

WHERE NEXT FOR OVERHEATING AUSSIE WATER RIGHTS MARKET?

AFTER THE RELEASE OF A CRITICAL NEW REPORT, AND A RISING TIDE OF COMPLAINTS FROM FARMERS, THE GOVERNMENT IS COMING UNDER PRESSURE TO LAY OUT A ROADMAP FOR REGULATION

WHO WILL BUY VEOLIA WATER N. AMERICA?

AS THE FRENCH MAJORS START TO LOOK BEYOND COVID-19, LONG-PLANNED ASSET DISPOSALS ARE INCHING CLOSER TO REALITY

PRIVATE PARTNERS NEEDED TO SELL SAUDI SEWAGE

SAUDI ARABIA NEEDS INVESTORS TO MAKE ITS REUSE DREAMS A REALITY. IS THERE ENOUGH APPETITE FOR RISK TO MAKE THE PROJECT WORK?



PUMPS

PREVENTING WATER SCARCITY REQUIRES AMBITION FOR BOTH TECHNOLOGY AND SOCIAL RESPONSIBILITY

READY TO SOLVE
AMBITIOUS PUMPING CHALLENGES

Mining needs clean water such as groundwater. In water-scarce areas, this is a challenge. The Quebrada Blanca mine is in the Atacama desert, one of the driest places in the world. To use the Pacific Ocean as a water source to save local groundwater for human use, a 165-kilometer water supply pipeline is built to connect

the mine with the company's port, which hosts a desalination plant. For this ambitious task, it needs reliable technology. ANDRITZ supplied process pumps and centrifuges for brine treatment made of specially resistant duplex steel to ensure highest efficiencies, a long service life and, highly economic plant operation.

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ANDRITZ AG / p: +43 316 6902-2509 / pumps@andritz.com / andritz.com/pumps

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Media Analytics Ltd.
Suite C, Kingsmead House
Oxpens Road
Oxford OX1 1XX
United Kingdom
T: + 44 (0)1865 204 208
F: + 44 (0)1865 204 209

E-mail domain name:
globalwaterintel.com

Publisher:
Christopher Gasson
cg@globalwaterintel.com

Editor-in-Chief:
Ian Elkins (E-mail: ie@)

Editor:
Tom Scotney (E-mail: ts@)

Editorial Director:
Sebastian Lennox (E-mail: sl@)

North America Editor:
Paul Hasler (E-mail: ph@)

Latin America Editor:
Steven Grattan (E-mail: steven.grattan@)

Technology Editor:
Charlie Walker (E-mail: cw@)

Technology Consultant:
Tom Pankratz (E-mail: tp@)

Europe Editor:
Sébastien Mouret (E-mail: smouret@)

Asia Editor:
Malin Hedlund (E-mail: mhedlund@)

Australia Editor:
Stuart Finlayson (E-mail: stuart.finlayson@)

Marketing Director:
Chantal Marchesi (E-mail: cmarchesi@)

Sales Director:
Jack Ceadel (E-mail: jmc@)

Head of Global Sponsorship:
Abigail Edwards (E-mail: abigail.edwards@)

Advertising Executive:
Ruth Newcombe (E-mail: rn@)

Registered Company Number: 4412085

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AUG 2020

GLOBAL WATER INTELLIGENCE



COVER STORY: Valuations of traded water rights in Australia's Murray-Darling Basin have shot up following three years of drought in a row. As anger rises among farmers, calls are growing for transparency in the largely unregulated market (see page 30).

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An easy reference guide to all the companies appearing in this issue

NEED TO KNOW

Quarterly results analysis; Evoqua outperforms; Progress on Veolia and Suez disposals; A boost for reuse in California and Saudi Arabia; Desal plants for sale in Saudi and Kuwait; China's smart water ambitions; Aussie water rights in the spotlight; all the latest news from around the world this month.

NOT SO BAD

● With the second-quarter results now in from most water businesses, we can now get a better picture of the impact of COVID-19 on the water business. In aggregate, the 24 companies we survey on page 11 showed a 1.9% dip in revenue and a 4.5% reduction in EBIT, but this disguises a much broader spread of performance. The two French giants, **Veolia** and **Suez**, lost 12.3% and 10.7% of their top line compared to Q2 last year, with water marginally outperforming. At the other end of the scale, **Essential Utilities** showed a 75.6% increase in revenue thanks to its acquisition of Peoples Gas, and **Energy Recovery** saw its revenues soar by 92.1% thanks to deferred revenue from its cancelled contract with Schlumberger.

● **Evoqua** wins the prize for the strongest stock market recovery – largely because people assumed the worst would happen back in March. In the event, like-for-like revenues were down just 0.3% (see story p14). It is easy to understand why investors might make this mistake. Revenues at its nearest US comparators, **Xylem** and **Pentair**, both fell by double-digit percentages, although in each case the downturn was less painful than anticipated.

ON THE BLOCK

● **Veolia** has conceded that it is planning to sell part of its North American water business. The move has been on the cards since the French company announced plans to ditch mature and low-impact businesses in February this year, but the sale process is unlikely

to start until the new year. The obvious buyer for the \$400 million-a-year business would be **Inframark**, the number four player in the US municipal contract operations market behind **Veolia**, **Suez** and **Jacobs**. Nevertheless, the auction is likely to attract private equity bidders simply because it is chunky and looks suitable for leverage (see story p16).

● How the business is valued is likely to be a function of how much one understands the market. Those who know too much about the bitter struggle for growth in contract ops over the past few years are likely to be reluctant to pay top dollar, leaving the field open to optimistic novices. The central problem is that no big cities

have opted for the outsourced model since 2002, when **Veolia** picked up, and then dropped the \$1.5 billion Indianapolis contract. Instead, what growth there is has largely come from overstretched communities which don't understand the level of risk in their water systems. If you want to win this auction, you will need someone serious about the problems, but creative about the potential.

● Meanwhile, **Suez** has kicked off its asset rotation programme with the announcement of two sales: a stake in the Melbourne desal project company **AquaSure**, and its **OSIS** sewer and industrial cleaning business. The latter is going to **Veolia**, which can see growth where **Suez** saw none.

WATER REUSE

● The City of San Diego this month released the first two construction packages for its flagship indirect potable water reuse project, Pure Water San Diego. Bids for the 34MGD (128,690m³/d) North City Pure Water Facility are due in on 1st October, while proposals for the first of several conveyance packages are due in five days later.

● Following action from a pressure group, a California court has made a ruling that looks like eventually codifying the idea that the disposal of treated wastewater is an “unreasonable use and waste” of resources. If ratified, this would mean utilities and plants having to take reuse far more seriously. This will in theory be a big boost for water reuse in the state. The challenge will be finding adequate demand that can be supplied on a cost-effective basis (see commentary p22).

● Saudi Arabia's **SWPC** has begun consulting on a new ►

DROUGHT HITS EUROPEAN POWER COUPLE

France and Germany are experiencing a third year of drought. It is having an immediate impact on shipping on the Rhine – whose dry river bed is pictured here at Düsseldorf. In the medium term, it is likely to reshape water resources strategy across the continent.



Source: Reuters

model for financing water reuse. It involves private developers bidding for the treated sewage effluent from wastewater treatment plants and financing the infrastructure needed to distribute it to customers. It is the first time developers have been asked to take any commercial risk on Saudi water projects, and it is not immediately popular with developers (*see story p36 and analysis p39*).

MIDDLE EAST

- Shares in Kuwait's first publicly traded power and water project **Shamal Az-Zour Al-Oula** quadrupled in value when they started trading on 16 August. 127,000 Kuwaiti citizens took up the offer to buy shares at the offer price last year, but 5,000 decided to take their profits on the first day of trading, and officials had to turn away more who wanted to sell their shares in person at the stock exchange building. The developer consortium of **Engie**, **Sumitomo** and **AlSagar** will also have booked a healthy paper profit. Together, they hold 40% of the equity (*see story p37*).

- **Taqa**, now an integrated and debt-free utility following the absorption of all Abu Dhabi's water and power infrastructure, is looking to step away from the energy investment plan that gave it massively unstable revenues. Instead, it has hinted at a return to investment in new independent water and power projects, similar to the plan it hatched back in 2014 when it hired **Acciona's** Alejandro Jiménez, which faltered after a planned project in Ajman stagnated. It has also revealed that more than half of its 1,100MIGD water portfolio will be accounted for by membrane desalination by 2020. The current figure is 14%, but this will rise to 30% when **ACWA Power's** 909,000m³/d Taweelah IWP is complete.

- This additional demand for desalination capacity is likely to

keep the market buoyant. Long enough, perhaps, to see Israel's **IDE Technologies** go head to head with the GCC's champion project developer **ACWA Power** in a tender. Both companies are equally convinced they are the smartest in the business, but until the UAE made peace with Israel this month, there was no hope of ever finding out which one was right.

- Meanwhile, geopolitical forces are opening up the Iranian market to Chinese desalters. With no one mainstream desalter prepared to take the risk on the next stage of the SAKO programme at Bandar Abbas, China's **Gold Tech CPDC** and local outfit **Kaveh Nahal Andish** have picked up the 200,000m³/d project.

- The **EBRD** has put €50 million of liquidity support into **ONEE** in Morocco as the latter struggles to make payments. The EBRD insists this is not

going to become the new normal for lending and that it will stay focused on projects, but more and more utilities are likely to have operational finance difficulties as a result of COVID-19 (*see story p38*).

- Requests for qualifications have been sent out for two big desal asset sales in the last month – Ras Al-Khair (KSA, 1.03 million m³/d) and North Shuaibah (Kuwait, 205,000m³/d). It will test the appetite of the market for taking on aged power and water assets from public authorities that built them at a time when cost, rather than efficiency, was the key consideration.

ASIA PACIFIC

- China's domestic smart water ambitions are moving beyond physical technology to IT and SaaS. It will significantly change companies' value propositions. The second part

of GWI's assessment of the Chinese smart water market can be found on page 28.

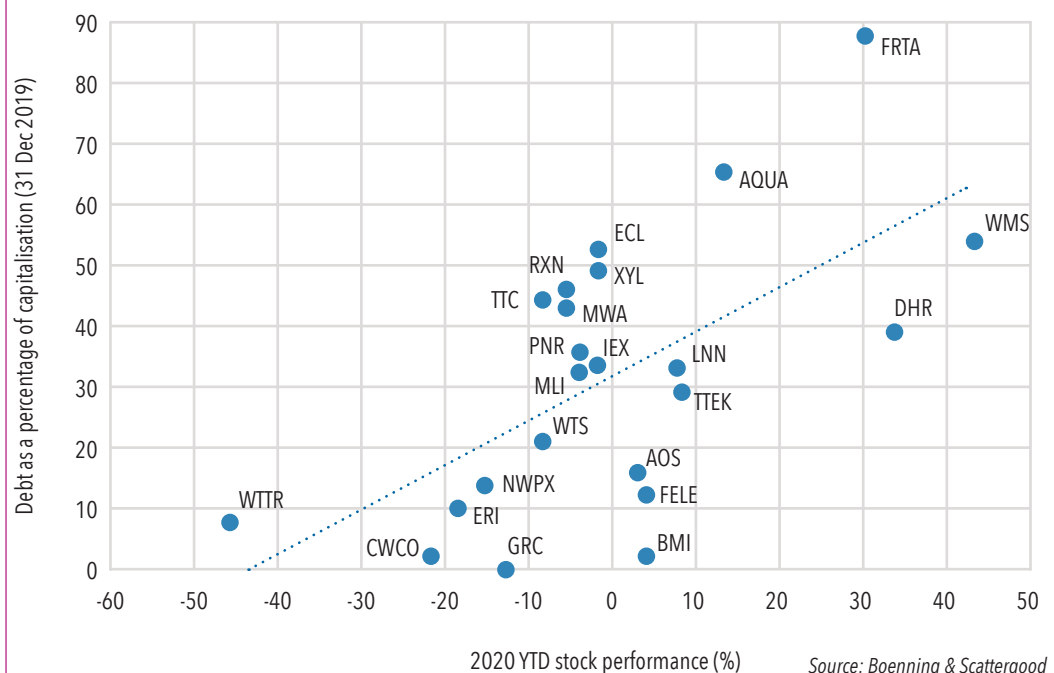
- Investor interest and three dry years in a row have pushed **Australia's** water rights trading market up and up in terms of valuations. Farmers are getting antsy, with allegations of rights hoarding and unhealthy levels of foreign investment. A major competition commission investigation this month said that the market lacks transparency and is in serious need of reform. Calls are growing for the 'wild west' market to be brought to heel (*see story p30*).

- A new order by **India's** environmental watchdog, the National Green Tribunal, on groundwater access conditions has raised concerns over water availability for industrial and commercial use. It is expected to accelerate technology adoption as projects seek alternative solutions (*see story p33*). ■

CHART OF THE MONTH: LEVERAGE IS KING

This month's chart comes from stock analyst Ryan Connors at Boenning & Scattergood. It shows the extent of leverage at publicly traded US industrial companies with water exposure, plotted against their share price performance so far this year. It shows that the markets are currently backing

companies with higher levels of debt in relation to their market capitalisation because of the Federal Reserve Bank's implicit support for corporate debt. For further analysis of recent stock movements, see our GWI Index coverage on page 8, and our quarterly results review on page 10.



THE LIST

The biggest water businesses in the world

Which companies in the water industry are the largest in terms of annual revenues? GWI WaterData has the answer.

France has the biggest private operators. America has the largest engineers and technology companies. Brazil has the largest private water concessionaires, while the UK has the most sizeable regulated utilities in the top 40. China's strength is

in project developers. Only the top two in our list would qualify for the Fortune 500 on the basis of their water revenues, which reflects the fact that water is a difficult business to get truly big in. The largest company which owns a water business is

Berkshire Hathaway, which is ranked number six in the Fortune 500, with revenues of \$256 billion. It owns Marmon Water, which has some neat industrial water technologies, but its water revenues are not more than \$1 billion. ■

Rank	Company	HQ country	Description	Est. water rev.	Expertise
1	Veolia	France	Global market leader with interests in solid waste and energy	\$12.2 billion	ChDIEnFiInSvTcUt
2	Suez	France	Utility operator with strong industrial technology portfolio	\$11.2 billion	ChDIEnFiInSvTcUt
3	Ecolab	United States	Water treatment chemicals supplier within services group	\$5.5 billion	ChDIInSvTc
4	Xylem	United States	Technology group with pumps, treatment, and digital	\$5.2 billion	DIInSvTc
5	Sabesp	Brazil	Utility concession serving São Paulo; traded on NYSE	\$4.5 billion	Ut
6	Grundfos	Denmark	Pump supplier diversifying into treatment and digital services	\$4.1 billion	DIInTc
7	Beijing Enterprises Water Group	China (mainland)	Project developer with international ambitions	\$3.6 billion	EnFiSvUt
8	American Water	United States	Leading investor-owned utility in the US	\$3.6 billion	Ut
9	Orbia	Mexico	PVC piping (Wavin/Amanco), irrigation equipment (Netafim)	\$3.4 billion	Tc
10	Pentair	United States	Pumps, membranes, pool, and point-of-use group	\$3.0 billion	InTc
11	Kubota	Japan	EPC contractor famous for membrane bioreactors	\$2.9 billion	EnInTc
12	Thames Water	United Kingdom	UK's biggest regulated water utility	\$2.7 billion	Ut
13	China Lesso Group	China (mainland)	Piping systems vendor	\$2.6 billion	InTc
14	Danaher	United States	Water treatment, analytical instrumentation and telemetry	\$2.4 billion	DIInTc
15	Kurita Water Industries	Japan	Full-service industrial water specialist growing in the US	\$2.4 billion	ChDIEnFiInSvTc
16	Doosan Heavy Industries	South Korea	EPC contractor best known for its mega-desal plants	\$2.4 billion	EnInSv
17	United Utilities	United Kingdom	Publicly traded UK regulated utility serving the North West	\$2.3 billion	Ut
18	Severn Trent	United Kingdom	Publicly traded UK regulated utility serving the Midlands	\$2.3 billion	Ut
19	Grupo ACS	Spain	Water EPC contractor within giant Spanish construction group	\$1.8 billion	Sv
20	Anglian Water	United Kingdom	Privately owned UK regulated utility serving East Anglia	\$1.8 billion	Ut
21	Beijing Origin Water Technology	China (mainland)	Project developer with a leading position in UF membranes	\$1.8 billion	EnFiInSvTc
22	Advanced Drainage Systems	United States	Makes high-density polyethylene and polypropylene pipes	\$1.7 billion	Tc
23	Saur	France	French number three player; recently acquired Nijhuis	\$1.7 billion	DIEnFiInSvTcUt
24	Tetra Tech	United States	Engineer specialising in federal water projects	\$1.6 billion	En
25	SNF Group	France	Makes coagulants, flocculants, chelates, and superabsorbents	\$1.6 billion	ChIn
26	Jacobs Engineering Group	United States	Engineering firm with interests in contract operations	\$1.6 billion	EnInSvUt
27	Gruppo Iren	Italy	Multi-utility service company serving parts of north west Italy	\$1.6 billion	Ut
28	Forterra, Inc.	United States	Water and drainage pipe manufacturer	\$1.6 billion	Tc
29	Beijing Capital	China (mainland)	China's second-largest water project developer	\$1.5 billion	EnFiInSvUt
30	Evoqua Water Technologies	United States	Technology group with municipal and industrial interests	\$1.5 billion	DIInSvTc
31	AECOM	United States	US engineer avoiding fixed-price contracts	\$1.4 billion	DIEnFiIn
32	Culligan	United States	Point-of-use specialist with some industrial interests	\$1.4 billion	ChDIInSvTc
33	Aqualia	Spain	Utility operator and project developer	\$1.4 billion	DIEnFiInSvUt
34	Acea	Italy	Multi-utility in Rome, with water interests in Latin America	\$1.3 billion	EnUt
35	Yorkshire Water	United Kingdom	Regulated utility serving Yorkshire	\$1.3 billion	Ut
36	Copasa	Brazil	Utility concession serving Minas Gerais state	\$1.3 billion	Ut
37	Guangdong Investment	Hong Kong	Hong Kong bulk water supplier turned project developer	\$1.3 billion	EnFiSvUt
38	Metawater	Japan	Systems integrator selling ceramic membranes outside Japan	\$1.2 billion	EnFiInSvTc
39	Nihon Suido Consultants	Japan	Consultant active in water supply and wastewater treatment	\$1.2 billion	Sv
40	Sanepar	Brazil	Utility concession serving Paraná state	\$1.2 billion	Ut

Ch Chemicals DI Digital En Engineering Fi Finance In Industrial Sv Services Tc Technologies Ut Utility operations

Source: GWI WaterData

EVENTS DIARY

All the key events coming up in the global water and wastewater industry.

AUGUST 2020

31-2 SEP Aquatech China. Shanghai, China

SEPTEMBER 2020

1-3 IWA Nutrient Recovery & Removal. VIRTUAL

8-10 Aquatech Mexico. VIRTUAL

15-16 Smart Water Systems. VIRTUAL

24-26 Taiwan International Water Week. Taipei, Taiwan

OCTOBER 2020

5-9 WEFTEC. VIRTUAL

6-7 Waste Water Management 2020. Kyiv, Ukraine

13-14 European Wastewater Management. VIRTUAL

21-23 Indonesia Infrastructure Week. Jakarta, Indonesia

NOVEMBER 2020

4-6 Texas Desal. San Antonio, TX, USA

11-13 Vietwater 2020. HCMC, Vietnam

24-26 African Utility Week. VIRTUAL

30-2 Dec Asia Water. Kuala Lumpur, Malaysia

DECEMBER 2020

7-9 5th Arab Water Week. Abu Dhabi, UAE

MAY 2021

16-18 Global Water Summit. Madrid, Spain

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www.globalwaterintel.com/events

PDF users can click through on the event names above

IN FUTURE EDITIONS...

SEP ● The 2020 GWI Global Water Tariff Survey

● Peru's PPP ambitions in water

OCT ● Opportunities for third-party equity investment in water

FROM THE PUBLISHER

How much is spending on water really worth?



Christopher Gasson does the maths and concludes that a dollar spent on water is worth \$4.38, and maybe as much as \$97.88, depending on how important life is.

What is a dollar spent on utility water worth? This month I tried to work it out. Starting with the assumption that \$1 pays for 250 litres of water supply and 200 litres of wastewater treatment, this is what I came up with:

1) **The convenience value of water supply:** without that dollar spent on utility supply, one would have to spend \$0.80 on bottled water, \$1.75 on tankered water supply, \$0.25 per day on home storage and treatment, and \$0.10 per day on septic tank ownership and management. Value multiplier = 2.9x.

2) **The economic multiplier:** the US Value of Water Campaign did a study of the impact of water spending on the broader economy, taking into account the impact of spending as it ripples out into the economy via pay packets and supply chains. It suggested that the value multiplier is 2.68x.

3) **The value at risk from water in industry:** the CDP Water project reports that the 2,433 companies backing its survey calculated their combined exposure to water risk at \$425 billion. They represent around 20% of the global economy, and as the report notes, only half of their risks are quantified. This suggests a total value at risk of \$4.25 trillion, relating to 920 billion m³ per year of usage. This suggests that there is \$4.62 of corporate water risk riding on every m³ of water used. Although there may be some conceptual objections to conflating value at risk with money in the pocket, there is a good argument that this figure represents the hidden value of water in industry not expressed by the price paid for it alone. On that basis, our \$1 spent on 250 litres of process water supply and 200 litres of wastewater treatment would generate a value multiplier of 2.16x.

4) **The health value of water:** water-borne diseases kill 3.4 million people around the world each year. They undermine the productivity of millions of others, either directly or through the time spent caring for others. On top of that, there is the burden on healthcare systems. The OECD has suggested that the health ben-

efit ratio might be 7x from water, sanitation and hygiene (WASH) in low-income countries, while a study of the introduction of chlorination and filtration in 13 major cities showed a benefit ratio of 23x. The World Health Organisation suggests a benefit ratio for WASH of 4.3x. Attributing two thirds of these benefits to water supply and wastewater treatment gives a benefit ratio of 2.9x.

5) **The environment value of water:** it is not easy to put a price on the value of wastewater treatment beyond that implied by the cost of it. In the UK, the government has valued water ecosystems at £98.6 billion, but 75% of this value is based on the value of the water abstracted from nature (the rest comes from leisure, fishing, and urban cooling). That would imply that three quarters of what we spend on protecting water ecosystems is captured by the utilities responsible for depleting them. In Ireland they tried a different approach, and conducted a survey to ask people how much they would be prepared to spend protecting their freshwater ecosystems. When 40% of respondents said they wouldn't spend a penny, the exercise was abandoned. The bottom line is that we value the environment as much as we are prepared to pay to protect it. This implies that the current benefit ratio from wastewater treatment is 1x. However, the dollar we spend today will be valued more highly by future generations than the dollar we did not spend. I can't calculate the value of that.

6) **The human right to water:** using the US Department of Transport's figure for the price of life, and adjusting it for global average income and life expectancy, gives an average global value of a human life of \$1.87 million. During this time we use around 5,000 m³ of water, which – on the basis of my original assumption – would cost \$20,000 (including the cost of appropriate treatment of the wastewater). This gives a benefit ratio of 93.5x.

Eliminating any double counting, this implies utility water is worth 4.38x what we pay for it without the human right, or 97.88x with it. ■

GWI WATER INDEX

Decoding water's 'flight from quality'

Some of this month's top performers are among the most highly leveraged names in the industry. How long can the investor euphoria last?

A euphoric rally fuelled by better-than-expected results from US water equipment suppliers sent the Americas segment of the GWI Global Water Index to a new record high this month.

The key seemed to be to under-promise and over-deliver, but while a lack of long-term end-market visibility means that sequential rises in quarterly numbers have become the new obsession, the euphoria won't last for ever, as coronavirus woes slowly feed through into a reduced ability on the part of clients to pay for goods and services (see commentary p10).

Of the top ten performers this month, eight were US-based equipment and service companies. The somewhat ironic twist is that highly leveraged companies seem to be outperforming those with more prudently managed balance sheets.

"In a normal recession, highly leveraged companies face huge downside leverage on their stock. In this case, the opposite has happened: the best performing stocks in the space are the companies with the worst balance sheets, because the Fed basically came in and said debt is a good thing," commented one analyst. "There's a clear flight from quality."

Only Indian EPC and O&M company Wabag was able to outrun them this

month. Wabag's shares have been in long-term decline for some time now, and a healthy set of full-year results contributed to a welcome 35% re-rating this month.

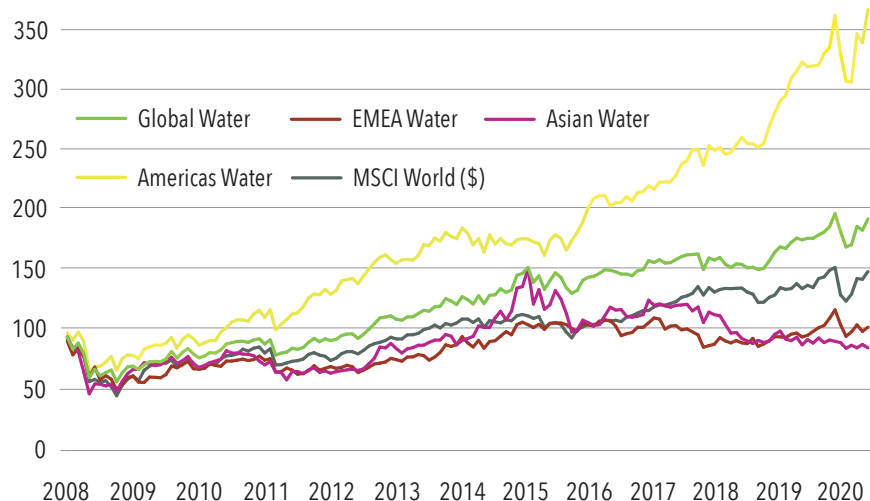
Chinese water names also benefited from a renewed sense of investing exuberance, with many rising to a peak on 20 July before profit-taking began.

At the other end of the scale, ASX-listed Fluence Corporation lost nearly one fifth of its value this month, partly on the back of rumours – swiftly denied by the company – that its flagship desalination contract in Baja California had been cancelled.

While US investor-owned utilities largely continue to escape the financial effects of COVID-19, wriggling out of undesirable regulatory situations can be harder. Of course you can give up and sell your holdings in a state you view as particularly unconducive (as American Water is doing in New York), but when the public utilities commission in your home state decides it's time to call a halt to an attractive revenue adjustment mechanism that's been in place for over a decade, you're almost inevitably going to cry foul (as Cal Water did this month). The irony is that if California were to remove full-scale revenue decoupling, it might actually feed through into higher returns on equity (see story p15). ■

HOW DID WATER STOCKS PERFORM THIS MONTH?

A new high for the Americas segment of the GWI Global Water Index saw equipment stocks outperform utilities, as many companies beat quarterly earnings expectations.



REGIONAL TRENDS

GWI Index	Value on 10 Aug	Change
Global Water	192.24	5.13%
Asian Water	85.30	-3.19%
EMEA Water	102.45	3.54%
Americas Water	365.67	8.09%

10 BEST PERFORMERS

Company	Monthly change (10 Jul-10 Aug)
VA Tech Wabag	35.05%
Forterra, Inc.	30.25%
Mueller Water Products	23.46%
Tetra Tech Inc.	20.78%
Evoqua	20.28%
Xylem Inc.	18.78%
Energy Recovery Inc.	18.76%
China Water Affairs Group	16.81%
Pentair	15.81%
Aegion Corporation	15.24%

10 WORST PERFORMERS

Company	Monthly change (10 Jul-10 Aug)
Fluence Corporation	-19.15%
Qianjiang Water Resources	-17.89%
Guangdong Investment	-15.10%
Manila Water	-9.52%
SIIC Environment	-9.09%
Copasa	-7.79%
Beijing Origin Water Tech	-5.96%
Kangda International Environmental	-5.19%
Sanepar	-5.15%
Salcon Berhad	-4.76%

BIG WATER

Company	Monthly change (10 Jul-10 Aug)
Xylem Inc.	18.78%
Pentair	15.81%
American Water	11.78%
Essential Utilities	10.47%
Suez	8.73%
Kurita Water Industries	5.67%
United Utilities	4.34%
Severn Trent	4.25%
Veolia	0.72%
Sabesp	0.46%



to be photographed Yossi & Uzzi

ISRAEL'S MEKOROT

NATIONAL WATER COMPANY AND THE VOLCANI CENTER DEVELOP COVID-19 ONLINE SENSING

Mekorot National Water Company leads national and international applied water and wastewater R&D projects with outstanding researchers from numerous leading institutes.

