

smart DUTCH WATER SOLUTIONS©



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Village women could run safe water franchises in arsenic-hit South- and South-East Asia

Arsenic is known to cause skin-, lung-, bladder-, liver- and kidney-cancer with evidence suggesting lung-cancer is the most common cause regardless of oral or inhalation pathways to exposure.

WOMENS' ROLE IN WATER PROVISION:

All over the world women collect and carry water for their families, use water for cooking and cleaning and for growing food. Yet, women are often not empowered to make important decisions about water.

Community and women's groups will be the front-line users of arsenic treatment technologies in countries such as Bangladesh, Cambodia, India, Laos, Myanmar, Nepal, and Vietnam where in many regions groundwater has high levels of arsenic.

Women are being encouraged to set up businesses to sell safe water to save lives in their communities and earn an income.

Arsenic is naturally present in groundwater and particularly high levels (up to 2,000 ppb, or 2 mg/l) are found in regions in Argentina, Bangladesh, Cambodia, Chile, China, Hungary, India, Laos, Mexico, Myanmar, Nepal, Philippines, Romania, Thailand, USA and Vietnam. The safe level according to WHO is < 10 ppb! or 200 times lower than what sometimes is found.

But also high levels of fluoride and iron pose serious health problems.

Arsenicosis - the effect of drinking water with elevated levels of arsenic over a long period can result in cancers of the skin, bladder, kidney and lungs, and diseases of the blood vessels of the legs and feet, high blood pressure and reproductive disorders, teeth and bones. Exposure to high levels of Fluoride shows some of the same effects. Young children that have been exposed to arsenic and fluoride are intellectually affected according to studies in the past 15 years.

NEW APPROACH:

Netherlands' based social enterprise **Enviro-Pure Foundation** has developed a new system for removing bacteria & viruses and at the same time toxic heavy metals and metalloids such as **Arsenic and Fluoride** from water and is seeking to scale up the process by selling the technology to community-based entrepreneurs with micro-credit loans.

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STATEMENT:

Chairman Dick van Dijk says his Singapore business-partner David Kang, inventor of a novel adsorbent, has recently sold and installed >800 units to the Government of Bihar State, India, to remove both groups of health effecting elements, poisonous toxins Arsenic and Fluoride, and micro-biological contaminants such as bacteria, viruses, cysts and protozoa and together they are now focussing on combined technologies for Bangladesh, Cambodia, Laos, Myanmar, Nepal, Philippines, Thailand and Vietnam to provide drinking water to WHO-standards in these countries.

We find **women are the agents of change for water**. You will never find men collecting water in Asia; this goes for all of Africa, South-America and Middle East as well. In Africa, but also large parts of Asia, it has become known that **women are the best entrepreneurs**. They are the best stewards of money, men tend to take more risks with the money.

Although there is no reliable data on the number of deaths caused annually by arsenicosis, the World Health Organization (WHO) has said arsenic in drinking water is "the largest case of mass poisoning of a population in history". A 2010 study in British medical Journal, The Lancet, said one in five deaths in Bangladesh were due to arsenic poisoning.

US\$1.6 billion has been spent by governments, donors, philanthropists and charities every year on cleaning up water but few have found an efficient, affordable and sustainable solution. Current water purification projects are not working(properly) as they often rely on donors with shifting priorities, or irregular funding and technology which needs specialized maintenance, or is too primitive to really make a difference over time.

Enviro-Pure Foundations' system uses state-of-the-art Ultrafiltration Technology and a specially conditioned, common mineral Zirconium, to remove heavy metals and metalloids such as arsenic and fluoride, while not removing beneficial minerals so there is no need to re-mineralize the water as is the case when using RO, a membrane technology that has been introduced as a cure-for-all but now is being seen by academia, and WHO, as a cause of many health issues. As a result, Dick van Dijk says his system can deliver 120 times more water and is 34 times more energy-efficient at 25% of the cost.

But scaling up the process at ground level to really have an impact is the main challenge facing the company now.

QUESTIONS:

What regions are you working in currently?

Bangladesh, Cambodia, India, Laos, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka and Thailand where in total some 1,000+ installations have been supplied, mainly in Cambodia, India, Indonesia, Malaysia and Philippines.

Have you visited the areas personally? If so, how bad is the water condition in these areas?

I have most; I have travelled the world since I was 15 years old! and it's very disturbing to see the way many of these households are dealing with water issues.

