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Utilities Tech Outlook

WASTEWATER MANAGEMENT EDITION

Michael J. Patey,
Founder &
Chief Technology Officer

Kristen Lamb,
Chief Operating Officer

Jason Mendenhall,
Chief Executive Officer

ECOVAP

TURBOCHARGER FOR MOTHER NATURE'S PROCESS OF EVAPORATION

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ECOVAP

BIOMIMICRY TO ACCELERATE EVAPORATION, ELIMINATE WASTEWATER

By Olivia Smith

A number of scientific studies have contended that dyslexia, which hampers a person's ability to read, write, and spell, is a blessing in disguise. Dyslexics are more curious, imaginative, and intuitive than the average person. Joining Albert Einstein, Richard Branson, and Steven Spielberg in the group of dyslexic trailblazers is Utah's own Michael J Patey, the founder of ECOVAP, a wastewater disposal solution provider. A popular figure in aviation, Patey has been featured on magazine covers for the better part of his life, setting a total of seven world speed records for planes that he designed, built, and flew. "I may not be able to spell, read, or type proficiently, but for some reason, my brain fires on all cylinders when it comes to mechanical and structural engineering," says Patey, whose aircrafts are YouTube sensations and a centerpiece of attraction at aviation shows across the globe.

Michael J. Patey,
Founder & Chief Technology Officer


TOP 10
WASTEWATER
MANAGEMENT
SOLUTION PROVIDERS - 2019
Jason Mendenhall,
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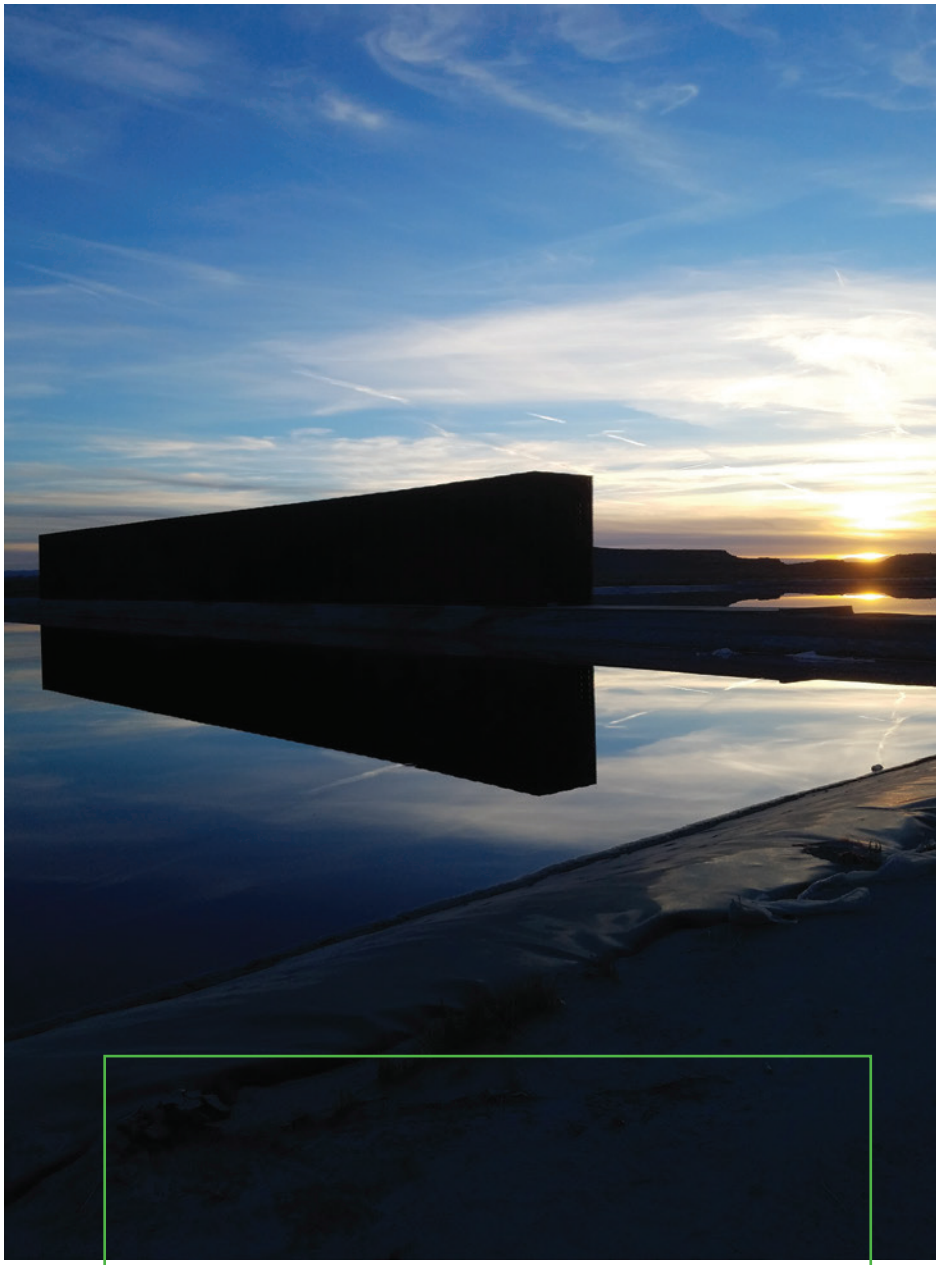
Photo by: Ciaranmae Photo