One example is the new Covid-19 wastewater online biosensor, jointly developed with the Agricultural Research Organization - Volcani Center (ARO).

This innovative sensor will enhance the surveillance capabilities of Covid-19 outbreaks in wastewater networks.

In contrast to Polymerase Chain Reaction (PCR) technology, which is offline, expensive, and complex, this affordable and simple online solution will map RNA traces to better understand a virus outbreak status and location.

In addition, once enough data is accumulated and analyzed, we believe this could be a basis for the creation of an Event Detection System (EDS) for future virus outbreaks.

Mekorot and the ARO are currently developing and testing this technology with the support of the Israeli Innovation Authority (IIA). The next phase will be to create a joint venture with additional partners to bring this sensor to the market.

Visit us at: www.mekorot.co.il

For further details: **Sivan Bleich**, Mekorot Innovation Unit at sbleich@mekorot.co.il

QUARTERLY RESULTS

Market digests a season of twists and turns

There were just enough bright spots in water companies' quarterly results to satisfy investors' desire for short-term gratification. Are they missing the bigger picture?

The quarterly results season may have resulted in a sea of red ink (*see table, facing page*), but in terms of sequential quarter-on-quarter improvements, the market on the whole got a pleasant surprise, with the resultant relief rally sending stock indices back up to near record levels (*see stocks commentary p8*).

Although Veolia reported a year-on-year slump in quarterly water revenues of 9.4%, CEO Antoine Frérot was keen to emphasise the strong rebound since the end of June, and predicts that the group will recover its 2019 operational performance metrics in Q4 this year, and enter 2021 having offset all remaining COVID-19 effects (barring a second wave of infections).

Suez, too, saw its water revenues dip by 8% in Q2, and with its disposals programme now very much up and running, the group is forecasting that the second half of the year will be 2-4% down on last year in terms of organic revenue generation.

Listed North American water equipment and services companies broadly performed better than many companies had previously anticipated, with Xylem reporting revenue slippage of just 13.8%, against its previous expectation of a revenue decline of 20% to 30% for the quarter.

While this ostensibly points to less severe COVID-19 impacts, there is a view that a number of firms erred on the side of caution in their previous assumptions.

"There was every incentive to drive down second-quarter forecasts as low as possible and then come out and say that things are actually a little better," Boenning & Scattergood analyst Ryan Connors told GWI.

Likewise, the impacts of the pandemic on profit margins were mitigated by the suddenness of the economic shutdown – with travel restrictions and facility closures serving to quickly reduce costs.

"It wasn't as if companies were being the shrewdest operators – they benefited from how quickly demand slowed down. While they would never wish that to happen, it really did take a lot of the costs out," RBC analyst Deane Dray observed to GWI.

Most companies nevertheless reported a sequential improvement in demand through the past quarter, with residential

construction in the US quickly springing back, which benefited the likes of Mueller Water and Advanced Drainage Systems.

Municipal water and wastewater activity in the US, meanwhile, has consistently held up. Aegion reported that its North American water and wastewater pipe rehabilitation business has grown double-digits in the year to date, in spite of the pandemic.

The industrial and commercial sectors remain a drag for the likes of Xylem and Ecolab, however, although Evoqua reported strong demand in sectors such as micro-electronics and pharmaceuticals.

ERI's marked revenue and earnings increase was largely down to the fact that the firm recognised the deferred revenue balance of a 15-year licensing deal with Schlumberger for its VorTeq hydraulic fracturing pressure exchanger product, which was terminated in June.

ERI is now testing VorTeq with Liberty Oilfield Services – and is free to explore other commercial arrangements with other operators – although newly installed CEO Bob Mao expressed to investors last month that the firm is prepared to terminate fur-

“There was every incentive to drive down second-quarter forecasts as low as possible and then come out and say that things are actually a little better.

Ryan Connors, Boenning & Scattergood

ther R&D if the product does not pass additional tests.

Increased interest in digital water capabilities such as remote control and monitoring as a result of the pandemic has been a key upside cited by Evoqua, Tetra Tech, Xylem, and others. However, while Xylem recently announced a \$90 million contract with Anglian Water in the UK, investors may feel that increased interest in digital water solutions has yet to translate into demonstrable deal flow for most firms.

"Thematically, we hear that water utilities are going to be more accepting of remote monitoring and digital solutions, but we now need to see the orders actually come through – because so far it's been underwhelming," observed RBC's Dray.

Flight from quality

One curious phenomenon among US companies active in the water space is that the some of the best performers in the quarter – such as Evoqua and Forterra – are among those with the most highly leveraged balance sheets. This is in no small part due to the fact that they have been propped up by the US Federal Reserve's efforts to buy corporate debt in order to stave off economic recession.

"Normally – if things were left to run their course – the companies with massive debt would be in a lot of trouble right now, but instead they're the top performers," Connors observed. "Meanwhile, the companies who are at the bottom of the performance list are ironically those that have been prudently managing their balance sheets. In this environment, there's a flight from quality into the most levered-up names."

Highly levered stocks could be left exposed if the Fed relinquishes its stimulus tactics in future, however, and those companies that exit the pandemic with a healthy balance sheet will be better positioned for inorganic growth activity in a recovering market.

While firms are still expecting the pandemic to place downward pressure on demand in the second half of this year, the broad consensus is that there will be sequential improvement over the coming quarters. Xylem is expecting a lower revenue decline of 10 to 12% in the next quarter, while Mueller is anticipating a 0 to 5% sales decline.

"Everyone is trying to focus on a short-term sequential improvement, when the big picture here is the capex cycle over the next two to five years," Connors argued. "We're now in a recession that's going to have longer-tailed ramifications for state and local budgets – and water capital project activity – which is totally separate from the shutdown." ■

GLOBAL WATER COMPANIES: QUARTERLY RESULTS DIGEST

Utilities generally posted robust quarterly numbers, even though their share price performance lagged behind that of equipment suppliers. Pragmatism may trump optimism when it comes to the second half of the year.

Company	Quarterly revenue		EBIT		Quarterly results highlights
Veolia	€5,737m (-12.3%)	▼	€629m (-35.2%)*	▼	Water down 9.4% in Q2; France down 16.1%; global businesses down 20.8%; delayed French projects back on track; strong recovery since June; group aims to recover 2019 operational performance by Q4 2020
Suez	€3,969m (-10.7%)	▼	€520m (-36.0%)*	▼	Water down 8.0% in Q2; water EBIT slumps €300m in H1; WTS revenues up 1% in H1; contract renewals in Spain and the US; volumes down in Asia, Europe, and Chile; H2 revenues expected to be down 2-4% organically y-o-y
Aqualia	€277m (-4.8%)	▼	€63m (-5.8%)*	▼	LatAm water revenues down on completion of plants in Colombia & Ecuador; MENA sales up strongly; brownfield WWTP O&M contract secured in Mexico
Acciona Agua	€250m (+50.6%)	▲	€23m (+130.0%)*	▲	Top line boosted by construction revenues from new desalination plants (Shuqaiq 3, Khobar 2, Tseung Kwan O)
Sabesp	BRL4,432.5m (+10.9%)**	▲	BRL1,581.4m (+28.4%)*	▲	Revenue up on Santo André and Mauá contracts; bad debt provisions rise again; weakening BRL raises debt service costs; net income down 16.8%
American Water	\$931m (+5.6%)	▲	\$313m (+3.6%)	▲	Capex plans intact; robust organic and acquisitive growth, with significant pipeline of deals to come; quarterly dividend maintained at \$0.55/share
Essential Utilities	\$384m (+75.6%)	▲	\$123m (+52.1%)	▲	Higher results partly reflect Peoples Gas acquisition and favourable weather; financial impact of COVID-19 negligible; quarterly dividend increased by 7%
California Water Service	\$175m (-2.0%)	▼	\$12m (-53.8%)	▼	Net income down by two thirds due to rate case delay in California; bad debt provision rises; facing threat of greater revenue volatility going forward
Danaher	\$5,297.4m (+19.2%)	▲	\$844.6m (+4.1%)	▲	Biopharma acquisition in Q1 2020; 3.5% organic revenue growth; water business saw mid-single digit revenue declines owing to industrial softness
Ecolab	\$2,685.7m (-15.3%)	▼	\$192.0m (-58.7%)	▼	Significant declines in restaurant and hospitality end-markets; industrial business revenues (incl. water) down 2% y-o-y
Advanced Drainage Systems	\$508.6m (+22.9%)	▲	\$107.1m (NM)	▲	Increase down to Infiltrator acquisition in 2019; 3% organic growth; double-digit growth in residential and agriculture markets
Xylem Inc.	\$1,160.0m (-13.8%)	▼	\$54.0m (-68.4%)	▼	Resilient utility wastewater offset by industrial weaknesses; China recovered to 6% organic growth; expecting 10 to 12% revenue decline in the next quarter
Rexnord	\$449.1m (-11.6%)	▼	\$66.0m (-17.7%)	▼	Water management revenues down just 2%, supported by strong demand for touchless solutions; expecting sales decline of 12 to 17% in the next quarter
Pentair	\$713.3m (-10.8%)	▼	\$111.1m (-17.0%)	▼	Pools business held up; industrial and commercial sales hit by spending delays; reinstated 2020 revenue guidance of \$2.8 billion (down 5% on 2019)
Energy Recovery Inc.	\$43.6m (+92.1%)	▲	\$21.3m (+432.5%)	▲	Deferred revenue from cancelled Schlumberger O&G licensing contract; desalination product revenue flat
Mueller Water Products	\$228.5m (-16.7%)	▼	\$20.0m (-57.6%)	▼	Quick recovery in residential construction; expecting 0 to 5% sales decline in next quarter
Aegion Corporation	\$245.0m (-23.1%)	▼	\$8.7m (+1,640%)	▲	Sharp decline in energy services; 12% y-o-y revenue decline in infrastructure solutions; double-digit growth in water/wastewater for the year to date
Evoqua	\$347.8m (-3.5%)	▼	\$22.6m (+83.7%)	▲	Memcor divestiture complete; Q2 revenues down just 0.3% organically; strong demand in microelectronics and outsourced water solutions
Forterra Inc.	\$426.2m (+3.9%)	▲	\$51.0m (+94.7%)	▲	Flat shipment volumes with increase in revenues and earnings primarily driven by higher sales prices
Tetra Tech	\$709.8m (-14.0%)	▼	\$63.5m (-2.0%)	▼	Canadian pipeline activities divested; state and local business (incl. water) up 5%; discretionary industrial projects down
Stantec	Can\$1,205.6m (-1.5%)	▼	Can\$144.9m (-0.7%)*	▼	0.3% revenue growth in water business; selected to lead the €456.5 million Fayoum wastewater expansion programme in Egypt
Badger Meter	\$91.1m (-12.0%)	▼	\$18.9m (-10.6%)*	▼	Municipal water sales down 9%, but up from April demand trough; flow instrumentation sales down 22%; 6% increase to quarterly dividend
Kurita Water Industries	JPY60,980m (-5.2%)	▼	JPY6,128m (-40.1%)	▼	Sales of water treatment facilities flat, but EBIT down 57% after one-time gain in Q1 2019; water chemicals sales dip on COVID-19, but EBIT rises slightly
VA Tech Wabag***	INR7.85bn (+15.6%)	▲	INR748m (+82.9%)*	▲	Q4 revenues up despite COVID-19; operational costs down 10%; one-time gain from sale of BOOT in Namibia; consolidated profit after tax down 25%

* EBITDA

** Net operating revenues

*** Quarter ending 31 March 2020

Source: Company data

COMPANY STRATEGY

Suez North America regains its winning spirit

The company has stagnated since its Indianapolis contract expired in 2016. New CEO Nadine Leslie is breathing new life into the business with a collaborative approach.

Suez North America CEO Nadine Leslie this month underscored the importance of the region as a key growth driver within the overall ten-year strategy outlined by group management in Paris at the end of last year.

Since its flagship \$42-million-a-year operations contract in Indianapolis expired at the end of 2016, Suez North America has struggled to grow, posting virtually identical revenues of around \$1.1 billion in each of the last three years. During that time, it has continued to close small tuck-in acquisitions on the regulated side, but had a lengthy fallow period on the contract operations front until breaking out of the doldrums with new wins in Norwalk (CT) and Hingham (MA) (see table below).

"One of the first things that I did when I started in the role last September was to reassess our growth strategy, our business development team, and the focus that we have," Leslie told GWI in an exclusive interview this month. "We have a renewed focus on growing the business, and we have put a strategy in place to position ourselves well by selecting where we want to go, what we want to pursue, and how we can position ourselves best to win. North America is a focus area for the group in terms of growth, and a significant contributor to the Shaping Suez 2030 vision that Bertrand Camus has laid out," she explained.

Suez's dry period in terms of winning new contract operations business was not

VETERAN IN CHARGE

Nadine Leslie is leveraging her two decades of front-line experience to drive renewed growth at Suez North America.



Source: Suez

for want of trying. It aimed big, approaching the City of Baltimore (MD) in 2017 with a conceptual concession idea, engaging with the City of Providence (RI) in 2018 to try to structure a concession-style deal, and negotiating hard with the Township of Edison (NJ) in 2019 for a proposed 40-year water and wastewater concession.

The hard reality that none of these deals ultimately went anywhere is not lost on

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Leslie, who was promoted to CEO of Suez North America just days before a local referendum dealt the final blow to the Edison deal.

"I have reviewed the project to understand what went wrong and what we could have done better," she told GWI. "Should we have new opportunities to pursue large and more complex projects, I believe that we are much better prepared to be in a winning position. We have a very motivated team, and we have put new talent in place."

Her renewed sense of what she refers to as "winning spirit" has already resulted in some key contract wins, which included pinching a \$78 million 10-year contract to operate a wastewater treatment plant in Norwalk (CT) from Jacobs.

"The relationship that we have with our existing clients and the operational excellence that we have demonstrated over the years to nearby existing clients is what really got us to the finishing line," she explained. "The client in Norwalk not only called Springfield and Holyoke, they also visited the sites to see how we were really managing the operations."

It is this level of communication which Leslie believes is increasingly important if the industry as a whole is to grow.

"A key element for me is that private companies in general really have to tell their story better. We need to highlight the benefits that we bring, and be more proactive in telling our story. We have to develop a new strategy, and we are working on enhancing our social media reach, because that's something I think the water industry is a little bit behind on. I think the other aspect of it is to ensure that the leadership in the municipal context is well prepared, and understands the complexity and advantages of our solutions, so they can themselves communicate in a more efficient way. For me, the communication aspect is really the one that determines success."

Her growth strategy is focused on two broad areas. Organic growth – which encompasses smaller tuck-in acquisitions on the regulated side and small to medium-sized O&M contracts in communi- ▶

SUEZ'S RECENTLY NEGOTIATED US O&M CONTRACTS

The group's recent winning streak comes after a series of large concession opportunities crumbled away. It has many more irons in the fire.

State	Location	Scope	Duration	Lifetime value (\$m)
MA	Springfield ^{a, b}	67MGD wastewater treatment plant	20 years	350 ^c
MA	Hingham	Weir River Water System	5+5	52
CT	Norwalk	18MGD wastewater treatment facility	10 years	78
CA	West Basin ^b	40MGD water recycling facility	5 years	75
MI	Lowell ^b	1.2MGD wastewater treatment facility	5 years	2.3
CT	Stonington ^b	Wastewater collection and treatment	5 years	11.4

a) Final contract signing awaited

b) Renewal of existing contract

c) Includes capex

Source: GWI

ties adjacent to Suez's existing operations – will be complemented by larger, more complex projects such as concessions, and strategic regulated acquisitions.

"In the last four years, we have taken on an additional 20,000 customers through tuck-in acquisitions, and we have two that are in progress to be finalised this year. We also are looking at bigger acquisitions of 50,000 connections and greater, although we have less appetite for systems that require substantial investment in the short term," Leslie explained.

Success on the regulated acquisitions front is seldom straightforward, however, and as Suez is only too aware from its contract operations activities, local politics can often play a part in overturning what might at one point have seemed like a slam-dunk decision. The news earlier this month that Suez's \$3.5 million bid to acquire the water system in Delaware City (DE) had been trumped by a \$2 million offer from Artesian Water had more than a few people scratching their heads.

"We are very comfortable with the offer that we put in, but there are some political forces that we cannot always control," Leslie says diplomatically.

Leslie's growth plans go much further than negotiating regulated tuck-ins while waiting for the next concession opportunity to come along. Her weekly call with Yuvbir Singh, CEO of Suez Water Technologies & Solutions, is one part of a wider strategy at the group level to maximise growth potential across divisional lines.

"We work in collaboration with the commercial team in order to produce the best offer possible for both industry and municipal markets," Leslie explained. "By

PERSONNEL FILE

Who is Suez NA CEO Nadine Leslie?

As the group's first female chief executive in North America, she brings a refreshing pragmatism to a division in need of visionary leadership.

The person tasked with reinvigorating stagnant growth at Suez North America is Nadine Leslie, who is both the first woman and the first person of colour to be appointed to the CEO role.

A twenty-year Suez veteran, she enjoys near legendary status among longer-serving company insiders for the way she turned events around at the company's regulated Toms River division, after the company was linked to a spike in childhood cancer cases in the early 2000s.

After a short stint as internal audit director, she was then put in charge of the company's North American contract operations portfolio in 2011, prior to

being reassigned to Paris in 2017 to head up the group's health and safety division.

Her refreshing pragmatism since taking on the CEO role in September 2019 has been honed by years of dealing with some of the biggest front-line challenges the company has faced (as well as rejuvenating Suez's relationship with Toms River, she was on the management team of the doomed Atlanta, GA contract). She is also not afraid to get her hands dirty, volunteering on the ground as part of Suez's Aquassistance programme following the earthquake in Haiti in 2010.

Battle-hardened she may be, but she remains highly personable, making her the ideal choice for the role. ■

sharing market insights and relationships across the two business platforms, this collaboration puts us in an even stronger position to provide diverse solutions customised to meet their needs. WTS is opening doors for us on the industrial side, because as they provide the equipment, we have the opportunity to team up with them to do O&M," she elaborated.

Leslie also played a role in the creation of a new global business line called Suez Environmental Solutions (SES) – which is being rolled out across the group this year.

"For me, this is the key to future growth. Our ability to provide digital solutions such as performance management, automatic metering infrastructure, and smart city solutions is really the focus of the new global business line, and we are in the process of putting together the structure for that in North America. We thoroughly believe that these services will be more and more attractive for the municipal marketplace, where we can help cities find the right solution customised to meet their needs. I'm very excited about it." ■

WATER DESALINATION REPORT

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PANDEMIC RESPONSE

Strong Evoqua results beat COVID gloom

The Pittsburgh-based water technology group was the surprise outperformer of Q2. CEO Ron Keating credits the company's business model and sees further growth in future as COVID-19 working conditions highlight the benefits of its Water One outsourcing service.

Evoqua shares have outperformed all major water stocks since lockdown began in mid-March as the resilience of the company's revenues surprised investors. Although second-quarter headline sales were down 3.5% compared to the same period last year, they were flat on a like-for-like basis, while adjusted EBITDA was up 5.3%. Net income increased from \$4.3 million to \$21.8 million, giving the impression that the COVID pandemic had effectively bypassed the company.

In fact, CEO Ron Keating put managing the pandemic right at the heart of his strategy for the quarter. "When the pandemic first broke out, we retained a former chief medical director from GE. We also retained a medical expert from the Ohio Department of Health and Safety. They came to one of our branches, sat down with our service team members, and said to them: 'Tell me what you do before you leave. Tell me what you do when you get on site with a customer. What do you do while you're there, and what do you do when you come back?' Our team is in and out of hospitals changing out water systems that are often next to the blood analysers that are testing for COVID. We have to make sure that we have the right safety protocols in place and make sure our employees are

taken care of. At the same time, we also need guarantee continuity of service to our customers and give them confidence that our teams are following health and safety protocols from one location to the next."

Besides this focus on protecting staff and customers, Keating attributes Evoqua's relative success to its strategy of diversifying its revenues so it is not over-dependent on single markets or single customers (see "What's doing well", facing page) – and on building recurring revenues.

Keating sees that industrial customers increasingly want to reuse their process water, but they don't want this to distract from their core focus, so they are increasingly willing to outsource responsibility for water management to Evoqua. Here the company has found something of an upside in the pandemic, justifying its investment in remote monitoring and control.

"Customers want us to minimise time on site, and when we are on site, they want to make sure we are doing everything safely. We were able to proactively provide our own protocols before many customers had their own in place. Our ability to adapt and respond played out very well with our customers, allowing us to say, 'This is our approach to safety when we come on site.' You know, it's paid a lot of very nice divi-

dends. It has kept companies up and running. It's kept us connected, and it's proving out the value proposition of our digital offering in Water One."

Keating believes that demand for the Water One service will pick up strongly after the pandemic, as customers who resisted the proposition initially are now seeing the value in it. "Putting in new systems right now is a little challenging, because customers may not want you on site. The offering is proving out quite well, and we are excited about expanding installations when we get to 'the new norm'."

Despite the reluctance of service customers to introduce new systems during the pandemic, Evoqua has been able to pull off major deals without face-to-face meetings. "We just signed a very large contract. We never saw each other face to face. It ►

EVOQUA'S DIGITAL RESILIENCE

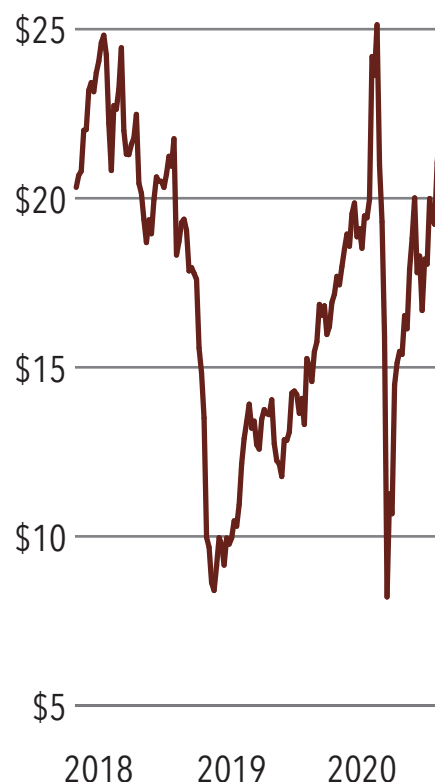
Evoqua CEO Ron Keating cited the company's focus on digital solutions, alongside reliable recurring revenues, as a shield from the impact of the COVID-19 pandemic.



Source: Evoqua

BOUNCING BACK

Evoqua shares have risen by more than 160% since mid-March, making them one of the best-performing water stocks of the pandemic. They have yet to regain their February peak of \$25.13.



was 100% Zoom calls.”

The recovery of the share price as a result of the company's solid second-quarter performance created the opportunity for Evoqua's original private equity backer AEA to sell down a 4.7% slug of its remaining shares. “They did a very nice job with taking the company public, making sure that we had the right investments around building the portfolio out, and building out the channel strategy to go into the vertical markets that we're playing in. The value is there,” Keating comments.

Evoqua today, with a market capitalisation of \$2.4 billion, is a very different company from the Siemens Water business that AEA acquired in 2014 for \$862 million. It has acquired 14 businesses, including Neptune Benson (for \$283.7 million in 2016), ADI Systems (for \$55.6 million in 2017), and ProAct Services (for \$133.8 million in 2018), sold its Memcor low-pressure membranes business (for \$131.0 million in 2019) and restructured into the business into two divisions (integrated solutions and services, and applied product technologies).

There has also been a big change in where the growth is. “We were historically 80% process water, 20% wastewater in our industrial pipeline,” Keating remembers. “Today, that's shifted. The pipeline of opportunities that we're dealing with is now closer to 60% wastewater, 40% process water, and it's not because the denominator's changed. The pipelines continue to grow, but the wastewater growth has accelerated tremendously.” ■

WHAT'S DOING WELL?

Evoqua operates in ten industry segments, none of which represents more than 20% of total revenues. The table below illustrates management's estimated demand outlook for the second half of 2020, with the segments listed in order of their sales as a percentage of Evoqua's total revenue number.

Sector	H2 2020 outlook
Light & general industry	Slight decline
Municipal wastewater	Neutral
Healthcare/pharma/biotech	Growth
Power	Neutral
Chemical processing	Slight decline
Microelectronics	Growth
Municipal drinking water	Neutral
Aquatics	Delays/cancellations
Refining/marine	Delays/cancellations
Food & beverage	Neutral

Source: Evoqua

EQUITY RETURNS

California utilities brace for renewed revenue volatility

Investor-owned water utilities in California are lobbying against a move to abolish a regulatory mechanism that protects revenues in years of low volumetric demand.

The California Public Utilities Commission (CPUC) is expected to vote as soon as 27 August on whether to abolish an accounting mechanism which reduces revenue volatility for investor-owned water utilities by decoupling sales from volumetric demand.

When it was introduced in 2008, the Water Revenue Adjustment Mechanism (WRAM) was heralded as a way of smoothing out year-on-year revenue fluctuations brought about by differing weather patterns, while removing the disincentive for investor-owned utilities to encourage conservation.

Five utilities adopted the mechanism – including NYSE-listed California Water Service (Cal Water) – and the CPUC's latest rhetoric has drawn fierce criticism from some in the industry.

“This decision is troubling for a number of reasons,” Cal Water CEO Marty Kropelnicki said on the company's earnings call at the end of July. “It draws conclusions on a very, very limited set of data and evidence [...] and also goes against the state's goals of making conservation a way of life.”

The CPUC holds that discontinuing the use of the WRAM would eliminate unfair surcharges on customer bills in years of low consumption, and argues that water consumption patterns at utilities using the full decoupling WRAM are highly correlated with those at non-WRAM entities. It advocates moving utilities over to the so-called Monterey-style WRAM, which, it argues, boosts affordability and supports conservation by adjusting for the difference between the revenue generated through metered sales using a tiered rate structure and the revenue the company would have received by implementing a single uniform rate.

Furthermore, its perception is that the successful water conservation programmes realised by companies such as San Jose Water (SJW) – which already uses the Monterey-style WRAM – is evidence that full decoupling is both unnec-

essary and undesirable. It was for this reason that the CPUC last year denied SJW's application to adopt a full decoupling WRAM.

While companies such as Cal Water are outspoken advocates for retaining it, not everyone on Wall Street is convinced.

“We believe it would be an unmitigated positive to remove decoupling from California, and it would mark a fundamental shift in the economics of doing business there,” commented Ryan Connors, water sector analyst with Boenning & Scattergood. “The ROEs [returns on equity] in California are some of the lowest in the country. If you look at the timing of how they stepped lower relative to when decoupling came in, it's clear that there's a relationship.”

The CPUC's Office of Ratepayer Advocates (ORA) has argued that the reduced year-on-year revenue volatility that investor-owned utilities enjoy by using a WRAM translates into reduced risk – and therefore provides justification for awarding lower ROEs.

“As long as you have a forward test year, you should be able to project out demand and deal with the issue of declining consumption,” commented Connors. “To take a hit on ROE for the benefit of removing consumption risk – which is something you could do with a forward test year anyway – is a bad trade. Simply utilising a forward test year and applying a healthy ROE would make the fundamental story for investors much easier to digest,” he argues.

There is no guarantee that discontinuing the water revenue adjustment mechanism in its current form will translate into higher ROEs in future.

“That will depend on the competence and drive of the companies at the cost of capital hearings,” said Connors. “Whether they are able to walk through the door and take advantage of the opportunity is an open question, but clearly the ORA will have to get creative in arguing why that shouldn't happen.” ■

CONTRACT OPERATIONS

Who will buy Veolia Water North America?

Veolia's municipal water contract operations portfolio in North America has a colourful history. Selling it may be the only way to reinvigorate growth, but prospective buyers will need to run a careful due diligence process.

Market players are starting to position themselves ahead of a potential sale of Veolia North America's municipal water contract operations business at some point within the next six months.

The business does not disclose its revenues publicly, but a bottom-up analysis conducted by GWI estimates that they are likely to be somewhere in the region of \$400 million.

The portfolio has come a long way since Veolia bought USFilter's contract operations business 20 years ago, during which time the group has won – and lost – some significant contracts. While still the undisputed market leader, it attracted fierce criticism after being linked to lead contamination scandals in Flint (MI) and Pittsburgh (PA). Despite strenuous denials, relentless hounding by anti-private water groups and the mainstream media has tarnished the company's reputation, with the result that it is starting to find it difficult to retain flagship contracts (it lost a \$20 million-a-year contract in Wilmington (DE) earlier this year after the city's advisor invoked Flint as a reason not to rehire the company). Now, it appears the only way to permanently disassociate the Veolia name with a legacy of perceived failings is to divest the business.

