



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

The ESD Newsletter is a monthly newsletter 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 is greatly appreciated.

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

1. ESD DIVISION NEWS

[ASME Energy Storage Committee](#)
[ESD Student Environmental Competition - Winners](#)
[ASME Policy Impact & Congressional Visits, May 24-26](#)

2. ENVIRONMENTAL TECHNOLOGIES

[Biodegradable plant-pollen sponges could soak up oil spills](#)
[Climate-friendly microbes chomp dead plants without releasing heat-trapping methane](#)

3. ENVIRONMENTAL REGULATIONS

[How the U.S. could halve climate emissions by 2030](#)
[New Infrastructure Proposal Prioritizes Equity and Environmental Justice](#)

4. EDITORIAL BOARD SELECTIONS

[American Chemistry Council Special Report: Chemistry and Climate Solutions](#)
[New Report Provides State-by-State Comparison of Recycling Rates for Food-Packaging Materials in the United States](#)
[Certified Non-GMO Salmon: a Healthy Alternative](#)
[National Academies of Sciences, Engineering and Medicine Report: Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy: 2025-2035](#)
[Crops could face double trouble from insects and a warming climate](#)
[Fifty years of EPA science for air quality management and control](#)

5. READER COMMENTS TO THE EDITOR

[None received this month](#)

1. ESD DIVISION NEWS

ASME ENERGY STORAGE COMMITTEE

The Clean Energy Technology Group (formerly EGSTG) formed a new Energy Storage Committee (ESC) in the Spring of 2020. The ESC is dedicated to the advancement of energy storage systems: for both utility and distributed systems. The focus of ESC extends across most of the other ASME Divisions and Sectors. This Committee works with the government, industry, academia, ASME Codes & Standards, ASME Government Relations, and other relevant professional and regulatory organizations to discuss, review, and promote practices that lead to the development, enhancement, and deployment of energy storage technologies.



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

The core values of ESC are to:

- Support international/intersociety professionals wishing to advance the application of energy storage thru basic research applied research, development, and implementation
- Create and publish peer-reviewed high-value content, reference documents
- Facilitate the creation, dissemination, and application of knowledge (science, engineering, technology) and information in energy storage within and outside ASME
- Attract students and young engineers into this area and provide them a forum to grow and advance their careers
- To encourage and facilitate a process for members to provide their expertise in the standards-setting process for energy storage
- To promote codes and standards for new areas energy storage
- To provide closer interface within and outside ASME through joint efforts/collaboration
- To help members keep pace with the latest developments

The main purposes of the Committee are fivefold:

- To develop and maintain the Energy Storage Matrix so that all (not only those on the Committee) know the status of the various technologies
- To develop standards (both ASME and IEEE as well as others) for energy storage: the Committee is a resource (e.g., people, volunteers, knowledge) for the various groups working on standards
- As central coordinating Committee (group) for sharing knowledge and answering questions on Energy Storage
- As a networking center for those directly (and indirectly) working on Energy Storage
- To develop events on Energy Storage such as webinars, forums, and conferences

ESC members include engineers (and others) conducting research and practicing engineers in energy storage, storage equipment design, regulatory programs, operations, design, maintenance, and testing of energy storage systems. Membership on the ESC is open to all ASME members, other professional society's (e.g., IEEE, AIChE, etc.), the governmental and regulatory community, and other interested individuals. Membership on the Committee is free to all. The intent is for the ESC to transition into an ASME Energy Storage Division in approximately one to two years. If you are interested in becoming a member of the Committee or need more information, please contact Arnie Feldman, Chair (jjdsenv@att.net).

[Back to Newsletter's Page 1](#)

ESD Student Environmental Competition – Winners

ESD is pleased to announce the winners for the ASME ESD 2021 competition (College Student level) as:

1st Place – Team 11 (Md. Fahim Hossain & Md. Mahadi Hassan)

2nd Place – Team 7 (Kamlesh Sahu and Ankan Mann)

3rd Place – Team 6 (Anand D Revgade & Shreyas N Dhisale)

Congratulations to all the winners!!



