Presentation of Aapo Sääsk, CEO of Scarab Development AB

Aapo Sääsk came to Sweden in 1944 at the age of one as a boat refuge from Estonia. After attending universities in Sweden and the US, he started to work on research and development projects.

These projects entailed working with organisations like the World Bank, WTO, FAO, EC, EDF, ADB, Sida, Swedfund, the Swedish Export Council, the Import Promotion Agency for Products from Developing Countries, the Swedish Board for Technical Development, the Swedish Council for Building Research and the Industrial Fund of Sweden.

Following this, he founded companies that work with proprietary technology in water treatment.

The most important project concerns arsenic mitigation. The technology developed removes all arsenic completely and also all other contaminants. And it does so in a safe and simple way.

Several independent institutes have tested prototypes, including Karolinska Institutet and BUET (Bangladesh University of Engineering and Technology) in Dhaka. Prototypes have also been evaluated and approved by Sida and the World Bank.

Presently Mr Saask and the Royal Institute of Technology in Stockholm are planning large demonstration units that work on waste heat from power plants and smaller ones that work on solar panels.

Education
BA 1964 at Brown University, Providence, Rhode Island, USA
Postgraduate Scholarship 1964-65 at Rutgers University, New Jersey, USA
MA Political Science and Philosophy 1968 at University of Stockholm, Sweden
M.Sc. in Education 1970 at University of Linköping, Sweden
MBA 1973, University of Stockholm, Sweden

Companies
Scarab Development AB, CEO
HVR Water Purification AB (publ), Chm
Purity AB (publ), Chm
Xzero AB (publ), Chm
Medea AB, owner

Web page: www.scarab.se

The Daily Star
Committed to **PEOPLE'S RIGHT TO KNOW**

Vol. 5 Num 771 Fri. July 28, 2006

Arsenic in drinking water
Bangladesh perspective and global technological development
Aapo Saask and Dr Azaher Ali Molla

In Bangladesh, arsenic contamination of ground water was first detected in 1993 by the Department of Public Health Engineering (DPHE) in Chapai Nawabganj district (Barugharia Union, Sadar Upazila). The main source of contaminated water is shallow tube-wells. It is estimated that Bangladesh now has 8 to 12 million shallow tube-wells. Reportedly, by 1997, 80 percent of the population had access to 'safe' drinking water. A large volume of the ground water -- the source of drinking water for about 75 percent of the -- population has been severely contaminated by arsenic. By early 1998, a total of 8,065 tube-well water samples from 60 out of the 64 districts of the country were tested for the presence of arsenic using field test kits and atomic absorption spectrophotometer. The highest reported concentration of arsenic in drinking water was found as 4730 ppb, which is also the highest in the world.

It is also estimated that more than 20 million people are potentially exposed to arsenic poisoning. The National Institute of Preventive and Social Medicine (NIPSOM) found in a survey at Rajarampur village of Nawabganj district in 1996-97, that 29 percent of the wells were contaminated above 50 ppb. Also, in 1996-97 Dhaka Community Hospital (DCH) and School of Environmental Studies (SOES) found that 91 percent of the 265 tube-wells tested contained greater than 50 ppb of arsenic in Samta village under Jessore district. In 41 districts, the arsenic contents exceeded the 0.05 mg/L, maximum permissible limits recommended by the World Health Organization (WHO).

The health effects that result from the ingestion of arsenic contaminated drinking water manifest themselves gradually after a long latent period (5-15 years). Arsenic can produce serious health hazards if ingested in toxic amount. Probable effects include skin lesion (melanosis, keratosis, and skin cancer), diabetes mellitus, chronic bronchitis, hypertension, cirrhosis of liver, peripheral neuropathy and cancer. In fact, arsenic may have a negative impact on every organ in the body. Hyper-pigmentation, de-pigmentation and keratosis are the commonest forms of skin lesions attributed to arsenic poisoning. The shortest period described in the literature (with high exposure) is 2.5 years. From the nutritional and metabolic point of view arsenic is likely to adversely affect human nutrition.

Apart from health and nutritional damage caused by chronic arsenicosis, its social and economic consequences are also crucial. Estimated economic loss may reflect in victims' households or community as a whole. Arsenicosis results in compromised loss of working hours/days and loss of wage among the victimised adult members. Also, it affects on household economy and ultimately decreases the quality of life. Little is known on the economic burden and total financial loss in patients' households.

Global technological development

Providing absolutely pure drinking water from the tap has been the ambition of international water professionals for more than a century. Time has proven that in most places, it does not work. Although water professionals are reluctant to give up their dreams and still keep arguing that water from the tap is the best solution, international consumers are already choosing another path.

Those who can afford it buy bottled water or they buy special purifiers for purifying tap or well water before drinking. Also, in Bangladesh the long-term solution for drinking water -- whether well or tap -- will be bottled water and home water purifiers according to consumer's choice.

It goes without saying that to be accepted, these solutions must have low life cycle costs, be technically robust, reliable, easy to maintain, socially acceptable and, above all, affordable.

Here is a proposal on how overcoming the curse of arsenic in some areas of the country could be turned into a blessing for the entire country.

