Concurrent Technologies Corporation (CTC) is an independent, nonprofit, applied scientific research and development professional services organization. Together with our affiliates, Enterprise Ventures Corporation and CTC Foundation, we leverage research, development, test and evaluation work to provide transformative, full lifecycle solutions. To best serve our clients’ needs, we offer the complete ability to fully design, develop, test, prototype, and build. We support our clients’ core mission objectives with customized solutions and strive to exceed expectations. CTC has been named one of the World’s Most Ethical Companies by Ethisphere Institute, the global leader in defining and advancing the standards of ethical business practices. In addition, CTC has been named a Best for Vets Employer by Military Times.

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Concurrent Technologies Corporation (CTC) has developed two scales of greywater reuse systems.

**Water Reuse**
CTC has developed two scales of greywater reuse systems. Independently, CTC developed a small-scale portable system for applications in austere environments, developing countries and disaster situations. On a larger scale in conjunction with the U.S. Air Force, CTC developed a containerized (20’ ISO container) system in support of Air Force expeditionary bases. These systems were developed to recycle 90% of greywater from showers and laundry which minimizes resupply and removal.

**Water Purification**
CTC developed a portable Small Unit Water Purification (SUWP) System to produce up to 100 gallons per hour of ultrafiltered water and up to 10 gallons per hour of drinking water. This feature allows for an energy efficient configurable solution to meet the specific water need and utilize the available energy source. For drinking water, reverse osmosis processes fresh or brackish water and can be configured for saltwater desalination.

**Alternative Energy**
CTC’s patented magnesium carbon battery called MagC is an advanced metal-air battery that uses magnesium as a fuel and the reverse osmosis waste stream as the electrolyte to generate electricity in an electrochemical reaction (Patent #8,968,948). It can produce up to four times the amount of water per unit weight than current advanced batteries. The MagC is a green battery that produces no caustic byproducts or thermal signature, is low noise and is not dependent on fossil fuels. It is self-contained, can provide exportable power, is easy to use, and can be scaled to meet specific needs.

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**The Water Challenge**

The need for pure water is one of the world’s most enduring problems. An estimated 884 million people, or 13% of the world’s population, do not have access to clean drinking water, and 2.5 billion do not have adequate sanitation. Dedicated to this challenge, Concurrent Technologies Corporation (CTC) has developed innovative solutions to assist government, commercial, and non-governmental organizations respond to water scarcity and security by providing usable water to meet their potable and non-potable needs. CTC solutions reduce water demand and/or provide drinkable water benefiting both DoD and commercial needs. CTC, through its affiliate, Enterprise Ventures Corporation (EVC), is making available to clients water purification systems that turn unsafe, undrinkable water into clean, sanitary water in a matter of seconds.

**Water Solutions:**
- Water demand reduction
- Custom water purification system design and development
- Scalable greywater reuse system design and development
- Water processing energy reduction
- Filtration system/filtration element evaluation
- Filter media evaluation and matching to source feed water
- Challenge water test recipe formulation
- Water quality testing (NSF P248, NSF/ANSI 350)
- Industrial process water purification

Contact us to implement these water sustainability solutions at your organization.
Water Purification Power Supply has up to 4 Times More Energy than Li-ion Batteries

Technology Description
The magnesium carbon battery, or MagC, is an advanced metal-air battery using magnesium as a fuel to generate electricity.

In the MagC battery, magnesium is used as the anode and paired with an advanced carbon-based air cathode. This creates an oxidation-reduction reaction, generating both electricity and hydrogen. The MagC requires saltwater brine as an electrolyte, and power production is enhanced through circulation.

The application of a circulating, saltwater electrolyte is unique. MagC technology is highly effective in applications where saltwater is plentiful or is a waste product from other processes.

An excellent application for MagC technology is reverse osmosis desalination. This not only provides saltwater brine from the reverse osmosis process, but also supplies it at a pressure allowing circulation through the battery cell.