"There's no shortage of buyers who want to buy a US O&M business, but Veolia is a shell of what it was a few years ago, and these are not expensive businesses," commented one contract ops veteran.

US municipal contract operations businesses sold in recent years have consistently attracted prices well below their annual revenues, with the former Severn Trent Services changing hands back in 2017 for \$62 million, against estimated revenues of around \$200 million at the time.

Private equity buyers seduced by suggestions that the market's growth prospects are more than just pedestrian are likely to take a look at the business, while there is also understood to be interest from Spanish private water companies. With the exception of Acciona, the Spaniards have consistently struggled to make their mark in the North American contract operations arena.

What would they be buying? Veolia's current portfolio boasts both the oldest operations contract in the sector (Burl-

VEOLIA NA'S TOP 20 MUNI WATER O&M CONTRACTS

A number of Veolia's largest North American operations contracts originated as DBOs undertaken by USFilter, which was acquired in 1999. Five of them are up for renewal within the next two years.

State	Location	Client	Scope	Expiry	Annual fee (\$m)
WI	Milwaukee	Milwaukee Metropolitan Sewerage District	WWTP	2028	48.7
GA	Big Creek	Fulton County	WW	2025	18.2
RI	Cranston	City of Cranston	WWTP	2027	17.0
MI	Wyandotte	Downriver Utility WW Authority	WWTP	2038	14.0
MS	Jackson	City of Jackson	WWTPs	2026	12.8
LA	New Orleans	City of New Orleans	WWTPs	2025	12.2
CA	Rialto	City of Rialto	W/WW	2042	10.0
IL	Stickney	Metropolitan Water Reclamation District of Greater Chicago	Biosolids	2030	10.0 ^a
CA	South Bay	Int'l Boundary & Wtr Commission	WWTP	2020 ^b	9.0
NY	Buffalo	City of Buffalo	WTP	2029	7.8
GA	Camp Creek	Fulton County	WRF	2022	6.4
AZ	Lake Pleasant	City of Phoenix	WTP	2021	6.3
FL	Tampa Bay	Tampa Bay Water	Surface WTP	2023	6.3
MA	Fall River	City of Fall River	WW	2024	5.8
HI	Honolulu	Honolulu Board of Water Supply	WRF	2038	5.7
LA	Kenner	City of Kenner	WW	2024	5.1
GA	North Fulton	Atlanta-Fulton County Water Resources Commission	WTP	2025	4.9
MA	Lynn	Lynn Water & Sewer Commission	WTP	2021	4.8
MA	New Bedford	City of New Bedford	WW	2020 ^b	4.5
MA	Gloucester	City of Gloucester	Filtration plants	2024	4.3

a) Fee varies according to sludge volumes

b) Competitively bid renewal ongoing

Source: GWI

ingame, CA, first awarded in 1972), and the largest (Milwaukee, WI, with an annual fee approaching \$50 million). While the company continues to win accolades from trade bodies and praise from many of its clients, it also has an alarming string of fines (Plymouth, Heavener), delinquent clients (it is owed \$4 million by the Western Hills Water District in California), and contract losses (Indianapolis, Oklahoma City, Wilmington) behind it, which any potential buyer will want to scrutinise closely.

"Veolia is a strange animal. I think they're on the right track on most occasions, but they rely heavily on regions, and how strong a regional VP is makes a difference as to how they're viewed," observed

one sector veteran. "You have to have somebody that ensures that everything is being done the proper way across the country so all regions are aligned, and Veolia has dropped that ball in some cases."

While divorcing the municipal contract ops business from its current parent could give it a fresh start, it also brings challenges in terms of differentiation.

"One of the things that always made Veolia so attractive on a project was that they have this sister company who is big in energy, and they could always bring so much more in terms of energy savings," commented one observer. "I think if they don't have that, they're just another O&M company." ■

WATER FINANCE

Upwell set to deploy \$1 billion in water

A new platform has the ambitious aim of becoming the leading specialty finance company in the water sector within a short space of time. The capital is there, but where will the opportunities come from?

Upwell Water is looking to deploy \$1 billion of capital in the global water market over the near term, with the stated goal of becoming the largest water-focused specialty finance company in the world.

Last month, the company announced a capital investment from Crestview Partners, which – together with existing commitments from the 2040 Fund and its parent, Upwell LLC – will give it sufficient equity so as to leverage a total of \$1 billion of investment capital.

“Upwell Water is a mission-driven organisation focused on enabling a sustainable water future, and we have a global mandate to buy and finance water assets and water-related businesses,” explained CEO Tamin Pechet.

Pechet’s pedigree in the sector includes co-founding water technology accelerator Imagine H2O (of which he is currently chairman), as well as water management software start-up Banyan Water. He has assembled a team of operating partners which includes Chris Schilling, the former COO of Texas-based regulated utility SouthWest Water, and Chris Morrison, who was chairman of distributed wastewater systems supplier Baswood Corporation up until its acquisition by Cambrian Innovation earlier this year.

“We’re long-term focused, which is a necessity in this industry, and we’re not a fund, which gives us flexibility,” Pechet explained to GWI. “Our strike zone really revolves around water assets and water businesses that have contracted revenues, and for the most part, we are looking at water, wastewater, and stormwater assets in end customer segments ranging from agriculture to commercial to industrial and beyond. The one place where we have not been active is in the large municipal market, where there are well-functioning capital markets to provide municipal bond financing.”

“Our strike zone really revolves around water assets and water businesses that have contracted revenues.

Tamin Pechet, Upwell Water

GREEN GROWTH IN WATER

Tamin Pechet hopes to leverage his experience to deploy \$1 billion of capital into sustainable water initiatives. His willingness to write tickets of all sizes sets his Upwell Water platform apart.



Source: Upwell

Although the platform has some exposure to international projects already, its first disclosed commitment is a \$20 million working capital and project finance facility with Fluence Corporation, which is extendible to \$50 million. The arrangement replaces a similar facility from Generate Capital, and some of the proceeds have already been earmarked to fund BOOT (build-own-operate-transfer) projects.

“We’ve known the board and management team for a long time, and one of the things that was a compelling attribute of a potential relationship with Fluence was their focus on being able to deliver water as a service,” Pechet observed.

While the small ticket size implies that it will take 50 such deals to deploy the full \$1 billion (before taking into account com-

petition from other platforms), Pechet is quick to defend his approach.

“One of the differentiating elements of Upwell Water is that we have a large capital base but no specified minimum,” he explained. “Most large infrastructure capital pools are not set up to deal with small initial deployments of capital, and we are willing to do what might, on the surface, seem like smaller transactions because a lot of our solutions partners in the water industry have programmatic opportunities where the first cheque is relatively small.”

He also sees potential for Upwell Water to leverage its parent’s experience as a financier of renewable energy projects to make a big impact in water.

“It was not until the financial markets figured out how to facilitate the sale and purchase of clean energy that clean energy adoption took off. At Upwell Water, we’ve been very involved with brilliant water technology companies, but the same set of financial tools that enabled the broad deployment of clean energy have not been widely available in water, and that’s what Upwell Water aims to solve,” he told us.

Together with technology partner APTwater, Upwell Water is due to present its case to the Crescenta Valley Water District (CVWD) in California later this month ahead of a potential design-build-finance-operate contract. CVWD is looking to add a nitrate removal step at its groundwater treatment plant, and Upwell Water envisages a deal whereby it would fund the installation of APTwater’s technology at the plant, and the District would purchase the water back at a negotiated rate of \$650-850 per acre-foot (\$0.53-0.69/m³), which is significantly lower than the rate it currently pays to Foothill Municipal Water District for water which is ultimately sourced from the Metropolitan Water District of Southern California (\$1,350-1,767/AF).

“Most of our existing asset base is currently water treatment-orientated, but we do have exposure to other areas, and we expect to have other transactions announced that would make it clear that we’re active participants in ag water, transport and delivery, and other pieces of the overall water value chain,” Pechet concluded. ■

POTABLE REUSE

Pure Water San Diego project back on track

The release of two construction tenders this month underscores a renewed sense of urgency for San Diego's mammoth potable reuse initiative following months of costly delays. Not all the elements of the project have survived.

The City of San Diego this month released the first two out of a total of ten construction packages for the initial phase of its flagship indirect potable water reuse project, Pure Water San Diego.

Bids for the 34MGD (128,690m³/d) North City Pure Water Facility are due in on 1st October, while proposals for the first of several conveyance packages are due in five days later.

The release of the tender documents is proof that the project is back on track after months of expensive delays, caused by a lawsuit initiated by the local chapter of the Associated General Contractors of America, which attempted to argue that the way in which the project was being procured discriminated against non-union contractors.

Now, with a court having overturned that argument – and a project labour agreement in place which enables both union and non-union construction companies to bid – the path was cleared for procurement to restart.

"Pure Water is alive and well in San Diego," affirmed Johnnie Perkins, deputy operating officer of the city's public utilities branch. "We estimated that it was costing us about \$4 million on a monthly basis when we were in a holding pattern, and that was significant," he explained to GWI

SECURING SAN DIEGO'S WATER SUPPLY

The North City Pure Water Facility is the first in a series of advanced water treatment plants which will see San Diego generate 83MGD (314,155m³/d) of recycled water for potable purposes by 2035.



Source: City of San Diego

this month.

While the delay is partly responsible for the projected cost of the North City Pure Water Facility rising from \$398 million to \$463 million, the overall impact on the total cost of phase 1 has not yet been recalibrated.

The fact that the project is moving ahead at all is testament to the city's science-based public education campaign, which has seen 25,000 people visit the

triple-barrier reuse demonstration plant at the Miramar Reservoir. Meanwhile, city officials have hosted countless community meetings, which helped to secure the support of the local press.

A virtual contractor expo held last month attracted more than 300 companies, and the granting of a NPDES permit allowing the treated effluent to be pumped directly into the Miramar Reservoir – where it will undergo conventional treatment before being piped to people's homes – is the icing on the cake.

The progress on permitting puts Pure Water San Diego comfortably ahead of the other proposed projects in the state which propose using advanced wastewater treatment prior to surface water augmentation, under legislation passed in 2018 (see table, facing page).

Local control

Behind the premise of the Pure Water San Diego project is the fact that around 85% of the region's fresh water is imported from the Colorado River or from Northern California, while only 8% of its wastewater is beneficially reused today.

"We just want to make sure that as a city and a region we have a safe, secure and reliable supply of water," Perkins explained. "We don't have say-so on our water supply in terms of securing our future, we're not ►

STAGGERED PACKAGES

The City of San Diego has tailored the release schedule for the ten tender packages which make up its Pure Water project in order not to overwhelm contractors. The first two were released earlier this month.

Project/construction package	Tender advertised	Expected NTP date
34MGD North City Pure Water Facility + pump station	August 2020	March 2021
Morena Northern Pipeline + tunnels	August 2020	February 2021
Morena pump station	September 2020	March 2021
Pure water pipeline, dechlorination facility, subaqueous pipeline, AC water group 1038, Miramar Rd/I-805 ramps	November 2020	May 2021
North City Water Reclamation Plant expansion, influent pump station, pipeline	December 2020	July 2021
Metro Biosolids Center improvements	December 2020	July 2021
Morena Southern Pipeline & Morena Pipeline	March 2021	September 2021
North City Water Reclamation Plant equalisation basin	May 2021	November 2021
Morena Central Pipeline	July 2021	December 2021
Miramar Reservoir pump station	November 2021	May 2022

Source: City of San Diego

recycling enough, and the cost of imported water has tripled in the last fifteen years, and it's going to keep going up," he told GWI.

By phasing a large-scale build-out of potable water reuse infrastructure over the next 15 years, San Diego hopes to source one third of its water supply from recycled water by 2035. The second phase of Pure Water San Diego – which is currently in the planning stage – will see the construction of one or more additional advanced water treatment plants which will feed water into Lake Murray and the San Vicente Reservoir, ultimately providing a total of 83MGD (314,155m³/d) of recycled water for indirect potable use.

Given the cost escalation, the city is currently recalculating the point at which the unit cost of the recycled water will cross with the cost of imported water (which is currently supplied at \$1,300 per acre-foot (\$1.05/m³)). "There will be a point in time where it's not just cost-competitive, but we're actually saving money," Perkins observed.

One casualty of the process is the renewable energy component of the project,

SURFACE WATER AUGMENTATION PROJECTS IN CA

Three projects in California aim to polish wastewater at advanced treatment plants before piping it directly into drinking water reservoirs. The granting of a disposal permit this month puts San Diego in the lead.

Client	Project	Capacity	Receiving body	Online
City of San Diego	Pure Water San Diego	30MGD*	Lake Miramar	2025
Padre Dam Municipal Water District**	East County Advanced Water Purification Project	16MGD	Lake Jennings	2025
Triunfo Water & Sanitation / Las Virgenes MWD	Pure Water Project Las Virgenes-Triunfo	6MGD	Las Virgenes Reservoir	2030

* Phase 1 ** Lead agency

Source: GWI Project Tracker

which had been scheduled to be procured as a P3. Although three bidding teams were shortlisted in 2019 to construct a compressor station and pipeline to turn fugitive landfill gas emissions into electricity to power the North City Water Reclamation Plant and the North City Pure Water Facility, Perkins confirmed that this element of the project has now been put on ice.

"We don't have the weather here that's conducive to generating the kind of gas that we need, and in addition there are state laws now where they want to keep more

organics out of landfill. The cost was just going to be prohibitive, and we're looking at other options from a renewable energy standpoint," he told GWI.

For now, though, the focus remains firmly on the advanced treatment and conveyance infrastructure.

"This is an exciting historic project, not just for the city of San Diego, but for our region in terms of ensuring that we have a safe, reliable and sustainable supply of water going forward," Perkins concluded. ■

LATIN AMERICA

Colombia faces renewed water PPP setbacks

For the best part of a decade, Colombia has been looking to spearhead two flagship water PPPs as part of wider efforts to attract private investment. One of the proposed initiatives has now been scrapped, while the other faces ongoing delays.

Colombia's long-running ambitions to procure a COP4.5 trillion (\$1.2 billion) wastewater treatment plant in Soacha and a COP600 million (\$159 million) aqueduct in Santa Marta under privately financed arrangements are facing a fresh volley of setbacks.

Market participants told GWI this month that the planned concession in the city of Santa Marta – which was initially conceived as a \$1 billion water supply aqueduct before being downsized to a smaller scheme in 2018 – will no longer move forward under a PPP arrangement. The 30-year BOT would also have involved the construction of a wastewater treatment plant and water system improvements to address rampant water losses in the city.

A source at Essmar – the public services company for Santa Marta – told GWI that the utility will now continue to operate the system independently. This

follows the election of a left-wing local government in January 2020 which is opposed to the national government's PPP plans.

However, with the local government short of funding capacity – an issue which has been compounded by budget constraints during the pandemic – a publicly funded scheme is also considered unlikely to move forward in the near term.

"[The local government] are saying they will use their own resources to make the system work through Essmar, but it just doesn't have the [financial and technical] capability," said one private water operator.

In April last year, Essmar resumed operations of the water and wastewater system following the expiry of an interim concession arrangement that was first awarded to a consortium led by Proactiva (Veolia) in 2017. The utility has since struggled to address supply constraints and water losses.

In the absence of the planned aqueduct and infrastructure improvements, José

Ramón Díez-Caballero, Aqualia's Colombia country manager, explained to GWI that he expects Essmar to initiate smaller projects to try to shore up the system in the short term, such as rehabilitating existing treatment plants.

Meanwhile, the procurement of the Canoas wastewater treatment plant in Soacha – initially expected this year – has been pushed into the middle of next year, owing to delays in the design process.

The project has been on the cards since 2011, but reached a major milestone in June last year when a co-financing package was agreed between Corporación Autónoma Regional de Cundinamarca and the City of Bogotá. Market participants suggest that the co-financing package does not preclude the possibility of a long-term BOT arrangement, however, with the private developer expected to front a portion of the project's capital costs. ■

SLUDGE TREATMENT

Steeper Energy kindles sludge-to-biofuels market in North America

The firm maintains that its hydrothermal liquefaction process is not only cost-competitive with other sludge management processes, but can provide an attractive revenue stream for private investors. Further uptake will be fuelled by a major equity raise later this year.

Biofuels technology company Steeper Energy intends to use a US\$20 million pilot project in Calgary to demonstrate that the conversion of municipal sewage sludge into advanced biofuels can be cost-competitive with conventional biosolids management processes.

A memorandum of understanding announced last month with the Canadian city will see Steeper deploy its hydrothermal liquefaction (HTL) technology, marketed as Hydrofaction, at the 100,000m³/d Pine Creek wastewater treatment plant. The pilot project will convert 5,000 kg per hour of primary and secondary wet sewage sludge into advanced biofuel such as renewable diesel or jet fuel.

Despite being a highly energy-intensive thermal process that uses supercritical water to liquify wet biomass, Steeper CEO Perry Toms maintains that Hydrofaction is cost-competitive on a per unit basis.

This is largely because the technology produces no waste stream, and therefore eliminates the transportation costs associated with the disposal of biosolids in landfills or application as agricultural fertiliser. Localised regulations and capacity constraints are increasingly requiring North American cities to dispose of their biosolids further afield, driving up the cost of disposal to the point where the economics of Steeper's thermal technology can compete.

"Our analysis and engineering to date suggests that we can be cost-competitive with existing biogenic waste management, plus we get the revenues from the biofuels," Toms told GWI this month. "In Calgary, when you add up the costs of their conventional treatment, the brand-new Can\$170 million aerobic composter taking some of the biosolids, plus their transportation costs for land application and so on, we're saying that they could pay us the same amount for a Steeper project that would make a break-even or positive rate of return before you even sell the biofuel.

"If you're able to aggregate the biofuels from a number of urban waste projects and sell them into a very high-value market like California – where you can get \$250 a barrel equivalent if you get every incentive

going – then you can make an exceptional rate of return," Toms continued.

The HTL technology has the added advantage of eliminating contaminants from sewage sludge, such as microplastics and spent pharmaceuticals – which are subject to increasing regulatory scrutiny – as well as PFAS, which California and other states are investigating in municipal wastewater and biosolids (*see story p21*).

Toms disclosed that Steeper – which has offices in both Denmark and Canada – is planning a major equity raise this year which will improve its ability to finance future projects using its own balance sheet. The firm intends to deploy full-scale facilities under a build-own-operate model alongside developers and private investors.

Steeper is not the only company looking to commercialise a hydrothermal technology for municipal sewage sludge management – US firm Genifuel is also piloting a process in Canada with Metro Vancouver. While Steeper has been piloting Hydrofaction in Denmark since 2013 – and in 2017 signed a licensing and pilot agreement for forestry waste in Scandinavia – it has yet to secure a commercial reference.

One challenge is that it requires scale for the conversion into high-value biofuels

such as jet fuel to be economically viable.

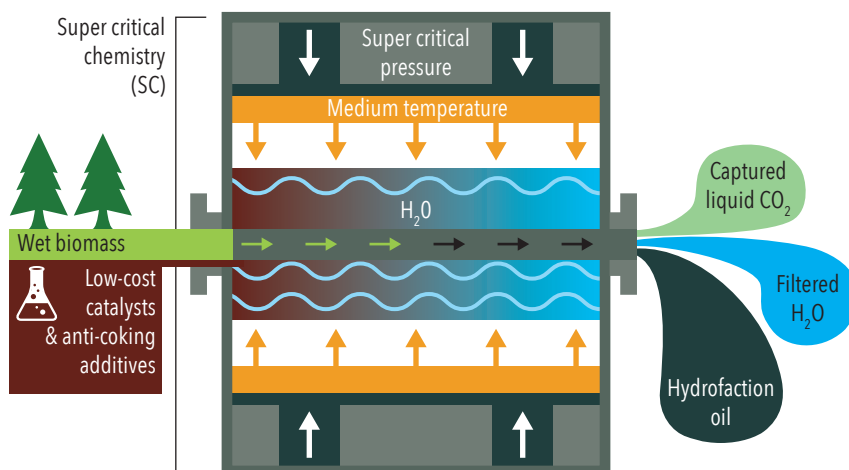
"The very first projects will probably produce biofuels for space heating – that you would sell to a hospital or an industry that is looking to generate steam – but in the longer term, as you grow and have more and more of these plants in proximity to one another, you can upgrade the bio-crude for transport fuels," Toms explained.

An increasing number of cities in the US are introducing kerbside collection programmes for organic waste, which would increase the volume of feedstock available to a Steeper facility – and therefore the biofuel volumes that can be produced. This year, Vermont became the first state in the US to ban the landfill of residential food waste.

Toms nevertheless concedes that few wastewater utilities are currently willing to switch wholesale from established anaerobic digestion processes to thermal treatment, although he suggests that Hydrofaction's modular design means that it can initially work alongside existing biosolids processes at a smaller scale while clients become familiar with the concept. The pilot in Calgary – which is due to break ground next year, pending final approvals from the City – could be scaled up to a commercial-scale 15,000 kg/hr facility in future. ■

CONVERTING SEWAGE INTO OIL

Steeper's Hydrofaction process treats wet feedstocks without the need for initial drying steps.



Source: Steeper Energy

WATER OUTSOURCING

JV targets distressed Caribbean desal assets

A new joint venture wants to provide water and wastewater services to resort properties hit hard by COVID-19. Is the timing right?

TSG Water Resources has formed a new joint venture with project development outfit WaterMark and investment firm Akira Partners, with the aim of owning and operating seawater desalination and wastewater treatment facilities serving hotels and resort properties in the Caribbean and Latin America.

Florida-based TSG Water Resources has provided design-build-operate (DBO) services for small-scale desalination and wastewater treatment facilities in the Caribbean and Mexico since 1998, and has a reference base of 30 operating contracts across seven countries. The company has primarily served high-end resorts in the region that require their own water and wastewater facilities to ensure reliable service, but which lack in-house O&M capabilities.

The intention of the new TSG Water Partners joint venture is to take TSG's business model a step further by moving into ownership of desalination and wastewater treatment facilities, and providing services to resort customers under long-term con-

tracts of at least ten years.

"Most of the resorts that we do business with would really like to replicate the situation they have with municipal utilities in the US, where there's a reliable system and they just pay a fee to have those services provided," TSG Water Resources CEO Jon Sprague told GWI.

While conceding that virtually all of TSG's existing resort customers have had to significantly curtail their activities during the COVID-19 pandemic, Sprague is nevertheless confident that there will be opportunities for the joint venture – particularly in acquiring distressed assets or those in need of upgrade or expansion.

"Coming out of COVID, resorts that have been closed or at minimal operations are going to be facing capital constraints, and we think there'll be an appetite to divest water and wastewater assets on their balance sheets," added Mark Lambert, former IDE Americas CEO and founding partner of WaterMark, which owns both a regulated wastewater utility and an O&M

firm in Hawaii.

Financial partner Akira, meanwhile, has deployed over \$3 billion into North American energy and infrastructure projects, although Lambert explained to GWI that the investment firm is not averse to small-scale investments – the SWRO facilities that TSG operates typically have treatment capacities ranging from just 100,000 gpd (378m³/d) to 2MGD (7,570m³/d).

The small-scale nature of the opportunity is one reason why the resorts business is a comparatively underserved area of the market for outsourced water services.

"Seven Seas Water and Consolidated Water are very active in our markets, but generally speaking they're doing work for governments in the region, the plants tend to be larger, and the contracts tend to be longer," Sprague explained. "The resorts market is much more fragmented, but it's worked well for us, and having done work for most of the large hotel chains and developers, I think we've developed a good reputation for quality and reliability." ■

REGULATING PFAS

California investigates PFAS in wastewater

Already home to stringent regulations for PFAS in drinking water, California is focusing its regulatory microscope on utility wastewater.

A new order issued by California's State Water Resources Control Board last month requires 259 municipal wastewater treatment facilities in the state to begin testing for per- and polyfluoroalkyl substances (PFAS) in wastewater effluent, biosolids, and RO concentrate.

With California having already adopted stringent response levels for PFAS in drinking water sources – while working to develop a maximum contaminant level by 2023 – the results of the new investigative order could form the basis for further regulatory action targeting the discharge or disposal of wastewater effluent streams.

The 259 facilities include all publicly owned treatment plants with a design flow greater than 1 MGD (3,785m³/d). Each facility will be required to sample for PFOA and PFOS strains over a one-year period, with the results reported back to the water board on a quarterly basis.

Participants expect the findings to

reveal ubiquitous background concentrations of PFAS in wastewater, with higher levels around sources of PFAS pollution such as industrial sites and airports.

"Because of its ubiquitous nature, we'll probably see PFAS concentrations between the single digits and twenties parts per trillion (ppt) in wastewater. With biosolids, that could be from single digits to 50 parts per billion," conceded Greg Kester at the California Association of Sanitation Agencies.

Kester pointed to a study that has been conducted in Michigan since 2018, which reveals that low levels (3 to 7 ppt) of PFOS were detected at WWTPs even when no significant industrial sources were present.

"The unfortunate thing is that, in some parts of the country like California, background levels are likely to exceed drinking water thresholds, and what that means for wastewater is still unknown," he told GWI.

The Michigan study also revealed that the implementation of an industrial pre-

treatment programme for PFAS – which regulated the disposal of industrial wastewater into municipal sewer networks – resulted in a 99% reduction in PFOS concentrations at some municipal WWTPs where the levels had previously exceeded state regulations.

Kester favours a similar approach in California, noting that source control measures could prevent wastewater utilities being saddled with the cost of PFAS removal, while enabling them to avoid restrictions on biosolids application in a state where three quarters of the biosolids produced are land applied as fertiliser.

"Hopefully we can identify where high concentrations originate, and then deal with those through pollution prevention," Kester argued. "I hope that we don't get to the point where we're regulating what's used in commerce and residential uses through the wastewater system – that's a backwards way of doing it." ■

AMERICAS IN BRIEF

● Shares in environmental services provider **Montrose Environmental Group** had climbed to \$25.80 as GWI went to press – up nicely from their IPO price of \$15.00 on 23 July.

● **Berkshire Hathaway** has sold its InTank ballast water treatment business to **BioMicrobics, Inc.**

● **Consolidated Water** has purchased an additional 10% stake in **PERC Water** for \$900,000, taking its interest in the company to 61%.

● **Essential Utilities** this month priced a \$311 million equity offering via RBC under a forward sale agreement. The proceeds should provide sufficient firepower to cover cost of the pending acquisition of **DELCORA**.

● Industrial wastewater treatment and reuse systems supplier **DMP Corporation** has been acquired by NYSE-listed specialty chemicals company **Element Solutions**.

● **Suez** has catered to increasing interest from US investors by launching a Level 1 American Depositary Receipt programme.

● Earlier this month, residents in the City of Eureka (MO) voted to sell their water and sewer systems to **American Water** for \$28 million.

● Brazilian utility **Copasa** has had its service shut-off moratorium extended until 30 August.

● Meanwhile, shantytown residents and those on social tariffs in **Sabesp's** franchise area will be exempted from paying their water bills for August.

● Ex-Xylem executive Chris McIntire has been appointed CEO of the water quality solutions platform launched last year by **KKR** and **XPV Water Partners**.

● Onsite wastewater treatment company **Epic CleanTec** has raised \$2.6 million of seed funding.

● **Sembcorp** completed the sale of its Chilean water assets to **Sacyr** at the end of July. ■

COMMENT

Is the tide turning for water reuse in California?



A court ruling this month could mean that disposal of treated wastewater is no longer an option for California. Reuse comes with its own challenges, says Wes Strickland.

On 4th August, the Superior Court of Los Angeles County issued a momentous decision concerning the reuse of treated urban wastewater in California. The environmental group Los Angeles Waterkeeper petitioned the court to order the State Water Resources Control Board (SWRCB) to evaluate whether the cities of Los Angeles, Burbank and Glendale are violating the state constitution by discharging wastewater from four large treatment plants to the Pacific Ocean rather than causing that water to be reused. The court held that the SWRCB must undertake such an evaluation, and signalled its belief that the discharge of treated wastewater by the cities to the ocean constitutes unreasonable use and waste of the resource.

The cities of Los Angeles, Burbank and Glendale own and operate an integrated wastewater collection and treatment system known as the North Outfall Sewer (NOS). That system is the largest in California, with a combined permitted discharge capacity of 530MGD (2 million m³/d). Approximately 50MGD (190,000m³/d) of treated wastewater from the system is reused, with the remainder discharged to the Los Angeles River and the ocean. All three cities have plans to increase their reuse of wastewater, but none has a legal commitment to do so. In particular, the SWRCB has not imposed any reuse requirements on the cities, but has focused its regulatory attention on the quality of water discharges. Statewide, the SWRCB has endorsed water reuse, while limiting its practical application based on concerns about public health.