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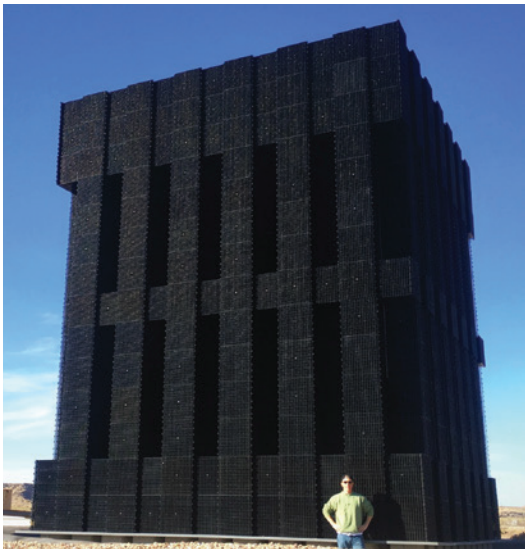
Owing to his high-flying background, one might wonder how Patey landed in the wastewater disposal business. The genesis of ECOVAP dates back to 2015 when Patey volunteered to pilot several oil and gas executives around remote oil fields. Looking over a horizon of thousands of drilling rigs, Patey inquired about the "huge, man-made square lakes" he observed from the air. When told that these "evaporation ponds" were used by oil and gas companies to dispose of huge volumes of wastewater, and after subsequent on-the-ground visits to injection wells, Patey was astonished to learn water management amounts to as much as 25 percent of the total cost of oil itself. "There's got to be a better way," Patey told himself.

A serial inventor and entrepreneur, Patey rushed to his airplane hangar-lab site and set about developing and testing various non-traditional means to reduce the costs of wastewater disposal. One of these oil/gas executives challenged Patey, "if you can devise a way to rid wastewater in an environmentally-friendly manner, at an economical price point, it would result in groundbreaking technology." In the following years, Patey visited many disposal sites across the country, building on his knowledge of one of the least-commoditized markets in the world. Indeed, the viability of many E+P sites is determined by water management, with costs that are primarily driven by the distance between the point the wastewater is produced vs. the disposal sites that must have under ground cavernous pores (for injection wells) or hot dry weather (for evaporation ponds). After several years of testing, always focusing on "lowest cost," Patey ultimately developed various patents and knowhow to evaporate the H2O portion of wastewater at more than 59 times the normal rate.

With fluid dynamics, aerospace, and mechanical engineering in his DNA, it was only natural for Patey to combine the three disciplines, developing simple biomimicry technology in a segment dominated by complex chemical treatments, thermal evaporation, porous filters, and osmotic membranes. Before arriving at the finished article, Patey purchased a few wastewater disposal sites across the country and used them as his testing ground and for the first deployments. "I used these sites to dabble with various technologies. As a result, I found a dynamic solution," says Patey.

Birth of a Disruptive Technology

Patey's dynamic solution is represented in the form of plastic/modular towers (see picture) that capitalize on natural resources such as sun, wind, and gravity-based motion to speed up wastewater evaporation. The towers, or Evaporation Matrices ("EMs"), are built in a Lego-like construction, using thousands of 2"x2'x2' panels, with each panel made of 100 percent recycled HDPE plastic and treated to be hydrophilic. The panels, designed to maximize water-to-air surface space and slow the speed of flow, are assembled in the "EMs" to create natural air-to-fluid temperature differentials, thereby producing their own wind channels. Patey notes, "Even if there's zero wind in the air, one can feel a breeze from close proximity to the tower."



In simpler terms, ECOVAP's technology makes suspended water stick to walls so that Mother Nature can evaporate it quickly and efficiently. "The proprietary hydrophilic properties of the towers allow the water to evenly disburse over millions of square inches of surface space, allowing for maximum air-to-water exposure and minimal pumping needs," explains Patey.