Distributed utilities: What is proposed by Scarab Development is that, waste heat from small power plants that run on bio-gas is used to purify water by low temperature distribution. Scarab's equipment is state-of-the art membrane distillation technology that is especially tuned to be maintenance free.

The plant is only meant to be used to make perfect food grade water. Distribution will be done in containers of convenient size -- 1.5 or 4 liters. Except for initial investment, the water will be virtually free since it runs on waste heat from the engine of the power pant it is being located at.

As an example, in this way a power plant may deliver 1 MW of electricity and 100 M3 water per day. Additional water output can, if necessary, be obtained by adding solar panels to the system or bio-fuel heaters.

Ecological sustainability: This type of distributed energy and water production will eliminate the need of huge dams and other environmental disruptions. And it will avoid huge investment in transmission infrastructures and the cost of their up-keep.

Neither the water treatment nor the energy production will create waste and modern engines create minimal air-pollution. And they will not contribute to global warming. Rather, both process utilities waste and return whatever residue to nature's cycle, even minerals to the soil, which will stop the present depletion of agricultural lands.

After the investment is made, the running costs are minimal. The total running input for the system, except maintenance, will be human and agricultural waste. According to a study made by the Swedish aid agency Sida, the world-wide energy content of agricultural waste approximately equals the energy content of annually used petrochemical fuels.

Social sustainability: A distributed utility of this kind will not only reduce poisoning from arsenic. It will contribute two of the most important factors for development -- electricity and clean water. In addition, it will free the human work now being used for fetching and treating water.

Commercial sustainability: Probably the most important aspect of this solution is that it will empower all the people that are beneficiaries of the systems and support their move from dependency to economic self-sufficiency. Specifically it will, of course, benefit the people who are directly involved in the commercial implementation and operation of the equipment.

Small is beautiful: Distributed utilities could vary very much in size, from a few hundred kW of electricity production and a few thousand liters of clean water per day to several MW of electricity and hundreds, may be thousands, of cubic meters of water per day. What they all have in common is that the electricity is delivered through a local grid and the drinking water is delivered in bottles and containers -- locally or regionally.

Cost: Assuming a rather large plant with an electrical capacity of 1 MW, 24000 kWh electricity and approximately 100,000 liters of water is produced per day.

The capital cost for such a plant will be approximately 2 million US$ and it should be written off in five years, although the real life will be much longer, more than ten for the power and water equipment, perhaps less for the bottling equipment. The capital cost for this high-grade water produced is therefore almost negligible.

Another capital cost would appear if there is no local grid to connect to. Then one would have to build a local grid. Also assuming that the water is not bought by a retailer, there would have to be delivery crucks for distribution to retailers or directly to end users. These cost fall outside of this calculation and would have to be added to the final price. However, these costs are not wasted. Just like the costs for producing electricity and clean water, they contribute to the over-all economic development of the region and the country.

The bio waste for the engine will initially have a collection cost and later when the use of bio-fuels is more common it will have a market price. A probable future market price should be used in the feasibility.

The power equipment and the water treatment need very little maintenance and service whereas the bottling equipment needs more. We can assume an average of a few percent of capital cost annually. Since the equipment is largely self-regulating, the labour cost is not high, there are virtually no consumables for the water treatment equipment. For the power plant, apart from bio-fuel, running costs are also small. For the bottling, the cost of bottles can be calculated on non-returnable bottles although in most cases bottles would be reused.

Total cost including depreciation, interest and operation would be less than 1 million US$ per year. A system ten times smaller in size (2400 kWh electricity and 10,000 liters of water per day) would have an annual total cost of approximately US$ 200,000. These will all be very profitable investment both in commercial and human terms.

Income: *Electricity*: In many of the target areas there is no electricity or not sufficient electricity. Many of the people may not be able to afford electricity. However, in the long run everybody should have electricity. Everybody would benefit from electricity and will eventually be able to pay for electricity.

To calculate the potential sales of electricity is the most important part of the feasibility plan for each project and will determine what capacity of equipment is included. If there is a small market for electricity at the actual site, the plant will be small and the system may produce less water than desired, but water production can be augmented by solar power or heating from biomass.

Water: The water produced will be completely free from arsenic but it will also be free from any other (known and unknown) contaminants. This will be a strong marketing point in an area that is afflicted by arsenic, but also in any other market.

Small plants will sell their water locally to villagers in the neighbourhood. Larger will also sell their water to neighbouring towns. In very destitute areas we would expect that the water be initially purchased for the villagers by NGOs and possibly by international aid agencies. However, no project should be financed unless it has a clear long-term commercial viability.

Site-specific feasibility: Although there would be standard models for the operations, each unit would have to be evaluated in its own context. A bankable feasibility study will have to be prepared by the aspiring entrepreneur. Scarab Development will of course assist with figures and calculations but in the end. The viability of the project will have to be the responsibility of the person, company, term or community that runs it.

Aapo Saask is Chairman, Water Purification AB, Stockholm, Sweden and Dr. Azaher Ali Molla is Assistant Professor, Institute of Health Economics, University of Dhaka and Advisor, UFSHA, Dhaka.