



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 NOVEMBER 2019

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

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1. ENVIRONMENTAL TECHNOLOGIES

Genetically modified superfood that almost saved millions

The cover of the July 31, 2000, edition of Time magazine pictured a serious-looking bearded man surrounded by a wall of greenery: the stems, leaves, and stalks of rice plants. The caption, in large block lettering, read, “This rice could save a million kids a year.” The man in question was **Ingo**



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Potrykus, a professor of **plant sciences** at the Swiss Federal Institute of Technology, in Zurich. The rice plants around him, although the joint products of many minds and hands, had been largely inspired by him. Their kernels were not the usual plain white grains of rice. Instead, they had a distinct golden hue, the color of daffodils. When spread out on a black surface, they looked like nothing so much as tiny yellow gemstones. This was **Golden Rice**, the fruit of nine years of research, experimentation, and development. The “gold” was, in fact, **beta-carotene**, a substance that is converted into vitamin A in the human body. Conventional rice plants already contained beta carotene, but only in their leaves and stems, not in the kernels. Golden Rice also carries the substance in the part of the plant that people eat. **This small change made Golden Rice into a miracle of nutrition:** The rice could combat vitamin A deficiency in areas of the world where the condition is endemic and could, thereby, “save a million kids a year.” Vitamin A deficiency is practically **unknown in the Western world, where people take multivitamins or get sufficient micronutrients from ordinary foods, fortified cereals**, and the like. However, it is a life-and-death matter for people in developing countries. Lack of vitamin A is responsible for a million deaths annually, most of them children, plus an additional 500,000 cases of blindness. In Bangladesh, China, India, and elsewhere in Asia, many children subsist on a few bowls of rice a day and almost nothing else. For them, a daily supply of Golden Rice could bring the gift of life and sight. (Ref. 1) [Top](#)

Bioremediation technology & services market: trend, CAGR status, growth, analysis and forecast to 2025

The global market for the bioremediation technology & services market was valued at USD 32.2 billion in 2016 and is estimated to reach USD 65.7 billion by 2025 at a CAGR of 8.3% from 2017 to 2025. Bioremediation is a process that uses naturally occurring organisms that help in the breakdown of hazardous substances into non-toxic or less toxic substances. Bioremediation does not use chemicals, and it allows the waste to be recycled once the contamination is removed or neutralized. It is applicable for many applications such as soil preservation, wastewater treatment, air pollution, radioactive hazard treatment, etc. Increasing awareness about water scarcity in the future, and government regulations & initiatives for environmental sustainability drives the market growth rate by 2025. The global bioremediation technology & services market is categorized based on technology, and by services. Based on technology, the bioremediation technology & services market is further classified into phytoremediation, biostimulation, bioaugmentation, bioreactors, fungal remediation, and land-based treatments. Fungal remediation was a major segment of technology in the bioremediation technology & services market due to the increase in the use of mycelium to disintegrate contaminants from waterways, soil, or even radioactive contaminated areas. This will increase the usage of fungus for treatment procedures of soil, which are being polluted by mercury & other heavy metals. Hence, the factors are likely to fuel the growth of the segment by 2025. The phytoremediation segment is the second major segment of technology in the bioremediation technology & services market due to an increase in metal-contaminated sites, rapid industrialization, and deeper soil contamination with toxic radioactive pollutants. The factors are likely to drive the segment growth in market share by 2025. (Ref. 2) [Top](#)



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2. ENVIRONMENTAL REGULATIONS

The deadliest form of energy: debunking misconceptions

One of the criticisms often leveled at nuclear power is that it poses a significant threat to human life, with disasters at Chernobyl and Fukushima highlighting the significant damage that can be done by a faulty nuclear facility. However, a study by Forbes calculated the “death print” of several energy sources – the number of people killed per kWh produced – and found that nuclear is, in fact, the **form of energy with the lowest mortality rate**, with tough regulation and proactive industry bodies leading the way. The performance of nuclear is particularly impressive, considering its contribution to global electricity production; of the eight energy sources profiled by Forbes, nuclear has the lowest global mortality rate, with just 90 people killed per trillion kWh produced. This figure is inflated by the inclusion of the Chernobyl and Fukushima disasters, which suggests that run-of-the-mill nuclear facilities are even less likely to see operational deaths than this figure suggests.

Energy sources such as coal, hydropower, and biomass all contribute greater proportions of the world’s electricity and have a significantly higher mortality rate than the nuclear sector, even though the reputation of nuclear, perhaps contributing to a legislative strictness not replicated in other sectors. power sources such as Biomass, which are largely decentralized and common in countries with less developed regulatory frameworks, see significantly higher mortality rates, despite the relatively small-scale nature of these facilities. The report notes that natural gas, which is responsible for twice the electricity contribution of nuclear power, has a mortality rate of 4,000, a death print well over double that of nuclear. (Ref. 3) [Top](#)

3. ESD CHAIRMAN/DIVISION NEWS

Congressional fellowship: 2020-2021 opportunities in energy and manufacturing

Who: Applicants must be a U.S. citizen, and member of ASME at time of application.