The first technology in history that can erect a 36-foot tall tower without a concrete footing or a base, ECOVAP's matrix point-load doesn't exceed the weight of a person standing on one foot. "Our towers snap together like a giant Lego set," says Kristen Lamb, COO of ECOVAP. Also, unlike other evaporative structures, ECOVAP's technology doesn't require digging, or installation of concrete walls, steel columns, or beams. There are no saws, drills, or tools needed, only a rubber mallet to connect each of the panels to form the towers. The towers also don't corrode, wear out, or rust.

For perspective, ECOVAP's technology evaporates water 59 times faster than Mother Nature alone. In December 2017, Golder Associates—a global environmental services consultancy—conducted a validating test at ECOVAP's wastewater collection site near Myton, Utah, by comparing ECOVAP's technology vs. traditional surface discharge. To quote the report, "For the entire duration, daily water meter data noted that the evaporation tower is 59 times more efficient in evaporating water than the approach relying on surface water evaporation."

Biomimicry: Leading to Significant Cost Savings

Since ECOVAP's proprietary wastewater technology relies on biomimicry for enhanced evaporation, it requires no thermal heating, and minimal power, labor, and maintenance costs. Also, the technology operates chemical-free, and the towers only need low-pressure water pumping for 20 minutes once every four to six hours. This is a far cry from the high energy costs of atomizing sprayers and bubblers needed for conventional ponds, not to mention the energy requirements to reach the pound per square inch (PSI) levels required for injection wells.

The towers are also "self-washing" and don't suffer from scaling/clogging since residual solids naturally rinse to the bottom and gather in a catchment pond. About once a year, the towers can be easily powerwashed to remove small amounts of adhesion, but this has only proven necessary in windy areas where there simply isn't enough water to keep self-washing at extraordinarily high evaporation rates. As an added business initiative and environmental benefit, ECOVAP's clients have the option of selling the residuals to "water mining" firms that need high TDS concentrations.

ECOVAP CEO Jason Mendenhall, with a chemical engineering background, explains further: "There are dozens of industries that contaminate water beyond the point where it can be economically treated. ECOVAP's value-add is that we can 'biomimic' Mother Nature to return the uncontaminated water to the natural water cycle, greatly improve the economics of harvesting the salvageable 'contaminants', while eliminating the vast majority of negative environmental externalities. Best of all, we can do this at a lower cost to our clients."

Further, ECOVAP's customers are not burdened with servicing the towers. In comparison, companies that invest

in evaporation ponds and surface discharge have to deal with recurring pain points such as leaks, leak repairs, and water spilling out of containment. Also, land restrictions are preventing companies from increasing the number of ponds in their treatment plants. In contrast, ECOVAP's technology requires little land, and its towers can even be constructed atop existing ponds. "Most wastewater plants require a million square feet of land or more; we require only 1/30th of that land," says Patey. The towers have no mechanical parts (except for a few low-pressure pumps), and ECOVAP can customize its towers to any size and shape per client requirements depending on location and wind direction.

Another noteworthy differentiator of ECOVAP's novel technology is its scalability. The towers are retractable and expandable, giving ECOVAP's clients the benefit of increasing the size of the tower, based on changing requirements/regulations. "We can go into a client site and snap more panels vertically or horizontally, on the fly," says Lamb, also highlighting that ECOVAP's towers are expected to last at least 40 years with negligible maintenance CAPEX.

"If a company spends 5-10 million dollars on an injection site or osmosis membrane technology, they are locked into that asset forever. Since those technologies rely heavily on geography, any problem with the site means the asset cannot be recovered. We are the first and only wastewater disposal solution provider that can literally package large scale disposal technology and move to another state," stresses Lamb.

It's also worth highlighting that ECOVAP's towers don't burden owners with transportation costs. Compare that to injection wells where transporting wastewater can dwarf the actual cost of disposal. Patey informs that ECOVAP's technology reduces the need for a trucking or pipeline infrastructure at wastewater plants. "The biggest advance in ECOVAP technology in the last year is the ability to reduce wastewater transportation costs by 70-90 percent."

