ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 JUNE 2020

The ESD Newsletter is a monthly enterprise involving ALL members of ESD. Members are encouraged to forward materials, authored papers on Environmental and Environmental Systems topics, and comments on newsletter topics or current events to the Editor. Your participation in submitting materials for the newsletter is greatly appreciated.

The ESD newsletter features **Five** Sections:
(Please use the **blue** links below to navigate within newsletter document)

1. ENVIRONMENTAL TECHNOLOGIES

Sustainable Fibers and their Use in the Automotive Industry

With climate change becoming an increasingly discussed topic, the public, governments, businesses, manufacturers and consumers are becoming more conscientious and seeking to make informed choices that have little or no detrimental impact on the environment. This shift in behavior has seeped into every industry, and while some have been early adopters of green alternatives, others have been slower to embrace eco-friendly alternatives. The automotive industry is one industry that is considered to be lagging behind. However, that looks set to change as Lenzing teams up with major manufacturers in the automotive

industry. Around 100 million tons of fibers are produced each year. Those made from materials such as single-use plastics are unsustainable, and companies and manufacturers are now seeking alternative materials to move away from the reliance on these environmentally harmful substances. Initiatives set by governments and global bodies worldwide are encouraging businesses to shift to using sustainable, environmentally friendly materials. While many industries have made changes in significant ways, the automotive industry has been slower to adapt. Although hybrid and electric cars have begun to make their mark in reducing the impact of the automotive industry on climate change, automotive interiors have made little moves to become more sustainable. Automotive manufacturers have been slower to embrace more sustainable interior materials and processes.

Given that making a new car generates almost as much carbon pollution as it does to drive it, changing the energy source is only half the picture and the manufacturing processes of the automotive industry must be updated. One way to target and reduce carbon emissions associated with these manufacturing processes is to make changes to the textiles used in the interiors of vehicles. The Environmental Protection Agency (EPA) states that just 15.2% of textiles produced in the US are recycled, demonstrating the generally low use of eco-friendly textiles, such as those made from sustainable fibers. The automotive industry is no exception, relying on around 30 kg of non-recyclable synthetic fibers to create the interiors of each car produced. However, things are changing. Lenzing will now make eco-friendly, sustainable fibers for use in car interiors to help reduce the detrimental impact on the environment caused by the automotive industry. (Ref. 1) **Back to Newsletter's Page 1**

How digital technology has revolutionized the agricultural sector globally

Advancement in digital technology, ubiquitous internet connectivity, and ever-increasing penetration of smartphones are all manifestations of the digital revolution. Agriculture too is taking advantage of this revolution in many ways. During the last few years, technology has empowered farmers with access to information and markets, streamlined supply chains, provided tools for food safety and security, and more. In a post-pandemic world, the transformation will only become faster. Farmer level interventions will give tools to farmers and thereby putting the power back in their hands is the biggest contribution of digital technology. Just like an entrepreneur, farmers now have access to a suite of solutions that tells them what crop will fetch them better returns, the best time to sow, when to water, where to sell and at what price, and much more. Most of these solutions already come at a price point where even a small farmer can afford them; and a few others need groups of farmers to come together.

Digital technology has also enabled farmers to use their phone camera to identify a pest or disease. They can also get customized weather advisories or information on mandi prices, etc. However, while an average farmer in the US or Europe can afford drones to spray pesticides or have IoT-enabled irrigation systems, farmers in developing countries still have to come together to make these technologies affordable. Nevertheless, in spite of that, we have seen new models evolve, and farmers across the world are gaining access to some advanced technologies. Digital technology has not just empowered individual farmers, but it has made the whole ecosystem more efficient and more sustainable. Market linkage platforms connect farmers with potential buyers, providing them with a guaranteed and

sustainable market. Digitized certification has made it easier to share farming practices and connect with conscious buyers who are willing to pay premium prices. Moreover, visibility to market prices and commodity futures can improve the price paid to farmers. Similarly, data on the consumption side is influencing how organizations come to know and learn about their customers. Digital technologies have also helped cut food loss and waste, which is to the tune of 14 percent of the world's food produced. Sensors are being used for crop monitoring, post-harvest, and market quality monitoring. Artificial intelligence and machine learning too has made great strides in detecting plant diseases and receiving advisory from authorized sources, and prevent crop loss. (Ref. 2) **Back to Newsletter's Page 1**