Why: ASME Federal Government Fellows have served in the Executive and Legislative branches of the U.S. Government for the past 46 years applying their engineering expertise to complex issues. Fellowships are a life-changing experience, resulting in new professional qualifications and providing Fellows with the satisfaction of having served the public good at the highest levels.

How: This program affords ASME Members an opportunity to move to Washington, DC, to serve a one-year Fellowship in the Executive and/or Legislative Branches of Government, where they provide engineering and technical expertise to policymakers.

More details: <https://lyris.askestaff.org/t/511188/4615455/82054/0/> [Top](#)

Regulatory engineering forum

ESD held a Regulatory Engineering Forum in Washington, DC, on October 3rd and 4th. Over 50 individuals representing US Congress, Federal regulatory agencies, professional engineering societies, state regulatory agencies, industry, and non-governmental agencies were invited.



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Topics included, among others, APA-101, the underlying scientific and engineering segments of regulations, how agencies do things, dealing with overlapping & duplicative regulations, the role of engineering standards in regulations, and regulatory engineering in educational curriculum/early career. The Plenary Speakers were Thomas Constable, Executive Director & CEO of ASME on October 3rd, and Douglas Benevento, USEPA Associate Deputy Administrator October 4th.

Some observations and outcomes of the forum were (in no order):

- Rare to get the different groups together and just talk/discuss items
- Engineers tend to over emphasize technical information to non-tech people
- Regulations need to be optimized – more efficient
- Regulatory Engineers need to understand how regulations are developed and enforced
 - Administrative Procedures Act (APA)
 - Statutes → Regulations → Judicial Decisions
 - Development/Enforcement
- Most important that the regulated community provide substantial and technical comments on proposed rules and where productive, file petitions for rulemaking
- Regulatory Engineers are uniquely suited to testify before Congress and serve as expert or fact witness
- EPA feels they made tremendous progress in 50 years of existence: yet some surveys say the environment is getting worse or that we are losing previously achieved gains
- Curriculum for regulatory engineering at Universities/Colleges would:
 - Improve the employability of graduates
 - Improve performance standards for stewardship established by the engineering profession
- Need to share knowledge and resources between regulators and the regulated community.

A consensus of the attendees resulted in the following recommendations (in no order):

- Attendees strongly agreed there is a need to expand/develop what we did at 'bench-scale' this year
- Need a better understanding/communication of the preamble to a regulation
 - Discussions with the Agencies
 - Webinars/Workshops on new regulations by agencies
- Develop a course on the APA for regulatory engineers covering the development and enforcement of regulations.
- ASME (and other professional engineering societies) should provide more comments on regulations and have better collaboration with agencies (e.g., ORD) on regulatory development
- Need a better way to streamline the regulatory process to keep up with current conditions
- ASME to look into new regulatory engineering "short courses" and training (e.g., webinars, workshops) on APA and Regulatory Engineering basics including:
 - Different levels of need for undergraduate, graduate, and continuing education.
 - Needs to be ACCESSIBLE – cost, location, duration/time, content learning styles, etc.



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- Work with other engineering societies (e.g., AIChE)
- Give at appropriate conferences IMECE 2020 (large attendance by academics)
- Future Regulatory Engineering Events
 - Short Courses/Webinars on Regulatory Engineering Basics
 - Directed at college Department Heads
 - Next Regulatory Engineering Forum
 - One Year
 - Have greater participation by regulators & regulated community

For more information, please contact Arnie Feldman at jjdsenv@att.net . [Top](#)

Dixy Lee Ray award announcement

Why: The Dixy Lee Ray Award, established in 1998 "for outstanding engineering achievement in environmental protection through improvements in technology, science, and policy," recognizes significant achievements and contributions in the broad field of environmental protection. Achievement in the following areas will be recognized: environmental engineering, including environmental technology and related topics; other environmental areas, including environmental health, environmental sciences, environmental management and policy, and related topics. The award was established in honor of Dixy Lee Ray's advocacy to the development of those technologies that serve humanity. She believed that the engineering profession was uniquely qualified to develop and implement environmentally acceptable technologies. The person winning this award will be presented with a \$1000 honorarium, a bronze medal, a certificate, and will also receive a travel grant (not to exceed \$750) to attend the presentation ceremony. [Top](#)

Submit Nominations: Send nominations to the Award Committee Chair, M.C. Edelson, at mcedelson@gmail.com

Deadline: Must be received by February 1, 2020.

More Information: Contact the Award Committee Chair.