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

We also congratulate the finalists, who couldn't make it to the top three and all of the participants. We must admit the judges had a tough call and we are overwhelmed by all of the competitors efforts.

We encourage all to participate next year.

[Back to Newsletter's Page 1](#)

ASME Policy Impact & Congressional Visits, May 24-26

It is our pleasure to invite you to our premiere public policy program, ASME Policy Impact, which will be convened virtually May 24-26, 2021. This new program will feature plenary talks, discussion panels and other opportunities for ASME members to engage with policy leaders on the most current science and engineering issues. We am also pleased to announce that we are offering all ASME members the opportunity to meet and directly interact with their congressional delegation virtually to discuss critical issues and legislation affecting the engineering profession.

We hope you will be able to join us as we both embrace and innovate our policy and technical initiatives in this virtual space. ASME continues to be a leader in advocating for the science and engineering community, and we are excited to provide this opportunity for our members to contribute and learn from staff and policy experts alike on the key issues impacting the engineering profession. The event website and registration link can be accessed [here](#) for your ease of reference. Let us know if there are any question or if we can assist with arrangements.

[Back to Newsletter's Page 1](#)

2. ENVIRONMENTAL TECHNOLOGIES

Biodegradable plant-pollen sponges could soak up oil spills

Last year, we heard how scientists had created eco-friendly soft gel particles from hard grains of pollen. Now, they have used those particles to create sponges that could soak up oil spills, then biodegrade once used up. Developed by a team from Singapore's Nanyang Technological University (NTU) and South Korea's Sungkyunkwan University, the gel-making process is described as being similar to the production of soap. The scientists started with pollen grains from sunflowers, which were already covered with naturally occurring sticky oil-based cement. That cement was removed by incubating the grains in alkaline conditions for three days, leaving their gel-like interior substance behind. That gel was then freeze-dried to form a three-dimensional spongy material, which was subsequently heated to 200 °C (392 °F) to stabilize it. Finally, the material was coated with a layer of stearic acid, a fatty acid found in vegetable and animal fat. The resulting sponges each have a diameter of 5 cm (2 in), although they could be made much larger for commercial applications. They are very porous, but the stearic acid also makes them hydrophobic, meaning that they repel water. Therefore, if placed in oil-polluted water, they soak up only the oil – they do not become saturated with water. In lab tests involving various types of oils and solvents, the sponges were found to have an



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

absorption capacity similar to that of commercially available polypropylene absorbents. Unlike those petroleum-based products, however, the pollen sponges are made from renewable materials that biodegrade once discarded – speaking of which, each sponge can be wrung out and reused at least ten times before needing to be replaced. By fine-tuning the material properties of pollen, the team successfully developed a sponge that can selectively target oil in contaminated water sources and absorb it. "Using a material that is found abundantly in nature also makes the sponge affordable, biodegradable, and eco-friendly." The research is described in a paper that was recently published in the journal *Advanced Functional Materials*. (Ref. 1) [**Back to Newsletter's Page 1**](#)

Climate-friendly microbes chomp dead plants without releasing heat-trapping methane

The tree of life just got a little bigger: A team of scientists from the U.S. and China has identified an entirely new group of microbes quietly living in hot springs, geothermal systems, and hydrothermal sediments around the world. The microbes appear to be playing an important role in the global carbon cycle by helping break down decaying plants without producing the greenhouse gas methane. "Climate scientists should take these new microbes into account in their models to more accurately understand how they will impact climate change."

