provided to the private taps. If use exceeds the allotted amounts the water level will fall and system users will have to get their water at the central public taps. This immediately puts a brake on over-consumption and signals that the community as a whole is not staying within its limits, *but without denying a basic level of service to anyone.* With reduced use[2] and heightened awareness of the issue, the water level recovers and the system can return to its optimum[3] delivery state. Everyone has an incentive to not waste and to watch that neighbours don't either, but more importantly, no one individual can completely suck the system dry. The tiered public/private tap system alone does not necessarily have a meaningful impact, but rather works in conjunction with the second factor described next.

Engineers as a species hate the word "failure", and a water system running dry for a civil engineer is a working definition of failure. In their earnest desire to avoid this failure, engineers reflexively add ample margins to per capita consumption figures in water system designs, often going far beyond real need. This is of critical importance to solar powered projects, where wide margins for excess consumption dramatically increase the initial system cost and make the hope of cost recovery ever more remote. Recent figures from the WHO (World Health Organization) put the recommended minimum per capita available water at or about 45 litres per day.[4] In Honduras where the project was implemented, engineers routinely use 95 litres (25 US gallons) of daily per capita consumption for rural design. However, by building in a way to avoid failure though an autocorrecting mechanism like the tiered system, the design per capita water consumption level can then be at least modestly reduced without jeopardising basic service delivery to users or traumatising engineers. In the El Fortin project the design per capita consumption was set at 65 litres per day.[5]

The third measure ties together the expandable nature (modularity) of solar power and population changes in a community. In conventional rural water system design, an anticipated increase in the population is calculated into the equation for water consumption. The

2. Per capita water consumption is closely correlated to distance between home and source; public tap consumption is usually a fraction of that from private tap distribution.
3. The desire of virtually all users is a system that provides water to individual house taps, and most will pay considerable attention to achieving that end.
4. Reference to as low as 20 litres per person per day can be found, but that number is intended in refugee/relief circumstances only.
5. Water conservation measure like the ones just described should include awareness education for the end users. Development workers are very much aware that education campaigns by themselves often do little to change behavior. The tiered distribution system provides the discipline and reinforcement necessary to support the educational message and the lower consumption design.

annual increase is as much as 3%, compounded over up to twenty years. The result is a design population on which the system is sized that can be nearly double the population at the time the project is carried out. In a gravity flow water system there are some solid arguments for this approach: the cost for example of adding capacity later to the supply line is relatively high, consisting of digging up and replacing the entire distance from source to distribution tank with new larger pipes or adding an additional pipe alongside the original. Both these options are unpalatable and generous oversizing of the system at the outset offers a solution. However there are serious flaws to this approach that are often overlooked. While populations as a whole are on the increase and in certain places up to 3%, that figure is highly arbitrary and is not typical of the situation of most rural areas. In reality, urban migration causes many rural locations to have stable or declining populations. In striving to avoid undersized system designs, the bias towards oversized system designs based on highly conjectural populations increases the risk of systems that are in the long run just that: oversized. While a rich nation may easily be able to absorb the waste of oversizing, for poor nations with very limited resources this tendency means literally less money for additional water systems.

If it were simply an engineering and budget question the evils of undersizing and oversizing might be roughly comparable, but there is another factor that argues decisively against oversizing.

The apparently pro-active principle of oversizing unwittingly converts rural water systems into “miniature resource waste institutes”, effectively training the entire community to grow accustomed to the hugely excessive water allotments found at the beginning of the project life and teaching early on that there are no negative consequences to wasting water. A “properly designed” system can provide a water allotment at the beginning of the project life of 80% over the final desired consumption level. Little wonder that so many rural community water systems have histories of egregious waste and short lives.

In a solar powered water system the oversizing/waste issue can be addressed and the initial cost substantially reduced by a “panel as you go” approach. The design equation becomes slightly more complex, but the benefits in terms of less cost and constraining gratuitous waste of water justify the effort. The tactic lies in taking advantage of the fact that it is usually possible to add modules (solar panels) at a later date to an existing solar array. Consequently, it is preferable to size the array based on actual rather than projected population, taking care to select an array/pump combination that is at the bottom of the pump’s capacity and permits the adding of modules (often must be done in groups of 2 up to 7). If the population truly looks to be increasing, oversize conventionally the water tank, pipes and pump using a projected future population (though preferably one based on data rather than reflex). Regardless of the size of the pump, tank or distribution line, the number of modules on the array are what will determine how much water gets pumped. If real needs for water increase, additional panels can be purchased.

