Inland desalination for relocation programs with the IBTS desalination Greenhouse

summary

Desalination is the process of producing fresh water from saline water. This document describes a building, comparable to a traditional solar still, but on an industrial scale. The building, called the "Integrated Biotectural System" or IBTS Greenhouse can produce 500.000 cubic meters of distillate per day. The IBTS operates on new and undisclosed evaporation and condensation concepts and novel combinations of alternative energy production and storage technologies available on the market.

This release is an update of the IBTS, as developed by Nicol-André Berdellé since 2007. Notably because the performance of the desalination facility within the IBTS Greenhouse has improved significantly. The operational efficiency of desalination could be driven down to 0.45 Kilowatt hours per cubic meter of distillate.
Challenges with the construction and frequently required refurbishment of the building envelope could be solved including fine dust deposits, strong sandstorm events and the degradation of the polymeric membrane.

The electrical energy required, mainly for pumping of water, is produced on site with a wind park. Consequently the IBTS operates without primary energy like fossil fuels. The desalination capacity is thus independent and secure compared to utilities relying heavily on large amounts of fossil fuels. On-site energy generation from sunlight and wind cause minimal operational costs. Investment for the building and staff for the agricultural enterprise are the main cost factors.

Inland desalination is the most important requirement for national relocation efforts in Arabia and Africa.
The only ecological alternatives for efficient desalination would be fresh water gneration with power from nuclear fusion, or alternative nuclear fission in the future (21th century).

This publication

is the result of in-house studies
from 2011 to 2019 by
structural engineering bureau
TS Prototype-Creation
as part of the
research and development for the
IBTS project

and the
National Programme for Afforestation
of Desert Lands in Egypt
from 2011 to 2014

The project

was terminally stopped
due to
Geopolitical instability in Egypt
and is
open for business in other countries

The author

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Relocation is inevitable

- urban areas do not have enough water for the population in countries with hot, arid climate
- urban sprawl takes place on fertile lands which are lost in the process
- food production requires space which is not sufficiently available in the urban areas (in the future)
- the quality of living in crowded, urban areas is unacceptably low
- urbanization, respectively centralized structures are insecure

Relocation on a national scale is a difficult task as the absence of seawater reduces the available water volume for desalination. Relocation, as a consequence of urban sprawl problematics is an issue for many countries, but desalination is not always required. Arabia and Africa are particularly suitable for the IBTS as the IBTS requires heat. Also these countries are particularly suitable for food production, which is a main feature of the IBTS greenhouse.
An adaptation of the inherent methodologies of the IBTS for cold climates has been developed. This document is only about the IBTS for hot climates.

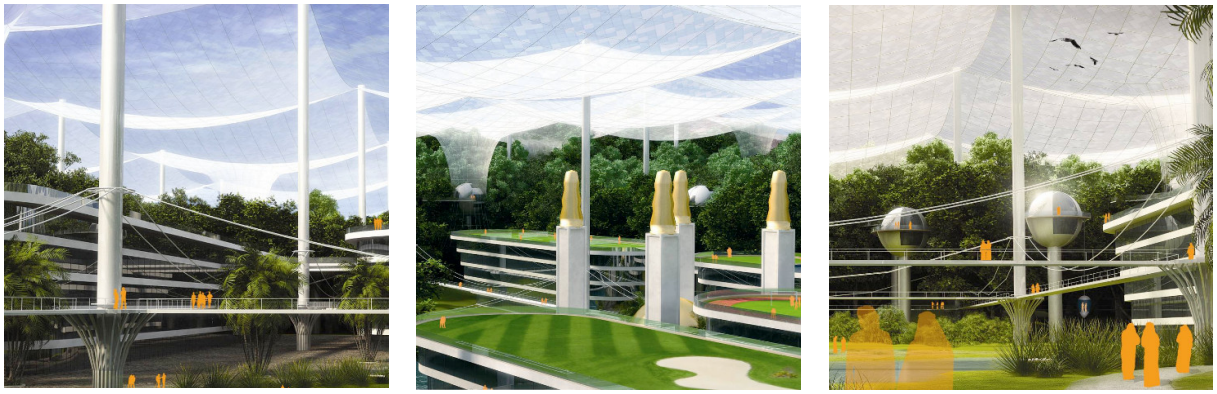
Advantages of Inland desalination

- No use of pricy estate on the coastline
- Independence of sealevel changes
- Secure from stormfloods
- No toxic effluent discharge into the sea
- Secure, decentralized national water infrastructure

