Transportation of fresh water in large quantities and over long distances by underwater flexible pipeline

Overall, there is enough fresh water on our planet. The "only" issue is that it is not available where it is required in particular in light of global population increase: about 3billion more over a few dozen years. This problem is more acute in coastal areas where about two thirds of the world population live.

Cities grow at a still faster pace due to rural emigration. Local water resources can no longer support this growth.

Also, more than ever before, global availability of foodstuff is a top priority. That's why FAO thinks it necessary to put under cultivation up to 40 million new hectares which will require an increase in irrigation of up to 8,000 m^3/s (agricultural consumption of fresh water is about 5 times larger than urban consumption). As deforesting subtropical areas is not an option (basically only available solution if one would like to rely only on rain fed agriculture), "turning deserts into orchards" should be considered by having recourse to irrigation of marginal land.

Increasing locally water resources at an affordable price will solve both these problems. But, all existing solutions suffer from major flaws. Desalination costs, in the best scenario, only slightly less than 1€/m^3 if one considers all its consequences; it is available only for limited quantities as the larger plants produce 2m^3/s (both parameters preclude its use for agricultural purposes); its energy consumption is greater than 3kWh/m^3 (a heresy in today's global warming context). Also, it can be operated only by a highly skilled workforce. But, why "manufacture" fresh water when it already exists? Wouldn't it be more logical, just to transport it? However, today, few traditional ground-based inter basin transfers can be carried out or even continued because they are difficult and costly to implement and induce numerous problems downstream. Other exotic solutions (e.g. tankers) are very expensive (>2€/m^3) or apply only for limited quantities (1m^3/s ~ 1 tanker of 100.000t/d).

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Therefore, to bring an acceptable solution to the water problem facing our planet, innovative alternative solutions should be considered. That's the purpose of our proprietary system named **submariver®**.

Available water at river mouths is obviously a resource of fresh water, so far untapped, which can be, at least partially, abstracted just upstream the salt wedge without significant impact (no more downstream issues). It is then transported by underwater pipes parallel to the coast (across the sea for islands). This patented system is structured around a special and very flexible pipe that adapts to the seabed profile without preparation of the ground. It is laid on the sea bottom (typically at 200m depth) and ballasted. At destination in coastal areas, it is distributed through the local network after usage-specific treatment.

See attached corporate brochure.

This system can also be used to transport farther away water flowing out of sewage treatment plants in coastal areas that pour their treated water into the sea and where there is no local reuse demand. Usually, these flows are much smaller than those available at river mouths, but they should nevertheless be considered as well, albeit cautiously in light of their real post treatment quality. Thus, **submariver®** could positively contribute to solving the issue of sea water pollution by diminishing substantially the flows disposed of into the sea and, at the same time, obtaining an economic and social return on these flows, once duly treated: i.e. turning the ecological constraint into a productive investment and at the same time alleviating the price of water for the first users upstream.

The main characteristics of this system are as follows, and they are very competitive:

1. Its prices are low (0.1 – 0.3€/m^3 in most cases). They are much lower than desalination and also several times less than traditional onshore transfers in most cases. Delivery of fresh water at an economical price satisfactorily meets large demands, especially agricultural uses.
2. Its energy consumption is less than 0.2kWh/m^3 in most cases, which is about 5% of the energy necessary for seawater desalination. Low energy consumption makes it more environment friendly and less sensitive to energy price.
3. Its construction can be conducted in 1 to 2 years in most cases as the laying pace is about 2km per day. An over investment of 15% at the outset typically brings the flexibility to meet a 50% increase in demand over time.
4. It is simple and sturdy which allows operation by workforce with lower qualification, without external technological dependence.

After only a limited market approach, we are already discussing more than 30 projects all over the world with the corresponding water authorities: South, Central and North America as well as Caribbean, all around the Arabic Persian Gulf, the whole Indian subcontinent, several places in South East Asia, China, Australia, etc. More than a dozen are located in the Mediterranean region, either along its Western coasts (Spain, Morocco,

Algeria), or in the Central region (Southern Italy, Sardinia, Sicily, Malta, Tunisia) or along its Eastern coasts (Greece, Turkey, Cyprus, Lebanon, Israel, Gaza, Egypt). For the time being, we estimate the total potential worldwide market at around two hundred projects.

These projects cover a wide range of magnitudes: small projects for only a few dozen kilometers transporting flows of a few cubic meters per second; large projects for several hundred kilometers (even more than one thousand kilometers for the very large ones) transporting flows of several dozen cubic meters per second. Indeed, projects transferring any volume over any distance can be considered: larger volumes require more parallel pipes beyond the two that are in most cases considered for security reasons; longer distances require intermediary pump stations which constitute so many supplementary abstraction or delivery points.

The projects we currently have under discussion cover all uses of water: urban human and industrial as well as agricultural.