List of Past Winners: Available at (<https://www.asme.org/about-asme/honors-awards/achievement-awards/dixy-lee-ray-award>).

Volunteers for ASME ESD events committee

ASME ESD is involved with several current events, including:

- Participating in **ACES** and **Power Conference**
- Leading International Conference on Environmental and Radioactive Waste Management [ICEM], –Regulatory-Engineering Forum, and Regulatory Engineering Conference
- Participating/leading Waste Information Exchange [WIE], and Regulatory Engineering Training

To better coordinate ESD's work and participation in the various events, the Executive Committee has set up a new ESD Events Committee (EC). The Executive Committee is NOT asking you participate in additional events (unless you want to) but is seeking volunteers (3-5) to serve on the EC.



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The EC will require a minimal amount of time and will be conducted only by conference calls (no travel) - probably bi-monthly – and through emails.

The EC will promote ESD's goals by sponsoring technical sessions within ASME and sponsoring/cosponsoring (with other professional societies and organizations) events including technical sessions, leading events, developing events and participating in events. The selection of sponsored sessions with ASME will be determined by the EC with input from the Executive Committee and from the ESD's membership. The EC recommends to the Executive Committee co-sponsorship with other organizations of technical sessions of interest to the ESD membership. The EC will coordinate all event activities for ESD and will report to the Executive Committee on an as needed basis.

More Information or Interest: please contact Arnie Feldman jjdsenv@att.net . [Top](#)

Sustainability study on 3D modelling software - engineering for change

Why: As part of this Fellowship program by *font size.....*Engineering for Global Development team, who has a research collaboration with Autodesk, whose research is led by an ASME Fellow, and aimed at gathering data on environmental sustainability in 3D modeling software (Fusion 360, Inventor and others).

What: 5-minute online survey from you and anyone else connected to your ASME professional sections/committees (SHARE IT WITH YOUR NETWORK) that have had experience using AutoCAD, Fusion 360, etc.

Here is the link to the survey: <https://forms.gle/XVeB9YoZX68qEfvc9>

If there are any experts in 3D modeling software in your network you believe would be willing to chat with our Fellows for at least 15 min, please pass those along. We would greatly appreciate your input to help better understand perceptions around sustainability in CAD modeling. We will send along the final report to be published on E4C's website following the conclusion of this research.

More Information: cruzalfonzoc@asme.org [Top](#)

ASME Environmental Student/Early Career Competition Committee

ASME Environmental Systems Division (ESD) has started work on a new Environmental Student/Early Career Competition. The competition is envisioned to be between like age/education individuals or groups (e.g., classes, schools, etc.). The Committee will work out all the details of the program, resolve issues, obtain approval first by the ESD Executive Committee and then by ASME, develop a budget, advertise the program and run the first competition (including obtaining questions & judges) in addition to anything else the Committee believes is necessary.

More Information or Interest: please contact Arnie Feldman jjdsenv@att.net . [Top](#)

01 NOVEMBER 2019**4. EDITORIAL BOARD SELECTIONS****A genius concept for eco-friendly batteries**

From smartphones to electric cars, we are going to continue to need plenty of batteries in the years to come. New research shows how an upgraded type of aluminum battery could offer several advantages over traditional lithium-ion materials in use today. The battery has low production costs and does not take the same environmental toll as the batteries we currently use, partly because it uses materials that are abundant and easy to find, reducing our reliance on ravaging the planet to power our electronics. This new battery concept is particularly suitable for large-scale power systems – sites where renewable energy needs to be stored until its ready, for example. In contrast, not only is lithium scarce, but lithium-ion batteries often make use of cobalt too – and that is tricky and potentially dangerous to mine. The switch over to aluminum, if scientists can make it work, would have several benefits, not least by reducing our reliance on fossil fuels for battery production and recycling. Aluminum batteries are not new, but in this case, researchers swapped out the graphite usually used as the cathode, replacing it with the carbon-based molecule anthraquinone (the cathode absorbs electrons as the battery is used). Helping achieve higher energy density, making aluminum batteries a lot more practical, sustainable and commercially viable than before – though there is plenty of room for improvement yet in the internal chemical mix, particularly in the electrolyte that encourages ions to travel between the anode and cathode. (Ref. 4) [Top](#)

What is the best way to cut vehicle greenhouse-gas emissions?

