A NATURE-BASED SOLUTION TO THE WORLD'S INCREASING DEMANDS FOR FOOD, WATER AND ENERGY

Profound change to secure, inexhaustible, affordable utilities through a merger of solutions.

Our creation of [and entry into] the Anthropocene age brings with it daunting and apparently intractable problems. The conflicting needs and worsening issues relating to the FOOD, WATER, ENERGY NEXUS simply **cannot endure.** The rise of human pressures on the planet is ceaseless and exponential and there is no universal, one-size-fits-all solution. On a global basis, we use almost twice what the earth produces or can absorb. **The prognosis for humanity is - *'unsustainable'***.

Two concepts, endorsed at the highest levels and promulgated as 'progressive' and 'enlightened are rapidly becoming mainstream responses to *the global need for profound change.*

1. ***NATURE-BASED SOLUTIONS*** [NbS] are increasingly promoted in key national policies and strategies, notably in connection with climate change and biodiversity policies.
   Campaigners and academics call on governments to scale up Nature Based Solutions.[1]

2. In connection with carbon neutrality and circular resource use, another increasingly referenced policy is ***'SECTOR INTEGRATION'*** [SI]. This has now emerged as a major theme of European energy policy. Interaction and symbiosis, integration and the synergies provided, all combine to deliver improvements that are significantly greater than the sum of the sector parts[2].

Telesis Synergy Systems Ltd [TSS] is a UK company, formed in mid-November 2020. Our business is the design and build delivery of **TELESIS.** The two methodologies above [NbS & SI] both offer sustainable development without compromising future needs - but are otherwise largely unrelated. **TELESIS** uniquely merges both concepts by using **natural** and renewable resources as the engine for **integrated,** multiple services and utilities production, the platform for socio-economic security.

TELESIS is the name we have given to an important response to the global **need for profound change,** one which reduces CO_2 emissions and pollution, facilitates ecosystem recovery, improves efficiencies and contributes significantly towards resolving the conflicting needs of the Food, Water, Energy Nexus. **The naturally purified, geothermally energised resource that serves as the nature-based platform for these downstream productions is the inexhaustible, uninterruptible subsurface water supply acquired by the 'next generation' TELESIS abstraction technologies.** The scale at which **TELESIS** functions provides the communities we serve with socio economic stability- simultaneously delivering sustainable, affordable services by '***doing more with less'***. According to the **OECD**, around USD $6.3 trillion of infrastructure investment is needed each year up to 2030 to meet the 17 SDGs, increasing to USD $6.9 trillion a year to align with the goals of the Paris Agreement. **TELESIS can provide a significant contribution to 14 of the UN's 17 SDG's.** To achieve net-zero emissions by 2050, investment in the power sector alone needs to triple from $760 billion in 2019 to $2.2 trillion in 2030, according to the **International Energy Agency**. Much of this investment will need to come from the private sector with support from the public sector, a key point raised during the **Leaders Climate Summit**.

TELESIS leads the way – globally - in integrated, synergistic utility and services production and has the **commercial attributes [ROI, profitability, etc.] necessary to attract interest from the private sector in taking the lead role in accomplishing all of the above**.

[1] *Christiana Figueres, Nick Stern, and Paul Polman lead renewed push for beefed up approach to nature-based emissions reduction.*
[2] *Decarbonised district heating and cooling (DHC) networks or 'surplus' renewable electricity stored in water, channelled by heat pumps.*

r.daniel@telesis-synergy.com 0044 7704 773 567 www.telesis-synergy.com

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BACKGROUND TO TELESIS

Attempts to acquire and capitalise on the qualities of subsurface water has a long and (largely) unsuccessful history. There are, however, a small number of subsurface water abstraction projects that are unquestionably successful and have been operational for periods ranging from 14 - 20 years without any lost down-time, without maintenance and without bio-fouling chemicals.

Two of this small number of successful versions were conceived and implemented by the Founder and MD of TSS, the author of this article. Using practitioners first-hand experience, Ron Daniel went on to research, develop and validate TELESIS, utilising a broad spectrum of engineering experiences to accomplish three developments that distinguish TELESIS from his earlier, successful precursor versions.