Mitigating Environmental Concerns

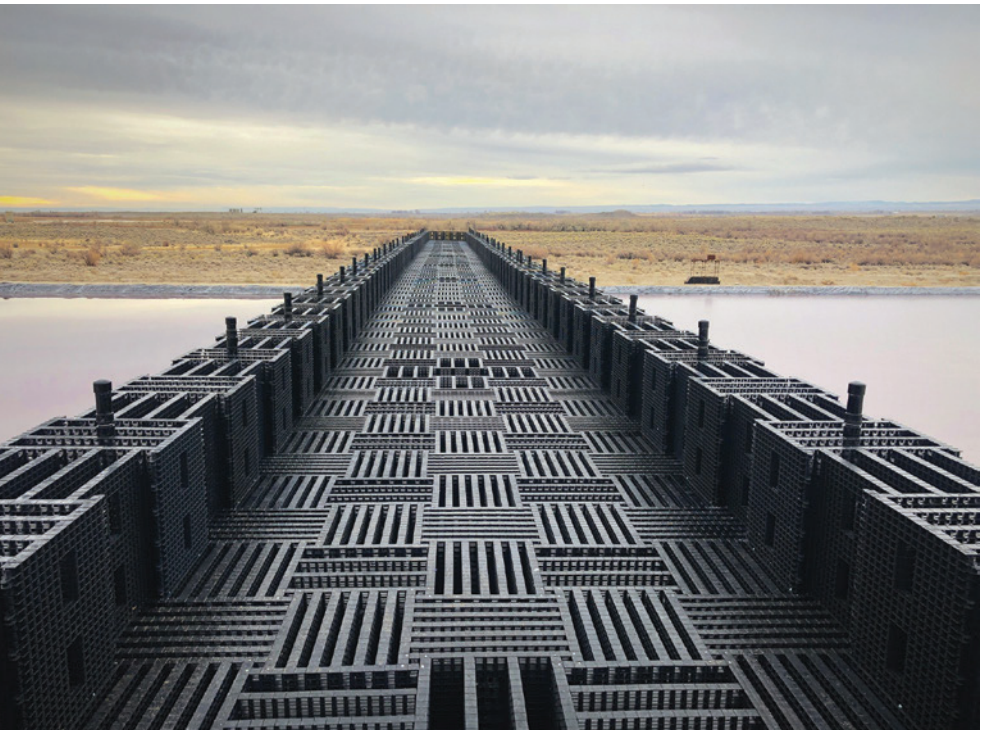
The efficient transportation of wastewater remains a major industry-wide pain point that ECOVAP greatly alleviates. However, it is only one of many environmental threats posed by traditional disposal methods that ECOVAP addresses. Some of the hazards include earthquakes and aquifer contamination (from the injection of water at high pressure back into the earth), seepage and overflows that lead to above-ground and below-ground aquifer contamination (mining tailings ponds, oil/gas produced water ponds).

A few years ago, the U.S. Geological Survey (USGS) took notice of "man-made earthquakes" and concluded that such quakes are common among all oil and gas states. Since then, the state of Pennsylvania has banned wastewater injection, and Oklahoma is no longer granting permits to instigate new injection wells. "Every oil and gas state is curbing back on the permits for new wastewater injection wells," says Rowe Michels, CEO of Alpheus Water Research and a lead investor in ECOVAP.

Due to its reliance on Mother Nature, ECOVAP's technology inherently eliminates nearly all of the environmental impacts and risks of wastewater disposal:

- No Seismic Risk: With its ability to de-water the volume of wastewater by 70-98 percent, ECOVAP reduces the volume and/or PSI, and/or the acids required by SWDs.
- Air Pollution: ECOVAP's towers, 1) emit less GHGs than other disposal means, particularly as there is very little trucking transportation required, and 2) can be fitted with a custom-designed louver to allow the entry of wind, thus enhancing evaporation without any contaminated water going out.
- Energy Footprint: ECOVAP's use of low-pressure pumps (as its energy source) and other processing equipment is drastically lesser than conventional evaporation.
- Land and Water Footprint: By reducing the pond footprint to 1/30th of a conventional evaporation pond, the cost of various safeguards (double-linings, leak sensors) become small compared with the cost of the land, pond infrastructure, and ECOVAP towers.

"Other technologies leave behind pipes, concrete holes, and whatever



> **We are the first and only wastewater disposal solution provider that can literally package large scale disposal technology and move to another state**

gets shoved into the earth. We literally return water back to the environment, rather than 'sweeping it under the rug," Patey says eloquently.

- Wildlife Contamination: Conventional evaporation ponds attract waterfowl and other animals. However, by "consolidating" many ponds into the same land footprint, ECOVAP's technology reduces the cost of installing wildlife protection (nets or fences).
- End-of-Life Solid Waste Disposal vs. Recycling: When conventional evaporation ponds fill with solids, the waste is wrapped up, and the site buried. By contrast, ECOVAP pumps out its residual slurry from small catchment basins with vacuum trucks once every 3-12 months, and can then recycle these solids or dispose of them.
- Remediation and HDPE Recycling: ECOVAP Matrices are made of recycled HDPE plastic, are expected to last over 40 years, and can be recycled at that time.