The new group, which biologists call a phylum, is named Brockarchaeota after Thomas Brock, a pioneer in the study of microbes that live in extreme environments such as the hot springs of Yellowstone National Park. His research led to a powerful biotech tool called PCR, which is used, among other things, in gene sequencing and COVID-19 tests. "The description of these new microbes from hot springs is a fitting tribute to Tom's legacy in microbiology." So far, Brockarchaeota has not been successfully grown in a laboratory or imaged under a microscope. Instead, they were identified by painstakingly reconstructing their genomes from bits of genetic material collected in samples from hot springs in China and hydrothermal sediments in the Gulf of California. Baker and the team used high-throughput DNA sequencing and innovative computational approaches to piece together the genomes of the newly described organisms. The scientists also identified genes that suggest how they consume nutrients, produce energy and generate waste.

When we looked in public genetic databases, we saw that they had been collected worldwide but described as 'uncultured microorganisms. "Genetic sequences were going back decades, but none of them were complete. So, we reconstructed the first genomes in this phylum and then we realized, wow, they are around the world and have been completely overlooked." The Brockarchaeota is part of a larger, poorly studied group of microbes called archaea. Until now, scientists thought that the only archaea involved in breaking down methylated compounds -- that is, decaying plants, phytoplankton and other organic matter -- were those that also produced the greenhouse gas methane. (Ref. 2) [**Back to Newsletter's Page 1**](#)



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

3. ENVIRONMENTAL REGULATIONS

How the U.S. could halve climate emissions by 2030

This week, President Biden will announce a number that could shape the rest of his presidency: a new goal to cut U.S. greenhouse gas emissions. The announcement marks the country's renewed commitment to the Paris accord, the international climate change agreement that former President Donald Trump withdrew from. Environmental groups, scientists, and major business leaders are urging the Biden administration to cut emissions 50% by 2030, as compared to 2005 levels. That target lines up with scientific assessments of the reductions needed to avoid the worst impacts of climate change. To limit warming to 1.5 degrees Celsius, emissions need to drop to net-zero by 2050. Above that and sea levels rise to extreme heights, heat waves get more intense, and hurricanes and wildfires become even more destructive. A 50% cut would not be the world's most aggressive target, but it would put the U.S. among the four most ambitious countries. Going back to 1850, the U.S. has pumped more emissions into the atmosphere cumulatively than any other nation. Still, achieving that target by 2030 won't be simple, requiring both political buy-in and a sweeping deployment of cleaner cars and clean energy sources. What would it take? Based on research from universities and advocacy groups, here's what the U.S. might look like in 2030.

1. Renewable energy takes over, coal fades away

The fastest and largest way to cut emissions by 2030 is likely through the way we generate electricity. Across three independent assessments which ran simulations of different policies, the power sector would have to make up the majority of the overall emissions cuts.

2. Car dealerships look very different

Today, transportation is the country's largest source of emissions. While cars have been getting cleaner on average, Americans have been buying more SUVs and other large vehicles, causing oil consumption to go up.

3. Buildings, industrial plants, and land all get in the game

Achieving steep emissions cuts also means every sector of the economy would need to contribute, but some could take much more time for new policies to affect. (Ref. 3)

[Back to Newsletter's Page 1](#)

New Infrastructure Proposal Prioritizes Equity and Environmental Justice

Many of President Biden's proposals fall into several of the four areas of federal policy intervention that environmental research institution Resources for the Future has identified as necessary for a fair transition to greener technology: workforce development and labor standards, economic development, environmental remediation, and infrastructure, and public benefits. The summaries below include some of that overlap.

Environmental Remediation and Infrastructure

- As discussed in the proposal, many of President Biden's proposals are specifically aimed at remediation efforts. Several of these efforts are specifically geared towards low-income communities and communities of color. These programs include:



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

- Investing \$45 billion in EPA's Drinking Water State Revolving Fund to eliminate 100 percent of lead pipes and service lines in the country. Currently, an estimated six to 10 million homes receive drinking water through lead pipes and service lines. Many of these homes are in rural communities and communities of color.
- Increase infrastructure resilience in low-income communities and communities of color vulnerable to flooding and extreme weather events caused by climate change. These investments take many forms, including FEMA's Building Resilient Infrastructures and Communities program, HUD's Community Development Block Grant program, unspecified Department of Transportation initiatives, and providing a tax credit for investments in disaster resilience, and modernizing public transportation. Households of color are twice as likely to use public transportation. Modernizing the infrastructure could create lower travel times and lower transit disruptions and encourage public transportation.
- Investing \$56 billion in grants and low-cost loans to modernize drinking water, wastewater, and stormwater systems in rural communities.
- Investing in \$100 billion to build a high-speed broadband infrastructure to reach 100 percent coverage. According to the proposal, more than 30 million Americans do not have access to high-speed broadband. Many of those without access are in rural communities, tribal lands, and communities of color.
- Plugging orphan oil and gas wells and cleaning up abandoned mines can cause ongoing air, water, and environmental pollution, and many of which are located in underserved rural communities.
- Investing \$4 billion in remediation and redevelopment of brownfield and Superfund sites, many of which are in disadvantaged communities. The plan also invests in economic and workforce development in these communities.

To support these newly created jobs, the plan calls for:

- Establishing labor standards for jobs related to the modernization of power generation and the delivery of clean electricity. These labor standards will promote unions and collective bargaining.
- Increasing penalties for employers who violate health and safety rules.
- Job training programs for formerly incarcerated individuals.

The other sections included in the proposal are economic development, Workforce Development and Labor Standards, and Public Benefits. (Ref. 4)

[Back to Newsletter's Page 1](#)

4. EDITORIAL BOARD SELECTIONS

American Chemistry Council Special Report: Chemistry and Climate Solutions

Climate change is a global challenge that requires long-term commitment and action by every segment of society. America's chemical industry supports efforts to reduce greenhouse gas (GHG) emissions. As Congress develops strategies to fight climate change, ACC members have



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

adopted Climate Policy Principles. A combination of technology, market-based, and policy solutions will be necessary to reduce GHG emissions and achieve climate goals, such as those of the Paris Agreement. To support climate progress, ACC calls on Congress to enact legislation to:

- Increase government investment and scientific resources to develop and deploy low emissions technologies in the manufacturing sector;
- Adopt transparent, predictable, technology- and revenue-neutral, market-based, economy-wide carbon price signals; and
- Encourage the adoption of emissions-avoiding solutions and technologies throughout the economy to achieve significant emissions savings.

Chemistry-based products and technologies support the fight against climate change through various applications such as renewable energy sources, electric and high-efficiency vehicles, and building materials that reduce energy consumption. Chemical industry scientists are developing new emission reduction technologies and clean energy alternatives to safeguard the environment and people worldwide. Chemical makers are among the manufacturers using natural gas to create two forms of energy—steam and electricity—for industrial facilities. Known as “combined heat and power” (CHP), this energy is generated close to where it is needed, so little is lost in transmission. CHP can produce energy twice as efficiently as older coal-burning electric utilities.

The chemical industry has been a pioneer in the development of catalytic technologies. Catalysts are added substances that increase the rate of a chemical reaction so that less energy is used per unit of product. Reduced emissions in modern cars, pharmaceutical breakthroughs that improve health, increased crop yields, and energy-saving laundry detergents are made possible by catalysis. About 90 percent of all chemical processes employ catalysis in production, and R&D can enable further advancements. (Ref. 5) **[Back to Newsletter's Page 1](#)**

New Report Provides State-by-State Comparison of Recycling Rates for Food-Packaging Materials in the United States

A state-by-state comparison of recycling rates for a common set of containers and packaging materials (CCPM) in the U.S. is provided in a recently released report commissioned by the Ball Corporation. The report ranks U.S. states based on overall and material-specific recycling rates using data from 2018 provided by the U.S. Environmental Protection Agency, state governments, local jurisdictions, sorting facilities, and material processors. The CCPM analyzed included plastics, cardboard and boxboard, glass bottles and jars, aluminum cans, and steel cans. The report identifies Maine (72%), Vermont (62%), Massachusetts (55%), Oregon (55%), and Connecticut (52%) as the states with the best overall recycling rates for CCPM when the cardboard is excluded from the analysis. The states with the best overall recycling rates for all CCPM (including cardboard) were Maine (74%), Oregon (66%), Connecticut (63%), Vermont (62%), and Iowa (62%).