While other energy technologies are used to power reverse osmosis desalination, they show weak performance as compared to the MagC. Compared to the most advanced battery technologies commercially available, MagC has approximately four times more energy for the same mass of battery. In other words, the MagC can produce four times the amount of water per unit weight than current advanced battery technology!

Concurrent Technologies Corporation (CTC) has developed the MagC battery specifically for use with water purification systems. The MagC employs a reject-water hookup and simple power hookup to the water purification system.
MagC Features and Benefits:

• Provides high density energy source for powering reverse osmosis desalination.
• With optional salt-adder, MagC has the ability to power any water purification system with a reject stream, including ultrafiltration.
• No dependence on fossil fuels — it is a “green” battery technology with no caustic or harmful byproducts.
• Easy to use, and the entire battery is self-contained.
• Longer operational times without recharging. May be coupled to solar energy generation and energy storage, which increases operational time by an order of magnitude.
• Can be used as a generator with the ability to export power to standard 120VAC with optional inverter.
• Highly scalable design with sizing to any common AC/DC voltage, any power level up to 750 watts and any energy capacity up to 40 kWh.
• Optional hydrogen recovery module that can be fully integrated with a Hydrogen PEM fuel cell to generate additional energy from operation.
• May be configured as a primary battery (i.e., throwaway) or mechanically-rechargeable battery.

MagC Technical Specifications:

• Voltage: 12 VDC (Std.), optional other voltages including 120VAC
• Power: 125 watts (Std.), optional down to 5 watts and up to 750 watts
• Energy: 10 kWh (Std.), optional down to 80 Wh and up to 40 kWh
• Weight: ~25 pounds (Std.)
• Optional hydrogen recovery module: Up to 100 watts additional power generation

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MagC for Water Purification

The MagC produces up to four times the amount of water per unit weight than any other advanced Li-ion battery technology!
The Small Unit Water Purification System (SUWPS) is designed to provide up to 100 gallons per hour of ultra-filtered water and up to 10 gallons per hour of drinking water from the reverse osmosis system. SUWPS is a fully configurable water purification system consisting of a pre-filtration module and a reverse osmosis module. The SUWPS can be used with the pre-filtration module only or the pre-filtration module and the reverse osmosis module can be tied together. The pre-filtration module can be either gravity fed or run in powered mode. The reverse osmosis module can process fresh or brackish water, and on request, can be configured for saltwater desalination. The system employs advanced pre-filtration and low energy reverse osmosis membranes to reduce the energy requirement of the system. The system is controlled with a power module that is multi-power capable, with included energy storage, and also has exportable power capabilities. The SUWPS modules are isolation mounted in ruggedized containers for transportability and durability in the field.

Water Purification System Technical Specifications:

**Pre-Filtration System**
- Stacked-disc pre-filtration: Two stages – 100 micron first stage; 50 micron second stage
- Ultra-filtration as third stage filter: Unique ultrafilter with integrated granular activated carbon for biological constituent removal and integrated silver for disinfection
- Can be run in both gravity fed mode and powered mode: Water production in gravity feed – 240 gallons per day; Water production in powered mode – up to 2000 gallons per day
- Fully cleanable and replaceable filters – easy replacement and easy maintenance
- Integrated storage space for tubing, electrical connectors and extra ultrafilters

**Reverse Osmosis System**
- Fresh/brackish water, low energy reverse osmosis membranes standard; desalination membranes available
- Nominal Water Production – 240 gallons per day with brackish water; higher throughputs in fresh water; similar throughputs in desalination
- Granular activated carbon filter on produced water with integrated silver disinfection

**Electrical Control Box Technical Specifications:**

**Multi-Power Capable**
- Operating Voltage of System – 24-28 VDC
- Other power connections available, including:
  - 120 VAC, 60 Hz
  - 28 VDC via NATO Plug
  - 12 VDC from any source, including solar

**2 Sealed Lead Acid Batteries**
- Energy Content – 35 Ah each
- System Run Time on Batteries Alone – Approx. 1 hour
- Lithium Ion batteries available

**Exportable Power System**
- 200W DC/AC Inverter with two 120VAC plugs @ ~2 Amps

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Expeditionary Waste Water Processing System

Problem:
When setting up an expeditionary base downrange, the Base Expeditionary Airfield Resources (BEAR) is responsible for rapidly fielding and sustaining critical air and space operations. As these deployed Air Force operations are energy and water intensive and considered critical infrastructure, the Air Force Research Laboratory’s (AFRL) Advanced Power Technology Office (APTO) and the BEAR are working to address these risks while meeting the priorities set forth by the 2013 Air Force Energy Strategic Plan.