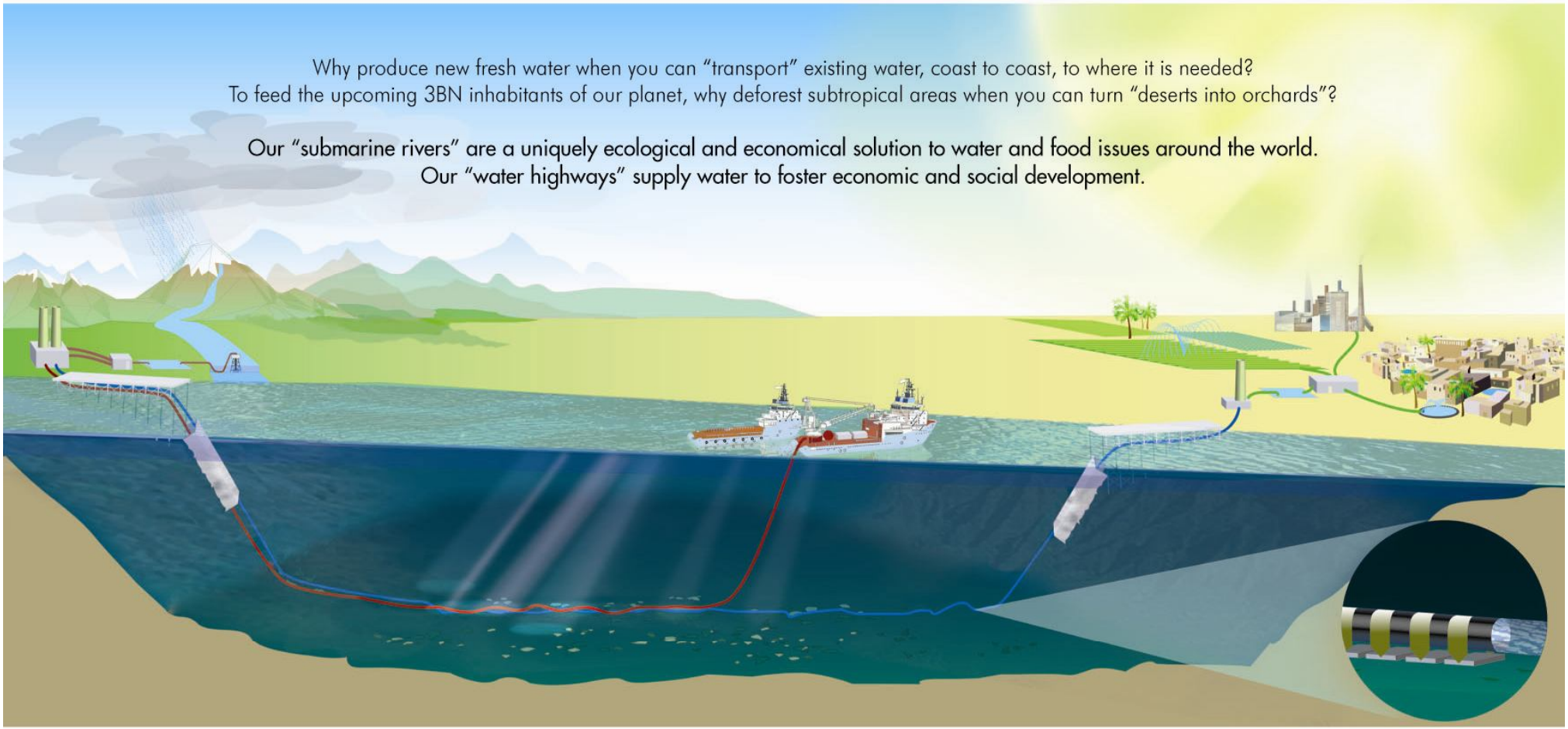
They result both from increases of existing demands: e.g. providing more water to meet the population growth of a coastal city as well as from brand new demands: e.g. developing a new irrigation perimeter in an arid zone.

They are both mere technical alternatives to existing projects: e.g. supplying a coastal city with an offshore pipeline instead of a traditional onshore canal both parallel to the coast, or brand new projects: e.g. invented as the result of a fruitful dialogue with potential customers.

We have already implemented the preliminary study of a major project in France. We expect to implement the preliminary study of a few more projects in the year ahead.

The construction of these “water highways” (to quote Mr. Loïc Fauchon, Chairman of the World Water Council) or “submarine rivers” (as we call them) can contribute efficiently to solving water and hunger problems around the world in the forthcoming decades.

Inter Basin Water Transfers in large quantities and over long distances by underwater flexible pipeline



Main Characteristics	Desalination	**submariver®**
Flow m^3/s	1-2	**Up to several dozens**
Energy consumption kWh/m^3	>3	**<0.5**
Total cost (incl. Capex and Opex) €/m^3	≈1	**<0.4**

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Up to several hundreds kilometers. Fast implementation: 2km/day.
Larger flows: more parallel pipes. Any depth.
Simple and sturdy. No external technological dependence.
Potential applications all around the world.