The authors of the study point out that every state has different policies, different levels of access, and different infrastructure when it comes to recycling, which makes it difficult to drive comprehensive and meaningful change. However, the report notes that increased recycling rates correlated with states having comprehensive, up-to-date data on recycling and state-



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

managed reporting systems in place. The stated purpose of the analysis was “to establish a 2018 baseline from which policymakers, service providers, operators, and investors can make informed strategic decisions on what measures are needed in the short, medium, and long term to support a circular economy, replace primary with secondary materials, and reduce greenhouse gas (GHG) emissions.” (Ref. 6) [Back to Newsletter’s Page 1](#)

Certified Non-GMO Salmon: a Healthy Alternative

Superior Fresh, an industry-leading aquaponics facility specializing in organic leafy greens and Atlantic salmon, is the first company to offer Certified Non-GMO by A Greener World (AGW) salmon. Raised in a recirculating system where all inputs and outputs are controlled, and welfare is ensured throughout the production process, Superior Fresh’s non-GMO salmon is a premium alternative to the genetically engineered salmon set to arrive in grocery stores this month. The U.S. market is preparing to distribute genetically modified salmon after the FDA’s recent controversial approval of the product—despite significant opposition from consumer advocates, fishing groups, public health officials and native communities. As public demand for the labeling of GMOs (genetically modified organisms, also known as GE, or genetically engineered) continues to grow, the market for non-GMO products is surging 17% annually and expected to reach 1.1 billion USD 2023, according to industry analyst, Technavio. Consumers seek out non-GMO products for various reasons, including environmental sustainability, health, corporate consolidation and transparency. A lack of clear labeling around GMOs means that consumers must actively seek out Certified Non-GMO products to avoid them.

Developed at the request of farmers and consumers seeking a meaningful non-GMO label, Certified Non-GMO by AGW guarantees food is produced without using the genetically modified feed, supplements or ingredients, and comes from animals raised according to higher animal welfare standards using sustainable agriculture methods. On salmon, the Certified Non-GMO by AGW label includes A Greener World’s Salmon Welfare Certified standards, incorporating the UK RSPCA’s respected higher welfare salmon standards. While most salmon farming relies on routine antimicrobials (e.g., antibiotics, antiparasitics, and antivirals) and GMO feed, Certified Non-GMO by AGW has meaningful prohibitions on GMO contamination (see comparison chart here for more details) and ensures that at no point in the growing, processing or manufacturing of the product will GMOs enter the system. Superior Fresh’s flagship aquaponics facility is the largest of its kind, practicing ecologically sound water conservation and native prairie restoration in a closed-loop, zero-discharge system. Their antibiotic-free Atlantic salmon, raised with a non-GMO, organic diet, also provide twice the omega-3 levels than other Atlantic salmon sampled in their market region. Superior Fresh proves through their innovative model that land-based aquaculture systems can protect the world’s oceans while providing healthy and environmentally beneficial proteins to consumers. (Ref. 7) [Back to Newsletter’s Page 1](#)



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

National Academies of Sciences, Engineering and Medicine Report: Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy: 2025-2035.

From daily commutes to cross-country road trips, millions of light-duty vehicles are on the road every day. The transportation sector is one of the United States' largest sources of greenhouse gas emissions, and fuel is an important cost for drivers. The period from 2025-2035 could bring the most fundamental transformation in the 100-plus year history of the automobile. Battery electric vehicle costs are likely to fall and reach parity with internal combustion engine vehicles. New generations of fuel cell vehicles will be produced. Connected and automated vehicle technologies will become more common, including the likely deployment of some fully automated vehicles. These new categories of vehicles will for the first time, assume a major portion of new vehicle sales. In contrast, internal combustion engine vehicles with improved powertrain, design, and aerodynamics will continue to be an important part of new vehicle sales and fuel economy improvement.