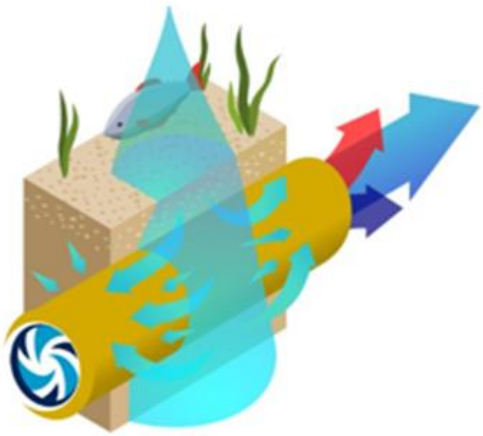
To transform TELESIS from *'very useful but eye-wateringly expensive',* it would be necessary to overcome installation costs, overcome maintenance issues and overcome the detrimental effects of ***the Inverse square law*** on the fluid dynamic performance of the drain.

When we launched in November 2020, all three of these objectives had been achieved.

- The cost has been significantly reduced by changing the method of installing the horizontal drains the form the key component of the intake.
- Maintenance can now be carried out non-disruptively from the safety and convenience of the onshore intake chamber.
- The performance is improved by Ron's ingenious design that overcomes the detrimental effect of the inverse square law on the uniformity of the horizontal drain abstraction pressure.

What benefits does TELESIS offer?

Water quality comparison NTU: Nephelometric Turbidity Units TSS: Total Suspended Solids		
	TELESIS	Open-intake
Bacteria Coliforms	0.1	30 - 35
Turbidity (NTU)	1.5	6
TSS	5	40
Temperature	Constant, year-round.	Diurnal & Seasonal variation



TELESIS advantages stem from a 24/7 supply a water that is naturally purified and comes with intrinsic latent geothermal energy.

TELESIS capitalises on the qualities of subsurface water to harmoniously and holistically create value, to produce potable water, to power our industries, to heat and/or cool our built environments and to grow our crops – all while facilitating eco-system regeneration.

By achieving ***more with less,*** opportunities of societal consequence flow with **TELESIS.**

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The qualities of subsurface water are capable of profoundly transforming the production of downstream utilities and serve as the engine for all TELESIS operations.

Low-zero CO_2 emissions

Inexhaustible,

unparalleled low costs,

harmless, Uninterruptible,

Platform for socio-economic stability & growth

Ceaselessly Sustainable,

Integrated,

Unparalleled Economics,

facilitates eco-system recovery

DISCRETE, SYNERGISTIC

TELESIS Highlights:

TELESIS is the municipal scale game-changer that will make it possible to accomplish a great deal by capitalising on shallow geothermal energy supplied intrinsically with the naturally purified water that we abstract from the subsurface of the nearby offshore.

TELESIS solves critical problems with an affordable, uninterruptible, decarbonised, combined heating and cooling service which is available in tandem with water supply; a uniquely multi-revenue solution with unparalleled economies.

TELESIS desalination is economic, harmless, facilitates ecosystem recovery and overcomes existing reticence and objections to Desalination by completely reversing the current (accurate) perception of Desalination, i.e. **unaffordable, destructive and discredited.**

Overview

Integrated issues require integrated solutions.

Subsurface water is naturally possessed of inexhaustible and uninterruptable attributes that serve greener, less expensive, synergistic, multiple utility productions, the platform for socio-economic stability. Opportunities and solutions flow from TELESIS that harmoniously and holistically create value, produce water, heat and/or cool our built environments, transform Data centre operation, grow our crops – all while facilitating eco-system recovery. **This is the solution for big problems**; from how to resolve the conflicting needs of the Food, Water, Energy Nexus, to transforming and driving the economies of the communities we serve with resilient, sustainable and affordable support.

r.daniel@telesis-synergy.com 0044 7704 773 567 www.telesis-synergy.com

- TELESIS contributes significantly to 14 of the UN's 17 SDG's
- TELESIS fills in the gaps that create the conflicting needs of the Food, Water, Energy, Nexus.
- TELESIS provides the platform for socio-economic stability for the communities we serve.
- TELESIS facilitates ecosystem recovery.
- TELESIS is a game-changer that addresses the limitations of the current, dominant, systemic approaches. Integrated problems such as the conflicting needs of the Food, Water, Energy Nexus require integrated solutions.