The Landuse issue

Desalination utilities are factory-sized machines on the beach. Their appearance does not allow for real estate development, or any type of tourism industry in the vicinity. They cause air pollution due to the burning of fossil fules and water pollution due to the use of anti-corrosion chemicals. They render many hectares of valuable coastline unusable for real estate development like hotels, residences, yacht harbors and new cities. Consequently there are hidden costs for desalination power plants. The Jebel Ali Power Station in Dubai uses 400ha for its property. 600ha would be required by the most efficient Electro-chemical desalination process to date, if scaled up to 0,5M m³ of freshwater generation per day, just for the provision of electricity from Concentrated solar power (this figure currently is 3 to 4 times smaller for electricity provision from natural gas).

The IBTS creates a beautiful place to live and work in the desert. Worthless, hostile desert lands are converted into an oasis including jobs, residence, proprietary energy- and water infrastructure, as well as sustainable food production. The desalination functionality of the IBTS is invisible for anybody living, or visiting the site. According to the global water-cycle the IBTS works with solar evaporation from saline water bodies. The condensation of moisture into droplets is also partly done according to the natural role model of the global water-cycle and invisible. The remaining parts of the condensation process are low-tech, underground facilities. Depending on the investors choices the IBTS Greenhouse will look nothing different from a green landscape on the inside. The landscape is a tapestry of multi-species agriculture and aquaculture, wetlands and forest.



architectural interpretation of the IBTS, full scale version with residence

Cost

The investment cost of about 2M Euros for the 3.0 hectares demonstration site of the IBTS is that of a feasibility study. Jebel Ali M-Station alone (which is one out of eight parts of the Jebel Ali M-Station power plant) cost about 1000x more. The demonstration site produces 900m³ of distillate per day, enough for 3000 residents. The entire project, including all documentation of the full scale version, can be bought for 70M Euros under the condition that TSPC will be the main contractor to ensure the successful implementation. TSPC will only accept "Best for project" investors and Best for project site locations to further raise the chance for a successful implementation of the IBTS methodology and to help solve the global water- energy- and food crisis.
There will be no time- and cost intensive patenting process. This has slowed down, or even ruined too many other projects and companies before. Patents moreover are internationally recognized publications and are not useful as protection of the intellectual property (in this case).
The project is profitable from the beginning due to the image gain for the investor, or country (green cities, green industry, sustainable agriculture etc.).