In 1928, the citizens of California adopted an amendment to the California Constitution, which provides that water resources of the state must be put to beneficial use to the fullest extent possible, and waste or unreasonable use of water must be prevented. For over 90 years, the courts and SWRCB have interpreted that provision to require that all uses of water be both beneficial and reasonable, and the Legislature and SWRCB have incre-

mentally adopted regulations in favour of water efficiency for urban and agricultural uses. In general, the courts have refused to decide what uses of water are reasonable, holding that reasonable water use is defined by common practice.

Waterkeeper sought to change the state's incremental approach to reuse, arguing that technology exists to reuse the discharged water, that the cost of reuse is reasonable, and that there are many uses for treated wastewater. In a clear break from past cases, the court agreed with Waterkeeper and held that the SWRCB has a mandatory duty based on the constitution and Water Code to analyse whether the discharge of treated wastewater to the ocean by the NOS is unreasonable or wasteful. In order to comply with the court's order, the SWRCB will need to make a determination of reasonable use by the cities, and instigate remedial actions if any unreasonableness is found.

It is expected that the cities will appeal the decision. However, for the first time it appears the State of California may legally require water reuse from local wastewater agencies, by action of either the SWRCB or the courts. The Legislature may be asked to address the question in 2021, but that body cannot avoid a constitutional ruling.

There are challenges to expanding reuse from the NOS and similar plants statewide, most notably finding reuse opportunities. The only uses that are likely for such large volumes would be groundwater recharge and direct potable reuse, both of which would require significant infrastructure development and regulatory changes related to water quality. However, according to the court, the Constitution may mandate such reuse. We may have reached an inflection point away from ocean discharges toward large-scale reuse. This case is definitely one to watch. ■

Wes Strickland is an attorney whose practice focuses on water projects and companies. He is a partner in the Austin and Los Angeles offices of Holland & Knight LLP.

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FIRST HALF RESULTS

French majors see light at the end of the COVID tunnel

Veolia and Suez insisted that revenue losses in H1 as a result of the pandemic masked a recovery that started as early as June. Both are bullish about the future.

Global water rivals Veolia and Suez both waxed optimistic on their recovery prospects by the start of 2021, as they presented their half-year results within 12 hours of each other late last month. Water took pride of place in both announcements, outperforming other business segments within both groups. Both also reported that ongoing savings plans would continue.

Veolia's CEO Antoine Frérot told investors that the "recovery began in May, and revenue in June was already 97% of June 2019." The group posted H1 revenue down 6.8% from last year, at €12.4 billion. Frérot said he expects the group to start 2021 without any remaining COVID-19 impact.

Frérot's opposite number at Suez, Bertrand Camus, also praised his company's resilience during the pandemic. "Our results [H1 revenue of €8.2 billion, -5.7% year-on-year] turned out better than we expected a month ago, thanks to a solid month of June," he said on the earnings call.

Camus stressed Suez's positive commercial dynamic over the period, with a

string of contract wins in Dijon, Tashkent, and Luanda, as well as a five-year renewal in Los Angeles (West Basin). He also expects the group's finances to be shored up by the first wave of asset disposals as part of a grand €4 billion plan (*see box, facing page*). This led him to predict that Suez's H2 EBIT would be much closer to normal, between €600 and 650 million (compared to €763 million in H2 2019, and just €76 million in H1 2020).

Frérot was especially bullish as he expects Veolia's full-year EBITDA to reach around €3.6 billion, only 10% down from last year, thanks to aggressive, one-off cost-saving measures put in place in response to the pandemic.

Both groups sought to appear optimistic in their guidance for the rest of this year, in a bid to reassure investors – something Suez achieved better than Veolia, if stock prices are to be believed. Suez shares outperformed the CAC40 by 11% on the day after the H1 announcement, but Veolia stock dipped nearly 1.5% below the index a day later.

This month in Europe:

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The difference may be due to the poor H1 performance of Veolia's non-water businesses, on which the company has staked much of its growth strategy for the past few years. While revenue from municipal water slumped by 2.8% year-on-year to €3.9 billion, the group's energy and solid waste activities took more significant hits, at -10.1% and -7.3%, respectively.

HSBC research also suggests that, besides Suez's strategy being seen favourably by markets, the strong performance of Suez stock may be attributed to signals from Engie, Suez's single largest shareholder with 32.06%, that it may seek to sell its stake in the future. Engie's chairman has been seeking to refocus the group's activities, leading HSBC to conclude that the energy group is unlikely to retain its participation over the long term. However, analyst Verity Mitchell added: "we do not believe a disposal or sale is imminent."

Costing COVID

In terms of revenue, Veolia CFO Claude Laruelle explained the water segment's ▶

SIFTING THROUGH THE NUMBERS

The world's two largest water companies (*see The List, p6*) break down their activities in different ways, making direct comparisons tricky. Suez recently created an overall Water division, however this does not capture all of the group's water revenue. A significant but undisclosed amount is generated by Suez WTS, which falls under Environmental Technologies & Solutions. Meanwhile, Veolia publishes figures for its overall water revenue – to which figures from VWT and SADE can be added – but fails to offer a systematic breakdown by geography within its municipal water business. As a result, it is not publicly known how much revenue from Asia, the Americas, and other regions comes from the water business. A quick subtraction shows €1,999m of reported water revenue in H1 2020 came from outside Europe.

Veolia division revenue	H1 2019	H1 2020	Variation	Suez division revenue	H1 2019	H1 2020	Variation
Water revenue (total muni)	€4,010m	€3,897m	-2.8%	Water	€3,374m	€3,221m	-4.5%
o/w Water France	€1,455m	€1,361m	-6.4%	o/w Europe	€1,818m	€1,754m	-3.5%
o/w Water C&E Europe	N/A	€537m	+2.9%*	o/w AMECA	€398m	€404m	+1.4%
Asia (all businesses)	€973m	€1,030m	+5.8%	o/w Asia Pacific	€263m	€239m	-9.0%
Latin America (all businesses)	€424m	€382m	-9.8%	o/w Americas	€895m	€824m	-7.9%
North America (all businesses)	€1,056m	€882m	-16.5% (-1.6%**)	ETS (incl. hazardous waste)	€1,708m	€1,642m	-3.8%
Veolia Water Technologies	€679m	€665m	-1.2%*	o/w Water Technologies & Services	N/A	N/A	+1.0%**
SADE (network contractors)	€654m	€534m	-18.3%*	Water EBITDA	€853m	€682m	-20.1%
Group revenue (total)	€13,324m	€12,412m	-6.8%	Water EBIT	€432m	€108m	-75.0%
Group EBITDA	€2,002m	€1,599m	-19.2%*	Group revenue (total)	€8,656m	€8,167m	-5.7%
Group EBIT	€857m	€438m	-48.0%*	Group EBITDA	€1,521m	€1,196m	-21.3%
				Group EBIT	€645m	€76m	-88.2%

* At constant FX

** Organic

AMECA: Africa, Middle East & Central Asia

ETS: Environmental Technologies & Solutions.

Source: Veolia, Suez

resilience by citing “flat volumes” in the company’s French municipal contracts and limited contraction elsewhere, which were largely offset by higher tariffs (+1.5% in France, +2.7% in Central & Eastern Europe).

The abrupt closure of French work sites in the spring (*see graph, below*) led to a 9.6% drop in revenue for the group’s construction and technology business. French networks contractor SADE bore the brunt of the impact, with revenues down -18.3% at €534 million. Veolia Water Technologies fared much better, dipping just -1.2% to €665 million, thanks to its more global and diverse profile, which combines construction revenue with technology and service offerings.

Overall, Laruelle evaluated the negative impact of COVID on the group’s H1 revenue at €813 million, while the pandemic also shaved €431 million off EBITDA year-on-year. Out of this, he added, direct COVID-related costs such as the purchase of masks for staff and thermal cameras for company premises amounted to €33 million.

Suez costed the pandemic’s impact on EBIT in the water division at -€300 million, with €124 million coming from lower volumes and €176 million from one-off costs to deal with the outbreak and its ramifications. CFO Julian Waldron explained that Suez’s municipal water business was hit by lower tariff collection rates than usual – an issue which Veolia said had not affected its own water business significantly – but was hopeful of recouping the loss eventually through price renegotiations.

Both groups were keen to stress that the pandemic had not prevented pre-existing cost-cutting plans from going ahead. Veolia’s Frérot told investors that deadlines within his “Impact 2023” programme may

M&A

Veolia starts off Suez’s asset disposals

Suez and Veolia have entered into exclusive negotiations for the €298 million sale of wastewater networks contractor Osis, the first of up to €4 billion in Suez cessions.

Suez kicked off its planned €4 billion asset sales programme (*see GWI October 2019, p10*) this month with a preliminary agreement to cede networks maintenance contractor Osis to Veolia for an estimated €298 million.

This follows a mention late last month by Suez CFO Julian Waldron on an earnings call of a separate agreement to sell part of Suez’s stake in AquaSure, an Australian desal plant, for about €50 million, to an undisclosed buyer, with an expected close in September. Suez currently holds 11% of the project company after a previous partial divestment in 2017 went to existing shareholders AMP Capital and UniSuper.

Osis has over 2,500 employees across France, and specialises in cleaning all manner of wastewater pipes, ranging from municipal sewers to treatment plant piping. It also offers hygiene services for apartment buildings, and has a presence in Germany and the Benelux besides France. The Suez subsidiary generated €311 million in turnover and €23 million in EBITDA last year. Veolia has announced its intention to integrate Osis with its own SARP brand (Société

GIANT ON A DIET

CEO Bertrand Camus wants Suez to slim down by shedding up to €4bn in assets.

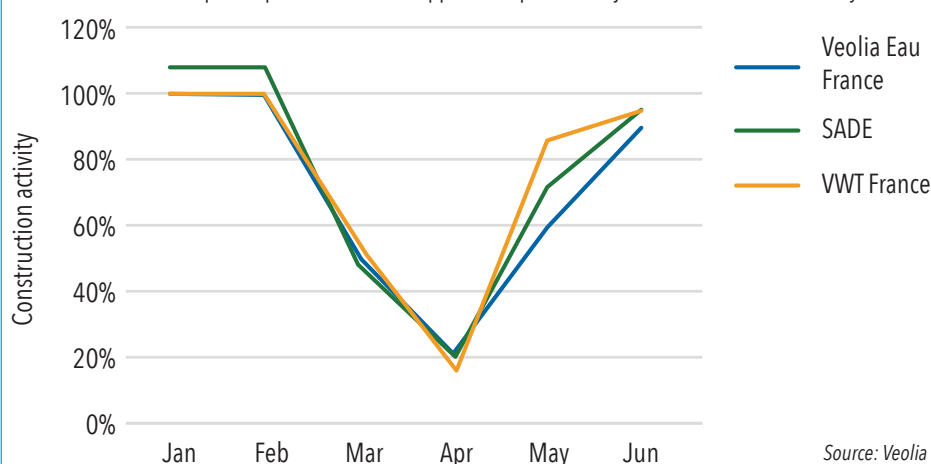


Source: Suez

d’Assainissement Rationnel et de Pompage), which offers similar services to clients in France and Germany. The Aubervilliers-based group said in a release that the acquisition of Osis would create significant synergies. Suez expects the deal to close in the first half of next year, as regulators and union representatives still need to sign off on the sale. ■

FRANCE’S V-SHAPED LOCKDOWN

With the government allowing work sites to reopen from 11 May, Veolia’s construction activity in France re-started at an even quicker pace than it had stopped. Competitors’ trajectories in France were likely similar.



be delayed, but made it clear the group had “lost less than a year in our development programme from the crisis.” Suez COO Jean-Marc Boursier – who is rumoured to be on his way out – said the Suez 2030 plan is “on track to deliver as planned”.

Suez’s plan includes reaching €1 billion in yearly savings by 2023, with an aim to get half-way there by 2021. Boursier insisted that these were not one-off cuts or short-term cost reductions due to lockdown, but lasting improvements to operational efficiency. He cited the implementation of WTS technologies in municipal plants, which allowed the latter to save on chemicals and energy, as an example.

Veolia COO Estelle Brachlianoff, by contrast, was unapologetic about “seizing every single opportunity from the crisis, including cost savings, digital, etc.” She expressed confidence that “one-third of these measures could generate recurring savings.” ■

SLUDGE MANAGEMENT

United Utilities gives market a 'blank sheet' to design new sludge solutions

English water company United Utilities has appealed to the market to revamp its sludge management processes. New rules from regulator Ofwat have opened up fresh possibilities for outsourcing, while encouraging technological innovation in the UK.

United Utilities, the publicly traded water and sewerage company (WaSC) serving the north-west of England, issued a call earlier this month seeking ideas for innovative sludge management solutions in the north of its territory.

The move is the first to take full advantage of a new regulatory framework for water companies in England & Wales, which encourages utilities to rationalise their sludge treatment systems through outsourcing.

Until now, WaSCs were expected to manage the sludge generated at their WWTPs in a self-sufficient way. With the start of AMP7 this year, however, industry regulator Ofwat has put a separate price review in place for bioresources, which actively encourages utilities to look beyond their own boundaries for the most efficient solution. This may involve reaching out to neighbouring utilities, or to other companies with sludge handling and treatment capabilities, notably firms specialising in the anaerobic digestion of food and agricultural waste (see *GWJ September 2019*, p35).

Because of this new regulatory environment, coupled with ongoing policy reviews by the Environment Agency over rules for the co-digestion of sludge with other wastes, the prior information notice (PIN) put out by UU remains deliberately vague on what the company is looking for. Tom Lissett, UU's bioresource & energy services director, explained to *GWJ* that "it really is a blank sheet of paper. If people want to consider the whole production line from sludge collection, transport, treatment, and ultimately recycling at the back end, we would be keen to hear what people think about that as well, rather than it just being about a treatment facility."

Summer holidays notwithstanding, the PIN has already received an enthusiastic response from a variety of market players. Lissett listed "pure technology providers, neighbouring water companies, as well as major engineering companies we work with". He has had conversations with fellow sludge czars at Yorkshire Water and Severn Trent to explore the possibilities of cross-boundary sludge trade in line with Ofwat's

COME DESIGN WITH ME

Tom Lissett, United Utilities' bioresource and energy services director, is hopeful that asking the market for ideas will result in the UK's most innovative sludge infrastructure.



Source: UU

new recommendations.

"Ofwat had been very clear, through the PR19 process, that they expect what is now a separate bioresources price control to be engaging with markets, encouraging us to trade across the boundary with neighbouring WaSCs, to embrace adjacent industries which also use anaerobic digestion, in order to make sludge treatment more efficient, which then benefits customers," he detailed.

"The biggest challenge we face when it comes to sludge is that production often exceeds treatment capacity," which he conceded "is probably very efficient for customers, because we're squeezing as much performance as we can out of the assets we've got." It is hardly sustainable, however, particularly as some assets will soon reach the end of their useful life, while volumes continue to grow.

"By the end of the AMP, we will need additional capacity, more than we can unlock from our existing assets. So the PIN we've put out to the market is exploratory, to find out who could be a potential partner: technology providers, potentially people who would get involved in financing

a facility in the north of our area, because that is where we need what we call a Northern Bio Hub to be located," Lissett went on. If this option is selected, this may make it the first independently financed sludge treatment plant in England and Wales.

The 'Northern Bio Hub' mentioned in the PIN would have a capacity of 30,000 tonnes of dry solids (tds) per year or more, with a tentative location at UU's Blackburn site, where a 13,000 tds/yr facility is set to be retired in the next few years. "Blackburn is a good location for us," Lissett said, citing convenient access for sludge tankers, a co-located WWTP as an energy offtaker, and a nearby gas connection to send excess biomethane into the grid. But, he was quick to add, "somebody out there might have a different solution to Blackburn, and we don't want to discourage that."

"Energy is our main value stream" from sludge, Lissett said, explaining that powering UU's WWTPs through biogas-fuelled CHPs, as well as a gas-to-grid scheme at the company's 85,000 tds/yr Manchester Bioresource Centre, "brings in over £20 million a year in revenue and offset energy costs." If regulations on co-digestion are loosened as part of an ongoing policy review, UU might choose to create "quite a wide-mouthed plant in terms of agricultural waste, food waste, and sludge," Lissett speculated. These additional feeds could lead to a plant with a bigger capacity.

As part of his "blank sheet of paper" approach, Lissett refuses to dismiss any potential idea out of hand. "We are already looking into phosphorus recovery from liquors," he told *GWJ* – a technology deployed by Thames Water at its Slough plant in 2013 – while the company is also looking to improve the quality of the processed sludge provided to farmers as fertiliser.

"It's all about totex," Lissett concluded. "It's about getting the right blend of opex and capex interventions to get that pounds per TDS as low as sustainably possible. We don't often get the opportunity to start with such a clean slate. Nothing is off the table."

An online Q&A session is planned for September, and procurement is expected to start in late January next year. ■

COMMENT

No slacking off for water in the anti-COVID fightback



The water sector made some of the first breakthroughs detecting infection hotspots. Now it needs to stay vigilant in the face of reinfection waves, says David Lloyd Owen.

In April, I considered the potential for sewage effluent testing as a tool for COVID-19 monitoring (see *GWJ April 2020*, p36). At the time, I felt it was an excellent idea which needed to be far more broadly adopted. Now it is becoming part of our new abnormal. When much of the world went into lockdown, the assumption was that after a couple of months of mild peril, all would be well again. When will all be well again? As things stand, we lie poised between a summer's leave and an autumnal relapse, which may in time be annealed by a vaccine.

Much has happened in the past four months. By testing stored sewage samples, we now have an idea about when infections began. In Barcelona, the earliest positive result was in January, 41 days before the first identified case in the city. In Italy, positive results came from samples taken on 18 December 2019 in Turin and Milan. In Brazil, the first positive result was taken from a 27 November 2019 sample, two months before any diagnosed cases. This is of crucial importance as we now know that many who are infected are asymptomatic, meaning it could be spreading for weeks in a community before being noticed.

Samples still have to be physically collected in the field and sent to a lab. This is both time consuming and labour intensive. Researchers in Australia have achieved testing times of 30 minutes, against several hours at present. The challenge is that the lower the concentration of the RNA, the more RNA amplification rounds are needed, adding to the time taken and early detection means highly dilute samples.

Oxford Nanopore may have an answer; a real-time lab-based RNA detection technology that identifies their presence through the resistance footprint each RNA sequence generates across a nanomembrane.

Sewage, by its nature, is not an easy medium to deal with and handling it in a lab is no picnic. So, another approach under trial involves using 'Affimer re-

agents' (developed by Avacta) to bind with the SARS-CoV-2 spike protein in the effluent. Here, a dedicated biosensor under development by Integumen would monitor for the presence of the spike proteins at the treatment plant in the sewerage network in real time. The biosensor would be added to an in-situ monitoring unit manufactured by Modern Water which is currently running in 3,000 locations. This is seen as a 'next generation' technology project. If it works, this could be a crucial element in monitoring further outbreaks.

Monitoring new outbreaks matters. It took decades of vaccination to deal with polio, which is now only found in Pakistan and Afghanistan. The rise of the 'anti-vaxxer' movement and anti-social media may result in low vaccination rates, which will ensure COVID-19's sustained presence and future pandemics.

The creation of national networks is developing at a most encouraging pace, with national testing networks involving utilities and universities emerging for example in the UK, Netherlands and Australia.

The big research emphasis here is the potential to relate laboratory-based data to the number of people being infected, so that a detailed appreciation about COVID-19's rise or fall in a community can be obtained. As ever with water, there is a question of common standards and a lot of work is needed to ensure that effective comparisons can be made between countries to gain a global appreciation.

Re-openings economies whenever possible is both an economic necessity and humane. Unfortunately, it tends to revive infections. Sewage based epidemiology allows testers to identify a new outbreak at the treatment plant level and then go up the sewerage network to hone into where a lockdown is really needed. This is already happening. In June, no COVID-19 samples were being detected in Paris's wastewater. In July, new cases were once again being identified. This time, they are ready. ■

EUROPE IN BRIEF

- **Saur** has continued its acquisition spree, purchasing 51% of **Derichebourg Aqua**, which has two water management contracts in France and one on the island of Réunion.

- **Águas de Portugal** has set out its ambitions to achieve energy neutrality in 2030 by moving towards 100% renewable energy across its global portfolio. The group currently consumes 1.4% of all Portugal's electricity.

- **Marlowe plc** has acquired **Rainbow Water Services** for £450,000. Rainbow provides water treatment and hygiene services, and generated revenues of £1.0m and EBITDA of £0.1m in the year to 31 August 2019.

- At the end of July, the **EIB** signed off on a €250 million loan to Italian utility **Acea** to support its investment programme in the Rome area, as well as a €150 million loan to Dutch water supply company **Vitens**.

- Meanwhile, the **EBRD** and the **EU** have agreed to provide a guarantee for up to €40 million of water sector loans extended by **Raiffeisenbank Bulgaria**.

- Austrian environmental technology company **Wolftank-Adisa Holding AG** has completed its takeover of a majority stake in Italian water treatment and soil remediation specialist **Rovereta**.

- Tbilisi-based private water utility and renewable energy company **Georgia Global Utilities** has priced a \$250 million 5-year green bond with a 7.75% coupon. The proceeds will be used to repay existing loans, and to finance water and wastewater capex.

- Scottish engineering group **RSE (Ross-shire Engineering)** has continued its string of water acquisitions by buying a majority stake in **W.E.S.**, a manufacturer of chemical dosing solutions for the UK water industry.

- **United Utilities** has launched a £95 million 20-year CPI-linked bond via **NatWest**, with a negative real yield.

- Following a delay, **Modern Water** now expects to publish its 2019 results by the end of the month. ■

DIGITAL WATER IN CHINA

China's digital players refine offerings as demand grows

The second part of GWI's Chinese smart water market coverage investigates how key players are approaching clients' appetites for cloud platforms and software as a service.

While most Chinese utilities are still in the early stages of adopting digital technologies, the country's smart water space saw a boom following COVID-19 (see *GWJ April 2020, p38*). Key players are already emerging in the market, and partnerships between specialists in multiple digital areas are becoming popular as companies try to gain a competitive edge (see *table, facing page*).

Manufacturers of physical water equipment like meters, sensors and pumps are cooperating with software development enterprises to evolve into software-as-a-service (SaaS) providers, helping clients analyse data collected from physical assets. Cloud service specialists, meanwhile, are working closely with water IT system suppliers to adjust their service to suit the water industry and the information available, and communication technology (ICT) giants Huawei and Alibaba are stepping into the market as local governments and water companies realise the importance of translating bulk historical data into valuable assets, while standardising data and service systems via cloud platforms.

From digital meters to software as a service

Over half of China's digital metering market is shared by twenty active players, with about 25% to 30% of the market share controlled by three big listed companies: Sanchuan, Ningbo Water Meter, and Suntront Technology.

While widespread adoption of digital meters is expected to be slow, there are significant opportunities on offer as remotely read digital meters are currently understood to make up less than 20% of all water meters in the country, and some companies are already looking at refining their products and services.

Ningbo Water Meter, China's largest water meter manufacturer, launched its third-generation digital meter solution, which includes attached multi-parameter sensors, earlier this year. "This product could be regarded as an integrated terminal of water related parameter collection, including temperature, pressure, water

CLOUDS WITH A SILVER LINING

As water data grows increasingly valuable to Chinese local governments and utilities, a space has opened up in the market for cloud services specifically adapted to the water industry.



Source: Shutterstock

quality and leakage besides the basic measurement of water volume. It can control the valve remotely when detecting leakage risks," Yao Ling, chief technology officer of Ningbo Water Meter, explained to GWI. "There are no similar products in China at the moment. We hope to help our clients to save on both space and spending on various sensors."

Meanwhile, Shenzhen Huaxu Tech Development, one of China's leading digital metering and service providers, has tried to enable traditional meters to upload Internet of Things (IoT) network-based readings during the long transition period from mechanical meters to digital meters by installing a camera device on the meters. "A lot of county-level utilities still largely rely on manual meter reading to prevent mass unemployment of on-site staff. Our device can achieve the readings remotely where mechanical meters are used by taking photos of the meter dials via a small camera. The cost of this solution is

much lower than even the cheapest digital meters," said Jia Peng, vice president of Shenzhen Huaxu Tech Development.

Aside from adding more functions onto the meters, leading meter players have also begun to develop SaaS-based solutions to add value to their digital meter offerings, for example through utilising collected data to do in-depth analysis and risk prediction modelling. The business model can vary depending on the client.

"Large utilities, for example those in Shenzhen, Beijing and Shanghai, only procure our meter products without software service as they themselves have IT departments and third-party software system operators. For mid-sized utilities, they purchase both meters and software systems and operate them by themselves, while the county-level small utilities are more inclined to buy all of our offerings including hardware, software and O&M service," Ma Surong, board secretary of Ningbo Water Meter, told GWI. ►

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A SMART MATCH

China's digital water players are finding partners with complementing areas of expertise to improve their services and approach complex projects. Information and communication technology (ICT) giants Alibaba and Huawei have made matches of their own.

Type	Players	Aims
Hardware and software	Qingdao iESLab Electronic (ultrasonic water meters), AMS AG (Austria-based, semiconductors), Alibaba (cloud service)	To promote Qingdao iESLab Electronic's water metering equipment with AMS's ultrasonic flow measurement technologies based on Alibaba's cloud
Hardware and software	WPG (Shanghai) Smart Water Public (water supply equipment), Shanghai 3H (smart water software)	To enhance WPG's expertise in online customer service platform development
Hardware and ICT	Shenzhen Huaxu Tech Development (digital metering), Sugon (cloud service)	To establish cloud platform Loushan, designed for the water sector
Hardware and ICT	Huawei (5G & NB-IoT technology), Ningbo Water Meter, Sanchuan Wisdom (both digital metering)	To develop digital water meters deploying a narrowband Internet of Things (NB-IoT) network
Software and ICT	Alibaba (cloud service), Shanghai 3H, Zhejiang Heda, Shanghai HC System (all smart water software)	To adjust Alibaba's cloud service to suit the water industry

Source: GWI

Advanced automation & remote control

There remains a huge potential for digital upgrades to water and wastewater treatment plants in China, with very few plants having reached a high standard of digital process control. Zhao Leping, general manager of Hanwei Electronics Group's smart water business, one of the country's leading sensor and IoT-based smart water solutions providers, told GWI that although many of China's water treatment plants could have 70% of work done automatically, less than 1% could realise functions such as simulation, modeling, and machine learning. "The current digital water projects in China are mainly focused on hardware infrastructure procurement, such as sensors, digital meters and pumps, with the development of plant-level digital upgrade accounting for a small part. For example, in one smart water project with a total investment of RMB70 million (\$10 million), only RMB10 million (\$1.5 million) went to IT system construction," Zhao added.

Around 10 water software system providers are regarded as major players in this market, most specialising in certain expertise areas. Shanghai 3H Computer is particularly strong in online customer service platform development, while Zhejiang Heda's expertise is network remote monitoring and digital management, and Shanghai HC System Control Technology is mostly known for advanced process control and optimisation solutions for wastewater

treatment plants.

Besides software development enterprises involved in water industry, some large water utilities have set up their own digital water technology subsidiaries to help upgrade plants. "One important advantage for big utilities in doing the digital plant upgrades by themselves is that they have a great number of water assets to use as implementation objects. This means that whenever they have new ideas, they can do pilots in their plants and promote the effective solutions in a large-scale application at a fast speed. Meanwhile, we technology companies have to bid for projects one by one," said Yang Bin, CEO of Beijing Jinkong Data Technology. "But our strength is that we have data and project experience from different type of clients, so our solutions are more comprehensive."

He added that previously large utilities usually developed the data management and analysis systems by themselves, but outsourced the simple automation part to technology companies. The present trend, however, is that utilities with digital expertise choose to also do the basic automation themselves.

A few of the leading utilities' digital subsidiaries have also managed to use their successful experience to win projects for other water companies. Shenzhen Kerong Software, the digital water business arm of Guangdong Investment, secured the HK\$20 million (US\$2.6 million) Hong

Kong Water Supplies Department's Water Intelligent Network Project in February last year with its smart network pressure control solution.

Big data analysis & cloud development

China's ambition is to take further advantage of water-related data for smart city development, and as data attracts increasing attention, local governments and utilities have tried to establish cloud platforms for data storage, classification, in-depth analysis, and management.

However, integration of data remains a major challenge as there is no standardised data system. Ma Jinquan, Shenzhen Kerong Software's CEO, told GWI: "The current problem is, for example, in the charging system of different water utilities, the ID of the same water indicator is different. [...] This will lead to the repeated construction of data systems and reduce the value of the collected data."