This study is a technical evaluation of the potential for an internal combustion engine, hybrid, battery-electric, fuel cell, non-powertrain, and connected and automated vehicle technologies to contribute to efficiency in 2025-2035. In addition to making findings and recommendations related to technology cost and capabilities, Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy - 2025-2035 considers the impacts of changes in consumer behavior and regulatory regimes. (Ref. 8) [Back to Newsletter's Page 1](#)

Crops could face double trouble from insects and a warming climate

For millennia, insects and the plants they feed on have been engaged in a co-evolutionary battle: to eat or not be eaten. The research team at Michigan State University's Plant Resilience Institute watched what happened in hotter weather when hornworm caterpillars attacked a tomato plant. The tomato lost. We saw a surprising trade-off by the plant during the heatwave: It defended itself against the caterpillars but this effort prevented it from dealing with the harmful effects of heat. This caused the plant to overheat, which strengthened the caterpillars' hand. Researchers in 2018 predicted that each degree of global warming would increase crop loss from insects by 10% to 25% because insect populations and their appetites surge in warm temperatures.

Unlike animals, plants cannot run or hide from predators. Instead, plants produce an arsenal of toxic chemicals that repel the attack by insects and other plant consumers. Producing these compounds is costly and often stunts their growth, so plants deploy this chemical defense arsenal only when damaged by a chewing insect. The plant wound hormone, jasmonate, which tightly controls the biosynthesis, distribution and storage of chemical defense compounds that repel insects, triggers this process. In their study, they challenged tomato plants with hornworm caterpillars under either normal temperature conditions: 82 degree F days (about 28 degrees C) and 64 degree F nights (about 18 degrees C). they also simulated heat waves, with temperatures rising to 100 F (38 C) in the daytime and falling to 82 F (28 C) at night for several days. The plants responded to the hotter temperatures by intensifying the production of jasmonate and, as a consequence, increasing the output of various defense compounds. Even so, insects ate the plants relentlessly in the heat. Meanwhile, a parallel study by the team found that moderate increases in temperature speeded up the insects' metabolism to eat faster and



ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

did more damage to the plants. Although tomato plants fought hard with their chemical response, they could not neutralize the insects' powerful heat-triggered eating stimulus. They unexpectedly discovered in their work that tomato plants challenged by caterpillars at the warmer temperature did not do these things and thus failed to cool their leaves. In the follow-up experiments, they found that when caterpillars ate its leaves and the plant activated the hormone jasmonate, this blocked the opening of the tiny stomata and prevented leaves from lifting to cool. The plant could not deploy its cooling response, and at the same time, photosynthesis (making food from sunlight and carbon dioxide) was reduced. Why insect attack keeps the plants from cooling themselves remains a mystery. However, when plants close their stomata during an insect attack, they conserve water by preventing it from evaporating from wounded leaves. We think this response may benefit the plant when water is in short supply, often during heat waves. (Ref. 9)

[Back to Newsletter's Page 1](#)

Fifty years of EPA science for air quality management and control

Research and development has been a key part of the foundation for improvements in US air quality since the establishment of the Environmental Protection Agency (EPA) 50 years ago. The paper provides a few examples of the advances in air pollutant measurement, monitoring, modeling, and control that we now consider to be routine, but which did not exist when EPA was established. Those advances provide the technical foundation that enabled later scientists and engineers to respond quickly and effectively to unexpected and emerging air pollution issues. The paper looks back at some of the accomplishments of EPA scientists and engineers and shows how the cumulative effect of continual, incremental advances can result in large and lasting benefits to society. (Ref. 10)

[Back to Newsletter's Page 1](#)

5. ESD NEWSLETTER READER COMMENTS

None received this month.

[Back to Newsletter's Page 1](#)

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ENVIRONMENTAL SYSTEMS DIVISION NEWSLETTER

01 MAY 2021

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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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