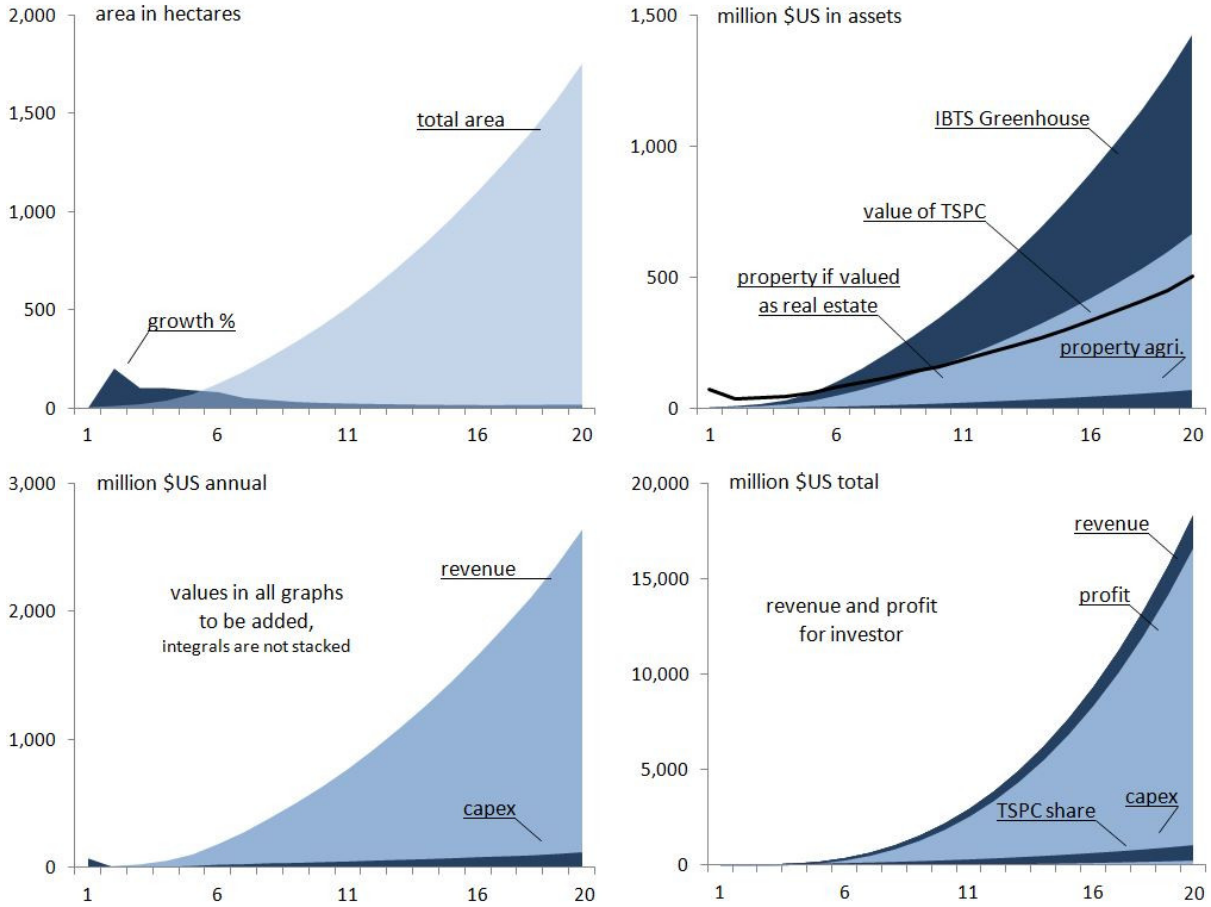
Strategy for implementation

The demonstration site is a minimum version of the IBTS without most of the technology of the full scale version (which produces 0.5M m³ of distillate per day). Based on the successful implementation, the IBTS can evolve through several variants until it reaches full functionality and full capacity in the full scale version. There is little risk for the investor because:

- low investment cost of a feasibility study
- research & development is finished
- detailed planning is finished
- construction time is short

Assets and Profit

[$US/ha*a]



Excerpt from the 20 year implementation plan

The water issue

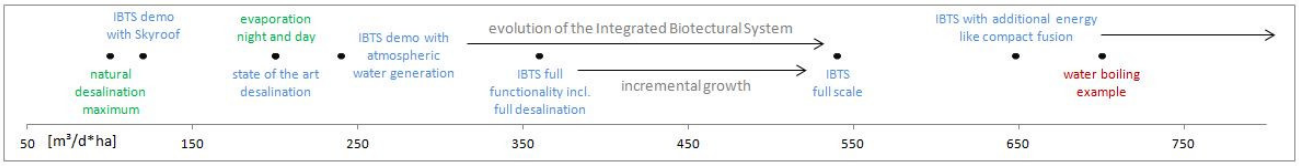
Other technologies based on atmospheric water generation (AWG) like water dispensers, or mobile military units do not match industrial efficiency so far, but are up to 200 times more energy intensive. Practices like the solar still, or air-well can not deliver industrial volumes and can not be scaled up because of land use and investment cost too high for the volumes of water produced.

The IBTS is a sustainable food-production greenhouse for its main purpose, yet it can generate freshwater with 4x higher efficiency than the most efficient (electro-chemical) desalination power plant to date (in Singapore). It is a product of its inherent design and new low-tech utilities. The IBTS concept has been developed up to scale to deliver industrial volumes of distillate for a compatible return of investment. The 20year financial plan is available for the investor.