To address the water industry's data island issue, leading cloud infrastructure and service providers Alibaba and Huawei have both started to promote their services to the water sector, targeting two different applications – Alibaba is mainly promoting its cloud service for local utilities' plant data and IT service integration, while Huawei is providing its cloud solutions for local governments to develop cities' digital water conservancy information systems.

"The Chinese water industry is fragmented with thousands of utilities scattered across the country. Compared to local water utilities, providing cloud service to governments is much easier to implement," Huo Hongtao, the R&D general manager of Huawei's water conservancy business, told GWI. "Our focus is water conservancy information system development for small rivers and lakes which have a desperate shortage of physical infrastructures like sensors, information systems and data analysis capabilities."

Meanwhile, a few digital water technology suppliers are also developing cloud services particularly for the water industry. Shenzhen Huaxu Tech Development established water cloud platform Loushan, which is specifically designed for the water sector, through a partnership with Sugon, a Chinese cloud service provider. "The cloud offerings of ICT companies like Huawei and Alibaba usually need time for adjustment to make their cloud systems suitable for water applications. Therefore, they sometimes choose to use our cloud platform for 2 to 3 years and then transmit the integrated data systems onto their own cloud after adjustment," Jia explained. ■

WATER RIGHTS TRADING

Calls grow for more regulation of Australia's 'wild west' water rights trading market

Following the release of a critical report, pressure is growing for major trading reform in the overheating Murray-Darling Basin.

Calls for reform of the water rights trading markets in Australia's Murray-Darling Basin have intensified, following last month's publication of the Australian Competition and Consumer Commission's (ACCC) much-anticipated interim report into market operating conditions.

Valuations of entitlements and allocations in one of the world's most sophisticated water rights trading markets have surged on the back of three dry years in a row (see table right), leading to increasing interest from investors – and growing suspicions from water users in the region.

The ACCC identified a number of issues with the current arrangements, including a lack of regulatory oversight and market fragmentation, and has floated the idea of a single regulator to oversee the market, which a number of industry observers believe should be acted upon by the federal government.

The 544-page report quoted "significant deficiencies associated with the settings and governance of water trading, which undermine the efficiency of water markets and their dependent industries."

The ACCC added that there is a need to reconsider governance frameworks focused on the proactive development and regulation of markets, to promote open and fair trade. It suggested that potential responses could include a licensing scheme operated at the Federal or Basin State level for brokers and other intermediaries, or an extension of the financial regulation framework to all water products so that water rights trades are regulated in the same manner as other financial trades.

Appointing a single regulator to oversee trade in basin markets, similar to arrangements in place in the financial services or energy markets, could also help address these issues, the report said.

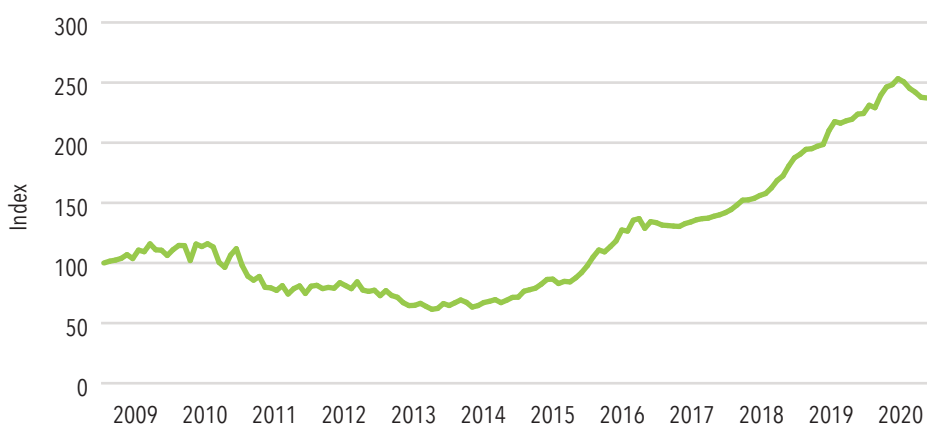
Sharp practice allegations

The market has come in for strong criticism, particularly from farmers in the region. Many have complained about the integrity of the current scheme, with allegations surfacing of traders hoarding water allocations to artificially drive prices up.

While the ACCC did not confirm such

HAVE WATER ENTITLEMENT PRICES REACHED A PEAK?

The combination of three dry years in a row and increasing investor interest has seen the value of water policy group Aither's Entitlement Index rise more than four-fold in the last six years. The return of winter rains in 2020 has added an element of instability to the figures this year.



Source: Aither Entitlement Index, August 2020

practices were taking place, its deputy chair, Mick Keogh, acknowledged that the water market faces significant problems.

"In basic terms, there is overly fragmented or complex regulation in some areas, not enough regulation in others, and

a concerning lack of regulatory oversight and robust enforcement in other areas," Keogh said in a statement.

Speaking to local media recently, Lex Batters, chief executive of water exchange H2OX, said the presence of investors "probably has had a little bit of upward pressure because of the way they transact, the way they aggregate water, and the way they trade across different brokers."

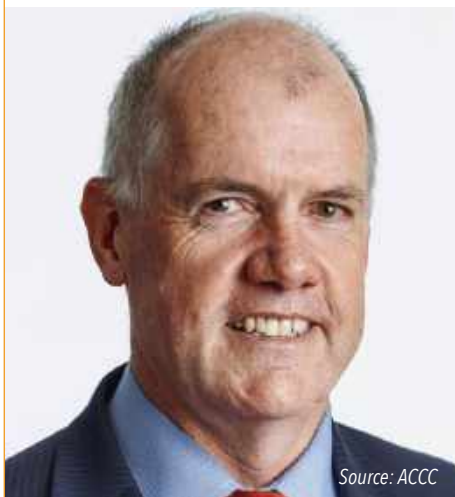
Keogh added that one of the most significant issues is that a range of different bodies oversee water markets in the basin under different legal frameworks. Roles and responsibilities overlap in some areas, while leaving significant gaps in others.

"The basin's water markets, and the bodies that oversee and interact with them, operate in a complex, fragmented and inconsistent system," Keogh said. "To make real and lasting improvements, we need to rethink how these water markets are governed."

According to the federal government's Murray-Darling Basin Authority, water allocations and entitlements (see box opposite) vary from state to state, meaning some entitlement holders can have an allocation, while others have little to none. The percentage of water that is allocated and not ▶

REPORTING IN

ACCC deputy chair Mick Keogh said regulation of the Murray-Darling Basin trading market was "overly fragmented or complex".



Source: ACCC

used varies from year to year, and depends on climate conditions, rainfall, trade, infrastructure development, and individual business decisions.

The government's response

Treasurer Josh Frydenberg, who directed the ACCC to undertake the inquiry in August 2019, and federal water minister Keith Pitt both welcomed the report, but would not confirm if they support a federal takeover of the management of the water market. But so scathing has the criticism been for the current set-up, both from the ACCC and the federal opposition, that it is likely there will be pressure applied on the government to act upon the findings and impose tighter controls.

Opposition water industry spokesperson Terri Dwyer said it was clear from the findings of the report that the government's current approach is deficient, and lacks transparency and integrity.

That lack of transparency was also alluded to by the ACCC in its report. The document notes that different record-keeping by different states and trade processes means that participants cannot get a full, timely or accurate picture of water trading, adding that the same information is not available to all water market participants.

Tim Goodes, executive director of basin plan regulation at the Murray-Darling Basin Authority, welcomed the report's findings. "This inquiry is the first of its kind in the Murray-Darling Basin, and the ACCC's interim findings deserve the full and considered attention of water managers, market regulators and participants in water trade more generally," he said in a statement. "It is clear that efforts to increase transparency and improve the regulation of water trading in the Basin need to keep pace with the market's increasing sophistication."

Trade in the basin's water market now

DOWN TO EARTH

Aither director Chris Olszak said that regulation of the water market needs to be more closely linked to the region's physical water footprint.



Source: Aither

averages A\$2 billion (US\$1.4 billion) a year, and over the past ten years it has become a key issue for farm enterprises managing their business. As trade activity grows, Goodes said it is vital to ensure that market processes within and across state jurisdictions are transparent and open, as required by the Basin Plan.

The call for transparency

Chris Olszak, director of water policy advisory firm Aither, told GWI that a number of questions remain about what fundamental reforms to the governance and market architecture will end up looking like, and who would pay for them.

"We need to know what the specifics are, what are the costs and benefits, and who's going to pay for the changes. There

are a lot of questions that still need to be resolved," he said.

Olszak added that the government has a key role in setting policies to make sure that the water market is well linked to the underlying hydrology of the system and the operation of rivers.

"We're talking about a financial market, but it operates within a large river system that covers three states and requires a lot of government oversight," he noted.

While the ACCC stopped short of saying there had been market manipulation of water pricing, it also said that that would be hard to identify if it were taking place, given the fact that there are very few rules in place to prevent market manipulation or similar conduct, and no regulator has been charged with monitoring trading behaviour in water markets.

There have also been calls from some market participants for a return to the system where water was tied to land, with only limited trade between water users, thus excluding investment firms altogether, but this idea was rejected by the ACCC, which argued that such a move would prevent water users from accessing the benefits that markets provide, and the value of water entitlements would be greatly diminished.

Olszak said one of the quick wins that could be achieved relates to trade data and the quality, accuracy, timeliness and verification of that data, ensuring that there is more descriptive information around any trade that comes through, particularly ones that are not reflective of the prevailing market. "Being able to provide that information in real time to the market will give the market confidence about the prices. To really tidy that up is simply a matter of changing the forms and the systems that support the trade processing."

What comes next?

The government has yet to declare which of the ACCC's recommendations it intends to implement, but it is clear that there is a strong appetite in the market for an overhaul of the current system in order to deliver greater clarity and transparency over water trades.

With the ACCC saying that major changes are needed to allow for "open, fair and efficient water trading that benefits water users, communities and the economy", reform is considered increasingly likely. The ACCC has called for feedback on the preliminary conclusions and options outlined in the interim report in order to assist in the preparation of its final report, which will be submitted to the treasurer in November. ■

How does Australia's water rights trading market work?

The water trading market in the Murray-Darling Basin is worth around A\$2 billion a year. The majority of the water traded is surface water, but groundwater also makes up a small proportion of trades. Irrigated agriculture in the basin – which spreads over the states of New South Wales, Queensland, South Australia, and Victoria – accounts for 60% of Australia's entire water consumption.

Trading allows water users to buy and sell water to meet their individual needs, with the aim of ensuring that water is made available for the highest-value

uses. It has also created a distinct class of financial investment.

Water trades are split into two types – permanent (entitlements) and temporary (allocations). Permanent trade is when a water entitlement holder sells that entitlement to another party, whereas temporary trade is when a rights holder sells all or part of their allocation in a season, according to their requirements at that time.

There are over 150 classes of water entitlement in the basin, adding to the complexity of the current set-up. ■

NEW ZEALAND WATER REFORM

Cities win out in NZ investment allocation

The country has revealed how its \$500 million investment into the water sector will be divided up, with metropolitan councils seeing the greatest benefit. Rural councils, however, could benefit more from the associated consolidation efforts.

The funding allocations for a new investment commitment to New Zealand's water sector look likely to benefit cities more than the rural councils that are most in need of cash. The prospect of additional money may still be enough for local authorities to sign up for the connected reforms.

New Zealand's government has revealed the planned allocations of its NZ\$761 million (US\$500 million) investment programme in the water sector. The catch is that local authorities responsible for water and wastewater services who want to get their hands on the money must agree to the first steps of a reform process ultimately targeting utility consolidation (see *GWJ July 2020, p37*).

Under the allocations revealed in early August, each local council or territorial authority has its own allocation (assuming it agrees to explore government reforms), while regions – which represent the top tier of local government above local councils – will additionally receive a second pot of money to divide as they see fit, as long as two thirds of their local authorities agree to the reform programme.

The allocations have been made based on population and land area, with the biggest total shares secured by Canterbury region, with NZ\$100 million (US\$65.6 million), Waikato region, with NZ\$66.61 million (US\$43.7 million), and Wellington region, with NZ\$59.8 million (US\$39.2 million). In terms of individual councils, the biggest allocations are planned for Christchurch City, Wellington City, and the four councils of Hawke's Bay. However, the cost of infrastructure upgrades remains more challenging for smaller rural councils with fewer ratepayers. An industry source commented to *GWJ* that it is still likely that councils – unwilling to turn down money during COVID-19 – will sign, given the additional regional funding on offer and the prospect of a bigger second funding tranche.

In addition to signing a memorandum of understanding by 31 August to consider the possibility of multi-regional water service providers, councils must also sign a funding agreement and provide a draft delivery plan outlining proposed projects by 30 September in order to receive their allocations. Water and wastewater works

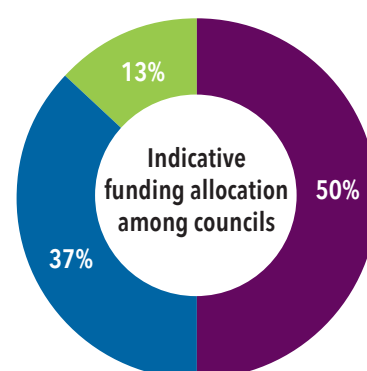
will take priority over stormwater, but funding can be used for both capital and operating expenditure.

Hawke's Bay will receive a total of NZ\$50 million (US\$32.8 million) in funding – more than it was set to be given under the allocation system – as the region has already explored reforms. The region was the site of the 2016 Havelock North campylobacter outbreak that spurred on the regulatory reforms connected to the push for consolidation. Meanwhile, Auckland, where utility Watercare is providing services, has not been mentioned in the initial allocation, and additional discussions will be held before further steps are taken. Watercare has, however, separately received money for water and wastewater upgrades under the government's 'shovel-ready' infrastructure funding programme.

NZ\$30 million (US\$19.7 million) will go towards non-council rural drinking water supply, and it is also understood NZ\$51 million (US\$33.5 million) will go to Taumata Arowai, the country's new water regulator, expected to become operational in mid-2021. Around NZ\$149 million (US\$97.4 million) remains unallocated. ■

MORE FOR THE METRO

New Zealand's metropolitan councils could get the biggest share of new funding, but rural councils are in even greater need of reform.



- Rural councils
- Provincial councils
- Metropolitan councils

Source: Department of Internal Affairs

REGIONAL FLOWS OF MONEY

New Zealand's regions have received their first funding allocations under the government's water sector reform programme. Auckland has yet to be included in the scheme.

Region	Numbers of councils/ territorial authorities	Total allocation (local + regional)
Northland	3	NZ\$28.26m (US\$18.5m)
Waikato	10	NZ\$66.61m (US\$43.7m)
Bay of Plenty	6	NZ\$42.23m (US\$27.7m)
Gisborne	1	NZ\$11.04m (US\$7.2m)
Hawke's Bay	4	NZ\$50m (US\$32.8m)
Taranaki	3	NZ\$17.89m (US\$11.7m)
Manawatū-Whanganui	7	NZ\$40.54m (US\$26.6m)
Wellington	8	NZ\$59.80m (US\$39.2m)
Tasman-Nelson-Marlborough	3	NZ\$28.02m (US\$18.4m)
West Coast	3	NZ\$15.25m (US\$10m)
Canterbury	11	NZ\$100m (US\$65.6m)
Otago	4	NZ\$41.20m (US\$27m)
Southland	3	NZ\$22.31m (US\$14.6m)

Source: Department of Internal Affairs

TECHNOLOGY TRENDS IN INDIA

Stiff new conditions for groundwater access in India speed up shift to technology

An attempt to limit use of the country's overstretched groundwater resources has created uncertainty for industrial projects expecting to rely on groundwater supplies, but could accelerate the uptake of high-recovery treatment technologies.

A new order by Indian environmental watchdog the National Green Tribunal (NGT) on groundwater access conditions has raised concerns about water availability for industrial and commercial use, and may accelerate technology adoption as projects seek alternative solutions.

The NGT passed an order last month that no permission can be given for commercial usage of groundwater without an environmental impact assessment, creating an uncertain scenario and potential delays for thousands of pending applications.

Additionally, the Central Groundwater Authority, the regulatory authority granting withdrawal permissions, known as no-objection certificates (NOCs), has put on hold all applications for new permissions for projects in areas categorised as over-exploited, critical or semi-critical from a groundwater availability standpoint. GWI also understands that even in areas with

more secure resources, the authority will be cautious granting permissions. NOCs are required for all withdrawals for industrial, infrastructure, commercial or residential purposes, with withdrawal limits imposed based on the quantity of planned recharge into the ground.

A senior source in the industry told GWI that having environmental impact assessments for commercial use of groundwater is a positive move, and will ensure better early-stage planning across different water sources. For planned industrial and commercial projects, the order's potential to delay all new withdrawal applications for the near future is expected to give further impetus to high-recovery water technologies as well as reuse technologies, a trend already visible in the last decade.

The NGT order also recommends that industries reduce water consumption by reusing treated wastewater, thereby reduc-

ing groundwater demand. Currently, a significant proportion of small- and medium-sized industrial facilities, commercial institutions such as hotels and hospitals and residential townships – typically with less than 300m³/d of raw water demand – rely on groundwater supplies. Groundwater is also used as a fallback measure to augment water requirements during seasonal variations in availability.

The increased use of high-recovery water technologies like multi-stage reverse osmosis across various industries has previously been led by food & beverage, which has struggled with groundwater scarcity during the industry's peak summer season. High-recovery technologies also create reject water requiring use of thermal zero liquid discharge (ZLD) technologies to meet discharge standards, which could create a knock-on demand for ZLD.

The NGT has also observed that conditions attached to NOCs granted in the past have not been effectively monitored, and it has now ordered that groundwater withdrawal be monitored with digital flow meters. Groundwater withdrawal will also be subject to third party audits, with stringent actions including prosecution and blacklisting on account of audit failures. Further, the NGT recommended additional conditions for withdrawal applications of 5,000m³/d or above, including detailed estimations of water availability.

India's groundwater withdrawal levels are the highest in the world, accounting for 25% of global groundwater withdrawal, although agriculture is responsible for the great majority of the country's groundwater consumption. The government's policy thinktank NITI Aayog painted a dire picture last year with its comprehensive water management index indicating that groundwater levels were decreasing in 54% of India's wells and that most states have not built infrastructure to recharge groundwater wells. A 2017 assessment also found 36% of India's groundwater wells are located in areas categorised as overexploited, critical or semi-critical. Such areas also make up over 80% of certain states like Punjab, Haryana and Rajasthan. ■

WATER WITHDRAWALS ON HOLD

Industrial and commercial projects in India are turning towards technology following a move which could limit their access to groundwater supplies. In states like Punjab, Haryana and Rajasthan, where groundwater resources are overexploited, most applications for new withdrawal permissions have been put on hold.



Source: Shutterstock

THAI WATER RESOURCES

Thailand revises plan for water resources management amid climate change pressure

Thailand is taking stock of its water resources in preparation for coming dry seasons and increased demand. GWI discussed the key challenges and solutions with the country's top water agency.

As climate change is increasingly straining water resources in Thailand, a multipronged water management strategy could present new opportunities in water transmission, non-revenue water (NRW) reduction and alternative water supply solutions.

After an arid first half of 2020, Thailand's central water agency, the Office of the National Water Resources (ONWR) is now using the respite of the rainy season to have a water management rethink which it hopes will achieve improved water allocation and distribution, increased efficiency and reduced reliance on surface water.

Dr Somkiat Prajamwong, secretary-general of the ONWR told GWI that due to drought for a couple of years, the agency is having to revise all the procedures of water management during the current monsoon season. "We have to prepare the plan until the next dry season, so I think the water management all year around has changed. [It is] not like only six months, we have to plan for all year round," Dr Somkiat told GWI.

ONWR, formed in 2017, is a key part of the country's water strategy alongside a new water law and a water masterplan covering the period 2018 to 2037. The agency's expected budget has been reduced due to the need to redirect money towards COVID-19, but the government may try to propose a loan for water activities in the long term as the sector is still a priority.

First of all, the demand side as well as the supply side requires work. "We have to decrease the demand and also increase the efficient use of water," Dr Somkiat said. With distribution systems currently experiencing up to 30% losses in the Eastern Economic Corridor and varying levels of losses elsewhere in the country, there is room for work on the NRW reduction side.

Reaching out to the public about storing water as much as possible during the rainy season will also be a key part of the strategy, but has been made harder by COVID-19 as face-to-face consultations have had to be suspended.

On the supply side, meanwhile, the challenge is to balance requirements from

PLANNING FOR ALL SEASONS

Dr Somkiat Prajamwong, head of Thailand's Office of the National Water Resources (ONWR) is overseeing a new year-round water management strategy in the face of increasing demand and unevenly distributed resources.



Source: ONWR

municipalities, industry, tourism, and agriculture, with resources not always evenly distributed. "We have [had] some insufficient rainfall, around 10% less than usual, but when we think about the distribution of the rainfall some areas have probably seen 40% less compared to the average rainfall," Dr Somkiat told GWI. To address this, ONWR wants to pump water from downstream into upstream reservoirs which have seen less rain, as despite the high associated energy costs there may no longer be a cheaper option. Planned projects under the country's water masterplan also include several water transmission projects and distribution systems.

Another recent development facilitating allocation is managing water by the river basin, with Thailand introducing new river basin committees this year. "This is the first year we are trying to encourage all the basin committees to formulate a seasonal water allocation plan, so they know how much [water they need] and where they can get the water," Dr Somkiat said, explaining that if the demand is more than this, they

have to request water through a mechanism of the basin committees.

In Thailand's industrial flagship area, the Eastern Economic Corridor, demand is likely to outstrip supply in 20 years' time. "We believe that demand will be increased up to almost 3 billion m³ per year," Dr Somkiat explained, an increase of around 600 million m³ from current levels. Additionally, 200 million m³ in water reserves will be required for the area.

While new storage dams are planned, some may not be possible to construct due to economic and social impacts. This will require a shift towards wastewater reuse and desalination to replace some of the surface water, with major efforts towards encouraging reuse already underway and studies ongoing for a potential desalination plant (see *GWJ* June 2020, p34). Dr Somkiat said that on the reuse side, there has to be a discussion on the municipal side too, with cities like Pattaya generating large amounts of wastewater. The possibility of using groundwater resources for drinking water in the region is also being explored. ■

COMMENT

Why are Asian water stocks too spicy for global ETF managers?

Exchange-traded funds are increasingly picking up on water as a defensive move in the current climate. Charles Bodhi looks at why they are steering clear of Asia.

I recently got to talk to an exchange-traded fund (ETF) investment strategist working for a major international bank specialising in infrastructure funds, and could not resist asking him what he thought of the water sector today, amidst the mayhem that COVID-19 has wrought on us all. For the uninitiated, an ETF is an investment instrument that tracks the gains and losses of a basket of what are usually stocks traded on public capital markets. Each ETF usually has a theme, like stocks of a certain value listed on a certain exchange, or stocks of companies that are active in certain sectors. What intrigued me was the view he gave, centred essentially on water ETFs today.

To be clear, while water is one of the most coveted and ubiquitous commodities in the world, its pricing is woefully irrational, in that it is often subject more to political and social drivers than economic ones. Also, insofar as most of the growth opportunities are in Asia, and are themselves subject to geopolitical and socio-political risks that are higher than in the developed world, water projects in these markets which tend to take years to develop come with significant risks and rewards. As such, some water ETFs seek to provide exposure to investors through companies either involved in the treatment and distribution of water directly, or in the upstream activity of building solutions that are in turn used by contractors to execute on the project in question.

How, then, should one view this class of assets, especially if one were still a believer in the Asian growth story? He made it clear that as an essential commodity, water ETFs are often used as a defensive position, to diversify against riskier assets one might otherwise hold.

But to the extent that future water scarcity becomes a growing threat, these ETFs could be a significant offensive play as well.

Without a doubt, the water ETF sector is niche, and if one excludes the exotic alternatives like inverse and leveraged ETFs, those below \$50 million

in asset value, and finally those that invest in water rights as a commodity, there is but a handful of such funds left that one could evaluate. Interestingly enough, the strategist made clear that one should avoid looking at firms that hold water rights as a commodity, in view of the risks I had warned of above. From sheer fund performance alone, comparing results over the year to date (which means the immediate impact of COVID-19 has been taken into account), the top three water ETFs he listed are the First Trust Water Index Fund (FIW) (1% growth), Invesco Water Resources (PHO) (0.55% growth) and Invesco S&P Global Water Index (CGW) (0.25% growth).

FIW and PHO invest in US stocks, focusing on companies in the potable water and wastewater industry, though PHO looks not just at water utilities, but also water equipment and materials companies, which means there is exposure to Asia, where these latter companies often have significant business operations and investments. CGW looks at both American and European firms, though like PHO, it takes a broad approach across various parts of the water value chain beyond just utilities.

I took away two observations from this: first, that the best performers have barely moved from pre-COVID days, when other sectors like industrials and energy remain down, while technology has gone up. This might echo the strategist's sentiment that water is defensive (if one were effective at picking the right counters) since these companies have recovered somewhat. Second, no Asian companies are represented in these ETFs. This corroborates my earlier statement, that operating a water company in Asia is challenging and rarely defensive or safe. The home countries of the components of the three best-performing water ETFs make this clear. For those that want to play in Asian water but still want their shirts on their backs, doing so through a larger US- or Europe-based firm that has interests in Asia would probably still be the best way to go. ■

ASIA PACIFIC IN BRIEF

- Singaporean project developer **Darco Water** has cancelled its proposed acquisition of 90% of Vietnamese Can Giuoc Water Works initiated in 2017, after determining the target's projects were not commercially viable. The company subsequently issued a letter of demand for financial compensation to its former managing director Thye Kim Meng in relation to material losses from the Can Giuoc acquisition and a separate solar project.

- A court hearing for an application to put troubled project developer **Hyflux** under judicial management by an independent manager has been scheduled for 14 October.

- The government of New South Wales in Australia has approved the state's first green hydrogen production facility, using potable water from the city's grid. Australia's water sector has been tipped as a key growth market for hydrogen production.

- Listed decentralised solutions specialist **Fluence** announced it had achieved positive operating cashflow in Q2, but the shares still closed down 7.5% on project delays in Mexico and Ivory Coast.

- Shares in fellow ASX-listed company **Phoslock** also closed down on delays to its Chinese water remediation projects due to flooding, although they jumped up again dramatically in mid-August on thin trading and negligible newsflow.

- Meanwhile, shares in industrial water technology and metals recovery specialist **Clean TeQ** closed down 22% on an expected write-down on its Sunrise mining project.

- Malaysian utility conglomerate **Ranhill** made a move for the BOT market in Indonesia by taking over the lead role of **Maynilad** and **Metro Pacific Water** in the project initiator consortium – which will have an advantage in an eventual tender process – for the Djuanda water supply project.

- Indian VA Tech **Wabag** divested its 70% stake in Bahrain-based subsidiary Wabag Operation & Maintenance. ■

WATER RECYCLING PPPS

Private partners wanted to sell Saudi Arabia's sewage

The Kingdom is leaning on external investors to market and sell the ocean of recycled water being produced. It will require a big step up in the private sector's appetite for risk.

Saudi Arabia is planning a revolution in the way it manages water recycling, by enlisting the private sector to help market and distribute treated wastewater as the country looks to hit ambitious water reuse targets from a near-standing start.

Under the new plans outlined by central water privatisation body, the Saudi Water Partnership Company (SWPC), this month, privately owned companies will buy treated sewage effluent from state-owned and independent wastewater treatment plants and sell it to agricultural and industrial users. Long-term supply agreements with end-users will be used to repay the up-front costs of storage and distribution infrastructure borne by the private bodies.

To set the stage for a move the country hopes will take reuse levels from less than 20% today to 95% by 2030, water authorities have announced major programmes to invest in wastewater treatment facilities, while beefing up the regulatory environment to make treated effluent a more appealing alternative to natural or desalinated water sources in the Kingdom.

However, there is still a significant level of apprehension from the private sector over the risk profile of the country's plans – a situation the SWPC hopes will change as more details of the programme are outlined.

The big plan

As part of its Vision 2030 national development plan, Saudi Arabia has committed to seeing 95% of treated wastewater reused by the end of the decade. As things stand, this leaves a huge gap to be bridged in terms of finding users for the recycled water. Currently, some 5 million m³/d of treated wastewater is produced at sewage treatment plants in the country, of which just 17-18% is reused. With a wave of new treatment plants coming online in the near future, the amount of treated wastewater produced is set to rise to 8 million m³/d, meaning a vast quantity of water will be available, if end-users can be found.

Under the SWPC's new plans, private special purpose vehicles will be created by private sector partners, which will be

linked to specific wastewater treatment plants, and will have the responsibility of sourcing customers for the recycled water, signing a long-term supply agreement with these end-users and then meeting the cost of building and operating the infrastructure to supply wastewater to the customers (see chart below).