Policies to encourage reductions in greenhouse gas emissions tend to stress the need to switch as many vehicles as possible to electric power. However, a new study by **MIT** and **Ford** Motor Company finds that depending on the location, in some cases, an equivalent or even bigger reduction in emissions could be achieved by switching to lightweight conventional (gas-powered) vehicles instead – at least in the near term. The study looked at a variety of factors that can affect the relative vehicle performance, including the role of low temperatures in reducing battery performance, regional differences in average number of miles driven annually, and the different mix of generating sources in different parts of the U.S. The study combined a variety of datasets to examine the relative impact of different vehicle choices down to a county-by-county level across the nation. It showed that while electric vehicles provide the greatest impact in reducing greenhouse gas emissions for most of the country, especially on both coasts and in the south, significant parts of the Midwest had the opposite result, **with lightweight gasoline-powered vehicles achieving a greater reduction**. The biggest factor was the mix of generating sources going into the grid in different regions. That mix is “cleaner” on both the East and West coasts, with higher usage of renewable energy sources and relatively low-emissions natural gas, while in the upper Midwest, there is still a much higher proportion of coal-burning power plants. That means that even though electric vehicles produce no greenhouse emissions while they are being driven, the process of recharging the car’s batteries results in significant emissions. In those locations, buying a lightweight car, defined as one whose structure is built largely from aluminum or specialized lightweight steel, would result in fewer emissions than buying a comparable electric car, the study found. (Ref. 5) [Top](#)



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We might be thinking about the ocean plastic problem all wrong - trash dumped from ships could be a major culprit

Scientists estimate that there are 5.25 trillion bits of plastic debris in the oceans worldwide — that is more plastic pieces than stars in our galaxy. Up to 14 million tons of plastic enter the ocean every year, **about the weight of 2 million elephants**. An estimated 40% of that falls into the "single-use" category, which means it winds up in the ocean within the same year it was produced. Scientists still are not sure where most of this floating plastic comes from. However, a new study provides a partial answer: when it comes to plastic bottles in the Atlantic, the culprit appears to be **Chinese merchant vessels** that are dumping garbage overboard. The researchers behind the study, published in the journal Proceedings of the National Academy of Sciences, examined plastic bottles and other debris that washed up on **Inaccessible Island**, a remote and uninhabited patch of land in the South Atlantic Ocean. They discovered that the number of plastic bottles that accumulated on the island had increased by 15% every year in the last 35 years. Most of the bottles that arrived during the researchers' 72-day monitoring period came from China, and **date stamps** on those bottles indicated that the majority were manufactured in the last two years. (Ref. 6) [Top](#)

FDA approves genetically modified cotton for human consumption

The Food and Drug Administration (FDA), in October, approved a genetically engineered (GE) form of cotton for use in human food. That is right, cotton. The stuff of t-shirts, mom jeans, bedsheets, and window drapes. Researchers believe that a modified species of the plant can create a new, cheap protein source for both people and animals. **American farmers produce** 9.6 billion pounds of cotton every year—worth \$7 billion in value—and contribute to a third of the world's exports of the crop, according to the Department of Agriculture (USDA). To this day, the lion's share of value is rooted in its fibers—the fluffy, white material that grows in big, round bulbs after flowering. What is game-changing about the new GE-version of the crop is that it will not affect the cotton fibers we have come to wear and love. Instead, its potential lies in the way that it alters cottonseeds, a byproduct of the plant. Unlike the seeds we are used to eating—sesame, poppy, sunflower—cottonseeds contain a **chemical called gossypol**, a toxin that can cause symptoms in humans, including severe respiratory distress, impaired immune, and reproductive functions, and even death. (In the 20th century, scientists researched gossypol as a cheap main ingredient for non-hormonal male birth control. That research was later abandoned due to concerns about toxicity and a lack of cultural support.) Gossypol is also toxic to most animals, except for ruminants like cattle, whose multi-chambered stomachs allow them to break it down—some cattle feed currently contains cottonseed. (Ref. 7) [Top](#)

Innovations that could build the food of the future

This is not the first time we see a population surge. Farming methods have evolved over the years to meet these growing demands in the form of farming tools, chemical fertilizers, and pesticides, etc. The earliest known tools were sticks and stones, which were later replaced by knives, scythes, and plows. It was not until the industrial revolution that modern machines were used in agriculture. Wheeled harvesters and threshers paved the way for steam-powered tractors. However, the introduction of **gasoline and diesel engines was the last great invention in agriculture technology**. Similarly, manure was partially replaced by chemical fertilizers such as



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Ammonium Sulphates and Urea. **OpenAg-** is a project by MIT's Media Lab that uses botany, machine-learning algorithms, and chemistry to optimize farming. The remarkable thing is that without using any genetic modification, the team was able to improve the flavor and medicinal qualities of plants such as basil by simply controlling the environment. Computer algorithms determine the optimal growing conditions to maximize the volatile compounds, which are primarily responsible for taste. The next challenge for OpenAg is to help farmers adapt to climate change. They plan to achieve this by using controlled simulations of the plants in hydroponic containers called 'food computers'. (Ref. 8) [Top](#)

5. ESD NEWSLETTER READER COMMENTS

None received this week.

Expecting the reader's comments and views on the newsletter. [Top](#)

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NEWSLETTER ARTICLE REFERENCES

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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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