A Message to Our Readers

JULY 2016

Dear Readers,

Welcome to the 3rd edition of the **Terragon Reporter** – No Waste News. This past quarter has seen the successful completion of the first WETT-O commercial prototype demonstration onboard a commercial tug named *Le Basque*. The treatment performance of WETT has met client expectations, and Terragon looks forward to first commercial sales in March 2017. Additionally, Terragon is in discussion with Québec's Société du Plan Nord concerning another exciting venture: how to contribute to the Plan's ultimate goal of "promoting the potential for mining, energy, tourism, and social and cultural development in Québec north of the 49th degree of latitude" (http://plannord.gouv.qc.ca/en/).

In recent months, Terragon has pushed for the approach of Total Resource Utilization (or TRU) Habitat. The concept is based upon generating resources from what is now "waste" to support autonomy and local sustainability. This vision is enabled through revolutionizing waste management by allowing for the local generation of resources with simple and cost effective appliances such as MAGS and WETT. A heavy focus is placed on how TRU can benefit various habitats in this edition of the Terragon Reporter

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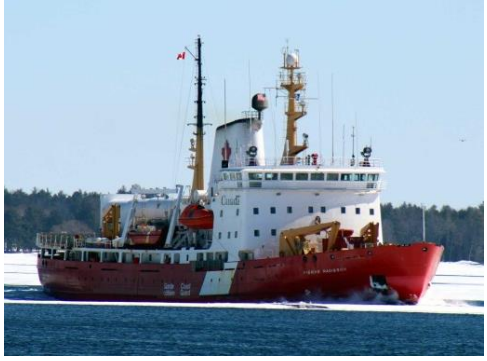
NEWS



The Zero-Waste Ship: Now a Cost-Effective Option

Ships and rigs generate a variety of solid and liquid waste streams that are typically removed at high cost and with the requirement for significant onboard space for storage. With new rules in effect since January 1, 2013 under MARPOL Annex V, all solid waste, with a few exceptions, must be dealt with onboard and is no longer allowed to be discharged into the sea. Current waste management approaches do not offer any benefits to the waste generator other than the elimination of waste from their site.

A new, more environmentally sustainable approach, named STEP or System for Total Environmental Protection, allows for the recovery of thermal energy and reusable water. STEP provides a solution that eliminates the transfer and discharge of waste and allows for the full recovery of resources from waste – for ships and rigs, allowing for the zero-waste discharge vessel.

STEP is the integration of two innovative technologies, namely the Micro Auto Gasification System (MAGS™) for the conversion of mixed combustible waste, such as plastics, paper food and sludge oil, into energy and biochar, and the Wastewater Electrochemical Treatment Technology (WETT™) for the conversion of wastewater into clean reusable water. An independent study by Alion Canada concerning the feasibility of STEP onboard ocean going vessels conducted in 2015 evaluated whether this new waste management equipment and operating philosophy from Terragon are a viable solution for waste handling onboard sea going ships.

The study examined three specific vessels, representative of the international shipping work; a tanker representing commercial cargo vessels, an offshore support vessel representing service vessels, and a frigate representing naval vessels (warship). Although the STEP philosophy and technologies present a higher capital costs, it allows for the treatment of all discarded material onboard for each platform, and at the same time reduces operating costs by significant margins.

The tanker shows good potential savings, Annual operating cost savings of STEP vs. existing practice is 73% which is considerable and translates into a return on investment of 39%. Of all vessels, the offshore support vessel tests the applicability of STEP the most, as the existing systems and procedures are already designed to minimize waste production. However, as presented, STEP still provides a total ownership cost savings of approximately 13% over 25 years. The annual operating cost saving of STEP vs. existing practice is 22% and translates into a return on investment of 11%. Finally, Warships, unlike cargo vessels, do not generate revenue, and finding efficiencies in design are not generally based on reducing costs, but rather on making them better, faster, more capable fighting machine. However, as space is a premium on warships, reducing the size of 'non-operational' equipment presents a great opportunity in maximizing capability, and as such, STEP presents a very interesting alternative for warships. For these ships, the annual operating cost saving of STEP vs. existing practice is 40% and its total cost of ownership saving is approximately 29% over 25 years. This translates into a return on investment of 29%.

Representing the future in green shipping, STEP enables ships and rigs to embrace the sustainable concepts of Zero-Waste and Zero-Discharge all the while benefiting from cost savings and dependable technologies that perform up to expectation.

UPDATE:

Terragon is proud to announce that **WETT-O™** (Wastewater Electrochemical Treatment Technology for Oily Bilge Water) has won in the category of Innovation at Lloyd's List North American Awards 2016! WETT-O is Terragon's patented technology for the purification of oily bilge water using a proprietary, compact and efficient electrochemical purification reactor to provide ultra clean water for safe discharge. You can explore all of the Lloyd's List awards and winners at the following link: http://lloydslistawards-northamerica.com/2016-winners/

Dr. Valérie Léveillé accepting the Lloyd's List Award 2016 for Innovation on behalf of Terragon

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The TRU Mining Camp

Mining camps are known for the environmental impact they impose, with resource extraction out and waste generation in. Minimizing this impact has been a constant goal of environmental ministries and conscientious mining companies for decades. What better setting to benefit from the concept of the TRU Habitat - Total Resource Utilization?- A TRU habitat allows for by-products, discarded materials and wastewater to be recovered and used as valuable resources – a TRU mining camp brings an end to waste generation and the challenges related to waste management.