The main target for treated wastewater is expected to be agricultural customers, although the SWPC said that industrial purposes such as mining would also suit the reused water. It has lined up half a dozen pilot programmes for the process, and has provisionally identified offtakers for treated wastewater. Its aim is to tender contracts to the private sector on a competitive basis, with the distribution licence awarded to the team that can promise the highest margin.

SWPC water management lead Omar Alayoubi told GWI that while it was possible that end-users themselves could invest

This month in the Middle East and Africa:

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in the recycled water vehicles, he expects water project developers to take the lead in the initial stages.

"If we consider the water developers and the agricultural developers we might end up with an SPV that will contain both of them," he said. "There may be a lead role for the water companies or the end users in the long term, but we believe in the short term the lead will be taken by the water industry because of the need to arrange EPC and O&M of infrastructure."

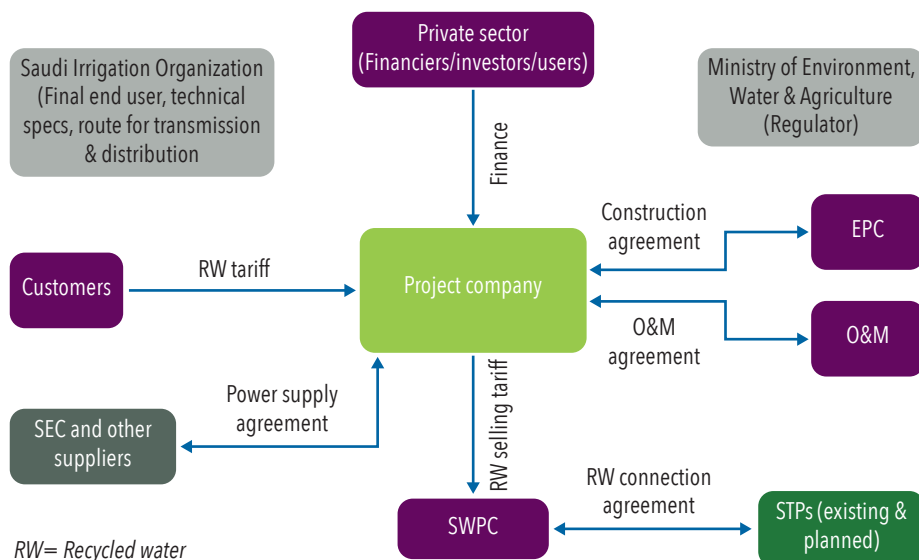
The regulatory environment

While both the availability of treated wastewater and the existence of demand for it in an increasingly arid country are undeniable, the main issue facing the expansion in the use of treated wastewater is the difficulty of making a commercial case for farms and industries to use it.

While the cost of producing treated wastewater is lower than the cost of ▶

GETTING THE PRIVATE SECTOR TO SELL WASTEWATER

The SWPC's plans for creating private wastewater reuse vehicles resemble the structure of independent desalination and wastewater treatment plants. Their success will rest on finding a sufficient price from customers for treated wastewater that will cover the cost of constructing and operating distribution assets, as well as a profit margin, plus a further margin paid to the SWPC to acquire wastewater in the first place.



Source: SWPC

desalinating seawater, the fact that it cannot be added to potable water distribution networks means a significant outlay on distribution will be required. Meanwhile, a lack of regulation and oversight of groundwater usage has meant that natural water resources are often essentially free in the Kingdom, making commercially produced sources of water a luxury option.

"We are not considering this like a water tariff," Alayoubi said. "We are considering the cost of investment and the payments required. It's not going to be regulated like a water tariff – the price might be different in Dammam compared to Khobar or Medina."

Instead, the plan will rest on the regulatory environment created by the recently introduced water law. Confirmed by royal order at the start of July, the law stipulates that all surface and groundwater resources are now public property, and can only be used by acquiring a licence from the country's Ministry of Environment, Water and Agriculture. Licences are non-transferable, and breaking the rules could result in a fine of up to SAR20 million (\$5.3 million).

There are also certain categories of agriculture – such as water-intensive crops like wheat and alfalfa – that can only be watered using treated wastewater under the new regulations. The phasing out of alfalfa production in recent years in Saudi Arabia helped ease the country's water deficit, but this has led industries to invest in overseas production, resulting in extra costs and a greater carbon footprint.

Meanwhile, the plans to increase the usage of treated wastewater have been spurred by major investment into the production and quality of treated effluent. Last month, the country's water and wastewater utility, the National Water Company, revealed plans to upgrade effluent quality at its portfolio of treatment plants through long-term operations agreements with private investors (see *GWJ July 2020, p42*). The SWPC has made tertiary-treated effluent a key stipulation at the new privately financed independent sewage treatment plants (ISTPs) it has procured.

Risk and reward

As well as pushing toward the Kingdom's vision for water reuse, the programme is also aimed at spurring private investors to take a greater share of the risk in developing new infrastructure.

Without a sovereign guarantee on income – or even a fixed customer base – investors in the reuse scheme will be taking a much higher proportion of business risk than is the case for the project finance-

“So far in the PPP process we haven't had a clear approval or consensus from the private sector that they are willing to take this risk ... we want someone who can take things forward, not only taking the technical risk but the commercial risk too.

Amer Alrajiba, SWPC

backed greenfield plant contracts that have comprised the largest part of the Saudi PPP programme so far.

Sources at the SWPC told GWI that they feel that while the process of getting private investors to support the funding of new desalination and wastewater treatment plants had been a major success, private investors could take a more active role in developing new business as well as just meeting the capital cost of investment.

"At the moment, the private sector is still in its comfort zone," said Amer Alrajiba, the SWPC's VP for capacity planning and analysis. "The private partner takes the project and has a government guarantee; the equity is guaranteed, the price is guaranteed, and the private sector is taking no risk.

"In these projects we are trying to push the private sector to take on the risk for the marketing and selling of the product to a

third-party customer. This will mean their revenue and profit will depend on how good things are on the marketing side."

In a strategy call with the agency earlier this month, some leading private sector investors expressed concerns over the level of risk attached to the initiative, saying that without any state involvement in guaranteeing revenue flow – or taking on equity in the reuse vehicles – the government would have no "skin in the game".

However, Alrajiba said this was a deliberate move. "So far in the PPP process, we haven't had a clear approval or consensus from the private sector that they are willing to take this risk. They are willing to build and develop pipelines if they are guaranteed revenue, but this is not what we want – we want someone who can take things forward, not only taking the technical risk, but the commercial risk, too." ■

RETAIL INVESTORS

Kuwait IWPP investors rush to sell as plant makes stock exchange debut

When trading kicked off at 400% of the IPO price earlier this month, many retail investors chose to cash in.

Nearly 5,000 trades were made on the first day after Kuwait's inaugural private power and water project debuted on the country's stock exchange, as stockholders looked to cash in on the surging share price.

550 million shares in the Az-Zour North 1 independent water and power project (representing a 50% stake) were allocated among 127,000 Kuwaiti citizens at a nominal price of 100 fils in December last year.

The opening of trading on the Boursa Kuwait at 400 fils on 16 August saw a rush to sell, with shares worth KWD21.8 million (\$71.4 million) changing hands on the opening day. The price rose to nearly 500 fils before settling to close at 371 fils at the end of the day.

A message on the home page of the Kuwaiti stock exchange urged holders looking to sell to remember distancing rules, and to contact brokers rather than turning up to the exchange in person.

While the IPO was restricted to Kuwaiti citizens as the authorities looked to distribute the state's holding in the public-private project to the population, the shares are understood to be particularly appealing to institutional investors thanks to predictable cashflows and predictable demand and availability levels.

This was boosted by the announcement from the plant's project company, Shamal Az-Zour Al Oula, that it would be paying a 25 fil-per-share cash dividend to shareholders based on pre-flotation earnings. ■

WATER INVESTMENT

Taqa eyes up new desal investment options

The state-owned Abu Dhabi energy and utility giant is shifting its focus toward water and power after international energy markets proved to be too unreliable. It could mark the revival of a desalination investment plan first floated in 2013.

Listed Abu Dhabi utility body Taqa has hinted at a return to an international water investment programme, after outlining a new company strategy in the wake of its AED200 billion (\$55 billion) asset consolidation move.

In its new “Strategy Direction” document released at the start of August, Taqa said it is evaluating the options for investment into water and power assets outside its home market.

In the document, Taqa points towards rising demand for renewables-driven power generation and membrane desalination in the Middle East and Africa region as a potential target for investment. It said that demand for membrane desalination in the region is set to grow by more than 5% a year.

It could mark a return of the company’s ambitions to become a greenfield water project developer. In late 2013, Taqa made a play to use its significant financial backing to invest in new water desalination assets, appointing a new VP for water business

development, and hiring Acciona’s Alejandro Jiménez to seek out investment opportunities.

However, a planned flagship project due to be funded by equity from Taqa in the neighbouring emirate of Ajman did not pan out, and the group returned to its energy-dominated expansion plans.

With energy markets proving increasingly unreliable recently, Taqa has shifted its focus back to the more stable business of regulated water and power supply, culminating in the asset deal this year that saw it add the emirate’s entire utility base to the stakes in independent water and power plants that it already held.

Taqa now owns all the power and water production, transmission and distribution infrastructure in Abu Dhabi following the conclusion of its deal with ADPower in July.

Prior to the move, its investment strategy has focused largely on oil & gas exploration and production around the world. This gave the body a wildly unstable revenue base as global energy prices moved. In

its most recent quarterly results, covering the final period before the asset consolidation, the crash in energy revenues pushed the group to an AED205 million (\$55.8 million) Q2 net loss, compared to a profit of AED208 million (\$56.6 million) in the same period last year.

With a more stable asset base, and increased backing from the government (Taqa is now 98.5% state-owned after the listed holding was diluted as part of the ADPower deal), the company could be set for a new phase of expansion focused on water and power markets.

Meanwhile, Taqa is planning a major investment in its own infrastructure network. In the strategy document, it outlined its ambition to ensure than 50% of its water desalination capacity is using more energy-efficient membrane-based technology by 2030.

Currently, 86% of the body’s 900MIGD (4.1 million m³/d) water capacity is generated using thermal desalination processes, which will require replacing. ■

DEVELOPMENT FINANCE

EBRD supports utility liquidity in COVID-hit Morocco

The European development finance agency has provided a €50 million loan to national water utility ONEE to keep services running. Despite a rising tide of utilities struggling to meet payments, the agency insists that budget support will not be a regular practice.

Morocco’s bulk water producer and national utility Office National de l’Electricité et de l’Eau Potable (ONEE) has received a €50 million loan from the European Bank for Reconstruction and Development (EBRD) to address urgent liquidity issues.

Sue Barrett, head of infrastructure for Turkey, Middle East & Africa at the EBRD, told GWI that the loan is part of the bank’s Vital Infrastructure Support Programme (VISP) under its COVID-19 Solidarity Package. “This is a crisis response, and not something that we usually do,” she said. “Our board approved a solidarity package to support our existing clients initially, under a resilience framework with provisions for liquidity support. The VISP was introduced later specifically to support infrastructure.”

According to the Department of State Enterprises and Privatisation (DEPP) at the Ministry of Finance, ONEE suffered monthly losses of MAD442 million (\$47 million) during the three months of lockdown. A number of other state-owned enterprises (SOEs) have also faced significant losses.

Barrett said that after conversations with the Ministry of Finance, they had decided to support ONEE, as well as the national airport company ONDA and the motorways company ADM. “It’s not budget support – it’s targeted liquidity support,” she explained.

For ONEE, Barrett said the shortfall was simply about “not being able to make payments under lockdown. During the crisis, ONEE committed to provide water to all households even if they were not

able to pay. The chances of recovering all of that money are uncertain [...] but they still have obligations to pay their suppliers. They need liquidity to keep the service going.”

The liquidity loan to ONEE is the EBRD’s first under the VISP in Morocco, and Barrett said it had been completed at record speed, with the programme only approved at the end of April. She dismissed the idea that this new form of support signals a change of approach in lending. “The biggest difference is in the use of the proceeds. We still uphold all our usual standards,” she said. “It’s very much a crisis response. The programme will be reviewed later in the year. It will not change us forever, and we continue to develop priority investment projects, albeit more slowly due to the pandemic.” ■

COMMENT

Saudi Arabia needs a stick for reuse, as well as a carrot



The Kingdom is making a brave bet on the free market for its wastewater recycling breakthrough. Tom Scotney wonders whether the regulatory environment is right yet.

Is there really a free market case for wastewater recycling? This seems to be what Saudi Arabia is banking on, with its plans to create a public-private vehicle that will take treated effluent from wastewater treatment plants, find customers for it, and then invest in the infrastructure to supply customers (*see story p36*).

It's a bold move, for sure, particularly when it comes to the complete separation of business between the treatment of effluent and the sale of that treated effluent. The new vehicle will have to market and sell recycled water without itself having direct input on the amount and quality of the recycled water produced.

This on its own might be enough to torpedo a project like this in many places. What makes the prospect different in Saudi Arabia's case is the sheer amount of coordinated planning and investment that is going into wastewater treatment and handling at the moment. There is obviously a strong level of central planning covering both the procuring of new sewage treatment plants by the central water privatisation body, and the upgrading of the currently running treatment plants under the umbrella of the National Water Company. So despite the organisational disconnect between treated effluent producer and vendor, there is still a decent reason to believe that this part of the supply chain can work effectively. What is less clear is how the process at the other end of the reuse business will stack up, financially at least.

As a potential source of water, treated wastewater is generally cheaper to produce than desalinated seawater – the main go-to choice for countries in the Middle East struggling with water shortages. But the fact that the idea of adding treated wastewater straight back into the drinking water system is unpalatable means that the distribution and supply of treated wastewater comes with a far greater cost implication than desal does.

With the Saudi reuse vehicle expected to cover the capital cost of wastewater distribution, the cost of building new pipelines could potentially push up the

price of the product they are offering to a point above that of desalinated water, let alone the cost of natural ground- or surface water supplies.

The Saudi authorities are adamant that there can be a commercial case for the use of treated wastewater that will cover the cost of marketing and distribution. However, it seems increasingly likely that there would need to be a stringent regulatory environment for end-users in place that would offer a stick poking them into taking treated wastewater, rather than relying on the carrot of cost-effectiveness. While some moves have been made recently (*see GWI weekly briefing, 9th July 2020*), it is not yet clear that this kind of environment exists yet.

Water recycling and reuse has to become a more significant part of the resource mix in the region. This is particularly true in larger countries like Saudi Arabia, where the high cost of generating water by desalination is compounded by the cost of transporting water to populations that are often some distance away from the sea.

But high national levels of wastewater reuse often hide the fact that this treated wastewater is being supplied for non-commercial uses such as landscaping for a nominal or zero cost. It's true that it's still better to use recycled water instead of higher-cost desalinated water or scarce natural water resources. But the suspicion is always there that the supply of recycled water is simply increasing overall use – enabling water to be used in places where the alternative would be not to use water at all, rather than replacing the use of desalinated or natural water sources.

To make the private reuse programme a success, Saudi Arabia will have to convince its potential investors that not only are they taking treated wastewater from a rigorously regulated and managed network, but that they are selling it into one as well. The former may have the larger capital cost attached to it, but it's the latter that may prove to be the more difficult part of the plan. ■

MIDDLE EAST IN BRIEF

- The World Bank has issued a request for expressions of interest from consultants to carry out a study of desalination challenges and opportunities in Morocco. The objective is to present a comprehensive overview of the sector to date, and of the role desalination plans play in medium- and long-term planning documents, as well as to identify challenges and potential solutions for bringing in private sector support for government efforts to scale up desalination in the country.

- Two high-profile African executives are understood to have thrown their hats into the ring to succeed Philippe Le Houérou as the next CEO of the International Finance Corporation (IFC). Amongst them are Cameroonian economist and executive secretary of the United Nations Economic Commission for Africa Vera Songwe, and Ivorian financier Thierry Tanoh, who previously worked for the IFC as a vice president responsible for Africa.

- Meanwhile, the IFC is seeking expressions of interest from consultants in developing a pipeline of water and wastewater projects in Morocco. The consultant will need to assess projects across the country and decide which ones may be suitable for financing by the IFC in the near future. It will also need to identify regional needs for advisory and capacity-building in order to deliver the projects.

- The sale process for two major state-owned desalination plants in the Gulf has begun after requests for expressions of interest were launched by Saudi Arabia's Saline Water Conversion Corporation and the Ministry of Electricity and Water in Kuwait. Potential bidders have been asked to submit statements of qualification ahead of taking over ownership of the Ras Al-Khair and North Shuaibah power and water projects, respectively.

- Iran is nearing completion on the first stage of its flagship seawater desalination and transfer scheme. Domestic contractor Sazeh Sazan has confirmed it is close to commissioning the 200,000m³/d first stage of the SAKO desalination plant at Bandar Abbas. ■

WATER SECURITY SOLUTIONS CENTRE

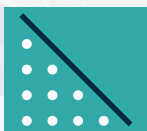
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CTO

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MARKET MAP

What happened to microbial fuel cells?

A technology that was once tipped to have a big impact on wastewater treatment has shown a resurgence in both research and commercial applications. GWI examines the state of the microbial fuel cell market after years in the wilderness.

After initial promise during the last decade turned to disillusionment, shoots of growth for the microbial fuel cell (MFC) in wastewater applications are beginning to emerge. The technology, which can produce electricity during wastewater treatment, continues to be subject of research and development, although it is also now enjoying some early-stage commercial traction in niche applications.

The main stumbling block for MFCs, and the reason that many in the wastewater business are sceptical, is the scalability of the technology. Expensive cathode and membrane materials are still limiting the market, while larger cathodes require structural support that brings additional capital expenditure. This, and the realisation that the technology is unlikely to become a significantly net-energy-positive process, has not stopped some commercial projects coming to light, however.

Modular systems and the treatment of low-volume, high-concentration wastewater have facilitated the installation of a handful of MFC systems, particularly in streams with high organic content – and this is likely to be the technology's main niche for the foreseeable future. MFCs are also being used as a bio-sensor – the purpose for which they were originally proposed – informing users about the microbial health and carbon consumption of a treatment system. The future of the technology depends heavily on further research into reducing the cost of the raw materials. Meanwhile, the microbial electrolysis market is likely to overtake MFCs.

What is a microbial fuel cell?

Microbial fuel cells fall under an umbrella of treatment technologies that use electrogenic bacteria to consume the pollutants in wastewater – a group often coined 'microbi-

al electrochemical technologies'. These bacteria are capable of transferring electrons to electrodes as part of their metabolism, and this process is also the driving force behind microbial electrolysis cells, which, in contrast to MFCs, use an electrical input and produce hydrogen.

MFCs work like any other fuel cell – defined as converting chemical energy into electrical energy using oxidation and reduction reactions. They consist of two chambers – one with an anode and one with a cathode. In microbial fuel cells, the anode accepts electrons from bacterial respiration, and transfers it to the cathode via a wire, creating an electrical current. Although the concept of a fuel cell is not new, an interest in making commercial microbial fuel cell systems for wastewater treatment ramped up in the early 2000s, starting with research teams in South Korea and North America.

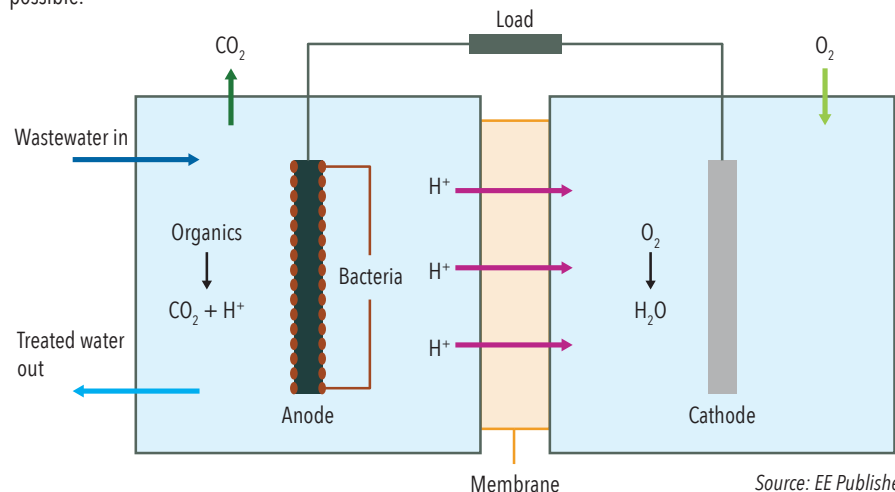
The scaling-up problem

Although the scalability of a system is an issue with any new water or wastewater treatment technology, the MFC has significant barriers in overcoming this issue. Unsurprisingly, the main issue in question is the cost. "When you have an electrode that grows biomass on it, it will cause structural stress on a larger scale installation. You have to have a tremendous amount of other infrastructure in order to support the thing," explained Stantec global lead for wastewater practice Art Umble.

Furthermore, an issue that researchers are trying to address is the cost of the raw materials for the cathode and anode. Although functioning materials have been discovered for fuel cell electrodes – such as graphite fibre and activated carbon – they are hitherto expensive and wear out quickly. Professor of environmental engineering at Pennsylvania State University – and ►

THE INTERNAL WORKINGS

Although MFCs are traditionally dual-chambered, like the one pictured, single-chamber configurations are possible.



key researcher in the field – Bruce Logan estimates that electrode materials below \$100/m² make microbial electrochemical technologies economical.

Some systems also use semi-permeable membranes in order to separate the anaerobic anode chamber and the aerobic cathode chamber. Through it, hydrogen is able to diffuse across whilst keeping the aerobic and anaerobic conditions in each chamber. However, some of the membrane materials can range from \$100-\$1000 per square metre, and building a system with a membrane can also cause the pH of each chamber to deviate from the optimum, killing off any bacteria in the system.

Another obstacle is the produced power density, which has been lower than expected. Although the promise of net positive power in these systems has not yet materialised, the prospect of having reduced operation expenditure and even net-neutral wastewater treatment is still driving the potential for the configuration in the future.

“There’s no economic benefit of the electricity, but there is an economic benefit of using no electricity for the process,” commented Logan. The cost and difficulties faced in commercialising MFCs have been realised in the past, notably by Arb-source, which sold its IP to Microorganic in 2016.

Viability is a mixed bag

Most of today’s research in the modern day focuses on increasing the produced energy density. Renowned Dutch research institute Wetsus is looking into overcoming scalability issues by conducting preliminary research into capacitive bio-anodes – which store electricity and allow the energy generation process to be decoupled from wastewater treatment. Both steps can then be optimised separately. The technology also claims to reduce the clogging and pH gradient issues faced by other MFC pilots. Furthermore, in the research realm, one team at Sichuan University, China, has attempted to create aerobic granular sludge inside an MFC, in order to promote nutrient removal. The team’s initial results seem promising, at least at bench-scale.

However, one of the earliest proponents of the technology, Emefcy (now a part of Fluence) – which started developing the technology in 2008 – decided to shelve the research in pursuit of other, more viable treatment technologies, such as membrane aerated biofilm reactors (MABR) and microbial electrolysis cells.

“We were commercially orientated, as opposed to research groups looking to produce the highest energy density, with no hesitation on cost,” explained CTO Ronen Shechter. The company used a singular spirally wound electrode, and had a number of other low cost, unique features for the sys-

tem that were protected by patents; however, Fluence thought the technology too complex, and ceased the research around 2012.

Emerging commercial success?

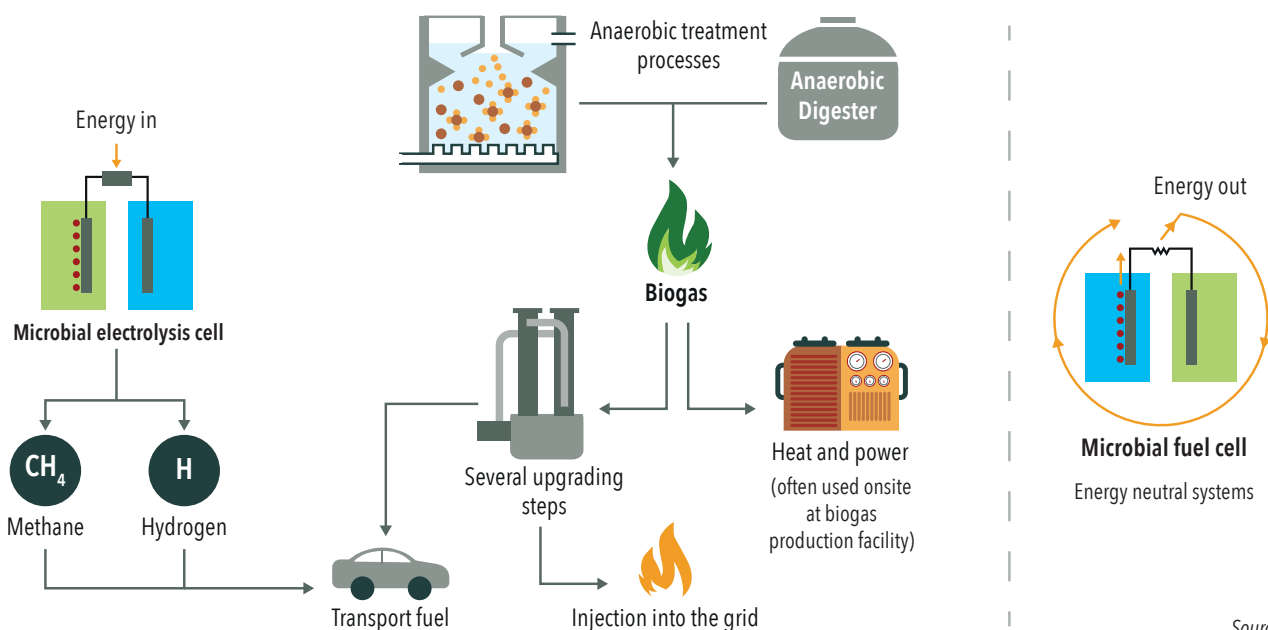
Despite the obstacles experienced, there are a select few technology providers who have taken successful steps towards commercialisation. California-based start-up Aquacycl appears to be leading commercialisation efforts for MFCs, and is targeting its BioElectrochemical Treatment Technology (BETT) for modular, on-site installations. The company has managed to find a niche for the technology in high-strength, low-volume applications – notably with clients in the food & beverage sector – with ideal chemical oxygen demand (COD) loads in the range of 20,000 and 300,000 parts per million (ppm). The system can also cope with total suspended solids of up to 35,000ppm, Aquacycl claims.

“We generally limit the size of the unit to around 600m³/d – that will be several containers – because beyond that it makes more sense for the customer to install an anaerobic digester. At that point you’re processing all of the wastewater from a facility and it will be too dilute,” explained CEO Orianna Bretschger. The company, instead, focuses on separated streams that are generally higher in concentration. “Our sweet spot is 30-60m³/d,” continued Bretschger.

Aquacycl has demonstration units ▶

HOW ELECTROCHEMICAL SYSTEMS FIT INTO THE BIGGER PICTURE

An attractive feature of the MFC is the direct conversion of waste to electricity. In contrast, biogas produced from anaerobic processes often requires complex and expensive cleaning systems to add value. The microbial electrolysis cell has the ability to produce ‘clean’ hydrogen – a fuel which is tipped to become more popular.



Source: GWI

currently active at food & beverage giants AB InBev and Mars, and a commercial unit at Joshua Tree Brewery, California, while it also has activities in off-grid military bases, and a residential system was installed in Tijuana, Mexico in 2016. The technology is scaled-up by stacking many modular units – that are the size of a car battery – into a shipping container. The company has also foregone the use of membranes to separate the two chambers, in order to reduce the cost of replacement and cleaning.

Although the aforementioned technological limitations associated with energy production are widely known in the MFC world, this is not limiting Aquacycl's activities. The company is not marketing its technology to be 'net positive' energy, however it does aim for net neutral. "Our customers don't seem to care about net positive energy, as the waste streams we're treating can't be done by any other technology," commented Bretschger. Although Aquacycl appears to be showing initial traction, some are sceptical of its design and the robustness of the cathodes.

New York-based Microrganic meanwhile started trying to bring the MFC to market over four years ago, and is currently running pilots of its VIVA product at a brewery, as well as a municipal wastewater treatment plant in Massachusetts. The latter project, which is sponsored by the Massachusetts Clean Energy Center, has been running for just over a year – however the results from it showed that the company needed to re-design in order to commercially deploy its VIVA modules. Microrganic is also currently testing performance on

nitrogen removal in this municipal setting – and is currently finding that the system removes 35-40% of the nitrogen load in the tested wastewater stream.

The company calculates that the treatment plant in this pilot, if installed at a larger scale, could save 85-90% of the energy used in its secondary treatment, and the system also has the potential to produce 50-80MWh.