Reliability

Uninterruptible, impervious to the shut-down events that plague daily the operations of surface intakes

Environmental Performance

TELESIS provides the opportunity for nature to reclaim its share of the water cycle which, in turn, facilitates ecosystem recovery. **Our processes are Chemicals-free and environmentally benign.**

Economic Drivers

TELESIS slashes the cost of Desalination and more than halves the cost of Cooling. The combination - through process integration - positions TELESIS economic benefits on an unparalleled magnitude of order

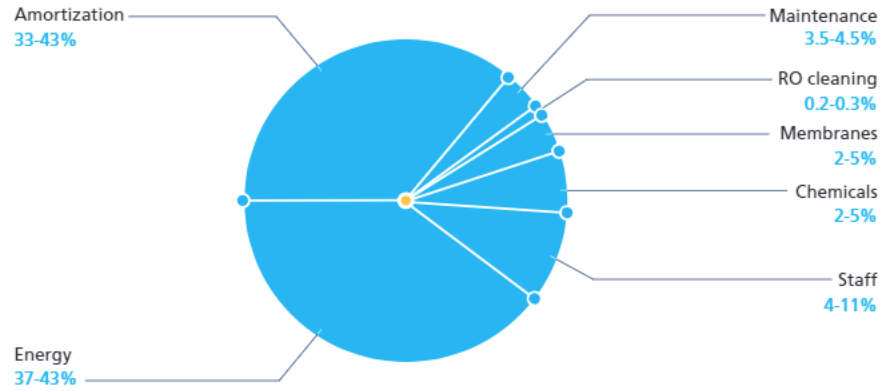

Figure 11 Production costs in sea water reverse osmosis plants (Sanz, 2020)

SOURCE: SWRO: Assessment and Pre-treatment of Fouling and Scaling. Chapter 1, Sergio G. Salinas-Rodríguez, Jan C. Schippers

Especially enthusiastic supporters of ***'SECTOR INTEGRATION'*** have described this approach as a **'REVOLUTION'.** A little less flamboyantly, we have chosen to illustrate the advantages of holistic, synergistic, integrated, renewable & clean TELESIS procedures by providing below details of three potential **TELESIS** deployments that cope with very different climatological conditions or serve very different functions.

A. TELESIS - Free-cooling PLUS Desalination **in Warm Arid climates**
B. TELESIS - Geothermal groundwater-source heat pump operations **in northern latitudes.**
C. TELESIS - Electricity generation using Thermal Generators or Salinity Gradient Power (SGP)

Ron Daniel
Managing Director

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A. TELESIS - Free-cooling PLUS Desalination in Warm Arid climates

At around the same time as the Egyptian population officially crossed the 100 million person milestone, the Egyptian Government announced the strategy to rely on desalination for the countries drinking water supplies. **The coming years will apparently see the construction of 19 new desalination plants before 2025, 47 by 2030, and 67 by 2050.**

This is no doubt in response to the convergence of events such as seawater intrusion into the Nile, dependence on upstream neighbours in relation to Nile basin water security, climate change and population growth.

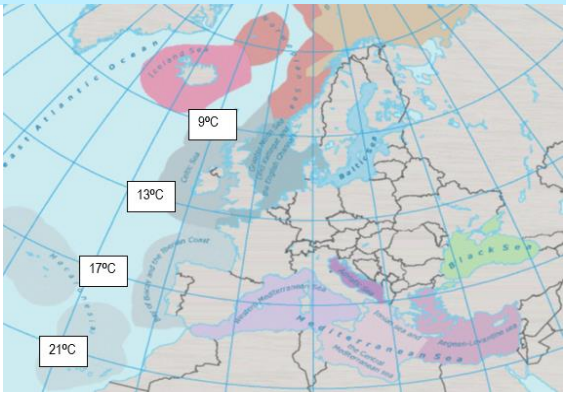
Data centre operators are currently looking at ways of gaining a presence and building operations to serve the vast, demographically youthful population of Egypt.

How can this be done when the host country is barely able to keep up with current rising electricity demands and increasing water demands?

Multi-utility, multi-revenue TELESIS in Egypt

Data centres are **HIGH ENERGY CONSUMING, WATER GUZZLING OPERATIONS.**

By utilising subsurface water harmlessly acquired from below the seabed of the Mediterranean @ 20ºC, 24/7, free-cooling is possible - which [with the addition of a desalination facility] transforms Data centre operation in Egypt[3] to **LOW-TO-ZERO ENERGY CONSUMPTION, NET WATER PROVIDER.**



This proposition can be applied effortlessly to a District cooling / Desalination combination.

In Egypt approximately 50% of the total power consumption relates to air-conditioning and refrigeration during summer-time.

- **TELESIS reduction in energy consumption is higher than 50%.**
- **TELESIS reduction in water production costs is higher than 50%.**

VALUE PROPOSITION

Reduce the Capex and increase the benefits by transforming the proposed Egyptian desalination programme into a **multi-utility facilities** that serves socio-economic well-being through job creation and securing the Food, water, energy nexus.

A further important attribute of TELESIS is the significant reduction in building volume (no cooling towers = increased floor space availability) and land area requirements[4] (TELESIS desalination requires half the land area of conventional operations).