In September 2017, Dr. John Pichtel, PhD, CHMM, heaped praise on ECOVAP's eco-friendly technology. "When ECOVAP is used according to specifications there is no risk of aquifer or soil contamination as may be encountered with reinjection of produced water; likewise, there is no risk of induced earthquakes and related liability," he wrote in an Environmental Impact Assessment.

Eliminating Wastewater for Multiple Industries

While ECOVAP's initial focus was on the oil and gas sector, the company is witnessing broader interest from other industries that dispose of wastewater. Some of these industries include mining tailings ponds, power plants, cooling towers, and salt manufacturers. "The ability to 'concentrate' water is also a growing market for an emerging 'water mining' sector that looks to capture valuable salts, nitrates, lithium, rare earths and various metals. They need high TDS so they don't waste too much energy extracting out low concentrations of a given element," notes Michels.

Since its towers can be built and installed on existing ponds, there are no new permitting needs. Due to a shortage of state permits, ECOVAP is building on existing facilities (i.e., E+P fields and/or disposal sites), and currently operating on sites with various proprietary configurations. In Utah, ECOVAP is working on an indoor R+D facility and test tower, and several conventional ponds that it plans to retrofit with more matrix configurations. In Texas, ECOVAP is operating an EM that is built at a well-head for oil/gas E+P, thus reducing this customer's wastewater transportation cost by about 95%.

ECOVAP's ability to install the towers quickly is an added market advantage. "Our customers are amazed at how fast we can deploy a full-scale evaporation matrix, usually in a matter of months from planning to full operation. They are also elated that our entirely modular system can be scaled up or down in days, or even redeployed should 'the well run dry' or when a given remediation project is complete," says Lamb.

One of ECOVAP's recent projects was for a client that needed rapid large scale deployment. The client was witnessing huge disposal costs at one of its E+P sites due to the need to transport wastewater. The customer was also concerned about local regulations curbing the PSI of some of its SWDs. "We couldn't be more pleased with ECOVAP's answer to all of these issues: our costs are low, and the permitting and installation was easy," reveals the customer.

A few years into its inception, ECOVAP is admittedly "beyond the point of concern" on how its product will be received in the market. "We are confident ECOVAP's proven technology and our team of engineers can significantly reduce wastewater disposal costs in almost any geographic region and in an environmentally-friendly manner," concludes Mendenhall.

Utilities Tech Outlook

SEPTEMBER - 03 - 2019 UTILITIESTECHOUTLOOK.COM WASTEWATER MANAGEMENT EDITION

Top 10 Wastewater Management Solution Providers - 2019

The diminishing water quality due to pollution and waste disposal has not only affected the global health per se but has also had immediate social and economic implications. The scarcity of clean water has led to falling in the average volume available for use, increased water-borne diseases, and definite price hype in other utilities. To combat this pacing crisis of water stress, technology vendors are striving to build solutions that are cost-effective and eco-friendly.

Having said that, 2019 is seeing a splurge in the utility of IoT powered devices for wastewater management. With IoT enabled smart sensors, monitoring the water leaks, chemical disposal, and regulation of water-flow has become an easier task. Moreover, the proliferation of AI-based technology has automated garbage separation by combining robotic applications with machinery. This has not only made the process efficient but has also substantially bolstered the speed. Alongside, the data-driven insights have shown greater potential compared to last year, which in turn has transformed the way government and consumers perceive water as a resource.

The most important aspect of wastewater management is 'awareness.' The lack of awareness among the citizens, industrial, and agriculture sector has posed a threat to sustainable usage of water and the disposal of waste. There are several reforms and technical upgrading that has been initiated for a sustainable future.

In the wake of similar trends a distinguished panel comprising of CEOs, CIOs, VCs, analysts, and Utilities Tech Outlook's editorial board have assessed several wastewater management technology solution providers and shortlisted the ones that are prominent in the field. The companies listed here showcase extensive business knowledge and exhibit competence in delivering innovative solutions that meet the needs of the customer.

We present to you Utilities Tech Outlook's "Top 10 Wastewater Management Solution Providers – 2019."

Company:
ECOVAP

Key Person:
Michael J. Patey, Founder, Chief Technology Officer; Jason Mendenhall, Chief Executive Officer; Rowe Michels, VP of Strategic Planning; Kristen Lamb, COO; Jeff Knowles, CFO

Description:
A wastewater management solution provider that utilizes an innovative, patent-pending technology to enable the quick and clean evaporation of wastewater

Website:
ecovap.com