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Water-engineer since 1976 and coming from a country that is the most specialized in water-engineering and -management in the world, I have seen rural village water habits since I was in my early twenties during (business) trips to countries around the world where people would collect water from an often distant, bacteria-infested, pond or river. In 2003, I realized it was time to use my experience and know-how of water technology in these remote areas, not just in the developed world, but I learned locals aren't willing to part with the little money they have made for just water in the hope of **long-term** improvements in health; there are too many short-term priorities such as daily food, healthcare, disasters or care for elders. Locals are however willing to pay for water that gives immediate benefits to their livelihood such as by making rice tastier, fish less salty, kids free of diarrhoea, and clothes cleaner— key properties that most treatment options are unable to deliver. The **long-term benefits** such as improved health will only be visible in the months after.

I read 20 % of the business owners in Indian villages are women?

We are looking at different operational models in the region, and what we learned is women are the untapped entrepreneurial resource in villages, like in Africa. In rural Asian villages, as on other continents, men think that women should stick to household chores but we found water is very much a woman's issue.

We are looking for women entrepreneurs because money in the hands of women is much more efficiently and effectively handled and spent in developing countries.

We want preferably women to run these systems. But knowing we are operating in regions where you have cultural and religious constraints, it's difficult not to tackle just the water issue but to tackle the women's empowerment issue as well. In Cambodia and India women may be working independently, in more conservative regions it may be more challenging.

It is mentioned \$1.6 billion is spent by governments, donors and charities every year on purifying water but few have found an efficient, affordable and sustainable solution. Why have previous attempts failed?

Despite spending US\$800+ million by NGOs (UNICEF, BRAC) and the Government of Bangladesh over the past 20 years, 35 million Bengalis still drink arsenic-laced water, mostly caused by changing to groundwater from surface(river) water for hygienic reasons, the biggest waste of money and man-made poisoning ever because of ignorance. The UN cites **three reasons** for why 60 percent of all water systems fail within 2 years. Most available solutions are based on primitive technology such as locally made clay-filters without quality control, UNICEF's systems require expensive media from the USA etc. to ensure continuity.

Enviro-Pure Foundation uses novel, patented filtration technology developed in The Netherlands by experts of > 40 years, and adsorbents developed in Asia and both are **manufactured in Asia** and tested by the National University of Singapore(NUS) and certified by the famous German Accreditation Institute TÜV-SÜD-Singapore Branch. Delivering 40 percent more water, 66 percent cheaper than reverse osmosis, requiring 17-times less electricity, and reducing waste by 10 orders of magnitude, that, as a bonus, is **non-toxic**(reports available)

This technology has been deployed across four Asian countries already.

Second is the lack of community buy-in. While BRAC(Bangladesh) uses a committee structure for buy-in, members rarely attend meetings due to a lack of incentives. **Enviro-Pure Foundations'** concept uses profit-sharing to ensure buy-in.

Third, government-installed wells are known to provide "poor people water" and often lack funding to maintain/repair the wells and equipment.

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What challenges are you facing when it comes to scaling-up the business or creating an impact. Any solutions, in your opinion?

According a UN report, about 60 percent of water projects fail after 2 years. There are many reasons for that including shifting priorities of the donors. That means one day they will care about clean water and next day they will care about toilets, climate, education or healthcare. There is a real need to focus on after-sales servicing and on delivery of water to the households like our good friends of **"1001 Fountains" in Cambodia** who have > 150 systems operational based on this philosophy. I think a lot of people love to donate for setting up a new water treatment network but how do you make sure that the family living 6-10 km away from that site will get access to safe water?

We want to disrupt the cost economics of the sector; we create a secondary market where the franchisee hires a driver and an operator to run the plant. Franchisees, like a local store or kiosk then sell clean drinking water for less than \$3 a month per family and earn 40 percent of monthly gross profits.

Donors should be focussed on delivery mechanism and the most important matter is quality assurance similar to the Cambodian situation. It would be great if donors turn financing focus away from Capex and more to efficient service engineering.

- **ENVIRO-PURE FOUNDATION transforms existing arsenic-affected GROUNDWATER, which is a source of stigma and hardship, into local profitable water enterprises. These enterprises deliver clean water by employing local villagers and build local markets that catalyse economic opportunity, ultimately allowing villagers and their children to realize their full potential.**

BENEFITS:

- The easy-to-operate, self-cleaning system provides safe drinking water through use of reliable, proved technology, **ULTRAFILTRATION** and, in case of arsenic or fluoride poisoning, an adsorbent that can be started or stopped with no real-time lag. Current solutions often use Reverse Osmosis (RO) technology that wastes 40-60% of input water, the waste water is now concentrated and poses an even greater risk, primitive solutions using iron filings/scrap and carbonized chicken-bones are all generating toxic waste; our **smartUF** with **conditioned ZrO₂(Zirconium)** discharges less than 2% of water that contains no toxins and supplies bacteria/virus-free water in abundance.
- Improved health outcome due to access to clean water (households no longer at risk for cholera, diarrhoea, arsenicosis, and other water-borne diseases).
- Productivity and economic gains through time saving: women and or children particularly spend 2-5 hours a day procuring water, valuable time that could be spent in school or engaging in income-generating activities.