2. ENVIRONMENTAL REGULATIONS

Pennsylvania VOC Emission Crackdown Eyed from Existing Natural Gas, Oil Infrastructure

Emissions from Pennsylvania's existing natural gas and oil infrastructure, including at Marcellus and Utica shale sites, are facing more stringent oversight under a draft proposal. The draft rulemaking covering volatile organic compounds (VOC) published by the Environmental Quality Board (EQB) for public comment over the next two months would be the first to address VOC emissions from the existing infrastructure. The Pennsylvania Department of Environmental Protection (DEP) initially issued a proposal in late 2018 to curb emissions from existing production and midstream operations, and late last year the ECB gave it the green light. Five source categories would be affected by the proposed VOC rules: Storage vessels; Natural gas-driven pneumatic controllers; Natural gas-driven diaphragm pumps; Reciprocating and centrifugal compressors; and Fugitive emissions components. The draft rules increase oversight for VOCs, requiring operators to adopt rules covering reasonably available control technology, aka RACT, as well as emission limits for gas and oil sources. In addition, the rulemaking would add federal Clean Air Act definitions to support the measures, requiring the U.S. Environmental Protection Agency to sign off to revise the State Implementation Plan. The proposal only requires VOC emissions to be reduced, but DEP noted that a "co-benefit" would be lower methane emissions, as VOCs and methane are emitted from gas and oil operations. "However, implementation of the proposed control measures would also potentially save the oil and natural gas industry about $9.9 million/year due to a lower natural gas loss rate during production," regulators noted. Cutting methane pollution from existing oil and gas sources is critical to meeting our climate goals. It is needed to ensure that we do not lose the progress we have made in reducing carbon emissions. This rulemaking moves us closer to a sustainable and economically viable energy portfolio by holding producers to a reasonable standard that can be met at little or no cost to them (Ref. 3) **Back to Newsletter's Page 1**

Impact of Covid-19 on Lead Recycling Battery market

The statistical surveying report comprises of a detailed study of the Lead Recycling Battery Market 2020 along with the industry trends, size, share, growth drivers, challenges, competitive analysis, and revenue. The report also includes an analysis on the overall market competition as well as the product portfolio of major players functioning in the market. To understand the competitive scenario of the market, an analysis of the Porter's Five Forces model has also been included for the market. The rising stringency of government regulations pertaining to reducing the emission of greenhouse gases and the protection and conservation of the environment has given the global battery recycling services market all the push it needs. Growing awareness about recycling among the general population has also resulted in the surge in battery recycling, signaling the immense potential this market possesses. Battery manufacturers around the world have also realized the environmental and health hazards of used batteries and have been setting up their own recycling centers. The level of awareness regarding pollution control and energy conservation is rather high among the people in Europe, resulting in the rising demand for battery recycling services. This demand is also supported by the participation of various government institutions.

The strict implementation of various rules pertaining to the proper disposal of used batteries and the strong support for recyclers in the form of compensations have greatly boosted the battery recycling services market in Europe. Stringent environmental regulations and the rising exports from developing and developed countries are anticipated to give the APAC battery recycling services market a significant push in the next few years. Batteries are made up of various materials such as cadmium, lead, lithium, mercury, nickel, manganese, and zinc, and quite a few of these are extremely toxic. Used batteries, if not disposed of properly, can result in hazardous health and environmental conditions. Lead Recycling Battery produces a host of hazardous wastes, including lead, cadmium, arsenic and volatile organic compounds.

Although the practice of battery recycling has been gaining strength at the industrial level with electronic appliances and automotive companies setting up their own recycling centers, the awareness level of among final consumers continues to remain low. This lack of knowledge about battery recycling is likely to act as a major impediment to the growth of this market. The report researches the worldwide Lead Recycling Battery market size (value, capacity, production and consumption) in key regions like United States, Europe, Asia Pacific (China, Japan) and other regions.