Microrganic is also taking advantage of a modular design in order to overcome the issues faced when scaling the MFCs. However, the company is currently making cathodes 20-40 times larger than Aquacycl's, and argues that its cathode manufacturing method is highly cost-effective and likely to provide a market advantage.

It is worth noting that the MFC is also being applied on natural water bodies to remediate sediments from pollutants. In theory, this is an attractive concept because no external power source is needed – but this application also suffers from the same scalability obstacle. However, one company in China – Fengge – has several commercial projects for this application.

Monitoring applications

While MFCs take tentative steps as a treatment technology option, originally the configuration was proposed by research teams in South Korea as a bio-sensor. The patent for this research was originally purchased by Chinese company SDL. When toxic pollutants are introduced to the environment, the activity of the microbes is inhibited – changing the current flowing through the sensor. MFC sensors have also been com-

mercialised by Canadian company Island Water Technologies (IWT), whose Sentry product deciphers the microbial health and activity amid treatment, telling the customer in real-time how much carbon the process biology is consuming.

"Instead of an operator not having an idea about what caused a microbial imbalance, they now have a visual, time-stamped indicator," explained CEO Patrick Kiely, who explained the importance of the accompanying online monitoring platform.

The sensors can be installed at any point throughout the wastewater treatment process, however aeration and nutrient removal are generally the most prioritised locations. IWT has also demonstrated the ability of the system on larger plants, with an installation at Chicago's 4.54 million m³/d Stickney water reclamation plant. Sentry has, furthermore, recently started activities in the drinking water space. The company now has over 50 installations, mostly in North America and the UK, but is increasingly expanding its global reach.

"It's the first real commercialisation of the technology for large volumes of wastewater, and I suspect that we'll see more of that moving forward," commented Umble. Fluence's Shechter also explained to GWI that the sensors are affordable and effective at measuring more directly than other types.

What does the future hold?

Predictions about how MFCs will develop are mixed. "In my opinion, the circular economy will focus on electrification in the future, and if we can get the power densities [of MFCs] up higher then they could be very central to future wastewater treatment," explained Umble. Logan, however, expressed that until a cheaper cathode is available, the market is likely to stay subdued.

"Microbial fuel cells will not be able to compete in the near-term because they require so many components," explained Shechter, who also explained that not all wastewaters are suitable for MFCs without pretreatment. MFCs may find a role in China as part of the move towards self-sustainable WWTPs, although cheap electricity prices there mean MFCs would not currently be profitable.

In the meantime, the microbial electrolysis cell has had more joy thus far. Massachusetts-based Cambrian Innovation has developed an installed base for its EcoVolt reactor in the food & beverage industry, and its recent acquisition of Baswood (see *GWI February 2020*, p28) has expanded its global reach. ■

Terminology

Aerobic granular sludge: sludge that self-flocculates and therefore doesn't need plastic carriers. The flocs have a number of benefits over traditional activated sludge, such as simultaneous nitrification/denitrification and phosphorus removal.

Anode: the electrode placed in the anaerobic side of a microbial fuel cell – where electrogenic bacteria attach and produce protons and electrons by oxidising organic material.

Cathode: the electrode placed in the aerobic side of a microbial fuel cell, where electrons flow to. Reduction of oxygen also takes place here.

Electrode: an electrical conductor that is

put into contact with a non-metallic part of a system.

Microbial electrolysis cell: a system that uses electrogenic bacteria to consume pollutants in wastewater, using an electrical input. The bacteria grow on the anode of the system and produce release electrons and protons, the latter of which are reduced to make useful products such as hydrogen or methane.

Microbial fuel cell: a system that uses electrogenic bacteria to consume pollutants in wastewater. The bacteria grow on or near the anode of the system, which is in an anaerobic chamber of the cell, and transfer electrons to the cathode – which produces an electrical current.

PATENT TRACKER

Turning up the voltage in water innovations

This month sees significant innovation activity for water treatment using electrical fields, particularly attempts to make capacitive deionisation (CDI) become more widespread in water treatment. An example of water's role in ammonia is also unearthed.

ELECTRIC DREAMS

Two innovations this month have proposed new electrode materials to expand the application of capacitive deionisation (CDI) in water treatment. CDI has been one of the more promising emerging technologies for desalting low-salinity waters, but is yet to seriously challenge reverse osmosis in typical brackish water desalination.

While in most CDI systems water flows between the electrodes, two research outfits are exploring electrode materials to enable a flow through (FT) configuration, whereby the feedwater is flowing directly through porous electrodes, enabling a higher desalination rate, but requiring greater feed pressures.

The Lawrence Livermore National Security consortium has proposed the use of carbon aerogel in electrodes for use in CDI systems targeting nitrate removal in groundwater, a growing problem in different parts of the world like the state of California. Carnegie Mellon meanwhile is proposing the use of organic material made up of a "porous plant portion or an architecturally intact expanded viscoelastic plant material", including glutenous products such as bread.

While this research sounds intriguing, it is worth bearing in mind some recent papers

from Yale University, which suggested that system design is more crucial than new electrode materials for energy efficiency in CDI, if it is going to compete with RO in brackish applications.

DISINFECTION IN THE PIPE

New electrodes might also be welcome in the disinfection space. Switching from chlorine in favour of ultraviolet (UV) systems at treatment plants has its challenges. UV does not create an antimicrobial residual for the distribution network to prevent microbial regrowth – chlorine is still typically dosed to provide this.

Use of an electric field could provide an alternative. Researchers at Georgia Tech University are proposing a tubular system composed of electrodes that is fitted within distribution pipes, using a locally enhanced electric field to inactivate biological cells via electroporation. Such a system sounds energy intensive, but the use of copper oxide nanowires can enhance the local electric field by orders of magnitude, enabling cell inactivation with a low voltage. Large-scale installation of this type of system would be slow; it would likely have to be synchronised with pipe replacement plans,

while it would also have to be able to withstand high rates of water flow and pressure.

Nonetheless, it is certainly an interesting idea for the industry to keep a close eye on.

WHY EVEN TREAT WASTEWATER?

There are certainly options to treat ammonia-rich wastewaters generated after sludge digestion, but why bother treating these streams at all? German company EEW Energy from Waste is proposing the use of ammonia-containing wastewater to clean flue gas from boilers in incineration plants. The wastewater would be injected into the flue by means of compressed air in such a way that the wastewater effectively evaporates before the ammonium compounds then clean the flue gas by reducing the nitrogen oxide content.

Not only could incineration plants reduce their reliance on ammonia-based cleaning solutions, but utilities could reduce their wastewater treatment costs too. As well as sludge return liquors, landfill leachate has also been earmarked as a stream with a suitable ammonia content. This is just another example of the role the water sector could potentially play in a future water-energy-food nexus heavily reliant on ammonia.

DISTILLATION FOR THE OILFIELD

Produced water comes in vast quantities and the company treating the most is Saudi Aramco. Cost-effective brine concentration still remains a rare phenomenon, never more so than in the oilfield for treating typically highly saline produced water. Perhaps Saudi Aramco did not fancy many of the technologies currently on the market: it has filed a patent for a hetero-azeotropic distillation process, which could desalinate produced water using less energy than typical thermal technologies. The oil giant is known to be interested in reusing more of its produced water, but a more pressing issue is the amount it spends on energy to pump for disposal; these costs could be brought down significantly if the volume being pumped was reduced. For its heteroazeotropic distillation process, it is claimed that pretreatment for oil emulsions and hydrogen sulphide may also not be required.

BIOLOGICAL DESAL

Maybe Saudi Aramco could also look at what Veolia is doing. The French water giant has proposed a process that involves using naturally present bacteria to remove sodium chloride ►



WATER'S DIGITAL FUTURE

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in seawater, bacteria which can then be washed to regenerate and be used again to desalinate.

MABR FOR SLUDGE?

Earlier this year, GWI ranked membrane-aerated biofilm reactors (MABRs) as the fourth best water technology to

emerge this decade (*see GWI January 2020, p6*), and installations are growing in number. Fluence is now proposing an MABR for aerobic digestion of waste activated sludge. This sludge is typically stabilised either by chemicals addition or by digestion, aerobic or anaerobic. The latter is increasingly

favoured for large volumes of sludge, and brings the benefits of biogas production while consuming next to no energy, although the equipment is expensive. Smaller WWTPs typically rely on aerobic digestion, the energy requirements of which make it cost prohibitive for large volumes. Using an

MABR – energy efficient compared to other aerobic technologies – could change the game, opening up the option of aerobic digestion at larger WWTPs. The promise of reducing nitrogen loads in the sludge centrate returning to the plant is also compelling as nutrient limits continue to tighten. ■

SELECTED PUBLISHED PATENT APPLICATIONS OVER THE LAST MONTH

As well as continued activity in innovation for desalination, other interesting ideas around control of wastewater treatment have also surfaced from Siemens and Triplepoint Environmental, a specialist in lagoons. Waterleau continues to push the envelope on the ageing upflow anaerobic sludge blanket (UASB) technology.

Patent title	Description	Organisation	Patent office	Publication Number
Composite Membranes	Three-dimensional (3D) printing technology where membrane polymer material can be printed directly on the polysulfone substrate	Aqua Membranes	WIPO	WO 2020/154734 A1
Sampling For Monitoring PFAS In Surface Water, Groundwater and Pore Water	Passive sampling of PFAS using sorbents	Battelle Memorial Institution	WIPO	WO 2020/163877 A1
High-Flow Intact Bio-Material Derived Electrode For Use in Capacitive Desalination	Porous electrode structures made from natural materials for use in capacitive deionisation	Carnegie Mellon	WIPO	WO 2020/154720 A1
Method for Purifying Smoke Gas Of A Combustion Boiler and Incineration Plant	Using ammonia-rich wastewater to treat flue gas	EEW Energy from Waste GmbH	DPMA	DE 102019103061
System and Method For Treating Hydrocarbon-Containing Feed Streams	System for treating produced water streams and recover minerals	Enviro Water Minerals	USPTO	US 2020/0239346 A1
Methods For Treating Waste Activated Sludge With A Membrane Aerated Biofilm Reactor	A membrane aerated sludge digester with oxygen-permeable membranes, which support biofilm growth to reduce volatile soluble solids concentration	Fluence Corporation	WIPO	WO 2020/152680 A1
Systems and Methods For Disinfecting Fluids	Locally enhanced electric field treatment for disinfecting water in pipelines	Georgia Tech Research Corp	USPTO	US 2020/0247695 A1
System and Method For Using Ultramicroporous Carbon For The Selective Removal of Nitrate With Capacitive Deionisation	Micron-sized pores enable a flow of water to be pushed through the electrodes while the first plurality of pores form adsorption sites for nitrate molecules	Lawrence Livermore National Security	USPTO	US 2020/0247693 A1
Systems and Methods For Desalinating Aqueous Compositions Through Hetero-Azeotropic Distillation	Forming a hetero-azeotropic mixture with salt water and an entrainer, which is then subjected to distillation lower than the boiling point of water	Saudi Aramco	WIPO	WO 2020/153994 A1
Calibration of a Simulation Model of a Wastewater Treatment Plant	An automated method for determining calibration values for parameters of a simulation model of a wastewater treatment plant	Siemens	EPO	EP 3 693 342 A1
Wastewater Treatment With Independently Controlled Mixing and Aeration	Fine-bubble-producing aeration units and mechanical mixing are independently controlled to regulate degrees of aeration and mixing	Triplepoint Environmental	USPTO	US 2020/0238229 A1
Lamp Sensor Modulation Of A Power Supply	A system and method for modulating the power supply to one or more UV lamps based on monitoring a lamp's condition	Trojan Technologies	WIPO	WO 2020/148597 A1
Biological Process For Desalination of Water	Using non-photosynthetic halotolerant bacteria to treat waters with salinities of between 20,000 and 80,000 ppm sodium chloride	Veolia Water Technologies	INPI	FR 20190000492
Anaerobic Wastewater Purification Tower	A type of UASB with new settlers and feed system, resulting in an Anaerobic High Rate Tower (AHRT)	Waterleau	EPO	EP3689829 A1

Source: DPMA; EPO; INPI; USPTO; WIPO

CTO OUTLOOK

Bringing treatment into the urban fabric

Hungary-based treatment plant provider Organica has a unique back-to-nature approach, well suited to the municipal market. The company's future hunting ground is nations with rapidly growing cities.



ATTILA BODNÁR

Founder & Executive VP of Business Development, Organica

Attila Bodnár is an architect by trade and worked in Europe as an urban planner in the early years of his career, as well as working in the New York metropolitan area. He established Organica with a partner 22 years ago after the realisation that traditional urban wastewater treatment, with huge treatment plants pumping recycled water back to the usage point, can be unsustainable. The company started building treatment plants that could be integrated into the urban fabric of a settlement.

Your key product is a variant on a biological fixed film reactor, but how are you offering a complete solution to customers outside of this?

Our industry participants – such as technology providers, consultants and decision makers – are focused on the details of the fixed film within the biological treatment space. And while those technical details are important, the urbanisation pressures require a broader approach. In today's environment it is not enough to just secure the technical details, all the other issues which arise as you move wastewater treatment into the city also need addressing.

What we see is that municipal decision makers are more open to this broader perspective than water industry experts, because they are in the forefront of trying to solve the broader urbanisation problems. Think about a mayor or a province leader: let's say they are presented with various traditional technologies such as A2O, MBBR, SBR or MBR. We in the industry see these as distinctly different options but to her all of them look and smell the same and are equally repulsive to the neighbours. Our mayor needs a solution which not only treats the water but also fits in the urban fabric – a facility you don't mind living next to.

What are the main elements of your technology strategy in terms of accelerating future growth? What are the key areas you are looking at in your R&D activity and why?

Our fixed film approach is unique, but we actually think about Organica as a full-solution umbrella. There are many evolving technical solutions out there which address various issues, such as pretreatment, biology, aeration, sludge treatment and tertiary treatment. We look at all of those and constantly evaluate which can be integrated into our approach.

Our criteria are simple: we are most interested in everything that contributes to better operational characteristics (lower energy, chemical use, smaller footprint) and preferably lower capex as well. Organica draws up plans for full treatment plants, and generally provides anything from 15-25% of the components for the whole investment.

We also do spend a lot of time in

improving various aspects of our own fixed film system – for example we decided after originally developing the technology that we should add artificial roots to the plant roots, to increase capacity – but we think of ourselves as particularly adept in integrating various new components. It is because over the years, our engineering and execution teams have learnt and refined the art of our overall approach. It requires a high level of integration of various disciplines, so integration sensitivity and skill are deeply entrenched in our culture.

Which driver or market is providing you with the most demand for your solutions?

The most active markets are where the demand drivers are rapid urbanisation and wastewater quality regulations. In many of these markets the urban sprawl has grown to be unmanageable and land value is astronomically high, so finding a solution where you can build a plant in the neighbourhood and on a small footprint becomes very appealing.

We have also developed the unique expertise of being able to upgrade traditional facilities to Organica facilities, which allows treatment to a higher standard in the same footprint. India and some countries in South East Asia satisfy one or both these demand drivers and hence will likely be our prime markets for years to come.

Which of your end markets has the most need for innovative technology solutions?

Although our first few installations as a company were industrial plants, we do focus on the municipal market because we feel that is where the global sustainable issues are the most pressing and because that is where we can have the biggest impact.

We also see an interesting phenomenon: laypeople are more and more interested in the quality of the treated water. As our world gets smaller our awareness of the environment, our desire to know, increases. I see this as increasing need/opportunity for technical innovation but it has to be coupled with a new set of skills: explaining it to the public.

How are you implementing digitisation into your product offering? Could you fill us in ►

“ I am a believer that the water sector needs to incorporate other disciplines - such as architecture, urban planning and psychology - in order to answer pressing sustainability challenges.

Attila Bodnár, Organica

on some details about the operating side of your business?

We see digitalisation as a very important frontier of our activities. We have handed over 15 projects in the past 5 years and have been working closely with numerous operators in a number of countries. What we see is that independent of the technologies they use, many treatment plants are struggling with operational issues. To solve those you need to know what is going on, need to analyse the data stream and this invariably will lead to optimisation opportunities. In other words, we use digitisation as a tool to help operators improve their performance.

The bottom line is improving impact on the environment therefore our digital offering is available for other technologies outside of Organica plants. We are also finding that the introduction of digital is improving compliance with permits in some countries. For example, the Indonesian government recently mandated a roll-out of online monitoring at every wastewater treatment plant, the data from which must be tied into the ministry.

Where are you looking for innovation outside of Organica?

Technical innovation in our industry is extremely time and resource intensive. While we follow many promising developments, we focus on solutions which have passed the pilot scale by speaking with other companies. Anybody who has been involved in tech start-ups in the water space knows how difficult it is to prove your concept in real life operating conditions. With our extensive presence in many countries we can help to test solutions in full scale. But even so we are talking about years of work and lots of resources deployed.

How could the pace or circumstances of the uptake of new technologies in the water sector be improved?

As with many human activities when it comes to our effect on the environment via water sector, it is still shrouded in secrecy. In many countries treatment results are treated as dirty laundry and if shared with the public it is wrapped in technical mumbo-jumbo. As the need in the general

population rises to know and control more, the pressure for incorporating more innovation will rise. So, I think the answer to the question is environmental education. Admittedly this is not a quick fix but it is unavoidable if we are serious about tackling environmental challenges: and innovation in the water sector can help tremendously if the need is there.

How do you think the water market is likely to be affected by the COVID-19 pandemic? What are the activities going on within Organica relating to this?

We see some slowdown across the board. But government and large international finance institution funded projects are

moving along – just slower than usual. Governments are trying to revive the economy, and these projects are at various stages in the pipeline, so pushing them along will produce relatively quick results. The sales cycle in our industry is 2-4 years and we have a very robust pipeline spread across many countries and three continents. So, we are quite optimistic in our outlook despite the short-term challenges.

What do you think will be the game changing technologies in the water sector in the next ten years? What is ripe for disruption?

I am a believer that the water sector needs to incorporate other disciplines – such as architecture, urban planning and psychology – in order to answer increasingly pressing sustainability challenges. If I have to hone-in, however, I see vastly more efficient aeration technologies – as they consume the most energy – and a completely different N cycle. Solutions to tackle emerging contaminants are likely to become more prevalent, as we become more aware of what is in even our treated wastewater. ■

MAKING THE NEIGHBOURS HAPPY

Organica treatment plants integrate botanical elements to produce attractive installations that fit into the urban fabric. The company now has over 100 global references.



Source: Organica

SMART WATER WATCH

Seeing double with the digital twin method

The concept of the digital twin is in the spotlight following a recent uptick in related acquisition activity. GWI examines what it means and what the concept can do for water utilities.

July and August saw geospatial technology firm Trimble and environmental consultancy Envirosuite (*see box, below*) invest in companies promising the concept of a ‘digital twin’ – a platform that provides a virtual representation of a water system. A growing number of vendors boast they can provide a digital twin for utilities. However, amid the hype, it is important to consider what one is and what it can do for the water sector.

“The digital twin is hardly an entity you buy off the shelf. It consists of lots of components and when you put the components together, that’s when you create a digital twin,” explained Gigi Karmous-Edwards, a consultant specialising in digital twins. On the hardware side, these components consist of sensors, actuators, and other physical assets for operating a network or treatment plant. The software side collects data from SCADAs, geographic information systems (GIS), computerised maintenance management systems (CMMS) and more.

The aggregation of these resources produces a model that captures the behaviour of the system. “When you have a calibrated model, it can alert you when there are anomalies to get an insight into where a leak may start happening,” said Karmous-Edwards. “Maybe there’s a pressure differential, maybe there’s a temperature change, maybe something subtle that is normally overlooked but if you have a model that is constantly running it is like having a million sensors because it will calculate the pressure at every point.”

The advantages of this model can be broken down into four key areas: descriptive, diagnostic, predictive and prescriptive. On the descriptive and diagnostic levels, a digital twin can assess the status of the system and how well it is functioning. On the predictive and prescriptive levels, a digital twin can anticipate future events and recommend courses of action.

It is the prescriptive level that yields some of the most exciting potential in digital twins. “Computational advancements will continue to develop and that allows us to integrate more data together, calculate more decision variables across different domains in a shorter time frame,” said Chengzi Chew, business development manager at consultancy firm DHI. “Down

the road we would like to offer an autopilot mode so that this digital twin can take over some night shifts and weekend shifts.”

Though this stage may be far in the future, utilities are increasingly warming to the concept of digital twins. When Karmous-Edwards started the SWAN Digital Twin Work Group in May 2019 to discuss the nature and implementation of digital twin technology, there were about 75 attendees, mainly vendors. At the third workshop held in July 2020 there were 405 attendees, many of them representing utilities.

As more and more digital twins enter the market, developers will be challenged to distinguish their offering. While companies like Watener pride themselves on their intuitive interface, Bentley is experiment-

ing with using virtual reality to visualise assets. Idrica, on the other hand, provides consulting services to help utilities to make the most of their existing digital structures alongside its digital twin ‘GoAigua’.

The challenges of data normalisation – ensuring information from different systems (e.g. CMMS) matches up – and data integration remain the chief barriers to implementation. Karmous-Edwards believes this challenge is not insurmountable, even for the smaller utilities.

“It’s not a matter of budgets completely,” she said. “It really requires leadership to question the way we do things, understand every aspect of each process and put all these pieces together to get the maximum insight from our digital technologies.” ■

SMART WATER WATCH

Envirosuite bets on digital twins

ASX-listed Envirosuite has snapped up fellow Australian software firm AqMB.

Environmental consultancy firm Envirosuite has this month completed the purchase of digital twin developer AqMB for a total consideration of A\$1.35 million (US\$980,000). AqMB, founded in 2014, provides a user-friendly, cloud-based process modelling platform.

Envirosuite’s exposure to the water sector has thus far been principally related to proactive odour management for WWTPs, but this acquisition marks the firm’s first foray into modelling water or wastewater. For Envirosuite, the chief attraction of this technology is its potential to simultaneously boost efficiency and promote sustainability. “We are an environmental technology business but the products that are most successful deliver operational gains as well,” said Chaim Kolominskas, Envirosuite’s global head of water and waste.

While digital twins are often used in water networks, they can also be applied to water and wastewater treatment processes, as AqMB’s platform is. “What makes AqMB different is it has a unique combination of both deterministic modelling and machine learning,” explained

Kolominskas. “The deterministic modelling is based on the physical principles behind the treatment processes but AqMB can apply that model in real time in combination with machine learning to forecast issues and choose the best approach for the performance of the system on a day to day basis.”

Another draw of AqMB’s platform is that it is widely applicable. “It covers water treatment, biological wastewater treatment, chemical treatment, industrial processes, and desalination so it’s very broad in comparison to other products on the market,” said Kolominskas.

Envirosuite sees a bright future in digital twins, in part because they can harness technologies that many utilities already have at their disposal. “The advantage of a digital twin is that it’s a way of realising the value of the data that is being collected already and translating it into something useful,” explained Kolominskas. “A digital twin can sit on top of all sorts of different legacy systems and provide immediate value without disrupting those processes which evolve over time.” ■

GWI PROJECTS

The second expansion of the Shoaiba 3 IWPP in Saudi Arabia was commissioned last year and was the starting point for a wave of new projects in the world's largest seawater desalination market

Source: Fisia Italmimpianti

DESALINATION

Can the rest of the world's desalination markets keep up with the Middle East?

Mega-projects in the Middle East have driven the international seawater desalination market over the past decade. Looking at the 300 desalination projects followed in GWI's Project Tracker database, where else can opportunities be found?

Seawater desalination technology and design are currently going through a revolution, as continuous breakthroughs in cost and energy efficiency break down some of the key factors that has held back the spread of desal. But can the technology break out of its heartland in the Middle East to make more of an impact in newer markets?

GWI's Project Tracker is currently following the progress of 283 live desalination projects around the world (see *Project Tracker*, p51).

As has been the case historically, development in desalination has been largely driven by building in the Middle East and North Africa, particularly within the GCC countries. Middle Eastern projects account for nearly 30% of the desalination projects tracked in the GWI database (see *pie charts*, right). When looking at projects by combined capacity the picture is even starker: nearly 60% of desalination capacity currently mapped out is accounted for by the Middle East.

A large proportion of this figure comes from the central water privatisation authority in Saudi Arabia, which has awarded a string of new plants with capacities in the six-figure range, starting with the second expansion of the Shoaiba 3 plant, commissioned in 2019. It currently

has more than a dozen plants lined up for future procurement, with capacities ranging up to 600,000m³/d.

Elsewhere in the Middle East the UAE has proved a fertile ground for similar mega-projects. The award of the record-breaking Taweelah IWP last year was followed this year by an announcement that Abu Dhabi utility Taqa would be investing heavily in replacement plants for ageing thermal facilities. Other major pri-

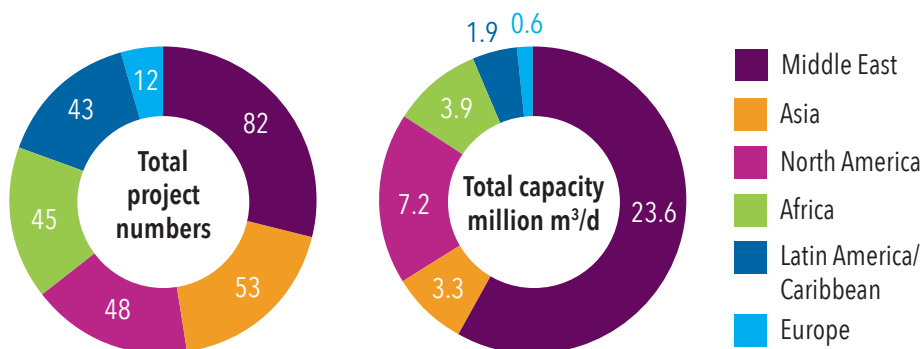
vately financed projects are being pursued around the Gulf.

Market innovator Israel, having just awarded a major privately financed contract to IDE at Soreq (see *table*, next page), is steaming ahead with another large plant in the Western Galilee region as it looks to shore up its water supply.

While Middle Eastern countries account for many of the most well-represented markets in the project tracker, ▶

THE MIDDLE EAST'S DESAL DOMINANCE

The Middle East is still the most significant region in terms of the number of live desalination projects by some distance. When looking at planned works by combined capacity, the gap is even more distinct.



Source: GWI Project Tracker

there are a number of other key hotspots (see chart below).

The US is the largest single source of desalination opportunities in the project tracker, with 48 individual projects being followed. This can be partly explained by the large number of brackish groundwater desalting plants commissioned in the country for potable water production.

However seawater desalination, which has often been suggested as a solution to water woes in coastal areas, has seen slower development. Seawater desalination in the US has proven a tricky prospect, despite the high level of interest. An expected wave of projects following the commissioning of the 50MGD (190,000m³/d) Carlsbad desalination plant in California in 2015 has so far failed to materialise, as environmental concerns, permitting and regulations held up major projects in the state.

The picture is somewhat more positive in India, another country with a stated

KEY DESALINATION CONTRACTS AWARDED THIS YEAR

A number of high-profile contracts have already reached final sign-off this year, despite the interruptions of the COVID-19 pandemic hitting business activity across the globe.

Title	Country	Description
Palma Bay SWRO O&M, Mallorca	Spain	O&M of 64,800m ³ /d desal plant
Soreq 2	Israel	548,000m ³ /d (200 MCM/yr) desal plant
Valdelentisco SWRO O&M renewal	Spain	O&M of 136,000m ³ /d SWRO plant
Morgan SWRO plant (GUPCO)	Egypt	40,000m ³ /d SWRO plant
Comodoro Rivadavia	Argentina	10,000-15,000m ³ /d SWRO
Khobar 2 replacement SWRO	Saudi Arabia	600,000m ³ /d SWRO plant
Jubail 1 replacement SWRO	Saudi Arabia	400,000m ³ /d SWRO plant
Los Pelambres	Chile	34,560m ³ /d seawater desal plant

Source: GWI Project Tracker

desire for investment in seawater desalination but also one that has struggled with the contracting process. 2019 marked a major breakthrough for desal in India, particularly with the award of a string

of major contracts in Gujarat, and the country is hoping to push more through, although access to finance is a constant worry for contracting bodies.

In Chile and Peru, spending on desalination has been driven by international commodities prices, with desalination projects driven by environmental restrictions on water usage by the mining industry in more arid areas.