The sustainable desalination of the IBTS makes inland deployment feasible. As well as the main purpose of food-production and job creation permits for relocation of parts of a population. The process of "full desalination" signifying a process without brine discharge as well as the production of salt for the industry, allows for deployment anywhere there is a saline aquifer, or brackish water source.

Together with a simple "Add-on" the IBTS can operate on a sewage water source, too. The Add-on has been developed as a facilitator project and is an eco-sanitation wetland,

respectively a desert-greening sub-project creating habitat for animals outside the Greenhouse building.
The energy is provided from an on-site mix of renewables and a flexible energy storage/conversion concept. Important to note: 0.45 kWh/m³ for desalination is not a laboratory value, those of which often turn out to be multiple times higher in real-life and scaled-up applications. The value stems from realistic model-calculations based on construction physics, most of which are simple basics of the hygrothermal conditions for example inside the humid atmosphere of the Greenhouse.
1000 hectares of the IBTS Greenhouse can generate 500.000m³ of distillate per day, the volume of an industrial desalination-power plant. Nevertheless it is a greenhouse, no high-tech or critical elements involved. Our finished feasibility study based on construction-, material- and labor cost of 2018 suggests that it can be build for 25% of the investment sum of the industrial counterpart Jebel Ali Desalination power plant.



Evolution of the IBTS project

The Integration issue

The IBTS is called Integrated System because it is a multi-disciplinary concept relying on the combination of more than 320 different sciences and technologies, practices and divisions of construction engineering. Among others it is competitive with industrial utilities for its combination of agriculture with architecture. This combination yields additional areas of revenue like that from real-estate sale.
The food-production inside the IBTS provides work for several ten-thousand staff in agriculture for a 1000 hectares site. 55000 residents in the full scale version are part of the model calculations.
The IBTS has undergone different feasibility studies and comparative models of various possible interpretations of the concept using different combinations of technology and weather conditions of a variety of locations in Arabia and Africa. This type of multi-variant prototype development is above state of the art in Construction Engineering.
In the course of the project an individual security concept for the safe implementation and operation has been devised. Examples like the “Upwind power-plant” of German company Schleich-Bergmann which collapsed because of strong winds, or the Masterplan of Norman and Foster for Masdar city which failed in all its major selling-points, have thought us lessons. These types of failures due to lack of integration, respectively unrealistic, or incomplete planning, can not occur in the planning process of TSPC.
Among other measures TSPC has developed a realistic Due Diligence process percolating down to extensive technical documentation inside all relevant individual cells of spread-sheet calculations.

Implementation facilitators

Construction in remote areas of deserts is between difficult and impossible. Construction workers need a base camp with proper conditions, shade, food and water. Therefore a sub-project for the compilation of a construction site setup (CSS) using the very features of the IBTS has been prepared. Desalination during the CSS requires more space and produces less drinking water.

A second facilitator sub-project is designed without the Skyroof, in an open-field variant. The agricultural concept of the IBTS does not rely on the Skyroof, after all. It is multi-trophic aquaculture based on saltwater, so called mariculture. As the products of mariculture replace staples from fresh-water, it can be considered a method for desalination: The mangrove shrub conducts desalination in its roots with an efficiency of 90%. The leaves in return are preferred fodder for goats and water buffalo, which are valued for their high-grade milk and meat in Arabia and Africa. The modelation of food-chains in this designed eco-system has shown that a yield of 80tons per hectare and year of sea-food, meat and poultry is feasible…

A third facilitator project including holiday and study opportunities was finished in 2019. The project called Aquascape would provide a safe diving holiday destination for children, a Biosphere2-type open field campus, worksite and laboratory, a profit generating *Designed Ecosystem* and novel housing suited for off-grit living in hyperarid deserts. The novel housing is a Tiny house design in container style. It has a large shield which prevents the sun to reach the house, over the entire course of the day. This sun tracing heat-shield is fully covered with solar cells producing more electricity than Aquascape requires…

Thank you for reading