This study categorizes the global Lead Recycling Battery breakdown data by manufacturers, region, type and application, also analyzes the market status, market share, growth rate, future trends, market drivers, opportunities and challenges, risks and entry barriers, sales channels, distributors and Porter's Five Forces Analysis. The report also provides a detailed outlook of the Lead Recycling Battery market share along with strategic recommendations, on the basis of emerging segments. (Ref. 4) **Back to Newsletter's Page 1**

USDA SECURE rule paves way for agricultural innovation

U.S. Secretary of Agriculture Sonny Perdue announced a final rule updating and modernizing the U.S. Department of Agriculture's (USDA) biotechnology regulations under the Plant Protection Act. The Sustainable, Ecological, Consistent, Uniform, Responsible, Efficient (SECURE) rule will bring USDA's plant biotechnology regulations into the 21st century by

removing duplicative and antiquated processes in order to facilitate the development and availability of these technologies through a transparent, consistent, science-based, and risk-proportionate regulatory system. This new rule will help provide America's farmers access to these critical tools to help increase agricultural productivity and sustainability, improve the nutritional value and quality of crops, combat pests and diseases, and enhance food safety. EPA applauds USDA's efforts to finalize the SECURE rule that will support our nation's farmers. EPA is continuing our own efforts to safely reduce unnecessary regulations and further break down barriers to support advancements in biotechnology. Alongside the USDA as they work to implement the SECURE rule, the FDA is committed to encouraging innovation in agricultural biotechnology while utilizing scientific risk-based approaches in our regulatory approach.

USDA's previous regulations focused on whether a plant pest was used in the development of a plant using genetic engineering and required a lengthy deregulation process for those plants that did not pose increased pest risk. After 30 years of experience, USDA's Animal Plant Health Inspection Service (APHIS) regulatory scientists know that simply using a plant pest in the development of a plant does not necessarily cause the plant to pose a risk to plant health. Thus, the final rule puts in place a more efficient process to identify plants that would be subject to regulation, focusing on the properties of the plant rather than on its method of production. APHIS will evaluate plants developed using genetic engineering for plant pest risk under a new process called a regulatory status review, regulating only those that plausibly pose an increased plant pest risk. USDA undertook an extensive outreach effort in developing the proposed rule, traveling the nation and meeting with the public, members of academia, state departments of agriculture, grower and commodity-related organizations, and non-governmental organizations. In issuing the final SECURE rule, APHIS carefully considered each of the thousands of comments received in response to proposed rule. (Ref. 5)

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3. ESD DIVISION NEWS

ESD Technical Representative to Waste Information Exchange Planning Committee – Volunteer Opportunity

The Environmental Systems Division (ESD), in conjunction with the ASME Materials and Energy Recovery Division, the ASME Research Committee on Energy, Environment and Waste, and the Air and Waste Management Association (A&WMA) are planning a Waste Information Exchange (WIE) in the Washington, DC area. The WIE will be based on the [Air] Information Exchange held annually in North Carolina. The main presenters will be EPA personnel.

ESD is looking for a volunteer to be the ESD Technical Representative to the Planning Committee. The individual should be familiar with the RCRA/HSWA regulatory program (including guidance and compliance/enforcement issues) on both solid and hazardous waste. Contacts in the Office of Resource Conservation and Recovery (ORCR) in DC would be a plus. Most of the work will be by telephone or electronic mail.

Submit Nominations: please contact Arnie Feldman at jjdsenv@att.net or Ryan Neil, ESD Chair, at ryanneil84@hotmail.com

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Dixy Lee Ray Award Committee – Volunteer Opportunity

The Dixy Lee Ray Award Committee is looking for a volunteer to serve as a committee member.

The Dixy Lee Ray Award is a prestigious ASME level award honoring those that have made a major impact in the environmental protection field. See https://www.asme.org/about-asme/honors-awards/achievement-awards/dixy-lee-ray-award for additional details

Committee members' primary responsibility is to review nominations and select the annual Dixy Lee Ray Award winner. Committee members also help promote and publicize the award to their colleagues and friends.

The committee normally meets thru conference calls and email. Nominations are due to the committee by February 15 each year so most of the discussion and teleconference meetings occur February, March and April. All committee members must be an ASME members. The term of service is5 years.

Submit Nominations: please contact Ryan Neil, ESD Chair, at ryanneil84@hotmail.com.

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Call for Papers - WTERT Biennial Conference 2020

Earth Engineering Center (EEC), City College of New York, (CCNY) in collaboration with ASME Material and Energy Recovery Division, are pleased to announce the WTERT Biennial Conference 2020. The Conference is set for Oct 22-23, 2020, at CCNY.