Solution:
Deployable Expeditionary Waste Water Processing System (EW2PS) unit designed to efficiently recycle gray water. The EW2PS will recover 90%+ of the water from the shower and laundry each day on the BEAR base. In addition to recycling the water, the EW2PS was developed with energy efficiency and low maintenance as key metrics.

The EW2PS is designed as a three-stage filtration:

- In the first filtration stage, mechanical filtration is performed utilizing stacked disc filters. The stacked disc filters are essentially maintenance free, in that the filters are automatically backwashed once a pressure differential across the filter is reached.
- In the second filtration stage, ultrafiltration is performed to polish the water to sufficient quality for reuse in the laundry wash cycle and to be further purified by reverse osmosis.
- The third and final filtration stage is reverse osmosis (RO). With energy efficiency being a key aspect of the system, the RO system is set up for a high recovery rate and low energy input.

Post processing, the EW2PS measures water characteristics and doses chlorine into the processed water as the disinfection technique. The EW2PS is packaged into a 20 foot ISO container for shipment to anywhere in the world that the BEAR base would be deployed.

Benefits:

- Reduces demand on infrastructure
- Reduces energy demand from fossil fuel at deployed operations
- Minimizes deployed labor requirements
- Improves installation security

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Concurrent Technologies Corporation’s (CTC’s) SYLAS-R2™ is designed to significantly reduce water usage by efficiently processing and recycling 90% of greywater generated by large commercial, governmental or institutional users.

Originally developed for the Department of Defense to reduce water resupply needs at forward operating bases, further real world implementation of SYLAS-R2 across various industries would markedly accelerate compliance with national water reuse standards and mandates.

This innovative, decentralized system relies upon a three-stage temperature-tolerant filtration sequence. Its uniqueness comes from incorporating separation media not traditionally used in water filtration. In addition, SYLAS-R2 uses customized control logic to optimize backwash recirculation and increase the overall processing rate. Finally, an energy recovery device in the reverse osmosis filtration stage dramatically reduces the system’s overall energy consumption.

These features, and more, hallmark SYLAS-R2 as a first-of-its-kind, energy-efficient, scalable and fully-automated greywater reuse system that requires little-to-no maintenance and uses few consumable inputs or parts.

**Key Benefits/Results**
- Highly scalable design efficiently delivers quality water at high flux rates.
- Designed for sustainability, SYLAS-R2 is energy efficient, low maintenance, and requires few consumables.
- Cost savings is achieved through reduced water and sewage fees.
- Social and environmental benefits are realized, especially in drought regions and in disaster relief operations across the U.S. and abroad.

Now is the time to ‘come clean’ with the greywater generated from our daily shower and laundry demands. Greywater from these sources is lightly-used, so it simply doesn’t make sense to let it flow down the drain. By separating, processing and recycling greywater with CTC’s SYLAS-R2, millions of gallons a day can be reused for non-potable applications—everything from toileting to agriculture, including reuse for laundry.

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**Three-stage Filtration:**

**First stage:** mechanical filtration is performed utilizing stacked disc filters. The stacked disc filters are essentially maintenance free, in that the filters are automatically backwashed once a pressure differential across the filter is reached.

**Second stage:** ultrafiltration is performed to polish the water to sufficient quality for reuse in the laundry wash cycle and to be further purified by reverse osmosis (RO).

**Third and final stage:** with energy efficiency being a key aspect of the system design, a unique energy recovery device reduces RO energy demand by more than 30%.
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Water Sustainability Solutions
Global Government and Commercial Applications