MICRO-ENTREPRENEUR BUSINESS MODEL TO REACH THE GOAL

Despite billions of dollars being spent, an estimated 780 million people still lack access to clean, potable drinking water. According to the UN Joint Monitoring Programme on Water and Sanitation, 50% of all water projects fail because communities have not or cannot assume responsibility for maintenance and repairs of water systems. **ENVIRO-PURE FOUNDATION, A NOT-FOR-PROFIT ORGANISATION**, leverages the profit incentive to sustain community involvement from project inception through maintenance and upkeep by using the same approach as our friends in Cambodia. Together with our local AGENTS a network of entrepreneurs operates, generating an income by selling clean drinking water that can improve the health, wealth, and productivity of the world's poorest populations.

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WASTE MANAGEMENT

ENVIRO-PURE FOUNDATION takes waste management very seriously, **WE DON'T PRODUCE ANY**

1. Once our filter media is exhausted, the adsorbent material is discarded and does not need to be transported (see a report from NUS) to a central location, where it must be treated, as is the case with other solutions
2. The waste volume from other systems, by "cleaning" the adsorbents of collected arsenic with chemicals and catching the leftover arsenic-sludge in a filter, still results in more waste material and is put in sand basins for **so-called safe storage**.
3. This "disposal" technique is scientifically fraud and not more appropriate than dumping arsenic-loaded classic adsorbents into landfills, which is the typical practice in developed nations

TESTIMONIAL

"Through this arsenic mitigation technology, we are able to transform the health crisis into a revenue generating business while drinking safe water."

BRIEF HISTORY

Over the past 5 years, the National University of Singapore(NUS) has partnered with Asxban to develop and test a novel adsorbent for AsIII and AsV and **ENVIRO-PURE FOUNDATION** worked with Asxban to design and test complete arsenic removal units for remote villages. Each system supplies nearly 2,000 villagers with arsenic-safe and bacteria-free water. With our local partners, **ENVIRO-PURE FOUNDATION** manages the system through a community-based committee or other appropriate body.

In 2005, **ENVIRO-PURE FOUNDATION** was introduced to a technology using an advanced and appropriate kiosk-business model. This revealed the enormous potential for scaling a micro-franchise model that spurs entrepreneurship at the individual level, clean water access at the household level, and economic growth and global health improvement at the community level. Many kiosk-based systems are operational in Africa, and Cambodia.

ENVIRO-PURE FOUNDATION was established in 1989 as a continuation of Enviro-Pure Environmental Technologies founded in 1977. Lessons learned in over 40 years with many implementations take advantage of the enormous market opportunity of providing clean drinking water to rural and peri-urban communities that lack access to affordable sources of clean drinking water.

TEAM:

ENVIRO-PURE FOUNDATION is a result of over 40 years of on-the-ground experience in the toxic water treatment market in Europe, Middle East, Africa, the Americas and Asia.

SUSTAINABLE TECHNOLOGY

ENVIRO-PURE FOUNDATIONS' water-filtration technology relies on a non-toxic adsorbent and robust UF-filtration that can run on solar-power(or wind-, micro-hydro) to sustainably deliver safe drinking water. The technology saves 20 x more water and electricity than current solutions that use reverse osmosis technology. Reverse osmosis cleans water by using electricity to pump water under high pressure through a membrane, trapping particles and dissolved matter to remove them. The process requires a lot of energy and wastes a high percentage of water, referred to as toxic brine wastewater.

"Say you have a hundred litres of raw water and you force it through a RO-membrane using electricity. You're only going to get fifty litres of potable* water. The remaining fifty litres is a toxic concentrate that has to be disposed of, just **increasing the problem at the cost of a lot of energy and water.**"

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Our technology, on the other hand, uses only 2% of water, less than 1 Watt per litre solar generated electricity (about the same as your phone) and there is no need for waste management. "After about 3 million litres, or one year, of purifying you just discard the old filter-cartridge and dispose it on a public waste dump **without any risk for humans, animals and nature**, we specifically targeted a long life cycle to keep the cost structure down. We compete on the lifetime value of our technology, more than any others."

EMPOWERING LOCAL (WOMEN) ENTREPRENEURS

In order to scale up, we are suggesting a micro-franchise model, based on the profit incentive that motivates communities to sustain clean drinking water. Currently, there are 150 such operators in Cambodia built by our friends of "**1001 Fountains**".