The “panel as you go” approach also fits well with the economic reality of small communities in developing countries. Though usually unable to muster the resources to cover an entire project, it is not outside their range to rally around an effort to add a couple of panels to an existing system, particularly if it is a well perceived need.

The combination of achieving a stricter per capita consumption through the tiered distribution system, and the use of present rather than projected population figures for determining the size of the solar array can have a stunning impact on the system design. Taking the case of El Fortin with 39 families, under conventional assumptions of 95 litres per person per day, 20 year design life and 3% growth, the daily water demand comes to approximately 33 500 litres per day. Using the principles of the preceding paragraphs: 65 litres per person and present population, the daily water demand for El Fortin comes to under 13 000 litres. Meeting the demand of the former design would require a solar array nearly three times the size needed for the design of the latter. With the array size being the single largest determinant of the cost for a solar powered water system, the difference in cost is on a similar scale.

Fourth, while improving cost recovery can largely be

Figure 3
(Accion contra el hambre) Action Against Hunger – technician prepares pipe for solar pump installation

Figure 4
(Adesol – Asociacion para el desarrollo de la energia solar) technician Ethel Enamorado connects control box wiring

Figure 5
Long walk for water, El Fortin, Honduras, prior to solar powered water delivery installation

about reducing the costs to be recovered, there is also a need for more realistic user payments. The challenge is in making a meaningful increase while not straying too far from previous fee experience in the surrounding area. In El Fortin each family pays a rate of approximately $3.25 per month for outdoor yard tap service. This level, while still some distance from recovering all costs, represents an order of magnitude increase over typical rural water service fees in neighbouring communities. A fair amount of negotiation was required to achieve commitment to this price level and like most payment schemes in poor rural areas the long term prognosis is not certain. Two measures help strengthen compliance: the non-profit overseeing the project retains the right to audit the bank account of the community water association and the system can be moved to another community in the event that the user payment scheme disintegrates.

Technical data on the installation
Power source: 6 to 8 BP 75 watt PV modules
Pump: Total Energie – Dankoff Solar TSP 1000
Pumping head: 24 metres (including friction losses)
Distance from well to community: 600 metres
Individual yard tap connections: 39
Public taps: 2

One question that inevitably comes up as payments exceed that required for simple O and M (Operation and Maintenance) is to whom should the money go. There are no perfect operation and maintenance answers. Small communities have generally poor records for managing capital replacement funds. This is one reason that the first avenue for cost recovery should be about designing systems that cost less but may need expansion with time, even if the final system cost is a bit greater. The cost recovery of the expansion can happen incrementally and at a local level.

"The next controversial issue is paying for water. Almost everywhere in the world, the cost of water is not being covered. People pay too little for the water they use. Because water is not valued, we waste it, and water services don't get expanded to poor people."

Bill Cosgrove

World Water Council 2000

The fees collected are a standard rate for each family. The flat fee system is the rural standard against which any new model for revenue collection and water allocation must compete. Because of its widespread use, the flat fee retains the appearance of and acceptance as a logical system when actually it is an irrational and anti-environmental aberration that exists only for two reasons:

1. water resource allocation has not historically been under the pressure that it is today, and
2. easy alternatives to a flat rate at the rural level up until recently have not been widely known or available.

A willingness to pay study can generate a number that corresponds to a single flat fee that the majority of families in a community would accept for a given level of water service. However, this is always a trade-off game: if broad acceptance of the fee is desired it must be set at an extremely low level. If the fee is positioned higher, the number of families

Figure 6
Into the well, El Fortin

willing to accept it goes down, even as revenue may for a time go up. At whatever service level, the flat fee system is hostage to the community members who least can afford it or least want to pay. When set against the attempt to achieve any sort of sustainability through a more realistic price level, it becomes a crude instrument indeed, neither fair to those who cannot afford the price, nor fair for those who would pay the flat price but use disproportionately large quantities of water.

It becomes apparent that reaching the goal of full cost recovery will almost inevitably require some type of metering in the system design. Metering is the key to more equitable allocation of charges according to use and ability to pay, and is clearly linked with reduced waste.

Unfortunately, metering is still far from carrying the day. The technology for rural use is becoming more accessible, but price, complexity, awareness of the technology, and its limited availability are still hurdles. It should also be noted that where implemented, metering at the rural level has not been without problems. For the near and intermediate future, flat fee systems will need to be part of the landscape.

It is precisely because rural metering is still over the horizon that the intermediate steps described are important. While still shy of the final goal of achieving full financial sustainability, when applied together they can make a large impact on the feasibility of using renewable energy for satisfying the water needs of rural communities and at the same time help move the principles of water conservation and cost recovery closer to becoming fully accepted.

ABOUT THE AUTHOR

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