Mining camps vary from a few to 50 people during a mine's exploration phase, to several hundred people during the production phase. The camp and mine itself generate a variety of materials such as, but not limited to, paper, cardboard, plastics, tires, wood, oily rags/filters, used oils, wastewater and sludge. For some low quantity waste generating camps, open air burning of solid waste and greywater to soil discharge are acceptable practices. However, for larger camps, typically 50 people or more, regulations usually require the transfer of solid waste to landfill, and liquid waste to a water treatment facility. Both present high costs for remotely located mines and camps. Alternatively, many remote camps opt to treat their solid waste, combustible liquids and domestic wastewater in situ using small incinerator and a packaged biological treatment plant.

Treating solid and liquid wastes on site is a cost effective solution; however, embracing the TRU habitat concept can offer more economical and environmental benefits. Camp solid waste and combustible liquid contain a great deal of latent energy that can be recovered using the MAGS energy generating device. MAGS is fuelled by such material to generate thermal energy in the form of hot water that can be used to heat the camp building or preheat water for boilers or hot water tanks. Greywater generated by the kitchen, laundry, showering and indoor cleaning activities can be treated by WETT-G a robust and rapid electrochemical treatment technology. This water can then be reused for any domestic applications aside from consumption. Blackwater generated by toilets can be eliminated using the urine diverting dry toilet (UDDT) which separates feces and urine. The feces can be sent to MAGS to generate thermal energy and the urine can be diluted and used as a complete fertilizer. If a UDDT cannot be used, WETT-S, a robust and rapid chemical and filter-free electrochemical treatment technology can be used to treat blackwater for safe discharge to the environment.

MAGS and the UDDT are already commercially available, while WETT-G and WETT-S will soon be demonstrated in real environment conditions including a mining camp. With this suite of technologies, mining camps, among other environments and habitats, can become more resource autonomous while reducing their operating costs and better protecting the surrounding environment – A TRU habitat reality.

Resource Recovery in Forward Operating Bases

Forward operating bases (FOB's) are "off-grid habitats" whose sustainability in remote locations around the globe is critical for military effectiveness. FOB's vary greatly, ranging from small temporary or semi-temporary camps operating on a tactical basis (supporting up to 50 people) to large permanent bases occupied by up to ten thousand people. In these "off-grid habitats", it is critical to reduce energy and water consumption, while still meeting mission requirements and protecting human health and the environment.

The delivery of water and fuel are the two most recognized logistics and force protection vulnerabilities faced by deployed forces. Challenges and security risks include overcoming tough terrain, coordinating with diverse military units, averting enemy attacks, and patiently dealing with host-nation trucks and local nationals. The onsite generation of energy using renewable fuels, such as combustible waste, and the treatment and reuse of greywater generated by showers and laundry would help to alleviate these burdens, and would significantly improve sustainability.

FOB's generate enormous quantities of solid waste from packaging, kitchens, soldier living quarters and latrines, and can amount to 8 kg/person/day. In comparison, the average civilian waste generation is approximately 1-2 kg/person/day. The most commonly used method of disposal of waste, especially for smaller deployed camps, include backhaul or contracting with local waste haulers, each of which poses a unique security risk, or open pit burning of the waste on site, a practice known to be extremely damaging to human health and the environment.

As with any human habitat, clean drinking water is essential for life, used for drinking, food preparation, laundering and personal hygiene. Potable water is generated on site through energy intensive reverse osmosis water purifiers, or is trucked in via bulk water trucks or palletized water containers. Depending on their size, available contractor services and location, FOB's deal with their wastewater using various techniques, most of which are not focused on water reuse, but instead only treatment for discharge. More austere FOB's, where the security risks related to water delivery is very high, use very primitive methods for wastewater disposal with no possibility for water reuse.

Terragon's TRU (Total Resource Utilization) Habitat approach would enable the onsite conversion of waste to valuable energy and the generation of unrestricted use non-potable water from greywater. This greatly reduces the logistics burden and security risks associated with the handling of such streams by local contractors and the delivery of fuel and water. An FOB supporting 150 military personnel would generate up to 2,500 kWh/day of thermal energy in the form of hot water (or warm air, if needed) and 3,700 gallons/day of reusable water from the treatment of greywater. The TRU habitat approach allows FOB's to operate globally with minimal environmental impact by providing sustainable solutions to local resource management. Empowering militaries to leave occupied environments in the same condition they were originally found demonstrates the epitome of sustainability and transnational respect.