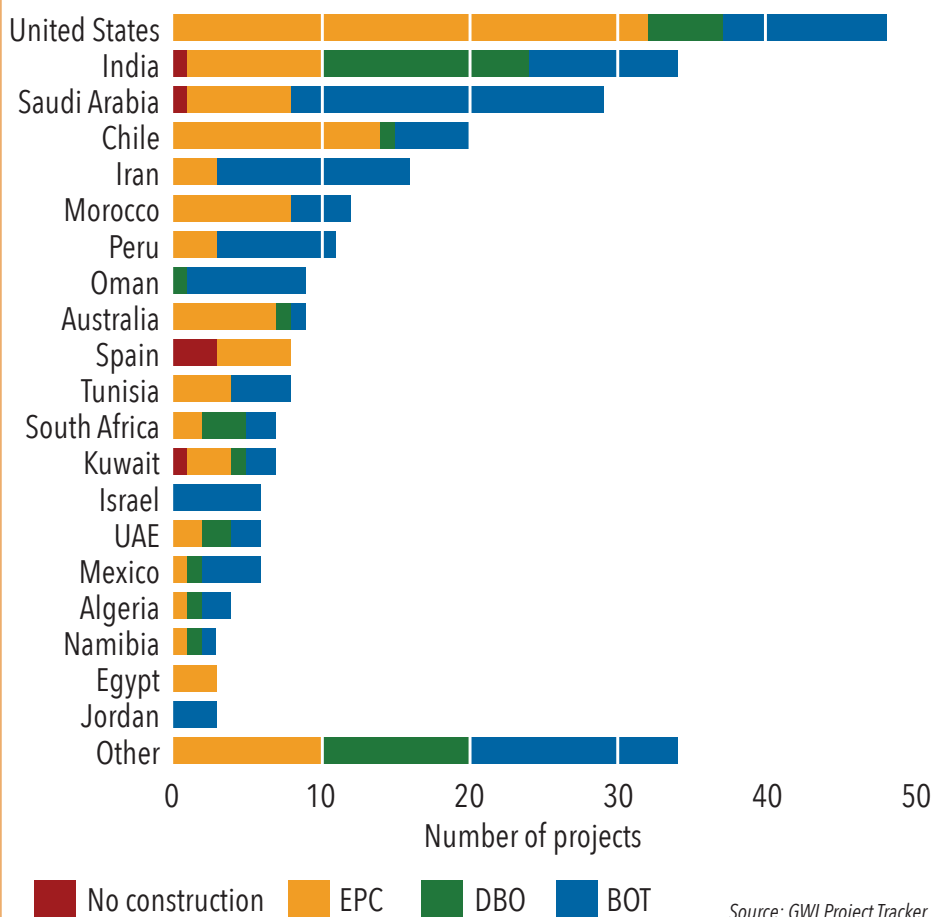
Countries where desalination is proposed as a drought insurance measure have also often seen major delays to projects. A number of high-profile plants have been mooted in South Africa and Australia, both of which have been hit hard by major droughts in recent years.

Desalination was mooted around as a solution to the Day Zero water crisis in Cape Town in 2018, but after severe water restrictions averted a catastrophe, desal projects lost some impetus.

Meanwhile in Australia, progress on desalination projects is often linked directly to dam levels, so new infrastructure is proposed during dry summer months, and then progress halted when rains arrive in winter. With water stress on an inexorable rise in the country, desalination has been picked out as the most feasible response by some sources (see GWI June 2020, p32). It remains to be seen whether the markets will turn back to desalination in the way they did to guard against the Millennium Drought at the turn of the century. ■

LIVE DESAL CONTRACTS IN THE PROJECT TRACKER

While the USA is the single largest market for active desalination projects by number according to GWI's project tracker, countries in the Middle East – and particularly those that have embraced private finance-based models of procurement – have seen more success bringing projects to fruition.



The ins and outs of the international desalination markets are explored in exacting depths in the recently published GWI DesalData Market Focus Deck. For more information visit <https://bit.ly/32FnwD> or contact Naftali Rumpaisum at nrumpaisum@globalwaterintel.com

PROJECT TRACKER

Large-scale California reuse projects come back to life; Changi's third NEWater factory moves forward; a chance to boost effluent reuse in Maharashtra; all the latest project news from around the world.

RESURRECTION IS LIFE

● The resurrection of a pair of stalled potable water reuse projects in California gave some welcome relief to what for many was a challenging holiday season, as soaring temperatures and power outages in the US Southwest served as uncomfortable reminders of the realities of climate change.

● With a series of significant legal and regulatory challenges now behind it, the Pure Water San Diego programme is very much alive and well, with the first two of an expected ten bid packages released this month

following an interactive online contractor expo that attracted more than 300 interested parties. Although the costs have escalated, the jewel of the initial build-out remains the 34MGD (128,690m³/d) North City Pure Water Facility, for which construction bids are due on 1st October. The one casualty thus far has been the renewable energy element of the project, which had been foreseen as a P3, but has now been placed on hold due to the cost being regarded as prohibitive.

● Hopes for the resurrection of another long-planned California reuse project were

raised earlier this month, after the recycled water committee of the Santa Clara Valley Water District recommended that the board re-start the procurement of a P3 which has been on the cards since the 8MGD (30,280m³/d) Silicon Valley Advanced Water Purification Center came online back in 2014. The provisional timetable foresees the release of a fresh RFQ at some point later this year.

OLD NEW WATER

● For more than two years now, Singapore's PUB has been preoccupied with tender-

ing the various elements of the 800,000m³/d Tuas Water Reclamation Plant. It was therefore refreshing to see a call for engineering services to assist with the development of the 50MGD (227,300m³/d) Changi NEWater Factory 3 (proposals are due in on 10 September).

● An interesting tender in Maharashtra's third city, Nanded-Waghala, caught our eye this month. It looks and feels like a straightforward O&M contract, but the operator will have the chance to earn extra cash from the sale of treated effluent. Although the operator can specify the desired royalty in their bid, the catch is that they will have to stump up the cost of getting the product water to the buyer, which could seriously affect the project economics.

● For all the latest updates from around the world, visit our website's Project Tracker: <http://tinyurl.com/gwi-tracker>. ■

WHAT'S HOT THIS MONTH?

Ten water and wastewater projects to watch in GWI's project tracker this month.

No.	Name	Description	Update
1	Ras Al-Khair privatisation	Sale of 1,025,000m ³ /d & 2,650MW water and power facility	The client is understood to be planning to issue a request for proposals by the end of October. A request for qualification documents has already been issued.
2	Antioch BWRO, CA	22,710m ³ /d BWRO	100% design is expected to be complete in September 2020. Construction bids are expected to be advertised in mid-September 2020, with a submissions deadline in early November 2020.
3	Rio de Janeiro concession	Water and wastewater concession	The State of Rio de Janeiro held a third virtual public hearing on 4th August 2020. An international bidding process is scheduled to commence later in Q3 2020.
4	Jamaica non-revenue water P3s	Non-revenue water reduction P3s	The procurement of a contractor for the Northern Parishes non-revenue water reduction P3 is now slated for late 2020.
5	Osaka concession	Renewal of water distribution network	An RFP for the project is now expected to be issued in October 2020, after a bill allowing the introduction of concessions was passed.
6	uMkhomazi Water Transfer	Transfer tunnel from uMkhomazi River to uMgeni River	This initiative is part of a list of 50 projects deemed strategic by the government, which was published on 24 July 2020.
7	Karey Gorou WTP	New 100,000m ³ /d WTP	SPEN has issued a request for expressions of interest from consultants. EOLs are due in by 15 September 2020.
8	Nanded-Waghala STPs O&M	O&M of wastewater treatment plants	A tender has been issued, and the bid submissions deadline has been set at 16 September 2020. The operator will receive a royalty from selling around 20% of the treated effluent for non-potable purposes.
9	Changi NEWater Factory 3	227,300m ³ /d NEWater plant	PUB has released a tender for professional engineering services to assist with the development of the plant. Proposals are due in on 10 Sep 2020.
10	Pure Water San Diego Program, CA	Multiple reuse upgrades	Bids relating to the \$463.16 million construction contract for the North City Pure Water Facility and pumping station are due in on 1st October 2020.

THE GWI PROJECT TRACKER - AUGUST 2020

All the project updates generated in the last month in the key markets tracked by Global Water Intelligence.



Build



Operate



Finance

DEEP TUNNEL SEWER

















Type	Country	Project name	Description	Status
	United States	San Antonio Deep Tunnel Sewer, TX	5-mile deep tunnel sewer	Construction contract awarded

DESALINATION PROJECTS

	Algeria	Alger West SWRO (Fouka Marine)	300,000m ³ /d SWRO	New tender expected in Q4 2020
	Algeria	El Tarf	300,000m ³ /d SWRO	New tender expected in Q4 2020
	Australia	Eyre Peninsula desal plant	5,480-10,960m ³ /d SWRO plant	New site required
	Cape Verde	Praia Grande	4,000m ³ /d RO plant	Feasibility studies underway
	Iran	SAKO Desalination & Power Plant	1,000,000m ³ /d SWRO complex	Next phase awarded
	Israel	Western Galilee	274,000m ³ /d desal plant	Five SoQs submitted
	Kuwait	Al Khairan phase 1 IWPP	568,250m ³ /d & 1,800MW IWPP	Three advisory bids under assessment
	Kuwait	Az-Zour North stage 2/3 IWPP	750,090m ³ /d & 2,700MW IWPP	Three advisory bids under assessment
	Kuwait	North Shuaibah privatisation	Sale of 205,000m ³ /d & 778MW water and power plant	Advisory RFP bids due in October 2020
	Saudi Arabia	Ras Al-Khair privatisation	Sale of 1,025,000m ³ /d & 2,650MW water and power facility	RFQ issued
	Saudi Arabia	Shoaiba 5 (SWCC)	600,000m ³ /d SWRO desalination plant	Bids due in August 2020
	Saudi Arabia	Shuqaiq 4 (SWCC)	400,000m ³ /d SWRO desalination plant	Bids due in August 2020
	Saudi Arabia	Yanbu 1 replacement	250,000m ³ /d SWRO	Three bids submitted
	Spain	Chira-Soria SWRO, Gran Canaria	7,400m ³ /d SWRO plant	Bids due in August 2020
	Spain	Torrevieja SWRO expansion	110,000-120,000m ³ /d SWRO expansion	Initial design contract awarded
	Tunisia	Phase 2, Southern Tunisia brackish water plants	31,000m ³ /d of BWRO capacity	Re-tender possible in Q3/Q4 2020
	United Arab Emirates	Hassyan SWRO, Dubai	545,520m ³ /d SWRO desalination plant	Bids due in September 2020
	United States	Alice BWRO, TX	11,355m ³ /d BWRO	Contract awarded
	United States	Antioch BWRO, CA	22,710m ³ /d BWRO	Construction RFP likely in Q3 2020
	United States	Brazosport BWRO, TX	22,710m ³ /d BWRO plant	Pilot RO procurement expected in September 2020
	United States	Cape May desal expansion, NJ	3,785m ³ /d BWRO expansion	Funding sought
	United States	Corpus Christi industrial BOO, TX	Up to 75,700m ³ /d seawater desal plant	Conceptual design complete
	United States	Corpus Christi SWRO, TX	75,700-113,550m ³ /d SWRO	TWDB funding awaiting City approval
	United States	Huntington Beach SWRO, CA	189,250m ³ /d SWRO	Permitting process underway
	United States	Monterey Peninsula Water Supply Project, CA	36,366m ³ /d SWRO	Permitting applications underway

UTILITY PROJECTS

	Brazil	Buriti Alegre concession	Water and wastewater concession	Bids due in September 2020
	Brazil	Rio de Janeiro concession	Water and wastewater concession	Bidding expected in Q3/Q4 2020
	Canada	Ghost River O&M, AB	O&M of water and wastewater assets	Bids due in September 2020
	Canada	Mapleton DBFOM, ON	DBFOM of water and wastewater assets	DBFOM option off the table
	Canada	Ramara Township O&M, ON	O&M of water and wastewater assets	Contract awarded
	India	Chandigarh 24x7 water (Manimajra)	24x7 water supply	Bids due in August 2020

Type	Country	Project name	Description	Status
	India	Satna smart city utility	Smart city water/wastewater infrastructure	Re-tender awaited
	India	Shimla 24x7 water supply	24x7 pressurised water supply	Bids due in September 2020
	Jamaica	Jamaica non-revenue water P3s	Non-revenue water reduction P3s	Northern Parishes RFQ expected in late 2020
	Japan	Kumamoto industrial water concessions	Concession of two industrial water systems	Preferred bidder selected
	Japan	Miyagi concession	Water and wastewater treatment concession	Evaluation of application documents underway
	Japan	Osaka concession	Renewal of water distribution network	RFP awaited
	Japan	Osaka industrial water concession	Industrial water concession	RFP awaited
	Kenya	Kenya NRW performance-based contracts	NRW performance-based contracts	Expressions of interest under evaluation
	Romania	Constanta NRW reduction	Non-revenue water reduction	Five companies shortlisted
	Saudi Arabia	Red Sea Project utilities	Power, water, sewage treatment and solid waste handling PPP	Two bids submitted
	United States	Accomack County O&M, VA	O&M of water and wastewater assets	Bids due in August 2020
	United States	Bell Gardens O&M, CA	O&M of water infrastructure	Contract awarded
	United States	City of Willows O&M, CA	O&M of wastewater treatment plant	Contract awarded
	United States	Cumberland Valley system sale, PA	Sale of water and wastewater assets	Process in limbo
	United States	Dinwiddie County O&M, VA	O&M of water infrastructure	Preferred bidder selected
	United States	Fayetteville O&M, GA	O&M of water and wastewater assets	SoQs due in September 2020

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Type	Country	Project name	Description	Status
	United States	Florida DOC O&M, FL	O&M of water and wastewater assets	Preferred bidder selected
	United States	Harford County Schools O&M, MD	O&M of wastewater treatment plants	Bids due in September 2020
	United States	Hood River O&M, OR	O&M of wastewater assets	Conceptual stage
	United States	Houston O&M renewal, TX	O&M of water and wastewater assets	RFP likely later in 2020
	United States	Live Oak O&M, FL	O&M of public works	Contract awarded
	United States	Lunenburg O&M renewal (2020), MA	O&M of wastewater assets	Bids due in August 2020
	United States	Milan O&M renewal, MI	O&M of water and wastewater assets	Bids due in September 2020
	United States	Parkville O&M, MO	O&M of wastewater assets	Contract awarded
	United States	Puerto Rico metering PPP	Smart meter roll-out/NRW reduction	Preferred bidder selection delayed
	United States	Springfield wastewater O&M, MA	O&M of wastewater assets	Preferred bidder identified
	United States	Sweet Home O&M, OR	O&M of water and wastewater assets	Preferred bidder selected

SLUDGE MANAGEMENT

	Germany	Nuremberg sludge plant	New 30,000 tDS/y sludge treatment facility	Design consultant selected
	Ireland	Dublin-Ringsend sludge expansion	Sludge treatment expansion	Bids due in September 2020
  	United Kingdom	United Utilities sludge	Sludge management infrastructure	Conceptual stage

WATER TRANSFER

  	Colombia	Santa Marta concession	Aqueduct plus WWTP	PPP shelved
	South Africa	Mokolo-Crocodile Augmentation Project	Water transfer from Crocodile River to Mokolo River	Tender release pending appeals outcome
	South Africa	uMkhomazi Water Transfer	Transfer tunnel from uMkhomazi River to uMgeni River	At pre-implementation stage
	United States	Arkansas Valley Conduit, CO	130-mile water transfer pipeline	First-stage construction RFP expected in mid-2021
	United States	Boston Metropolitan Tunnel Redundancy Program, MA	\$1.4bn urban water supply scheme	Preliminary design contract awarded

WATER TREATMENT PLANTS

  	Greece	Halkidiki dam and WTPs	Dam + 55,000m ³ /d of water treatment capacity	Bids due in September 2020
 	India	Ambala Sadar WTP	30,000m ³ /d water treatment plant + network	Bids due in August 2020
  	India	Beed District WTPs	255,000m ³ /d of water treatment capacity	SoQs due in September 2020
 	India	Jalandhar Water Supply Project	275,000m ³ /d water treatment plant	Two bids under evaluation
 	India	Kota WTPs	120,000m ³ /d of water treatment capacity	Two bids under evaluation
  	India	Latur & Osmanabad district WTPs	370,000m ³ /d of water treatment capacity	SoQs due in September 2020
  	India	Marathwada WTPs and water supply	Regional water treatment and supply project	SoQs due in September 2020
 	India	Munger WTP	34,000m ³ /d water treatment plant	Single bid under evaluation
 	India	Patiala & Fatehgarh Sahib WTPs	69,000m ³ /d of water treatment capacity	Contract awarded
  	India	Patiala 24x7 water supply	115,000m ³ /d water treatment plant	Three bids under evaluation
 	India	Punjab Municipal Services Improvement Project	1.02 million m ³ /d of water treatment capacity	Bids due in September 2020
  	India	Punjab villages water supply	Drinking water supply for 257 villages	Four bids under evaluation
 	India	Purulia WTP	68,000m ³ /d water treatment plant	Bids due in September 2020
 	India	Radhanpur WTP	60,000m ³ /d water treatment plant	Bids due in August 2020

Type	Country	Project name	Description	Status
B O	India	Ranchi WTP	213,000m ³ /d water treatment plant	Single bid under evaluation
B O	India	Tarn Taran District water supply	30,000m ³ /d water treatment plant	Four bids under evaluation
B O	India	Uluberia WTP	96,000m ³ /d water treatment plant	Bids due in August 2020
B O F	Indonesia	Djuanda water supply project	838,080m ³ /d water treatment infrastructure	Feasibility study awaited
B O F	Indonesia	Tabanggele water supply project	47,520m ³ /d water supply system	Pre-qualification awaited
B	Niger Republic	Karey Gorou WTP	New 100,000m ³ /d WTP	EOIs for TA contract due in Sep 2020
B	Romania	Turnu Măgurele WTP	New 10,000m ³ /d WTP	Bids due in September 2020
B	Serbia	Belgrade Water	WTP refurbishment and upgrade	TA proposals due in September 2020
B	South Africa	uMkhomazi WTP	500,000-550,000m ³ /d WTP	EIA in progress
O	Spain	Sollano WTP O&M, Bizkaia	O&M of 129,000m ³ /d water treatment plant	Bids due in September 2020
B O F	United States	CVWD nitrate removal, CA	Nitrate removal upgrade	Conceptual stage
B	United States	Pender County RO plant, NC	11,355m ³ /d RO plant	Engineering SoQs due in August 2020

WASTEWATER TREATMENT PLANTS

B	Belarus	Polotsk WWTP	New 67,000 PE WWTP	Tender possible in September 2020
B	Bosnia-Herzegovina	Delibaskin Selo WWTP	New centralised WWTP	Assessing financing options
B O F	Botswana	Glen Valley WWTP upgrade	40,000m ³ /d WWTP upgrade for reuse	Construction tender delayed
B	Canada	Iona Island WWTP, BC	New tertiary wastewater treatment plant	Conceptual stage

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Type	Country	Project name	Description	Status
	Canada	Jean-R.-Marcotte WWTP upgrade, QC	Treatment upgrade and possible expansion at 2.8 million m ³ /d WWTP	Feasibility study underway
	Canada	Winnipeg North End STP upgrades, MB	Upgrade of 380,000m ³ /d WWTP	Headworks award awaited
	Colombia	Canoas WWTP	New 1,209,600m ³ /d WWTP	Construction procurement delayed until mid-2021
	Croatia	Bjelovar WWTP upgrade	WWTP upgrade	Bids due in August 2020
	India	Ankleshwar STP	14,000m ³ /d sewage treatment plant	Bids due in September 2020
	India	Asansol/Durgapur/Burdwan STPs	Multiple STPs in several cities	Consultancy contract awarded
	India	Bandra WWTP	360,000m ³ /d wastewater treatment plant	Tender cancelled
	India	Banswara water and sewer	Water and sewerage infrastructure	Four bids under evaluation
	India	Barahiya STP	6,000m ³ /d sewage treatment plant	Three bids under evaluation
	India	Barhi CETP	10,000m ³ /d industrial CETP	Bids due in August 2020
	India	Bhandup WWTP, Mumbai	Phased 323,000m ³ /d WWTP	Tender cancelled
	India	Bhavnagar STP (Akwada)	19,200m ³ /d sewage treatment plant	Bids due in August 2020
	India	Chandigarh Smart City STPs	Construction and rehabilitation of STPs	Bids submitted for all projects
	India	Coronation Pillar STP upgrade	Upgrade of 318,220m ³ /d sewage treatment plant	Consultancy bids due in August 2020
	India	Danapur, Phulwari Sharif & Fatuha STPs	45,000m ³ /d of sewage treatment capacity	Re-tender awaited
	India	Delhi (Sonia Vihar) WWTP	31,822m ³ /d wastewater treatment plant	Consultancy bids under evaluation
	India	Faridabad (Badshahpur 2) STP	30,000m ³ /d sewage treatment plant	Contract awarded
	India	Faridabad (Pratapgarh) STP	180,000m ³ /d of sewage treatment capacity + tertiary	Bids due in August 2020
	India	Ghatkopar WWTP, Mumbai	Phased 506,000m ³ /d WWTP	Tender cancelled
	India	Gurugram STP expansion	20,000m ³ /d sewage treatment plant	Contract awarded
	India	Gurugram STPs O&M (Chandu Budhera)	O&M of 2 x 100,000m ³ /d STPs	Bids due in August 2020
	India	Hisar STP	15,000m ³ /d tertiary treatment plant	Four bids under evaluation
	India	Indore CETP O&M	O&M of 4,000m ³ /d CETP	Bids due in August 2020
	India	Jalandhar STP and TTP	5,000m ³ /d STP + 5,000m ³ /d tertiary treatment plant	Two bids under evaluation
	India	Kahalgaon STP	6,000m ³ /d sewage treatment plant	Three bids under evaluation
	India	Khagaria STP	4,500m ³ /d of sewage treatment capacity	Three bids under evaluation
	India	Kolkata STPs	Build and rehabilitate WWTPs	Bids due in September 2020
	India	Lucknow STPs	Construction of two new STPs	Re-tender awaited
	India	Ludhiana STP O&M	O&M of sewage treatment plant	Bids due in August 2020
	India	Ludhiana STPs and ETPs	Construction and rehab of multiple STPs	Bids due in August 2020
	India	Malad WWTP, Mumbai	454,000m ³ /d WWTP	Tender cancelled
	India	Malerkotla STP	22,000m ³ /d sewage treatment plant	Contract awarded
	India	Mandawa water and sewerage	3,900m ³ /d STP + ancillary infrastructure	Four bids under evaluation
	India	Mandi STP upgrade	5,250m ³ /d WWTP upgrade and expansion	Bids due in August 2020
	India	Manesar STP	25,000m ³ /d sewage treatment	Bids due in August 2020
	India	Mirzapur-Ghazipur STPs	Build and rehabilitate WWTPs	Bids due in August 2020
	India	Nanded-Waghala STPs O&M	O&M of wastewater treatment plants	Bids due in September 2020
	India	New Delhi WWTP (Supplementary Drain)	113,650m ³ /d wastewater treatment plant	Consultancy bids due in August 2020
	India	Patiala District STPs & ETP	43,500m ³ /d of wastewater treatment capacity	Bids due in August 2020
	India	Puducherry STPs	Construction and/or rehab of STPs	Consultancy EoIs due in August 2020

Type	Country	Project name	Description	Status
	India	Pulivendula STP	12,000m ³ /d of sewage treatment capacity	Bids due in August 2020
	India	Raikot STP	7,000m ³ /d sewage treatment plant	Bids due in August 2020
	India	SAS Nagar/AERO City STP and TTP	10,000m ³ /d STP + 5,000m ³ /d TTP	Bids due in August 2020
	India	Umargam STP	6,500m ³ /d sewage treatment plant	Bids due in September 2020
	India	Versova WWTP, Mumbai	180,000m ³ /d WWTP	Tender cancelled
	India	Worli WWTP	500,000m ³ /d WWTP	Tender cancelled
	India	Yamunanagar TTP	20,000-25,000m ³ /d tertiary treatment plant	Consultancy contract awarded
	Iran	Eqbaliyeh STP	9,412m ³ /d wastewater treatment plant	Iols due in August 2020
	Iran	Golbahar WWTP	New wastewater treatment plant	SoQs due in September 2020
	Iran	Kashmar STP	21,000m ³ /d wastewater treatment plant	SoQs due in September 2020
	Iran	Khaf STP	8,000m ³ /d wastewater treatment plant	SoQs due in September 2020
	Macedonia	Skopje WWTP	New 130,000m ³ /d WWTP	Statements of qualification due in September 2020
	Montenegro	Podgorica wastewater complex	New wastewater complex	Statements of qualification under evaluation
	Netherlands	Boxtel WWTP upgrade	WWTP nutrient removal upgrade	EOIs for market evaluation due in August 2020
	Pakistan	Quaid-e-Azam Industrial Estate CETP	72,736m ³ /d industrial WWTP	Tender possible in late August 2020
	Pakistan	Sundar Industrial Estate CETP	72,736m ³ /d industrial WWTP	Tender possible in late August 2020
	Serbia	Niš WWTP	286,000 PE WWTP complex	Tender expected in October 2020
	Singapore	Changi NEWater Factory 3	227,300m ³ /d NEWater plant	Engineering bids due in Sep 2020
	Singapore	Tuas WRP	800,000m ³ /d WWTP complex	MEICA bids due in September 2020
	South Africa	uMdloti and uMkhomazi WWTPs	Two wastewater treatment plants	Tender likely in early 2021
	Spain	Crispiana WWTP O&M, Araba	O&M of 200,000m ³ /d WWTP	Bids due in October 2020
	Spain	Guadarranque, Cádiz	Tertiary WWTP	Plant under design
	Spain	Málaga Norte WWTP	100,000m ³ /d tertiary WWTP	DB tender possible in summer 2020
	Spain	Martorell WWTP O&M, Catalunya	O&M of 10,500m ³ /d WWTP	Contract awarded
	Spain	Monte Orgegia WWTP O&M, Alicante	O&M of 60,000m ³ /d WWTP	Bids due in September 2020
	Spain	Montsià WWTPs O&M, Tarragona	O&M of 5,500m ³ /d WWTP	Bids due in August 2020
	Spain	Silvouta WWTP, Galicia	86,400m ³ /d WWTP	Four bidders shortlisted
	Spain	Tajo and Tajuña WWTPs (O&M)	O&M of wastewater treatment plants	Five bidders in the running
	Turkey	Doğubayazıt WWTP	New 74,000 PE WWTP	Consultancy bids due in September 2020
	United States	East County Advanced Water, CA	43,528m ³ /d advanced water treatment plant	Owner's advisor award awaited
	United States	Inland Empire RP-5 expansion, CA	113,550m ³ /d MBR system	Contract awarded
	United States	Matanuska-Susitna septage P3, AK	Septage treatment facility	Bids due in July 2020
	United States	Palm Bay WRF, FL	7,570m ³ /d phased water reclamation facility	Construction bids due in September 2020
	United States	Pure Water Project Las Virgenes-Triunfo, CA	22,710m ³ /d advanced water treatment plant	Owner's advisor award awaited
	United States	Pure Water San Diego Program, CA	Multiple reuse upgrades	Bids due in October 2020
	United States	Silicon Valley AWPC expansion, CA	Expansion of advanced treatment infrastructure	RFQ possible in Q3 2020
	United States	South Sioux City WWTP, NE	Possible 151,400m ³ /d WWTP	Preliminary design report underway
	United States	Weatherford reuse project, TX	2MGD (7,570m ³ /d) of IPR capacity	Pump station bids due in August 2020
	United States	Worthington WWTP, MN	New 18,925m ³ /d WWTP	Preliminary plans approved

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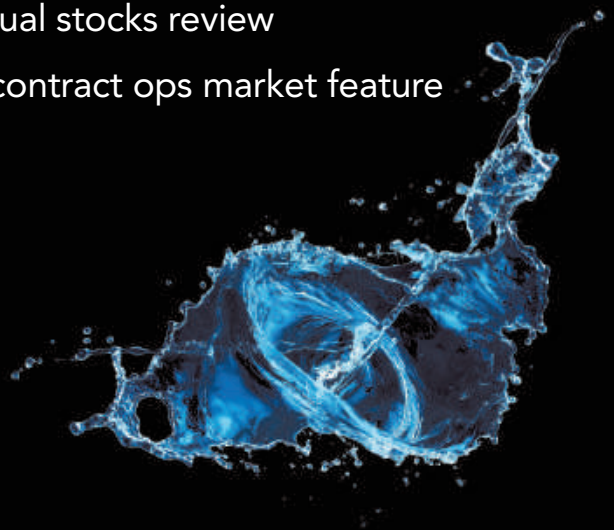
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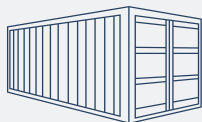
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