- Cooling without Cooling towers provides a significant reduction in building dimensions and size [and a concomitant reduction in Capex] with more building floor space for more economic utilisation.
- Desalination with TELESIS requires less than half the land otherwise needed for pretreatment and has aggregate economies amounting to a 50% reduction in production costs.

[3] Or elsewhere around the Mediterannean

[4] Nestlé's goal of offsetting 13m tonnes of CO_2 a year with "nature-based solutions" would require 4.4 million ha [hectares] of land a year, according to NGO Grain – an area about the size of Denmark.

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B. TELESIS - groundwater-source heat pump operations

TELESIS is a 'Shallow Geothermal energy source' of seismic-shift capability, one which is similar (but superior) to existing versions that utilise groundwater from vertical wells.

- We obtain our Aquifer water from horizontal drains located within the subsurface sands of the near off-shore. This averts the prospect of **saline intrusion in coastal aquifers.**
- It would require several hundred vertical wells to get a capacity comparable to TELESIS [a single, discrete, underground (invisible) supply] all linked up in a network that, in addition to the district heating network itself, doubles the level of urban infrastructure cost, disruption and aesthetics issues.
- The temperature of the abstracted ground water is 24/7 constant and will not detrimentally change, whereas, vertical systems have been found to have a temperature fall ***of 2-4°C during the first three years of operation.'***
- Unlike vertical systems, the abstracted water quantity cannot be impacted / threatened / reduced by subsequent, nearby groundworks activity.
- Unlike vertical systems, there is no risk of abstracting toxic chemicals (e.g. ARSENIC) which introduces disposal issues.
- Unlike vertical systems, here is no risk of our ground water abstraction leading to **subsidence issues**.

The information below relates to the potential of a TELESIS service that will be of considerable benefit to the **SOUTH WALES INDUSTRIAL CLUSTER [https://www.swic.cymru/].**
TELESIS is the optimum low-carbon, green, clean, inexhaustible, uninterruptable and above all, affordable district heating service. Vertical wells are exposed to risks encountered with the diverse constituents associated with heterogeneous geology, whereas, the horizontal TELESIS wells are positioned in the uniform, homogeneous structure, the unconfined Aquifer that is the near offshore sub seabed.

In South Wales, TELESIS subsurface water will be delivered at 12+ºC (min) every minute of the day, every day of the year. This energy source assists with optimising seasonal or episodic load variations.

The system delivery life-cycle is measured in *multiple 100's of years.*

The volume of water we deliver is available in system capacities ranging from 16 – 160,000,000 litres/day.

This relates to 6.5 – 65 MW of Heat Pump heating capacity if we use a conservative delta T of 6.5 deg C [12.5ºC in – 6.0ºC out]

The water @ 6ºC, returned at 12.5ºC will deliver sufficient Free-cooling to serve the 350,000 sq ft² of the Next Generation Data Centre, the largest in the Wales.

***With the first UK emissions target deadline less than 10-years away,* TELESIS is the game-changing requirement that will make it possible to achieve these targets.**

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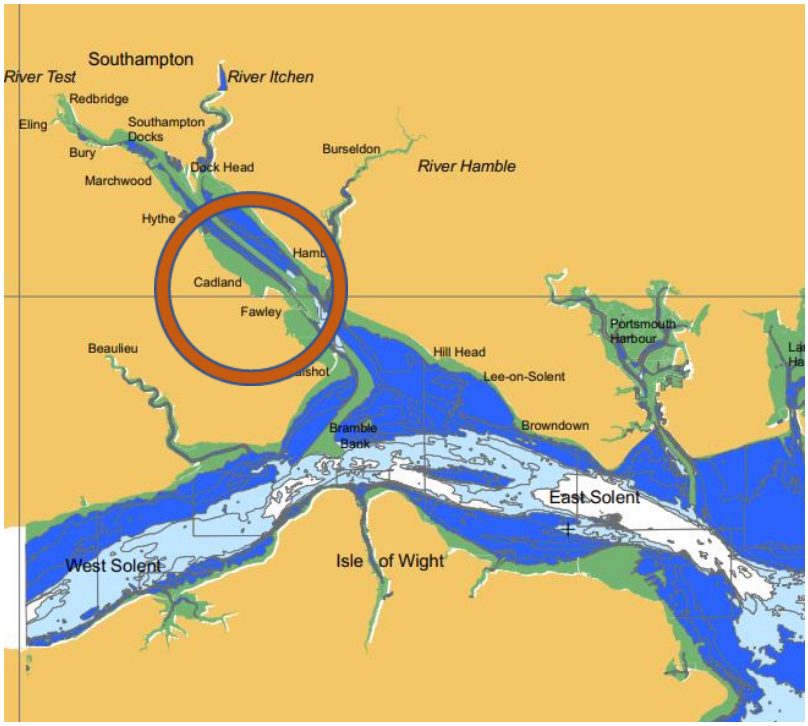
C. **TELESIS - Electricity** generation by Salinity Gradient Power (SGP)

https://www.sciencemag.org/news/2019/12/rivers-could-generate-thousands-nuclear-power-plants-worth-energy-thanks-new-blue