The abstract topics include:

- Thermal conversion technologies
- Operations
- Metal recovery
- Improvements
- New projects
- Residual upgrading and use
- Sustainable waste management solutions

If you are interested in submitting abstract, please send it to eec2020@eecconferences.com. For all abstract inquiries, please contact jeff.leblanc1@yahoo.com.

The call for abstracts now open through June 14, 2020. **Back to Newsletter's Page 1**

ICEM 2021 ANNOUNCEMENT, Call for Volunteers

ASME, the Nuclear Engineering and the Environmental Systems Divisions, are pleased to announce the return of the International Conference on Radioactive Waste Management and Environmental Remediation (ICEM). The Conference is set for Oct 10-13, 2021, in Stuttgart, Germany. As with past, ICEM's the Conference will feature Plenary and Luncheon speakers, breakout sessions, and a large exhibit hall suitable for equipment displays for radioactive D/D&D tasks. The breakout sessions will feature panel discussions, invited speakers, articles, and presentations, as well as peer-reviewed papers.

The Tracks for ICEM 2021 include:
Track 1: Robotics and Remote Handling and Viewing Technologies
Track 2: Facility Decommissioning, Decontamination & Demolition (D/D&D) Overall (Plan, Decommissioning, Demolition, R&D)
Track 3: Major facilities experience in handling accidents and D/D&D
Track 4: Spent Fuel, Fissile Material, TRU, and HLW Management:
Track 5: L/ILW Radioactive Waste Management:
Track 6: Environmental Remediation (ER) including Activities at NORM/TENORM Sites
Track 7: Special Topics 1 - Public Involvement/ Crosscutting Issues/Global Partnering/Human Resource Development
Track 8: Special Topics 2 – New Facility Planning/ Environmental Management (EM)/ Health & Safety
Track 9: Student/Young Engineers Program
Track 10: D/D&D Research & Development Activities

If you are interested in being a Track Chair, a Session Chair, or helping to develop the conference, please do not hesitate to contact Arnie Feldman (jjdsenv@att.net) or Bob Stakenboroghs (bob@evisive.com).

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4. EDITORIAL BOARD SELECTIONS

Reducing Fuel Consumption and GHG Emissions of Medium- and Heavy-Duty Vehicles

Medium- and heavy-duty trucks, motor coaches, and transit buses - collectively, "medium- and heavy-duty vehicles", or MHDVs - are used in every sector of the economy. The fuel consumption and greenhouse gas emissions of MHDVs have become a focus of legislative and regulatory action in the past few years. This study is a follow-on to the National Research Council's 2010 report, Technologies and Approaches to Reducing the Fuel Consumption of Medium-and Heavy-Duty Vehicles. That report provided a series of findings and recommendations on the development of regulations for reducing fuel consumption of MHDVs. On September 15, 2011, NHTSA and EPA finalized joint Phase I rules to establish a comprehensive Heavy-Duty National Program to reduce greenhouse gas emissions and fuel consumption for on-road medium- and heavy-duty vehicles. As NHTSA and EPA began working on a second round of standards, the National Academies issued another report,

Reducing the Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase 2: First Report, providing recommendations for the Phase II standards. This third and final report focuses on a possible third phase of regulations to be promulgated by these agencies in the next decade. (Ref. 6) **Back to Newsletter's Page 1**

The Macroproblem of Microplastics

Right up until the coronavirus pandemic hit, the Northwest was near the forefront of the global movement against plastics. Scores of cities in the region had banned various single-use products, and in March, the Washington State Legislature banned plastic grocery bags statewide, effective January 2021. The laws in Cascadia were part of a wave of bans on disposable consumer plastic products—especially straws and bags—that swept across North America and Latin America. This wave has even extended to China, the world's biggest consumer of single-use plastics. Now many of those laws are in jeopardy or have been temporarily suspended, with grocery stores and restaurants offering takeout and eschewing reusable products in favor of single-use plastics that are believed to be more hygienic. This response may be understandable as a short-term public health measure, but it carries a serious long-term risk. With 335 million tons of plastic produced annually—and 9 million tons of it ending up in the ocean—plastic is widely recognized as a major threat to the climate, wildlife, and oceans. Scientific studies have found plastic fibers almost everywhere—in the stomachs of whales, in tap water, and even in table salt. In addition, recent research shows that solar radiation degrades plastic, causing it to emit climate-warming methane.