"In places like South-and South East Asia, there's an appetite to make a living, it's really incredible when you can see how science and technology allows women to empower and employ themselves". Being able to provide safe water in your community is a very proud job. One critical factor to success is ease of use. Naturally when you look at the micro-finance model, if the entrepreneur doesn't think your product is easy to use, they're not going to build a business around it. If an uneducated, often illiterate but ambitious woman wanted to make a living by operating our system, how could we make their life easiest? One way is to replace an inefficient pen-and-paper payment and tracking model with smartphones or RFID-tags and water KIOSKS, which allow customers to deposit water credit on their debit cards and swipe their cards to dispense their water. Using water KIOSKS, operators can easily track utilization rates over seasons. "You can actually predict water sales, see how your entrepreneurs are performing across your network, and determine what lessons can be shared between your group,"

NON-PROFITS AND GOVERNMENT PARTNERS

To continue to scale operations, we eye other entrepreneurial partners such as non-profits and NGOs who could operate water systems to boost their own revenue streams. "Non-profits can earn revenue by using their relationships and social capital to sell water in villages where they already have relationships,"



Dick van Dijk, Senior Water Consultant and Chairman
ENVIRO-PURE FOUNDATION

ATTACHED: EXAMPLE BASED ON SITUATION IN NEPAL(for reference only)

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1. Groundwater or river water can be pumped-up by small solar-driven pump or micro-hydro turbine-generator. In case reliable grid-supply is available, system can operate without solar-panels and is lower in initial cost.
2. Depending on level of pollution, including Arsenic a common pollutant in Nepal, Fluoride, Iron or other metals, the raw water will pass various purification steps in series, each of them robust, compact, and field tested technologies, resulting in WHO-compliant safe drinking water. Systems may be fitted in enclosure to prevent vandalism.
3. Systems are almost autonomous and run with minimal supervision and maintenance; life span > 5 years, consumables are calculated for exchange after approx. 1 year without skilled labour.
4. Local people will be trained to perform service and maintenance if and when required.
5. System is provided with 1 or multiple taps, each with an electronic, fully encapsulated water meter, operated by RFID-tags(smartcards) that can be uploaded in a kiosk or shop to provide 1 month of drinking water per family (1,000 – 2,000 Litres/month)
6. The shopkeeper receives part of the revenues(approx. 40%), the rest will be deposited on a bank-account of the financing party. This assures funds for service and maintenance and money comes in a revolving fund. At the same time the shop/kiosk can sell and upload SIM cards and sell daily needs.
7. Because the shopkeeper now has a regular income, she or he will take care of the system and acts when there are any issues, by alarming the service organization. The integrated software of the system will provide data to the central organization about use and revenues, as well as technical issues.
8. Similar systems were developed for installation in Africa, Cambodia and India, where they have been successfully operating for a number of years. We have simplified the concept using standard components and smart software to significantly reduce the initial costs.
9. If quantities justify, we will use components available on local, Asian markets and local labour for assembly and installation to create more local jobs, next to service and maintenance.
10. Using the situation in Nepal as example, the costs per family/month will amount to approx. Nepal Rupee 450, or NR 0.6/litre, resulting in 15 NR/day/family of 5 members for 25 litres of safe water for drinking, cooking, bathing babies and surplus for the vegetable garden to produce arsenic-free food.
11. Gross revenue per family/year will be approx. €(euro) $44 \times 75 \text{ families} = € 3,300/\text{yr}$ of which 40% goes to the operator = € 1,320, a substantial sum in this country, allowing children to follow (higher) education, construction of a decent house, clothing, medication etc. The organization will get the remaining revenues = € 1,980/yr
12. A system with a capacity of 2,500 l/day, based on solar power can provide water for 100 families and costs approx. € 4,000 (depending on import-duties and other taxes and fees) With additional costs and contingency we estimate a total per system to stay under € 6,500, allowing for pay-back in about 3-4 years. Note: We have used 75 families, but capacity of system can handle 100 on solar.
13. If reliable grid-power is available investment will be approx. € 800-1,000 lower, energy required is 4,400 kWh/yr but capacity will double (approx. 6,500 litres/day or sufficient for 260 families) allowing for a home-delivery-system generating more revenues and jobs.
14. In case Arsenic needs to be removed the investment will be approx. € 1,500 higher, bringing the litre-price to maximum NR1/litre including consumables.
- 15. NOTE THAT OUR SYSTEM DOES NOT PRODUCE ANY TOXIC WASTE AND DOES NOT POLLUTE!**