Estuaries, where rivers pour freshwater into the ocean, could become giant power plants with the help of a newly made membrane



Fawley waterside is a 365 Hectare site that is about to be re-developed from the bottom up.
New infrastructure will incorporate Ground source heat pumps that utilise 80,000,000Litres per day of subsurface seawater @ 13ºC every day.
After the heat pumps harvest the energy from the seawater to deliver both heating and cooling utilities, it is transferred to the desalination process.
Our desalination process produces 40,000,000Litres per day of brine at 70g/Litre.
The brine and 40,000,000Litres per day of brackish water at 20g/Litre is delivered to the Salinity Gradient electricity production facility to create sufficient electricity to serve both the Heat Pumps and the Desalination facility [80MWhrs]. Doing more with less.

THREE *NET ZERO* UTILITIES FOR LESS THAN THE PRICE OF ONE.

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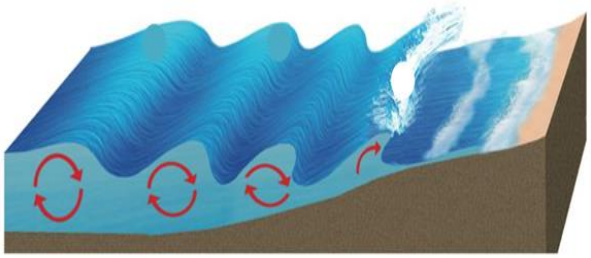
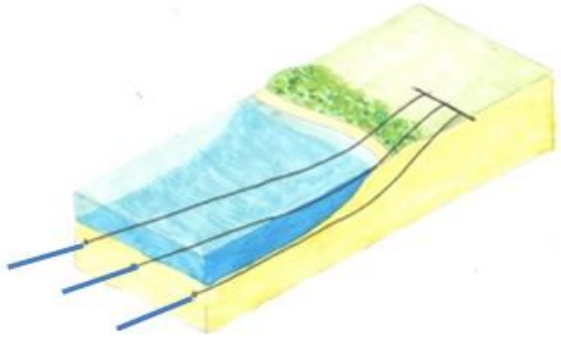


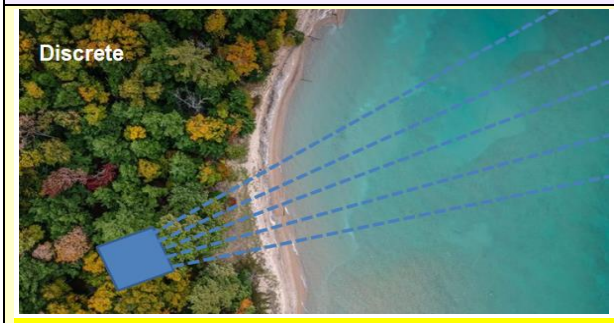
NATURALLY PURIFIED.

The natural filter media through which **TELESIS** water is abstracted is perpetually maintained by the dynamic actions of the seas above; waves, tides, currents, and storms.

INEXHAUSTABLE

Our indestructible subsurface HDPE pipes will perform over a life cycle measured in **hundreds of years**; for as long as the water above exists.





INVISIBLE

TELESIS can be deployed discretely and unobtrusively, serving utilities **without any aesthetic issues.**

ENERGETIC

The constant year-round subsurface temperature and its variance with above-ground temperatures create latent energy opportunities.
This temperature is particular to the local geography.

RESILIENT, UNINTERRUPTIBLE

TELESIS is impervious to shut-down events.
Nothing that occurs above ground can impact on the abstraction of water from the saturated offshore sands.

HARMLESS, BENIGN

In 2015, open intakes were banned by law in California, despite years of consistent drought. This was a consequence of the combined destruction caused at the Intake and the toxic, carcinogenic effluent at the Outfall. **Chemicals-free TELESIS** is simply incapable of harm, is environmentally benign and in addition **reduces production costs by ≥ 50%.**

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