Bans on plastic use are one of the few ways to reduce the manufacturing of plastic in the first place. The world's plastic problem is not only a problem of proper waste management (a serious issue in a few countries) but also one of the very existences of plastic. Before plastics become products (lawn chairs, thin grocery sacks, or hundreds of other items), they often start as nurdles. Designed for ease of transport and versatility in manufacturing, these tiny pellets are the intermediate stage between raw petrochemicals like ethane and finished consumer goods. Roughly, the size of a lentil, nurdles is considered microplastics—diminutive in stature but huge in its potential threat to the ecosystem. Researchers estimate that each year approximately 230,000 tons of nurdles end up in the environment, accidentally spilled or otherwise released by the plastics industry. Given that a single nurdle weighs only about 20 milligrams, this means that more than 10 trillion tiny plastic pellets are entering the world's rivers and oceans every year. Birds and sea creatures often mistake nurdles for food, and their ingestion can lead to poisoning (in part, because the pellets can absorb toxic chemicals like DDT) or starvation, as nurdles cannot be digested and can fill up an animal's stomach over time. (Ref. 7) **Back to Newsletter's Page 1**

California trash-to-hydrogen plant promises dirt-cheap, super-green H2

Lancaster, California will be home to a "greener than green" trash-to hydrogen production plant (SGH2), three times the size of any other green H2 facility. SGH2 says its process is the cleanest of all on the market, while matching the price of the cheapest producers – and pulling tens of thousands of tons of garbage out of landfills. For better or worse, many world economies are gearing up to make hydrogen a significant part of the future energy economy.

Japan and Korea in particular are making big moves and enormous investments to get this zero-local-emissions energy storage format up and running. Production of hydrogen can vary from the relatively green (electrolysis of fresh water using solar or wind-based energy) to the profoundly filthy (gasification of brown coal) – and the filthiest are by far the cheapest. Adding carbon capture and sequestration to dirty processes simply makes them more expensive. That's what makes this SGH2 project so interesting – the company claims it can take trash that would otherwise sit in a landfill and rot, and turn it into super-green hydrogen at bargain-basement prices. According to a recent memorandum of understanding, the city of Lancaster will host and co-own the SGH2 Lancaster plant, which will be capable of producing up to 11,000 kg of H2 per day, or 3.8 million kg per year, while processing up to 42,000 tons of recycled waste per year. Garbage to clean fuel, with a US$2.1 to $3.2 million saving on landfill costs per year as a sweetener.

The process, developed by SGH2's parent company Solena, uses high-temperature plasma torches putting out temperatures between 3,500 and 4,000 °C (6,332 to 7,232 °F). This ionic heat, with oxygen-enriched gas fed in, catalyzes a "complete molecular dissociation of all hydrocarbons" in whatever fuel you have fed in, and as it rises and begins to cool, it forms "a very high quality, hydrogen-rich bio-syngas free of tar, soot and heavy metals." The process accepts a wide variety of waste sources, including paper, old tires, textiles, and notably plastics, which it can handle very efficiently without toxic by-products. The bio-syngas exits the top of a plenum chamber, and is sent to a cooling chamber, followed by a pair of acid scrubbers to remove particulate matter. A centrifugal compressor further cleans the gas stream, leaving a mixture of hydrogen, carbon monoxide and carbon dioxide. This is run through a water-gas shift reactor that adds water vapor and converts the carbon monoxide to carbon dioxide and more hydrogen gas. The two are separated, neatly capturing all the CO2 as hydrogen comes out the other end. A Berkeley Lab lifecycle carbon analysis concluded, says SGH2 that each ton of hydrogen produced by this process reduces emissions by between 23 and 31 tons of CO_2 equivalent – presumably counting emissions that would be created if the garbage was burned instead of converted into hydrogen. That would be between 13-19 tons more carbon dioxide avoided than any other green hydrogen production process. What's more, while electrolysis requires some 62 kWh of energy to produce one kilogram of hydrogen, the Solena process is energy-positive, generating 1.8 kWh per kg of hydrogen, meaning the plant generates its own electricity and does not require external power input. (Ref. 8)

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Directed evolution" gets around CRISPR's inherent limitations

DNA, the genetic material that produces life on Earth, is made of unique sequences known as "genes." It is possible to edit those genes, using technology called CRISPR-Cas9. CRISPR essentially acts as a pair of molecular scissors to replace an existing gene by cutting the DNA at a desired sequence and swapping in a newer version. In the case of a disease caused by a single mistake in a gene, this has huge potential – CRISPR could be delivered to the mutation and fix it by replacing the wrong sequence with the correct one. Applications of gene editing spread beyond gene therapy as well, from engineering more resilient crops to curbing insect-borne diseases and more. However, there is a catch: in order for editing to occur, a short but highly specific sequence of DNA known as a 'PAM', must be located directly beside the editing sequence, like runway lights for a plane to land on.

In a recent study, scientists used cutting-edge research techniques to improve that system. Many diseases, including sickle cell anemia, are caused by mutations without a nearby PAM, ruling out CRISPR-gene editing as a potential treatment. The researchers in this study wanted to design new versions of CRISPR that could recognize more common PAMs, and could therefore reach more genes for therapeutic intervention. To do this, they used a Nobel prize-winning technique known as directed evolution, a method to quickly make and test thousands of variants of CRISPR to design a more versatile version of the gene editor. The authors showed that the new CRISPR editors could repair the mutation causing sickle cell anemia. They might also have the be able to target far more single mutations that cause disease than ever before possible. While there are still challenges before CRISPR reaches the clinic, the results of this paper enormously increase the scope of medical, environmental, and agricultural impacts that gene-editing technology can have on society. (Ref. 9) **Back to Newsletter's Page 1**

Air Protein – Creating Meat Out Of Air

By 2050, the population is expected to reach 10 billion, resulting in a 70% increase in the demand for food production. This means an increased need for land and resources for food production. Current food production accounts for more greenhouse gas emissions than the entire transportation sector, and has led to the clearing of an area of land equivalent to the size of Africa and South America combined. In October 2019, the Air Protein team announced that they had transformed CO_2 to develop the world's first air-based meat – meat made with protein that does not require any arable land. Air Protein uses a process similar to fermentation to make a protein that is rich in vitamins. It is also free from hormones, antibiotics, pesticides, or herbicides. We are focused on demonstrating the versatility of air-based protein to make meat analogues across a variety of categories, including poultry, beef, pork, and seafood.

Like plants, air-based protein uses CO_2, which is in the air we breathe and renewable energy as inputs. Whereas seeds are planted in soil to grow, air-based protein starter cultures grow in water. Crops require months to go from seed to harvest, but air-based protein is ready for harvest in a few short days and the output is a nutritious protein that is rich in all the essential amino acids, vitamins and minerals. To make meat, we apply a combination of pressure, temperature, and culinary techniques to our protein to give it different flavors and textures. In this way, we are able to make delicious analogues to poultry, pork, beef, or seafood. Air-based meat uses a fraction of the environmental footprint versus alternatives. The key ingredient, protein, is made in the most sustainable way to make protein. It does not require any arable land – not for production and not for the inputs. In fact, it would take a soy farm the size of Texas to produce the same amount of protein that one would get from an Air Protein farm the size of Walt Disney World. This independence from arable land means that protein can be made day or night, rain or shine, and in any climate or in any geography. This flexibility can make for a more resilient and secure supply chain. (Ref. 10) **Back to Newsletter's Page 1**

5. ESD NEWSLETTER READER COMMENTS

None received this month.

Expecting the reader's comments and views on the newsletter.

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ESD NEWSLETTER BOARD

NEWSLETTER ARTICLE REFERENCES

1 https://www.azocleantech.com/article.aspx?ArticleID=1095
2. https://yourstory.com/2020/05/digital-technology-revolutionised-agricultural-sector-globally
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ABOUT NEWSLETTER

ENVIRONMENTAL ENGINEERING features the application of environmental technologies to engineering systems to attain optimal performance according to established standards. The Newsletter of the Environmental Systems Division (ESD) will attempt to highlight a variety of environmental technology applications aimed at enhancing engineering systems performances in accordance with the latest standards by presenting excerpts of and links to selected articles from a variety of websites.

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